WYOMING GAME & FISH DEPARTMENT

Nongame Program

2020

WYOMING GAME & FISH DEPARTMENT: NONGAME PROGRAM

Wyoming's natural history is rich with wildlife and a diversity of habitats. To maintain our natural heritage, and to ensure diversity for future generations, the Wyoming Game and Fish Department has been tasked to manage all wildlife within the state. The nongame Program's function is to manage bird and mammal species designated as nongame within Wyoming. The Wyoming Game and Fish Departments Nongame Bird and Mammal Program aims to conserve and manage more than 8,400 species within the state, including 131 Species of Greatest Conservation Need (SGCN). The 2017 State Wildlife Action Plan (SWAP) designates 80 bird species and 51 mammal species as SGCN in Wyoming. Through monitoring, we are able to collect information that has practical applications for understanding the status of nongame bird and mammal populations, as well as identify management actions needed to help ensure nongame species population health and survival.

The reports included within this document are the annual summaries of current work the Nongame Program has completed from April 15, 2019 to April 15, 2020. If additional information is needed for any of the projects listed in this report, please contact the Nongame Program at 307-332-2688.

TABLE OF CONTENTS

ACKNOWLEDGMENTS 4

BIRDS

Bald Eagle monitoring in Western Wyoming 5

Rocky Mountain population of Trumpeter Swans in Wyoming 6

Marsh bird monitoring: Year 5 summary 8

Grassland bird monitoring: Year 5 results 10

Raptor nest survey: Thunder Basin National Grasslands 12

Peregrine Falcon monitoring 14

Wyoming Partners in Flight 16

Breeding Bird Survey 18

Burrowing Owl: Migration across North America 20

Central Flyway Technical Committee 22

Flammulated Owl Survey 24

Common Loon research and monitoring in Wyoming 26

Sagebrush bird demography and populations: Effects of climate 28

Wyoming Bird Records Committee 30

MAMMALS

Pygmy rabbit occupancy and distribution in Wyoming 32

Introduction to Black-footed ferret monitoring in Wyoming 34

Black-footed ferrets in Meeteetse 36

Black-footed ferrets in Shirley Basin 37

Introduction to Bats of Wyoming 38

North American Bat Monitoring Program in Wyoming 40

Little Brown Myotis fall tracking to characterize hibernacula 42

White-nose surveillance: Spring roost and landscape captures 44

Winter White-nose Syndrome surveillance and hibernation population monitoring 46

LITERATURE CITED 47

FUNDING AND DISCLAIMER 51

2019 NONGAME PROGRAM

Zack Walker
Statewide Nongame
Bird and Mammal Supervisor

Andrea Orabona
Nongame Bird Biologist

Nichole Bjornlie
Nongame Mammal Biologist

Leslie Schreiber
Sage Grouse and Sagebrush
Biologist

Nyssa Whitford
Wildlife GIS Analyst

Alex Lewis
Bat Technician

Anika Mahoney
Grassland Bird Project
Biologist

Christine Peterson
Bat Technician

Courtney Rudd
Nongame Biologist

Dana Nelson
Black-footed Ferret
Project Biologist

Emmalee Buss
Black-footed Ferret
Technician

Frank Stetler
Nongame Technician

Kaitlyn Leist
Black-footed Ferret
Technician

Katie Sauer
Grassland Bird Project
Biologist

Laura Beard
Bat Project Biologist

Monika Libson
Black-footed Ferret
Technician

Ryan Kindermann
Pygmy Rabbit
Technician

Sean Ryder
Pygmy Rabbit
Technician

Shawn Pladas
Bat Technician

Stephanie Rhine
Nongame Technician

ACKNOWLEDGMENTS

The Wyoming Game and Fish Nongame Program would like to thank the volunteers and wildlife professionals from this and other natural resource management agencies for their valuable contributions. We would also like to extend our gratitude to the landowners across the state that allow us access and/or preform field work on private land. Without the generous contribution from these people, the work of the Nongame Program would not be possible.

BALD EAGLE MONITORING IN WESTERN WYOMING

The Bald Eagle is listed as a Species of Greatest Conservation Need in the Wyoming State Wildlife Action Plan, with a Native Species Status 3 (NSS3) and Tier II (moderate conservation priority), due to limited population size and breeding distribution, and vulnerability to human disturbance during the breeding season (WGFD 2017). The Wyoming Game and Fish Department (Game and Fish) initiated statewide monitoring for Bald Eagles in 1978. Although Bald Eagles nest along all major river systems in the state, 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). Management guidelines have been developed for nest sites in the GYA based on a long-term ecological study, and provide valuable information for avoiding disturbance to nesting eagles (GYBEWG 1996). Territories located along the Snake River continue to serve as a source of Bald Eagles for other areas of Wyoming (Harmata and Oakleaf 1992). Since 2000, we have also documented a substantial increase in the number of nesting pairs in the Green River Drainage (GRD).

In 2019, we conducted aerial surveys over portions of western Wyoming to monitor occupancy and productivity at a majority of known Bald Eagle nest sites. We conducted fixed-wing aircraft surveys in early April to document the number of occupied sites with incubating adults, and again in late May/early June to determine number of mature young produced per site. During aerial surveys, we recorded the number of adult and young Bald Eagles observed, UTM coordinates of nests, condition of nests, and species of nest tree.

In the GYA, we evaluated 34 Bald Eagle nest sites for occupancy (Table 1). Of those nest sites, 28 (82%) were occupied with 1 or more adult birds, and 19 (68%) were productive. The number of mature young produced was 1.42 per successful nest. Overall, 8 nests failed in the GYA. For the GRD and Seedskadee National Wildlife Refuge (NWR) portion of western Wyoming, only productivity surveys were completed due to unfavorable weather for flying. In the GRD, 9 nests produced 10 mature young, for an average of 0.9 young per successful nest. At Seedskadee NWR, 11 nests produced 15 mature young, averaging 1.34 young per successful nest.

The 2019 nesting data for the GYA indicate that current productivity, or the number of young produced per occupied site, is within the historic range. Although unfavorable weather conditions prevented us from conducting occupancy surveys in the GRD and on Seedskadee NWR, the productivity data indicate that the average production is consistent with trends from previous years.

Nesting data collected	WY portion of GYA
2019 Territories checked for occupancy (*n*)	34
2019 Territories occupied (*n*)	28
2019 Percent of territories occupied	82%
2019 Territories surveyed for productivity (*n*)	28
2019 Territories that produced young (*n*)	19
2019 Percent of successful nests [a]	68%
2019 Mature young produced [b] (*n*)	27

Table 1. Summary of Bald Eagle nesting data we collected in 2019. GYA does not include data from Yellowstone National Park. [a] Percentage of occupied territories checked for productivity that produced mature young. [b] The number of fully feathered nestlings counted prior to fledging in June and July.

In the future, additional surveys may be needed in areas where energy developments (oil, gas, and wind) occur or are proposed along major drainages or known migration routes and wintering areas. We hypothesize that, in areas undergoing high levels of development along major river corridors, Bald Eagles could experience higher mortality rates, lower productivity, or loss of nest sites if adequate mitigation measures are not applied. In addition, stands of cottonwood trees that are failing to regenerate may also reduce nesting habitat in some area.

Prepared by:
Stephanie Rhine, Nongame Biologist; Andrea Orabona, Nongame Bird Biologist

Funding Source:
US Army Corps of Engineers,
Wyoming Game and Fish Department

MONITORING AND MANAGEMENT OF THE ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS IN WYOMING

The Trumpeter Swan (swan) is classified as a Species of Greatest Conservation Need in the Wyoming State Wildlife Action Plan with a Native Species Status 2 (NSS2), Tier II (moderate conservation priority; WGFD 2017). In 1989, the Tri-State Area Flock (TSAF; Wyoming, Montana, and Idaho) was petitioned for listing as a Distinct Population Segment (DPS) under the Endangered Species Act. However, in 2003, the US Fish and Wildlife Service (USFWS) determined that listing was not warranted because the TSAF did not represent a DPS (USFWS 2003).

Trumpeter Swans have been a focal management species for federal and state agencies in the Greater Yellowstone Area (GYA) or the Tri-State Area since the establishment of Red Rock Lakes National Wildlife Refuge in Montana in 1932. This refuge was created to conserve about 70 swans in the GYA, which were believed to be the last remaining Trumpeter Swans in the world. Due to conservation efforts, the number of swans in the GYA increased to >600 by the 1950s (USFWS 1998). However, the population has fluctuated greatly since that time, dropping to a low of 239 white birds (adults and subadults) in 1994. The total number of adult birds in the GYA exceeded 500 white birds in 2015 for the first time since 1967 (Olson 2020). This non-migratory segment of the population remains of concern, even though populations in Alaska, interior Canada, and the mid-western states have been increasing (Groves 2012).

The Pacific Flyway Council (PFC) coordinates management of this swan population and designated swans that nest and reside year-round in the GYA, including western Wyoming, as the TSAF. The TSAF are managed as part of the US segment of the Rocky Mountain Population (RMP) of swans, which includes those that nest in interior Canada and migrate south to winter in the GYA (USFWS 1998). The Wyoming Game and Fish Department (Game and Fish) coordinates with the 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 (cygnets) in the TSAF. Since the late 1980s, Game and Fish has worked to expand the distribution of swans in Wyoming (Patla and Oakleaf 2004). These efforts have established a new nesting population in the Green River Basin. Since 2004, Game and FIsh has cooperated with willing landowners to restore

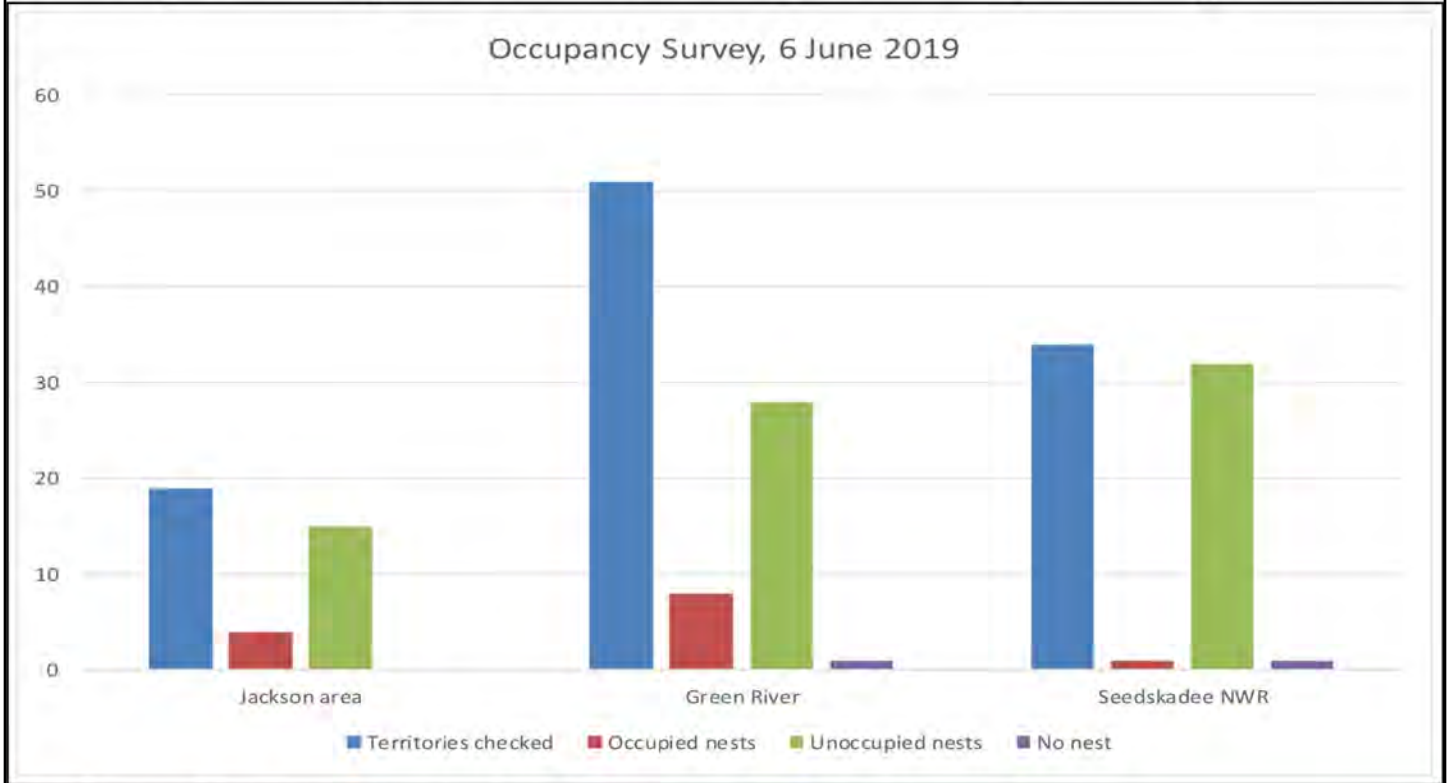


Figure 1. Trumpeter Swan occupancy survey conducted in western Wyoming on 6 June 2019.

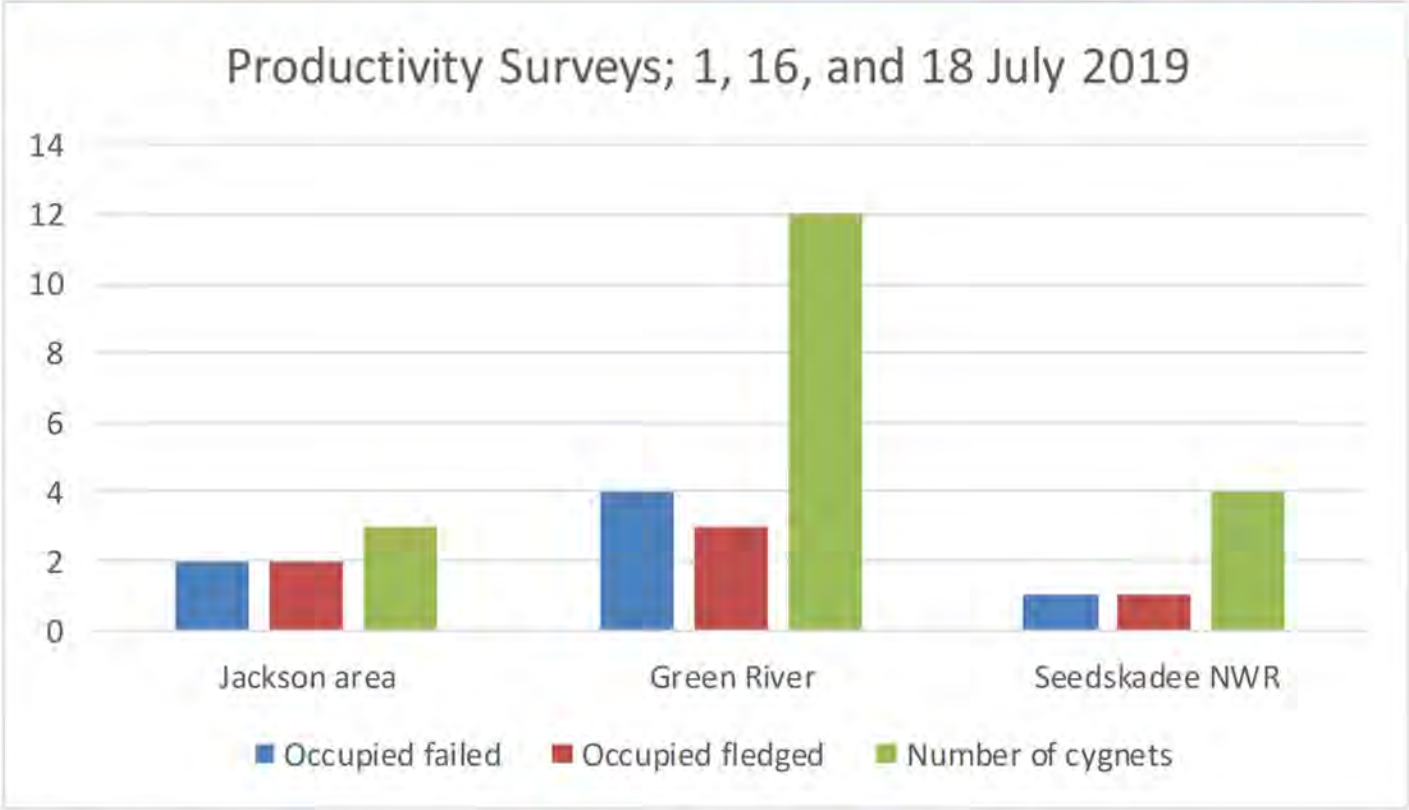


Figure 2. Trumpeter Swan productivity surveys conducted in western Wyoming on 1, 16, and 18 July 2019.

and create summer habitat in the Upper Green River Basin to accommodate this expanding resident flock.

Game and Fish is a member of the Greater Yellowstone Trumpeter Swan Working Group, which consists of state and federal agencies, non-governmental organizations, and interested citizens. The Working Group meets annually to discuss productivity and population trends and to coordinate management actions. Wyoming also coordinates with the PFC RMP Trumpeter Swan Study Sub-committee.

In 2019, we conducted 3 fixed-wing airplane surveys to collect swan data, and used the same pilot (Mark Packila, Wildlife Air) and Scout aircraft to fly all surveys. Flying elevation averaged 100-230 feet above ground level depending on terrain and surface winds; flight speed varied between 85-100 mph. We counted white birds (adults and subadults) and gray cygnets (young).

We surveyed swan nesting areas on 6 June to determine nest occupancy. We checked 19 territories in the Jackson area, 51 territories along the Green River, and 34 territories on the Seedskadee National Wildlife Refuge (NWR; Figure 1). Due to inclement weather, we were unable to check 9 territories

On 1, 16, and 18 July, we surveyed the previously occupied nests for productivity and counted the number of young (cygnets) fledged (Figure 2). A high snowpack, wet spring, and delayed snow melt likely contributed to the reduced number of occupied nests and number of young fledged.

The fall survey was coordinated by USFWS in the Tri-State Area. On 15 September 2019, we flew the Wyoming portion of the fall survey. We counted 9 adults and 3 cygnets in the Jackson area, 67 adults and 11 cygnets along the Green River, and 24 adults and 3 cygnets on Seedskadee NWR.

Additional swan data were collected or provided through site-specific ground surveys, reports provided by federal agencies, and observations from the public. The USFWS Migratory Birds and State Programs Mountain-Prairie Region Office produces an annual report summarizing results for the coordinated RMP surveys that includes data collected in Wyoming (Olson 2020).

Compared to the 1990s, the status of the resident Wyoming Trumpeter Swan population has greatly improved. Both number and distribution of swans have increased, as well as the amount of important wetland habitat. However, certain risks (climate change, drought, diseases, an increase of wintering swans, and human developments and disturbance) still need our attention.

Prepared by:

Andrea Orabona, Nongame Bird Biologist; Frank Stetler, Nongame Biologist

Funding Source:

Wyoming Game and Fish Department

IMPLEMENTATION OF THE STANDARDIZED NORTH AMERICAN MARSH BIRD MONITORING PROTOCOLS FOR SPECIES OF GREATEST CONSERVATION NEED IN WYOMING: YEAR 5 SUMMARY

The American Bittern is classified as an uncommon summer resident in Wyoming (Orabona et al. 2016) and a Species of Greatest Conservation Need (SGCN) with a Native Species Status 3 (NSS3), Tier II (moderate conservation priority) by the Wyoming Game and Fish Department (Game and Fish) because of severely limited wetland habitat necessary for reproduction and survival (WGFD 2017). Due to their secretive behavior, a species-specific call-playback technique is needed to document the presence of American Bitterns. In previous years, we used the Standardized North American Marsh Bird Monitoring Protocol (Conway et al. 2009) to conduct annual monitoring along 5 survey routes on the Cokeville Meadows National Wildlife Refuge (CMNWR; Refuge) in western Wyoming to determine presence and evaluate population trends of American Bitterns over time.

In 2015, we eliminated 3 of the survey routes on the CMNWR due to issues beyond our control (flooding, blocked access) and concern for human health and safety along the railroad right-of-way through a portion of the marsh habitat along which these surveys were located. However, due to willing participation by 2 landowners with property adjacent to the Refuge, we were able to add 2 new routes in place of the routes we eliminated, for a total of 4 routes on the Refuge (Figure 1).

Virginia Rail. Photo by: Pete Arnold.

To better ascertain distribution and status of American Bitterns and other secretive marsh birds in Wyoming, we evaluated marsh habitat throughout the state to locate additional sites suitable for implementing the standardized survey methods for secretive marsh birds. We set up 7 new survey routes (Yellowtail Wildlife Habitat Management Area [WHMA], 3 routes; Table Mountain WHMA, 1 route; Ocean Lake WHMA, 1 route; Dad Wetland, 1 route; and Hutton Lake NWR, 1 route) for a total of 11 routes in 6 wetland sites across Wyoming (Figure 2).

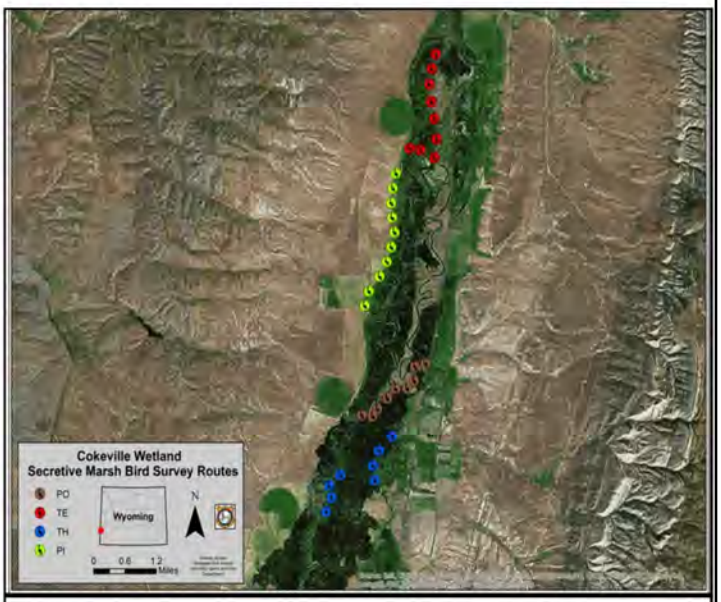


Figure 1. Locations of secretive marsh bird survey routes we established on and adjacent to the CMNWR in Wyoming using the Standardized North American Marsh Bird Monitoring Protocol (Conway et al. 2009). PO = Pope route (private land), TE = Teichert route (private land), TH = Thornock route (CMNWR), and PI = Pixley route (CMNWR).

In 2015, we initiated an annual monitoring program for the American Bittern at these sites, and included 3 additional national marsh bird focal species: Pied-billed Grebe, Virginia Rail, and Sora. Although the Virginia Rail and Sora are game species, there are no survey efforts in place to ascertain their distribution and occupancy in Wyoming. Furthermore, the Virginia Rail is classified as summer resident in Wyoming with unknown abundance (Orabona et al. 2016) and a SGCN with a Native Species Status Unknown (NSSU), Tier III (lower conservation priority) due to restricted population size and distribution (WGFD 2017).

Using the national secretive marsh bird call-playback technique will both standardize and add value to our survey efforts. Our results will be able to be compared with those from across the US where this method is also being employed, and our data can be added to the national marsh bird

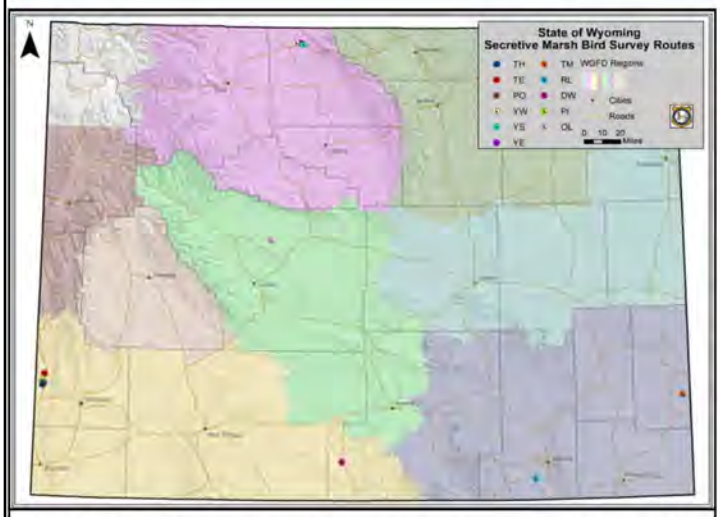


Figure 2. Locations of all secretive marsh bird survey routes we established in Wyoming. TH = Thornock route, TE = Teichert route, PO = Pope route, YW = Yellowtail West route, YS = Yellowtail South route, YE = Yellowtail East route, TM = Table Mountain route, RL = Rush Lake route, DW = Dad Wetland route, PI = Pixley route, and OL = Ocean Lake route.

database to increase knowledge of species distribution and status on a larger scale. A summary of the species detected in 2019, the 5th survey year, is presented in Figure 1. Surveys could not be conducted at 2 sites in 2019 due to flooded conditions—the Ocean Lake Wildlife Habitat Management Area route and the Pope route (private land south of Cokeville, Wyoming).

