Yellowstone National Park
Montana, Wyoming, Idaho

National Park Service
U.S. Department of the Interior

Yellowstone National Park Bird Program Annual Report 2017

A male mountain bluebird perched in a big sagebrush. Photo © D. & L. Dzurisin

Cover photo: Great horned owl. Photo © D. & L. Dzurisin

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Yellowstone National Park Bird Program Annual Report 2017

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Horned lark. NPS Photo-J. Frank

Executive Summary

During the spring and summer of 2017, Yellowstone National Park (YNP) continued its long-term bird monitoring program for the 34th year, monitoring raptors, songbirds, and waterbirds throughout the park during their breeding season and migration. In addition, we hosted several public outreach events and classes highlighting bird ecology.

Raptors: YNP supports at least 36 **peregrine falcon** territories, many of which are occupied annually. In 2017, 13 of 20 monitored territories were occupied. Although nesting success has remained at or below the 30-year average in 6 of the last 10 years, numbers of peregrine falcons in YNP have remained relatively stable. In contrast, the nesting success of **bald eagles** and ospreys has been at or above the long-term averages for both species during the last several years. There are 51 historic bald eagle territories in YNP, one-half of which are usually occupied by a mated pair each year, although occupancy in 2017 was below average. Only 15 of 27 monitored bald eagle territories were occupied; 9 of 14 (64%) eagle nests were successful. Biologists banded one bald eagle nestling and collected feather samples from the successful Goose Lake nest in YNP in 2017. We monitored 38 osprey territories, a sample of the total number in the park. Twenty-eight territories were occupied, and 21 of 28 territories that attempted to nest (75%) were successful. Two osprey pairs initiated nesting on Yellowstone Lake but only one was successful. Although Yellowstone Lake historically provided nesting habitat for upwards of 50 osprey territories throughout the 1990s, declines in the cutthroat trout population have had negative impacts on this fish-eating species.

We monitored **golden eagles** for the seventh consecutive year. Between April and August of 2017, we visited 26 of the 28 known territories and found all to be occupied by golden eagles. Breeding attempts and nesting success have varied greatly across the seven years of monitoring. Based on 23 territories with known outcomes in 2017, golden eagle nesting success was 30% and productivity was 0.3 young per occupied territory, slightly below the seven-year average (2011–2017, nest success 30% and productivity 0.4).

In September and October 2017, 312 **migrating raptors** across 16 species were documented in Hayden Valley. The most abundant species observed were red-tailed hawk (42%), Cooper's hawk (15%), and bald eagle (6%). During late winter/early spring **owl surveys,** observers detected 15 individuals belonging to three species of owl: 4 great horned owls, 9 northern saw-whet owls, and 2 northern pygmy owls. We observed both the lowest species richness and total abundance of owls since surveys began in 2013.

Waterbirds: Pairs of **trumpeter swans** occupied both Grebe and Riddle lakes in 2017, but neither pair nested. In partnership with Wyoming Wetlands Society, three cygnets raised in captivity were released on the Yellowstone River to augment local swan numbers and establish more breeding pairs. During the autumn survey in late September, we observed 23 adult swans in the park.

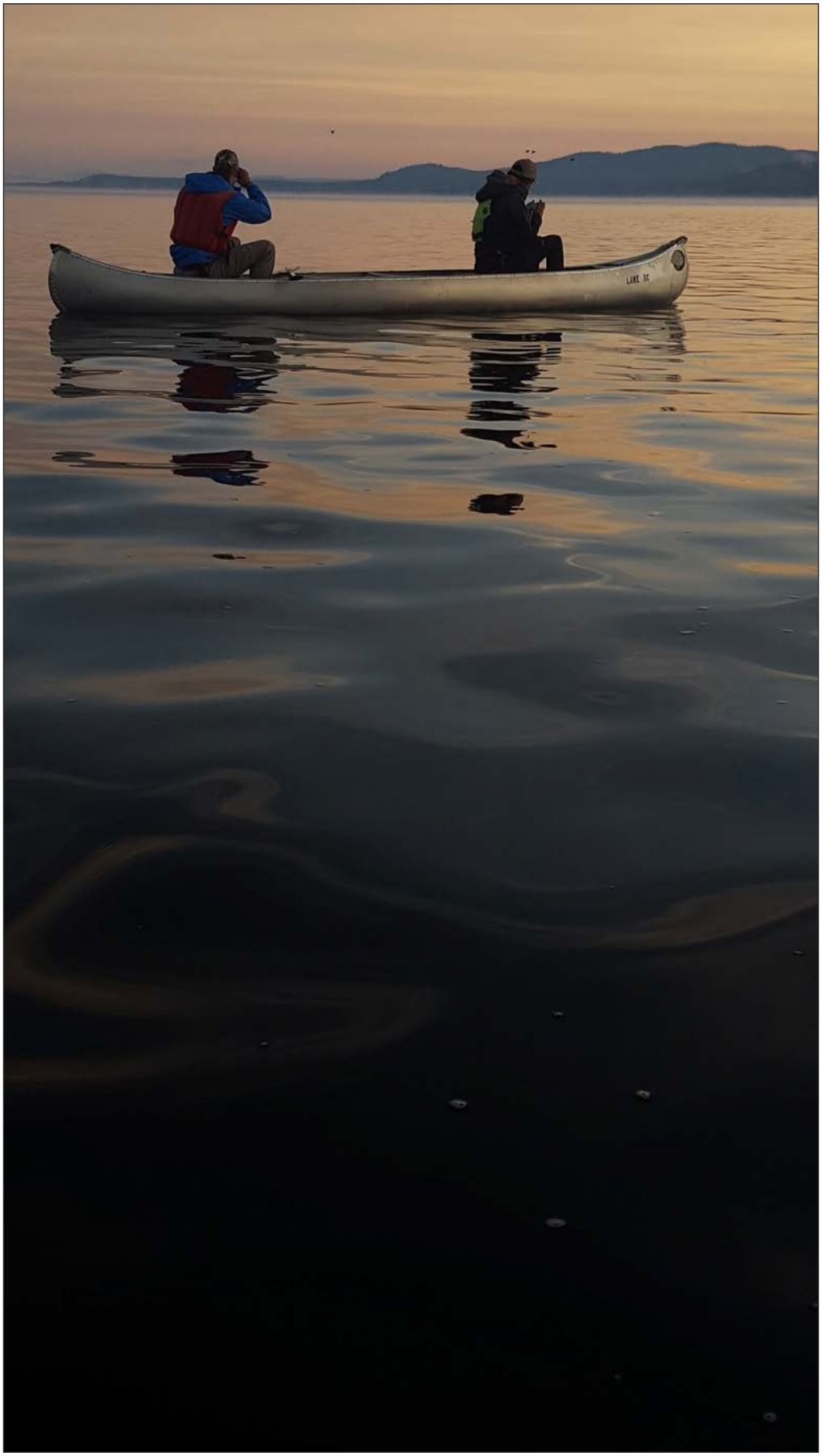
From a small colony on the Molly Islands, **American white pelicans** fledged 29 young, while **double-crested cormorants** fledged 12 young. No **California gulls** or **Caspian terns** nested on the islands. The number of pelicans, cormorants, and gulls fledged from the Molly Islands has declined since the early 1990s, and Caspian terns have not nested there since 2005.

Fifteen pairs of **common loons** fledged eight young in YNP in 2017. An additional seven unpaired loons were also observed. The Biodiversity Research Institute (BRI) is working with park biologists to learn more about the Wyoming population, since it is isolated by more than 300 kilometers (186 mi) from the nearest breeding population in northwestern Montana. The park supports the majority of loons in Wyoming and, as a result, is extremely important for the persistence of this isolated population.

Two **harlequin ducks,** one male and one female, were caught and banded in May 2017 near LeHardy Rapids. The male was outfitted with a satellite transmitter; in late June, researchers tracked it to the west coast of Vancouver Island, British Columbia, where it likely remained for the winter.

Passerines and Near Songbirds: We used four methods to monitor breeding songbirds in YNP in 2017: point counts in **willow stands,** recently **burned forests,** and **old growth forests,** and the **North American Breeding Bird Survey** (BBS). We recorded 25 songbird species within the three willow growth types. Songbird species richness was relatively high in released and previously tall willows, and low in suppressed willow stands. Taller willows support willow specialists, such as Wilson's warbler and willow flycatcher. The forest burn surveys assess the responses of woodpeckers and songbirds to fires in recently burned plots. Of 19 species observed in this forest type, the most abundant were tree swallow, dark-eyed junco, yellow-rumped warbler, and American robin. To identify and monitor the bird assemblages using old-growth forests, we conducted point counts in mature evergreen forests. Observers recorded 29 species and the most abundant species were yellow-rumped warbler, dark-eyed junco, pine siskin, and American robin. The BBS indexes population trends through time; in 2017, we observed nearly 3,200 individuals belonging to 86 species along three routes in YNP. In addition to breeding season surveys, we also monitored **migrating songbirds** in three habitats (willows, old growth forests, and grasslands) from late August through late September, which was a new survey in 2017.

Passerine fall migration survey, Slough Creek willows. NPS Photo-M. Paulson



Sunrise paddle, Trail Creek. NPS Photo-M. Paulson

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Introduction

Yellowstone National Park (YNP) is surprisingly rich in bird diversity, given the challenging environmental conditions that characterize the landscape. Variations in elevation and the broad array of habitat types found within YNP contribute to the region's relatively high diversity. The YNP bird program monitors a small portion of the birds that utilize the park for breeding, migration, and wintering, with the broad goals of both gathering information (e.g., reproduction, abundance, habitat use) on multiple species from a wide variety of avian taxonomic groups and maintaining long-term datasets (more than 30 years) for several species. Maintaining long-term monitoring efforts will inform biologists of potential shifts in ecosystem function (e.g., climate change effects) and may guide future management decisions with the aim of conserving avian resources in the park. There are more than four million visits to YNP annually, many by avid bird watchers. This report summarizes data gathered for the YNP bird program during 2017. Details regarding field protocols and program history were provided in the 2011 annual report, which is available at http://www.nps.gov/yell/naturescience/birdreports.htm. New and updated protocols for recently added surveys are detailed in this report.

The core bird program for YNP is divided into three subgroups meant to represent YNP's avian diversity: the Raptor Monitoring Program, Wetland Bird Monitoring Program, and Passerine and Near Passerine Monitoring Program. Bald eagles, peregrine falcons, and ospreys are monitored under the Raptor Monitoring Program. With the removal of the peregrine falcon and bald eagle from the Federal List of Endangered and Threatened Wildlife and Plants in 1999 and 2007, respectively, there are no federally listed bird species that breed in YNP. However, we continue to monitor these species because they are of historical concern and to meet obligations outlined in post-delisting plans developed by the U.S. Fish and Wildlife Service (2003).

Trumpeter swans, common loons, and colony-nesting birds on the Molly Islands are included in the Wetland Bird Monitoring Program and are of particular concern in YNP due to small and locally declining numbers. The North American Breeding Bird Survey (BBS) and the willow, forest burn, and old growth surveys monitor breeding songbirds in YNP as part of the Passerine and Near Passerine Monitoring Program. In 2017, we also began monitoring songbirds during fall migration in willows, grasslands, and old growth forest. The Passerine and Near Passerine Monitoring Program is particularly valuable since species in this group represent the majority of all bird species found within YNP. Additionally, songbirds are declining across North America and are vulnerable to habitat changes due to human development, as well as climate warming (Askins 1993, Ballard et al. 2003). For example, changing climate patterns and management policies could potentially affect the local fire regime in the park. Documenting baseline measures of songbird abundance and diversity, as well as how those measures change through time, may provide valuable insight into the drivers of songbird population trends and aid in their conservation.

Beyond YNP's core bird program, the bird program and outside researchers monitored several additional avian groups in 2017, including spring migrants, bald eagle population genetics and connectivity, breeding golden eagles, fall raptor migration, wintering bald and golden eagles, harlequin ducks, and owls.

