FALL 2017 RAPTOR MIGRATION STUDY IN THE BRIDGER MOUNTAINS, MONTANA

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INTRODUCTION

The Bridger Mountains Raptor Migration Project in southwestern Montana is an ongoing effort to monitor long-term population trends of raptors using this portion of the Rocky Mountain Flyway (Omland and Hoffman 1996, Hoffman and Smith 2003, Smith et al. 2008a). HawkWatch International (HWI) initiated a partial-season count at this site in 1991, with standardized, full-season annual monitoring commencing in 1992. Beginning in 2009, Montana Audubon took the lead in funding and coordinating these annual counts. In 2017 primary responsibility for conducting the count was transferred to Sacajawea Audubon Society (based in Bozeman, MT). This flyway is renowned for large numbers of migrating Golden Eagles (see Appendix A for all raptor species observed at this site). To date, 18 species of raptors have been documented migrating along the Bridger Mountains, with annual autumn counts typically ranging between 2,000 and 3,500 migrants. This report summarizes count results for the 2017 season, the 26th consecutive full-season autumn count of migratory raptors at this site.

The Bridger Project is one of eight long-term, annual fall migration counts conducted or co-sponsored by HWI in North America in autumn 2017 (and it is one of four annual, full-season raptor migration monitoring sites conducted in 2017 by various entities in western Montana). The primary objective of these efforts is to track long-term trends of diurnal raptor populations in western North America (Hoffman et al. 2002, Hoffman and Smith 2003, Smith et al. 2008a & b). Raptors serve as important biological indicators of ecosystem health (Bildstein 2001), and long-term monitoring of migrating raptors is the most efficient, cost-effective method for assessing regional population status and trends of multiple raptor species (Zalles & Bildstein 2000, Bildstein et al. 2008).

STUDY SITE

The Bridger Mountains is an isolated, relatively narrow range that runs primarily along a north–south axis. From Sacajawea Peak (2,950 m elevation) the range extends southward for 40 km before ending at Bozeman Pass, 20 km east of Bozeman, Montana. Consistent westerly winds collide with the Bridger Range and create strong, predictable lift, attracting good numbers and diversity of southbound migrant raptors each fall. The observation site is a helicopter-landing platform atop the Bridger Bowl Ski Area at an elevation of 2,610 m (45° 49.022' N, 110° 55.778' W; Fig. 1). The site is situated within the Custer Gallatin National Forest on the crest of Bridger Ridge, about 25 km northeast of Bozeman and 3 km north of Saddle Peak. The helicopter pad is a 5m x 5m concrete platform located approximately 50m north of an avalanche cache/ski patrol hut. The site is accessed by walking along a primitive dirt road on the east-facing slope for 5 km (780 m rise in elevation) to the top of the Bridger Bowl Ski Area chairlift, then continuing westward a few hundred meters along a narrow footpath to the crest of the Bridger Ridge, and finally north for 50 m to the observation site.

METHODS

Since this project's inception two official, well-qualified observers have conducted standardized daily counts of migrating raptors from a designated observation site from late August/early September through late October/early November. In 2017 Bret Davis returned to the Bridger Hawk Watch for his 5th season (the most by any Bridger observer; see Appendix B for a complete history of official observers for this project). Bret was accompanied by Adam Bradley, who observed for his first season in 2017. Daily observations began on 27 August (for the second consecutive year), and continued through 8 November (the latest observation date in the 26 seasons of the Bridger count). Counts typically began at 0900 H and ended at 1700 H Mountain Standard Time (MST). Bret Davis provided on-site training for Adam Bradley and local volunteer Chris Smith; both were experienced birders but without experience doing extensive

ridgetop migratory raptor counts. Local birding enthusiast (and expert observer) Matt Keefer as well as Chris Smith frequently contributed full days to the hawk watch effort as volunteers, providing one day off each week for Bret and Adam (as did several other expert local birders; see Acknowledgments for a list of volunteer-substitute observers).

The observation site was accessed daily by the observers, either by hiking two miles (with a 2000-foot elevation gain) from the lower parking area, or from the ski patrol hut on the ridge near the observation site, which often served as overnight lodging.

As in previous years, two owl decoys were used again in 2017 to attract passing migrant raptors; both were elevated about 4m above the ground to make them more visible to passing raptors. A nearby owl was situated 5m directly to the north of the observation point; it was fastened to a pole that was tied to the top of a live Douglas-fir tree. A more distant owl was situated 600 m to the north at the far (north) end of "Tilly Peak" atop a metal post that is part of Bridger Bowl's avalanche control system. The near-owl was erected at the start of the count, and the far-owl became operational on 11 September. Both owls remained up through the end of the count season.