We wish to acknowledge Katie Theule, wildlife biologist with the US Fish and Wildlife Service Cokeville Meadows National Wildlife Refuge, for annually loaning us an all-terrain vehicle and trailer to access the survey sites on and adjacent to the Refuge. We also thank private landowners Evan Pope and Tim Teichert for their interest in secretive marsh birds and for graciously allowing us to access their properties to conduct the annual surveys.

Prepared by:
Andrea Orabona, Nongame Bird Biologist; Courtney Rudd, Nongame Biologist

Funding Source:
Wyoming Game and Fish Department

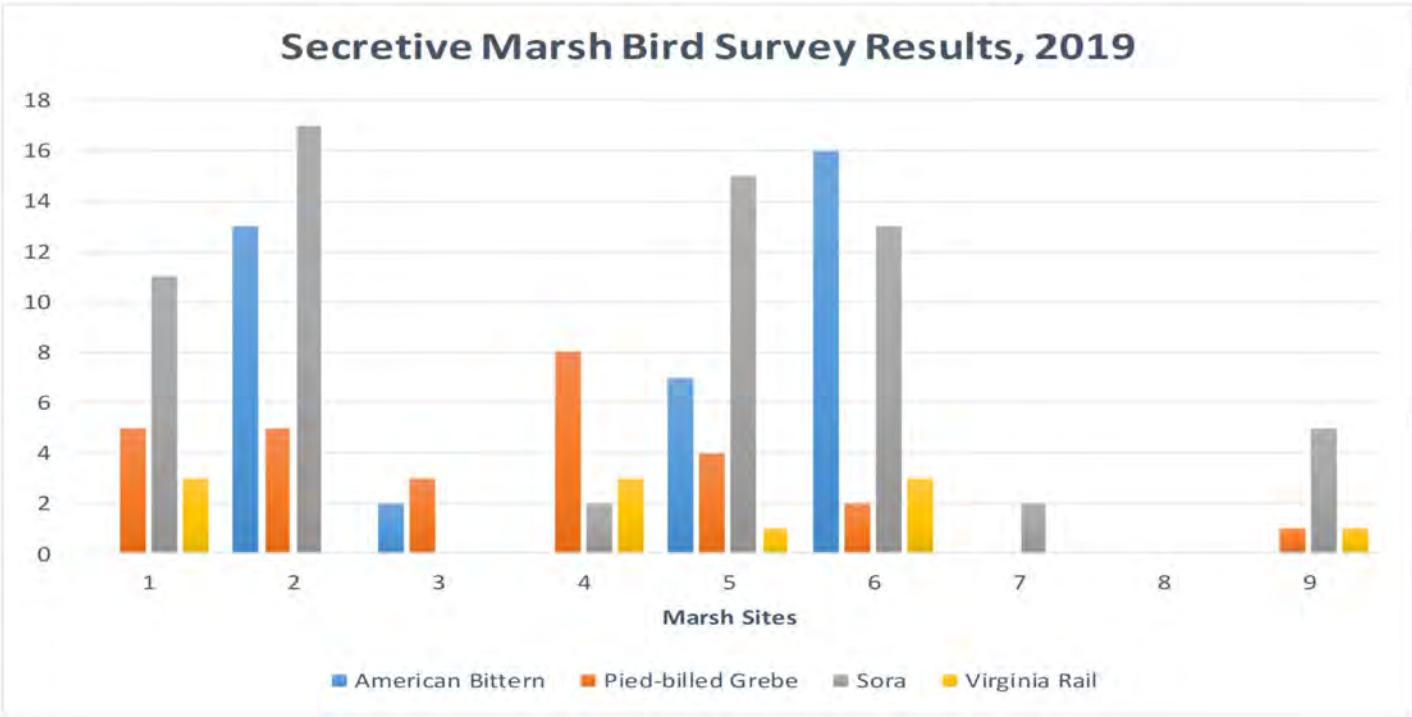


Figure 1. Highest count of each target species during the 2019 secretive marsh bird surveys. Site 1 = Dad Wetland; Site 2 = Pixley, Cokeville Meadows National Wildlife Refuge (CMNWR); Site 3 = Rush Lake, Hutton Lake National Wildlife Refuge; Site 4 = Table Mountain Wildlife Habitat Management Area (WHMA); Site 5 = Teichert, Cokeville, WY; Site 6 = Thornock, CMNWR; Site 7 = Yellowtail East, Yellowtail WHMA; Site 8 = Yellowtail South, Yellowtail WHMA; Site 9 = Yellowtail West, Yellowtail WHMA. Surveys could not be conducted at 2 sites due to flooded conditions—Ocean Lake Wildlife Habitat Management Area and Pope, Cokeville, WY.

LONG-TERM MONITORING OF AVIAN GRASSLAND SPECIES OF GREATEST CONSERVATION NEED IN WYOMING: SUMMARY OF YEAR 5 RESULTS

Grasslands are known to be among the most biologically productive of all plant communities (Williams and Diebel 1996). Their exceptional productivity is a result of a high retention of nutrients, efficient biological recycling, and a structure that provides for an immense assemblage of animal and plant life (Estes et al. 1982). However, land conversions from native prairie to agricultural uses, industrialization including wind energy development and natural resource extraction, the introduction and spread of invasive and noxious plants, urbanization, fire suppression, wetland draining, and the removal of native grazers have transformed the grasslands of the Great Plains into one of the most imperiled ecosystems in North America (Knopf 1996; Samson et al. 1998; Fellows and Jones 2009). Substantial declines in avian populations have occurred due to degradation of grassland ecosystems, including those of the Great Plains; as a group, grassland birds have shown steeper, more consistent, and more widespread declines than any other guild of species in North America (Knopf 1992, 1994, 1996).

In 2003, Wyoming Partners in Flight participants presented information, issues, and recommendations for priority species in the Wyoming Bird Conservation Plan, Version 2.0 (Nicholoff 2003). Recommendations included dedicated monitoring for priority species. In 2006, Wyoming Game and Fish Department (Game and Fish) Nongame Program personnel developed a Plan for Bird and Mammal Species of Greatest Conservation Need in Eastern Wyoming Grasslands (Grassland Plan) that identified habitat and species issues and presented objectives to address these concerns (WGFD 2006). The objectives included maintaining inventory and monitoring programs for wildlife populations, working toward removing species from Species of Greatest Conservation Need (SGCN) classification, and working cooperatively with landowners to achieve common goals. The Wyoming State Wildlife Action Plan (SWAP) further identifies problems, conservation actions, and monitoring and research needs for all SGCN (WGFD 2017). Two grassland endemics—Mountain Plover and Long-billed Curlew—and two secondary grassland associates—Burrowing Owl and Upland Sandpiper—are classified as SGCN in the SWAP (WGFD 2017).

This project addresses these four avian SGCN, three of which are classified as Native Species Status Unknown (NSSU; WGFD 2017) and will benefit greatly from a dedicated monitoring program. Current long-term monitoring programs (i.e., Breeding Bird Survey and Integrated Monitoring in Bird Conservation Regions) adequately monitor numerous species of birds in Wyoming, but do not sufficiently quantify population parameters for these four grassland species due to the seasonal timing during which the surveys are conducted and/or the survey techniques used.

The Mountain Plover is an uncommon summer resident in Wyoming (Orabona et al. 2016) with a NSSU, Tier I (highest conservation priority) classification in the SWAP (WGFD 2017). A narrow range of habitat requirements combined with a high degree of site fidelity and susceptibility to disturbance during the nesting season increases its vulnerability to impacts that occur at breeding sites. In addition, crucial breeding areas are only partially identified, so management efforts may not adequately address conservation needs. Throughout its breeding range, the Mountain Plover is classified as uncommon to relatively common, but the species exists in low densities. The Mountain Plover was previously petitioned for listing as Threatened under the federal ESA on two separate occasions, further emphasizing the need to adequately determine population status (USFWS 1999, 2010).

The Upland Sandpiper is an uncommon summer resident in Wyoming (Orabona et al. 2016) with a NSSU, Tier II (moderate conservation priority) classification in the SWAP (WGFD 2017). Populations in eastern Wyoming may be experiencing serious declines due to habitat conversions, the encroachment of woody vegetation into grassland habitats, humanization, and the invasion of noxious species, all of which severely degrade breeding habitat for this species. Upland Sandpipers are also sensitive to human disturbance during the breeding season. Population status and trends are largely unknown in Wyoming, and current monitoring programs do not adequately track this species because populations occur at low densities.

The Long-billed Curlew is an uncommon summer resident in Wyoming (Orabona et al. 2016) with a NSS3, Tier II classification in the SWAP (WGFD 2017). Although the breeding status is well known in the northwestern portion of Wyoming and monitoring is on-going, populations in eastern Wyoming are not well documented and may be declining significantly. Habitat degradation is one of the most considerable threats to this species, particularly in the Great Basin grasslands.

The Burrowing Owl is an uncommon summer resident in Wyoming (Orabona et al. 2016) with a NSSU, Tier I classification in the SWAP (WGFD 2017). It has experienced range-wide contractions due to habitat loss and degradation and the elimination of burrowing rodents. While distribution of this species is understood in the state, there is concern about the impacts of ongoing and proposed oil, gas, and wind energy development in Burrowing Owl habitat in Wyoming, and informed management decisions are difficult to make without adequate occupancy and population trend information.

Wyoming contains substantial areas of known and potential habitat for these SGCN, including areas where habitat degradation and conflicts with industrialization are likely to occur in the near future. However, due in part to personnel and funding constraints, important breeding areas and population status are only partially identified, which makes effective statewide management decisions challenging. Once we are able to implement targeted monitoring for these species, we can use survey results to address concerns, data deficiencies, and conservation actions presented in the Wyoming Bird Conservation Plan (Nicholoff 2003), Grassland Plan (WGFD 2006), and SWAP (WGFD 2017).

As part of a pilot study, we used existing information to identify preferred breeding habitat for our focal species, and followed standardized, peer-reviewed survey techniques specifically designed for each of our focal SGCN to delineate our survey routes. The survey methods vary across the 4 species, but all follow a road-based, point-count methodology with point-count locations grouped into routes. In 2019, we refined our survey methodology for some species to be able to use distance sampling or removal model approaches for generating detection probability-corrected estimates of occupancy and abundance. Due to the low number of late season detections reported in years 2015-2018, we also established and evaluated the use of an early season Mountain Plover survey to increase detection probability and sample size.

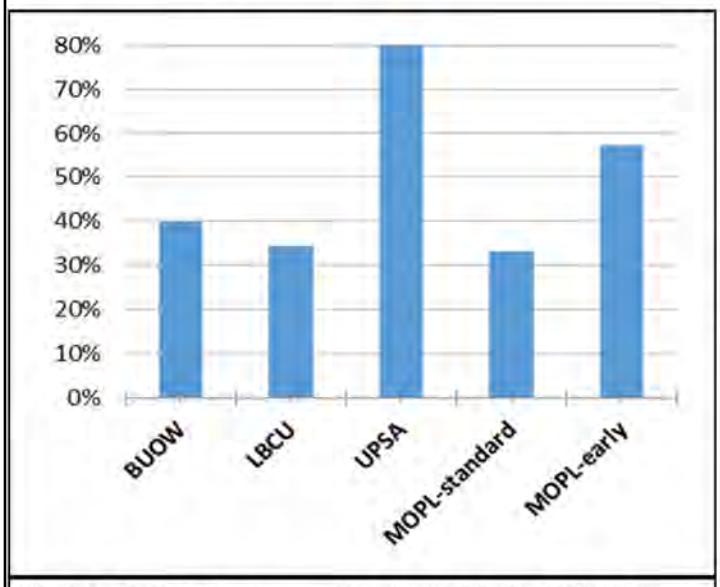


Figure 1. Percent of survey routes with detections, broken down by species.

Overall we surveyed a total of 91 routes in 2019; 15 standard (late season) and 15 early season trial Mountain Plover routes, 15 Upland Sandpiper routes, 32 Long-billed Curlew routes, and 15 Burrowing Owl routes. We detected birds on 33% of the late season Mountain Plover routes, 57% of the early season trial Mountain Plover routes, 80% of the Upland Sandpiper routes, 34% of the Long-billed Curlew routes, and 40% of the Burrowing Owl routes (Figure 1). We detected a total of 420 birds over the season; 62 Mountain Plovers, 124 Upland Sandpipers, 185 Long-billed Curlews, and 49 Burrowing Owls (Figure 2). We detected 11 times more Mountain Plovers in the early season trial (n=55) versus the late season (n=5), and had detections on twice as many early season routes (n=8) than late season routes (n=4). We also found that there were no sites with late season detections that did not also have early season detections. In 2020, we plan to repeat the early season Mountain Plover trial to see if we can replicate the success of the 2019 results; we also plan to analyze the data collected from 2015-2019 to obtain estimates of occupancy and abundance of these four SGCN in Wyoming.

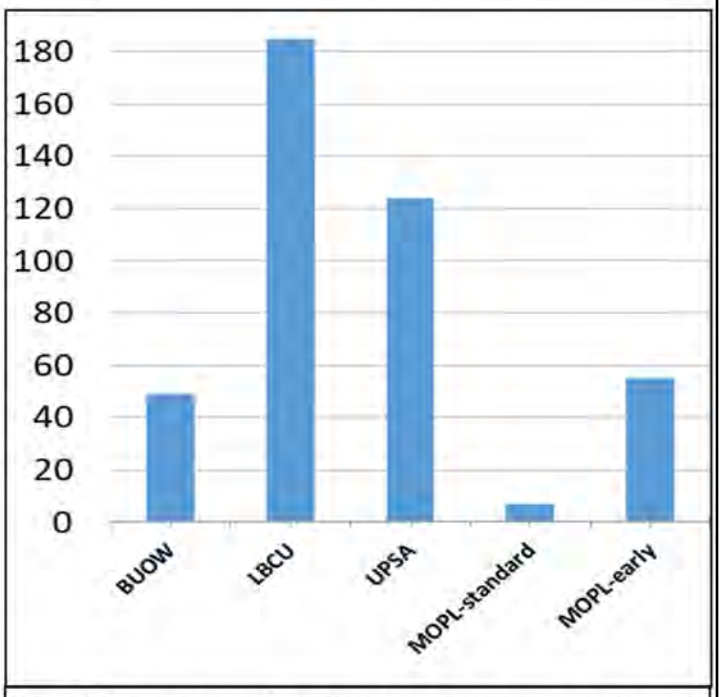


Figure 2. Raw number of detections of each species over the course of the 2019 survey season.

Prepared by:
Andrea Orabona, Nongame Bird Biologist; Katherine Sauer, Nongame Biologist

Funding Source:
Wyoming Game and Fish Department

2019 RAPTOR NEST SURVEY FOR THE UNITED STATES FOREST SERVICE THUNDER BASIN NATIONAL GRASSLANDS

Photo by Mike Lockhart

The purpose of this study is to inventory known raptor nests and document new raptor nest locations on the United States Forest Service Thunder Basin National Grasslands (USFS TBNG) in northeastern Wyoming. Several raptor species that may inhabit the TBNG (American Kestrel, Golden Eagle, Ferruginous Hawk, Swainson's Hawk) are listed as Species of Greatest Conservation Need in the Wyoming State Wildlife Action Plan (WGFD 2017). Some are year-round residents and some are migratory species.

A cost-share agreement to survey for nesting raptors was initiated in 1996 between TBNG and the Wyoming Game and Fish Department (Game and Fish), and has continued periodically since (1996-1999, 2001, 2004-2006, 2008, and 2017-2019). During all survey years, priority survey areas included specific portions of the TBNG as designated by USFS personnel. Surveys in 2019 focused on Priority Area 5 within the TBNG (Figure 1).

Funding for this cooperative effort was provided by the USFS TBNG. Wyoming Game and Fish Department Nongame Program personnel conducted all aerial surveys and prepared the final report.

In May 2019, we conducted aerial surveys with Flightline Laird Flying Service (Gillette, Wyoming) using an Aviat Husky fixed-wing aircraft. We flew north/south transects, with transects placed 600 m apart for compatibility with other Wyoming raptor surveys.

Ferruginous Hawk nest. Photo by: Pete Arnold.

We used a standardized raptor nest survey data sheet and survey codes developed by Game and Fish in cooperation with numerous stakeholders and raptor experts from public agencies and private organizations. The data sheet and codes were first field tested by the author during the 2018 raptor nest surveys.

Figure 1. Designated Raptor Nest Survey Priority Areas in the United States Forest Service Thunder Basin National Grasslands. In May 2019, we completed aerial surveys of Priority Area 5.

All nests we located were georeferenced using Universal Transverse Mercator (UTM) coordinates. We also used an on-board Global Positioning System (GPS) unit to maintain accurate flight patterns on survey transects and as a backup recording system, if needed.

Each nest we located was checked for evidence of nesting activity and the presence of adult birds, young birds, or eggs. We recorded the nest status, nest status level, nest outcome, physical condition of each observed nest, nest substrate, nest type, and the primary habitat type in which each nest occurred. We recorded all raptor nests encountered, regardless of activity status or condition. Due to inclement spring weather that was not compatible with conducting aerial surveys, we were only able to spend 7.5 hours of flight time to survey Priority Area 5.

During the May 2019 survey, we located a total of 35 raptor nests within the Thunder Basin National Grasslands Priority Area 5 (Figures 2 and 3). We located 7 occupied raptor nests—Ferruginous Hawk (*n*=1), Golden Eagle (*n*=1), and Red-tailed Hawk (*n*=5). Occupied nests are those with one or two adults present at or near the nest and/or fresh lining material in the nest. We also recorded 28 unoccupied raptor nests (Figures 2 and 3)—Golden Eagle (*n*=13), Red-tailed Hawk (*n*=14), and unknown raptor species (*n*=1). Unoccupied nests are those with no apparent recent use or adult presence at the time of observation. All nests were located in cottonwood trees in riparian habitat along creeks or rivers, or in cottonwood trees growing in ephemeral drainages within grassland habitat or a combination of sagebrush/grassland habitat. Ferruginous Hawks and Golden Eagles are classified as Species of Greatest Conservation Need in the 2017 Wyoming State Wildlife Action Plan.

The 2019 survey coincided with the timing of the incubation and hatching stages for Ferruginous Hawks and the incubation, hatching, and nestling stages for Golden Eagles. Although the 2019 survey was conducted in mid -May, we still noted a lack of Swainson's Hawk detections. In addition, falcons (such as the American Kestrel and Prairie Falcon) cannot be effectively detected using fixed-wing aircraft surveys. These species require adequate ground or helicopter surveys instead, neither of which were conducted in 2019.

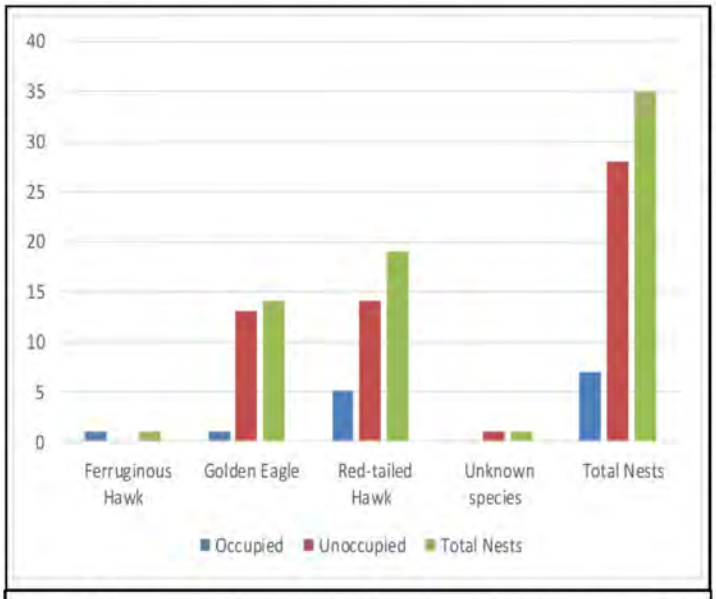


Figure 2. A summary of occupied and unoccupied nests by species and total number of nests located during the 2019 raptor nest survey we conducted for the US Forest Service Thunder Basin National Grasslands Priority Area 5.

The prolonged wet spring weather in 2019 likely contributed to the limited raptor nesting activity we observed overall in the reduced number of survey days. Thus, the absence of records in 2019 for raptor species known to occupy habitats in eastern Wyoming should not be considered documentation that they do not occur in the Priority Area surveyed.

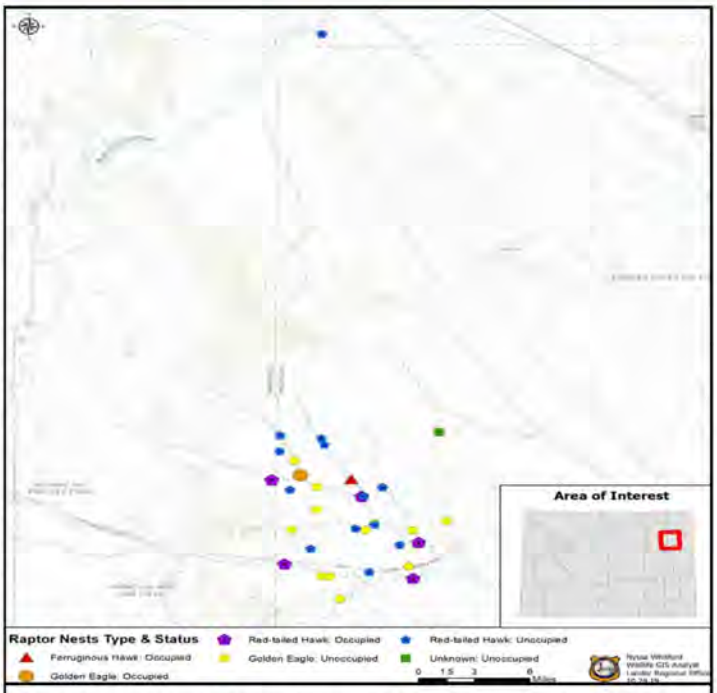


Figure 3. Locations of raptor nests we detected during the 2019 aerial survey of the US Forest Service Thunder Basin National Grasslands Priority Area 5. Note the different colored symbols denoting occupied and unoccupied nests.

Lastly, the prey base (black-tailed prairie dogs) for all expected raptor species in the area was substantially affected by a recent sylvatic plague outbreak, which inevitably had negative effects on raptor nest occupancy and productivity during the 2019 breeding season.

Prepared by:
Andrea Orabona, Nongame Bird Biologist

Funding Sources:
United States Department of Interior,
US Forest Service, Thunder Basin National Grasslands;
Wyoming Game and Fish Department

Photo by: USFWS National Digital Library

SUMMARY OF PEREGRINE FALCON MONITORING IN WYOMING

The Peregrine Falcon is an uncommon year-round resident in Wyoming (Orabona et al. 2016). It is designated as a Species of Greatest Conservation Need with a Native Species Status 3 (NSS3), Tier II (moderate conservation priority) in the Wyoming State Wildlife Action Plan (WGFD 2017). Nesting Peregrine Falcons (peregrines) were mostly extirpated from Wyoming, and national population trends warranted the US Fish and Wildlife Service (USFWS) to de-list the species in 1999 (USDI 1999). Cade et al. (2003) detailed factors contributing to the national endangered species status and recovery of the species prior to the 1970s (Oakleaf and Craig 2003). We did not locate any nesting pairs during surveys from 1978-1983. We documented the first nesting pair in1984, and at least 121 nesting territories in Wyoming by 2015. Recovery of peregrines in Wyoming resulted from nationwide restrictions on the use of the insecticide dichlorodiphenyltrichloroethane (DDT), and reintroduction of 325 captive produced young in Wyoming, 1980-1995 (Oakleaf and Craig 2003, Enderson et al. 2012, Baril et al. 2015). We have not released peregrines since 1995 because we attained project objectives in 1994-1995, and the species was subsequently de-listed at the national level in 1999. We do, however, continue monitoring efforts, as populations are relatively limited.