Yellowstone Core Bird Program

Raptor Monitoring Program

Peregrine Falcon

Peregrine falcons were once an imperiled species in North America because of widespread use of the pesticide DDT. Due to nationwide recovery efforts, including those in and around YNP, and bans placed on DDT, peregrines now thrive in the park. In 2017, the 30th year of YNP's peregrine monitoring effort, we monitored 20 of 36 known breeding territories from late March through July (see Appendix A for Raptor Nesting Terminology). Thirteen territories were occupied, and we were able to determine the final outcome of breeding attempts for all but one occupied territory. Six of 12 pairs with a known outcome successfully fledged at least 11 young for a nesting success per occupied territory of 50% (figure 1). On average, peregrine pairs produced 0.9 young (productivity per occupied territory with known outcome), with an average brood size of 1.8 young fledged per successful pair (figure 2).

The major cause of peregrine endangerment (thin eggshells as a result of chemical contamination) is no longer a threat, and numbers of peregrine falcons in YNP appear stable (Baril et al. 2015). Furthermore, although both productivity and nesting success have remained below the 30-year average for the last five years, both measures have increased slightly since 2015 (figures 1 and 2). The relatively low nesting success and productivity in the last decade warrants continued close monitoring of this species and may require further study to determine the cause(s).

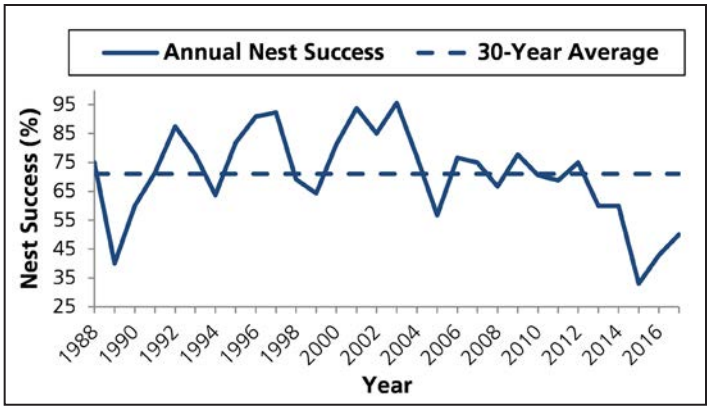

Figure 1. Peregrine falcon nest success per occupied territory in Yellowstone from 1988 to 2017, and comparison with the 30-year average.

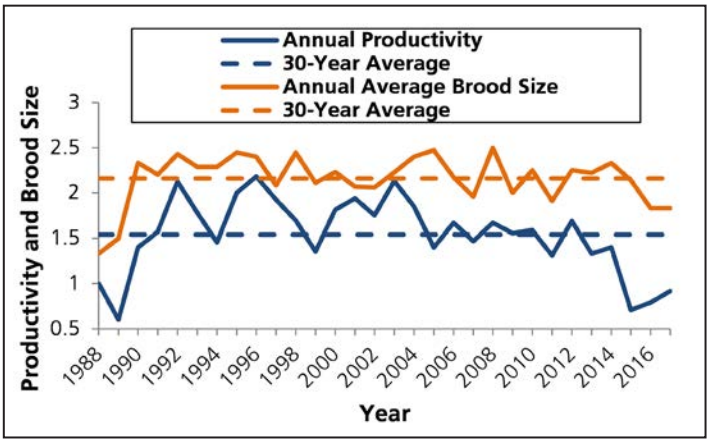

Figure 2. Peregrine falcon productivity per occupied territory and average brood size per successful nest from 1988 to 2017, compared with the 30-year averages.

Bald Eagle

We monitored 27 of the 51 known extant and historical bald eagle territories for nesting activity in 2017. Similar to peregrines, not all territories are occupied every year and some have been inactive for years. We confirmed that 15 of the 27 territories were occupied by territorial individuals; seven territories were unoccupied, and we were unable to determine occupancy at the remaining five. Long-lived birds like eagles forgo breeding in some years, depending on the availability of spring food sources and the condition of adults as they enter the breeding season (Steenhof and Newton 2007).

We determined the breeding season outcome for all confirmed occupied territories. Fourteen territories were confirmed active, and 9 successfully fledged 14 young for a nest success of 64% successful nests per active territory, substantially greater than the 34-year average of 51% (figure 3). Bald eagle productivity in 2017 was 1.0 young per active territory and the average brood size was 1.6 young per successful nest (figure 4). Across all territories with known outcomes, bald eagle nest success was 60% and productivity was 0.9 young.

The bald eagle population in YNP appears stable, and both nesting success and productivity have been above average since 2011. However, this parkwide success may be largely attributable to a notable increase in nesting success around Yellowstone Lake, despite the substantial decrease in Yellowstone cutthroat trout (*Oncorhynchus clarkia*; Kaeding et al. 1996, Koel et al. 2005), a historically important eagle prey item (Swenson et al. 1986). Eagles have likely switched to other prey, perhaps including the colonial nesting birds on the Molly Islands (pelicans, cormorants, and gulls) and waterfowl.

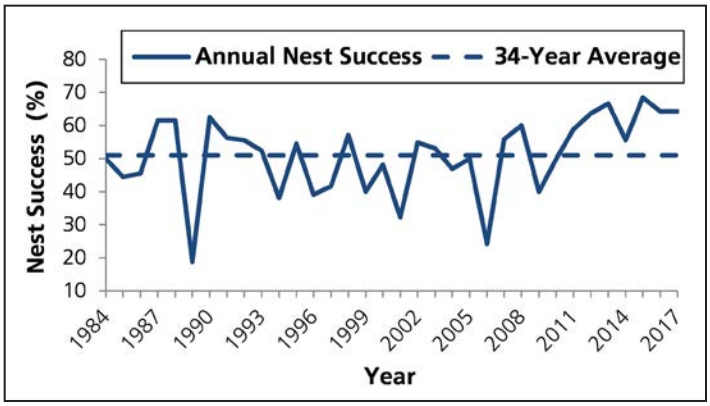

Figure 3. Bald eagle nest success per active territory from 1984 to 2017, and comparison with the 34-year average.

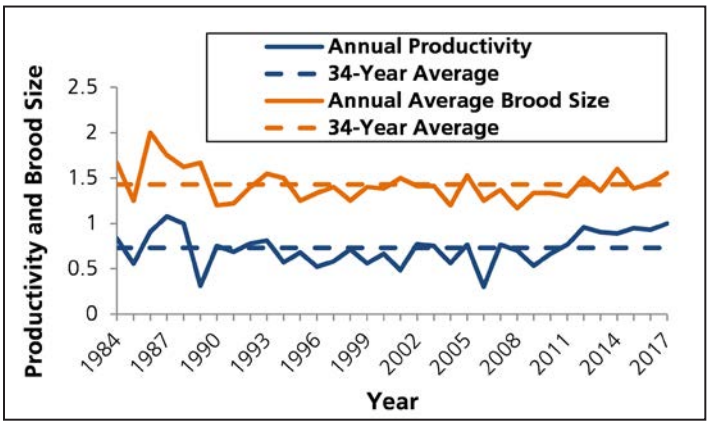

Figure 4. Bald eagle productivity per active territory and brood size per successful nest from 1984 to 2017, compared with the 34-year averages.

Osprey

We monitored 38 of the 56 known osprey territories from mid-May to mid-August. Of these territories, 28 were occupied, 4 were unoccupied, and the occupancy for the remaining 6 could not be determined. We were able to determine the breeding season outcome for all 28 occupied territories and confirmed 28 active nesting territories. Twenty-one territories were successful and fledged a total of 36 young for a nest success per active territory of 75%, well above the 31-year average of 52% (figure 5). In 2017, we calculated a productivity of 1.3 young per active nest; the average brood size was 1.7 young fledged per successful nest (figure 6). The productivity of occupied territories with known outcome was 1.3 young.

In 2017, only three osprey pairs nested on Yellowstone Lake; one nest on the lake fledged one young. From 1987 to 2017, numbers breeding on Yellowstone Lake, as well as the local nest success (figure 5), has declined dramatically (Baril et al. 2013), while osprey numbers elsewhere in the park have remained relatively stable (figure 7). Osprey nesting near the lake historically depended on native Yellowstone cutthroat trout populations, which were decimated by the invasion of non-native lake trout *(Salvelinus namaycush)* in the late 1980s (Kaeding et al. 1996, Koel et al. 2005). Unlike bald eagles, osprey are highly-specialized obligate fish-eaters, unable to adapt to alternate prey and, as a result, are particularly vulnerable to declines in the native fish population (Baril et al. 2013).

Osprey with fish. NPS Photo-C. Meyer

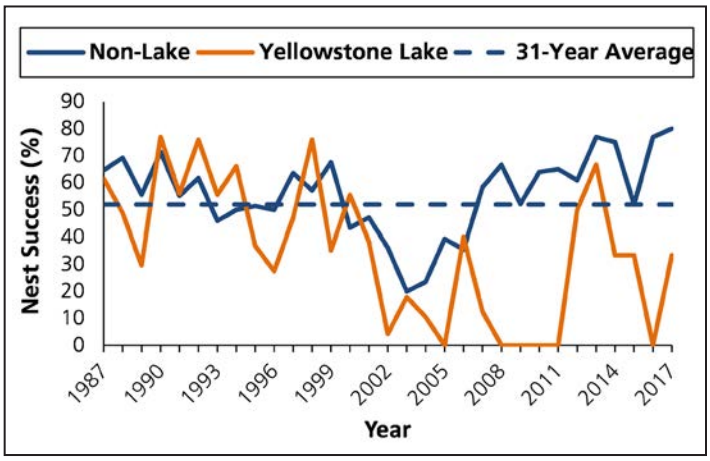

Figure 5. Osprey nest success per active territory on and off of Yellowstone Lake from 1987 to 2017, and comparison with the 31-year average across the park.

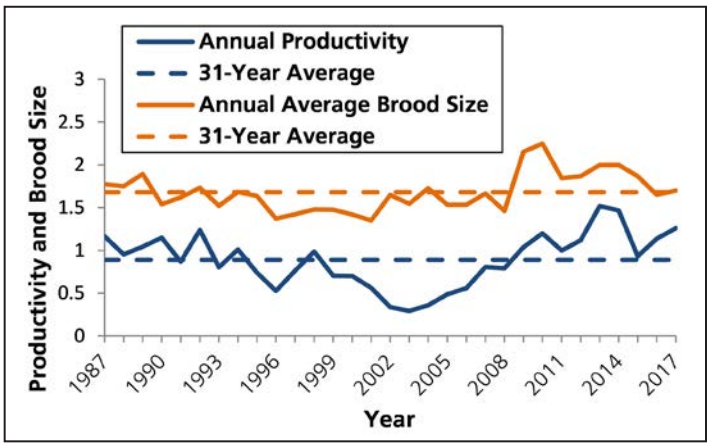

Figure 6. Osprey productivity per active territory and brood size per successful nest from 1987 to 2017, compared with the 31-year averages.

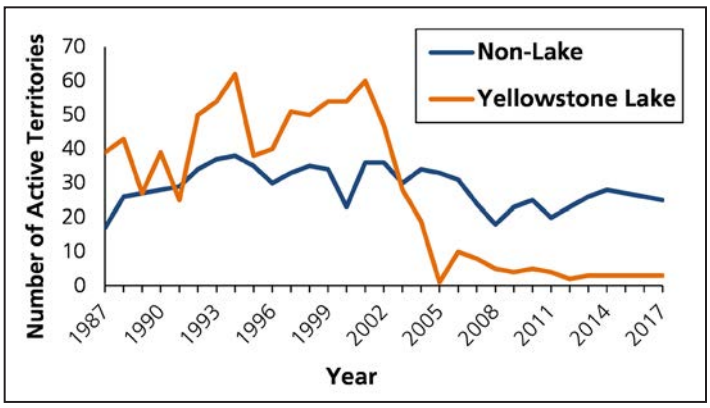

Figure 7. Osprey breeding populations on and off of Yellowstone Lake, from 1987 to 2017.

