Yellowstone National Park
Montana, Wyoming, Idaho

National Park Service
U.S. Department of the Interior

YELLOWSTONE NATIONAL PARK
Bird Program Annual Report

2014

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Yellowstone Bird Program Annual Report 2014

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Executive Summary

During 2014, Yellowstone National Park (YNP) continued its long-term core bird monitoring program for the 31st year and completed the fourth year of the Yellowstone Raptor Initiative, a 5-year project focusing on the role of aerial predators (hawks, eagles, and owls).

Raptors: Yellowstone National Park supports at least 36 peregrine falcon territories, the majority of which are occupied annually (19 in 2014). Peregrines in YNP continue to be highly successful and abundance remains stable, although nesting success has remained at or below the 27-year average in 6 of the last 10 years. In contrast, nesting success of bald eagles and ospreys has been above the long-term averages for both species during the last several years. There are 50 historic bald eagle territories in YNP, one-half of which are occupied annually. Ten of 18 (56%) active bald eagle nests were successful in 2014. We monitored 30 osprey nests, 22 (73%) of which were successful. Four pairs nested on Yellowstone Lake, but only one was successful.

Three new golden eagle territories were discovered, bringing the total known territories to 26. All territories are occupied every year, but breeding attempts and nesting success varies among years. Only 1 of 19 pairs successfully fledged young in 2014. The density of golden eagles in YNP appears high, which could influence breeding success through competition for limited resources during late winter and early spring. Only 9 of 28 (32%) monitored red-tailed hawk territories successfully fledged young, which was lower than nesting success in previous years (70-90%). Ten of 11 Swainson's hawk territories were occupied, and two of three monitored nests produced young. Since 2011, there have been at least 90 American kestrel sightings, mostly in northern Yellowstone. Two of three prairie falcon sites were occupied, but successful nesting was confirmed at only one site.

During autumn, 1,677 raptors across 17 species were documented migrating through the Hayden Valley. Among those observed were 35 broad-winged hawks, a species commonly seen in the eastern United States, but rarely observed in the West. During 16 winter and spring surveys, biologists detected five boreal owls, eight great horned owls, three great gray owls, one northern saw-whet owl, and one northern pygmy-owl in northern Yellowstone, while one boreal owl and one great gray owl were detected in the southern part of the park. In addition, we hosted several public outreach events and classes highlighting bird ecology, and we assisted with the design of a new online raptor and rare bird observation form.

Trumpeter Swans: Two pairs attempted to breed in 2014. The Grebe Lake pair failed after laying two eggs on the nesting platform installed in 2011. The Riddle Lake pair successfully fledged one cygnet, the first since 2007. In partnership with Wyoming Wetlands Society, four cygnets raised in captivity were released on the Yellowstone River in the Hayden Valley to augment the population and establish more breeding pairs. Fifty-three swans were observed in the park during the winter survey in late February, while 18 swans were observed during the autumn survey in late September.

Molly Islands Colonial Nesting Birds: American white pelicans fledged 276 young from a total of 307 nest attempts, while double-crested cormorants fledged 25 young from 56 nests. Eighteen California gull nest attempts were observed; however, no fledglings were found. The number of pelicans, cormorants, and gulls fledged from the Molly Islands has declined since the early 1990s; Caspian terns have not nested there since 2005. These trends may be due to declines in cutthroat trout, their primary prey, over the last two decades.

Common Loons: Ten pairs fledged 14 young, and another nine unpaired loons were observed in YNP. The Biodiversity Research Institute is working with park biologists to learn more about the Wyoming population, since it is isolated by more than 200 miles 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.

Songbirds: Three methods were used to monitor songbirds, including point counts in willow stands, point counts in recently and formerly burned forests, and the international breeding bird survey. The willow-bird study monitors the responses of songbirds to changes in the abundance, distribution, and sizes of willows in the northern portion of YNP. Willows represent one of the few deciduous habitat types in YNP and support considerably higher densities of songbirds than other habitat types in the region. Fifteen songbird species were recorded among three willow growth types. Species richness and diversity of songbirds increased along a gradient from height-suppressed willows to tall, dense willows. Taller willows support willow specialists, such as the Wilson's warbler and willow flycatcher.

The forest burn surveys assess the responses of woodpeckers and songbirds to fires by comparing recently burned plots to older burned plots. Observers recorded 23 bird species in these forest types, with American three-toed and black-backed woodpeckers only observed at low densities in recently burned forests. The breeding bird survey indexes population trends through time, and 2,800 individuals across 54 species were observed along three routes in YNP during 2014.

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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 its breeding bird species, with the broad goals of gathering information (e.g., reproduction, abundance, habitat use) on multiple species from a wide variety of avian taxonomic groups, as well as to maintain 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. Over 3 million visitors are welcomed by YNP annually; many of them are avid bird watchers. This report summarizes data gathered for these programs during 2014. 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**.

The core bird program for YNP is divided into three groups meant to represent YNP's diversity: 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 in YNP. However, these species are monitored 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 species are included in the Wetland Bird Monitoring Program. Trumpeter swans and common loons are of particular concern in YNP due to small and locally declining numbers. The breeding bird survey, willow-bird survey, and forest burn survey are part of the Passerine and Near Passerine Monitoring Program. This program is particularly valuable since species in this group represent the majority of all bird species found within YNP.

The Yellowstone Raptor Initiative is a five-year project initiated in 2011 to focus on diurnal and nocturnal raptors. Yellowstone supports 25 species of raptors that either breed or migrate through the park. Several are of growing conservation concern in the United States, including golden eagle, Swainson's hawk, and northern goshawk. Yet despite Yellowstone's raptor diversity, large relatively undisturbed landscape, and heightened conservation focus for several species, little data exists regarding the abundance, productivity, and seasonal movements for raptors in YNP. The Initiative is designed to fill this gap in knowledge by expanding inventory and monitoring efforts to select raptor species not traditionally covered under the program.

Climate Change

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. 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. Twenty-two observers submitted sightings in 2014, including observations of a mountain bluebird on February 28, a red-winged blackbird on March 3, and an osprey on April 6 (table 1). Eventually, this dataset may be used to determine if mean arrival date for certain species has shifted or if there is greater variability in mean arrival date. In addition to first arrivals, we monitor timing of nest initiation, incubation, and fledging for several species of raptors to monitor the effects of climate change on breeding behavior.

Table 1. Spring arrival dates for common species in the Mammoth-Gardiner area from 2005-2014. Asterisk (*) indicates estimated arrival from Paradise Valley (24-March) and Phantom Lake, YNP (17-March). Note that 2011-2014 observations were collected by multiple observers.

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

Yellowstone Core Bird Program

Raptor Monitoring

Peregrine Falcon

Peregrine falcons were once an imperiled species in North America because of widespread use of the pesticide DDT; owing to nationwide recovery efforts, including those in and around YNP and bans placed on DDT, peregrines now thrive in Yellowstone. In 2014, we discovered three new **breeding** pairs, bringing the total known extant and historical territories to 36. Seven of the 36 territories are currently **unoccupied** (terms mentioned for the first time appear in bold and are defined in the Appendix), but are monitored for activity every few years. Attrition of some nesting territories is expected as they become unsuitable or pairs relocate to nearby cliffs (Craig and Enderson 2004). Attrition can also occur, at least temporarily, as a result of normal mortality of adults and is not cause for concern unless many territories remain vacant.