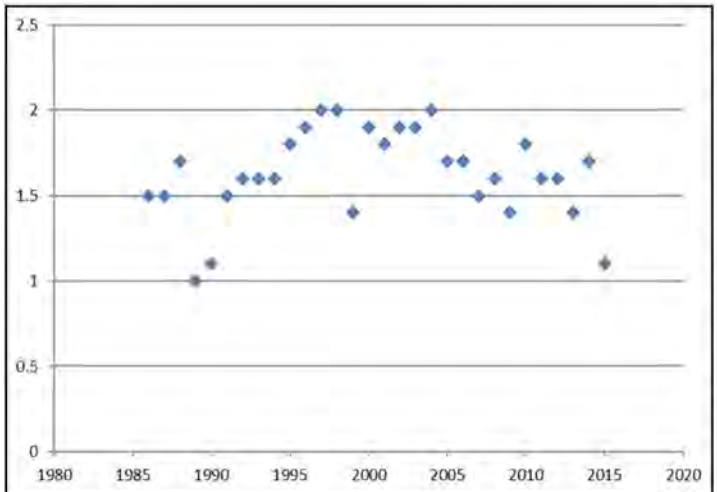


Figure 1. Average young per occupied Peregrine Falcon nest site in Wyoming, 1986-2015. Data for 1984-1985 are not included, as there was only 1 site.

The Wyoming Game and Fish Department, Yellowstone National Park, and Grand Teton National Park continued monitoring nesting success of peregrines until 2015. We documented the production of over 1,057 nesting attempts of peregrines in Wyoming (Figure 1).

Portions of monitoring included cooperative efforts with the USFWS post de-listing protocol (USDI 2003). We followed standard raptor monitoring protocol and terminology (Steenhoff and Newton 2007). Continued monitoring of nesting success beyond 2015 is warranted due to the large investment for recovery, continued high public interest, and the concept that peregrines have proven valuable as an environmental indicator. Although DDT has been banned, other potentially detrimental compounds are likely to be developed that may become concentrated in the food chain and affect top level predators. For example, Baril et al. (2015) reviewed the literature relating to potential risks of compounds within the family of brominated flame retardants. DeWeese et al. (1986) provided additional information on organochlorine contaminants in peregrine prey. In addition, the potential risks to avifauna from some diseases such as West Nile Virus are not well known.

The monitoring database for Wyoming peregrines was extremely costly to collect. Such expenditures and effort will likely never be repeated. Yet, if we take advantage of the opportunity to use the database as a foundation for continued monitoring, expenditures could be minimal and a fraction of what it would take to recreate such a foundation, if ignored for years. Some of our preliminary findings could guide future monitoring efforts.

The amount of effort required to annually monitor a nesting site can vary from a few hours to several days depending on the location, characteristics of the site, and other factors influencing logistics. We compared sites that were easy to monitor to more difficult sites. The criteria for a site to be classified as easy included sites that are within 2 hours from the nearest town with public access, have a good view conducive to a complete young count, have a history of few alternate sites, and have recent years of occupancy. Sites with less than 3 years of monitoring were not included in the analysis. We found that easy sites averaged as many or higher young per occupied site than more difficult sites (Table 1). We believe that complete counts of mature young are more likely to occur at easy sites, and factors such as nearby roads do not negatively impact production. Monitoring of these sites could also be completed with less experienced personnel or trained volunteers. Monitoring of these sites could also be completed with less experienced personnel or trained volunteers, and the Game and Fish appreciate the help of these volunteers.

Evaluations of Wyoming data indicate that we can focus on

indices requiring less effort. Past monitoring protocol required occupancy surveys during early phases of the nesting season. Once established, we found that nearly all known nest sites were reoccupied in following years. The few sites (<3%) recorded as not occupied were mostly associated with incomplete understanding of alternate nesting sites or, in a few cases, the establishment of nesting at extremely marginal sites. All of the sites recommended for long term monitoring do not have any years when they were recorded as not occupied; all (100%) were occupied during years surveyed. Therefore, we recommend a monitoring scheme that assumes all sites are occupied and primarily focuses on documenting the number of mature young during the fledging period.

Survey area [a]	Easy to survey [b]		Difficult to survey	
	n	Young/ occupied nest	*n*	Young/ occupied nest
YNP	12	1.7	16	1.6
BTGTA	10	1.9	11	1.3
SBHNF	17	1.9	16	1.7
All	39	1.8	43	1.5

Table 1. Average production recorded at Peregrine Falcon nesting sites that were classified as easy to survey compared to difficult sites to survey.

[a] Includes Yellowstone National Park (YNP); Bridger-Teton National Forest, Grand Teton National Park, and adjacent areas (BTGTA); and the Shoshone and Bighorn National Forests and nearby habitats (SBHNF).

[b] Sites classified as easy to monitor can be accessed within 2 hours from the nearest town, have public access, have a good view conducive to a complete count of young, have a history of few alternate sites, and have recent years of occupancy. Sites with less than 3 years of monitoring were not included in the analysis.

In addition to monitoring the number of young at these historic sites, we still need data at many locations in Wyoming before they can be classified as established peregrine nesting sites. For example, in 2016 we documented peregrine young at 7 sites where only adults had been recorded previously. The database includes 21 probable nesting sites that should be surveyed until young have been documented. In addition, there are reports of nesting peregrines at 3 sites that need further documentation while the information is current.

We recommend selecting 5 of the easy nest sites for each survey area. Ideally, nest sites with the most years of data would be selected. In addition, Grand Teton National Park may continue to monitor nest sites (*n*=5) within the Park, and results could be additive or evaluated separately. Approximate survey dates can be identified from previous fledging data. Trained volunteers or agency personnel should plan at least 1 day in July to record success and number of young at selected sites according to survey protocol. We also recommend that experienced personnel follow-up on reports or survey sites that need better documentation.

A summary of 2019 survey results is presented below.

Selected Monitoring Sites

Selected Site 1: 4/23/2019—2 adults and several copulations; 4/25/2019—2 adults, female incubating; 5/30/2019—2 adults feeding young; 6/7/2019—2 adults; 6/20/2019—no adults or young; 6/25/2019—no adults.

Selected Site 2: 4/17/2019—2 adults, incubation was probably started.

Selected Site 3: 7/22/2019—1 adult male and 2 fledglings.

Selected Site 4: 7/12/2019—2 adults and 3 young that were largely feathered.

Selected Site 5: 4/17/2019—2 adults and 4 copulations, but not incubating; 7/10/2019—2 adults, no young observed.

Selected Site 6: 7/18/2019—2 adults and 2 fledglings not yet flying; 8/8/2019—2 adults and 2 young flying.

Additional Sites

Additional Site 1: 4/17/2019—1 adult (female?).

Additional Site 2: Not checked in 2019.

Additional Site 3: Not checked in 2019.

Additional Site 4: Not checked in 2019.

New Sites

New Site 1: 4/17/2019—1 adult, presumed to be a male; 6/12/2019—2 adults, female feeding young, could not see into the eyrie; 7/6/2019—2 adults, 2 young flying.

New Site 2: Not checked in 2019.

New Site 3: 1 adult and 3 fledged young on 16 July; a subadult female was set up on this cliff in 2013, so this would be briefly checked coming and going to nearby sites.

Prepared by:
Andrea Orabona, Nongame Bird Biologist;
Courtney Rudd, Nongame Biologist,
Susan Patla, retired, WGFD

Funding Source:
Wyoming Game and Fish Department

WYOMING PARTNERS IN FLIGHT AND INTEGRATED MONITORING IN BIRD CONSERVATION REGIONS

Photo by: Bruce Gallinger

Long-term data analyses indicate that population trends for many species 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 that benefit 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 among the governments and citizens of Canada, the US, and Mexico (NABCI 2016).

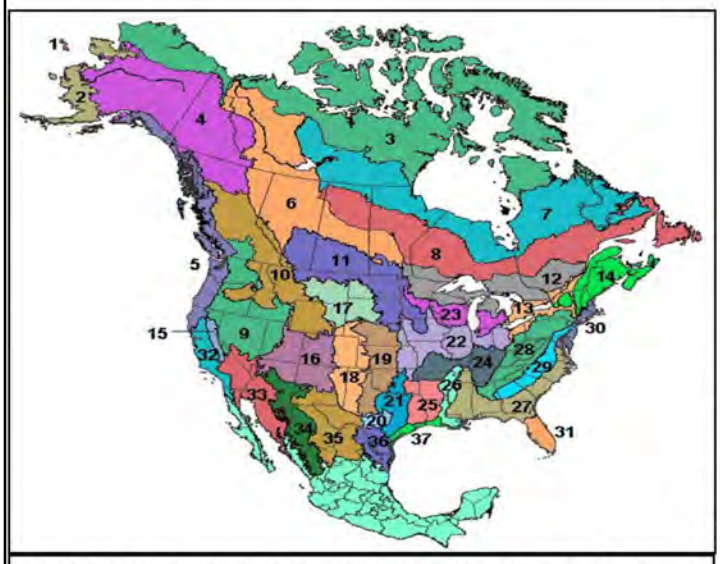


Figure 1. Bird Conservation Regions (BCRs) throughout North America, excluding Hawaii and Mexico. (Source: http://nabci-us.org/resources/bird-conservation-regions-map/.)

The state PIF working group, Wyoming Partners in Flight (WYPIF), was established in 1991. Participants include Wyoming Game and Fish Department (Game and Fish), Bird Conservancy of the Rockies (Bird Conservancy), Bureau of Land Management (BLM), US Forest Service, US Fish and Wildlife Service, National Park Service, Bureau of Reclamation, Audubon Rockies and affiliate chapters, Wyoming Natural Diversity Database, University of Wyoming, and The Nature Conservancy. The Game and Fish Nongame Bird Biologist serves as the WYPIF chairperson. 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 populations of birds and the habitats they require remain intact and viable into the future through proactive and restorative management techniques. Many components of the Plan have been used to develop portions of the 2017 Wyoming State Wildlife Action Plan (Department 2017).

Figure 2. The spatial extent of the Bird Conservation Regions sampled in 2019 using the IMBCR design.

One of the highest priority objectives throughout the Plan for populations of birds is to implement robust population monitoring programs. Population monitoring 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 (Lyons et al. 2008, Alexander et al. 2009) and landscape and climate changes (Baron et al. 2008, Lindenmayer and Likens 2009).

In conjunction with many partners, Bird Conservancy conducted the 12th consecutive year of landbird monitoring in 2019 using the Integrated Monitoring in Bird Conservation Regions (IMBCR) program. IMBCR uses a spatially balanced sampling design that allows inferences to avian species occurrence and population sizes at various scales (local management units, entire states, or regions). This facilitates conservation at both local and national levels. The IMBCR sampling design allows analysts to estimate species densities, population sizes, occupancy rates, and trends, providing an understanding of the status and annual changes of bird populations. Collaboration across different organizations and spatial scales increases sample sizes and improves the accuracy of population estimates. Analyzing the data collectively permits us to estimate detection probabilities for species that would otherwise have an inadequate number of detections at local scales. The IMBCR partnership's 6 monitoring objectives are listed in the 2019 IMBCR Field Season Report (McLaren et al. 2020).

Bird Conservation Regions (BCRs) provide a spatially consistent framework for the IMBCR program (Figure 1). In 2019, IMBCR covered all or parts of 16 states, 4 USFS Regions, and 10 BCRs (Figure 2). All monitoring partners collaborated to define strata and superstrata within the BCR sampling frame based on smaller-scale areas upon which we wanted to make inferences (e.g., National Forests, BLM lands, individual states). Bird Conservancy biometricians overlaid BCRs with 1 km^2 sample grids, randomly selected the grids to survey, and used a 4 x 4 point count array with 16 survey points spaced 250 m apart and 125 m from the grid boundaries within each sample grid (Hanni et al. 2018). A minimum of 2 sampling grids within each stratum are required to adequately estimate the variances of population parameters, (McLaren et al. 2020). Wyoming contains 37 strata (Figure 3).

Between 23 May and 19 July 2019, field technicians completed 185 of 186 planned surveys (99.5%), conducted 2,424 point counts within the 185 surveyed grid cells, and detected 196 bird species, including 46 Species of Greatest Conservation Need (SGCN; McLaren et al. 2020). Bird Conservancy biometricians were able to estimate occupancy (the proportion of 1 km^2 grid cells occupied; Psi, ψ) for 218 species that have been detected in any given year of the monitoring program, including 39 SGCN (18%; McLaren et al. 2020). Data provided robust occupancy estimates (CV <50%) for 133 of the 218 species detected, including 67 SGCN (50%; McLaren et al. 2020). Biometricians were able to estimate density (*D*) and population size (*N*) for 210 species that were detected in any given year of the monitoring program, including 55 SGCN (26%; McLaren et al. 2020). Data provided robust density estimates (CV <50%) for 100 of the 210 species (48%), including 66 SGCN (66%; McLaren et al. 2020).

Annual and multi-year reports, species accounts, and density estimate tables and graphs are available on the Rocky Mountain Avian Data Center web site (Bird Conservancy 2020). To view a map of survey locations in Wyoming; occupancy, density, and population estimate results; and species counts across all years of the IMBCR program, follow the link below, click "OK" on the disclaimer box, and click the "Run Query" button highlighted in red near the top of the page. To view just the 2019 field season results, follow the link, select "Year" from the Filter drop down box on the top left of the screen, click the "Add" button, select 2018, click "Add Filter", and then click "Run Query" (McLaren et al 2020).

www.rmbo.org/new_site/adc/QueryWindow.aspx#N4IgzgrgDgpgTmALnAhoiBbEAuABCAdQE0QBfIAA

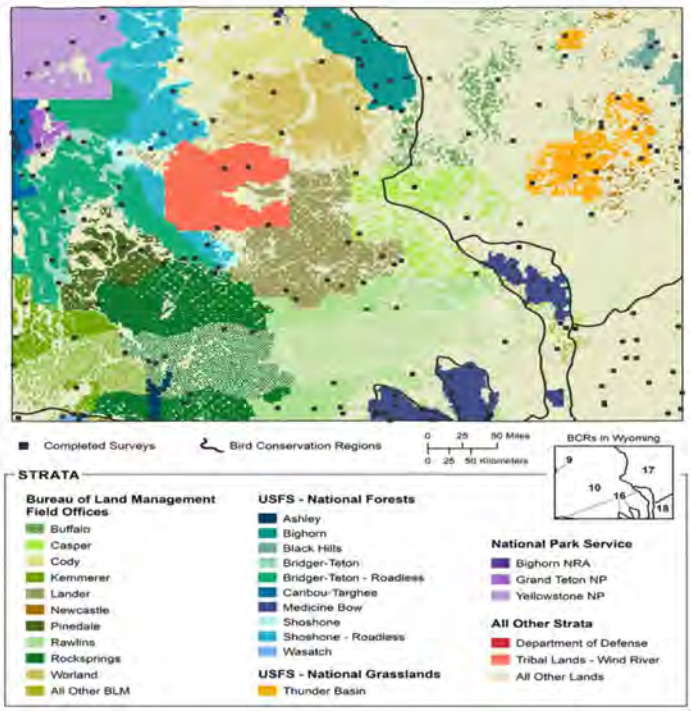


Figure 3. 2019 survey locations in Wyoming.

Prepared by:
Matthew McLaren, Matt Smith, Jennifer Timmer, Nancy Drilling, Adam Green, B.J. Leslie, Chris White, Nick Van Lanen, David Pavlacky, Rob Sparks, and Alex Van Boer, Bird Conservancy of the Rockies;
Andrea Orabona, Nongame Bird Biologist

Funding Sources:
Bureau of Land Management, National Park Service, US Fish and Wildlife Service State Wildlife Grant, US Forest Service, Wyoming Game and Fish Department

Photo by: Pete Arnold

USING THE BREEDING BIRD SURVEY TO MONITOR POPULATIONS OF AVIAN SPECIES IN WYOMING

The Breeding Bird Survey (BBS) has provided long-term monitoring of a variety of avian species in Wyoming since 1968. The BBS is used to monitor trends of breeding birds across North America. The BBS is sponsored jointly by the United States Geological Survey (USGS) Patuxent Wildlife Research Center (PWRC) and the Canadian Wildlife Service. This roadside survey methodology was field tested in 1965 and formally launched in 1966, with 600 routes established in the US east of the Mississippi River and in Canada (Sauer et al. 1997). In 1967, the BBS spread to the Great Plains states and prairie provinces. By 1968, about 2,000 BBS routes were set up across southern Canada and the contiguous 48 states, and more than 1,000 routes were surveyed annually; establishment of Wyoming's routes were included in this effort. During the 1980s, the BBS expanded further into Alaska and Canada's Yukon and Northwest Territories, and additional routes were added in many states. Today, over 4,600 BBS routes are located across the continental US and Canada, including 108 active routes in Wyoming (Figure 1).

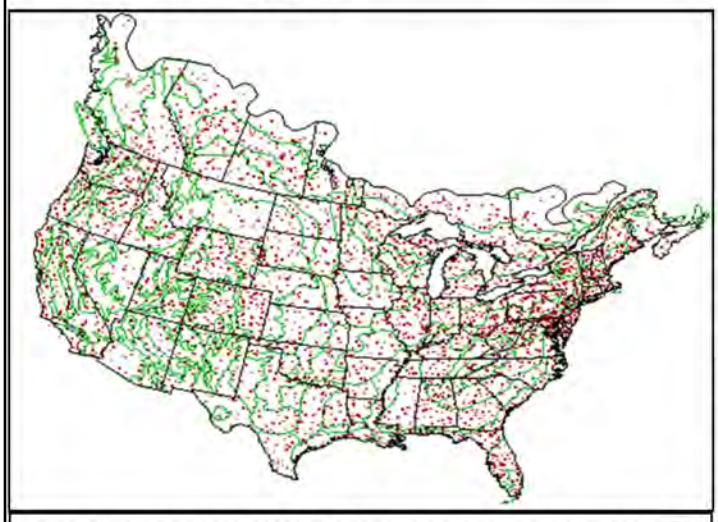


Figure 1. Location (red dots) of all Breeding Bird Survey routes in the United States and Canada (Sauer et al. 1997).

The BBS was designed to provide a continent-wide perspective of avian population change. All routes have been randomly located in order to sample habitats that are representative of the entire region. Other requirements are needed to produce comparable data over time (consistent methodology, observer expertise, visiting the same stops each year, and conducting surveys under suitable weather conditions; Sauer et al. 1997). A large sample size (i.e., number of routes conducted) is needed to average local variations and reduce the effects of sampling error.

BBS data can estimate population trends and relative abundance of individual species at continental, regional, statewide, and physiographic region scales. The most effective use of BBS data is to analyze population change on survey routes; however, these data do not provide an explanation for the causes of population trends. To evaluate population changes over time, BBS indices from individual routes are combined to acquire regional and continental estimates of trends (Sauer et al. 1997).

Due to the scope of the BBS effort, there is always a lag time between data submittal by observers and data release from USGS PWRC. Despite the BBS's best efforts, final data from the survey year immediately preceding is usually not available in time to meet Wyoming Game and Fish Department (Game and Fish) spring reporting deadlines. Furthermore, BBS trend analysis is not released on an annual basis. As such, this year's reporting includes various degrees of information for survey years 2018, 2019, and basic trend analysis for certain Species of Greatest Conservation Need (SGCN) through 2017.

Volunteers are instructed to conduct BBS routes during the height of the avian breeding season when birds are most vocal. This is typically during the month of June, although routes in higher elevations can be conducted through the second week of July. Each route is 24.5 miles long and consists of 50 stops spaced at 0.5 mile intervals along the route. Beginning 0.5 hour before sunrise, observers record birds seen within a 0.25 mile radius and all birds heard at each stop during a 3-minute count period. Each BBS route is surveyed once annually, and data are submitted to the USGS PWRC for analysis.

2018 Results. In 2018, observers surveyed approximately 2,665 of 3,563 (75%) active routes in the US. In Wyoming, 37 observers surveyed 62 of the 108 (57%) available routes. Many of these volunteers survey 2 or more routes. Since 1990, the number of routes surveyed in Wyoming has decreased by 0.35 routes per year (Figure 2). Consistent with this trend, the number of routes surveyed in 2018 (i.e., 62 routes) was less than the average number of routes completed from 1990-2016 (66 routes).

Observers detected 29,648 individual birds representing 183 species in Wyoming. Since 1990, the number of individual birds detected has decreased by 4.0 individuals per route per year, while the number of species detected has increased by 0.14 species per route per year. Consistent with the first trend, the number of individuals detected per route in 2018 (478 individuals) was less than the average number of individuals

detected per route from 1990-2017 (528 individuals). However, the number of species detected per route in 2018 (39 species) was about the same as the mean number of species detected per route from 1990-2017 (38 species).

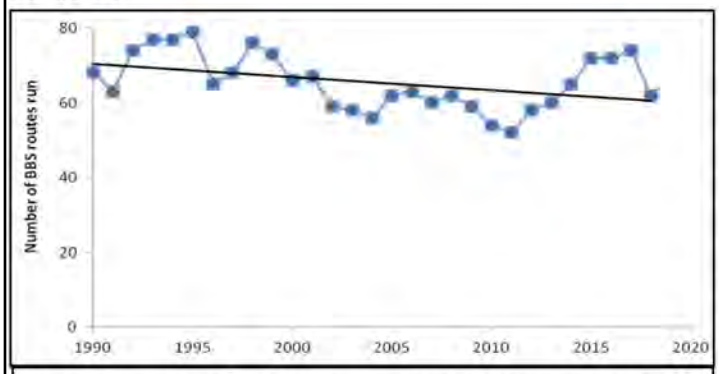


Figure 2. Number of BBS routes completed in Wyoming, 1990-2018. The black trend line is shown for reference.

Of the 183 species detected in 2018, 38 are SGCN. As of our publishing deadline, the BBS had not posted trend analysis for 1968-2018 to their website. We will incorporate trend analysis in next year's report, if it is available, in order to determine whether there are notable trends in SGCN populations.

2019 Results. As of our publishing deadline, the BBS had not posted final 2019 data. Additionally, the 2019 report Summary of Annual Effort is not yet available. However, limited preliminary data are available and indicate 39 observers surveyed 62 of the 108 (57%) active routes in Wyoming. Like 2018, many of these volunteers survey 2 or more routes. The draft data indicate 27,513 individual birds were detected, representing 186 species. Additional trends typically calculated will be incorporated into next year's report.

1968-2017 Trend Analysis. The BBS recently published trend analysis for survey data through 2017. For purposes of this report, we examined trend analysis for Game and Fish's 80 avian SGCN only. Remaining species trend analysis is available at the BBS website: https://www.mbr-pwrc.usgs.gov/ (Sauer et al. 2019). BBS data for each species are assigned a credibility category: *important deficiency* (i.e., very small sample size), *with deficiency* (i.e., small sample size), and *meets standards* (i.e., at least 14 samples in the long term, of moderate precision, and of moderate abundance on routes.). We report trends for the 9 SGCN that are in the *meets standards* category for both the US and Wyoming. Brewer's Sparrow, Clark's Nutcracker, Common Nighthawk, Greater Sage-Grouse, Loggerhead Shrike, Red Crossbill, and Sage Thrasher all demonstrated non-significant population declines at the state level; at the national level, only Clark's Nutcracker, Red Crossbill, and Sagebrush Sparrow demonstrated non-significant population declines. Of particular note, Brewer's Sparrow, Common Nighthawk, Grasshopper Sparrow, Greater Sage-Grouse, Loggerhead Shrike, and Sage Thrasher all demonstrate significant population declines nationwide. Conversely, Sagebrush and Grasshopper Sparrows demonstrated population increases in Wyoming, while the former demonstrates a significantly increasing population. One SGCN, American Kestrel, fell into the *meets standards* category at the state level, but not at the national level. This species currently demonstrates a significant population decline per the Wyoming dataset.

BBS trend analysis will continue to contribute Game and Fish's recommendations for future monitoring of these and additional SGCN, especially those exhibiting significant population declines at the state level. Additional regional and local datasets will also be consulted as a component of ensuring which Wyoming avian species and their associated habitats warrant further investigation by the Game and Fish. These trends also contribute to future decisions about which avian species will be included on the SGCN list in Wyoming's State Wildlife Action Plan.

We would like to thank the many volunteers and biologists from this and other natural resources management agencies for their valuable contributions to the 2018 and 2019 Breeding Bird Survey. The continued dedication of these individuals and agencies to this monitoring effort makes it possible to collect long-term population trend data on avian species in Wyoming. In closing, the consistent recruiting and retainment of knowledgeable volunteers to conduct active routes is critical to ensuring the future success of the BBS and our ability to continue to adequately monitor Wyoming populations of breeding birds.

Prepared by:
Courtney Rudd, Nongame Biologist; USGS Patuxent Wildlife Research Center

Funding Sources:
Bureau of Land Management Cooperative Agreement,
Bureau of Reclamation Cooperative Agreement,
National Park Service Cooperative Agreement,
United States Fish and Wildlife Service Cooperative Agreement,
United States Forest Service Cooperative Agreement,
Wyoming Game and Fish Department

TRANSCONTINENTAL TRAVEL: MIGRATION OF WYOMING'S BURROWING OWLS ACROSS NORTH AMERICA

Burrowing Owls used to be common across grasslands in the United States and Canada during the summer breeding season. However, in some parts of the owls' breeding range, decades of survey data show that their populations have declined and their distribution has contracted. To understand the reasons why, we also need to know where Burrowing Owls spend the winter months and their migration pathways between their breeding grounds and wintering grounds.

