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THE YEAR I LOST MY BIRDING MIND

and while at first one of the pair flew and scolded me, once I started saying, “Hello, friend” to the pair as they flew overhead, they eventually stopped calling. After about a week, they just stayed perched as I jogged past. *There’s that woman with the red jacket and the two dogs. We know her; no need to worry.*

My List Year completed, I look back on my notes and the numbers (Figs. 6.5 and 6.6). Sometimes it feels like I saw a lot, and other times I remember that I saw more sandhill cranes in one day in 2018 than all birds in 2019. But I remind myself that the total birds was not the goal. The goal was to improve my birding skills and to

document my everyday, corner-of-the-eye sightings. To figure out what I normally see that used to hit my optic nerve and send an image to my occipital lobe but didn’t go any further than that. To make those sightings, in a split second, grab my full attention, open a file of neurons to my past experiences, and find the matching identity, then make my arm move and hand muscles contract to create a tiny *Date: October 14, 2019/Common Raven:2*. To have a record of the experience and remember it years from now. To connect to a place and another life and say hello to a familiar creature. To help me be present wherever I am and to truly see the lives all around me.

FIGURE 6.6 Feathers from important birds observed by Kira Cassidy during 2019 in the Greater Yellowstone Ecosystem. Number of days observed is the numerator of the fraction, followed by the percentage of days observed. **ARTWORK BY KIRA CASSIDY**



GEORGE BIRD GRINNELL

JOHN TALIAFERRO

7

First, let's establish George Bird Grinnell's birder bona fides—and we're not talking about his middle name, which, it's worth noting, he used faithfully. (He sometimes signed his name "Geo. Bird Grinnell," but never "George B. Grinnell.") If anything, his future was foretold not by a birth certificate but rather by the cosmic kismet of growing up on the estate of John James Audubon, on the wooded western shore of Manhattan Island. Grinnell's father, a New York merchant and broker, moved his family onto the Audubon's property in 1857, when Grinnell was six years old. Audubon had died in 1851, but his widow, sons, and grandchildren remained, as did the spirit of the already legendary naturalist, plus a selection of his artwork. Under the tutelage of Madame Audubon, Grinnell came to appreciate the birds that frequented what came to be known as Audubon Park, including the massive migration of passenger pigeons along the Hudson flyway.

AS GRINNELL GREW, so did his engagement with the winged world (Fig. 7.1). He hunted ducks, rails, and woodcocks in the surrounding countryside. Then, as a student at Yale, he mastered the discipline of ornithology under the mentorship of renowned bone hunter Othniel C. Marsh. Grinnell's doctoral dissertation was a morphology of the roadrunner.

He became a bit of a roadrunner himself. In 1874, he was the designated naturalist on the US Army's reconnaissance of the Black Hills, led by George Armstrong Custer—an intrusion into sovereign Native territory that triggered a stampede of white settlers and Custer's demise on the Little Bighorn River; it also honed Grinnell's talents in field observation and specimen collection. Over the next fifty years, in his wanderings across the West—pursuing big game, scaling mountains and glaciers, advocating for protection of wildlife and national parks—Grinnell always found time for his first love, birds. "Secured several birds new to me," he recorded in his Black



FIGURE 7.1 Photo of George Bird Grinnell. NPS PHOTO/YELLOWSTONE ARCHIVES

Hills notebook. "I found a nest of *Plectrophanes maccownii* [chestnut-shouldered longspurs] with four eggs." The specimens he collected that summer are still preserved in climate-controlled drawers in Yale's Peabody Museum. A year later, during a pack tour of the nation's first

GEORGE BIRD GRINNELL

national park, he compiled a thorough inventory of Yellowstone National Park's (Yellowstone; YNP) birdlife, including a species that won his particular affection, the American dipper, more familiarly known as the water ouzel (Fig. 7.2). "I must confess to the most ludicrous feeling of astonishment the first time I saw the bird walk calmly down a flat stone until its head disappeared under the water," he observed of this submarining curiosity. "When carried down a few feet by the force of the current, it would fly a few feet upstream and dive from the wing."

History tends to footnote Grinnell as a cofounder, along with a bumptious Theodore Roosevelt, of the Boone and Crockett Club, a cohort of well-heeled big-game hunters

whose self-interest in "fair chase" became a contagious force for broader-gauge conservation in the late 19th century. Yet what history often overlooks is that Teddy Roosevelt was an unabashed game hog up until the time he came under the moderating influence of George Bird Grinnell; and that in 1886, two years before the Boone and Crockett Club organized, Grinnell had started the first Audubon Society, a conservation group whose influence would prove further-reaching than that of the B & C fraternity. If anybody invented a bully pulpit for conservation, it was Grinnell, who used his journal, *Forest and Stream*, to preach sensible bag limits and hunting seasons, protection of habitat, and, in general, a holistic approach to

FIGURE 7.2 The American dipper, also known as the water ouzel, a lifelong favorite species of George Bird Grinnell; he observed one in Yellowstone "walk calmly down a flat stone until its head disappeared under the water." His visit to Yellowstone in 1875, three years after the establishment of the park, produced the most thorough inventory of birds (and mammals) in the region to date. PHOTO BY CAMERON HO



nature that presaged today's environmental conscience. The tactic of shaming women—and the rookery raiders who catered to female vanity—from adorning their hats with the plumes of egrets (etc.) was, if you will, a feather in Grinnell's (and the Audubon Society's) own cap.

Let us also give Grinnell at least partial credit for the following: In 1911, when the National Association of Audubon Societies, of which Grinnell was a director, spurned a donation from Winchester, Remington, and other gun manufacturers, in support of bird protection (without birds, gun sales would suffer), Grinnell gave his blessing to a new organization, the American Game Protective and Propagation Association, whose purse and persuasions would eventually ensure passage of the Migratory Bird Treaty Act, a cornerstone of federal wildlife legislation and the precedent for the Endangered Species Act of 1973. "As long as the game is protected and increased," Grinnell reasoned, "the aim [of the gunmakers] is of no great importance." Grinnell was the prototype of a new breed of conservationist, passionate but pragmatic.

Similarly, Grinnell's strategic lobbying on behalf of national parks brought results that resound today. From the time he first gazed upon Yellowstone's wonders, in 1875, through many subsequent visits until his death in 1938, the park had no greater or more effective proponent. John Muir, the high priest of Yosemite, fought the damming of the Hetch Hetchy valley with his idealism—and lost. Grinnell did more than write vivid, lachrymose editorials on behalf of his beloved Yellowstone; he stalked cabinet members, congressmen, and the White House and helped draft the laws that created a buffer of national forest around the park (thus creating the *first* national forest); stopped commercial development from defacing the geyser basins and other natural treasures; prohibited hunting inside park boundaries; prevented a railroad from penetrating the Lamar Valley; and headed off a dam at the mouth of Yellowstone Lake (Fig. 7.3). Before Grinnell, Yellowstone was America's *only* national park; thanks to Grinnell, Yellowstone came to embody what all national parks should be.

FIGURE 7.3 Grinnell's first visit to Yellowstone in 1875 included a trip to the Grand Canyon of the Yellowstone and the Upper Falls that he described as "altogether the grandest and most beautiful that I have ever seen. It altogether beggars description." The trip cemented his love of the park, and throughout his life, he tirelessly championed its beauty and wildlife, critically protecting it from development, including a dam that would have impacted Yellowstone Lake. **NPS PHOTO/YELLOWSTONE ARCHIVES, JACKSON EXPEDITION 1871**



GEORGE BIRD GRINNELL

His maturation as a conservationist may not have been inevitable, but it was not hard to follow. The rapacity that violated the Black Hills led directly to his activism in Yellowstone. And finally, the lessons and methods incubated in these grand places would mold his vision for a

national park on the crown of the continent, Glacier National Park.

An estimable career indeed. The boy who grew up loving birds grew mighty wings (Fig. 7.4). If only we could soar as far and high as he.

FIGURE 7.4 A prairie falcon, a species Grinnell encountered in the Black Hills in 1874 on an expedition with George Armstrong Custer. Grinnell was appointed trip naturalist and found a prairie falcon nest with three young. He took a shot with his shotgun at the female but did not kill her; apparently, the gun was loaded with “small bird seed.” **PHOTO BY RONAN DONOVAN**



CITIZEN-SCIENCE-LED BIRD MONITORING IN YELLOWSTONE

8

LAUREN E. WALKER, JOHN PARKER,
and KATHARINE E. DUFFY

According to a 2016 United States Fish and Wildlife Service Report, over 45 million Americans identify as birders. Embraced by new generations, birders seek both to relish the quiet calm of time spent outdoors, enjoying the company of wildlife in their natural setting, but also the secret thrill when scopes and binoculars find a new species or observe a unique behavior. For many birders, citizen science allows them the opportunity to put additional significance to their birding, combining their love of birds and their interest in contributing to local research programs by helping collect scientific data. In Yellowstone, intrepid volunteers have historically organized and conducted several broadscale programs, perhaps most notably the complementary Breeding Bird Survey (BBS) and Christmas Bird Count (CBC).