In 2014, we monitored 23 breeding territories from late-April through July. Nineteen territories were occupied by at least one adult. Nine of the 15 pairs for which we could determine the final outcome, successfully fledged at least 21 young for a **nesting success per occupied territory** of 60% (figure 1). On average peregrines produced 1.4 young per occupied territory (**productivity per occupied territory**) with an average brood size of 2.3 young fledged per successful pair (figure 2). While **brood size** has remained relatively constant, productivity has declined slightly in recent years.


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Nesting success has remained at or below the 27-year average in 6 of the last 10 years. Although not a cause for immediate concern, the lower nesting success warrants continued monitoring. Despite lower nesting success and productivity in recent years, these measures of reproduction are at or above the target values identified by the U.S. Fish and Wildlife Service (2003) and those found for the Rocky Mountain/Great Plains region during the 2003 national survey.

We also collected prey remains (nestling diet) and eggshell fragments (contaminants indicator) from two **eyries** or nesting ledges during 2014. These samples are still being analyzed, but past sampling indicated peregrines hunt mostly songbirds and shorebirds, including American robins, mountain bluebirds, Franklin's gulls, and red-necked phalaropes. Eggshell thicknesses were within normal range, indicating low exposure to DDT or similar contaminants.

Bald Eagle

We monitored 26 of the 50 known extant and historical bald eagle territories for nesting activity. Similar to peregrines, not all territories are occupied every year and some have been inactive for years. Twenty-four of the 26 territories were occupied, but four pairs did not breed. 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.

We monitored 18 **active nests**, 10 of which (56%) were successful. **Nesting success per active territory** in 2014 was similar to the 31-year average of 50% (figure 3). The 10 nests fledged 16 young and **productivity per active territory** averaged 0.89. The average brood size was 1.6 (figure 4). Overall, bald eagle numbers in YNP are stable, including those nesting on Yellowstone Lake where nesting success declined from 1987-2007, prob-

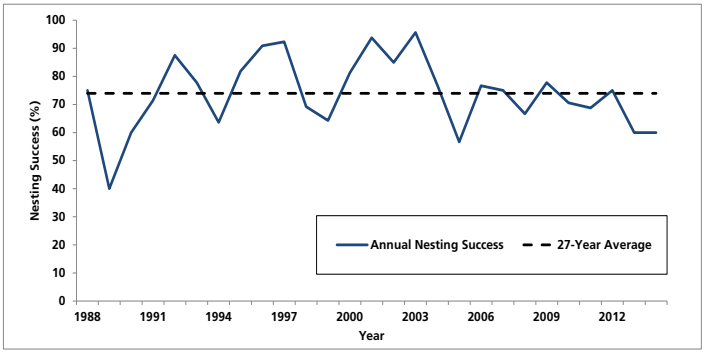

Figure 1. Peregrine falcon nesting success during 1988-2014 and comparison with the 27-year average.

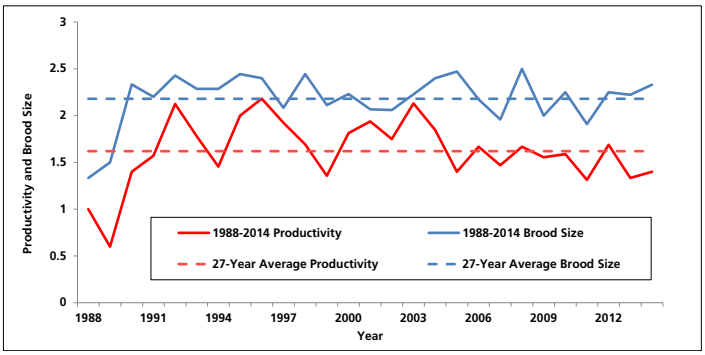

Figure 2: Peregrine falcon productivity and brood size during 1988-2014 and comparison with the 27-year average.

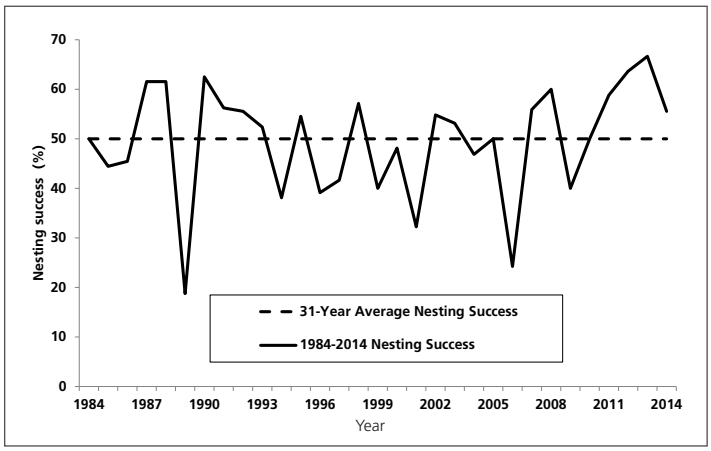

Figure 3. Bald Eagle nesting success during 1984-2014 and comparison with the 31-year average.

ably as a result of the catastrophic decrease in cutthroat trout (Baril et al. 2013). However, during the last three years (2012-2014), nesting success at Yellowstone Lake is well above average for the park, probably because eagles have switched to other prey, such as waterfowl or birds nesting on the Molly Islands.

Osprey

We monitored 41 osprey territories in 2014. We could not determine occupancy for seven territories; one was unoccupied. In total, we monitored 30 active osprey nests from mid-May through mid-August. Of the 30 nesting pairs, 22 (73%) successfully fledged a total of 44 young, similar to 2013 (figure 5). The overall productivity in the park was 1.5 young produced per nesting pair, and the average brood size was two young fledged per active nest (figure 6). Only one of the four nests on Yellowstone Lake produced young. Parkwide, trends in nesting success and productivity remain well above average after reaching their lowest values during 2003, although few ospreys nest at Yellowstone Lake as a result of cutthroat trout declines.

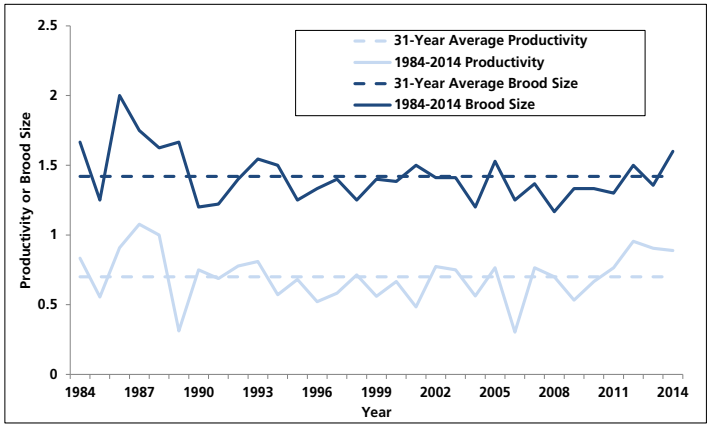

Figure 4. Bald eagle brood size and productivity during 1984-2014 and comparison with the 31-year average.