The Burrowing Owl is listed as a Tier II (moderate conservation priority) Species of Greatest Conservation Need in the 2017 Wyoming State Wildlife Action Plan with a Native Species Status of Unknown (NSSU; WGFD 2017). The reasons for this listing include currently unknown population trends, habitat loss or a decline in the quality of habitat, and land use practices that may be incompatible with the owls.

One potential cause of declines is the elimination of prairie dogs across the owls' range. Year-round, Burrowing Owls need prairie dog burrows for nesting sites, shelter, and to escape from predators. Other potential causes of declines include control of grasshopper outbreaks (food), changes in prairie dog populations due to the disease plague (fewer burrows for owls), or problems along the owls' migration routes or on their wintering grounds.

To address knowledge gaps for this species, the Wyoming Game and Fish Department became a partner in a regional Burrowing Owl study that includes 11 states in the western United States and 3 provinces in Canada. Since 2013, almost 100 Burrowing Owl adults have been captured on their breeding grounds across the region and fitted with solar-powered transmitter backpacks so biologists can follow their seasonal movements. We call this a full annual life-cycle conservation project.

In July 2019, 15 project partners, 17 organizations (state and federal agencies, University of Wyoming, private consultants, and the coal industry), and 16 volunteers across the state helped us locate nests, capture owls, attach uniquely numbered leg bands on both adult and juvenile owls, and deploy transmitters on adults. We used 3 types of traps to capture owls—a 2-way trap on female nest burrows, a 2-way MP3 player trap on male burrows (the MP3 played the male's "coo-coo" territorial call), and a bow-shaped spring trap baited with a live mouse. All 3 trap types successfully captured a total of 27 Burrowing Owls: 13 adults (6 males, 7 females) and 12 juveniles (ranging in age from ~13-27 days old). During processing, we measured wing, tail, and tarsus length; recorded weight; checked the condition of the brood patch on females; and noted the presence of fleas.

We trapped owls at 11 nest sites in 6 locations across the state—Pinedale Mesa west of Pinedale, Jonah Field southwest of Pinedale, Red Desert northwest of Wamsutter, Red Wash north of Baggs, Buckskin Coal Mine north of Gillette, and the Thunder Basin National Grassland. We deployed solar-powered satellite transmitter backpack units on 6 adult male and 6 adult female Burrowing Owls, including 5 pairs where both the male and female received transmitters.

To date, we have results of the 2019 fall migration (Figure 1) and some noteworthy information on the 2020 spring migration (Figure 2). We received infrequent locations during the winter because of the shorter daylengths and more overcast skies, but are seeing increased action in the spring as the days get longer, the solar-powered transmitters recharge, and the owls start moving again. Project results thus far are summarized below.

Figure 1. Movements and migrations of the 12 Burrowing Owls fitted with satellite transmitters in Wyoming in 2019. The map also includes the 6 owls transmittered in Nevada in 2019.

- 2 of the 12 transmittered owls never left Wyoming, so are likely down or dead. 1 was from the Pinedale area, and 1 from the Gillette area.
- 10 of the 12 transmittered owls initiated migration southward from late July (earlier than usual) through late October.
- 3 of the 10 migrating owls stopped transmitting signals while en route on their fall migrations (2 in west-central Colorado and 1 in eastern

Wyoming near Torrington). We are waiting for any additional locations from these owls. They may be dead or the transmitters may not be receiving enough solar power to communicate with the satellites.

- 1 of the 10 migrating owls was killed by a farming operation during a migratory stopover to rest and refuel in southern Kansas (see the dark blue line in Figure 1 that ends at the Kansas– Oklahoma border). That farmer contacted our US project lead, Dr. Courtney Conway (US Geological Survey, University of Idaho Cooperative Fish and Wildlife Research Unit) and sent him the owl carcass. The owl carcass was reported to be in excellent condition. A talon likely got caught under the baling twine as the owl perched, she was unable to escape, and ended up dying of exhaustion or starvation.
- 6 of the 10 owls that initiated migration wintered in Mexico.
- During their migrations to Mexico, 2 owls from the Pinedale area had stopovers in Arizona (1 in south-central and 1 in northeastern Arizona), and 2 owls from the Gillette area stopped over on the northwestern plains of Texas (from west of Stratford to west of Amarillo to west of Lubbock). 1 owl from the Red Desert area travelled nonstop to Mexico.
- 3 of the 6 Wyoming owls in Mexico wintered in coastal areas on the west coast of Mexico – 1 from the Red Desert migrated to the west coast of Baja California, and 2 from the Pinedale area flew to the coast of the state of Sonora.
- 3 of the 6 Wyoming owls in Mexico (all from the Gillette area) wintered inland in the central rib of Mexico's mainland. 2 of the 3 owls wintered in the Chihuahuan Desert Grassland in the state of Coahuila, and 1 of the 3 owls continued south to the state of Guerrero (see details below).
- 1 of the 6 owls in Mexico flew to Ocotequila, in the state of Guerrero (lime green line in Figure 1). This is both the farthest south and the longest migration ever documented of any of the ~100 Burrowing Owls transmittered in the western US and Canada during the entire regional project. This female owl migrated 2,200 miles southward from her breeding area north of Gillette to her wintering area in southern Mexico (northeast of Acapulco). En route, she stopped over on the eastern grasslands of Colorado, the northwestern plains of Texas, and the Chihuahuan Desert Grasslands in north-central Mexico.
- Spring migration began between 6-8 March 2020 for 1 owl from the Pinedale area. This is a very early spring movement, as most owls initiate their northward migration in late March and early April. He flew ~435 miles in 48 hours from the coast of Sonora, Mexico to northeastern Arizona. On 5 April, he flew to western Colorado, crossed the Wyoming border on 7 April, and returned to his exact 2019 location on 11 April.
- A female owl from the Pinedale area that wintered near the coast of Sonora flew to southeastern Arizona on 24 March, moved into west-central Colorado on 28 March, and migrated back into Wyoming in the southern Red Desert on 31 March.
- A male owl from the Red Desert area that wintered on the west coast of Baja in Mexico flew to northeastern Arizona on 24 March, and returned to his exact 2019 location on 11 April.
- The female owl captured north of Gillette that flew ~2,200 miles to winter northeast of Acapulco flew to south of Mexico City on 24 March, was in San Luis Potosi on 3 April, back in Coahuila on 5 April, and then flew to southwestern Texas on 7 April for a 2-week stopover to rest and refuel. She was in southwestern Kansas on 1 May, in northeastern Colorado on 2 May, in southwestern Nebraska on 6 May, and in east-central Wyoming on 7 May. On 9 May she returned to her exact 2019 capture site, for a record ~4,500-mile round trip migration.

Figure 2. The fall 2019 and spring 2020 migration pathways of the farthest traveling Burrowing Owl in the entire 11-state and 3-province full annual life-cycle conservation project.

Thus far, for Burrowing Owls that breed in Wyoming, the timing and length of migrations and stopovers varies; parts of Texas, Colorado, and Arizona are key migratory stopover hotspots, and several states in Mexico are important wintering areas. Project results will help us direct conservation actions on the landscape.

We plan to deploy more transmitters at more breeding areas across Wyoming in 2020. Project results will help direct where our conservation actions should occur on the landscape, and provide a framework for collaborative management efforts for Burrowing Owls across transcontinental boundaries.

Prepared by:
Andrea Orabona, Nongame Bird Biologist;
Dr. Courtney Conway, USGS University of Idaho Cooperative Fish and Wildlife Research Unit

Funding Sources:
Arch Coal, Black Thunder Coal Mine;
Wyoming Game and Fish Department

Photo by: Pete Arnold

SUMMARY OF THE ANNUAL ACTIVITIES OF THE CENTRAL FLYWAY NONGAME MIGRATORY BIRD TECHNICAL COMMITTEE

The Central Flyway Council (CFC) was established in 1951 to represent the 10 states (Montana, Wyoming, Colorado, New Mexico, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas) and 3 Canadian provinces (Saskatchewan, Alberta, and the Northwest Territories) that occur within the flyway. The function of the CFC is to work with the US 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 season setting of migratory bird hunting regulations. The CFC, via technical committees, also conducts and contributes 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 accomplish their objectives. Various Technical Committees (TCs) have been established to fulfill this role. The Central Flyway Waterfowl TC and the Pacific Flyway StudyCommittee 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 Flyway Council established the Central Flyway Nongame Migratory Bird TC (CFNMBTC) 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 Council's focus beyond traditional game bird issues (Figure 1).

It is the intent of the CFC 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 Dove TC is responsible for the Columbidae family (i.e., doves only). The CFNMBTC is responsible for all migratory birds, as per the Migratory Bird Treaty Act, not included in the above division of responsibilities. Technical Committee members do recognize, however, that they may need to collaborate on some issues. For example, the webless TC should coordinate with the nongame TC on issues related to shorebirds, rails, and federally threatened or endangered species that are not hunted.

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. The function of the TCs is to serve the CFC, with primary responsibility for the technical information needs of the Flyway Council 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 Council for their collective consideration or implementation. The Wyoming Game and Fish Department's Nongame Bird Biologist serves as the state's representative on the CFNMBTC.

Since the its inception, the CFNMBTC has submitted 22 recommendations to the CFC for signing and submission, and 49 letters of correspondence to a variety of recipients on a diversity of nongame issues, both regulatory and non-regulatory. A summary of recommendations and correspondence completed from 2019-2020 thus far is presented in Tables 1 and 2, respectively.

Figure 1. Members of the CFNMBTC, WY 2019.

Table 1. Summary of recommendations submitted to the Central Flyway Council by the Central Flyway Nongame Migratory Bird Technical Committee, 2019-2020.

Date	Rec. #	Recommendation
3/5/2019	3	The Central Flyway Council recommends that the 48 permits available to the Central Flyway for the passage take of first year Peregrine Falcons for falconry in the United States east of 100° west longitude and south of 31° north latitude for the September 20, 2019 to October 20, 2019 trapping season be allocated among states as follows: 30 permits to the state of Texas with the understanding that 40% of the permits will be reserved for nonresident falconers, 6 permits to the state of Oklahoma, 6 permits to the state of Kansas, and 6 permits to the state of Nebraska.
3/5/2019	4	The Central Flyway Council recommends that the process detailed in the March 2019 document, *Golden Eagle Allocation Procedure*, prepared for the National Flyway Council be used to allocate take of Golden Eagles for falconry in the United States.
3/10/2020	5	The Central Flyway Council recommends that the 48 permits available to the Central Flyway for the passage take of first year Peregrine Falcons for falconry in the United States east of 100° west longitude and south of 31° north latitude for the September 20, 2020 to October 20, 2020 trapping season be allocated among states as follows: 30 permits to the state of Texas with the understanding that 40% of the permits will be reserved for out-of-state falconers, 6 permits to the state of Oklahoma, 6 permits to the state of Kansas, and 6 permits to the state of Nebraska.

Table 2. Summary of correspondence submitted to the Central Flyway Council by the Central Flyway Nongame Migratory Bird Technical Committee, 2019-2020.

Date	Key Central Flyway remarks
12/20/2019	The Central Flyway Council recommends delisting the Interior Least Tern from the federal list of Threatened and Endangered wildlife species.
3/8/2020	Central Flyway Council comments regarding the proposal to gather information necessary to develop a proposed rule to expand Double-crested Cormorant management throughout the US
3/10/2020	The Central Flyway Council asks that the US Fish and Wildlife Service reconsider the proposed Migratory Bird Treaty Act rule and work with the states through their flyways to develop and implement reasonable measures that will protect migratory bird populations from avoidable forms of take.

Prepared by:
Andrea Orabona, Nongame Bird Biologist; Jim Dubovsky, USFWS

Funding Source:
Wyoming Game and Fish Department

Photo by: James Kennerley, Macauley Library

COORDINATED STATEWIDE FLAMMULATED OWL SURVEY

The Flammulated Owl is a small, nocturnal, cavity-nesting owl that occurs in forested habitats of western North America. The status of Wyoming's Flammulated Owl population is largely unknown. Accordingly, it is designated as a Species of Greatest Conservation Need (SGCN) with a Native Species Status rank of Unknown (NSSU, Tier III) in the State Wildlife Action Plan (WGFD 2017). The Flammulated Owl is also included on the Sensitive Species lists for both U.S. Forest Service (USFS) Regions in Wyoming (2 and 4) and classified as a Species of Special Concern in Canada (COSEWIC 2010). The Partners In Flight (PIF) Western Working Group has designed Flammulated Owl a priority species and recommended a westwide inventory and regional monitoring plan (Neel and Sallabanks 2009).

Historically, there were only a small number of occurrence records for Flammulated Owl in Wyoming (Faulkner 2010). Most range maps did not classify the state as breeding habitat and prior to 2016 breeding-season records were limited to a small area on the western slope of the Sierra Madre Mountains near the Colorado border. The breeding population in the Sierra Madre was discovered in 2005 when a joint effort between the Rocky Mountain Bird Observatory and Audubon Wyoming documented 10 signing males and 1 occupied nest (Faulkner 2010). In 2012, the Wyoming Natural Diversity Database (WYNDD) conducted surveys in areas of the Medicine Bow National Forest adjacent to the known range and detected Flammulated Owls at 2 sites (I. Abernethy, WYNDD, unpublished data). From 2016–2018, the Teton Raptor Center expanded the known range in Wyoming to include the area around Jackson Hole by conducting nighttime callback surveys and deployments of automated recording units (ARUs) that resulted in 35 detections from an estimated 23 nesting territories (B. Bedrosian unpublished data). These efforts revealed that the Flammulated Owl occurred in areas of Wyoming contiguous with its known distribution in adjacent states. However, prior to this study, no broad-scale surveys had been conducted to clarify the breeding distribution of the Flammulated Owl across Wyoming.

Because the Flammulated Owl is one of the only Neotropical migrant owls, it is unlikely to be detected during surveys for other owl species, typically before its arrival from spring migration. Flammulated Owls generally return to the Northern Rockies in early May (Linkhart and McCallum 2013), while most owl surveys are completed by mid-March. Although their later phenology requires dedicated surveys, detection rates of Flammulated Owls are nearly 100% when callback surveys are conducted during the courtship and incubation period (Barnes and Belthoff 2008).

Flammulated Owl habitat typically consists of Douglas fir and ponderosa pine forests with large, older-aged trees, and open stand structures, often adjacent to mature aspen where these insectivorous owls find prey and cavities for nesting (Reynolds et al. 1992, Hayward 1994, Carlisle and Stuber 2010). Recent data from Wyoming recorded the species in lodgepole pine, aspen, and spruce-fir forests (B. Bedrosian unpublished data). These forest types are increasingly at risk in Wyoming due to insect outbreaks, disease, drought, and wildfire.

To address the need for information on the distribution of the Flammulated Owl in Wyoming, we developed a statewide deductive model of potential habitat that we used together with expert opinion on habitat and accessibility to select a sample of survey areas. We then surveyed these areas using nocturnal callback routes and verified a subset of positive detections with ARUs.

Objectives:

1) Develop a statewide model of potential nesting habitat for Flammulated Owl based on existing literature and models.
2) 2) From this deductive model, select a sample of survey locations.
3) 3) At these survey sites, conduct nighttime callback surveys from early May–June, 2019. Verify detections at a subset of sites by deploying ARUs for 5–7 nights.
4) Use detections to determine where nesting populations may occur.
5) Assess effectiveness of current survey protocols based on callback and ARU results.
6) Evaluate habitat associations of Flammulated Owl to refine deductive models of potential nesting habitat across Wyoming.
7) Provide results and data to inform conservation planning and ranking of the Flammulated Owl in Wyoming.

This report contains results from Objectives 1-3. From May 2 to June 29, 2019 we surveyed a total of 720 points across Wyoming (512 in the NW and 208 in the SE region). We surveyed portions of 128 townships across Wyoming (NW: 94, SE: 34) and deployed 9 acoustic recorders at locations with positive nighttime detections (NW: 3, SE: 6; Figure 1). We detected Flammulated Owls at 32 (4%) points and 19 (15%) townships surveyed (Figure 1). Surveyors from Audubon Rockies detected 1 Flammulated Owl on Casper Mountain in the Laramie Range (Z. Hutchinson, Audubon Rockies, personal communication); that location is included on maps (Figure 1), but information on the points and townships surveyed were not available in time for this report. The percentage of points with detections was greater in the SE survey region (11%) compared to the NW region (2%). We detected Flammulated Owls in five mountain ranges where the species had not previous been documented during the breeding season: the Absaroka, Laramie, Medicine Bow, Wind River, and Wyoming ranges. We

did not detect Flammulated Owls in the Bighorn Mountains, but only conducted opportunistic surveys of a limited area near the end of the survey period. Points with detections of other owl species and nightjars included 3 Boreal Owls, 1 Eastern Screech Owl, 13 Great Horned Owls, 4 Long-eared Owls, 34 Northern Saw-whet Owls, 8 unidentified owls, 11 Common Nighthawks, and 16 Common Poorwills. Results should be considered preliminary until recordings are reviewed to verify species identifications.

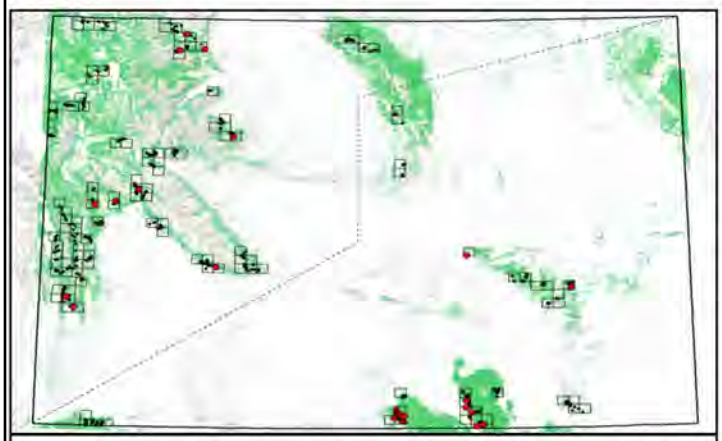


Figure 1. Results of coordinated Flammulated Owl surveys, 2019 (red circles—Flammulated Owl detections, black dots—points, black squares—townships surveyed, dashed line—study regions boundary, and green areas—potential habitat).

Preliminary results from this survey suggest Flammulated Owls are considerably more widespread in Wyoming than previously known. In 2019, we documented multiple individuals across the western, central, and southern portions of the state, including five mountain ranges where the species had not previously been detected during the breeding season. Our initial results expand the known range of the Flammulated Owl by >150 km and suggest this species could breed throughout most of Wyoming's mountain ranges.

In the southeastern region of the state, we detected numerous Flammulated Owls within and adjacent to their known range in the Sierra Madre Mountains, as well as in the western portion of the Medicine Bow Mountains. We detected Flammulated Owls on two occasions in the central Laramie Range near Esterbrook in the same townships as a historical observation recorded on October 29, 1969 and previously assumed to be a migrant. Additionally, the detection on Casper Mountain further expands the known distribution of the Flammulated Owl in the Laramie Range.

In the northwestern region, we focused on surveying townships outside of Jackson Hole since previous surveys have documented many Flammulated Owls there in the past three years. We detected Flammulated Owls on the southeastern end of the Wind River Range, southern end of the Wyoming Range, Hoback, Upper Green, western edge of the Owl Creek Mountains, and in the Absarokas west of Cody. We did not detect any owls during surveys of the northern, southern, and central portions of Yellowstone National Park. We did not detect Flammulated Owls in in the Bighorn Mountains, but conducted only a small number of surveys there and did not cover the range well enough to infer absence.

Survey conditions during the 2019 field season were challenging due to an unusually late spring, high snow pack and heavy rains. These conditions limited our access and resulted in loud background noise from rivers and creeks at many survey points. We delayed surveys by several weeks and reduce our effort accordingly. Snow limited access to roads across western Wyoming for the entire survey period. Thus, while our detections of Flammulated Owls significantly expand known range and number of records for the state, the absence points recorded during this survey should be interpreted with caution. The low intensity of sampling over a broad area and expert opinion-based selection of sample units make it impossible to determine absence of the species from any township or mountain range where it was not recorded. Areas with potentially suitable habitat but no detections include the Uinta Mountains, the Laramie Range, Wyoming Range, eastern slope of the Wind River Range, Bighorn Mountains, much of the habitat surrounding Dubois, western edge of the Teton Range and Yellowstone Plateau, and northern range of Yellowstone National Park. Detections in the Laramie Range and Absarokas suggest surveys are warranted in the neighboring Bighorn Mountains and Black Hills.

Prepared by:
Bryan Bedrosian, Teton Raptor Center; Zach Wallace, Wyoming Natural Diversity Database

Funding Sources:
Wyoming Game and Fish Department;
US Fish and Wildlife Service State Wildlife Grant

Photo by: Mark Gocke

COMMON LOON RESEARCH AND MONITORING IN WYOMING

The Common Loon (loon) is an uncommon summer resident in Wyoming (Orabona et al. 2016). It is classified as a Species of Greatest Conservation Need (SGCN) with a Native Species Status 1 (NSS1), Tier I (highest conservation priority) in the Wyoming State Wildlife Action Plan (WGFD 2017). Loons in Wyoming have an extremely small and isolated breeding population that is at risk of extirpation, are very sensitive to human disturbance and recreation activities, and have very limited and specific breeding habitat. Loon nesting sites in Wyoming are currently restricted to the Greater Yellowstone Ecosystem (GYE), making this the rarest breeding bird species in the state. Since 1987, Wyoming Game and Fish Department (Game and Fish) Nongame Program and Yellowstone National Park (YNP) biologists have been monitoring loon occupancy and productivity in nesting areas within the GYE. This continues to be a cooperative effort with personnel from the Caribou-Targhee National Forest (CTNF), Bridger-Teton National Forest (BTNF), and Grand Teton National Park (GTNP).

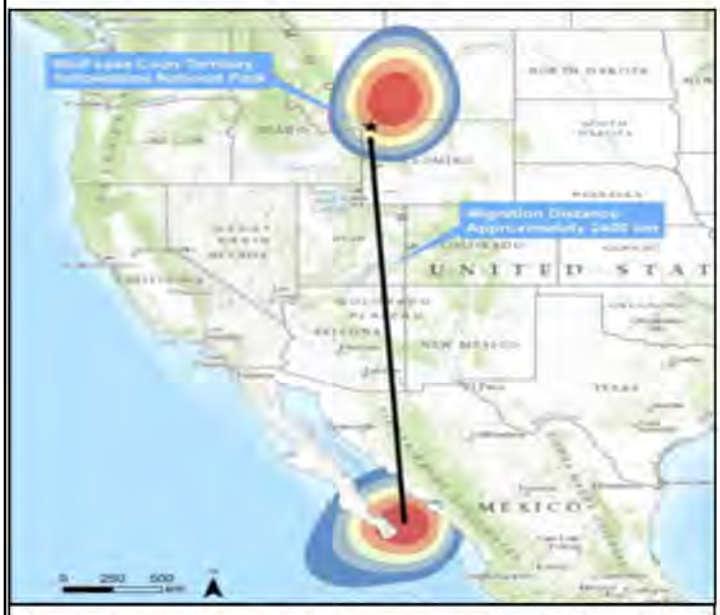


Figure 1. Movement of a female Common Loon from the GYE population in Wyoming based on geolocator data. Density range: blue=low, red=high.

The GYE loon population has historically been about 21-22 territorial pairs. Some territories are not occupied every year, some territorial pairs use multiple lakes, and other pairs may not nest (Evers et al. 2019). A decline to 14 pairs was noted between 2006-2013 (Spagnuolo et al. 2016). To address multiple complex issues with loon management and conservation in the GYE, a collaborative and comprehensive partnership began in 2013 with representation from the Game and Fish, YNP, CTNF, BTNF, GTNP, Biodiversity Research Institute (BRI), and Ricketts Conservation Foundation (RCF) to investigate and understand the status of the loon population, assess threats to loon survival and reproduction, and inform management actions (Spagnuolo et al. 2020). In 2019, the Shoshone National Forest, Idaho Department of Fish and Game, and Wind River Indian Reservation were included to further accomplish annual loon population and conservation objectives.

Starting in 2012, BRI has aimed to better define loon territories, locations of nest sites, and reproductive success using shoreline, boat, and aerial surveys. From 2013-2019, 20 adult and 13 young loons were captured and sampled (including 5 adult recaptures and 7 chicks that were too young to band), and 8 adult loons were fitted with geolocators (Evers et al. 2019). We use geolocators to calculate the loon's approximate location (latitude and longitude) by recording sunlight levels over time, which is then used to identify approximate migration routes and wintering areas (Evers et al. 2019).