THE BBS AND CBC are both long-term and widespread surveys, conducted annually for decades at sites across the continent. Equally important, their survey target is broad, including all birds that are detected within the constraints of the survey protocol—all songbirds, but also all raptors, shorebirds, and waterfowl. Widespread and long-term datasets such as these are especially useful for documenting changes in bird communities, and across North America and in Yellowstone National Park (Yellowstone; YNP), the BBS and CBC have helped highlight decades of patterns in bird abundance and diversity. Further investigation may allow for the association between these trends in bird diversity and other broadscale ecosystem changes in the park due to changing predator and prey communities, evolving wildfire dynamics and fire management, and exponential growth in visitor presence.

BREEDING BIRD SURVEY (BBS)

Started in 1966, the BBS (www.pwrc.usgs.gov/bbs/; USGS 2018) was initiated by Chandler Robbins and the United States Geological Survey (USGS) at the Patuxent Wildlife Research Center, near Laurel, Maryland, to monitor breeding bird populations across the North American continent. Initially a means to monitor and document the impacts of the widespread effects of DDT (dichlorodiphenyl-trichloroethane) and other pesticides in the first half of the 20th century, after 55 years, BBS survey data now provide valuable insight into the impacts of changing human populations and the growing human influence on the landscape through habitat loss,

CITIZEN-SCIENCE-LED BIRD MONITORING IN YELLOWSTONE

fragmentation, and climate change. To date, this vast and long-term database has contributed to hundreds of scientific publications.

BBS survey routes are run each summer during the peak of the North American nesting season, anywhere from late May through early July, depending on latitude, altitude, or other climatic considerations. Birds at this time of the year are active, displaying for mates and singing to define and defend their territories, making them relatively easy to detect (Fig. 8.1). Routes are located along road corridors and are 24.5 miles (39.4 km) long, with 50 survey locations spaced every half mile (0.8 km)—a strategy designed to sample birds from a broad diversity of

habitats. At each stop, the observer conducts a 3-minute point count of all birds seen or heard within a quarter-mile (0.4-km) radius. Today, over 4,000 survey routes are coordinated by the USGS, the Canadian Wildlife Service, and, more recently, the Mexican National Commission for the Knowledge and Use of Biodiversity to study the status of bird abundance, distribution, and population trends.

BBS IN YELLOWSTONE

In Yellowstone, four BBS survey routes are conducted in mid-June to help tally and track trends of the park's bird abundance and species diversity. Three routes are located



FIGURE 8.1 Birds use a variety of displays to attract mates each spring. (A) A male calliope hummingbird shows off his bright purple gorget. (B) A pair of sandhill cranes bond with a courtship “dance.” (C) A male lazuli bunting shows off his bright plumage and sings to attract potential mates and deter trespassing rivals. **PHOTOS:** (A) BY GREG ALBRECHTSEN, (B) AND (C) BY HOWARD WEINBERG

BREEDING BIRD SURVEY (BBS)

entirely within the park (Fig. 8.2) and have been in operation since the 1980s; a fourth route that lies partially within the park boundary was added in 2017.

The Mammoth BBS route starts at the Indian Creek Campground south of Mammoth, ends at Elk Creek west of Tower Junction, and has been run continuously since 1982. Overall, the Mammoth BBS route is the lowest in elevation and the driest of the three routes inside the park. Observers conducting this route have recorded 135 different species of birds, the greatest diversity of any route in Yellowstone. Rock wren and green-tailed towhee are two of the birds commonly found on this route but rarely seen elsewhere in Yellowstone.

Conducted continuously since 1988, the Northeast Entrance BBS route starts at Tower Junction and ends across from Barronette Peak near the northeast entrance. The first 20 miles (32 km) of this route travel through the Lamar River Valley, a habitat representative of Yellowstone's northern range. Observers have tallied 125 species of birds on the Northeast Entrance route, with high numbers of sage thrashers and Brewer's sparrows in the extensive grasslands and sagebrush.

Initiated in 1987, the Yellowstone BBS route starts near the top of Dunraven Pass, at 8,800 feet (2,682 m), and continues south, following the Yellowstone River upstream to Yellowstone Lake and ending at Mary Bay along the East



CITIZEN-SCIENCE-LED BIRD MONITORING IN YELLOWSTONE

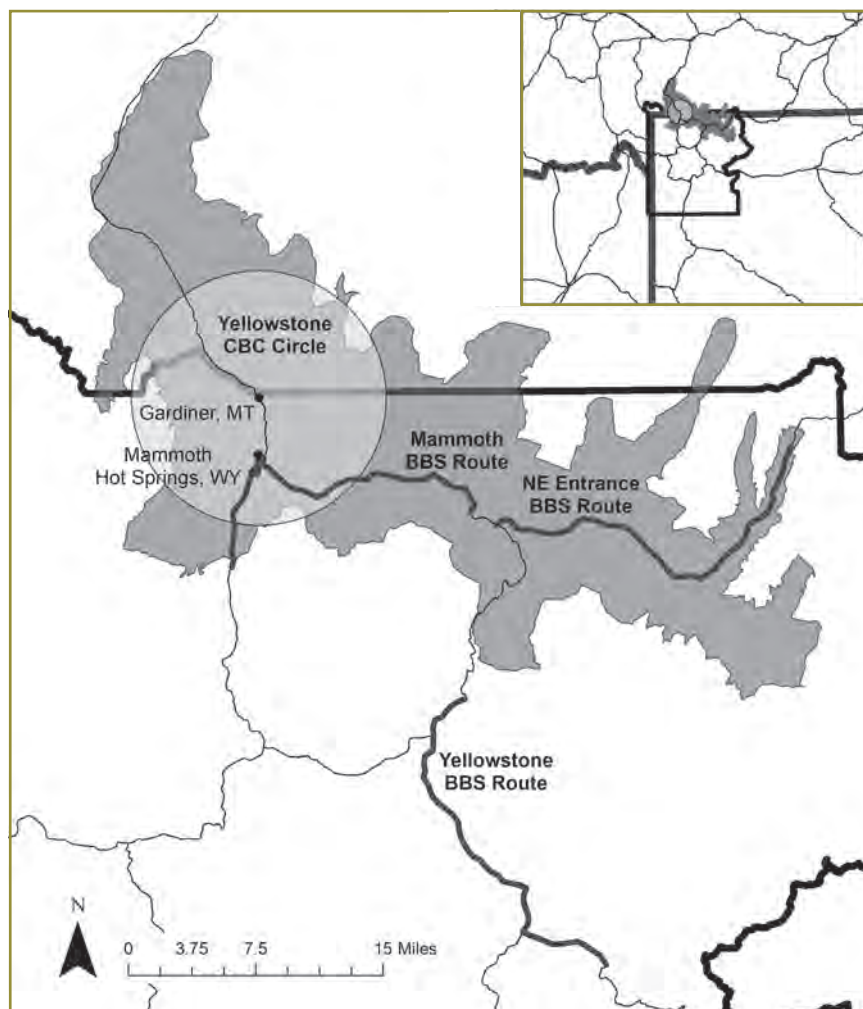


FIGURE 8.2 Long-running avian citizen-science studies in Yellowstone include the Breeding Bird Survey (BBS; three 24.5-mile/39.4-m road transects, highlighted in dark gray) and the Christmas Bird Count (CBC; a 7.5-mile/12-km radius circle, centered around Gardiner, Montana). The park boundary is delineated by a thick black line; the area shaded in gray indicates Yellowstone’s northern range.

Entrance Road (Fig. 8.3). Surveyors have recorded 128 species of birds along this high-elevation route; waterfowl are both diverse and abundant, particularly Canada geese.

A fourth route, the Hebgen Lake route, was initiated relatively recently in 2017 and is located partially within the park, stretching along Yellowstone’s western edge. While in Yellowstone, the Hebgen Lake route follows Grayling Creek, sampling a long stretch of high-elevation willow riparian habitat that features obligate species that only use willow, like willow flycatcher and Wilson’s warbler. In total, 87 species of birds have been recorded during the short time this route has been conducted.