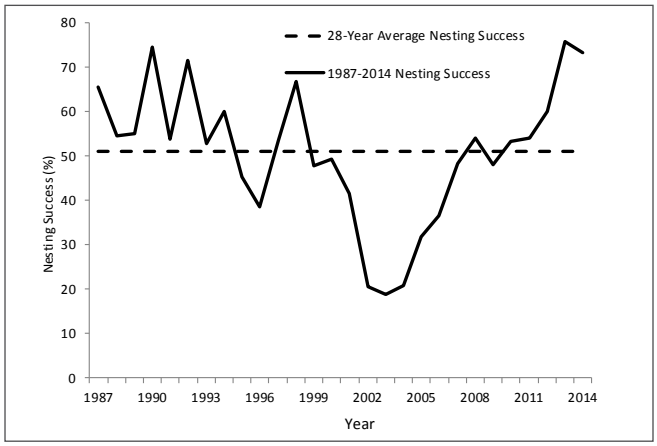

Figure 5. Osprey nest success during 1987-2014 and comparison with the 28-year average.

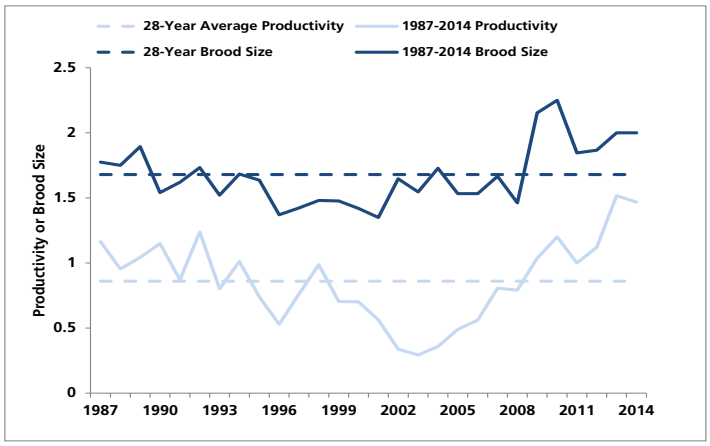

Figure 6. Osprey brood size and productivity during 1987-2014 and comparison with the 28-year average.

Wetland Bird Monitoring

Trumpeter Swan Winter Count

We counted 53 swans in YNP during the aerial mid-winter survey (table 2). The number of swans wintering in YNP has declined since surveys began in 1999 (figure 7). Changes in the wintering population cannot be attributed entirely to the declining resident population. Rather, declines in wintering swans appear to be driven by changes in the number of Canadian swans migrating to YNP for the winter.

Swans were also counted weekly from late November, 2013, through February, 2014, along the Madison River from the West Yellowstone entrance to Madison Junction, and along the Yellowstone River from Fishing Bridge to Chittenden Bridge. Many swans spend the first half of winter in the park, but numbers depend on the availability of ice-free portions of the rivers. In late November, 167 adults and 36 cygnets were counted on the Yellowstone River. By the end of February, the number of swans on the Yellowstone River declined to two adults and one cygnet. By mid-December, as many as 103 adults and 17 cygnets were wintering on the Madison River. By February 28, only one adult remained.

Reproduction & Breeding Season Observations

Two pairs of trumpeter swans nested in YNP in 2014. The pair at Grebe Lake returned this spring and nested on the platform installed in October 2011; however, their nest failed. Although the pair laid two eggs, one had been predated and only fragments remained; the other remained intact but was nonviable. The western half of Grebe Lake was closed to protect this pair from human disturbance. The Riddle Lake pair successfully nested and raised one cygnet, which was the first to fledge from Riddle Lake since 2007. To protect nesting swans from human disturbance, which possibly interacts with bald eagle predation, Riddle Lake was closed for the entire summer.

Ten additional non-breeding adult swans over-summered in YNP. Two moved between Ice Lake and Wolf Lake, and may be the two remaining cygnets produced by the Grebe Lake pair in 2012. Two other swans spent the summer on White Lake and were probably swans released to Tern Lake in autumn 2013. A single swan was commonly seen on the Firehole River, and five additional swans were observed together on the Southeast Arm of Yellowstone Lake. These latter swans have been in the area for several years, yet do not appear to be paired or attempting to breed.

Swan Release

Four 95-day-old trumpeter swan cygnets were released near Alum Creek in the Hayden Valley on September 17. They were released near a pair of two-year old cygnets that moved to the Yellowstone River after spending the summer at Ice and Wolf lakes. All four of the released cygnets were females; we suspect both of the two-year old cygnets are males, which may lead to future pair formation and a new territory.

Table 2. Mid-winter aerial survey for trumpeter swans in YNP during 1999-2014.

Year	Adults	Cygnets	Total
1999	292	48	340
2000	87	13	100
2001	53	11	64
2002	233	35	268
2003	146	34	180
2004	149	33	182
2005	124	30	154
2006	121	14	135
2007	144	25	169
2008	65	7	72
2009	88	2	90
2010	18	5	23
2011	125	42	167
2012	51	4	55
2013	2	0	2
2014	45	8	53

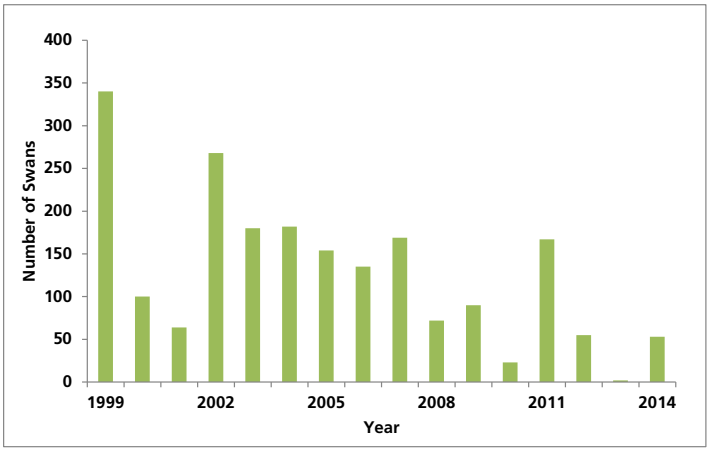

Figure 7. Total count of swans during the mid-winter aerial survey, 1999-2014.

Trumpeter swans in YNP have declined since the early 1960s. The number of nest attempts peaked during the 1990s, but has since declined substantially and is currently comprised of only two breeding pairs (figure 8). The current management goal is to increase the number of territorial pairs and, in turn, the probability of long-term persistence. To accomplish this goal, YNP has partnered with the Wyoming Wetlands Society.

Autumn Count

On September 25, we counted 18 trumpeter swans, including the four released swans, during the autumn aerial survey. The autumn count provides an estimate of the resident population and total productivity for the region, which have both declined over the last several decades (figure 9).

Colony Nesting Birds

Through photographic interpretation from four overflights made June through August 2014, we observed approximately 307 American white pelican nests that fledged an estimated 276 young. We counted 56 nesting double-crested cormorants that fledged an estimated 25 young. Eighteen California gull nests were observed, but they did not produce young; none of the four photosets show Caspian terns nesting on the Molly Islands.

The number of pelicans, cormorants, and gulls fledged from the Molly Islands has declined since the early 1990s; Caspian terns have not nested there since 2005. (figure 10). The reasons are not well understood, but a previous study indicates high levels of water in Yellowstone Lake are associated with low reproduction for pelicans nesting there (Diem and Pugesek 1994). While high lake levels flood nests and prevent re-nesting, the ultimate cause for declines may be the catastrophic decrease in numbers of cutthroat trout, the primary food source for colonial nesting birds.