In 2019, BRI captured 3 adults (including a recapture to replace bands) and 6 chicks in the GYE population and sampled them for mercury, genetics, and cyanobacteria concentrations. To date, 20 adult loons have been banded in the GYE (including 2 that died or are missing), which reflects 18 of the 42 territorial adults (43%) that are color banded in the GYE (Evers et al. 2019).

From 31 July-4 August 2019, BRI captured and banded loon families at 4 lakes in the GYE using night and day capture methods. Night captures use a combination of spotlighting and playback recordings (Evers 1993, 2001). Day captures use a loon decoy and vocalizations for adults without chicks. A total of 3 adult and 6 young loons were banded with uniquely numbered US Geological Survey metal leg bands and a unique combination of plastic colored leg bands. Color marking provides additional information about territory boundaries, fidelity to territory sites, mate switching, survivorship, intra-seasonal movements, and loon population recruitment (Evers et al. 2019). During handling, loons were weighed, feathers were collected, and blood samples were taken. Combined with loon reproduction information, these data help evaluate population growth and sustainability over time. To date, adult survivorship for the GYE population is 52 out of 55 adults (95%) and is similar to other areas in the US where loons breed (Evers et al. 2019).

BRI analyzed blood mercury concentrations of 16 adult loons in the GYE and found them to be generally low compared to other studies in the western US and Canada, although 1 female had a higher concentration (Evers et al. 2019). Feathers and eggs were also collected from 2013-2019 to evaluate long-term mercury uptake during summer and winter (feathers) and uptake of mercury on-site (eggs). Feather mercury load was elevated for females at 2 sites and males at 3 sites (Evers et al. 2019).

BRI deployed 8 geolocators from 2013-2015, but data were only retrieved from 1 female. Data suggest that she migrated south over land, spent most of October on the west side of the Baja Peninsula, and then moved east to winter on the Sea of Cortez (Figure 1; Evers et al. 2019). Two tagged loons likely died, 3 have yet to be retrieved, and 2 geolocators were defective.

BRI's genetic analyses indicate that Wyoming's loons are not a genetically distinct population, and are more closely related to breeding populations in Alberta, Saskatchewan, and Manitoba in Canada rather than those in Montana and Washington (Evers et al. 2019, Lindsay et al. 2019).

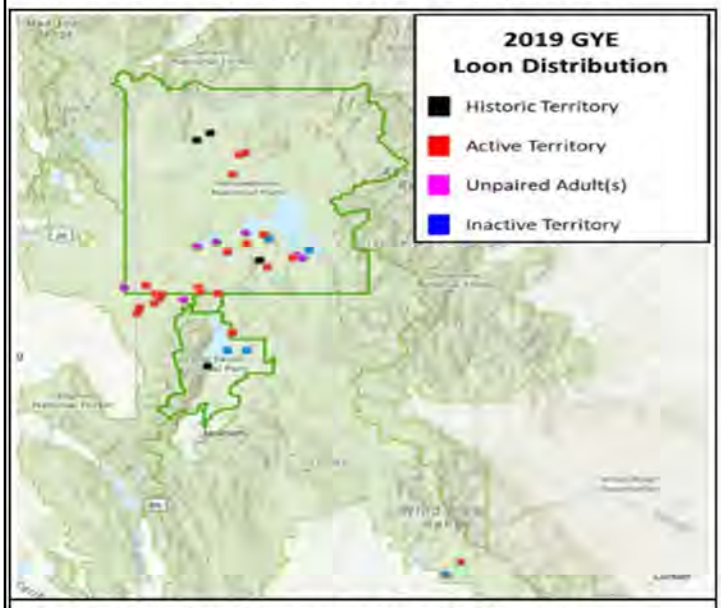


Figure 2. Distribution of Common Loons in the GYE, 2019.

From late April - early September 2019, RCF biologists monitored loons in YNP, CTNF, BTNF, and GTNP with historic or recent loon presence, and searched other lakes in the GYE for territorial pairs and unpaired adults. Using approved methods (LPC 2004), surveys were conducted from shore, motorboat, canoe, and aerially. Populations were measured using territorial pairs; nesting pairs; successful nesting pairs that included pairs that hatched at least 1 egg, chicks hatched, and chicks surviving to at least 6 weeks of age; nests failed; and unpaired adults. Trail cameras were used at 14 loon territories to provide information on nesting biology, causes of nest failures, human disturbance of nest sites, and the effectiveness of area closures. RCF also deployed and maintained nest rafts at 4 territories following approved methods (LPC 2004, Desorbo et al. 2007).

The 2019 survey results showed there were 22 territorial pairs in the GYE—15 in YNP, 5 in CTNF, and 2 in BTNF—and 17 loon chicks survived to fledge—9 in YNP, 7 in CTNF, 1 in BTNF, and 0 in GTNP (Spagnuolo et al. 2020). Of the 22 territorial pairs, 18 nested and hatched a total of 19 chicks, 17 of which survived, resulting in a 77% productivity rate (Spagnuolo et al. 2020). RCF documented nest failures at 6 sites in YNP, 2 sites in CTNF, and 1 site in BTNF, and successful re-nesting at 1 site in YNP, 1 site in CTNF, and 1 site in BTNF (Spagnuolo et al. 2020). RCF found 13 unpaired adults (23% of the adult population)—10 in YNP and 3 in CTNF—as well as loons occupying 2 recently formed territories in YNP, 1 new pair in YNP, 2 vacant territories in YNP, 1 vacant territory in BTNF, and 1 new territorial pair in BTNF (Figure 2; Spagnuolo et al. 2020).

Artificial nest platforms were used by loons at 2 of the 4 sites in the GYE in 2019, with 1 pair successfully fledging 2 chicks for the first time since 2015 (Spagnuolo et al. 2020). Temporary closures at 11 sites in YNP and CTNF also aided successful nesting at most sites, with human disturbance suspected to be the cause of nest failures (Spagnuolo et al. 2020).

Overall, the GYE loon population trend looks positive regarding observed and future growth and expansion potential, the ability to manage and mitigate human disturbance, and the ability to detect the presence of new loons (Spagnuolo et al. 2020).

Prepared by:
Dave Evers, Chris Persico, Lucas Savoy, and Katie Taylor, Biodiversity Research Institute; Vincent Spagnuolo and Walter Wehtje, Ricketts Conservation Foundation; Andrea Orabona, Nongame Bird Biologist

Funding Sources:
Ricketts Conservation Foundation;
Wyoming Game and Fish Department;
Yellowstone National Park

EFFECTS OF CLIMATE ON NONGAME SAGEBRUSH BIRD DEMOGRAPHY AND POPULATIONS

Photo by: Eva Crane

PROJECT OBJECTIVES: 1) Use archived BBS, IMBCR, and weather station data to model population trends of sagebrush songbirds in relation to climatic variables (e.g., temperature, precipitation). 2) Leverage existing nesting productivity data of sagebrush songbirds from 13 years of previous study at 4 study sites (Belfry, MT; Grand Teton National Park, WY; Pinedale, WY; Jeffrey City, WY) and relate to archived weather data. 3) Quantify sagebrush songbird reproduction (investment and output) in relation to ambient variation in weather at multiple spatial scales. 4) Utilize data derived from analyses for objectives 1-3 to model sagebrush songbird population trajectories in Wyoming given the range of future projected climatic conditions.

OBJECTIVE 1: We identified all Breeding Bird Survey (BBS; Pardieck et al. 2018) routes in Wyoming surveyed from 1968–2017 (n=124) to address objective 1. To determine whether BBS routes were located in or near sagebrush habitat, we overlaid all routes with a sagebrush habitat layer (USGS 2010) using ArcGIS (ESRI 2017). We determined that 67% (n=83) of routes were located within sagebrush habitat, 26% were close to sagebrush habitat (within 1 km; n=32) and 7% were over 1 km from the nearest sagebrush cover (n=9; primarily in mountainous regions or grasslands). Over the 50 years since BBS survey routes began in Wyoming, each route has been surveyed an average of 15.2 years (range 1–44 years). We removed the 9 survey routes considered 'not in sagebrush habitat' and 14 additional survey routes which were surveyed fewer than 5 years since 1968, leaving 101 survey routes for further analysis. Brewer's Sparrows were observed at least once on 100% of survey routes, while Sagebrush Sparrows were observed on 65% of routes, and Sage Thrashers on 87%. All 3 species experienced a peak in the number of birds observed per route from 1975–1980 (Figure 1). Aside from this brief increase, however, the average number of sagebrush-obligate songbirds observed per survey route has remained fairly constant across years since 1968.

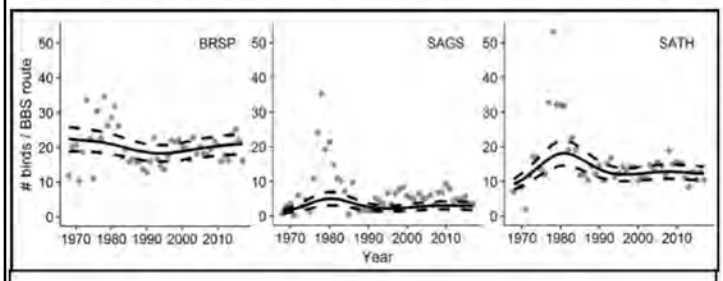


Figure 1. Mean number of Brewer's Sparrow (BRSP), Sagebrush Sparrow (SAGS), and Sage Thrasher (SATH) observed per Breeding Bird Sur-

We were also interested in how songbird trends varied in relation to weather conditions. To address this question, we first matched BBS routes spatially and temporally with gridded temperature and precipitation data (4 km; PRISM). PRISM data only became available in 1981, so 13 years of BBS data (1968–1980) were excluded from these analyses. We identified 3 pertinent time periods for summarizing weather data: the winter prior to a survey season (January 1 to March 31), the spring prior to a survey season (April 1 to May 30) and the survey season itself (June 1 to June 30). Weather patterns in the winter and spring leading up to a breeding season can affect the timing and productivity of the system during the summer months (Palmquist et al. 2016), whereas conditions during the breeding season can have direct effects on avian distributions and local abundances (Maxwell 2019 et al.). We investigated the effects of 5 weather metrics on the number of birds observed per route for each of the 3 species: total precipitation summarized separately over the winter, spring and June, as well as mean temperature summarized over the spring and June3.

We found substantial support for the effect of mean temperature both during the spring and during the survey season on the number of sagebrush songbirds observed. The largest number of Brewer's Sparrows and Sage Thrashers were observed following springs with moderate temperatures (~4–7°C; Figures 2a and 2c). Sagebrush Sparrows, on the other hand, tended to be observed in higher numbers following colder springs (Figure 2b), although in general their numbers were very low when compared to the other 2 species. When we investigated temperatures during the survey season (the month of June), we found contradictory effects across species. We observed very low numbers of Brewer's Sparrows when June temperatures were close to 6°C, but counts steadily increased up to ~12°C, above which numbers remained fairly constant regardless of temperature (Figure 2d). We observed the highest counts of Sage Thrashers, on the other hand, during the lowest June temperatures, with counts consistently decreasing as June temperatures increased (Figure 2e). Sagebrush Sparrow numbers, on the other hand, were not strongly affected by June temperatures. We found minimal evidence for the effect of precipitation on bird observations, with no effect of total winter or total June precipitation on any of the 3 species. We observed an effect of spring precipitation for Sage Thrashers only, indicating that more spring precipitation typically leads to fewer Sage Thrashers observed during surveys (β = -0.44 + 0.21).

Future climate predictions indicate that temperatures in the sagebrush are likely to become warmer and more variable in the next century (Palmquist et al. 2016). Our research indicates that under these warming conditions, we may see fewer sagebrush songbirds present across Wyoming. To know the extent of these effects, however, we need additional research investigating how songbird site occupancy and densities (incorporating detection probabilities) vary under observed climatic conditions.

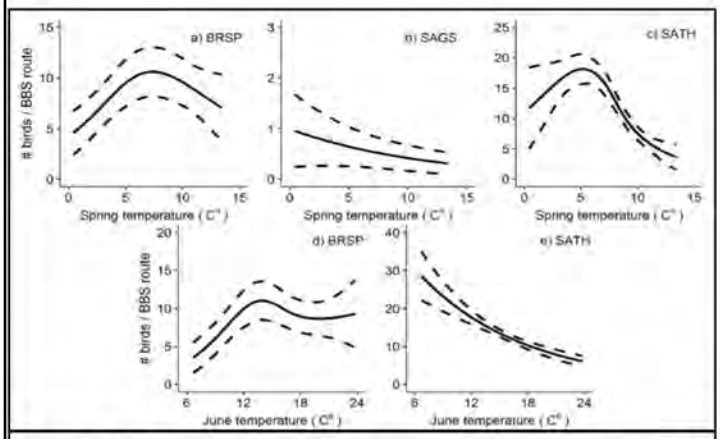


Figure 2. Relationship between the mean spring temperature (°C, a-c), mean June temperature (°C, d-e), and the average number of Brewer's Sparrow (BRSP), Sagebrush Sparrow (SAGS), and Sage Thrasher (SATH) observed per BBS route. Data were collected across Wyoming from 1981-2017.

OBJECTIVE 2: We successfully merged data collected across 4 different study areas spanning 22 breeding seasons, from 2002–2019, into 1 large database. This database contains nest survival information for 7,077 nests of sagebrush-dependent songbirds (Brewer's Sparrow, Sagebrush Sparrow and Sage Thrasher) and was collected across 4 major study areas (referred to here as Montana, Tetons, Pinedale, and Jeffery City, based on geography). We paired 4-km2 PRISM weather data (temperature and precipitation) both spatially and temporally to each nest. Given the long timespan over which our study took place, and the substantial climatic variation between study areas, this allowed us to investigate the long-term demographic effects of weather variability on avian reproduction.

OBJECTIVES 3 & 4: All analyses relating to objectives 3 and 4 are complete. A manuscript is currently in preparation, and will be available in 2020. For objective 4, we will make predictions and discuss possible outcomes in the discussion of our forthcoming manuscript. We provide a summary of our findings here.

We examined the influence of weather variability during the breeding season on productivity of sagebrush-obligate songbirds: Brewer's Sparrow (*n*=3,189 nests), Sagebrush Sparrow (*n*=873) and Sage Thrasher (*n*=639). We were interested in the effects of temperature and precipitation on the number of young fledged from each nest, a metric which integrates clutch size, likelihood of hatch and the probability of nest success. We used AICc model selection (Mazerolle 2019) to compare the effect of temperature and precipitation during the active nesting period on the number of young fledged per nest.

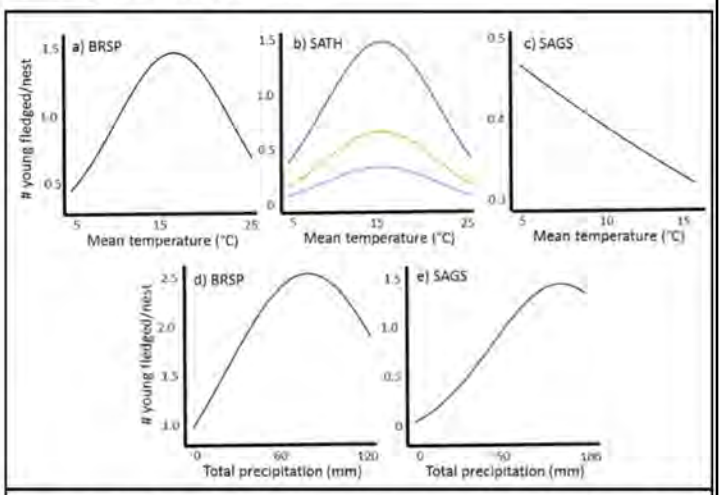


Figure 3. Relationship between mean temperature (°C, a-c), total precipitation (mm, d-e), and the average number of Brewer's Sparrow (BRSP), Sagebrush Sparrow (SAGS), and Sage Thrasher (SATH) young fledged per nest. Data were collected from our study areas in western Wyoming and south-central Montana from 2002-2016.

The model containing combined quadratic effects of temperature and precipitation far out-performed all other models in the suite for all 3 species (Brewer's Sparrow ΔAICc=54; Sagebrush Sparrow ΔAICc=21; Sage Thrasher ΔAICc=11). Brewer's Sparrows fledged the largest number of young when they experienced moderate temperatures (~14–20°C, Figure 3a) and moderate to large amounts of precipitation (60–110mm, Figure 3d) during the nesting period. Sage Thrashers also fledged the most young when they experienced moderate temperatures (~10–20°C, Figure 3b) and moderate precipitation (60–110mm). Sage Thrashers were also the only species with substantial differences in the strength of the effect between study areas, with the strongest effects observed in Montana, and the mildest effects observed in Pinedale (Sage Thrashers were not present at our Tetons sites). Sagebrush Sparrows, on the other hand, fledged the largest number of young when they experienced cooler temperatures (Figure 3c) and large amounts of precipitation (>70mm, Figure 3e) during the nesting period.

Prepared by:
Dr. Anna Chalfoun, Wyoming Cooperative Fish and Wildlife Research Unit;
Dr. Embere Hall, Regional Wildlife Coordinator;
Andrea Orabona, Nongame Bird Biologist

Funding Source:
Wyoming Game and Fish Department;
US Fish and Wildlife Service State Wildlife Grant

Photo by: Frank Stetler

WYOMING BIRD RECORDS COMMITTEE: SUMMARY OF REPORTS REVIEWED IN 2019

The Wyoming Bird Records Committee (WBRC) was established by the Wyoming Game and Fish Department (Game and Fish) Nongame Program in 1989 to accomplish the following goals:

1) To solicit, organize, and maintain records, documentation, photographs, audio recordings, and any other material relative to the birds of Wyoming.

2) To review records of new or rare species or species difficult to identify and offer an intelligent, unbiased opinion of the validity or thoroughness of these reports. From these reviews, the WBRC will develop and maintain an Official State List of Birds in Wyoming.

3) To disseminate useful and pertinent material concerning the field identification of Wyoming birds in order to assist Wyoming birders and ornithologists with increasing their knowledge and skill.

The WBRC is comprised of 5 voting members and the Game and Fish's Nongame Bird Biologist, who servers as a non-voting Secretary. The WBRC is interested in promoting and maintaining quality and integrity in the reporting of Wyoming bird observations, and it treats all bird records as significant historical documents. The WBRC operates under a set of bylaws that were approved in 1991 and updated in 1992, 1998, and 2015.

During 2019, an intentional effort was made by the WBRC to encourage birders to submit their rare and unusual observations largely due to the abundance of rare and unusual bird sightings in Wyoming that observations posted on eBird. The Cornell Lab of Ornithology oversees eBird, a citizen science-based website for avian observations worldwide. More than 100 million records are submitted to eBird annually, and all are reviewed by regional experts. Four of the five voting WBRC members are currently eBird reviewers for Wyoming. Their efforts to increase submissions were successful, as demonstrated by an increase of 89 reports submitted in 2019 from a total of 15 in 2018.

As of 31 December 2019, the WBRC has reviewed 1,532 reports of rare and unusual birds in Wyoming. A total of 1,256 (82%) have been accepted and 276 (18%) have not been accepted. A total of 104 reports were submitted for review in 2019. Of those, 92 were accepted and 12 were rejected. Observations of the following species were notable first documented records for Wyoming:

Alder Flycatcher (*Empidonax alnorum*). Jackson Lake, Grand Teton National Park, Teton County. This species and the Willow Flycatcher are very difficult, if not impossible, to distinguish by sight. However, their songs are distinct. The observer was able to provide multiple, high quality photos, heard the song, and had previously observed Alder Flycatcher on known breeding grounds and during migration elsewhere.

Black Phoebe (*Sayornis nigricans*). Laramie River Greenbelt Trail, Albany County. The breeding range for this species includes far southern portions of Colorado and Utah. The Black Phoebe strongly prefers habitats with water and a mud source for nest building during the breeding season.

California Condor near Medicine Bow Peak. Photo by: Donald Jones.

California Condor (*Gymnogyps californianus*). Near Medicine Bow Peak, Snowy Range, Albany County. Multiple observers photographed the tagged 2-year old female. She made the journey from northern Arizona. Unfortunately, she was found deceased shortly thereafter. Lab testing indicated the bird died from a neurological disorder. Prior to this documented and reviewed observation, there was a report of a California Condor at Flaming Gorge Reservoir in the 1990s. It was never determined whether that bird was observed on the Utah or Wyoming side of the reservoir, nor was a report submitted to the WBRC for review.

Red-flanked Bluetail (*Tarsiger cyanurus*). Residential backyard, Laramie, Albany County. This is an especially remarkable observation, as this species typically breeds in higher altitude forests of northern Finland, Siberia, China, Japan, and North Korea.

Currently, the WBRC requests reports for species that are included on two separate lists. The first list is known as 'All Sightings' and includes 147 species that are reviewed, regardless of the location observed in Wy-

oming. When a species is documented for the first time in Wyoming, it is automatically placed on the All Sightings list. The second list is known as 'First Latilong' and currently includes 65 species. Latilongs are determined by latitude/longitude degree blocks. There are 28 latilongs in Wyoming (Figure 1).

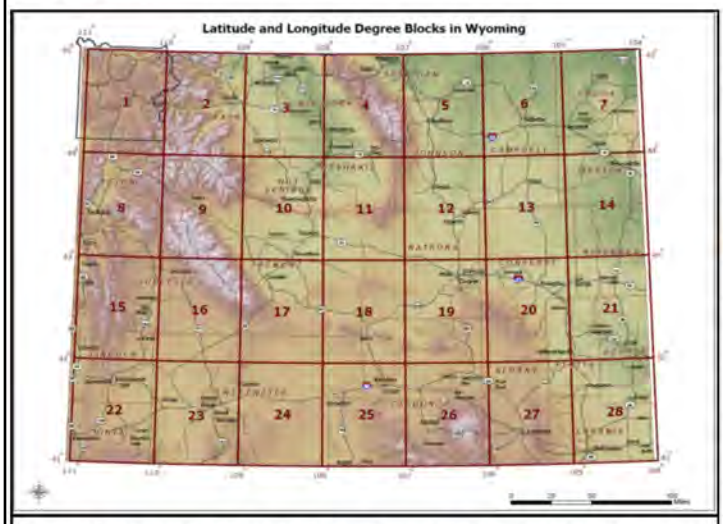


Figure 1. Wyoming Latilong Map. Prepared by Wyoming Game and Fish Department GIS Analyst, Nyssa Whitford.

When a species on the First Latilong list is observed in a latilong with no previously confirmed WBRC record, we request a report from the observer. In addition, if nesting activity is observed for any species on the First Latilong list, the WBRC requests a report for that observation, regardless of whether the species has been previously documented in that latilong. The WBRC is currently reviewing the observation records database to determine if changes are warranted for both lists.

Gyrfalcon west of Riverton. This species is one of the 147 species currently on the 'All Sightings' list. Photo by: Bob Hargis.

The WBRC review process is also helpful for understanding changes to species' distribution in Wyoming. Of the 104 records submitted in 2019, 54 updated the distribution of the observed species on a latilong scale. Interestingly, a Red-necked Grebe observation in Yellowstone National Park was the only record that conclusively updated breeding distribution. These changes will be incorporated into the Game and Fish *Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming* (Orabona et al. 2016).

The WBRC database is a dynamic document, typically updated once or twice a year following the review of a record batch. A full report of all sightings submitted to the WBRC through 2019, species for which the WBRC requests documentation, rare and unusual bird sighting forms, information on how to document rare and unusual birds, and the WBRC bylaws are available from the Nongame Bird Biologist in the Game and Fish Lander Regional Office or on the Game and Fish website: https://wgfd.wyo.gov/Wildlife-in-Wyoming/More-Wildlife/Nongame-Birds under the Wyoming Bird Records Committee heading. The WBRC is currently working on an online form and additional online information that will be available in summer 2020.

We wish to thank all observers for taking the time to submit their sightings to the WBRC. We are also indebted to the following current Wyoming Bird Records Committee members for their invaluable efforts and expertise: Shawn Billerman, Matt Fraker, Greg Johnson, Don Jones, and Frank Stetler.

Prepared by:
Courtney Rudd, Nongame Biologist;
Andrea Orabona, Nongame Bird Biologist

Funding Source:
Wyoming State Legislature General Fund Appropriations,
Bureau of Land Management Cooperative Agreement

PYGMY RABBIT DISTRIBUTION AND OCCUPANCY IN WYOMING

The pygmy rabbit (*Brachylagus idahoensis*) is a sagebrush-obligate that depends on sagebrush for cover and food. Pygmy rabbits are most commonly associated with areas of dense, tall sagebrush with deep, friable soils, as the species is unique in its ability to build and maintain extensive burrow systems, the entrances of which are typically located at the base of sagebrush. Although diet varies throughout the year, sagebrush is a dominant food source in all seasons and may comprise up to 99% of the diet in winter. Pygmy rabbits are also prey for a variety of avian and mammalian predators, and their burrow systems are often used by other species, including other rabbits. Consequently, pygmy rabbits may be considered a keystone species in sagebrush habitats.