CHRISTMAS BIRD COUNT (CBC)

The winter season counterpart to the BBS is the CBC. Once each winter, in late December or early January, birders, naturalists, and budding scientists gather to document all the birds within survey circles 15 miles (24 km) in diameter. In the first CBC, in the winter of 1900–1901, citizen-scientists surveyed 25 circles, counting around 18,500 birds of 89 species (Chapman 1901). More recently, in the 120th CBC count during the winter of 2019–2020, volunteers surveyed 2,646 circles across the North American continent, Caribbean, and Pacific Islands, documenting

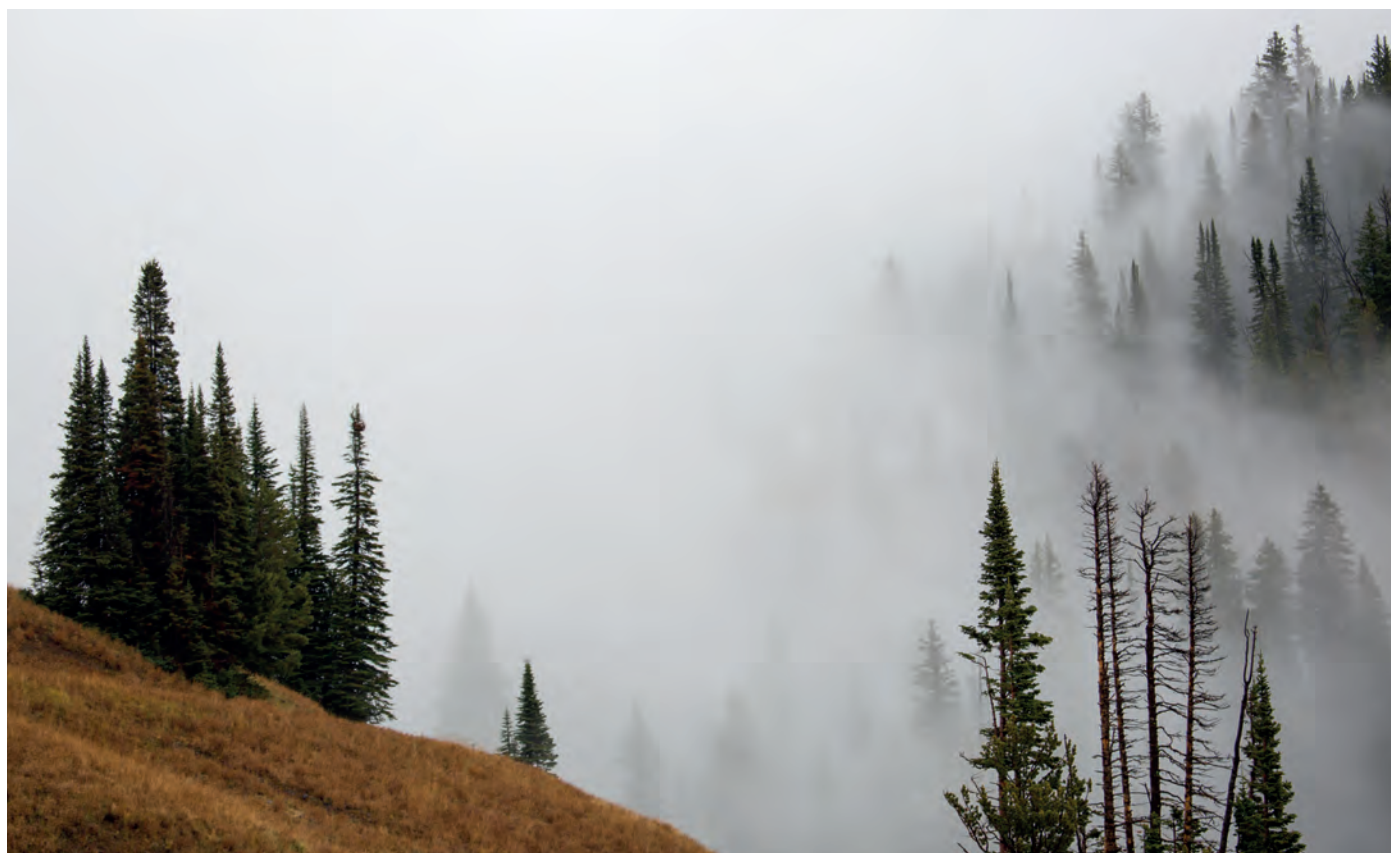


FIGURE 8.3 Heavy fog is a common impediment to early-morning Breeding Bird Surveys on Dunraven Pass and along the Yellowstone River through Hayden Valley. **NPS PHOTO**

the presence of 2,566 species and over 42.7 million individual birds.

The Yellowstone Christmas Bird Count circle is centered on the town of Gardiner, Montana, located along the northern boundary of Yellowstone National Park (Fig. 8.2). The count circle crosses both Montana and Wyoming and covers the central portion of Yellowstone's northern range, extending from the community of Jardine, Montana, to the northeast, Blacktail Deer Plateau to the southeast, Swan Lake Flat, Wyoming, to the southwest, and Aldridge Lake, Montana, to the northwest. The circle covers an elevational range from 5,118 to 10,958 feet (1,560 to 3,340 m) and represents a microcosm of the wide variety of Yellowstone's habitats, including rugged mountains, talus slopes, open grasslands and sagebrush, mixed-conifer

forests, hydrothermal areas and hot springs, creeks and wetlands, and the Gardner and Yellowstone rivers. Each winter, an average of 14 citizen scientists (range: 2–50) conduct the Yellowstone CBC survey, and despite the logistical constraints of wintertime access that limit most surveyors to the roadways, they document an average of 40 species (range: 28–102).

While the CBC survey method is not precisely standardized, there is wide applicability for the collected data, particularly over broad spatial or temporal scales. Although Yellowstone National Park is represented by only a single CBC circle, the survey has been conducted annually since the winter of 1975–1976, covering a 45-year period of significant ecosystem change both local to the region and continent-wide.

CITIZEN-SCIENCE-LED BIRD MONITORING IN YELLOWSTONE

The eBird (www.ebird.org) system is a relatively new database for bird observations that was first launched in 2002 by the Cornell Laboratory of Ornithology, allowing bird-watchers and professional ornithologists alike to document their observations into a single system that is readily searchable and available to the public. By 2010, eBird was expanded to include worldwide bird observations and began to be used by a rapidly increasing number of active bird enthusiasts across the globe.

Primarily, the eBird system is a way for people to keep lists of the birds they have seen and heard, tracking where, when, and how the observations were made, and allowing the individual birder to store their personal observations and lists for posterity. Observers' photographs and sound recordings can also be uploaded into the individual lists. There are many portals into the database so that information can be accessed in numerous different ways, and along with the value for science and research, eBird data are also being used in numerous ways for bird education and conservation.

Currently, eBird is the best means for visiting birders to contribute to our knowledge of birds in and around

Yellowstone National Park. The reported bird observations are continually reviewed by people with local knowledge and expertise using a system of filters. These filters alert the reviewers to unusually high numbers of birds, out-of-season birds, and rare birds that are out of their usual range or habitat. When an unusual observation is flagged for review, the reviewer can then query the observer, so that the reviewers can make the decision whether to accept the record.

Before the advent of eBird, the list of birds occurring in Yellowstone was limited to personal observations from a small number of park employees and the very few rare bird reports turned in to park staff and verified by the Yellowstone Bird Observation Committee. Prior to 2015, there were few observers using the eBird system in Yellowstone National Park, but in the last few years, there has been explosive growth in the number of people entering data from the region and beyond. As the system has expanded, the volume of data has vastly increased our understanding of bird distribution and abundance. While park biologists conduct focused studies and surveys of Yellowstone's birds, the eBird database is a treasure trove for a broader understanding of the birds in Yellowstone.

DOCUMENTING ECOSYSTEM CHANGE

In comparison with much of the country, Yellowstone National Park is protected from significant development, and the park's land use and habitats have seen relatively little change over the past several decades. Yellowstone is not immune, however, from broad ecosystem changes, many of which (e.g., wildfires, invasive species, increasing human visitation, climate change) have the potential to profoundly impact the park's bird community. These changes have been well-documented in the BBS and CBC survey datasets.