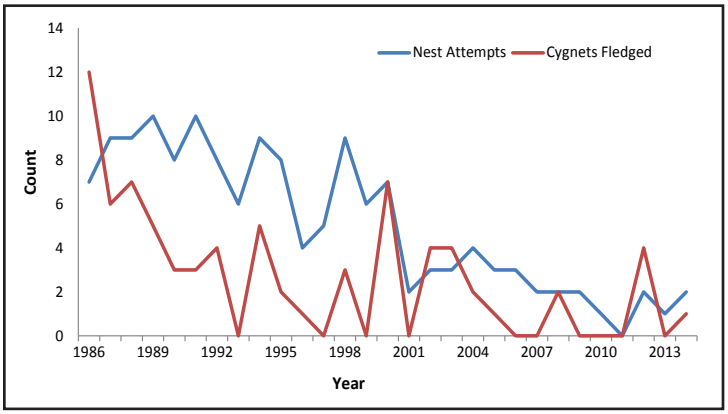

Figure 8. Trumpeter swan nest attempts and cygnets fledged from 1986-2014 in YNP.

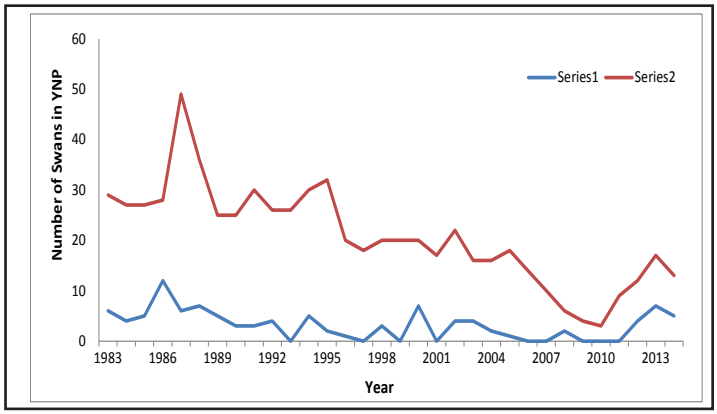

Figure 9. Autumn counts of trumpeter swans from 1983-2014 in YNP.

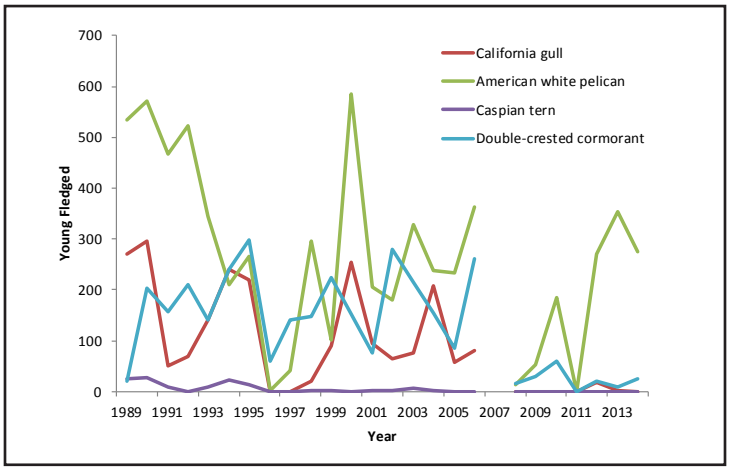

Figure 10. Number of young colonial nesting birds fledged from the Molly Islands during 1989-2014. No data collected in 2007.

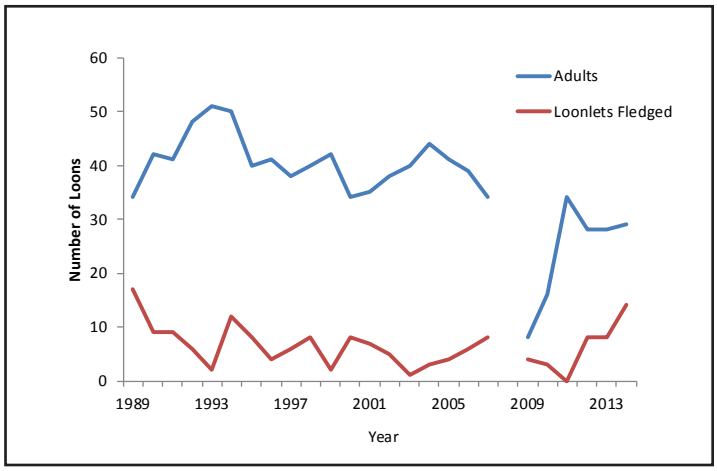

Figure 11. Common loon adults and fledglings in YNP during 1989 - 2014. No data collected in 2008.

Common Loon

In 2014, all 10 pairs of common loons nested and nine were successful, hatching a total of 16 chicks (figure 11). Of these 16 chicks, 14 survived to fledge. One pair failed, likely due to human disturbance of the nest site. This was the only failure in YNP during 2014. Another pair hatched two chicks, but lost both for unknown reasons. In addition to the territorial pairs, eight unpaired (or non-breeding) adults were observed in the park. Two loons were accidentally caught and killed in gillnets used for lake trout removals on Yellowstone Lake. The origin of these loons is uncertain (Wyoming loon population or southward migrants from outside Wyoming), since both loons were captured in October when loons are migrating.

There were two new pairs of common loons on Yellowstone Lake during 2014. One pair may have moved from a different breeding location within the lake; the other probably resided on Yellowstone Lake for at least the last three years, but remained unconfirmed until 2014. A new pair also recolonized a historical territory in Bechler (southwestern portion of YNP), which has not supported loons since 2001. Loon presence and behavior suggests pairs may occur elsewhere, including other parts of Yellowstone Lake and Shoshone Lake. Considering the high productivity (greater than 0.48 chicks surviving per territorial pair) in four of the last five years, we suspect the Wyoming loon population will experience an increase in adults (breeders and non-breeders) in the coming years.

Passerine & Near Passerine Monitoring

Willow Songbird Surveys

This year was the 10th consecutive year of monitoring willow-songbird communities in YNP. Details of the sampling protocol are available in Baril et al. (2011). In most years, three types of willows were surveyed for breeding passerines, including previously tall (averaging more than 1.5 meters in height and experiencing little browsing), suppressed (generally less than 1 meter in height and experiencing heavy browsing), and released (formerly height suppressed - now similar in height to previously tall willows but with lower overall canopy cover) (figure 12).

We recorded 15 species across the range of willow growth conditions. Species richness, which is the average number of species found in a particular habitat, was highest among the previously tall willows, slightly lower for released willows, and lowest in suppressed willows (figure 13). Wilson's warblers, a willow specialist, were only found in previously tall willows, while gray catbirds were only found in released willows (table 3). Gray catbirds are ground nesters and released sites tend to be drier than previously tall sites, while still providing adequate shrubby cover not available in suppressed sites. Suppressed willows essentially function as grasslands and provide habitat for generalist species like Lincoln's sparrows. Lincoln's sparrows were common in all three willow types. In addition to Lincoln's sparrows, the most common species observed in previously tall sites were common yellowthroat and yellow warbler. Yellow warblers were found in both released willows and previously tall willows. Savannah sparrows were common to released and suppressed willows. Released willows exhibit characteristics of both suppressed and previously tall willow sites.