Wetland Bird Monitoring Program

Trumpeter Swan

Trumpeter Swan Reproduction and Breeding Season Observations

Trumpeter swan populations in the Rocky Mountains and across North America are doing well, steadily increasing in numbers since the mid-1960s. In YNP, however, the number of resident trumpeter swans has decreased substantially from nearly 70 individuals in 1961 to only 5 in 2010. More recently, the number of nesting pairs has been in decline since the early 1990s (figure 8).

We suspect multiple factors are to blame for these declines. Nesting swans are known to be sensitive to human disturbance (Henson and Grant 1991), and the increasing numbers of visitors to the park may have negative impacts on swan's nesting success. Furthermore, human disturbance may push swans and cygnets away from protected shorelines, making them more vulnerable to predation by bald eagles. Predation pressure on swans and other waterfowl by bald eagles, particularly around Yellowstone Lake, may have increased since the late 1980s, as cutthroat trout populations have declined and eagles have been forced to find alternative food sources (Koel et al. 2005, Baril et al. 2013). Finally, quick spring melt-off events, perhaps made more frequent or extreme by changing climate patterns, can cause shoreline flooding and destroy active breeding attempts or deter swans from breeding altogether. By gaining more information on the specific causes of swan decline, we hope to adjust the current management strategy to most effectively increase the number of territorial swan pairs and improve upon nesting success.

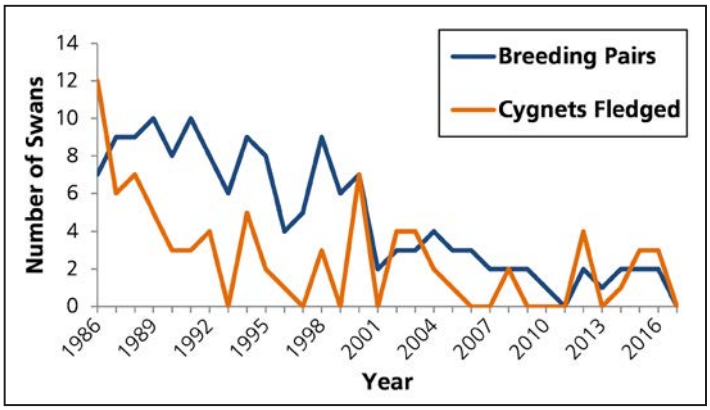

Figure 8. Trumpeter swan breeding pairs and cygnets fledged in Yellowstone, from 1986 to 2017.

Trumpeter swan. Photo © K. Cassidy

Although we observed trumpeter swan pairs on both Grebe and Riddle lakes (where nesting has occurred in previous years), we observed no evidence of nesting attempts in YNP in 2017. This was only the second year since 1986, and the first year since 2011, that no trumpeter swan breeding occurred within the park. The 2016–2017 winter in YNP was characterized by an above-average snowpack. When warm spring temperatures arrived in May, the snow melted quickly, leading to high stream flows and flooding lakes and waterways throughout the park. Swans may have been discouraged from nesting in 2017 by the long-lasting snow cover in the early spring or by the flooded shorelines when the snow melted. Alternatively, some swans may have attempted shoreline nests that were then inundated when water levels rose, causing them to fail. We are confident the pair at Grebe Lake did not attempt to nest in 2017. However, we are unable to say for sure whether the Riddle Lake pair failed or simply never attempted to nest because the trail to the lake is closed throughout much of the spring and summer.

In addition to the pairs on Grebe and Riddle lakes, we periodically observed four other swans that moved between Grebe, Wolf, Ice, and Cygnet lakes. These may include the two cygnets produced by the Grebe Lake pair in 2012; however young cygnets are not banded in YNP and the origins of these birds are unknown. We also observed a white swan (at least one year old) on Riddle Lake throughout most of the summer that was tolerated by the territorial pair; we suspect this individual may also have been a young bird returning to its home lake. A pair of adult swans moved among Twin Lakes, Grizzly Lake, and Swan Lake for most of the summer. The pair seemed to eventually settle on Swan Lake in August, as they did in 2016. The YNP bird program installed a nest platform on Swan Lake in September 2016 in

hopes that this territorial pair will nest there in the coming years. Although one of these swans is banded, it is difficult to identify this individual with certainty because it has lost its plastic field band and retains only the metal USGS (United States Geological Survey) band. However, given observations from previous years, it is likely the banded individual is F33, released as a cygnet on West Tern Lake in 2013.

As many as 11 additional non-breeding adult swans oversummered in YNP. A single swan was commonly seen on the Firehole River near Fountain Flats, where a single bird has been observed each year since at least 2013. Banded female H52 spent several weeks alone at Trout Lake and on the Lamar River. Banded bird F32 was seen consistently with another banded bird, moving between Cygnet Lakes and Hayden Valley throughout the summer. The unknown banded bird has unfortunately lost its plastic field band, leaving only the metal USGS band. A pair including banded bird H51 ranged widely, from Grebe Lake into the northeast Lamar Valley. Five swans spent the summer in the south and southeast arms of Yellowstone Lake; adult swans are consistently seen in this area, but there has not been evidence of any nesting behavior. Throughout the breeding season, observers occasionally documented swans at Duck Creek, Lilypad Lake, and Fern Lake, but no breeding activity was observed.

Trumpeter Swan Release

Since 2013, the YNP bird program has partnered with the Wyoming Wetlands Society (WWS) to increase the number of resident swans in YNP through the release of captive-raised cygnets. On 11 September 2017, YNP biologists and WWS released three swans (two females and one male) on the Yellowstone River in the Hayden Valley, near the confluence with Alum Creek. In total, the park has released 23 cygnets, including the three swans released this year. Although several individuals are frequently seen within the park boundaries during the breeding season, none of the released cygnets have nested within the park. Swans typically take at least four years to reach sexual maturity (Mitchell and Eichholz 2010), so we are hopeful these young birds may breed in coming years.

Autumn Trumpeter Swan Count

During an aerial survey on 27 September 2017, we counted 21 adult trumpeter swans within YNP. The three cygnets released on 11 September were not detected, although they were seen on the Yellowstone River using ground surveys both before and after the aerial counts on 21 September and 4 October. Two additional adult swans were observed on a flight on 11 October, bringing the autumn count total to 23 trumpeter swans (figure 9). The autumn count provides an estimate of the resident population and total productivity for the tri-state area at the junction of Wyoming, Idaho, and Montana. In YNP, numbers of both adults and cygnets have declined over the last several decades, but numbers have increased slightly since swan releases began in 2013 (figure 9).

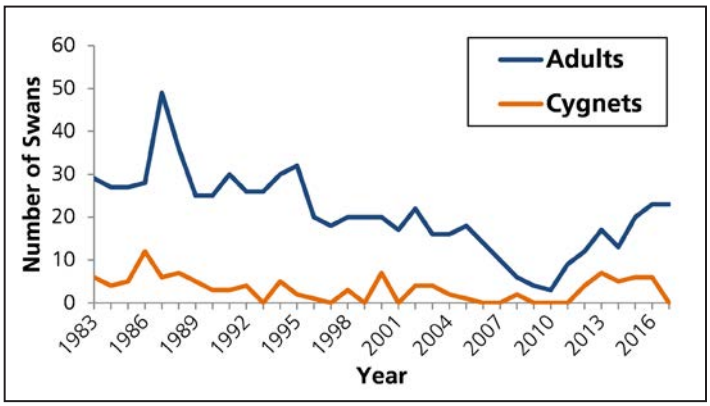

Figure 9. Autumn counts of trumpeter swans in Yellowstone, from 1989 to 2017.

Trumpeter swan release along the Yellowstone River, near Alum Creek. NPS Photo-B. Cassidy

Colony Nesting Birds

We made three flights over the Molly Islands (comprised of Sandy and Rocky islands) from June to August 2017. From aerial photographs taken during those flights, we observed approximately 280 American white pelican nests that fledged an estimated 29 young. We counted 16 nesting double-crested cormorants that fledged an estimated 12 young. Although we observed several California gulls perched on the islands, we did not observe any nesting attempts. We did not observe any Caspian terns on the Molly Islands in 2017.

The number of pelicans, cormorants, and gulls fledged from the Molly Islands has declined since the early 1990s, and Caspian terns have not nested there since 2005 (figure 10). The reasons for the decline in colonial nesting bird populations are not well understood, but a previous study indicates high levels of water in Yellowstone Lake are associated with low reproduction for nesting pelicans (Diem and Pugesek 1994). Notably, quick spring melt-off events can cause a significant rise in the water level on Yellowstone Lake and flood the Molly Islands. We estimate that an increase in lake level of 0.5 meter (1.6 ft) can result in a loss of approximately 2,700 square meters (8,858 ft²) of land area on Sandy Island, destroying any nests built within the flood zone. During the May 2017 flight, water levels were moderate and we estimated the area of Sandy Island to be approximately 4,739 square meters (15,548 ft²). At the peak lake level on 24 June, the above-water area of Sandy Island was likely only around 607 square meters (1,991 ft²).

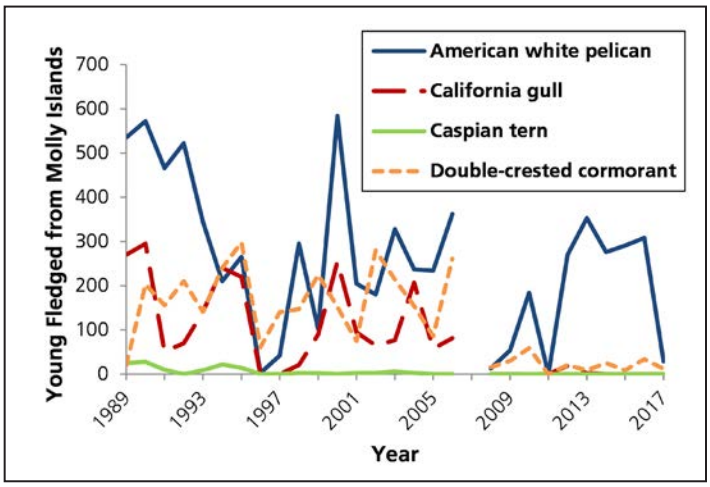

Figure 10. Number of young waterbirds fledged from the Molly Islands, from 1989 to 2017.

The decline in cutthroat trout, a known food source for the Molly Island colonial nesting birds (Schullery and Varley 1995), may also influence nesting success for these species. Furthermore, bald eagles on Yellowstone Lake that formerly depended on cutthroat trout may have switched prey to target the flightless and vulnerable young of the nesting birds on the Molly Islands (Baril et al. 2013). During our August 2017 flight, we observed five bald eagles perched on the islands.

To better understand the drivers of colonial waterbird decline, bird program staff visited the Molly Islands twice in 2017. In late July, biologists observed nine bald eagles on the islands during 3.5 hours of observation. Staff also witnessed an immature eagle actively hunt and depredate an American white pelican nestling. Although the chick was similar in size to the eagle, it was not capable of flight and thus vulnerable. We also observed a common raven removing a double-crested cormorant egg from an unattended nest. On 12 September, staff biologists examined the islands directly to count visible nests and remove human litter. We were pleasantly surprised to find minimal fishing line and human debris on the islands. Biologists also observed upwards of 20 bald eagle feathers, confirming our observations from late July and suggesting eagle presence on the islands is common. Bird program biologists plan more intensive work on the Molly Islands in future years to better understand these declines.

Bird program staff conducting observations on the Molly Islands. NPS Photo-B. Cassidy

Common Loon

In the western United States, common loons breed in Idaho, Montana, Washington, and Wyoming, with a total of approximately 115 territorial pairs. Wyoming's breeding loon population, largely found within YNP, is one of the most southerly in North America and is isolated from the nearest breeding population in Montana by more than 300 kilometers (186 mi). Loons are long-lived but have relatively low annual productivity and a poor ability to colonize new breeding areas (Evers et al. 2010). Given the very small size and isolation of Wyoming's breeding loon population, it is at a particularly high risk of local extinction.