Over the past 100 years, wildfires in Yellowstone and throughout the West have changed in frequency and intensity due to evolving strategies surrounding land use, water rights, and fire management (Zimmerman 2009). Under likely climate change scenarios, future fires in the park may occur more frequently and at greater intensity (Westerling et al. 2011), potentially causing long-term shifts in forest composition and subsequent changes in wildlife habitat quality. The large wildfires in Yellowstone in 1988 provide an excellent example. Immediately following those fires, BBS surveys along the Mammoth and Yellowstone routes reflected a decrease in overall songbird abundance (Fig. 8.4). While some cavity nesters and insectivores may have benefited from the burned snags

DOCUMENTING ECOSYSTEM CHANGE

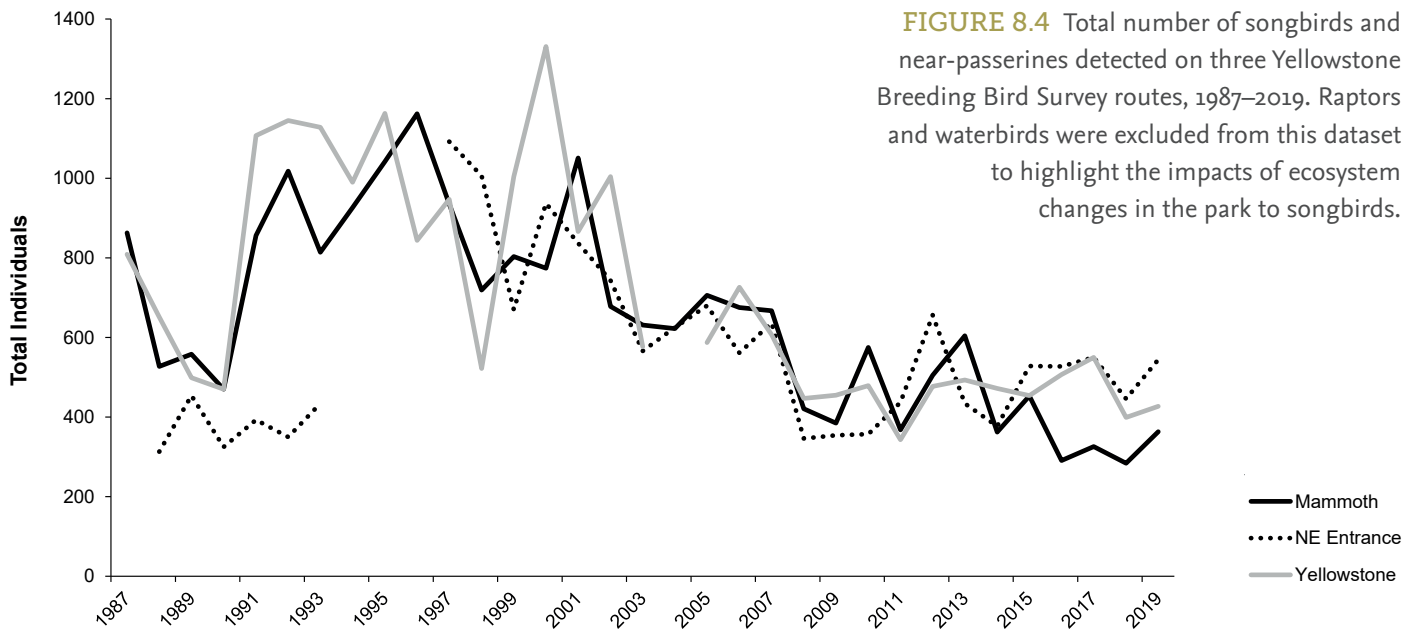
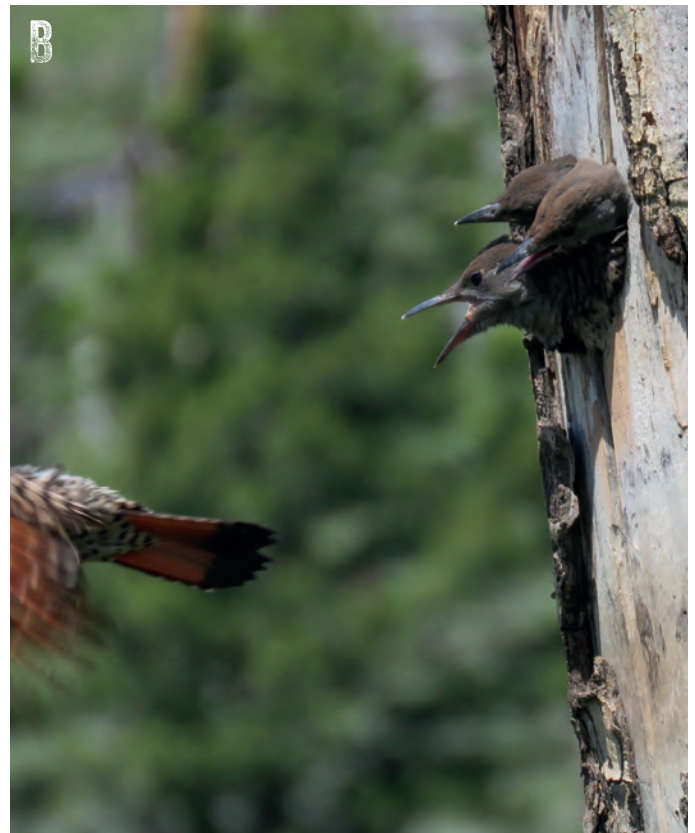


FIGURE 8.5 Cavity nesters—including swallows, chickadees, and woodpeckers, like this northern flicker—readily utilize snags to nest and raise young. PHOTOS BY KEEGAN BURKE



CITIZEN-SCIENCE-LED BIRD MONITORING IN YELLOWSTONE

left behind (Fig. 8.5), at least in the short term, most others would have needed to relocate to find suitable habitat. Even after the forests regrew, it was not the same as before the fires; many areas regrew as lodgepole-dominant forest, with relatively little tree or understory diversity. Ultimately, this observation helped motivate the introduction of Bird Program surveys in both recently burned and unburned, mature forests—surveys that are discussed further in chapter 25.

While the extent of non-native bird species in the park is relatively limited, both house sparrows and European starlings are present. These widespread species are highly associated with people and developed areas, and in the Yellowstone area, they are most abundant in the northern range, particularly in the areas around Gardiner, Montana, and Mammoth Hot Springs (Fig. 8.6). During the winter, European starlings have been detected in the CBC in small numbers going back to 1976, while house sparrows did not appear in the counts until 1994 and have since averaged 77 birds per survey. In contrast, house sparrows have not been detected on BBS routes during the summer, while starlings are regularly counted, averaging 23 birds a year since 1988 and peaking in 1997 with 122 starlings. These patterns in invasive species abundance could be correlated with increasing human presence on the landscape, both in surrounding communities and within the park itself. Although year-round park residents have not changed significantly in the recent decades, visitation has increased dramatically. In 1982, the year in which the first BBS route was conducted in Yellowstone, approximately 2 million people visited the park. By 2021, however, annual visitation had increased to nearly 4.9 million visitors, the majority of visits occurring in the summer months. For some species, like swans and loons, more people may mean more nest disturbance and lower reproduction. For other, anthropogenically adapted species, including non-natives like house sparrows and starlings, the increase in the human presence on the landscape may provide opportunities for range expansion. In addition to impacts to the habitat and the park's bird diversity, the increase in visitation to the park also impacts the ability

of observers, especially during the BBS, to effectively conduct their surveys. Parking spaces from which to conduct counts are hard to come by in the summer, even in the early morning, and traffic noise can make it difficult to detect the quieter chip and call notes.

Although the Canada goose is a native species, many ecologists consider these birds invasive, with a locally growing population that may ultimately interfere with regular ecosystem processes. Most Canada geese recorded in the park during the BBS surveys occur on the Yellowstone route (since 1987, between 87% and 100% of the park's total), and the total number of geese observed there has been increasing (Fig. 8.7). Anecdotally, Canada geese are common and numerous on all the park's water bodies in the summer, and the Bird Program staff suspects they may compete with other waterfowl (e.g., trumpeter swans) for resources. Additionally, the abundance of goslings, combined with the decrease in cutthroat trout availability, may have inspired bald eagles to switch primary prey targets to include young waterbirds. In contrast to the summer, Canada geese are detected sporadically during the CBC (Fig. 8.7), with numbers that likely reflect some variability in weather conditions and ice on the available water bodies (YNP Bird Program, unpublished data).

And that leads us to the elephant in the room—climate change. At the broad, continent-wide scale, climate change is already leading to range shifts for some bird species. More specific to Yellowstone, climate change has the potential to amplify the effects of wildfire (as discussed above) and invasive species, and may contribute to significant habitat change. Inevitably, these changes will be reflected in the bird communities detected in the BBS and CBC, potentially reducing the observations of some species, increasing observations of currently “rare” species, or expanding the seasons in which birds may be expected to be encountered.