Pygmy rabbits are negatively affected by habitat loss due to manipulation and degradation of sagebrush systems. In addition, the species was previously petitioned for listing under the Endangered Species Act, although the US Fish and Wildlife Service subsequently found that listing was not warranted (USFWS 2003). Pygmy rabbits are further impacted by edge effects, likely due to competition with cottontails (*Sylvilagus* spp.) and jackrabbits (*Lepus* spp.) as well as predation, which is a major cause of pygmy rabbit mortality (Crawford et al. 2010, Pierce et al. 2011). The relatively large home ranges and long dispersal distances utilized by pygmy rabbits further emphasize the need for contiguous sagebrush habitat connected by dispersal corridors (Sanchez and Rachlow 2008). However, the lack of data on population densities and trends of pygmy rabbits in Wyoming make assessing population status and potential impacts of habitat manipulations or reductions difficult.

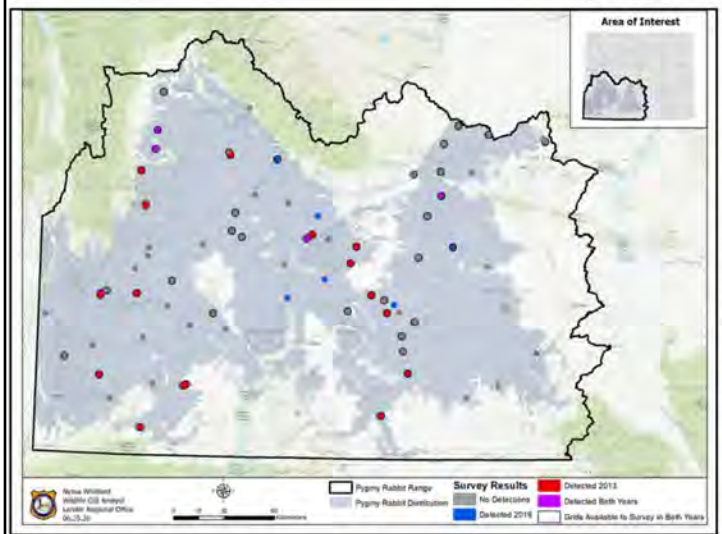


Figure 1. Locations and results of grid cells surveyed for pygmy rabbits in southwestern Wyoming, January through April 2013 and 2019. Grid cells where pygmy rabbits were detected in 2013 only are shown in red, and grid cells where pygmy rabbits were detected in 2019 only are shown in blue. Grid cells where pygmy rabbits were detected in both years are shown in purple; grid cells where pygmy rabbits were never detected are shown in gray. Sites surveyed in both years have a black outline. Modeled distribution is shown in gray for reference.

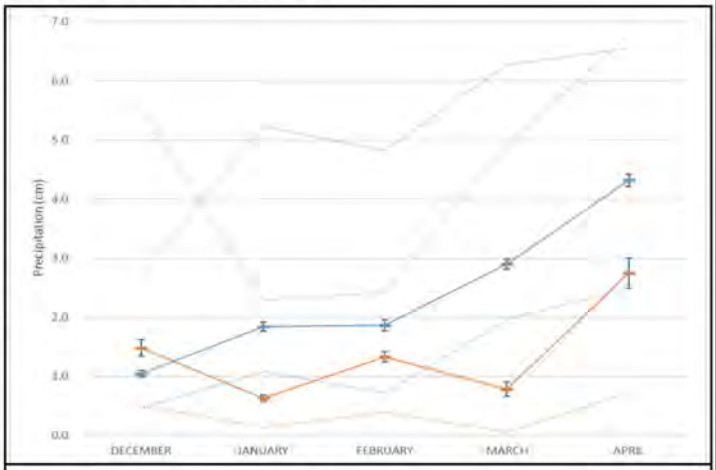


Figure 2. Monthly average with standard error (solid lines), minimum, and maximum (dashed lines) precipitation for the duration of the winter season for pygmy rabbit surveys in 2013 (orange) and 2019 (blue) across all survey grid cells.

From January through April 2019, Wyoming Game and Fish (Game and Fish) conducted pygmy rabbit surveys to document distribution, evaluate the impact of a number of variables on occupancy of pygmy rabbits, and continue to monitor trends. We used two observers to survey 74 grid cells for pygmy rabbits and their sign (i.e., fresh tracks and pellets and active burrows). We detected pygmy rabbits on 11 grid cells (15%) throughout the predicted distribution in southwestern Wyoming (Figure 1). Similar to surveys conducted in 2013, pygmy rabbit detections were patchily distributed throughout the study area. There was no variation in detection between observers. Naïve occupancy was 69% lower in 2019 (15%) than previous surveys in 2013 (48%). Given that 2019 had significantly more precipitation (i.e., snow) than 2013 (Figure 2), it is possible that snow conditions favored subnivean behavior. Because our surveys relied on observing pygmy rabbits or their sign above the snow, even with high detection probability of these types of observations, above-

snow occupancy may have underestimated true site occupancy. Observations across all sites also suggest that a combination of limited precipitation and high wind-free days prior to a survey could be important to maximizing pygmy rabbit presence above the snow (Brubaker et al. 2014). Unfortunately, the low number of observations in 2019 precluded our ability to estimate the influence of various factors on pygmy rabbit occupancy.

To ensure pygmy rabbits or their sign are present above the snow and available for detection, future surveys should include a stringent protocol for survey periods based on climatic events (Brubaker et al. 2014). Because detectability is high regardless of observer, we recommend implementing repeat surveys instead of single visits with dual observers in order to capture the true variation in conditions that may affect above-snow presence. Evaluating snow conditions (e.g., snow pack, snow depth, amount of sagebrush above the snow's crust) at the time of survey would allow us to better analyze true site occupancy using above-snow observations. More refined sagebrush and soil layers would help better predict pygmy rabbit distribution and narrow the survey area (e.g., Gabler et al. 2001, Rachlow and Svancara 2006). These changes would increase our potential to locate appropriate habitat, increase detections of pygmy rabbits and other sagebrush-dependent species of interest, and gain a better understanding of this important ecosystem overall.

Nongame biologist surveying for Pygmy Rabbits.
Photo by: Anika Mahoney.

Prepared by:
Stephanie Rhine, Nongame Biologist; Nichole Bjornlie, Nongame Mammal Biologist

Funding Source:
Wyoming Game and Fish Commission

BLACK-FOOTED FERRET (*MUSTELA NIGRIPES*) MANAGEMENT IN WYOMING

Wyoming has a unique history with the conservation of black-footed ferrets (*Mustela nigripes*, ferrets). The rediscovery of the species after perceived extinction in 1981, the initiation of a captive breeding program, and the establishment of the first reintroduction site each took place within the state's borders. For nearly four decades, Game and Fish has worked in collaboration with private landowners and state and federal agencies to ensure that ferret populations succeed in the wild. Game and Fish remains committed to the goal of recovering this native, endangered species through management of ferrets and their habitat. To that end, the Game and Fish Commission approved a statewide management plan for the species in 2018, detailing statewide population objectives and conservation and management strategies.

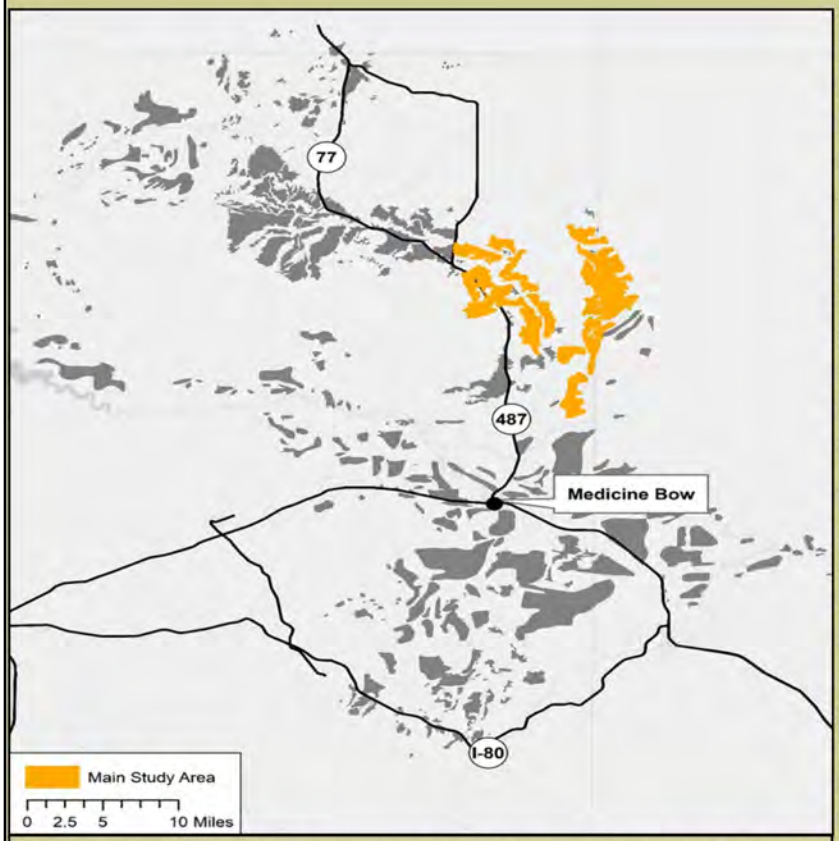


Figure 1. Overview of white-tailed prairie dog colonies within the Shirley Basin Reintroduction Area, Wyoming. The regularly surveyed main study area is highlighted in orange.

Since prairie dogs (*Cynomys* spp.) constitute a majority of ferret diet, and ferrets live in burrows excavated by prairie dogs, managing ferret habitat equates to maintaining adequate density and area of prairie dog colonies. Efforts to support ferrets and their habitat are most hindered by disease, specifically plague, which is caused by the bacterium *Yersinia pestis*. Plague is transmitted by fleas, and capable of producing severe die-offs in both ferret and prairie dog populations. While monitoring and management of prairie dogs, disease, and ferrets are common to both reintroduction areas in the state, the history, size, and specific methodologies used at each site vary.

The Shirley Basin Reintroduction Area (SBRA; Figure 1) was established in 1991, following sufficient production of captive-bred kits for release, and remains the longest lasting ferret reintroduction site. The long-term success is typically attributed to the large amount of quality ferret habitat, as previous estimates of white-tailed prairie dog (*C. leucurus*) colony area have been recorded as more than 180,000 acres. Due to this massive scale, monitoring and management activities for prairie dog and ferret populations within the SBRA have largely been concentrated within approximately 20,000 acres that have historically supported the highest density of ferrets, referred to as the "main study area".

Within the SBRA main study area, large population fluctuations have occurred through the site's long history, with reintroduced ferret populations slow to establish in the 1990s, experiencing exponential population growth in the mid-2000s, and then sharply declining between 2012-2013. Recent ferret surveys suggest moderate increases in population size and reproduction, but numbers remain low relative to previously observed peaks. However, Game and Fish fully expects that additional ferrets occupy

lands outside of the main study area, and, consequently, the population is likely substantially larger than the number of ferrets reported from surveys.

Following the statewide designation of ferrets as a non-essential, experimental population in 2015, the Meeteetse Reintroduction Area (MRA; Figure 2) was established in 2016 on the same prairie dog colonies where the species was rediscovered in 1981. The MRA consists of approximately 6,200 acres of white-tailed prairie dog colonies. Through collaboration with a multi-agency disease management team, the MRA has been actively managed for plague through the use of insecticide (DeltaDust) and oral sylvatic plague vaccine for prairie dogs (SPV) annually since 2016. The first two years following initial establishment of the MRA were marked by successful litter production, supplemental releases to provide increased reproductive opportunities for ferrets, and completion of a pilot project to assess efficacy of scent detection dogs as a method for detecting ferrets. While the ferret population appeared to become quickly established at MRA, the effects of plague were made evident in 2019 through reductions in both prairie dog density and ferret relative abundance.

Management decisions to support reintroduction sites are determined by annual monitoring efforts conducted by Game and Fish and volunteers for both ferrets and prairie dogs. Prairie dog colonies are mapped (either on the ground with GPS units or through a combination of remote and field verification) to estimate active and potential area of ferret habitat. Prairie dog density is estimated through visual count surveys at each reintroduction area. Standard protocol is to visit 200 m^2 plots for three consecutive days between 0730-1030 on warm, dry mornings in June and July. Finally, relative density of prairie dogs is assessed before other management activities, such as plague management or releases of captive-bred ferrets.

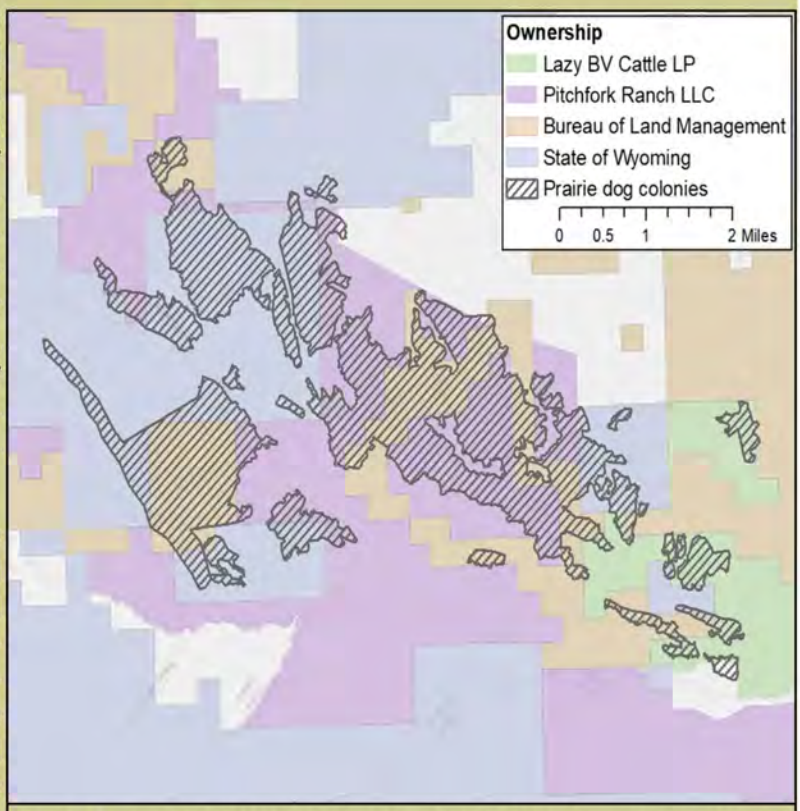


Figure 2. Prairie dog colonies and landownership of the Meeteetse Reintroduction Area, Wyoming.

Due to the nocturnal habit of ferrets, spotlighting is the primary survey method employed to locate ferrets and estimate population size. Surveyors use high-powered spotlights to search portions of previously mapped prairie dog colonies looking for ferret eyeshine from 2000-0600 in blocks of three consecutive nights. To coincide with kit emergence and dispersal, surveys are conducted from mid-August through mid-September. Demographic data can be collected when ferret capture efforts are incorporated into spotlight surveys. During these efforts, ferrets are trapped, anesthetized, marked, and vaccinated against plague and canine distemper, and then returned to their point of capture. Ferret numbers are reported as minimum number alive within each reintroduction area, unless captures are sufficient (greater than 30 individuals) to estimate population size via mark-recapture methods. When spotlight surveys reveal decreases in ferret numbers, populations can be supplemented through release of captive-bred kits or kits translocated from other sites.

Ferrets in Wyoming are managed by Game and Fish, but recovery efforts are the product of engagement with many stakeholders. The Wyoming Black-footed Ferret Working Group, comprised of representatives from local, state, and federal agencies and non-governmental organizations, meets annually to discuss plans and progress towards recovery goals. Further, no efforts would be possible without the cooperation and generosity of private landowners. As new conservation challenges are encountered and as technology continues to develop, ferret management in Wyoming remains collaborative and adaptive.

MEETEETSE REINTRODUCTION AREA FOR BLACK-FOOTED FERRETS

In September 2019, we conducted 238 hours of spotlight surveys that covered 8,154 acres of the reintroduction area. During surveys, five ferrets were detected and subsequently captured, marked, and vaccinated. Two individuals were kits, providing evidence of at least one litter produced. The other three ferrets captured were adult males; two were marked and vaccinated in previous years while one adult male was not previously marked. Each of the ferrets encountered in 2019 was born at the MRA (i.e., not captive-bred and released). The minimum number alive estimate of five individuals is dramatically reduced from the at least 26 ferrets and five litters detected at the site during surveys in 2018 (Figure 3).

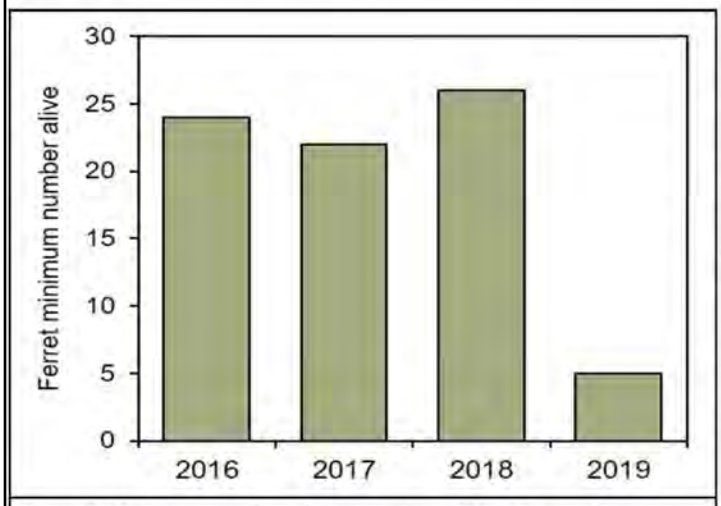


Figure 3. Minimum number alive estimates of black-footed ferrets (*Mustela nigripes*) within the Meeteetse Reintroduction Area, Wyoming since the site was established in 2017.

Prairie dog visual count surveys were conducted at 12 plots across the MRA. High counts from three days of consecutive surveys suggested a reduction of 63.8% in average density since 2018, resulting in an overall density of 0.78 prairie dogs per acre (range = 0 to 2.33; SD = 0.63). This reduction compounds the 43% decline observed between 2017 and 2018. We also assessed ferret habitat according to relative density by navigating through previously mapped colonies and counting the number of prairie dogs visible without binoculars. Areas were assigned to one of three categories (high, moderate, few) based on the number of prairie dogs observed aboveground during a single viewing session (more than ten, between two and ten, and fewer than two, respectively). These cursory assessments revealed that 1,480 acres support few-to-no prairie dogs, which includes the loss of 740 acres on State of Wyoming lands in 2018. Approximately 1,400 acres were classified as low density, while 3,300 acres remain with moderate to high density.

In collaboration with a multi-agency disease management team, funding was secured to apply plague management treatment throughout the MRA. Portions of the colony on BLM and private land were prioritized based on prairie dog density and previous ferret detections. In 2019, a total of 4,094 acres of prairie dog colonies received DeltaDust. SPV baits were distributed on 733 acres, coincident with dust. Dusting and distribution of SPV was completed by USDA APHIS Wildlife Services.

Undoubtedly, these declines in ferret habitat and population size at the MRA can be attributed to plague. The disease was confirmed in two prairie dog carcasses collected by the dusting crew in July 2019 and tested by the Wyoming State Veterinary Lab.

Following this plague event, Game and Fish intends to update colony boundaries in spring 2020 and provide an additional early season relative density assessment for prairie dogs prior to scheduled plague management treatments. Additional captive-bred ferrets may be released, pending allocation from USFWS and sufficient prairie dog density at MRA. Plague management, regular monitoring activities, and support for the MRA from partners and Game and Fish will continue in 2020 despite recent setbacks.

Prepared by:
Dana Nelson, Nongame Biologist

Funding Source:
USFWS State Wildlife Grants, USFWS Endangered Species Act Section 6, WGFD Commission Funds

SHIRLEY BASIN REINTRODUCTION AREA FOR BLACK-FOOTED FERRETS

In August 2019, we conducted 372 hours of spotlight surveys for ferrets on 15,576 acres within the main study area. These surveys produced a minimum number alive estimate of 39 ferrets and at least ten litters, both metrics representing the highest values since extensive survey efforts in 2015 (Figure 4). A total of 22 individuals were captured, marked, and vaccinated, representing ten kits and 12 breeding adults. While numbers in 2019 indicate a moderate increase from recent estimates, the population within the main study area is still much smaller than what the area has historically supported (i.e., at least 193 individuals observed in 2006).

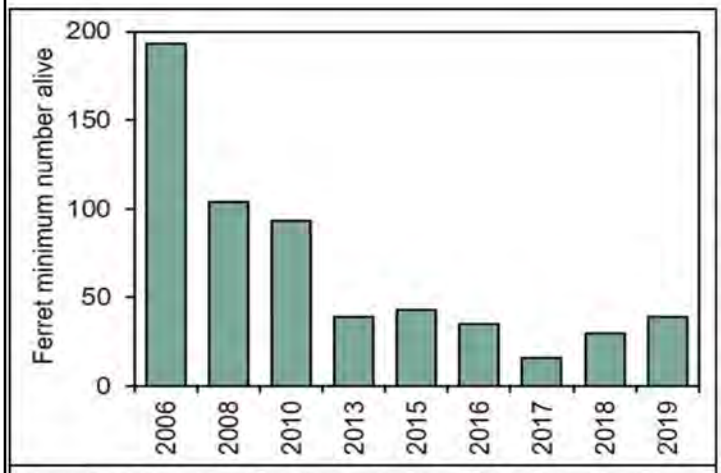


Figure 4. Minimum number alive estimates of black-footed ferrets (*Mustela nigripes*) within the main study area of the Shirley Basin Reintroduction Area, Wyoming since 2006.

Several areas of high-quality habitat but no ferret observations within the last five years were identified as suitable locations for release of captive-bred ferrets. A total of seven adult ferrets were released onto BLM administered lands in September 2019.

Since 2017, prairie dog density has been estimated from surveys at 15 visual count plots within the main study area. These annual trend data indicate an increase in density for the second consecutive year in 2019, as average counts increased by 42.8% and produced an estimate of 4.04 prairie dogs per acre (range = 2.02 to 6.38, SD = 1.49). The prairie dog population growth over the last two years is likely driving trends in ferret litter production.

In addition to regular monitoring activities within the main study area, a combination of remote and field verification of prairie dog distribution was assessed across a greater portion of the SBRA. We used aerial imagery to classify 500 m^2 cells as containing no burrows, low burrow density (<50% of the cell), or high burrow density (>50% of the cell) across approximately 2.2 million acres. From these assessments, 115,000 acres were classified as high density, including 65,000 acres that had never been mapped or surveyed previously. Over 40% of all cells contained at least some prairie dog burrows, highlighting the large amount of potential habitat available for ferrets in the SBRA.

Current prairie dog activity was confirmed on a subset of the imagery grid cells through additional visual counts and windshield surveys within historically mapped colonies throughout the SBRA. Visual counts at all 104 locations suggest an overall mean density of prairie dogs across SBRA of 2.00 prairie dogs per acre (range = 0 to 8.30, SD = 1.91). Important results of this combined field and remote effort were not only the identification of high density prairie dog acreage on which to focus management and survey efforts in the future, but also the identification of locations where burrows were visible in imagery but prairie dogs were no longer present, suggesting future effort need not be expended in those areas.

Efforts in the next two field seasons will be aimed at continuing to improve maps and knowledge of ferret and prairie dog distribution across the extent of the SBRA. Building off of pilot work conducted at the MRA and in Arizona, Game and Fish has contracted Working Dogs for Conservation to deploy professionally trained scent detection dogs to survey for ferrets across the SBRA. Ferret presence will be confirmed by a combination of targeted spotlighting and remote camera deployment. These data will be used to refine long-term management strategies and to better address presence and distribution of ferrets across the large scale of the SBRA.

Prepared by:
Dana Nelson, Nongame Biologist

Funding Source:
USFWS State Wildlife Grants, USFWS Endangered Species Act Section 6, WGFD Commission Funds

BATS OF WYOMING

There are 18 species of bats in Wyoming, all of which are insectivorous. Each species has its own feeding niche and method, with some species gleaning prey from the ground and others feeding high above the canopy and still other species feeding in every space between. Together Wyoming's bats prey on a wide variety of insects, many of which are considered pests or disease vectors, such as mosquitoes. Many of Wyoming's bats have special conservation status with Game and Fish or with Federal agencies; for instance, bats make up 25% of the mammalian SGCN in Wyoming. Because bats are small, nocturnal, cryptic, and volant, they are difficult to study, so large knowledge gaps exist in our understanding of their basic ecology. These include knowledge about population sizes and basic life histories that will be important in supporting populations through various conservation challenges. Bats have a very slow reproductive strategy, with most species having only one pup each year and individuals of several species capable of living into their mid-30s. Because of these traits, if populations become depressed for any reason, they are not capable of a rapid recovery. There may be additional impacts if populations lose older, more experienced animals in greater than normal numbers.