The observers routinely recorded the following data each day:

1. Species, age, sex and color morph of each migrant raptor, whenever possible and applicable (Appendix A lists common and scientific names for all species, information about the applicability of various age, sex, and color morph distinctions, and two-letter codes used for each species).

2. Hour of passage for each migrant; e.g., the 0900-0959 H, etc. (MST).

3. Wind speed and direction, air temperature, percent cloud cover, predominant cloud type(s), presence of precipitation (and type), visibility and a subjective assessment of thermal lift conditions (i.e., excellent, good, fair & poor) for each hour of observation (assessed on the half-hour).

4. Predominant direction, altitude, and horizontal distance (from the observation point) of the migratory flight for each hour.

5. Total minutes observed, and the mean number of observers present during each hour (which included designated observers plus volunteers/visitors who contributed substantially to the count [actively scanning, pointing out birds, recording data, etc.] for at least 10 minutes in a given hour).

6. A subjective visitor-disturbance rating (high, moderate, low, none) was determined for each hour.

7. Observation start and end times for each observer.

For the 2017 season the field crew took advantage of a weather station maintained by Bridger Bowl at the top of the Poma Lift on the ridgeline directly above the observation point. In 2017 this weather station was active 6 October – 4 November and measured temperature as well as wind speed and direction. The information was obtained online at MTavalanche.org and transcribed onto the official weather data sheets hourly. Weather measurements were made using a hand-held 2500 Kestrel weather station during all other days of the count.

The Bridger weather station is likely to give a more accurate reading of the wind, due to being approximately 10 m aloft and above the cover of the trees on the west side of the observation point. For this reason the Bridger station consistently measured a higher wind speed, especially when typical WSW

winds predominated. It is also assumed that the Bridger weather station gave a more accurate temperature reading, since the Kestrel occasionally displayed inexplicable variations for this parameter. For this reason, we suggest data from the more-accurate Bridger weather station be compared daily with the Kestrel readings sot the Kestrel readings (taken on days when the weather station was not operational) can later be calibrated to reflect accurate (and comparable) weather parameters.

The method for recording data in 2017 was expanded from the typical paper data sheets to include real-time, hourly updates for raptor and non-raptor species' totals, as well as weather, utilizing the Dunkadoo (dunkadoo.org) application on an Android tablet. HMANA's (Hawk Migration Association of North America) website, hawkcount.org, was automatically updated via Dunkadoo in real-time and at the end of each hour. The data entered electronically mirrored that recorded on the paper data sheets, hence no electronic data-entry at the end of the day (or season) was necessary.

Hourly raptor count totals and a general summary of the day's events, including weather, were posted on hawkcount.org daily. Daily and seasonal Bridger raptor count totals were also periodically posted on Sacajawea Audubon website's home page (sacajaweaaudubon.org). Daily lists of all bird species were also posted on the eBird website by Adam Bradley at the Bridger Bowl Hawk Watch Hotspot (go to: ebird.org/ebird/hotspot/L2979461).

Calculation of "adjusted" (to standardize sampling periods) passage rates (migrants counted per 100 hours of observation) and analysis of trends, updated through 2017, generally follows Hoffman and Smith (2003), using standard linear and quadratic regression statistical techniques. In comparing 2017 data (for each species) with annual means and 95% confidence intervals for all previous seasons, we determined significance when the 2017 value fell outside the 95% confidence interval of the associated mean for the1992-2016 passage rates.

RESULTS AND DISCUSSION

OBSERVATION EFFORT AND WEATHER SUMMARY:

In 2017 observers conducted counts on 60 of 74 possible days between 27 August and 8 November, for a total of 424.3 observation hours. Total observation hours were 20% above the 1992-2016 mean of 352.0 (± 21.7) hours. Since 2009 the count has typically run from 1 September through 5 November, and in 2016 the start date was advanced five days to 27 August to account for the likelihood of a progressively earlier raptor migration, presumably due to climate change (see Filippi-Codaccioni et al. 2010, Therrien et al. 2017). This was repeated in 2017, as well as extending the planned end-date to 10 November. However, heavy snowfall in the Bridgers caused the end-date to be moved up 2 days to 8 November.

Inclement weather and/or difficult access prevented any observations on 14 days during the 2017 season. In addition, inclement weather reduced the total daily observation period to less than four hours on three additional days. In 2017, one of the observers, Adam Bradley, resided atop the Bridger Ridge, and so was able to count during brief breaks in weather during long-lasting storms. He was the lone observer during all three days for which the daily observation period was less than four hours, and recorded a total of only two birds during these three days. Adam also made the effort to start the count early or extend it later some days (hourly observation efforts available on hawkcount.org).