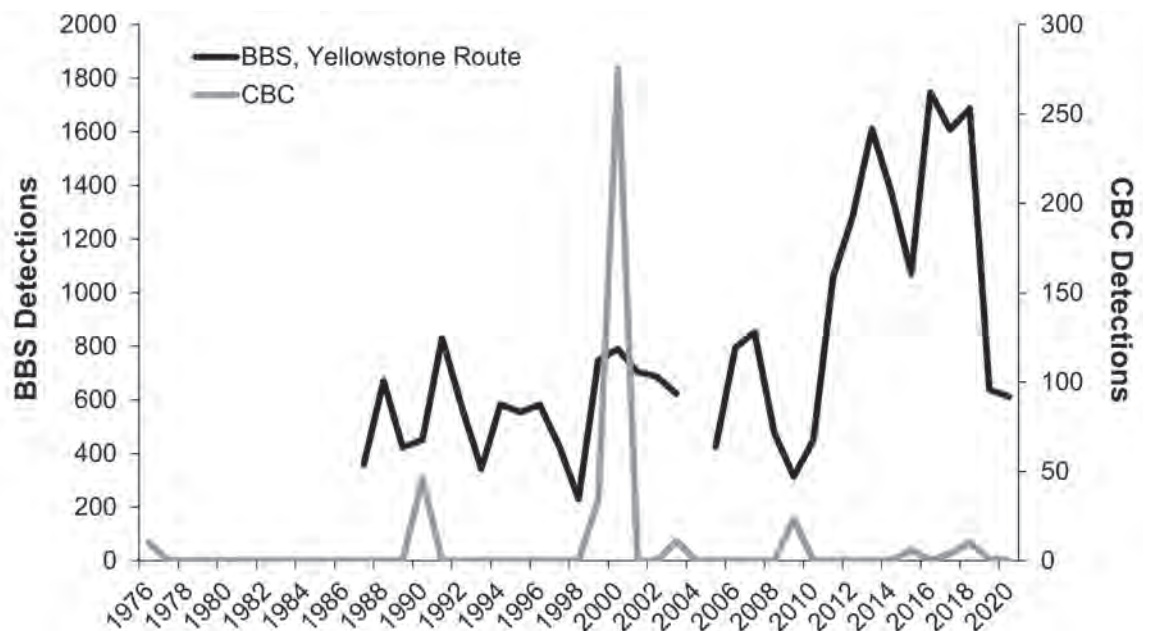
For example, in the winter months, we expect to see the climate change toward shorter, warmer winters, with less snow and ice and more open water, especially in the northern range. Geese and other winter residents, like mallards, may become more abundant in the winter months and in

DOCUMENTING ECOSYSTEM CHANGE



▲ **FIGURE 8.6** Non-native European starlings gather on the backs of sleeping bison near Yellowstone’s north entrance station in Gardiner, Montana. **NPS PHOTO**

▼ **FIGURE 8.7** Canada geese detected on the Yellowstone Breeding Bird Survey route and during the Christmas Bird Count.



CITIZEN-SCIENCE-LED BIRD MONITORING IN YELLOWSTONE

The Yellowstone Bird Observation Committee, the park's rare-bird committee, reviews sightings of species in the *Accidentals* section of the bird checklist and species not on the checklist at all. These sightings contribute to advancing knowledge of bird occurrence and distribution in Yellowstone and provide essential information when park checklists are updated. Rare-bird sighting forms are available to the public at park visitor centers and online: www.nps.gov/yell/learn/nature/wildlife-sightings.htm

the CBC. Even some songbirds (e.g., American robins) that are now only occasionally detected by the CBC may become more regular winter visitors as the warming climate allows for the availability of more food. Contrarily, species that rely on the cold winter months, like Canada jays (Fig. 8.8), are already uncommon on the CBC and may decrease further in abundance if our winters become shorter and warmer.



THE IMPORTANCE OF CITIZEN SCIENCE

According to the *Cambridge Dictionary*, citizen science is “scientific work, for example collecting information, that is done by ordinary people without special qualifications, in order to help the work of scientists.” This definition, however, is both wholly inadequate and, in our opinion, insulting. Citizen scientists are not ordinary, and while they may come from a variety of backgrounds, they have many of the qualifications that are most important in conducting science: motivation to learn, willingness to invest their time, and an appreciation for the scientific pursuit of a better understanding of the world around us. Much research that Yellowstone relies on to document trends, make predictions about the future, and guide management decisions would be financially and logistically impossible without the enthusiastic participation of citizen scientists. For Yellowstone National Park and the Yellowstone Bird Program, citizen science plays a vital and diverse role that goes well beyond the Breeding Bird Survey and the Christmas Bird Count. Every visitor (including you!) can contribute to a better understanding of the park's avian ecology simply by paying attention to the birds you see, observing how the bird community changes between habitats and seasons, and noting your observations. Your notes can be as simple as an internal acknowledgment of what you've seen or as elaborate as a formal report to the Yellowstone Bird Program or the Yellowstone Bird Observation Committee. If you're the “listing” type, you might record your observations on a citizen-science platform like eBird. Regardless of how you contribute, we thank all our volunteers and citizen scientists for their continuing efforts and support.

FIGURE 8.8 A Canada jay fluffs up its feathers to keep warm. Canada jays rely on cold winters to preserve stashes of food intended for their nestlings, which hatch in early spring. **PHOTO BY GREG ALBRECHTSEN**

THE GROUSE OR GALLIFORMES OF YELLOWSTONE NATIONAL PARK

9

DAVID J. DELEHANTY

The taxonomic order Galliformes are the chicken-like birds of the world, birds such as grouse, quail, pheasants, and partridge. These are economically and culturally important birds worldwide. The chicken, perhaps the most important food-producing animal on Earth, is a galliform bird domesticated from an Asian forest pheasant, just as the turkey, another galliform bird, is the domesticated form of North America's wild turkey. As a group, galliform birds are often referred to as "game birds" because they are so widely hunted for sport and for food.

THE ORDER GALLIFORMES IS a diverse and ancient lineage of birds distributed worldwide. Distinct taxonomic forms occupy different major land masses or climate zones. Yellowstone National Park (Yellowstone; YNP) has two species of grouse, both abundant year-round. They are the dusky grouse and the ruffed grouse, both members of the pheasant family. Colloquially, both dusky and ruffed grouse are called "forest grouse." This is understandable considering that both rely heavily on forests during much of the year, but evolutionarily the dusky grouse aligns closely with North American prairie grouse, such as the greater prairie chicken and the sharp-tailed grouse (Persons et al. 2016). One can think of the dusky grouse as the member of the prairie grouse group that has become most adapted to forests, living where mountain brush communities meet mountain forests. Evolutionarily, the ruffed grouse is distinctly separate from other North American grouse and is a true forest dweller, a species that thrives in the West where northern deciduous forests meet northern conifer forests (Fig. 9.1).

At one time, a third grouse, the white-tailed ptarmigan, may have resided year-round at high elevation within

current park boundaries. Two other grouse, the sharp-tailed grouse and the greater sage-grouse, are regionally present and may occasionally traverse the park's boundary but are not known to breed or otherwise have a meaningful presence in the park. Lastly, the spruce grouse occurs in northern conifer forests, including the Northern Rockies of Idaho and western Montana. Its distribution meets the northwestern corner of the park, but they are not documented to be present in the park currently.

Yellowstone's two current grouse species exhibit important traits shared by others in their order. Dusky grouse and ruffed grouse, like so many galliforms, spend much time on the ground, where they forage and nest. They have well-developed legs for walking and are strong runners. These grouse have complex plumage patterns that provide camouflage, and they are expert at hiding quietly when a threat is present. Like other galliformes, dusky grouse and ruffed grouse are strong flyers, at least for short distances, and if a threat becomes too great, they burst into flight with startling wing claps to escape.

The feet of grouse and other galliformes have three forward-facing toes and a strong rearward-facing hind

THE GROUSE OR GALLIFORMES OF YELLOWSTONE NATIONAL PARK

toe. All toes have well-developed claws. Forest grouse like the dusky grouse and the ruffed grouse can readily grasp branches, allowing them to perch and roost in trees. For forest grouse, this arboreal ability importantly translates into being able to forage on buds, fruits, and leaves from trees and shrubs, so they are not restricted to foraging on the ground. This is an essential adaptation that allows them to forage in trees during the winter when heavy winter snow blankets the park. When snow does not cover the ground, grouse can use their feet to scratch the ground and sift through leaf litter for shoots, seeds, and insects that comprise terrestrial elements of their diet. All galliformes possess a robust, decurved bill that is well suited for clipping vegetation for consumption.

Importantly, Yellowstone's grouse possess a very well-developed crop and gizzard. The crop is a stretchable out-pocketing of the esophagus, near the base of the neck, where the throat enters the body cavity. The crop serves as a storage compartment for food prior to any digestion. When a grouse picks up and swallows a food item, it can swallow the food directly into the stomach, or it can divert the food into the crop for temporary storage. Essentially, grouse and other galliformes fill their stomach at good

foraging sites but then can continue to forage, storing one or more additional meals in their crop to be taken with them to roosting sites, where the food progressively is advanced to the stomach for digestion. In Yellowstone, this means that grouse can carry substantial food back to nocturnal roosts and essentially continue to eat while roosting through the long, cold winter nights.