Forest Burn Surveys

The persistence of cavity nesting birds in YNP is dependent on patterns of fire across the landscape. Variations in burn severity, time since burn, 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—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

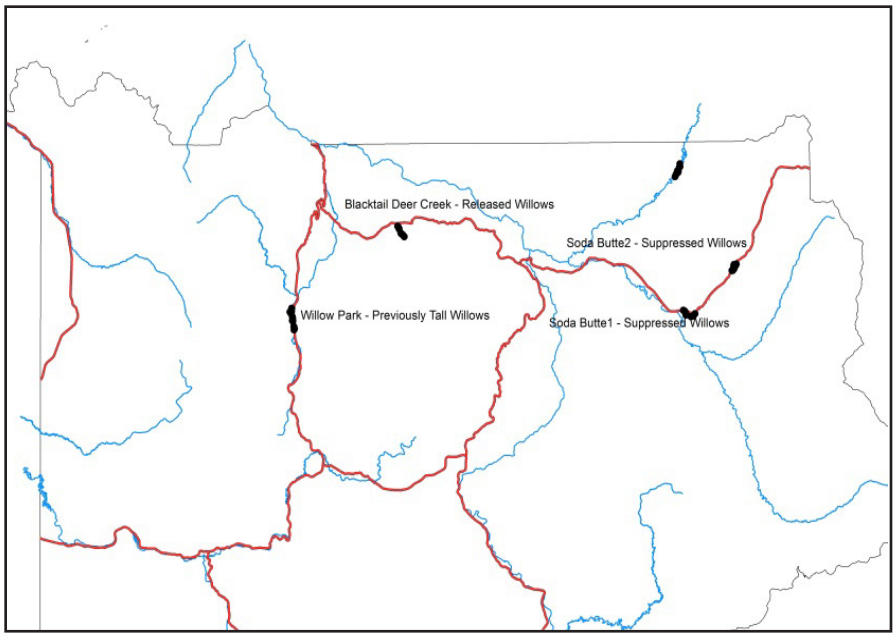

Figure 12. Map of willow point count locations in Yellowstone.

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. Therefore, we initiated a monitoring program in 2009 to evaluate the presence and abundance of post-fire adapted bird species.

Table 3. Relative abundance of songbirds observed in previously tall, released, and suppressed willow stands during 2014. Bold numbers indicate highest abundances.

Species	Previously tall	Released	Suppressed
American Robin	0.09	**0.91**	0.22
Brewer's Blackbird	0.06	0.13	**0.78**
Common Yellowthroat	**0.63**	0.38	0.14
Fox Sparrow	0.28	0.19	-
Gray Catbird	-	0.13	-
Lincoln's Sparrow	**1.06**	0.63	**0.56**
Red-winged Blackbird	0.06	0.19	0.08
Savannah Sparrow	0.09	**0.69**	**0.81**
Song Sparrow	-	0.16	0.08
Warbling Vireo	0.09	0.25	0.06
White-crowned Sparrow	0.16	0.09	0.14
Willow Flycatcher	0.41	0.41	-
Wilson's Warbler	0.28	-	-
Yellow Warbler	**1.53**	**1.34**	0.50

We conducted point count surveys in four burned areas throughout YNP in 2014: the Point Fire (8 points); the Cygnet Fire (8 points); the Arnica Fire (8 points); and the LeHardy Fire (4 points) (figure 14). The Point Fire burned 867 hectares along the east shore of Yellowstone Lake during 2011, and the Cygnet Fire burned 1,431 hectares south of the road between Norris and Canyon during 2012. These are considered recent fires (less than 4 years since time of burn). LeHardy and Arnica burned in 2008 and 2009, respectively, and are considered mature fire stands (4-8 years since time of burn).

We observed 23 species across the four study areas, including 15 species in recently burned areas and 19 in mature burn areas during 2014 (table 4). Nine of the 23 species (39%) were obligate cav-

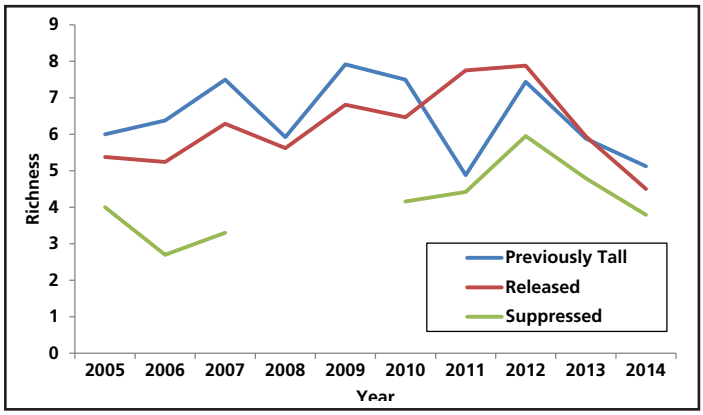

Figure 13. Species richness across three willow growth conditions during 2005-2014.

ity nesters. Average richness and relative abundance were both greater in mature burn areas than in recently burned areas (table 4). The most abundant species in recent burns were the tree swallow, dark-eyed junco, and yellow-rumped warbler. The most abundant species in mature burns were tree swallow, dark-eyed junco, and American robin. Tree swallows were substantially more abundant in the mature burn areas and the most abundant species overall. Four of the 23 spe-

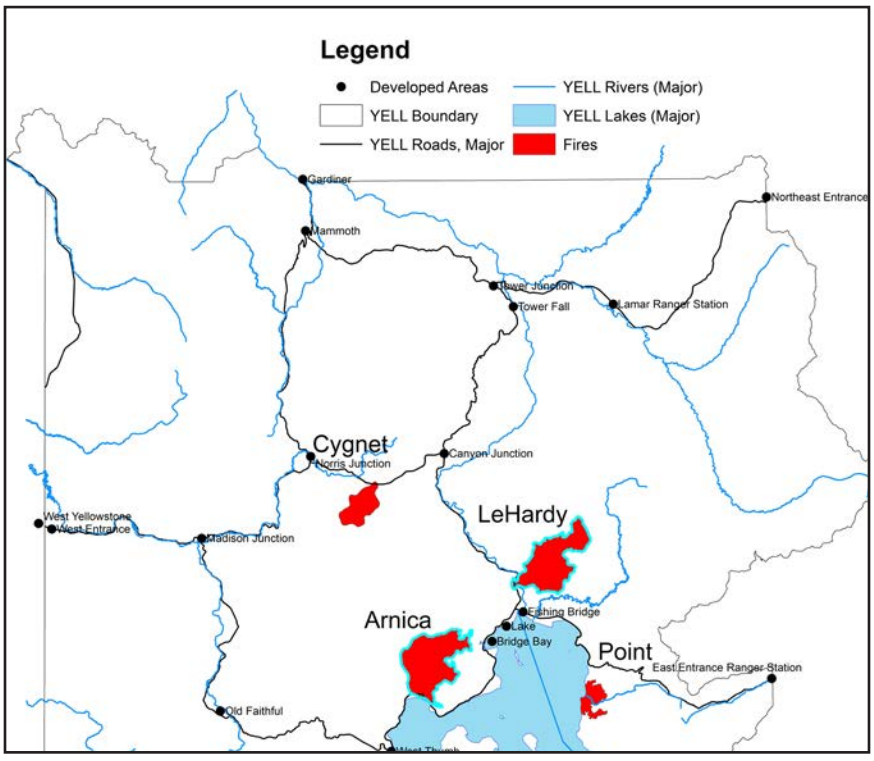

Figure 14. Map of burn area point count transect locations in Yellowstone.

cies recorded were primary cavity nesters (i.e., excavate their own nest holes) and occurred in low abundance (less than 5 detections) in both burn types. Five of the species detected were secondary cavity nesters (i.e., use the abandoned holes of primary cavity nesters or natural holes). Of these, the mountain bluebird preferred recently burned areas, while tree swallows preferred mature burned areas. American three-toed and black-backed woodpeckers were observed in recently burned forests only, but in low densities.