The 2017 season saw multiple long-lasting storms that obscured the ridge due to persistent, low clouds, rain and/or snow, eliminating visibility. These occurred from 13 – 16, 19 – 24 September, 30 September – 3 October, 8 – 9, 12 – 14, 20 – 22, 26 – 27 October, and 31 October – 6 November. In addition, a brief afternoon thunderstorm came through on 9 September. Over a foot of snow fell on the ridge during the

storms of 13 – 24 September, effectively clearing the sky of wildfire-related smoke and haze for the remainder of the season. Varying amounts of snow accumulation remained on the ridge and slopes throughout the remainder of the season.

Each storm in October yielded approximately 4 – 8 inches. A severe, early season winter storm hit the Bridgers on 31 October, with over two feet of snow accumulating on the ridge by the time it cleared on 6 November. This deep snow cover remained beyond the last day of the count.

Until the first storm of the season, temperatures were unseasonably warm, with daily highs averaging in the mid-20's Celsius. The mid-September storm cooled things off, with lows dipping below freezing until a brief "Indian summer" appeared in late September, when low temperatures remained above freezing. Through the month of October highs averaged in the single digits above zero (Celsius), and lows in the single digits below zero. The month of November was relatively cold, rarely reaching above zero (Celsius), with temperatures often dipping below –10 C.

During periods of active observation skies were recorded as clear 31% of the time, partly cloudy (22%), mostly cloudy (16%), and overcast (31%). The 1992-2016 mean values are quite similar: 32% clear, 21% partly cloudy, 17% mostly cloudy, and 30% overcast. Fog was present for the count on many days, due to the Bridger Ridge often holding low cloud cover and heavy fog for days at a time during prolonged storms. Eight of the 60 observation days were dominated by fog (on three of those days we observed for fewer than 4 hours of observation). Typical for this site, winds were primarily from the west and southwest throughout the 2017 season. East winds were rare and generally occurred for short periods, and never longer than a day at a time (and usually just prior to or immediately following the passage of a cold front). East winds predominated on only 7 of the 60 active observation days in 2017.

Intermittent rain and snow was recorded periodically throughout much of the season, with thunderstorms occurring on 9 September, and again during the 30 September – 3 October storm. Haze from local forest fires was severe from the first count day until the 13 – 24 September storms abruptly cleared the air; hazy conditions comprised 28% of the count days. The severity of haze was much greater than what we have typically experienced over the past decade, due to an especially severe late summer fire season. Several of the forest fires were visible from the observation point, including two in the Bangtails and one in the Crazy Mountains. The Blacktail fire in the Crazies was especially brutal, beginning on 10 September and burning over 5,000 acres. It created a huge cloud of smoke that greatly affected visibility in the Bridgers for several days (https://inciweb.nwcg.gov/incident/5606/). One of the fires in the Bangtails, the Grassy Mountain Fire, was first reported by the Bridger observers (illustrating that the Bridger Hawk Watch can sometimes provide additional, unexpected benefits!).

FLIGHT SUMMARY:

The fall 2017 raptor migration count tallied 2,696 diurnal raptors of 17 species (Table 1). This is 25% above the 1992-2016 mean of 2,488 (∓ 216). Species recorded in higher than average numbers (above the 95% confidence interval of the long-term mean) were: Ferruginous Hawk, Swainson's Hawk, Rough-legged Hawk, Red-tailed Hawk, Merlin, Golden Eagle and Turkey Vulture. No raptor species was recorded in numbers below the 95% confidence interval about the mean, hence all other species were counted in numbers that were within the 95% confidence intervals about the long-term mean. Only the Turkey Vulture was counted in record numbers in 2017 (29 vultures were tallied, shattering the previous record of 16 in 2013).

Eagles represented the largest proportion of any raptor group this season, comprising 57.6% of the total raptor count in 2017 (equaling the long-term mean for this parameter; Fig 2). Accipiters were the next

largest group tallied (22%, slightly below the long-term average of 24%), followed by buteos (12%, considerably above the long-term average of 8%), and falcons (5%, which is average). Harriers, vultures, ospreys and unidentified raptors comprised 2% or less each. Northern Harriers were counted in average numbers.

Golden Eagles were the most numerous species, making up 55% of the total count, followed by Sharp-shinned Hawks (12%), Red-tailed Hawks (8%), Cooper's Hawks (7%), American Kestrels (3%), and Bald Eagles (3%), with the remaining 10 species together comprising 12% (less than 3% each).