The avian stomach is composed of two parts, a forward chamber known as the proventriculus and a rearward chamber known as the gizzard. Food swallowed to the stomach moves quickly through the proventriculus, where it is treated with digestive enzymes, and then it enters the gizzard, the muscular portion of the avian stomach. The gizzard crushes food in a manner analogous to mammals chewing food in the mouth. A powerful gizzard allows grouse to consume hard or tough foods, like seeds and fruit, and efficiently crush them for effective digestion. This mechanical pulverization of hard foods in the gizzard is aided by the grouse swallowing small stones that are held in the gizzard, where they act like free-floating teeth in the grinding process. The scientific term for gizzard stones is gastrolith. The use of gastroliths is an ancient digestive trick used by birds as



FIGURE 9.1
Ruffed grouse in snow.
PHOTO BY RONAN
DONOVAN

DUSKY GROUSE

well as their evolutionary ancestors, the dinosaurs. In winter, when heavy snow covers the ground, grouse will use the hard pits of dried fruits as grinding “stones.”

Grouse have an additional trick of digestion that is central to the ability of dusky grouse and ruffed grouse to occupy Yellowstone National Park. It is called hindgut fermentation. In hindgut fermentation, grouse use their intestines to detoxify and digest plant foods that many other animals could not use. Plants often protect exposed buds and needles from herbivores by infusing vegetative parts with unpalatable secondary compounds that are bitter or noxious. Grouse defeat the plant’s anti-herbivory strategy by using hindgut fermentation to neutralize plant secondary compounds. Good examples are the needles of Douglas-fir and lodgepole pine. Pine needles are nutritious but cannot be consumed in large quantities by most herbivores due to volatile oils within the needles that can alter the gut microbiome. Yet pine needles clipped from living trees make up the primary winter food of dusky grouse. Similarly, aspen and willow buds are protected by bitter acids yet are major winter foods for ruffed grouse. In fact, it is the ability to neutralize plant secondary compounds through hindgut fermentation that allows the grouse of the world to occupy the cold regions of the Northern Hemisphere. In Yellowstone, it allows dusky grouse and ruffed grouse to stay in the park year-round.

DUSKY GROUSE

The dusky grouse as a distinct species is a recent restoration of species status. For approximately 60 years prior to 2006, the dusky grouse was conjoined with the sooty grouse as a single species known as the blue grouse. Strong genetic, morphological, and behavior evidence supports the separation of these sister species. Ironically, early naturalists recognized the distinctiveness of the dusky grouse, referring to it as Richardson’s grouse (e.g., Anthony 1903). Early records and commentary on Richardson’s grouse apply to what is now known as the dusky grouse.



FIGURE 9.2 Dusky grouse display.
PHOTO BY HOWARD WEINBERG

The dusky grouse has evolved to exploit both mountain brush communities and mature conifer forest on a seasonal basis. Typical dusky grouse habitat consists of mountain brush with accessible mature conifer forests in the area, often upslope. Dusky grouse use brushy mountain meadows for breeding, nesting, brood-rearing, and foraging. With the onset of spring, dusky grouse depart from high-elevation conifer forests and move down to snow-free areas with mixed brush and grass, such as south-facing slopes or the margins of chokecherry stands. There, males announce their presence with low-frequency hooting whistles and court females they encounter with displays of posture, plumage, brightly colored and inflated throat pouches, and a bright yellow-orange supraorbital comb (Fig. 9.2). Males are assumed to be polygynous (having more than one female mate at a time). Little is known of female mating patterns. Females nest alone, without assistance from males and away from other females. Nests are placed on the ground in a wide range of shrubby or open habitats, but most nests are placed under a shrub canopy and contain clutches of 1–12 eggs that are

THE GROUSE OR GALLIFORMES OF YELLOWSTONE NATIONAL PARK

incubated for about 26 days. Females brood young chicks and lead the brood to foraging sites, where the young feed themselves, and to roosting sites on the ground. Young progressively become thermally independent and capable of rapid flight. Broods break up from the end of summer through early fall. Dusky grouse do not appear to be highly social, though small groups are sometimes seen. With the onset of winter, dusky grouse make an altitudinal migration, moving upslope into conifer forests, where they switch to a wintertime diet of conifer needles, living and roosting above the snow in the trees.

Relative to many other North American game birds, dusky grouse have been lightly studied. Much of the existing literature on the species is from the perspective of the conjoined “blue grouse” species rather than exclusively dusky grouse. Nevertheless, populations in the western United States are widely believed to be secure at this time. This is because large portions of their mountain habitat lie within public lands, especially national forests and parks, which are not subject to a high degree of habitat conversion. Barring catastrophe, dusky grouse are likely to persist in the park into the foreseeable future.

RUFFED GROUSE

Ruffed grouse are common throughout deciduous and mixed conifer/deciduous forests of northern North America. They are extremely popular with hunters as a game bird; one result is that they are the subjects of substantial scientific investigation. Typical ruffed grouse habitat consists of brushy forest edges where forbs (non-woody flowering plants other than grasses, sedges, and rushes—e.g., wildflowers), fruiting shrubs, and surface water are available. In the mountain West, ruffed grouse are found where deciduous forests and conifer forests intermingle and are intersected with riparian habitat. In brief, ruffed grouse forage on green herbaceous plants from the ground in spring, adding fruits taken from shrubs, such as chokecherry and dogwood, as they become available in summer and fall, then turning to the



FIGURE 9.3 Ruffed grouse display.
PHOTO BY HOWARD WEINBERG

buds of shrubs, such as willows, and trees, such as aspen, with the onset of winter. Conifer trees serve as valuable roosting sites that provide visual cover from predators and thermal cover during winter. Under harsh winter conditions, the ruffed grouse also may burrow into soft snow on the ground to form a temporary roosting chamber that modulates severe winter weather.

The presence of ruffed grouse is easy to detect in the spring due to the loud drumming of males seeking mates (Fig. 9.3). Drumming consists of a series of about 50 sharp, snapping wing claps across an approximately 10-second interval. Wing claps start slowly, rapidly increase in tempo, and finish with claps so rapid that the sounds merge in human hearing. For drumming, males use an elevated platform, commonly a fallen log within brushy cover. Males may drum at any time of year, but drumming peaks during spring, with a lesser peak during autumn.

For breeding, females visit drumming males and select their mates. Females will mate with more than one male, just as males will mate with more than one female.

Females select a nest site, always on the ground and frequently at the base of a tree or stump, where they incubate 9–14 eggs without assistance from males. Typical incubation is 23–24 days, after which females lead their broods away from the nest. As is typical of grouse, females brood young chicks as needed during the day and through the night until the young become thermally independent. Females lead their young to foraging sites on the ground, where young must feed themselves, first with insects and then, increasingly, with herbaceous matter clipped from plants.

Barring unforeseen catastrophe, ruffed grouse are highly secure in the mountain West, including the park, as long as brushy riparian zones with surface water occur with aspen and other deciduous tree stands, especially if conifers are present for secure roosting.

OTHER GROUSE

Several additional grouse species should be considered as possible for occurrence in Yellowstone National Park, though intensive survey might be necessary to confirm any presence or to have confidence in true absence. Wild turkeys, native to North America but not to the northern mountain West, and three non-native galliformes (the gray partridge, chukar, and ring-necked pheasant) have all been widely introduced to the American West as game birds over the last century, an activity still being conducted by state wildlife agencies. Currently all four species occupy private and public lands in proximity to the park. Additionally, three native species of grouse may, at some point, colonize or be present within park boundaries, including the spruce grouse, the white-tailed ptarmigan, and the greater sage-grouse. Of these, the greater sage-grouse is perhaps the most interesting possibility, due to the tenuous population status of this species.

The greater sage-grouse is an iconic bird of the American West and a sagebrush obligate species—that is, it depends on sagebrush during all phases of its life history. Sage-grouse are not known to be in the park, despite

being present regionally and despite the park containing sagebrush stands within its interior basins. However, sage-grouse avoid tree cover and may be unlikely to transit high-elevation forests circling the park to reach relatively small interior sagebrush communities that are tree-free. Additionally, sage-grouse rely on exposed sagebrush for food during winter, making Yellowstone's heavy snow cover a severe winter challenge. Lastly, because of the park's high elevation, the temporal opportunity for breeding is small.

Sage-grouse employ a lek breeding system in which large male grouse with bright white plumage ornaments congregate in exposed, traditional locations within sagebrush communities and conspicuously display visually and with low-frequency sounds broadcast across the landscape. This makes sage-grouse leks relatively easy to locate, yet no leks are known to exist in the park. Sage-grouse are not reported on the Breeding Bird Survey, nor are they listed as occurring within the park, although a few reports of sage-grouse sightings have been made on citizen science (eBird) sites. Unfortunately, these reports do not contain photo documentation. It is plausible that dispersing or reconnoitering sage-grouse could be observed in the park as they transit the area. Alternatively, it is also very plausible that dusky grouse, which regularly occupy sagebrush communities in the vicinity of conifer forests, could be mistaken as sage-grouse by citizens who are unfamiliar with the grouse of the mountain West, especially large, multi-colored male dusky grouse.