Since the mid-2000s, Wyoming's loon population has declined by 38%; because of its limited range, small population, sensitivity to human disturbance, and loss of breeding habitat outside of YNP, the common loon is listed as a Species of Special Concern in Wyoming. In YNP, the breeding loon population has declined steadily since surveys began in 1989, with a more dramatic decline since 2006. In 2013, a

five-year study was initiated in collaboration with the Biodiversity Research Institute (BRI) to allow for more intensive, and comprehensive, monitoring of the loon population in Wyoming, including YNP. That study, completed in 2017, indicates the number of loons present in the park can vary widely from year to year. Continuing research into loon productivity, nesting success, and abundance will help determine the source of both the overall decline and the annual variability in the loon population.

In 2017, Wyoming's loon population was comprised of 54 total adult birds, 20 territorial pairs, and 12 nesting pairs, of which 8 successfully fledged 10 young. In YNP, BRI biologists and bird program staff and volunteers checked at least 27 known or historic loon territories. Seventeen of the territories were occupied by at least 1 loon; in total, the park housed 37 adult loons and 15 pairs (figure 11). Only eight pairs attempted to nest, and two of those failed. The six successful pairs produced eight loonlets during 2017 (figure 11) for a productivity of 0.5 chicks per territorial pair. In 2017, BRI biologists also captured and banded three loons in the park, including the adult females at Riddle and Lewis lakes and the chick fledged at Lilypad Lake. BRI also assessed blood and feather samples from each captured bird for mercury contamination.

Yellowstone National Park provides the majority of loon breeding habitat in Wyoming; in 2017, the park hosted 69% of the state's total loon population and 66% of the breeding pairs. Furthermore, loons in YNP produced 80% of the Greater Yellowstone Ecosystem's (GYE) fledged chicks, highlighting the park's important role in population stability and persistence. From information gathered over the previous five years of intensive loon monitoring in the park, it appears mortality is exceeding production due to factors such as human disturbance, spring flooding, raptor predation, mercury toxicity, and lake trout gill netting operations on Yellowstone Lake.

Direct human disturbance to shoreline nests lowers survival rates, as does the loss of breeding habitat due to water level fluctuations (e.g., erratic spring flooding; Evers et al. 2010). Given the limited number of nesting pairs in YNP, occasional predation of adult loons and chicks by bald eagles and other predators may also significantly impact the overall population.

Fish are the primary prey of loons and may additionally serve as a vector for mercury contamination. Fish from four lakes in YNP were screened for mercury contamination in 2012; fish from Beula, Grebe, and Yellowstone lakes had mercury concentrations high enough to result in behavioral impacts to adult loons (Depew et al. 2012, Eagles-Smith et al. 2014). Fish from Lewis Lake also contained low amounts of mercury, but not at levels thought to cause toxicity in loons (Depew et al. 2012, Eagles-Smith et al. 2014). Mercury levels measured in blood samples from captured loons have also been below the threshold for adverse effects, although the female from Wolf Lake (captured in 2014 and recaptured in 2015) had concentrations above what has been observed in other northwestern Wyoming loons.

Finally, due to YNP's efforts to eradicate lake trout from Yellowstone Lake, loons are occasionally caught and drowned in gill nets. In most cases we believe the captured birds are autumn migrants, although at least one resident bird has been caught. In 2017, two birds were killed by gill nets in Yellowstone Lake on 22 August and 18 October. The carcasses were shipped to BRI for necropsy. The BRI determined that both loons, one male and one female, were likely migrants and not part of the local YNP breeding population. Genetic testing to make a final determination is ongoing.

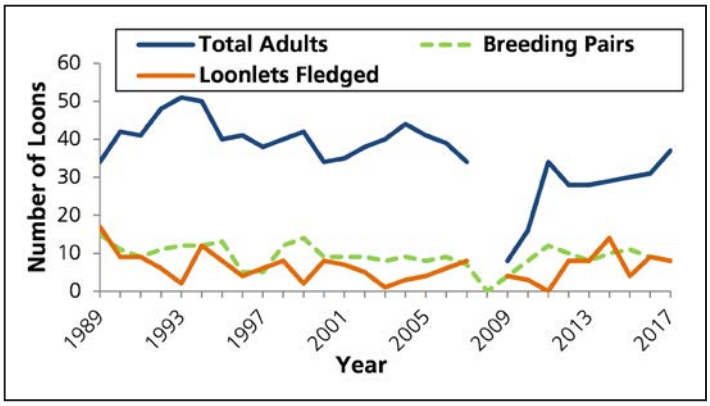

Figure 11. Common loon adults, breeding pairs, and young fledged in Yellowstone, from 1989 to 2017.


Biologists from Biodiversity Research Institute and Yellowstone holding a loon captured for banding. NPS Photo-D. Smith

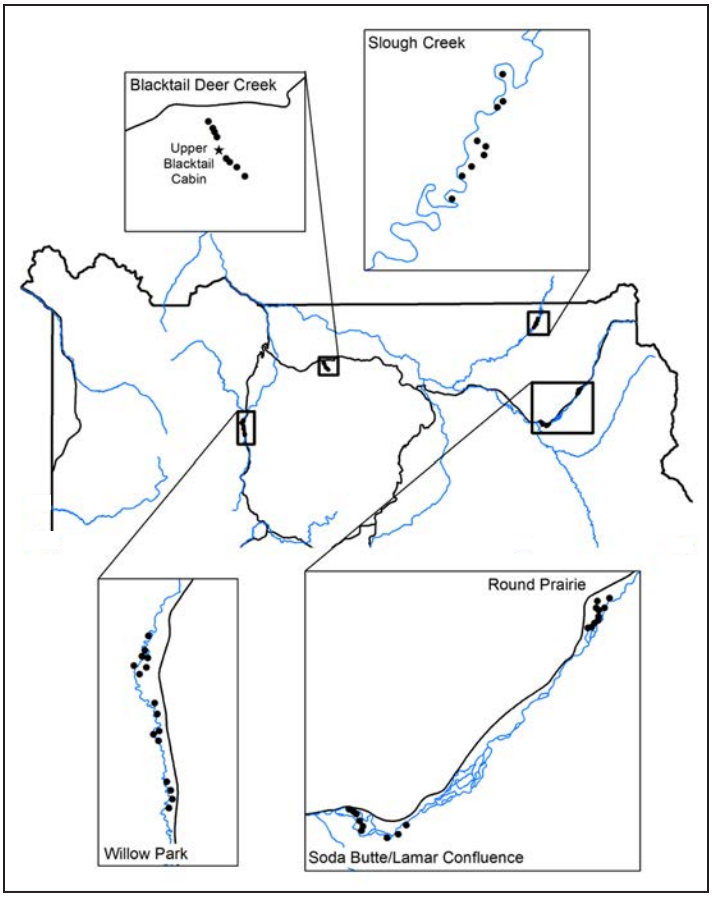

Figure 12. Map of willow point count locations in Yellowstone.

Passerine and Near Passerine Monitoring

Breeding Season

Willow Surveys

The YNP bird program has monitored willow-songbird communities in the park since 2005. In most years, three types of willows were surveyed for breeding passerines (see Baril et al. 2011 for detailed methods). We surveyed previously tall willows, averaging more than 1.5 meters (4.9 ft) in height and experiencing little browsing, in Willow Park (figure 12). Suppressed willows (generally less than 1 meter [3.3 ft] in height and experiencing heavy browsing) were surveyed in the Soda Butte/Lamar Confluence area. Finally, we surveyed released willows (formerly height suppressed, but now similar to previously tall willows but with less canopy cover) along Slough and Blacktail Deer creeks, and in the Round Prairie area.

In 2017, we recorded 25 songbird species across the range of willow growth conditions. Species richness, which is the average number of species found in a particular habitat, was higher in both previously tall willows and released willows than in suppressed willows (figure 13). Wilson's warbler, a willow specialist, was only observed in previously tall willows (table 1). In contrast, gray catbirds were most likely to be found in released willow stands. Released willow sites, while generally drier than previously tall sites, provide shrubby cover not available in suppressed sites but necessary for ground nesting species such as gray catbird.

White-crowned sparrow. NPS Photo-C. Meyer

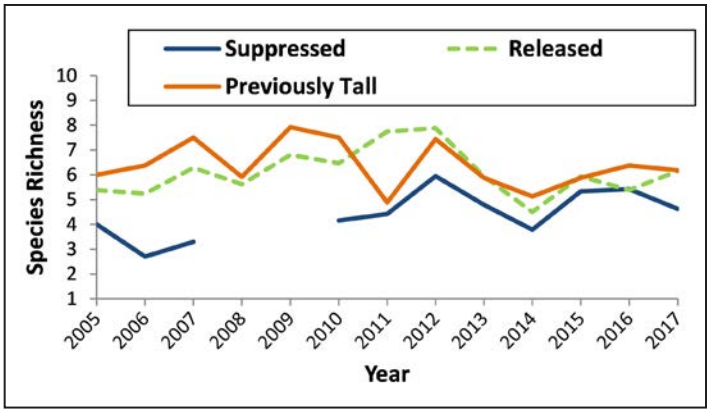

Figure 13. Songbird species richness across three willow growth conditions, from 2005 to 2017.

Suppressed willows appear to function similar to grasslands and provide habitat for generalist species. We observed yellow warblers most often in released and previously tall willows but documented savannah sparrows most commonly in released and suppressed willows (table 1). Song sparrows had a high relative abundance in previously tall and released willows, and we rarely observed this species in suppressed willows. Released willows exhibit similar structural characteristics to both previously tall and suppressed willows (i.e., tall but dispersed willow shrubs), which contributes to the species overlap. Willow stands are slowly changing; in response, we plan to reassess the vegetation characteristics and reclassify stands in the 2018 season.

Table 1. Relative abundance of songbird species observed in suppressed, released, and previously tall willow stands in 2017. Bold numbers indicate species with the greatest abundance in each stand type.

Species	Suppressed	Released	Previously Tall
American Robin	0.38	0.27	0.25
Black-billed Magpie	**1.13**	-	-
Brown-headed Cowbird	0.44	-	0.13
Brewer's Blackbird	0.06	0.17	0.06
Broad-tailed Hummingbird	-	0.02	-
Cliff Swallow	0.44	0.23	0.06
Common Yellowthroat	0.31	0.73	0.66
Fox Sparrow	-	-	0.13
Gray Catbird	-	0.06	-
Lincoln's Sparrow	-	1.06	0.59
Marsh Wren	-	-	0.06
MacGillivray's Warbler	-	0.02	-
Mountain Bluebird	-	0.04	0.03
Northern Rough-winged Swallow	0.31	0.10	0.09
Pine Siskin	0.56	0.52	-
Red-winged Blackbird	0.13	0.04	-
Savannah Sparrow	1.00	0.52	0.19
Song Sparrow	0.13	0.69	0.84
Tree Swallow	0.19	0.08	0.06
Violet-green Swallow	-	0.02	0.03
Warbling Vireo	-	0.10	-
White-crowned Sparrow	-	0.40	0.13
Willow Flycatcher	0.13	0.37	0.44
Wilson's Warbler	-	-	0.28
Yellow Warbler	0.31	**1.29**	**1.56**

Forest Burn Surveys

The persistence of cavity nesting birds in YNP is dependent on patterns of fire across the landscape. Forest fires are predicted to increase in future years due to climate warming, so park staff began sampling bird communities post-burn in 2009. Variations in burn severity, age, and post-burn forest structure create a mosaic that supports a diversity of species (Saab et al. 2007). Standing dead trees attract bark and wood-boring beetles, the primary prey for woodpeckers (Saab et al. 2007). Woodpeckers excavate nest holes in standing dead trees, many of which have been softened by fungus, thus making excavation easier. Nest cavities created by woodpeckers are also used by a host of secondary cavity nesters, such as chickadees, nuthatches, and bluebirds. Fire size, frequency, and intensity in YNP is expected to increase, at least in the short-term, as the climate becomes warmer and drier (Rocca et al. 2014); however, it is not clear how changes in fire regimes will affect cavity nesting and fire-dependent bird species in the region. Since birds are among the first returning vertebrates to a fire-affected area, studying this ecological relationship is important.