Water collects on bats during hibernation. Photo by: Teal Cufuade.

Conservation Challenges

According to the Western Bat Working Group, the most important conservation challenges facing bats are climate change, habitat loss, persecution, wind energy development, and white-nose syndrome (WNS). These challenges are not evenly distributed across the country, and they affect Wyoming's bats to varying degrees. It is unclear how hibernating populations may be affected by climate change, as an unstable climate can increase mortality during hibernation. The effect of habitat loss on Wyoming's bats is difficult to measure as well. We have a basic understanding of habitat use in the state, but population numbers and trends within these habitats are largely unknown. Persecution in Wyoming has not been studied explicitly, and more information is needed to evaluate this potential threat to Wyoming's bat populations. Wind energy development and WNS have enjoyed the most research attention in Wyoming, as both are urgently emerging issues for the state.

Persecution of bats remains an issue in Wyoming. The general public does not always recognize bats as wildlife, and fear and a lack of information can lead to unnecessarily negative interactions for bats when humans and bats come into close proximity. Education can go a long way toward alleviating these fears. Game and Fish has developed a number of educational and outreach materials for the public that address these issues and seeks out opportunities to directly interact with individuals through one-on-one communications and community presentations. Further training for wildlife professionals is needed to ensure consistency in the handling of bat-human interactions. Proper training can ensure that these interactions are handled in a safe and humane way for both humans and bats. Formal research into attitudes about bats in the state and the efficacy of outreach and training on these beliefs may be beneficial in the long term.

Wind energy development often takes place along migration corridors for multiple bird and bat species, as the long, unobstructed fetches, such as those on the sage steppe, that enable reliable wind generation are the same corridors that facilitate migration of animals that use the wind to travel. Wind farms cause bat mortality both by direct strikes and barotrauma, during which the localized low air pressure from the turbine causes the bat's lungs to be sucked out of its body. Any bat can have a fatal encounter with a wind turbine, but the most affected species are those that migrate to warmer climates in the winter months. In Wyoming, the species most affected by wind development are hoary (*Lasiurus cinereus*), silver-haired (*Lasionycteris noctivagans*), and eastern red bats (*Lasiurus borealis*). Specific migration routes for Wyoming's bats are unknown, but the current and projected increase in wind energy development in Wyoming highlights the need for this information.

WNS is a disease caused by an introduced fungal pathogen that attacks bats when their immune systems are depressed during hibernation. The exact means of mortality is unknown but is thought to include starvation and exposure. Mortality in hibernacula in the East has been reported as 99.9% for many colonies, especially among species in the genus *Myotis*. Mortality in the West will be extremely difficult to access, as less is known about hibernation behavior and habitat of western bats. Monitoring for *Pseudogymnoascus destructans* (Pd), the fungus that causes WNS, has been carried out by Game and Fish since 2014. Monitoring for Pd is done by swabbing bats or by sampling the substrate of caves or mines that could serve as reservoirs for the fungus. Both types of samples are tested for the fungal DNA. Samples from bats have been shown to result in detection of the fungus earlier in the invasion than substrate samples, but the latter allows sampling without disturbing bats during the critical hibernation season. Pd was first documented in the state in 2018 and 2019, in Goshen and Niobrara counties, respectively. Both detections were from active bats in samples taken in the spring after bats emerged from hibernation but before they had cleared the fungus completely from their skin. Bats with clinical signs of WNS have not been found in the state thus far. Species occurring in Wyoming that are known to be affected by WNS elsewhere in their range include big brown bats (*Eptesicus fuscus*), American perimyotis (*Perimyotis subflavus*, better known as the tri-colored bat), and several myotis species. The rest of the *Myotis* genus are expected to be affected, though many western species have not yet encountered the fungus.

Hibernating myotis cluster in a cave in central Wyoming. Photo by: Teal Cufuade.

THE NORTH AMERICAN BAT MONITORING PROGRAM IN WYOMING (STATIONARY ACOUSTICS MONITORING: JUNE 1ST – AUGUST 15TH)

Long-term monitoring of bats in Wyoming has previously been limited to a few known roosts and limited areas in the state. Conservation challenges to bats, such as WNS and wind energy development, require a more comprehensive monitoring scheme. To this end, Wyoming Game and Fish (Game and Fish) implemented the North American Bat Monitoring (NABat) Protocol on a statewide basis in 2018. This protocol is supported by the USGS as the NABat Program.

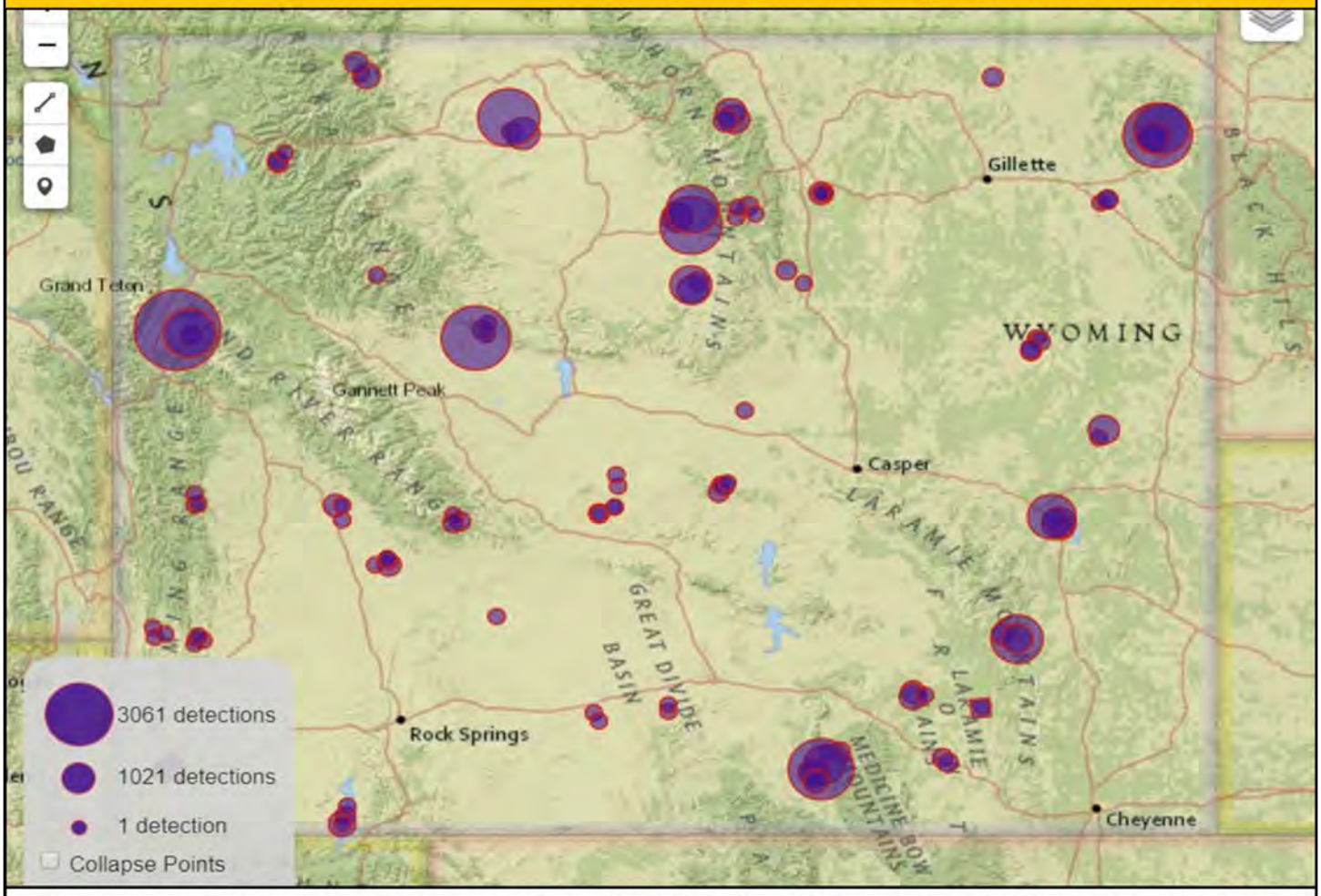
The NABat Program is an international, multiagency program that uses four monitoring approaches to gather data to assess changes in bat distributions and abundances: hibernaculum counts, maternity colony counts, mobile acoustic surveys, and acoustic surveys at stationary points (Loeb et al 2015). Previous capture and roost inventories have laid the groundwork for bat monitoring in Wyoming by establishing species distribution and locating many important roosts.

Game Warden Tom DeSomber sets up a bat detector in his monitoring cell near Tensleep. Regional state and federal personnel who have agreed to help have taken on 1 or 2 cells to monitor each year. Photo by: Laura Beard.

The roost monitoring portions of the NABat Protocol are designed to support ongoing roost monitoring as well as to guide new efforts. One of the longest running bat monitoring efforts in Wyoming focuses on locating and monitoring bat roosts. The NABat database housed at USGS has the capacity to store and make widely available all information on bat roosts to users nationwide. In 2019, we uploaded all recent and historic roost information belonging to Game and Fish into the NABat database to allow for easy collaboration with federal partners. Prior to this upload, all identifiable features, such as cave names and specific location information, were removed to protect roost locations. Location specific information is available from Game and Fish to relevant partners to facilitate collaboration.

The acoustic portions of the NABat Protocol will provide a baseline index of bat activity using acoustic techniques. During the summer of 2018, Game and Fish implemented the stationary acoustic survey portion of the NABat Protocol on a statewide basis. Equipment was deployed at the same sites in 2019, with a few exceptions where permission could not be obtained for the current field season. We also added an additional cell. In total, 114 sites in 36 sampling cells have been established. Of these, 83 sites were successfully monitored for bat activity in 2019. The remaining sites were not surveyed or failed for a variety of reasons. One site could not be accessed because unusually high water covered the location. No legal access could be gained for seven established sites where the landowner was unreachable in 2019. At 21 sites, the detector was deployed but the equipment failed due to cows or operator error. Improvements to instructions and additional training materials are being developed to mitigate this concern. Yearly monitoring at these locations will allow Game and Fish, in partnership with the NABat Program, to document changes in bat distribution and activity though time.

The Nongame Program is currently serving the needs of technical support, coordination, data processing, and analysis for this project. The field implementation of the NABat Program as established in Wyoming relies on the continued effort of regional personnel from state and federal natural resource management agencies. While this use of regional personnel is an efficient way to carry out monitoring efforts in a large state such as Wyoming, bat detectors are not generally user-friendly, and few wildlife professionals are trained or experienced in bat behavior or acoustic survey techniques. Thus, it is important that technical support be available to maintain and troubleshoot equipment. Central coordination of survey timing also remains necessary to ensure sites are surveyed at similar times each year and facilitate gear transfer among locations. Per the NABat Protocol, Game and Fish is responsible for classifying calls and uploading all data to the NABat database, which will provide seamless data sharing for partners. Data from this project require considerable time to analyze and should be examined in reference to trends between years as well as species occurrence within grids. The NABat Program will provide continent-wide trend analysis of all submitted data; however statewide analysis using this dataset is possible as well and may be com-



Screen shot of a map map of acoustic detections generated automatically within the NABat database. Circle size indicates number of detections. A number of automatically generated analyses are available through the database to help managers visualize their data. Levels of data sharing are set by project so that sensitive data is shared appropriately. Data from this project will be used at the state, regional, and national levels to monitor bat distribution and activity over time.

pleted on a five-year basis by the Nongame Program.

The original implementation of this project in 2018 was especially timely, as the fungus that causes WNS was documented in the southeastern corner of the state in the spring of 2018. The NABat Program may provide insight into the effect of the disease on bat populations and community assemblages as it progresses throughout the state (Ford et al 2011). In Wyoming, most of the species currently or suspected to be affected by WNS echolocate in the high frequency category (above 30kHz), while most of the species that echolocate in the low frequency category (below 30kHz) have not been found to be affected by the disease. There are exceptions, but this frequency division between WNS affected and unaffected bat species provides a convenient, though imperfect, method for using acoustic monitoring to access statewide effects of the disease. Though not all bat calls are of sufficient quality to be assigned to a species, even calls of poor quality can be confidently categorized as either high or low frequency, allowing a relative activity index to be easily and reliably produced. Appreciable changes in this index could indicate a shift in species assemblages as the fungus progresses across Wyoming.

In addition to tracking trends in species assemblages, the NABat Program will enable detection of changes in species occupancy across the state. Bats in North America face a variety of conservation challenges that can act in combination to exacerbate the negative pressure on populations. Monitoring continued occupancy in known ranges and potential expansion of populations will allow managers to better serve the conservation needs of this taxon in the face of these combined threats.

Prepared by:
Laura Beard, Nongame Biologist

Funding Source:
United States Fish and Wildlife Service Competitive State Wildlife Grant

LITTLE BROWN MYOTIS FALL TRACKING TO CHARACTERIZE HIBERNACULA (AUGUST 15TH-APRIL 30TH)

While bats in the eastern US hibernate in subterranean structures in large numbers, far fewer large hibernacula have been found in the West, which tend to host smaller groups of bats (Weller 2018). In Wyoming, few hibernacula are known that host more than five observable myotis of any species. As WNS spreads across the country and the state, it is increasingly important to understand where little brown myotis, one of the most widespread and historically abundant bats in the country, hibernates, as they are evidently not using cavernous hibernacula in large numbers in Wyoming. Researchers in other western states such as Alaska and Colorado have found little brown myotis hibernating in non-cavernous rocky habitat, which prompted Game and Fish to start a project designed to track the species to fall and winter roosts.

In 2019, we identified several little brown myotis maternity roosts in the Lander Region where we had landowner approval to capture and track. We selected two of these based on ease of physical and legal access to the surrounding landscape to give us the best chance of accessing subsequent roosts to which the tagged bats moved. During August and September, we glued VHF radio transmitters onto little brown myotis a few at a time, tracking all tagged individuals every day from the ground as well as weekly from the air. Once bat numbers at the roosts started to decline, we attached as many transmitters as possible on every capture night available by capturing over water sources where bats spend time feeding and drinking.

Radio tagged bat near the surface in a crack in a granite boulder. Photo by: Shawn Pladas.

Tracking resulted in 15 ground locations. All bats were located in cracks in rocks, despite the presence of several trees with characteristics typical of little brown myotis roost trees, such as sluffing bark. At ten of these locations, we were able to observe the roosting bat. This shallow roosting behavior likely helped us to locate bats. There were many bats that we were unable to detect a signal from after tagging; this could indicate that they left the area or that the granite in which they roosted effectively blocked the radio signal. Radio signals may escape from cracks in solid rock less well than they do from talus habitat (S.Hilty, pers. comm.), and talus has been noted to be a difficult media to track in previous projects (D.Neubaun, pers. comm.). We intend to follow up on this question in the summer of 2020 with a field experiment to see how quickly the radio signal disappears when the transmitter is lowered into a crack in the granite at our study area.

Fall bat roost (circled in green) typical of where bats were located. Photo by: Christine Peterson.

We lost contact with all bats while they were still moving between roosts, so it is unclear whether the roosts we located were hibernacula or transitional roosts. One bat, moved among several roosts on a single ridge until the signal disappeared during some very cold weather. From this "prospecting" behavior that left little time to move a significant distance before the onset of cold weather, it is likely that this bat choose a hibernation roost in the area. We monitored all roosts over the winter with acoustic bat detectors with no possible little brown myotis detections during the winter months that would suggest their presence in the area.

Detectors have a limited range and battery life, and while every effort was made to maintain detectors to ensure continuous functioning, detector nights were lost over the course of the winter. For these reasons as well as the extremely low activity levels of bats in the winter, the lack of detections is not necessarily a confirmation of their absence in the area during the winter.

These findings are somewhat novel, as most previous little brown myotis roosting behavior centers on trees, buildings, and cavernous subterranean structures. More recent work in several western states have established that non-cavernous rocky habitat is important for hibernation, but this work has centered primarily on talus or colluvial zones where bats are roosting between rocks. In our work, bats were seen to use a different type of rocky habitat, the cracks in large rocky structures. This growing body of work illustrates the unique roosting behavior of little brown myotis and how the behavior of the western population may differ from that in the East. These accumulated findings may have important implications for the spread of WNS in the West and highlight the necessity for a wider variety of monitoring protocols than those traditionally used for bats, which have focused on large centralized roosts and primarily use hibernacula to monitor population trends. The dispersed, cryptic, non-cavernous nature of these potential hibernacula make traditional internal surveys impossible to carry out. We will continue this project in the same location for an additional year.

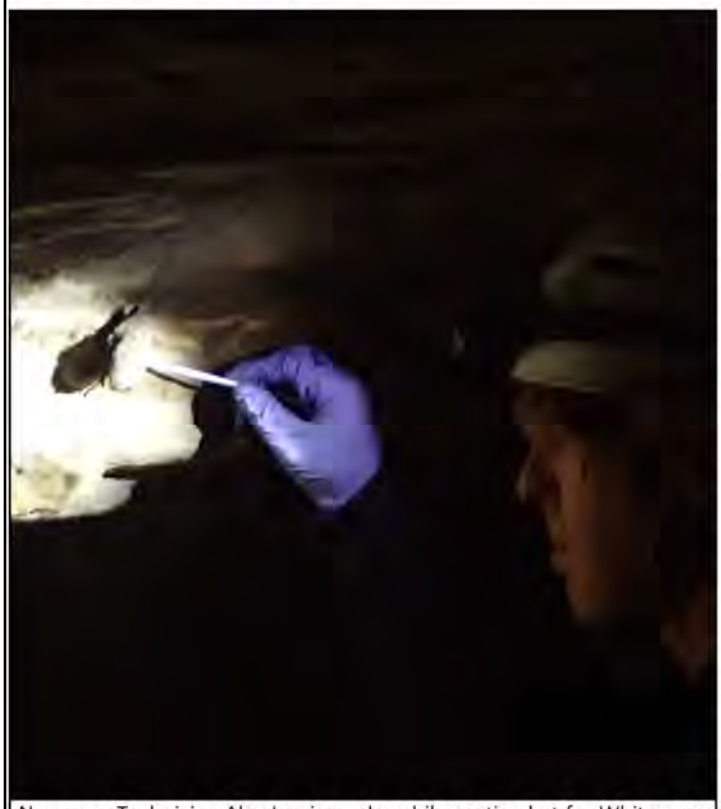
Fall bat roost (indicated by the green arrow) on the ridge where the greatest number of roosts were located. Photo taken looking north, other roosts were located on this ridge, to the east. The maternity roost is to the west of the ridge, along the Sweetwater River. Photo by: Christine Peterson.

Prepared by:
Laura Beard, Nongame Biologist

Funding Source:
Wyoming Governor's Endangered Species Account Fund

WINTER WHITE-NOSE SYNDROME SURVEILLANCE AND HIBERNATION POPULATION MONITORING (NOVEMBER 16TH -MARCH 15TH)

Wyoming Game and Fish has maintained records of surveys at bat roosts and potential roosts since 1992. Since the discovery of WNS in the US in the mid-2000s, these surveys have focused on locating and monitoring hibernation locations for changes in both populations and WNS status. To date, the largest hibernacula known in Wyoming contains around 75 bats. As no large hibernacula (those housing hundreds or thousands of bats) have been found in the state, we have reduced the effort expended in winter surveys as a surveillance approach for Pd. Repeated surveys at priority locations help monitor the population, even though the large numbers of bats seen in the summer months remain unaccounted for in the winter. Pd sampling in conjunction with hibernation surveys allows Game and Fish to monitor actual disease status of priority locations, as observing clinical signs in bats is required to determine presence of the disease as opposed to the fungus alone.



Nongame Technician Alex Lewis swabs a hibernating bat for White nose syndrome testing. Swabs are sent to the National Wildlife Health Center for DNA analysis. Photo by: Teal Cufaude.

In the 2019-2020 hibernation season, four subterranean structures were visited to monitor populations, sample for the presence of Pd, and look for clinical signs of WNS. Two additional caves were attempted but were inaccessible due to unusual snow conditions. All results were negative for Pd.

With assistance of the Bighorn National Forest and the Hole in the Wall Grotto, we sampled a popular recreational cave on the eastern side of the Bighorn Mountains. No bats were present, so all samples were environmental. This large cave is known to house very small numbers of hibernating bats but attracts many visitors; as a popular recreational cave, it is a potential point of entry for Pd into the Bighorn Mountain's bat population.

With the assistance of the Medicine Bow Game Warden and the Saratoga Wildlife Biologist, we sampled a cave in the Shirley Mountains that contains the largest known hibernacula in the state. This cave has historically housed Townsend's big-eared bats (*Corynorhinus townsendii*) as well as little brown (*Myotis lucifugus*) and western small-footed myotis (*M. ciliolabrum*) in roughly equal numbers, as well as a few long-eared myotis (*M. evotis*) and big brown bats (*Eptesicus fuscus*). Townsend's big-eared bats, little brown myotis, and western small-footed myotis were observed in 2019. Sufficient bats wer0e present to sample for Pd using bat swabs, augmented by environmental samples.

With the assistance of the Wyoming Air National Guard's (WANG) Civilian Natural Resources staff, we sampled a cave on the Camp Guernsey Joint Training Center, where we had previously installed a bat gate. This cave has had historically exceptionally high levels of human disturbance, including excessive vandalism. The Natural Resources staff at WANG have tested guano found in the cave, revealing the presence of several species, including the American perimyotis, which has only been found at two other locations in Wyoming. No bats were present during the hibernation survey, and all samples were taken from the cave substrate.

With assistance from WANG's Natural Resources staff and permission from a private landowner, we surveyed and tested two abandoned mine structures that are extremely close together. These mines are treated as a single site for sampling purposes, as they are both satellite hibernacula to a central Townsend's big-eared bat maternity roost. The bunker portion of this site has consistently housed around 20 western small-footed myotis, as well as an occasional Townsend's big-eared bat, big brown bat, or little brown myotis. There were fewer western small-footed myotis in the bunker, but the adjacent adit saw an increase in the number of west-

ern small-footed myotis. The combined population of the site was similar to previous years.

The two sites we were unable to sample were both natural caves. Partners in the WANG and the Hole in the Wall Grotto were trained to conduct surveillance and left with kits for sampling bats and hibernacula substrate (WANG) and substrate only (Grotto) following national protocols. Training partners to sample for Pd on previously planned trips helps Game and Fish facilitate and expand testing in subterranean structures beyond what we could accomplish alone. Due to the COVID-19 pandemic, these sampling efforts have been delayed indefinitely.

Wildlife Biologist Teal Cufuade and Game Warden Rob Shipe assist the Nongame Bat Crew during a cave survey in central Wyoming. Logistical support from Regional personnel allows the program to to carry out a variety of challenging statewide bat work successfully. Photo by: Laura Beard.

Prepared by:
Laura Beard, Nongame Biologist

Funding Source:
Wyoming Governor's Endangered Species Account Fund, United States Fish and Wildlife Service Competitive State Wildlife Grant

WNS SURVEILLANCE: SPRING ROOST AND LANDSCAPE CAPTURES (APRIL 1ST- MAY 31ST - REPORTING DELAYED 1 YEAR)

Spring capture in order to test for the presence of Pd is an important surveillance tool in the effort to manage bats in the face of WNS, especially in the West, where bats do not congregate in hibernacula in large numbers. Spring capture sites are selected for their potential to yield high numbers of myotis, which are especially susceptible to WNS. A common strategy for selecting these sites is to target maternity roosts in the early spring as bats are returning to their summer roosts. An alternative strategy is to sample a location with historically high numbers of bats captured. This "landscape site" strategy is much less likely than the roost targeting strategy to result in a sufficient number of samples from bats to confidently determine that the fungus is not present. While less desirable because of their low capture rates, landscape sites are useful for sampling in areas where no hibernaculum or maternity roost is known. The National Wildlife Health Center WNS surveillance guidelines indicate that at least 25 bats must be sampled for a confident determination of fungal absence; false negatives are still possible though less likely with a sufficient sample size. In the spring of 2019, we conducted WNS spring surveillance efforts at six sites, two maternity roosts and four landscape sites, which resulted in the change in status of one county in Wyoming to "WNS suspect." The fungus was not detected at any other site tested by Wyoming Game and Fish (Game and Fish).

Preparing to swab a little brown bat during spring white nose syndrome sampling. Photo by: Alex Lewis.