Yellowstone's two grouse species are widespread and frequently encountered by visitors but, despite their commonness, and perhaps in part due to their categorization as game birds, we know relatively little about their populations in and around the park. Certainly, this is one of the avian groups that deserves more attention within the park, especially with potential climate-induced changes to habitats and fire regimes. Backcountry travelers should be on the lookout for any of the two known species and possibly for a spruce grouse, whose range abruptly ends at the northwest park line. And who knows? It may be you who spots Yellowstone's first sage-grouse.

**YELLOWSTONE'S
BIRDS**

3

RAPTORS





KEY

- Forested
- Not forested

Northern Range
Habitat type:
 Primarily open country with stronger relief
Species:
 American Kestrel
 Golden Eagle
 Great Horned Owl
 Peregrine Falcon
 Prairie Falcon
 Red-tailed Hawk

Yellowstone Interior
Habitat type:
 Plentiful forests with some large valleys, but less relief
Species:
 Accipiters
 American Kestrel
 Great Gray Owl
 Northern Harrier
 Northern Saw-whet Owl
 Swainson's Hawk



PEREGRINE FALCON

THE MOST BEAUTIFUL BIRD?

10

**DOUGLAS W. SMITH, KATHARINE E. DUFFY,
DAVID B. HAINES, and LAUREN E. WALKER**

A blue-backed bullet, a male peregrine, hurtles out of the sky and surprises a common raven flying only a few feet from the nest where the peregrine's mate has just begun incubating eggs. The raven squawks as it hastily exits the area, the male peregrine on its tail. No matter that the peregrines' nest this year is a hole in a rock wall last claimed by ravens—it most definitely belongs to peregrines now!

KATHARINE E. DUFFY

NOTHING COMPARES TO a peregrine falcon. Of course, comparing anything in nature is foolhardy. Nonetheless, when beholding this bird, perched or flying, one can only think of superlatives. Strikingly beautiful, masked face, the fastest animal, and a gaze of majesty knowing the ages. Bold and powerful. Untouchable. If you have seen it, you know what we mean—the falcon epitomizes the raw power and beauty of nature all at once. Their worldwide distribution makes them observable to many and has them clinging to rocky cliffs, usually above waterways, but also city skyscrapers, which they use as cliffs. Once nearly brought to extinction, these birds have made a remarkable comeback. Nature's stunning bird has been restored, and Yellowstone National Park (Yellowstone; YNP) is no exception.

Evolution honed peregrine falcons to be unparalleled speed machines. They have long, pointed wings, enabling them to swoop and dive in flight at mind-boggling speeds as they pursue avian prey, from small birds to shorebirds to ducks, that they capture in midair (Fig. 10.1). Their bodies are tightly cloaked in sleek feathers that contribute to their streamlined aerodynamic efficiency—no

fluffy owl feathers on a peregrine. Their nasal openings have a post that baffles air so that peregrines can continue to breathe as they dive. Being struck by a diving peregrine often kills prey instantly, but if it does not, the peregrine inserts the upper part of its bill, with projections called tomial teeth, between the prey's neck vertebrae. With a quick twist, the peregrine instantly severs the spinal cord of its prey. As it flies with prey held by tightly clenched feet, each toe ending in a sharp piercing talon, the peregrine might even eat on the wing.

Peregrines are the most far-reaching terrestrial vertebrate, occupying every continent except Antarctica (White et al. 2020). This wide global reach makes them hard to characterize, as they live across a broad range of ecosystems, from desert to tundra and coasts to mountains. The species has such a broad reach that one peregrine researcher said that his boss referred to a peregrine as “a weed among hawks,” as this bird adapts to almost everything—like a weed (Cade 1969). They can also be tolerant of humans. Equally broad is their diet; although they eat birds almost exclusively, they rarely specialize in a particular species (White et al. 2020). This breadth of

PEREGRINE FALCON



FIGURE 10.1 Classic peregrine falcon sighting in the Grand Canyon of the Yellowstone. NPS PHOTO

range and diet makes them resilient, a characteristic needed for life in Yellowstone because of its high elevation, unpredictable weather, and large swaths of relatively unproductive (for birds of prey) coniferous forests.

Although tough, peregrines were not spared from worldwide population declines due to organochlorine pesticide use, mainly dichloro-diphenyl-trichloroethane, commonly known as DDT. Widely used in agriculture in the 1940s and 1950s, this pesticide was used in forest management as well. Some 62 tons of DDT were applied in northern Yellowstone in 1953, 1955, and 1957 to control a spruce budworm outbreak (Furniss and Renkin 2003). This pesticide-induced decline was first identified in

Great Britain (Ratcliffe 1967) but was soon found to have global reach. Although few direct mortalities were attributed to DDT, its sub-lethal effects caused eggshell thinning, resulting in widespread reproductive failure. Across North America, peregrine populations declined during the 1950s to 1970s, depending on the level of exposure to DDT. Populations in eastern North America and southern Canada were completely extirpated, and falcons in western and northern populations declined between 10% and 75%. The portion of the population in Yellowstone National Park was lost. Some thought there would be no peregrines south of the 50th parallel, and there was nothing to be done (Cade 1969).

PEREGRINE HISTORY IN YELLOWSTONE

Piecing together peregrine history in YNP is difficult due to inconsistent records and monitoring. Likely abundant in what is now YNP for centuries, the first peregrine falcon in park archives was recorded in 1914 by naturalist Milton Skinner. Spotty records exist through the next several decades, with sightings in the Bechler area (1929; an adult with two young), the Firehole River corridor, Osprey Falls, and especially the Grand Canyon of the Yellowstone. With towering cliffs astride the Yellowstone River, the Grand Canyon was and is ideal habitat for peregrines. Others, most notably Jay Sumner and Jim Enderson, did some additional monitoring during the 1960s, knowing there was evidence of nesting in the 1950s, but the effects of DDT were already taking hold (McEneaney et al. 1998). Enderson visited the Grand Canyon of the Yellowstone in 1961, 1962, and 1964 and found no peregrines. At another site that had been active in 1960, he saw an adult in 1964 and heard a second but did not find a nest (Enderson 1969).

By the 1970s, sightings in YNP were rare and confirmation of breeding tenuous. Peregrine falcon expert Bob Oakleaf (Wyoming Game and Fish Department; WGFD) conducted surveys during this period and presumed peregrines were present, although he was unable to locate any. The last known nesting territory was vacant by 1970 (Baril et al. 2015). The combination of inconsistent monitoring and DDT-induced declines made putting together the peregrine story problematic; they were nearly extirpated before people really started looking. Because there were no estimates of population size or adequate records of known nest sites, it was impossible to know much about them or how their populations were changing within the park. Elsewhere in North America, populations reached their lowest levels by the mid-1970s. Peregrines were listed as endangered in 1970 under the Endangered Species Conservation Act of 1969, a precursor of the Endangered Species Act (ESA) of 1973 (Peakall 1976), and then listed under the ESA.

It is hard to imagine what the canyons and cliffs of Yellowstone would have been like without the cry and jet-like sound of a blurred peregrine falcon whizzing by. Having arrived post-recovery, the authors of this chapter have only known their presence; for us, the park is almost unthinkable without them. Few things can compare to pulling up binoculars and seeing that distinctive black mask and sharp pointed wings, sensing the seemingly fearless personality, or hearing the *cack cack* cry and their distinctive *ee-chup* call reverberating off canyon walls. There is something almost eerie and ancient in these sounds, and once accustomed to them, it's hard to visit these spots and not experience it.

REINTRODUCTION AND RECOVERY

Once DDT was banned and ESA protections were put in place, recovery efforts began in earnest. A massive, North America-wide reintroduction effort was undertaken. Most prominently, the Peregrine Fund was born, with a goal to captively rear peregrines for release across their decimated range. Along with others, the Peregrine Fund released nearly 7,000 peregrines across North America between 1974 and 1998 (White et al. 2020). YNP was part of this significant endeavor and was considered the center of recovery efforts for the Wyoming, Montana, and Idaho region, with 36 captively raised young released in the park at four sites between 1983 and 1988 (Oakleaf and Craig 2003). These acclimation and release areas, called hack sites, were located at Madison Junction, Slough Creek, Crown Butte, and Terrace Mountain. Regionally, 644 birds were released at 35 sites within 162 miles (260 km) of YNP from 1980 through 1997 (Baril et al. 2015). Interestingly, the last territory known to be occupied in YNP, located in the Grand Canyon of the Yellowstone, was the first to be reoccupied in 1984 by two of these released birds. The female came from a Jackson, Wyoming, release area and the male from a nearby location in Idaho (McEneaney et al. 1998).