We conducted point count surveys in two burned areas in YNP in 2017: the Arnica Fire (8 points) and the Cygnet Fire (8 points; figure 14). The Arnica Fire burned 4,314 hectares (10,660 ac) north of the West Thumb of Yellowstone Lake in 2009, and the Cygnet Fire burned 1,431 hectares south of the road between Norris and Canyon during 2012.

We observed 19 species in the two study areas (table 2), including six obligate cavity nesters. The most abundant species in these burns were tree swallow, dark-eyed junco, yellow-rumped warbler, and American robin. Of the species recorded, 2 of 19 were primary cavity nesters (i.e., excavate their own nest holes). Although occurring in low abundance (less than five detections), hairy woodpecker and northern flicker were detected in both burn areas. We also observed four species of secondary cavity nesters (i.e., species that utilize existing natural cavities or the abandoned holes of primary cavity nesters). While mountain bluebirds, mountain chickadees, and tree swallows were detected at both sites, brown creepers were found only at the Arnica fire site.

The response of a given species may vary substantially from fire to fire (Smucker et al. 2005). These mixed responses are likely due to variation between and even within an individual fire (e.g., fire severity), as well as the type of forest and forest structure present prior to a fire. All surveyed burns included some points that contained a mixture of burned and live trees or wet meadow areas. Because of this, some species were recorded that may not have been strictly using burned habitat.

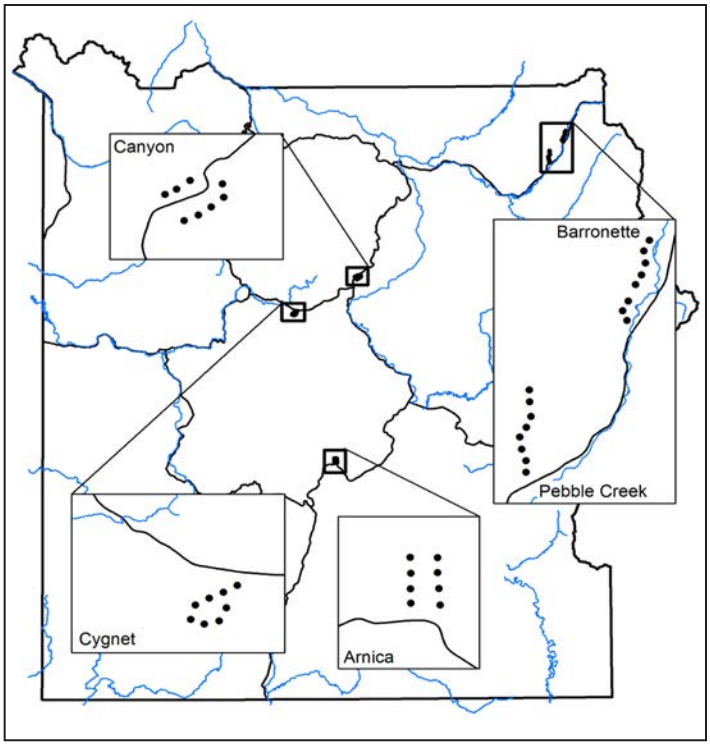

Figure 14. Map of burn (Cygnet and Arnica) and old growth (Canyon, Barronette, and Pebble Creek) point count locations in YNP in 2017.

Table 2. Relative abundance of songbird species observed in burn areas in 2017.

Species	Abundance	Nesting Guild[a]
American Robin	0.32	OC
Brown Creeper	0.09	2° CA
Cassin's Finch	0.04	OC
Clark's Nutcracker	0.03	OC
Common Raven	0.02	OC
Dark-eyed Junco	0.56	OC
Hairy Woodpecker	0.05	1° CA
Mountain Bluebird	0.17	2° CA
Mountain Chickadee	0.14	2° CA
Northern Flicker	0.15	1° CA
Olive-sided Flycatcher	0.05	OC
Pinyon Jay	0.03	OC
Pine Siskin	0.08	OC
Ruby-crowned Kinglet	0.25	OC
Red Crossbill	0.02	OC
Townsend's Solitare	0.06	OC
Tree Swallow	0.92	2° CA
Western Wood-pewee	0.25	OC
Yellow-rumped Warbler	0.38	OC
Richness per Point	4.94	
Abundance per Point	3.61	

[a]Nesting Guild: 1°CA = excavates own cavity, 2°CA = uses natural or abandoned cavities, OC = open cup.

Old Growth Forest Surveys

There is a lack of consensus on how the term "old growth" is defined. Specific definitions are typically based on some minimum level of structural features, such as large trees and snags, canopy layering, dead biomass, and large fallen trees (Spies et al. 2006). For our purposes, we defined old growth as a forest that has not had a major disturbance (i.e., wildfire) in at least 100 years. While the importance of old growth forests to songbirds is poorly understood, these mature forests provide nesting habitat and foraging opportunities, especially for cavity-nesting birds, that young stands do not (Carey et al. 1991). Climate warming may cause more frequent and severe fires in YNP (Rocca et al. 2014), which could prevent regeneration of old growth forests post-burn and ultimately convert old growth stands to woodland or non-forest habitat, though modeling predictions are highly variable and uncertain (Westerling et al. 2011). In 2017, we added point count surveys of three old growth forests (figure 14) to the overall monitoring tasks of the core bird program, to document and monitor bird assemblages that currently utilize old growth forests in the park.

While all of the study sites were classified as old growth, the forest structure and tree species composition varied. The Canyon site was composed of mid-successional to climax lodgepole pine (*Pinus contorta*) forest, while the Pebble Creek forest was composed of climax Douglas-fir (*Pseudotsuga menziesii;* figure 14). The forests at the Barronette site were composed of late-successional lodgepole pine.

Bird Program staff traversing through a burned area enroute to a point count survey. NPS Photo-M. Paulson

We observed 29 species in the three old growth study areas (table 3). In general, the most abundant species in old growth forests were the yellow-rumped warbler, dark-eyed junco, pine siskin, and American robin. Species richness increased along a gradient with the fewest species detected at the Canyon site and the most species detected at the Pebble Creek site. Nine species detected at the Pebble Creek site were not found at either of the other two sites, including three flycatchers: dusky flycatcher, Hammond's flycatcher, and olive-sided flycatcher. Birds observed flying overhead were included in our counts, but may not have been strictly using old growth forest habitat.

Table 3. Relative abundance of songbird species observed in old growth forests in 2017. Bold numbers indicate species with the greatest abundance along each transect.

Species	Canyon	Barronette	Pebble Creek
American Robin	0.21	0.75	0.50
Brewer's Blackbird	-	-	0.04
Brown Creeper	0.08	0.04	-
Cassin's Finch	0.04	0.04	0.13
Cedar Waxwing	-	-	0.04
Chipping Sparrow	-	0.17	0.25
Clark's Nutcracker	0.04	-	-
Cliff Swallow	-	-	0.04
Common Raven	0.04	-	-
Dark-eyed Junco	0.13	0.71	**1.17**
Dusky Flycatcher	-	-	0.21
Golden-crowned Kinglet	-	0.04	-
Hammond's Flycatcher	-	-	0.04
Hermit Thrush	-	0.17	-
House Wren	-	-	0.04
Lincoln's Sparrow	-	0.20	0.20
Mountain Chickadee	0.08	0.50	0.33
Olive-sided Flycatcher	-	-	0.13
Osprey	0.04	-	-
Pine Siskin	0.40	**0.80**	0.80
Red-breasted Nuthatch	0.08	-	0.13
Ruby-crowned Kinglet	0.25	0.29	0.33
Swainson's Thrush	-	0.38	0.13
Townsend's Solitaire	-	0.04	0.04
Tree Swallow	0.04	-	0.04
Violet-green Swallow	-	-	0.04
Warbling Vireo	-	-	0.08
Western Tanager	-	0.13	0.50
Yellow-rumped Warbler	**0.42**	0.46	**1.17**

North American Breeding Bird Surveys

The North American Breeding Bird Survey (BBS) is a widespread, long-term international effort to monitor trends in bird populations throughout Canada, Mexico, and the United States. In YNP, three BBS routes have been monitored during most summer breeding seasons since the mid-1980s: Mammoth, Northeast Entrance, and Yellowstone. In 2017, the YNP bird program surveyed the Mammoth route (along the Grand Loop Road from Indian Creek Campground northeast to the Blacktail Deer Drive exit) on 20 June; the Northeast Entrance (the Grand Loop Road from Tower Junction east to nearly the Wyoming/Montana boundary) on 20 June; and the Yellowstone route (Dunraven Pass to Steamboat Point on the east side of Mary Bay) on 21 June. We observed nearly 3,200 individual birds and a total of 86 species. Since 1987, the number of species observed has remained fairly stable for all three routes; with an average of 61 species, the Mammoth route is most diverse (figure 15). The total count of individual birds has also remained stable through time, varying around an average of 3,006 birds (figure 16). In nearly every year since 1987, the majority of birds are counted along the Yellowstone route, where the average total count is 1,764 birds (figure 16). In recent years, the number of Canada geese observed in Hayden Valley has increased dramatically, boosting the total count along the Yellowstone route and compensating for decreases in observations of other waterbird species, including lesser scaup and Barrow's goldeneye (figure 17).

Cedar waxwing. Photo © K. Cassidy

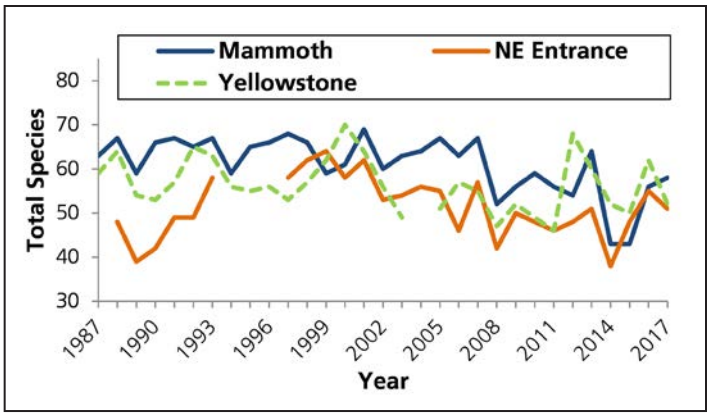

Figure 15. Number of total species observed along three breeding bird survey routes, from 1987 to 2017.

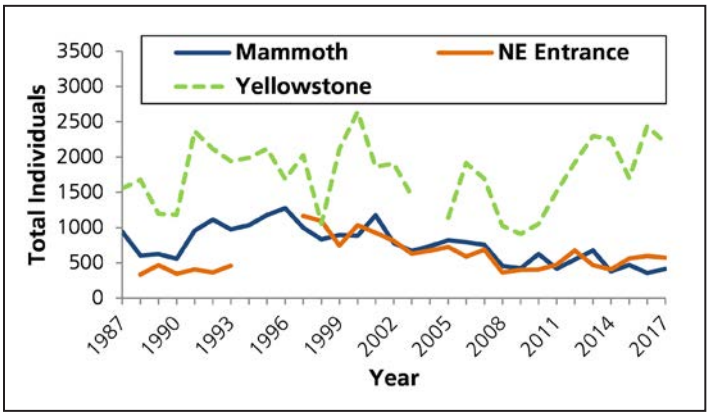

Figure 16. Number of total individuals observed during three breeding bird survey routes, from 1987 to 2017.