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), and the type of forest and forest structure present prior to a fire. All 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.

Breeding Bird Surveys

During 2014, surveys were conducted in and near Mammoth on June 23, the Northeast Entrance on June 19, and along the route from Dunraven Pass to Mary Bay on June 20. More than 2,800 individual birds and 81 species were observed (figures 15 and 16). The number of species observed has declined since 2002 along all three routes, while the number of individuals has declined for the Mammoth and Northeast Entrance routes, but not for the Yellowstone route largely due to an increase in the number of Canada geese along the Yellowstone route (figure 17).

Table 4. Average abundance per burn type, by species, occurring in recent (1-3 years since time of burn) and mature burns (4-8 years since time of burn) during 2014. Nesting Guild: 1° CA = excavates own cavity, 2° CA = uses abandoned cavities, OC = open cup, PA = nest parasite. Bold numbers indicate highest abundances.

Species	Recent Burn	Mature Burn	Nesting guild
American Robin	0.22	0.46	OP
American Three-Toed Woodpecker	0.13	-	1° CA
Black-backed Woodpecker	0.03	-	1° CA
Brown Creeper	-	0.04	2° CA
Cassin's Finch	0.03	0.04	OC
Chipping Sparrow	-	0.04	OC
Clark's Nutcracker	-	0.04	OC
Dark-eyed Junco	0.34	**0.67**	OC
Great Grey Owl	-	0.04	OC
Hairy Woodpecker	0.06	0.21	1° CA
Hermit Thrush	0.09	-	OC
House Wren	0.03	0.08	2° CA
Lincoln Sparrow	-	0.10	OC
Mountain Bluebird	-	0.29	2° CA
Mountain Chickadee	0.16	0.08	2° CA
Olive-Sided Flycatcher	-	0.21	OC
Red-breasted Nuthatch	0.13	0.08	1° CA
Ruby-crowned Kinglet	0.19	0.08	OC
Ruffed Grouse	0.03	-	OC
Towsend's Solitare	-	0.04	OC
Tree Swallow	**0.63**	**1.33**	2° CA
Western Wood-pewee	0.09	0.03	OC
Yellow-rumped Warbler	0.34	0.17	OC

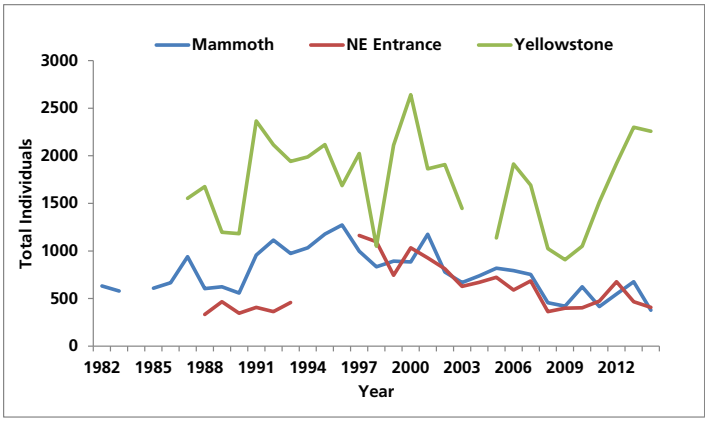

Figure 15. Number of total individuals observed during three breeding bird surveys from 1982-2014.

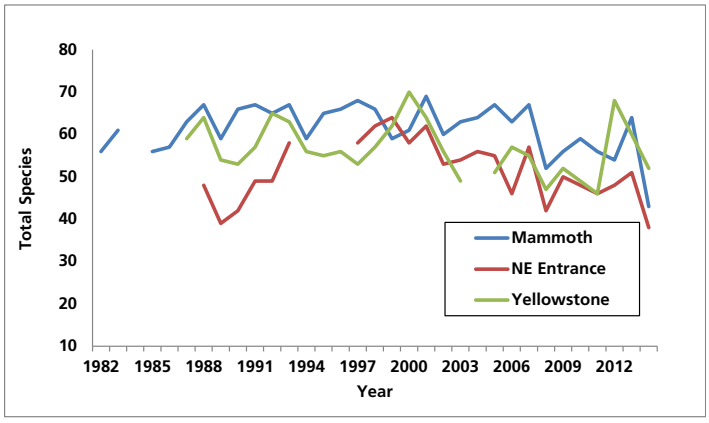

Figure 16. Number of total species observed during three breeding bird surveys from 1982-2014.

Mid-winter Bald & 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 United States Geological Survey since 1992. The objectives are to establish an index of the winter population, determine winter distribution, and identify important wintering habitat for eagles. Yellowstone has participated since at least 1987, but there were a few years surveyed prior to that date.

Sixteen volunteers participated in the mid-winter eagle survey on January 11, 2014. Observers recorded two adult bald eagles along the Madison River, one immature bald eagle along the Firehole River, two adult bald eagles along the Gardner River, and seven golden eagles on the northern range between Mammoth and Cooke City. Most eagles migrate to lower elevations outside YNP for the winter where food is more abundant (e.g., road-killed ungulates, gut piles, and small mammals).

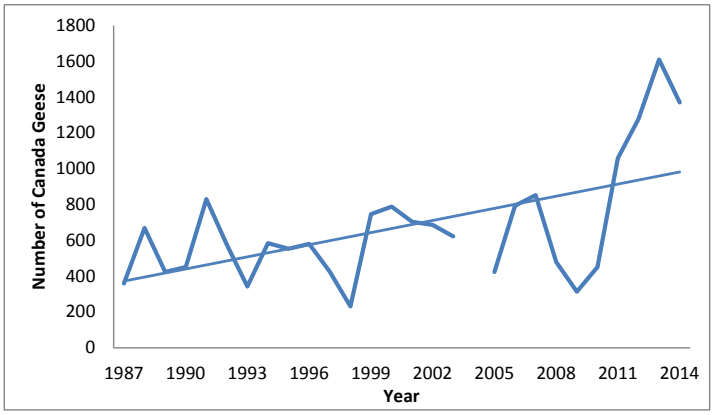

Figure 17. Number of Canada geese observed on the Yellowstone Breeding Bird Survey route during 1987-2014.

Yellowstone Raptor Initiative

Golden Eagle

We identified 26 golden eagle territories in YNP during 2014, with the highest density in the northern portion. We monitored 25 of these territories, all of which were occupied. However, we could only confirm nesting success for 19 of these pairs. Twelve pairs did not nest, and only one of four pairs that did nest was successful. The remaining three pairs did not produce young, but it was unclear whether they nested and failed or did not nest at all.