PEREGRINE FALCON

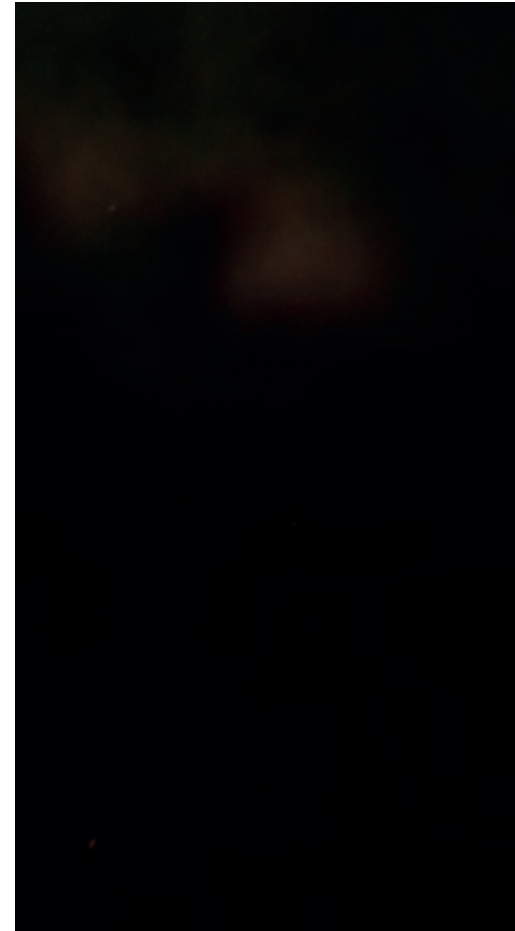
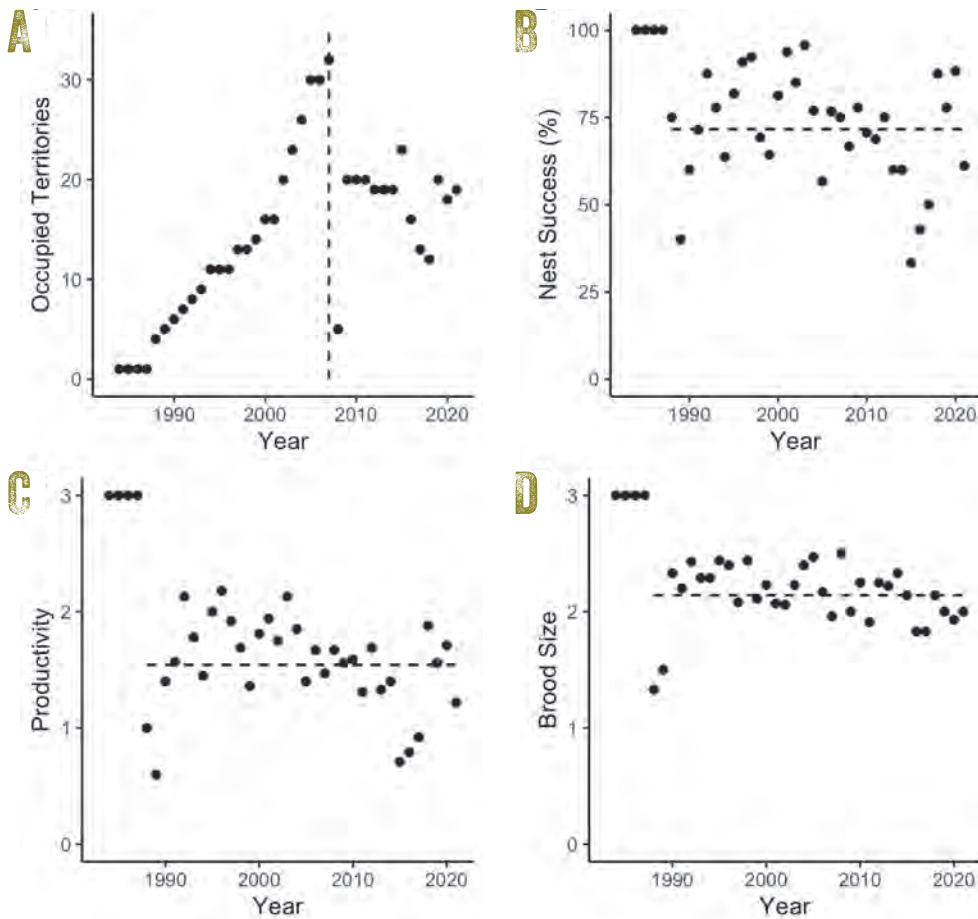


FIGURE 10.2 Population data on peregrine falcons in Yellowstone National Park, 1982–2020: (A) occupied territories, (B) nest success, (C) productivity, and (D) brood size.

After the Grand Canyon of the Yellowstone territory was occupied, reoccupation of the park was spotty and slow (Fig. 10.2). By 1994, only 11 pairs (about one new pair per year) had reoccupied YNP. Additionally, reproductive success was initially low, and through 1989, only about three young per year were produced park-wide. After 1989, however, reproduction accelerated, and in 1992, 17 young were produced. Furthermore, there was evidence, based on banding records, that most of the recruitment was from birds born to wild and not released parents. As time went on, reoccupation continued to increase, and by 2007, there were 32 known pairs across the park (Baril et al. 2015).

HOW WE MONITOR PEREGRINES

Peregrines do not winter in Yellowstone, but adult males return each year by late March or early April and claim or reclaim their nest territory, with adult females arriving soon after. Once a female is on-site, an adult male peregrine will perform spectacular aerial acrobatics as the female peregrine watches from a perch, sometimes joining the male in flight. A male peregrine rises effortlessly on updrafts along rock walls and ridges, then uses his long and pointed wings to swoop and dive. Two peregrines

HOW WE MONITOR PEREGRINES



FIGURE 10.3 Peregrine falcons commonly live near rocky cliffs by water and use rock outcroppings for perches. **PHOTO BY RONAN DONOVAN**

circling each other high in the air is a spectacular sight. While this phenomenal aerial display is breathtaking, it's not the easiest way to detect peregrine courtship activity.

A male peregrine perched in a prominent location, often at the top of a rock wall or rugged canyon, offers a definite clue to territory occupancy (Fig. 10.3). When two peregrines are perched near each other, the size difference is usually apparent. Peregrines, like many other raptors, exhibit reverse sexual dimorphism, meaning the male is considerably smaller than the female.

For an eyrie (nest site), peregrines claim a horizontal ledge, crack, or hole on a cliff or rock outcrop, formed by extensive lava flows that cloak much of Yellowstone (Fig.

10.4, 10.5, and 10.6). Male and female peregrines frequently display together on the nest ledge during early courtship; observing this behavior helps to pinpoint the chosen ledge. Vocalizations described as *ee-chup* and *ee-chip*, given by both male and female, accompany ledge displays; these calls can sometimes be heard quite far from the nest wall. During courtship, loud and strident wailing by the female can serve as solicitation for copulation. When they copulate, the male lands on the female's back, and she holds her tail to the side so that his cloaca meets hers, transferring the male's sperm to the female, with the male often flapping his wings as they copulate. The cloacal kiss, as it's called, lasts just a few seconds (Fig.

PEREGRINE FALCON



❑ **FIGURE 10.4** Looking inside a nest ledge with three chicks. Although it is a natural ledge, it almost seems constructed for them. Note signs of multi-year use. Peregrines do move nest sites, but some are used repeatedly. **NPS PHOTO/ DOUGLAS SMITH**

❑ **FIGURE 10.5** One territory with two nest ledges, each used in different years (note: the ledge on the right is the close-up in Fig. 10.4). **NPS PHOTO**



HOW WE MONITOR PEREGRINES

10.7). The female might wail after copulation, and the male might make calls, too. More than once, a male peregrine nesting near Mammoth copulated with his mate immediately after chasing a rival peregrine or other raptor from the nest area. His predictable reaction to his prowess at nest defense made it easy to find where the female was perched.

Woe to rivals and intruders daring to enter a peregrine's territory. A monitor watched as a sub-adult golden eagle

flew along the top of a nest wall, right above an active peregrine falcon eyrie. As the eagle nearly reached the end of the wall, the male peregrine appeared out of nowhere and dive-bombed the eagle. With that, the hapless young eagle turned around and did the worst possible thing. It flew back over the wall, directly above the active nest. Now the male peregrine displayed his fury by swooping again and again, dancing on the back of the eagle as both flew out of sight. Peregrines can make loud "cacking" calls as



▼ **FIGURE 10.6** Typical eyrie or scrape on a canyon wall. Almost no actual nest is used. This site, just off the Grand Loop Road in Yellowstone National Park, may be the most-viewed natural peregrine eyrie in North America.

PHOTO BY RONAN DONOVAN

▼ **FIGURE 10.7** Copulating peregrine falcons in Yellowstone National Park. Notice the size dimorphism, with the smaller male on top of the female. PHOTO BY RONAN DONOVAN



PEREGRINE FALCON



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