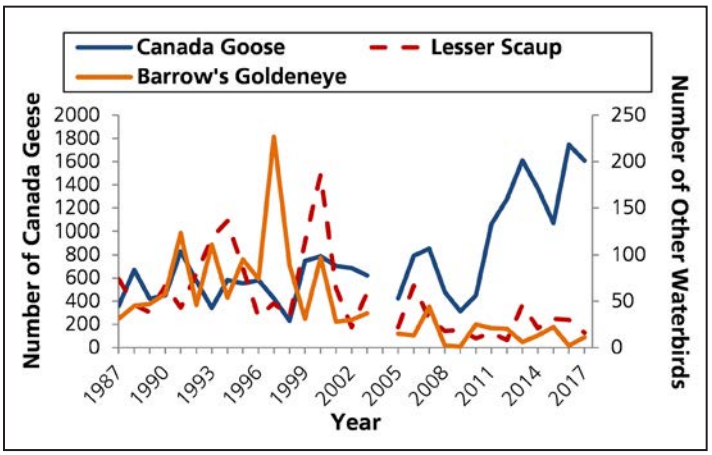

Figure 17. Canada geese, lesser scaup, and Barrow's goldeneye observed on the Yellowstone breeding bird survey route, from 1987 to 2017.

Fall Migration

We monitored songbirds during the fall to document patterns in habitat use by migrating passerines (bird species that breed in YNP or pass through during migration, but do not over-winter). Between 24 August and 28 September 2017, we conducted 17 surveys along line transects in three habitat types (willows, grasslands, and old growth forest) and noted all birds detected. Transects were between 500 (1,640 ft) and 2,070 meters (6,791 ft); after we tallied diversity and abundance for each transect, we corrected abundance counts for the length of each transect. We divided observed abundance values by the total transect length to calculate a measure (abundance per kilometer) that was comparable between transects and, ultimately, habitat types.

We monitored songbirds using 4 surveys along two line transects in willow habitat and 11 surveys along four transects through old growth forest. We observed 8 resident (bird species that reside in YNP year-round) and 18 migrant songbird species in willow habitat, including an average of 45 migrant songbirds per kilometer (.6 mi) and 11 residents per kilometer. In old growth forest, we detected 11 migrant species, with an average of 9 migrants per kilometer. We detected 14 resident species in old growth forests, with an average of 32 birds per kilometer. We also detected notable trends through time. In willow habitat, the most migrants were detected in early September, while migrants in old growth were most abundant in late September (figure 18).

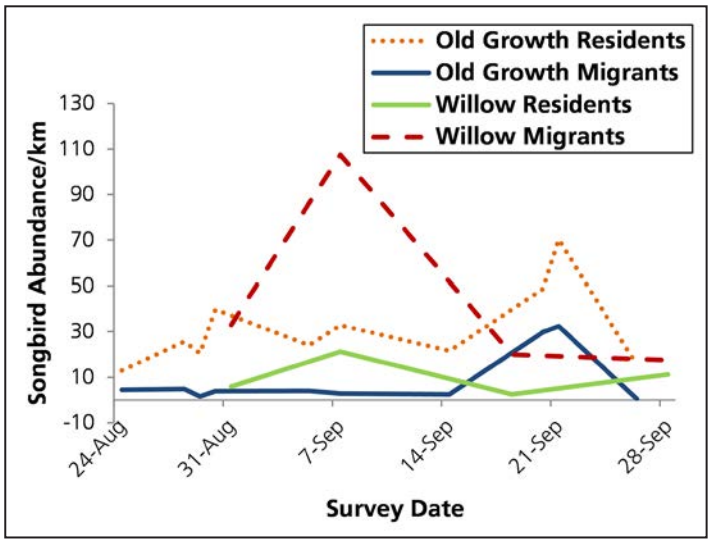

Figure 18. Abundance of passerines in Yellowstone during fall migration, per kilometer of transect. Surveys were conducted in old growth forest and along willow corridors in 2017.

We conducted only two songbird migration surveys in grassland habitat in 2017 and detected five species of migrant songbirds and four resident species of YNP. We detected an average of 5 migrants per kilometer and 14 resident birds per kilometer. Although we detected more migrants and more residents in our second grassland survey in late September, we could not determine a trend from only two surveys. Furthermore, we suspect effective surveys in grasslands may require a different survey protocol (D. Fagre, University of Montana, personal communication). Thus, we do not compare our observations in grasslands with those in other habitat types.

Climate Change and Spring Migrants

Within YNP, climate change effects on ecosystem processes are largely unknown, especially with respect to birds. Detecting changes in ecosystem processes (e.g., timing of migration or onset of breeding) will inform management decisions and add to our understanding of the significance of such changes for bird communities in and near YNP. Birds are touted as bio-indicators of climate change because of their sensitivity and relatively rapid response to shifts in seasonal weather patterns (e.g., Hurlbert and Liang 2012). For example, climate change has influenced migration patterns, population size and distribution, and the timing of reproduction and nesting success for several bird species (Crick 2004).

Since 2005, D.W. Smith has recorded spring arrival dates (migrants) in the Mammoth/Gardiner area for many common species. In 2012, we expanded the scope of this project by encouraging park staff to submit their first arrival sightings. Notable observations in 2017 included red-winged blackbird on 6 March, mountain bluebird on 12 March, osprey on 5 April, and lazuli bunting on 6 May (table 4). For four species (American robin, red-tailed hawk, red-winged blackbird, and western meadowlark), the first arrival date has become significantly earlier over the past 13 years (figure 19). Eventually, we may be able to detect shifts or increased variability in mean arrival times across a wide range of species.

Table 4. Spring arrival dates for common species in the Mammoth-Gardiner area from 2005 to 2017. Observations from 2011 to 2017 were collected by multiple observers.

Species	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
American Kestrel		April 4	April 12	April 14	April 30	April 17	April 18	April 16	April 6	April 5		April 12	
American Robin	March 20	April 14	March 17	March 28	March 21	March 18	March 25	Feb. 18	March 6	March 1	March 10	Feb. 8	
Mountain Bluebird	March 8	March 4	March 18	March 29	March 12	March 25	March 17	March 7	March 9	Feb. 28	March 10	March 7	March 12
Osprey		April 6		April 8	April 19	April 12	April 7	April 5	April 4	April 6		April 11	April 5
Red-tailed Hawk		April 4	March 23	April 3		March 20[a]	March 18	March 19	March 9	March 21		March 12	March 6
Red-winged Blackbird	March 10	March 16	March 18	April 8	March 17	March 29	March 21	March 5	March 10	March 3	March 11	Feb. 28	March 6
Ruby-crowned Kinglet		April 28	April 29	April 21	May 3	April 17	May 10	April 9	April 17	April 11	April 12	April 13	
Tree Swallow		April 28	April 8	April 13	May 2	April 24	May 11	April 22	April 25	April 27		April 12	April 27
Vesper Sparrow		May 3	May 13	May 4	May 6	May 7			May 9				May 9
Western Meadowlark		April 3	April 5	April 14	April 8	April 1		March 31	April 8	March 16	March 12	March 20	
White-crowned Sparrow				May 1	May 1	May 7		May 26				March 21	May 6
Yellow Warbler	May 18	May 12	May 13	May 19	May 17	May 18	May 21	May 8		June 4		May 13	May 19
Yellow-rumped Warbler		April 28	April 29	April 20	May 9	April 17		May 7	May 6	May 16		April 13	

[a]**Arrival date estimated from observations in Paradise Valley on 24 March 24 and Phantom Lake, Yellowstone on 17 March.**

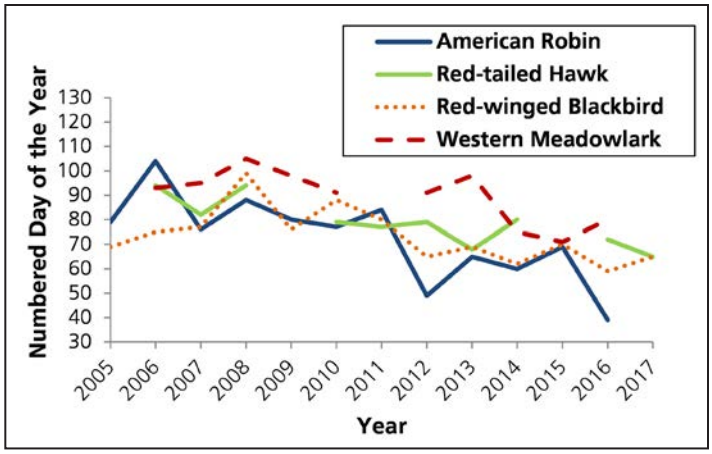

Figure 19. Spring arrival dates for four common species in the Mammoth-Gardiner area from 2005 to 2017. Since 2005, all four species have significant trends towards earlier spring arrival.

Bald Eagle Population Genetics and Connectivity

During the 1980s, the bald eagles of the GYE were considered a source population that was relatively successful and contributed individuals to other populations. Ultimately, the local GYE population significantly helped the recovery of this formerly endangered species. Hundreds of bald eagle nestlings in the GYE were banded in the 1980s and 1990s, and several remain known breeders within and around the GYE.

Resightings of banded individuals by researchers, visitors, and citizen scientists continue to contribute to knowledge of eagle movement throughout the region. On 2 October 2017, a park visitor reported a banded adult bald eagle on the Madison River in YNP. The visitor supplied pictures of the banded individual dating back to 2015, but reported seeing the individual as far back as 2009. The band combination indicates the male eagle was banded at Hauser Lake near Helena, Montana, in 1991 and is at least 26 years old. In the wild, bald eagles live about 20 years on average; the oldest known bald eagle was banded in 1977 and died in 2015 at 38 years old (Smith 2015).

Complementing the early banding efforts, researchers from the Teton Raptor Center are currently collaborating to continue banding nestling bald eagles throughout the GYE, as well as collect feather samples for genetic analyses. From these efforts, biologists hope to better understand how eagles within the GYE are related to one another and how that might affect long-term population stability. Additionally, they hope to establish how the GYE population as a whole is connected to other populations across North America.

Due to the difficult logistics of accessing many YNP bald eagle nests, and several nest failures, Teton Raptor Center researchers collected data from only one nest in 2017. On 20 June, researchers accessed the Goose Lake bald eagle nest, banded the single nestling, and collected feather samples for genetic analyses. Bird program staff observed the nestling in the nest on 14 July, shortly before fledging.

Banded bald eagle. Photo © J. Rantowich

Golden Eagle Monitoring

In 2011, the bird program began monitoring golden eagles throughout the park under the Yellowstone Raptor Initiative (YRI), a five-year project focused on diurnal and nocturnal raptors. Golden eagles in western North America are of conservation concern (Kochert and Steenhof 2002); previous to the YRI surveys, little information was known about golden eagles in YNP. With the completion of the YRI in 2015, golden eagle reproductive measures averaged low and warranted concerns for the stability of the local population (YRI 2017). Thus, we continued monitoring golden eagles in 2017, with hopes of establishing long-term efforts to understand the demographics of this top avian predator in YNP.

We monitored 26 of the 28 known golden eagle territories in 2017, all of which were occupied. We determined the breeding season outcome for 23 territories. Twelve pairs nested and nine were confirmed as non-breeders. For the two remaining territories, we were unable to confirm if nest-

ing was initiated, but we did determine no young fledged. Seven of 12 nesting pairs were successful and fledged a total of seven young. Nest success in 2017 was 30% per occupied territory with known outcome, equivalent to the average success rate since 2011 (figure 20). Average productivity in 2017 was 0.3 young per occupied territory with known outcome, slightly below the seven year average of 0.4.

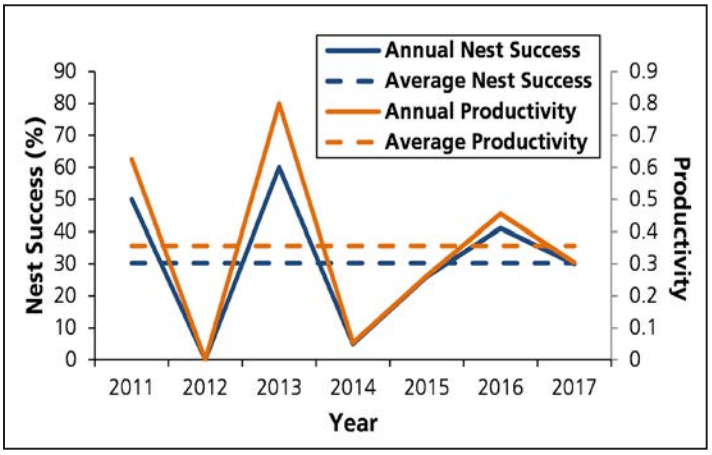

Figure 20. Golden eagle nest success and productivity in Yellowstone, from 2011 to 2017.