In Niobrara county, one maternity roost and one landscape site within the same municipality were sampled. Multiple samples at each site tested "inconclusive" for Pd, meaning that the samples required too many amplifications of the DNA to detect the fungus for the lab to rule out other sources of error. As samples from multiple bats at both sites in the county resulted in inconclusive results, and because of the proximity to Jewel Cave (WNS positive) and Ft. Laramie (Pd positive), Game and Fish, in consultation with the USFWS, determined that Niobrara county should be managed as though Pd was present (i.e., WNS suspect). The decision by Game and Fish to identify both Goshen and Niobrara counties as WNS suspect mandates that bat researchers do not use equipment previously used in bat handing or internal roost surveys from these counties anywhere else in the state in an effort to reduce human-facilitated spread of the fungus. Research permits in the state already prohibit the use of equipment previously used in an external Pd or WNS positive area to be used for bat work in Wyoming.

Sites that were sampled in 2019 but where Pd was not detected include a maternity roost in Fremont county, a landscape site with historically high numbers of little brown myotis captures in Natrona county, and two landscape sites in Crook county. One of the Crook county sites has historically had very high rates of several myotis species, including the federally threatened northern long-eared myotis (*Myotis septentrionalis*), a species listed due to widespread population declines from WNS. Game and Fish will continue to conduct surveillance at selected sites statewide to document the spread of WNS and Pd across Wyoming.

Prepared by:
Laura Beard, Nongame Biologist

Funding Source:
United States Fish and Wildlife Service WNS Grants to States

LITERATURE CITED

Alexander, J.D., J.L. Stevens, G.R. Geupel, and T.C. Will. 2009. Decision support tools: bridging the gap between science and management. Pages 283-291 *in* Tundra to Tropics: Connecting Birds, Habitats, and People. Proceedings of the 4th International Partners in Flight Conference, 13-16 February 2008 (T.D. Rich, C. Arizmendi, D. Demarest, and C. Thompson, Editors). Partners in Flight, McAllen, Texas, USA.

Barnes, K.P., and J.R. Belthoff. 2008. Probability of detection of Flammulated Owls using nocturnal broadcast surveys. Journal of Field Ornithology 79:321–328.

Baron, J.S., S.H. Julius, J.M. West, L.A. Joyce, G. Blate, C.H. Peterson, M. Palmer, B.D. Keller, P. Kareiva, J.M. Scott, and B. Griffith. 2008. Some guidelines for helping natural resources adapt to climate change. International Human Dimensions Programme on Global Environmental Change Update 2:46-52.

Bird Conservancy of the Rockies [Bird Conservancy]. 2020. The Rocky Mountain Bird Observatory Avian Data Center, Brighton, Colorado, USA. https://rmbo.org/v3/avian/Home.aspx (accessed 30 April 2020).

Brubaker, D.R., A.I Kovach, M.J Ducey, W.J. Jakubas, and K.M. O'Brien. 2014. Factors influencing detection in occupancy surveys of a threatened lagomorph. Wildlife Society Bulletin 38:513-523.

Carlisle, J., and M. Stuber. 2010. Flammulated Owl breeding season survey results from three study areas in southern Idaho in 2009. Idaho Bird Observatory.

Conway, C.J. 2009. Standardized North American marsh bird monitoring protocols, version 2009-2. Wildlife Research Report #2009-02. US Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, USA.

COSEWIC. 2010. COSEWIC assessment and status report on the Flammulated Owl *Otus flammeolus* in Canada. Committee on the Status of Endangered Wildlife in Canada.

Crawford, J.A., R.G. Anthony, J.T. Forbes, and G.A. Lorton. 2010. Survival and causes of mortality for pygmy rabbits (Brachylagus idahoensis) in Oregon and Nevada. Journal of Mammalogy 91:838-847.

DeSorbo, C., J. Fair, K. Taylor, W. Hanson, D.C. Evers, H. Vogel, and J. Cooley. 2007. Guidelines for constructing and deploying Common Loon nesting rafts. Northeastern Naturalist 15 (1):75-86.

Donovan, T.M., and C.H. Flather. 2002. Relationships among North American songbird trends, habitat fragmentation, and landscape occupancy. Ecological Applications 12:364-374.

Dreitz, V.J., P.M. Lukacs, and F.L. Knopf. 2006. Monitoring low density avian populations: an example using Mountain Plovers. The Condor 108:700-706.

ESRI 2017. ArcGIS Desktop: Release 10.5.1. Redlands, CA: Environmental Systems Research Institute.

Estes, J.R., R.J. Tyrl, and J.N. Brunken (Editors). 1982. Grasses and Grasslands; Systematics and Ecology. University of Oklahoma Press, Norman, USA.

Evers, D.C. 1993. A replicable capture method for adult and juvenile Common Loons on their nesting lakes. Pages 214-220 *in* L. Morse, S. Stockwell, and M. Pokras (Editors). Proceedings of the 1992 Conference on the Loon and its Ecosystem. U.S. Fish and Wildlife Service, Concord, New Hampshire, USA.

Evers, D.C. 2001. Common Loon population studies: Continental mercury patterns and breeding territory philopatry. Ph.D. Dissertation. University of Minnesota, St. Paul, USA.

Evers, D.C., C. Persico, L. Savoy, and K. Taylor. 2019. Wyoming Common Loon Demographic Investigation: 2019 Technical Report. Report #2019-50. Biodiversity Research Institute, Portland, Maine, USA.

Fellows, S.D., and S.L. Jones. 2009. Status assessment and conservation action plan for the Long-billed Curlew (*Numenius americanus*). US Department of Interior, Fish and Wildlife Service, Biological Technical Publication, FWS/BTP-R6012-2009, Washington, DC, USA.

Greater Yellowstone Bald Eagle Working Group [GYBEWG]. 1996. Greater Yellowstone Bald Eagle Management Plan: 1995 Update. Greater Yellowstone Bald Eagle Working Group, Wyoming Game and Fish Department, Lander, USA.

Groves, D.J. 2012. The 2010 North American Trumpeter Swan Survey. Unpublished report. US Fish and Wildlife Service, Division of Migratory Bird Management, Juneau, Alaska, USA.

Harmata, A., and B. Oakleaf. 1992. Bald Eagles in the Greater Yellowstone Ecosystem: An Ecological Study with Emphasis on the Snake River, Wyoming. Wyoming Game and Fish Department, Cheyenne, USA.

Hayward, G.D. 1994. Conservation status of Boreal Owls in the United States. Pages 139–147 *in* G.D. Hayward, and J. Verner, editors. Flammulated, Boreal, and Great Gray Owls in the United States: a technical conservation assessment. U.S. Department of Agriculture, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Knopf, F.L. 1992. Faunal mixing, faunal integrity, and the biopolitical template for diversity conservation. Transactions of the North American Wildlife and Natural Resources Conference 57:330-342.

Knopf, F.L. 1994. Avian assemblages on altered grasslands. Studies in Avian Biology 15:247-257.

Knopf, F.L. 1996. Prairie legacies – birds. Pages 135-148 *in* Prairie Conservation: Preserving North America's Most Endangered Ecosystem (F.B. Samson and F.L. Knopf, Editors). Island Press, Covelo, California, USA.

Lindenmayer, D.B., and G.E. Likens. 2009. Adaptive monitoring: a new paradigm for long-term research and monitoring. Trends in Ecology and Evolution 24:482-486.

Lindsay, A.R., B. Larison, C. Bossu, J. Rajbhandary, M.D. Sorenson, J.M. DaCosta, J.D. Kaplan, D.C. Evers, J.D. Paruk, T.B. Smith, and K.C. Ruegg. 2019. The Common Loon Genoscape. American Ornithological Society 137th Stated Meeting. Anchorage, Alaska, USA.

Linkhart, B.D., and D.A. McCallum. 2013. Flammulated Owl (*Psiloscops flammeolus*), version 2.0 *in* A.F. Poole, editor. The Birds of North America. Cornell Lab of Ornithology, Ithaca, NY.

Lockman, D. 2005. Wyoming Green River Basin Trumpeter Swan Summer Habitat Project, February 14, 2005. Wyoming Game and Fish Department Nongame Program, Lander, USA.

Loon Preservation Committee [LPC]. 2004. Field collection protocol for surveying and managing Common Loons in New Hampshire. Unpublished report, Loon Preservation Committee, Moultonborough, New Hampshire.

Lyons, J.E., M.C. Runge, H.P. Laskowski, and W.L. Kendall. 2008. Monitoring in the context of structured decision-making and adaptive management. Journal of Wildlife Management 72:1683-1692.

Marsh, D.M., and P.C. Trenham. 2008. Current trends in plant and animal population monitoring. Conservation Biology 22:647-655.

Maxwell, S.L., N. Butt, M. Maron, C.A. McAlpine, S. Chapman, A. Ullmann, D.B. Segan and J.E.M. Watson. 2019. Conservation implications of ecological responses to extreme weather and climate events. Diversity and Distributions 24(4): 613-625.

Mazerolle, M.J. 2019. AICcmodavg: Model selection and multimodel inference based on (Q)AIC(c).

McLaren, M.F., M. Smith, J.M. Timmer, N.E. Drilling, A.W. Green, B.J. Leslie, C.M. White, N.J. Van Lanen, D.C Pavlacky Jr., R.A. Sparks, and A.G. Van Boer. 2020. Integrated Monitoring in Bird Conservation Regions (IMBCR): 2019 Field Season Report. Bird Conservancy of the Rockies. Brighton, Colorado, USA.

Neel, L., and R. Sallabanks. 2009. The Partners in Flight Western Working Group five-year action plan 2008-2012. Partners in Flight Western Working Group.

Nicholoff, S.H. (Compiler). 2003. Wyoming Bird Conservation Plan. Version 2.0. Wyoming Partners in Flight. Wyoming Game and Fish Department Nongame Program, Lander, USA.

North American Bird Conservation Initiative [NABCI]. 2016. The US North American Bird Conservation Initiative. http://nabci-us.org/ (accessed 27 April 2020).

Olson, D. 2020. Trumpeter Swan survey of the Rocky Mountain population, US breeding segment, Fall 2019. (January 2020). US Fish and Wildlife Service, Migratory Birds and State Programs, Mountain-Prairie Region, Lakewood, Colorado, USA.

Orabona, A.C., C.K. Rudd, N.L. Bjornlie, Z.J. Walker, S.M. Patla, and R.J. Oakleaf. 2016. Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming. Wyoming Game and Fish Department Nongame Program, Lander, USA.

Palmquist, K.A., D.R. Schlaepfer, J.B. Bradford and W.K. Lauenroth. 2016. Mid-latitude shrub steppe plant communities: climate change consequences for soil water resources. Ecology 97(9): 2342-2354.

Pardieck, K.L., D.J. Ziolkowski Jr., M. Lutmerding, V. Aponte and M-A.R. Hudson. 2019. North American Breeding Bird Survey Dataset 1966-2018, version 2018.0. U.S. Geological Survey, Patuxent Wildlife Research Center. https://doi.org/10.5066/P9HE8XYJ.

Pardieck, K.L., D.J. Ziolkowski Jr., M. Lutmerding, V. Aponte and M-A.R. Hudson. 2018. North American Breeding Bird Survey Dataset 1966 - 2017, version 2017.0. U.S. Geological Survey, Patuxent Wildlife Research Center.

Patla, S., and B. Oakleaf. 2004. Summary and update of Trumpeter Swan range expansion efforts in Wyoming, 1988-2003. Proceedings and Papers of the 19th Trumpeter Swan Society Conference, Richmond, British Columbia. North American Swans 32:116-118.

Patla, S., and D. Lockman. 2004. Considerations and prescriptions for the design, construction, and management of shallow water wetlands for spring through fall use by Trumpeter Swans. Wyoming Game and Fish Department Nongame Program, Lander, USA.

Peterjohn, B.G., J.R. Sauer, and C.S. Robbins. 1995. Population trends from the North American Breeding Bird Survey. Pages 3-39 *in* Ecology and management of Neotropical migratory birds (T.E. Martin and D.M. Finch, Editors). Oxford University Press, New York, New York, USA.

Pierce, J.E., R.T. Larsen, J.T. Flinders, and J.C. Whiting. 2011. Fragmentation of sagebrush communities: does an increase in habitat edge impact pygmy rabbits? Animal Conservation 14:314-321.

Reynolds, R.T., and B.D. Linkhart. 1992. Flammulated Owls in ponderosa pine - evidence of preference for old growth. Old-Growth Forests in the Southwest and Rocky Mountain Regions: Proceedings of a Workshop 213:166–169.

Robbins, C.S., J.R. Sauer, R.S. Greenberg, and S. Droege. 1989. Population declines in North American birds that migrate to the Neotropics. Proceedings of the National Academy of Sciences 86:7658-7662.

Samson, F.B., F.L. Knopf, and W.R. Ostlie. 1988. Grasslands. Pages 437-472 *in* Status and Trends of the Nation's Biological Resources. Volume 2 (M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran, Editors). US Department of the Interior, US Geological Survey, Reston, Virginia, USA. www.nwrc.uses.gov/sandt/Grasslnd.pdf (accessed 27 April 2020).

Sanchez, D.M. and J.L. Rachlow. 2008. Spatio-temporal factors shaping diurnal space use by pygmy rabbits. Journal of Wildlife Management 72:1304-1310.

Sauer, J.R., and M.G. Knutson. 2008. Objectives and metrics for wildlife monitoring. Journal of Wildlife Management 72:1663-1664.

Sauer, J.R., D.K. Niven, J.E. Hines, D.J. Ziolkowski, Jr, K.L. Pardieck, and W.A. Link. 2019. The North American Breeding Bird Survey Results and Analysis 1966-2017, Version 5.03.2019. US Geological Survey, Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Sauer, J.R., G.W. Pendleton, and B.G. Peterjohn. 1996. Evaluating causes of population change in North American insectivorous birds. Conservation Biology 10:465-478.

Sauer, J.R., J.E. Hines, G. Gough, I. Thomas, and B.G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis, Version 96.4. Patuxent Wildlife Research Center, Laurel, Maryland, USA.

Spagnuolo V., A. Leavitt, C. Southwick, L. Bailey, K. Low, and W. Wehtje. 2020. Greater Yellowstone Ecosystem Common Loon (*Gavia immer*) Summary Report 2019. Unpublished Report #2019-01. Ricketts Conservation Foundation, Denver, Colorado, USA.

Spagnuolo, V.A., A.J. Byrd, J. Fair, C.W. Brown, C. Persico, G. Stout, M.R. Kneeland, and D. C. Evers. 2016. Wyoming Common Loon (*Gavia immer*) Summary Report 2015. Report # 2016-07. Biodiversity Research Institute, Gorham, Maine, USA.

Swenson, J.E., K.A. Alt, and R.L. Eng. 1986. Ecology of Bald Eagles in the Greater Yellowstone Ecosystem. Wildlife Monographs 95:1-46.

Thompson, W.L., G.C. White, and C. Gowan. 1998. Monitoring Vertebrate Populations. Academic Press, San Diego, California, USA.

United States Fish and Wildlife Service [USFWS]. 1998. Pacific Flyway Management Plan for the Rocky Mountain Population of Trumpeter Swans. Pacific Flyway Study Committee, Portland, Oregon, USA.

United States Fish and Wildlife Service [USFWS]. 1999. Endangered and threatened wildlife and plants – proposed threatened status for the Mountain Plover. Federal Register 64(30):7587-7601.

United States Fish and Wildlife Service [USFWS]. 2003. Endangered and Threatened Wildlife and Plants: 90-Day Finding for a Petition to List the Tri-State Area Flock of Trumpeter Swans as Threatened. Federal Register 68.

United States Fish and Wildlife Service [USFWS]. 2010. Endangered and threatened wildlife and plants.

Williams, J., and P. Diebel. 1996. The economic value of prairie. Pages 19-35 *in* Prairie Conservation: Preserving North America's Most Endangered Ecosystem (F.B. Samson and F.L. Knopf, Editors). Island Press, Covelo, California, USA.

Witmer, G.W. 2005. Wildlife population monitoring: some practical considerations. Wildlife Research 32:259-263.

Wyoming Game and Fish Department [WGFD]. 2006. A Plan for Bird and Mammal Species of Greatest Conservation Need in Eastern Wyoming Grasslands. Wyoming Game and Fish Department, Cheyenne, USA.

Wyoming Game and Fish Department [WGFD]. 2017. State Wildlife Action Plan. Wyoming Game and Fish Department, Cheyenne, USA.

Wyoming's Species of Greatest Conservation Need

BIRDS

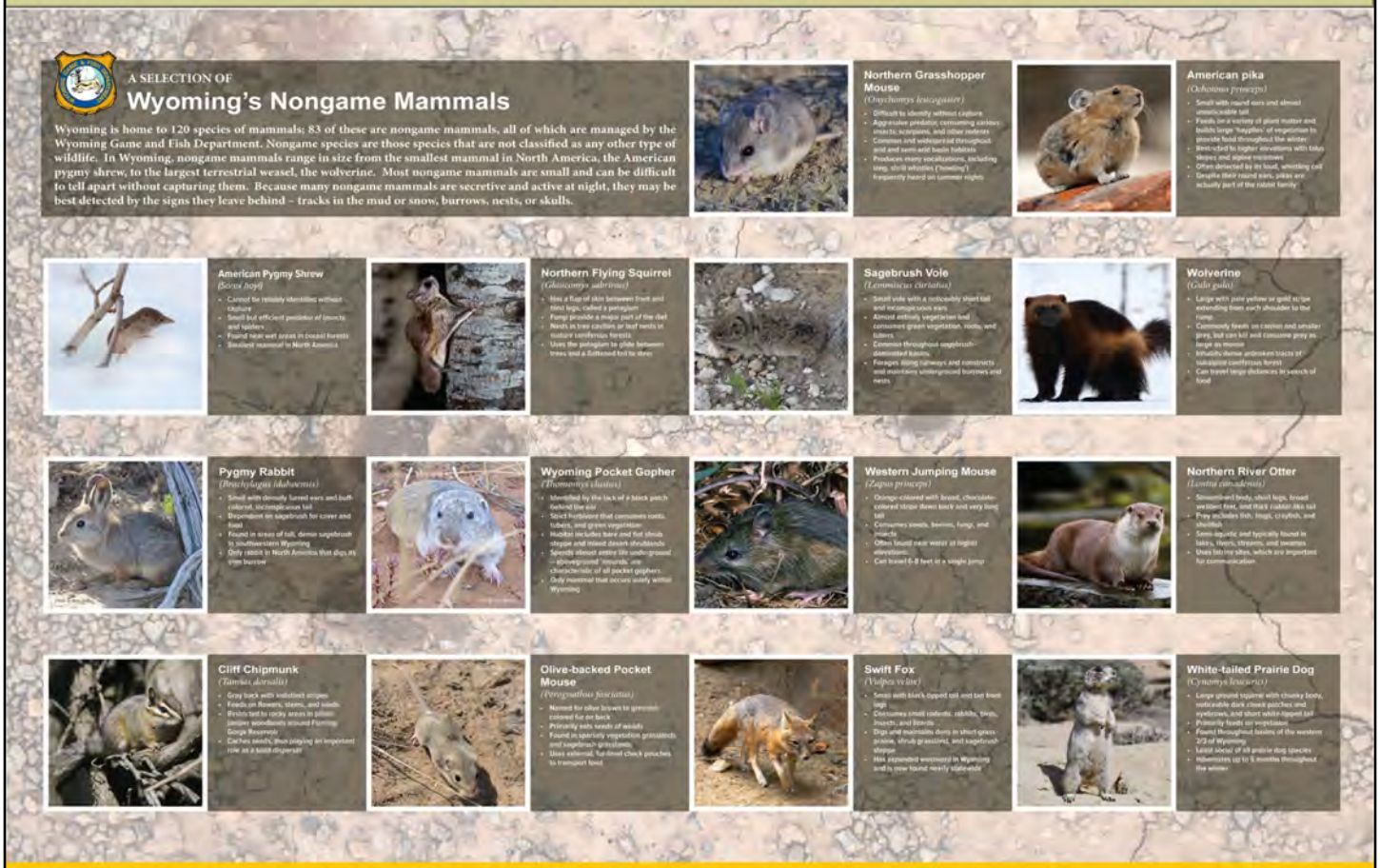
American Bittern
American Kestrel
American Pipit
American White Pelican
Ash-throated Flycatcher
Bairds Sparrow
Bald Eagle
Bewicks Wren
Black-backed Woodpecker
Black-billed Cuckoo
Black-chinned Hummingbird
Black-crowned Night-Heron
Black Rosy-Finch
Black Tern
Black-throated Gray Warbler
Blue-gray Gnatcatcher
Blue Grosbeak
Bobolink
Boreal Owl
Brewer's Sparrow
Brown-capped Rosy-Finch
Burrowing Owl
Bushtit
Calliope Hummingbird
Canyon Wren
Caspian Tern
Cattle Egret
Chestnut-collared Longspur
Clark's Grebe
Clark's Nutcracker
Columbian Sharp-tailed Grouse
Common Loon
Common Nighthawk
Common Yellowthroat
Dickcissel
Ferruginous Hawk
Flammulated Owl
Forster's Tern
Franklin's Gull
Golden Eagle
Gray Vireo
Great Blue Heron
Greater Sage-Grouse
Great Gray Owl
Grasshopper Sparrow
Harlequin Duck
Juniper Titmouse
Lewis's Woodpecker
Loggerhead Shrike
Long-billed Curlew
MacGillivrays Warbler
McCown's Longspur
Merlin
Mountain Plover
Northern Goshawk
Northern Pygmy-Owl
Peregrine Falcon
Purple Martin
Pygmy Nuthatch
Red Crossbill
Red-eyed Vireo
Red-headed Woodpecker
Rufous Hummingbird
Sage Thrasher
Sagebrush Sparrow
Scott's Oriole
Short-eared Owl
Snowy Egret
Snowy Plover
Swainson's Hawk
Trumpeter Swan
Upland Sandpiper
Virginia Rail
Virginia's Warbler
Western Grebe
White-faced Ibis
Williamson's Sapsucker
Willow Flycatcher
Woodhouse's Scrub-Jay
Yellow-billed Cuckoo

MAMMALS

Abert's Squirrel
American Pygmy Shrew
American Pika
Bighorn Sheep
Black-footed Ferret
Black-tailed Prairie Dog
Canada Lynx
Canyon Deermouse
Cliff Chipmunk
Dwarf Shrew
Eastern Red Bat
Eastern Spotted Skunk
Fringed Myotis
Great Basin Pocket Mouse
Hayden's Shrew
Hispid Pocket Mouse
Idaho Pocket Gopher
Least Weasel
Little Brown Myotis
Long-eared Myotis
Long-legged Myotis
Meadow Jumping Mouse
Moose
Northern Flying Squirrel
Northern Long-eared Myotis
Northern River Otter
Olive-backed Pocket Mouse
Pallid Bat
Pinon Deermouse
Plains Harvest Mouse
Sand Hills Pocket Gopher
Plains Pocket Mouse
Preble's Meadow Jumping Mouse
Preble's Shrew
Pygmy Rabbit
Ringtail
Sagebrush Vole
Silky Pocket Mouse
Spotted Bat
Spotted Ground Squirrel
Swift Fox
Townsend's Big-eared Bat
Uinta Chipmunk
Water Vole
Western Small-footed Myotis
Western Spotted Skunk
White-tailed Prairie Dog
Wolverine
Wyoming Pocket Gopher
Yellowpine Chipmunk
Yuma Myotis

Wyoming's Nongame Mammal Poster

Available at the Wyoming Game and Fish Regional Offices



FUNDING

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

Bureau of Land Management Cooperative Agreement (BLM CA) Bureau of Reclamation Cooperative Agreement (BOR CA) Lenox Baker Foundation (LBF) National Park Service Cooperative Agreement (NPS CA) United States Army Corp of Engineers (USACE) United States Fish and Wildlife Service Cooperative Agreement (USFWS CA) United States Fish and Wildlife Service Section 6 Funding (USFWS S6) United States Fish and Wildlife Service State Wildlife Grants and Competitive State Wildlife Grants (USFWS SWG and C-SWG) United States Fish and Wildlife Service WNS Grants to States (USFWS WNS GS) United States Forest Service Cooperative Agreement (USFS CA) Western Association of Fish and Wildlife Agencies (WAFWA) Wyoming Game and Fish Department Commission Funds (WGFD/WGFC) Wyoming Governor's Big Game License Coalition (WG BGLC) Wyoming Governor's Endangered Species Account Fund (WG ESAF)

DISCLAIMER

The Wyoming Game and Fish Department receives Federal financial assistance from the US Fish and Wildlife Service. Under Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, and Title IX of the Education Amendments of 1972, the US Department of the Interior and its bureaus prohibit discrimination on the basis of race, color, national origin, age, disability, or sex (in educational programs). If you believe that you have been discriminated against in any program, activity, or facility, or if you desire further information, please write to:

The US Fish and Wildlife Service Office for Diversity and Civil Rights Programs – External Programs 4040 North Fairfax Drive, Suite 130 Arlington, VA 22203

WYOMING GAME & FISH DEPARTMENT