Over the past four years, nesting success and productivity have fluctuated substantially (table 5). Despite these fluctuations, all territories remained occupied; and new territories are located annually. This relatively high density of golden eagles may limit productivity through competition for limited food resources in late winter and early spring.

Prey remains and eggshell fragments were collected from three golden eagle nest sites, two of which were active in 2014. Nests were entered in late August after chicks fledged and breeding activity subsided. This sampling method only identifies what eagles feed young during the nestling stage. Prey remains collected in 2014 are still being identified; but in 2011 and 2013 we found a nestling diet composed largely of birds, such as Clark's nutcracker, Canada goose, black-billed magpie, dusky grouse, and even other raptors such as Swainson's hawk. We also found the remains of ground squirrels and marmots. Eggshell fragments are measured for thickness as an indicator of environmental contaminants, primarily DDE (a derivative of DDT), and may later be analyzed for specific compounds.


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Red-Tailed Hawk

In 2014, we monitored 30 territories occupied by red-tailed hawks in the northern portion of YNP. Though we did not monitor all known territories, we continued to document all nest sites found. We determined the breeding season outcome for 28 of the occupied territories. Pairs in 21 territories laid eggs; only nine successfully fledged young, yielding a nest success rate of 32%. Productivity, or young per occupied territory, was 0.5 and brood size was 1.4. Seven pairs did not lay eggs. Nesting success and productivity were the lowest since monitoring began in 2011 (table 6).

Table 5. Golden eagle nesting success and productivity during 2011-2014.

Year	% Nesting Success	Productivity
2011	50	0.63
2012	0	0
2013	60	0.8
2014	5	0.05

Table 6. Red-tailed hawk nesting success and productivity during 2011-2014.

Year	% Nesting Success	Productivity
2011	79	1.36
2012	89	1.74
2013	70	1.16
2014	32	0.46

Swainson's Hawk

Ten of 11 known Swainson's hawk territories were occupied; and only three were monitored for nesting, two of which successfully fledged four young. An additional six probable territories were noted, but require further observations to confirm. We were unable to visit all other territories documented in previous years due to time constraints.

The majority of Swainson's hawks occur at higher elevations within the interior of the park. The mostly forested interior is dominated by lodgepole pine. Swainson's hawks nest along the edges of open valleys and meadows. Some nests are situated near the top of live conifers set back from the forest edge, creating difficulty determining actual nest locations. Yellowstone differs from most described breeding habitat in that it

is generally higher in elevation, more densely forested, and lacks agricultural influence (Bechard et al. 2010). Yellowstone more likely represents historical nesting habitat for Swainson's hawks in the northern Rocky Mountains.

Prairie Falcon & American Kestrel

We monitored two prairie falcon territories in 2014. Both were occupied and one fledged three young. We could not confirm nesting in the second territory. Prairie falcons appear to be outcompeted for territories by more dominant peregrine falcons and golden eagles.

American kestrels have been observed at multiple locations. Biologists documented 90 sightings of a territorial individual, mated pair, fledglings, or nest cavities during 2010-2014. This total includes some repeat locations. American kestrels may be declining in some areas throughout their range, with most research done on populations using nesting boxes. Therefore, natural nest cavities in YNP provide a baseline and contrast to these studies (Smallwood et al. 2009).

Road-side Raptor Survey

The objective of the road-side raptor survey is to estimate raptor density for adult red-tailed hawks, Swainson's hawks, and American kestrels in the northern portion of YNP. The protocol consists of 20-minute surveys conducted at established points along the road, beginning at Indian Creek Campground and ending at Barronnette Peak. Each point is surveyed twice: once in May and once in June. For more details regarding this survey, please refer to the 2012 annual bird report (www.nps.gov/yell/learn/nature/birdreports.htm). We recorded 273 raptors across 12 species during the two surveys in 2014. Red-tailed hawks (68%), American kestrels (9%), and Swainson's hawks (3%) comprised 80% of all observations.

Raptor Migration Count

The goal of monitoring migrating raptors is to provide long-term information on changes in migratory populations. Observations began on September 3 and continued through October 28. Weather and staffing allowed for counts on 40 of the 56 available observation days. We counted migrating raptors for six hours each day, from 10 am to about 4 pm. Fifteen observers participated in the count over the study period, with an average of 2-3 observers per day. The observation point was staffed for 222 observation-hours and 636 observer-hours (i.e., total hours multiplied by the number of observers per day and summed over all days).

A total of 1,677 raptors across 17 species were recorded over 40 days of counts, for an average of 7.6 raptors per hour. The majority of all raptors observed were buteos (48%), followed by eagles (17%), accipiters (13%), falcons (12%), northern harriers (7%), turkey vultures (2%), and osprey (1%). The most abundant species observed were red-tailed hawk (23%), Swainson's hawk (12%), and golden eagle (11%). All other species each represented less than 10% of the total (figure 18). A highlight this year was the increase in observed broad-winged hawks, a common migrant along the eastern flyways, but rarely observed in the West. We observed 35 individuals during the season and had previously never seen more than seven.

Because Hayden Valley is a non-traditional count site, observations made from that location are difficult. The wide valley disperses raptors one mile or more east and west from the count site, rather than concentrating them as ridgelines do. These distant raptors usually require more time to identify, resulting in less time scanning for other migrating raptors which may then pass unnoticed. Furthermore, Hayden Valley appears to be a stopover location. Raptors passing over the mountains to the north often drop into the valley and begin foraging, which makes it difficult to differentiate between a bird actively migrating and one that is foraging for a day or two before continuing to migrate. Because of these difficulties, we are actively scouting for other more favorable count sites where bird passage is more consistent.

On September 25, October 10, and October 17, biologists counted raptors from the top of Observation Peak, which lies north of Hayden Valley at the southern terminus of a north-south ridge on the western side of the Washburn Range. With over 10 kilometers of ridgeline, Observation Peak provides topography that can promote orographic lift and serve as a more traditional count site. Over the three days, we counted 126 raptors across nine species during 13 hours of observation (figure 18). Migrant sightings averaged 9.5 raptors per hour; about two more raptors per hour than in Hayden Valley.