Fall Raptor Migration

By monitoring raptors migrating through YNP, the bird program aims to establish baseline information on the abundance, diversity, and timing of raptor migration. Ultimately, we hope to provide long-term information on changes in migratory populations. To this end, we monitored migrating raptors in Hayden Valley from 2011 through 2015 as part of the YRI (see Baril et al. 2017a,b). Although we did not monitor migrating raptors in 2016, we reestablished these fall surveys in Hayden Valley in 2017.

The 2017 raptor migration count began in early September and concluded in mid-October. From 11 September to 9 October, we conducted migration counts two days each week from an established observation point in Hayden Valley. On 6 and 10 September, we counted raptors from the summit of Observation Peak, as our established observation point in Hayden Valley was closed due to bear activity. At least two people counted each day.

Weather was a persistent problem during the fall raptor counts in 2017. Snowstorms and subsequent road closures resulted in the cancellation of 3 of 13 planned count days (15 and 16 September and 14 October). On 24 and 25 September, our observation site was covered in 20 centimeters (8 in) of snow that fell during a storm a few days before. On 4 October, we were forced to terminate our count early due to snow and rain; on 7 October, we relocated our observation location partway through our count because of high winds.

Across 11 observation days, we counted 312 raptors of 16 species (table 5). The highest daily count of 54 raptors was recorded on 25 September. We observed the fewest migrating raptors (nine individuals) on 9 October. As expected from previous seasons of raptor migration observation (Baril et al. 2017a,b), red-tailed hawks were the most common migrating raptor and accounted for 42% of our observations (131 individuals). We also counted 46 Cooper's hawks (15% of our observations), with 21 tallied on

Yellowstone's Observation Peak lookout tower, and fall raptor observation point. NPS Photo-M. Paulson

25 September alone. Cooper's hawks comprised a greater proportion of our observations than in previous years (Baril et al. 2017a,b). Conversely, we observed relatively few Swainson's hawks; in 2017, we counted only five Swainson's hawks, comprising only 5% of our total observations. We also observed 19 migrating bald eagles, 18 northern harriers, and 18 golden eagles, each comprising 6% of our total observations. Contrary to expectations, counts before and after cold fronts (pre- and post-frontal days) did not appear to result in greater numbers of raptors seen. Days with temperatures below or near freezing (e.g., -2.2°C [28°F] on 9 October) and strong winds (e.g., 54 kilometers per hour [31 mi/hr] on 18 September) presented wintry conditions, but low numbers of migrating raptors.

Table 5. Summary of migrating raptors observed from two count locations in Hayden Valley in Yellowstone in 2017.

Species	Observation Peak	Hayden Valley	Total	%
American Kestrel	2	14	16	5.1
Bald Eagle	2	17	19	6.1
Broad-winged Hawk	0	0	0	0.0
Cooper's Hawk	9	37	46	14.7
Ferruginous Hawk	0	3	3	1.0
Golden Eagle	1	17	18	5.8
Gyrfalcon	0	0	0	0.0
Merlin	1	2	3	1.0
Northern Goshawk	1	2	3	1.0
Northern Harrier	0	18	18	5.8
Osprey	2	6	8	2.6
Peregrine Falcon	0	2	2	0.6
Prairie Falcon	0	3	3	1.0
Red-tailed Hawk	30	101	131	42.0
Rough-legged Hawk	0	1	1	0.3
Sharp-shinned Hawk	7	8	15	4.8
Swainson's Hawk	2	3	5	1.6
Turkey Vulture	1	1	2	0.6
Unknown Accipiter	1	2	3	1.0
Unknown Buteo	3	5	8	2.6
Unknown Eagle	0	2	2	0.6
Unknown Large Falcon	0	0	0	0.0
Unknown Small Falcon	0	4	4	1.3
Unknown Raptor	0	2	2	0.6
Total	62	250	312	100

Rough-legged hawk. NPS Photo-J. Frank

Turkey vulture. NPS Photo-J. Peaco

Mid-winter Bald and Golden Eagle Survey

The mid-winter bald and golden eagle survey was initiated by the National Wildlife Federation in 1979, but has been organized by the USGS since 1992. The objectives are to establish an index of the winter eagle population, determine winter distribution, and identify important wintering habitat for eagles. YNP has participated in the mid-winter count since at least 1987.

Ten volunteers participated in the mid-winter eagle survey on 14 January 2017. Observers recorded 15 adult bald eagles, 2 adult golden eagles, and for the first time since 2014, 2 immature bald eagles. All eagles were observed on the northern range, close to Gardiner, Montana. Juvenile bald eagles in the GYE usually migrate south and west in the fall, wandering over a wide area before returning to the GYE in the late winter-early spring (Harmata et al. 1999). There is no information on golden eagle movements in YNP.

Harlequin Ducks

The harlequin duck is one of the rarest breeding birds in the state of Wyoming and is designated a Species of Greatest Conservation Need (Wyoming Game and Fish Department 2010). Biodiversity Research Institute and Wyoming Game and Fish (WYGF) have collaborated to conduct comprehensive surveys of Wyoming's breeding population of harlequin ducks, including surveys within YNP. Additionally, BRI and WYGF hope to track a subset of Wyoming's breeding harlequin ducks throughout the year to better determine specific habitat requirements needed by these birds during the breeding, migration, and wintering periods.

In YNP, two primary areas serve breeding harlequin ducks, both on the Yellowstone River: LeHardy Rapids, just north of Yellowstone Lake, and near the Yellowstone River Bridge, east of Tower Junction. On 22 May 2017, researchers from BRI and WYGF caught and banded two harlequin ducks, one female and one male, near the LeHardy Rapids on the Yellowstone River. A geolocator was attached to the female duck, but she must be recaptured for researchers to retrieve her movement data. The male harlequin duck was outfitted with a satellite transmitter so that researchers could track his movements in real time. The male remained in YNP near its capture site through 19 June and then travelled west across Montana and Washington to the coast, settling on the western coast of Vancouver Island, British Columbia on 25 June. The male harlequin duck has remained there throughout the winter, until early May 2018.

Top: A pair of harlequin ducks rest on a rock in LeHardy Rapids. A satellite transmitter is visible near the tail of the male (left). NPS Photo-S. Stewart. Bottom: A pair of young fledged long-eared owls. NPS Photo-L. Walker

Owls

We conducted nocturnal surveys for owls from 8 February 8 through 11 May 2017 in the northern portion of YNP using passive listening, call playback, and observations of perched owls. Owl surveys, commenced in 2013 as part of the YRI, have been able to continue after the completion of the YRI in 2015 because they are conducted solely by volunteers. Surveys are designed to provide an index of sites that attract advertising males of several northern forest owl species. Of the five years owl surveys have been conducted, we observed the lowest owl species diversity and abundance in 2017 (table 6). Observers detected individuals of three owl species: great horned owl (4), northern saw-whet owl (9), and northern pygmy-owl (2). Notably, we detected no boreal owls, a first since the owl surveys began in 2013.

Although we did not detect any long-eared owls during our late winter-early spring surveys, a nesting pair of long-eared owls was observed on 5 July in Indian Creek Campground when two young successfully fledged from their nest. While long-eared owls have long been assumed to breed within the park, this is the only recent nest record for this species. In August 2009, three long-eared owl fledglings were found near Old Faithful and, based on plumage characteristics, must have come from a nearby nest.

Great Gray Owl

During the summer of 2016, a breeding pair of great gray owls nested in the Canyon area in the interior of YNP. Unfortunately, in October, the male was hit by a car and injured. Because the injury was human-caused, the owl was transported to the Montana Raptor Conservation Center in Bozeman, Montana, where he was successfully rehabilitated. On 5 January 2017, the great gray owl was released

Table 6. Owl detections during nocturnal surveys in Yellowstone in the late winter-early spring from 2013 to 2017.

	Survey Year				
Species	**2013**	**2014**	**2015**	**2016**	**2017**
Boreal Owl	8	5	8	12	
Northern Saw-whet Owl	3	1	3	7	9
Northern Pygmy Owl	1	1	3	6	2
Great-horned Owl	12	8	7	6	4
Long-eared Owl				1	
Great Gray Owl		3			
Total Owl Abundance	24	18	21	32	15
Owl Species Richness	4	5	4	5	3

back into the wild, in the Mammoth Hot Springs area. Two days later, on 7 January, a YNP employee was hiking north of Gardiner, Montana, on USDA Forest Service land and discovered the banded owl dead, 6.4 kilometers (4 mi) from its release site. The owl was returned to the Montana Raptor Conservation Center to evaluate the cause of death, and x-rays revealed the owl had been shot. Although a report was filed with the district game warden, the responsible parties have not been located.

This great gray owl was released near Mammoth Hot springs in January 2017. The owl was later found dead, due to a gunshot wound. NPS-B. Cassidy

Public Outreach and Education

For the seventh year, retired education ranger Katy Duffy led hawk ecology and identification programs during September. Fourteen visitors met at the Fishing Bridge Visitor Center to learn about raptor ecology and identification using mounts of raptors. The talk was followed by a field trip to Hayden Valley, where over 120 visitors stopped to observe migrating raptors, discuss identification tips, and learn about the ecology of raptor migration. Duffy also taught three classes for the Yellowstone Forever Institute, including a migration course in late May, an owl ecology and identification class in early June at the Lamar Buffalo Ranch, and a raptor ecology and identification course in September. Finally, Duffy presented four talks on birds for the Yellowstone Co-op Employee Recreation Programs during the summer.

Noteworthy Birds and Bird Sightings Program

Since 2010, visitors and park staff submitted more than 1,600 observations from 25 species of raptors. Red-tailed hawks and bald eagles are most commonly reported; also reported are rarely observed species, such as short-eared owls, broad-winged hawks, and merlins. These sightings help staff locate new breeding territories and refine the bird species checklist. We encourage park staff and visitors to submit all raptor sightings and observations of rare or unusual birds at http://www.nps.gov/yell/naturescience/wildlife-sightings.htm.

An adult lesser black-backed gull was observed foraging along Lakeside Beach on 16 September, marking the first sighting of this species in YNP. Lesser black-backed gulls breed in Europe, winter along the eastern coast of the United States, and are rarely reported in western North America. In the Hayden Valley, a group of 10 white-faced ibis were seen along the Yellowstone River on 23 August, and approximately 25 pinyon jays were observed on 4 October. Although pinyon jays are not uncommon in Gardiner, Montana, they are rare inside the park, especially in the interior. A juvenile Harris's sparrow was seen along the northern boundary of the park, west of Gardiner, on 12 October.

Most unusual or rare bird observations occur during spring or autumn when birds are migrating and more likely to wander or get blown off course. For this reason, the shoulder seasons are excellent times to birdwatch. These observations provide important information regarding distribution, occurrence, and breeding status of species for which we have little information (see appendix B for a complete list of birds observed in 2017).

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Staff conducting trumpeter swan observations at Cygnet Lake. NPS Photo-M. Paulson

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Appendix A: Raptor Nesting Terminology

Active nest – a nest in which eggs have been laid. A nest is considered active if evidence of reproduction (e.g., one adult is observed sitting low in the nest, eggs or young are seen, or food is delivered into eyrie [nest site]).

Breeding pair – a mated pair of birds that have demonstrated breeding behavior, laid eggs, or raised young.

Brood size – the average number of young fledged per successful nest.

Nest or Eyrie – a structure built or occupied by birds for the purposes of breeding. For cliff-nesters, this definition denotes an individual scrape or ledge (i.e., eyrie).

Nesting success per active territory – the percentage of active nests in a monitoring region in which one or more young fledges successfully (used for ospreys and bald eagles). Young at least 80% of fledging age for eagles and ospreys are expected to fledge and are, therefore, considered successful nests at this point.

Nesting success per occupied territory - the percentage of occupied territories from which one or more young fledges successfully (used for all raptors except osprey and bald eagles). Golden eagle nests containing young of at least 80% fledging age, and peregrine nests with young at least 28 days old, are expected to fledge and are considered successful. Nesting success per occupied territory is a widely accepted measure of nesting success since not all raptors, particularly eagles, nest every year. Including non-breeding territorial pairs in measures of nesting success is important to understanding population health and long-term trends. It also allows for the inclusion of nesting pairs that failed early (before eggs were laid) or territorial pairs discovered late in the season that may have nested, but did not produce young.

Occupied territory – a territory where either a mated pair of birds is present, or a single bird is present that exhibits territorial display or other reproductive-related activity. A territory is also considered occupied if there is evidence of reproduction (e.g., one adult is observed sitting low in the nest, eggs or young are seen, or food is delivered into nest or eyrie). Fresh nesting material added to a nest structure may also indicate occupancy, but care must be taken to be sure these materials were added by the species in question. Occupancy within a region is the number of occupied territories divided by the number of territories that were checked for occupancy.

Productivity per active territory – the total number of young fledged per active nest (used for ospreys and bald eagles). We included these results to enable comparison with historical data but also include a measure of productivity per occupied territory with known outcome (described below).

Productivity per occupied territory with known outcome – the total number of young fledged per occupied territory with known outcome (i.e., we know whether the pair successfully fledged young; used for all raptors except ospreys and bald eagles). This is a more comprehensive measure of productivity since not all raptors, particularly eagles, nest annually. Including non-breeding territorial pairs in measures of productivity is important to understanding population health and long-term trends. It also allows for the inclusion of nesting pairs that failed early (before eggs were laid) or territorial pairs discovered late in the season that may have nested, but did not produce young.

Territory – an area that raptors defend and use for breeding. A single territory may contain multiple nests or eyries. We report on breeding territories in this report, but raptors also use non-breeding territories, which may be the same or different than breeding territories.

Unoccupied territory – a known raptor territory in which we observed no activity patterns diagnostic of an occupied territory. A minimum monitoring effort was needed to determine if a territory was unoccupied and varied by species and method. Bald eagle and osprey territories required at least two aerial or ground-based surveys with no detections of individuals. Peregrine falcon and golden eagle territories required at least two, four-hour ground-based surveys (eight hours total) with no detections of individuals to determine a territory was unoccupied.

Definitions based on Postupalsky 1974, and Steenhof and Newton 2007.

Appendix B: Bird Species Observed in 2017

American Avocet *(Recurvirostra americana)*+
American Coot *(Fulica americana)*
American Crow *(Corvus brachyrhynchos)*
American Dipper *(Cinclus mexicanus)*
American Kestrel *(Falco sparverius)**
American Pipit *(Anthus rubescens)*
American Robin *(Turdus migratorius)*
American Three-toed Woodpecker *(Picoides dorsalis)*+
American White Pelican *(Pelecanus erythrorhynchos)*
American Wigeon *(Anas americana)*
Bald Eagle *(Haliaeetus leucophalus)**
Bank Swallow *(Riparia riparia)*
Barn Swallow *(Hirundo rustica)*
Barrow's Goldeneye *(Bucephala islandica)*
Belted Kingfisher *(Ceryle alcyon)*
Black-backed Woodpecker *(Picoides arcticus)*+
Black-billed Magpie *(Pica hudsonia)*
Black-capped Chickadee *(Poecile atricapillus)*
Black-necked Stilt *(Himantopus mexicanus)*+
Black-rosy Finch *(Leucosticte atrata)*
Blue-winged Teal *(Anas discors)*
Bohemian Waxwing *(Bombycilla garrulous)*
Boreal Owl *(Aegolius funereus)**
Brewer's Blackbird *(Euphagus cyanocephalus)*
Brewer's Sparrow *(Spizella breweri)*
Broad-tailed Hummingbird *(Selasphorus platycercus)*+
Broad-winged Hawk *(Buteo platypterus)**
Brown Creeper *(Certhia americana)*
Brown-headed Cowbird *(Molothrus ater)*
Bufflehead *(Bucephala albeola)*
California Gull *(Larus californicus)*
Calliope Hummingbird *(Stellula calliope)*+
Canada Goose *(Branta canadensis)*
Canvasback *(Aythya valisineria)*
Caspian Tern *(Sterna caspia)*+
Cassin's Finch *(Carpodacus cassinii)*
Cedar Waxwing *(Bombycilla cedrorum)*
Chipping Sparrow *(Spizella passerine)*
Cinnamon Teal *(Anas cyanoptera)*
Clark's Grebe *(Aechmophorus clarkii)*+
Clark's Nutcracker *(Nucifraga columbiana)*
Cliff Swallow *(Petrochelidon pyrrhonota)*
Common Goldeneye *(Bucephala clangula)*
Common Loon *(Gavia immer)*
Common Merganser *(Mergus merganser)*
Common Nighthawk *(Chordeiles minor)*
Common Raven *(Corvus corax)*
Common Redpoll *(Acanthis flammea)*
Common Yellowthroat *(Geothlypis trichas)*
Cooper's Hawk *(Accipiter cooperii)**
Cordilleran Flycatcher *(Empidonax occidentalis)*+
Dark-eyed Junco *(Junco hyemalis)*
Double-crested Cormorant *(Phalacrocorax auritus)*
Downy Woodpecker *(Picoides pubescens)*
Dusky Flycatcher *(Empidonax oberholseri)*
Dusky Grouse *(Dendragapus obscurus)*
Eared Grebe *(Podiceps nigricollis)*
Eurasian Collared-Dove *(Streptopelia decaocto)*+
European Starling *(Sturnus vulgarus)*
Evening Grosbeak *(Coccothraustes vespertinus)*
Ferruginous Hawk *(Buteo regalis)**
Fox Sparrow *(Passerella iliaca)*
Franklin's Gull *(Larus pipixcan)*+
Gadwall *(Anas strepera)*
Golden Eagle *(Aquila chrysaetos)**
Golden-crowned Kinglet *(Regulus satrapa)*
Gray Catbird *(Dumetella carolinensis)*
Gray Jay *(Perisoreus canadensis)*
Gray-crowned Rosy-Finch *(Leucosticte tephroctis)*+
Great Blue Heron *(Ardea herodias)*
Great Gray Owl *(Strix nebulosa)**
Great Horned Owl *(Bubo virginianus)**
Greater Scaup *(Aythya marila)*+
Green-tailed Towhee *(Pipilo chlorurus)*
Green-winged Teal *(Anas crecca)*
Hairy Woodpecker *(Picoides villosus)*
Hammond's Flycatcher *(Empidonax hammondii)*
Harlequin Duck *(Histrionicus histrionicus)*+
Hermit Thrush *(Catharus guttatus)*
Horned Lark *(Eremophila alpestris)*
House Sparrow *(Passer domesticus)*
House Wren *(Troglodytes aedon)*
Killdeer *(Charadrius vociferus)*
Lazuli Bunting *(Passerina amoena)*
Lesser Scaup *(Aythya affinis)*
Lincoln's Sparrow *(Melospiza lincolnii)*
Loggerhead Shrike *(Lanius ludovicianus)*+
Long-eared Owl *(Asio otus)**
MacGillivray's Warbler *(Geothlypis tolmiei)*
Mallard *(Anas platyrhynchos)*

+Indicates species for which documentation is requested to improve the park's bird database.
*Indicates raptor species for which documentation is requested to improve the park's bird database.

Marbled Godwit *(Limosa fedoa)+*
Marsh Wren *(Cistothorus palustris)+*
Merlin *(Falco columbarius)**
Mountain Bluebird *(Sialia currucoides)*
Mountain Chickadee *(Poecile gambeli)*
Mourning Dove *(Zenaida macroura)*
Northern Flicker *(Colaptes auratus)*
Northern Goshawk *(Accipiter gentilis)**
Northern Harrier *(Circus cyaneus)**
Northern Pintail *(Anas acuta)*
Northern Pygmy-Owl *(Glaucidium gnoma)**
Northern Rough-winged Swallow *(Stelgidopteryx serripennis)*
Northern Saw-whet Owl *(Aegolius acadicus)**
Northern Shoveler *(Anas aclypeata)*
Northern Shrike *(Lanius excubitor)+*
Olive-sided Flycatcher *(Contopus cooperi)*
Orange-crowned Warber *(Oreothlypis celata)*
Osprey *(Pandion haliaetus)**
Peregrine Falcon *(Falco peregrinus)**
Pied-billed Grebe *(Podilymbus podiceps)*
Pine Grosbeak *(Pinicola enucleator)*
Pine Siskin *(Spinus pinus)*
Pinyon Jay *(Gymnorhinus cyanocephalus)+*
Prairie Falcon *(Falco mexicanus)**
Red Crossbill *(Loxia curvirostra)*
Red-breasted Nuthatch *(Sitta canadensis)*
Red-headed Woodpecker *(Melanerpes erythrocephalus)+*
Red-naped Sapsucker *(Sphyrapicus nuchalis)*
Red-tailed Hawk *(Buteo jamaicensis)**
Red-winged Blackbird *(Agelaius phoeniceus)*
Redhead *(Aythya americana)*
Ring-billed Gull *(Larus delawarensis)*
Ring-necked Duck *(Aythya collaris)*
Rock Pigeon *(Columba livia)*
Rock Wren *(Salpinctes obsoletus)*
Rough-legged Hawk *(Buteo lagopus)**
Ruby-crowned Kinglet *(Regulus calendula)*
Ruddy Duck *(Oxyura jamaicensis)*
Ruffed Grouse *(Bonasa umbellus)*
Rufous Hummingbird *(Selasphorus rufus)+*
Sage Thrasher *(Orescoptes montanus)*
Sandhill Crane *(Grus canadensis)*
Savannah Sparrow *(Passerculus sandwichensis)*
Sharp-shinned Hawk *(Accipiter striatus)**
Snow Bunting *(Plectrophenax nivalis)+*
Snow Goose *(Chen caerulescens)+*
Song Sparrow *(Melospiza melodia)*
Sora *(Porzana carolina)*
Spotted Sandpiper *(Actitis macularia)*
Steller's Jay *(Cyanocitta stelleri)*
Swainson's Hawk *(Buteo swainsoni)**
Swainson's Thrush *(Catharus ustulatus)*
Townsend's Solitaire *(Myadestes townsendi)*
Tree Swallow *(Tachycineta bicolor)*
Trumpeter Swan *(Cygnus buccinator)+*
Tundra Swan *(Cygnus columbianus)+*
Turkey Vulture *(Cathartes aura)+*
Vesper Sparrow *(Pooecetes gramineus)*
Violet-green Swallow *(Tachycineta thalassina)*
Warbling Vireo *(Vireo gilvus)*
Western Grebe *(Aechmophorus occidentalis)+*
Western Kingbird *(Tyrannus verticalis)+*
Western Meadowlark *(Sturnella neglecta)*
Western Tanager *(Piranga ludoviciana)*
Western Wood-Pewee *(Contopus sordidulus)*
White-breasted Nuthatch *(Sitta carolinensis)*
White-crowned Sparrow *(Zonotrichia leucophrys)*
White-faced Ibis *(Plegadis chihi)*
White-throated Swift *(Aeronautes saxatalis)*
Willet *(Tringa semipalmata)+*
Williamson's Sapsucker *(Sphyrapicus thyroideus)*
Willow Flycatcher *(Empidonax traillii)*
Wilson's Phalarope *(Phalaropus tricolor)+*
Wilson's Snipe *(Gallinago delicata)*
Wilson's Warbler *(Cardellina pusilla)*
Wood Duck *(Aix sponsa)+*
Yellow Warbler *(Setophaga petechia)*
Yellow-headed Blackbird *(Xanthocephalus xanthocephalus)*
Yellow-rumped Warbler *(Setophaga coronata)*

Accidentals and Vagrants

Harris's Sparrow *(Zonotrichia querula)*
House Finch *(Carpodacus mexicanus)*
Lesser Black-backed Gull *(Larus fuscus)*

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