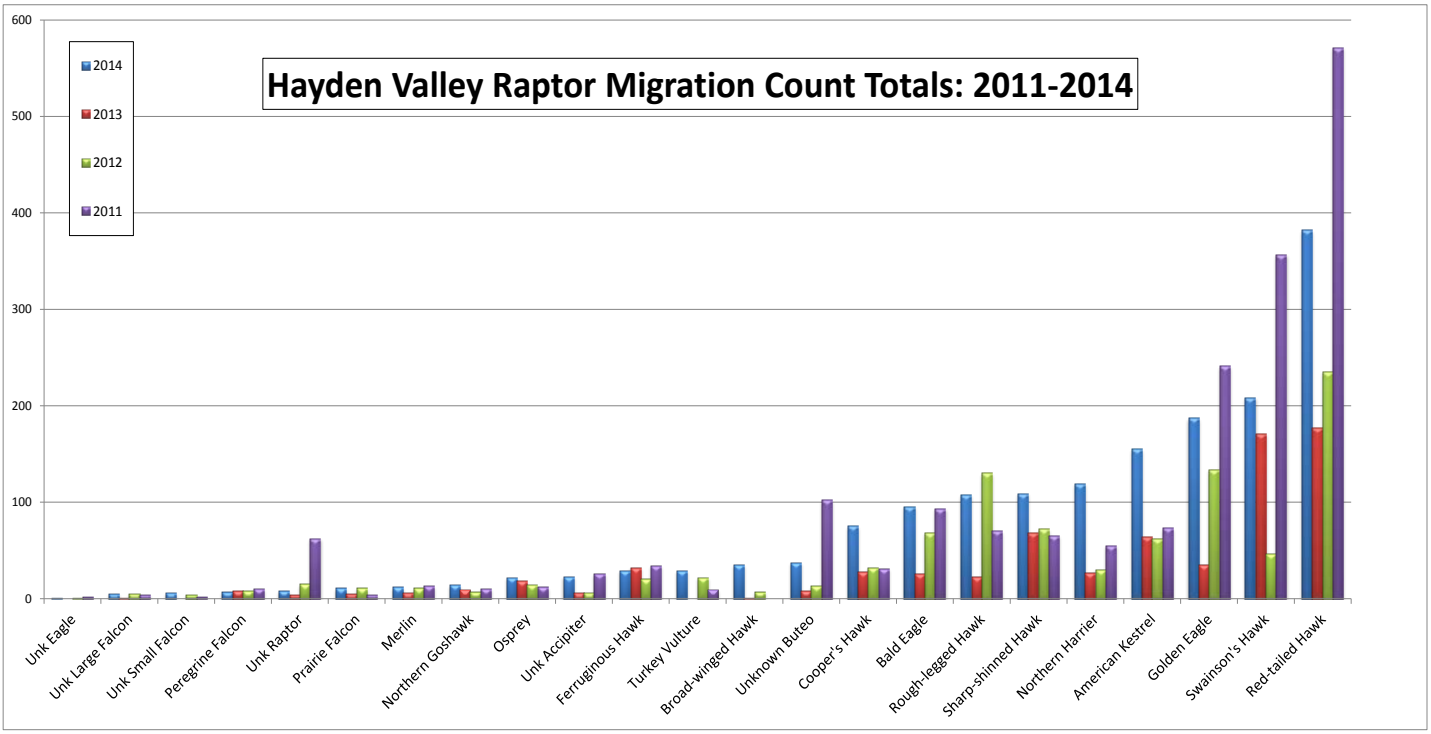

Figure 18. Migrating raptors counted during September and October in Hayden Valley from 2011 to 2014.

Golden eagles (52%) were the most abundant species, followed by red-tailed hawks (16%), Cooper's hawk (9%), and sharp-shinned hawk (7%). All other species each represented less than 5% of the total. Counts from Observation Peak occurred simultaneously with Hayden Valley; on each occasion observers recorded more raptors, fewer unidentified birds, and significantly more accipiters and golden eagles at Observation Peak. Because birds pass closer to observers at Observation Point, raptors are more easily seen and identified. Furthermore, observers spend less time watching a migrating raptor as it makes its way past the migration point before scanning for other birds. These factors are responsible for the greater number of birds and altered species composition between the two sites.

Owl Survey

In addition to raptor migration counts, 16 nocturnal surveys, designed to detect territorial owls of several species, were conducted during late winter and spring of 2014. Twelve surveys focused on the northern portion of YNP, while four surveys occurred in the southern part of the park. Surveys followed a specific protocol involving the broadcast of recorded vocalizations for selected species, along with passive listening and visual observation of all owl species encountered. Survey results provide an index of site occupancy, but no information on nesting success or productivity.

Five boreal owls, eight great horned owls, three great gray owls, one northern saw-whet owl, and one northern pygmy-owl were detected during surveys in northern Yellowstone. One boreal owl and one great gray owl were detected in the southern part of the park.

A pair of great horned owls that nested successfully on Officers' Row at Mammoth Hot Springs attracted multitudes of photographers and other visitors, especially once the three owlets fledged and were readily observed.

Public Outreach, Education, Collaborations

For the fifth year, education ranger Katy Duffy led hawk ecology and identification programs during September. Forty 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 with 80 visitors to observe migrating raptors, and discuss identification tips and the ecology of migration. Duffy also taught two classes for the Yellowstone Association Institute. An owl ecology and identification class was instructed on May 24-25 at Lamar Buffalo Ranch, and a raptor ecology and identification course was taught on September 5-7. Duffy led a session on Yellowstone birds at the spring resource education training attended by nearly 300 Yellowstone Association Institute guides, Xanterra tour guides, and commercial guides operating in the park.

Noteworthy Birds & Bird Sightings Program

Since 2010, visitors and park staff submitted more than 1,600 observations from 24 species of raptors. Red-tailed hawks and bald eagles are most commonly reported. However, observations also include 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. For example, several summer observations of merlins were submitted in 2014. Merlins are not known to breed in YNP, but observations like these may lead to a changed breeding status for this species.

In cooperation with the Resource Education and Youth Programs Division of YNP, we launched a new online sightings form for both raptors and rare birds other than raptors at www.nps.gov/yell/naturescience/wildlife-sightings.htm. The number of submissions has tapered significantly since the program began in 2010; and the easier, paperless format may encourage more visitors and staff to submit their sightings.

The Teton Raptor Center Poo-Poo Project

The Poo-Poo Project aims to prevent wildlife entrapment within vent pipes found on vault toilets throughout the United States by installing safe and effective screens. According to the Teton Raptor Center, thousands of cavity-nesters (animals that prefer dark, narrow spaces for nesting and roosting) become entrapped in vertical open pipes, such as ventilation pipes, claim stakes, and chimneys because the vents mimic their natural nesting habitat. The Teton Raptor Center requested YNP outfit all vent toilets with screens, which they generously provided. Eric Reinertson, Nathan Buckhout, Katy Duffy, and Kerry Gunther checked 114 pit toilets for screens and installed screens on 27 of them. The remaining 87 toilets were already fitted with screens. We thank the Teton Raptor Center for initiating the project and providing screens. We also thank park staff for implementing the project.

Acknowledgements

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Appendix: 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 – a mated pair of birds that have laid eggs or raised young. Often breeding areas contain multiple nests or eyries.

Brood size - the 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 nests/territories in a monitoring region in which one or more young fledges successfully (used for all raptors except ospreys and bald eagles). Young reaching at least 28 days old for peregrines and 80% of fledging age for eagles and ospreys are expected to fledge and are, therefore, considered successful nests at this point. This is a better measure of nesting success since not all raptors, particularly eagles, nest annually. Including non-breeding territorial pairs in measures of nesting success is important to understanding population health. It also allows for the inclusion of nesting pairs that failed early 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 eyrie [nest site]). 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). Although accurate, a better measure of productivity would be productivity per occupied territory (described below); since the number of non-breeding pairs was not collected prior to 2008, it is not possible to calculate productivity per occupied territory.

Productivity per occupied territory – used for all raptors except ospreys and bald eagles (see definition above). This is a better 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. It also allows for the inclusion of nesting pairs that failed early or territorial pairs discovered late in the season that may have nested, but did not produce young.

Unoccupied – a known breeding area containing a nest or group of nests at which none of the activity patterns diagnostic of an occupied nest were observed.

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

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