LONG-TERM TRENDS:

The most worrisome trend documented by the Bridger Mountain Hawk Watch over the past 25 count seasons is the significant long-term decline in Golden Eagle passage rates ($p<0.001$; Fig. 3e & f). This trend is consistent with most other long-term Golden Eagle migration counts across western North America (see https://www.birdscanada.org/birdmon/default/popindices.jsp or http://www.rpi-project.org/2016/graphs.php?rsite=592%3AF). However, since 2009 the passage rate of Golden Eagles along the Bridger Ridge has stabilized, suggesting that the long-term decline of this species has arrested in recent years. In fact, there is actually a recent upward trend in passage rates of adult, non-adult, and total Golden Eagles, which may suggest a slight increase in Golden Eagle populations using this Rocky Mountain Front flyway during the past five years. These graphs of long-term trends show that the lowest passage rates for all age-classes of Golden Eagles was in 2009. Our 2017 count continues to give us reason for optimism – ***this season we tallied the highest number of Golden Eagles (1476) since 1999 (1870)***. Causes for this long-term decline are not fully understood and thus cannot be addressed in this report (although habitat degradation and fragmentation, with a concomitant reduction in their favored prey (especially jackrabbits) are likely contributing factors).

We are pleased to report that two accipiter species have shown recent increases, with upswings in Sharp-shinned Hawks and Northern Goshawks from extreme lows in passage rates occurring in 2002 (Northern Goshawk) and 2008 (Sharp-shinned Hawk; Fig. 3c).

A remarkable increase in Turkey Vultures recorded at the Bridgers over the past five years suggests these birds are expanding their range northward in response to a warming climate (Fig. 3b). This phenomenon has been documented at other Rocky Mountain migration sites as well as sites throughout the Midwest and eastern North America (as shown by hawkcount.org and rpi-project.org). We predict this continent-wide trend in Turkey Vulture abundance will continue for decades to come. This season a concerted effort was made to conservatively count migrating Turkey Vultures. Numerous resident vultures were identified, and these were sometimes difficult to separate from migrants. Especially warm and remarkably calm weather during the first two weeks of the 2017 count season may have contributed to these thermal-loving birds utilizing the high-mountain Bridger flyway in record numbers.

We are pleased to report generally positive count trends for Red-tailed Hawks, Broad-winged Hawks, Peregrine Falcons, Merlins, and Bald Eagles (Figs. 3d, 3g & 3h). The Red-tailed Hawk has shown a recent upswing since a record low in 2000. Merlins, Peregrine Falcons and Broad-winged Hawks have all shown significant long-term increases, although we have less confidence in these trends due to small sample sizes for these three species (under 15 birds/100 hrs.). It is notable that nationwide count trends generally show gradual long-term declines in Broad-winged Hawk counts in eastern North America (Bildstein et al. 2008; rpi-project.org), but an increasing trend over the past 20 years in the West (Smith et al. 2008). The reason(s) for the Broad-winged Hawk increase in western North America is unknown. Peregrine Falcons are continuing their comeback from historic lows in the early 1970s; their decline (from 1946-1975) was caused by the widespread use of DDT throughout the Americas. In addition, Bald

Eagles have shown a recent upswing from all-time lows in the 2008 & 2009 seasons. This is a reversal from the linear decline that was reported in previous years based on the Bridger counts. Bald Eagles are primarily a late-season migrant, and it is possible that climate change is now causing them to migrate earlier and hence be detected in greater numbers within our count-season window.

Of the remaining eight species, four (Cooper's Hawks, American Kestrels, Northern Harriers, and Rough-legged Hawks) exhibited passage rates exceeding 10 birds/100 hours, and none showed significant long-term count trends in either direction. Ferruginous and Swainson's hawks, Ospreys and Prairie Falcons are all infrequently observed, and these low counts preclude meaningful analyses of trends (see Figs. 3b, 3d & 3g for trend graphs of these species). The significant long-term trend for total raptors ($p < 0.001$, Fig. 3a) illustrates a recent upswing from a low point in 2006, suggesting migratory raptor populations as a whole have generally been doing well in recent years across much of western North America.

Smith et al. (2008a) reported trend analyses for data collected through 2005 for most of the long-term autumn migration studies in western North America, including the Bridger Mountains. These and subsequent analyses (reported by the Raptor Population Index or "RPI" project; see http://www.rpi-project.org for updated trend graphs) are based on a more complex analytical approach (see Farmer et al. 2007, and Crewe et al. 2016) than what was reported in Hoffman and Smith (2003) and used herein to present trend analyses through 2017. With few notable exceptions the long-term trend estimates for each species as calculated by this more complex method generally yield similar results to those obtained from the simpler methodology used herein and described more fully in Hoffman and Smith (2003).

AGE RATIOS:

Overall immature-to-adult ratios this season suggest an improvement from below-average ratios seen in 2016 for most species (see Table 2). Four of the seven species for which we can visually differentiate age classes, and see in statistically significant numbers (this excludes the Broad-winged Hawk), revealed immature: adult age ratios within the 95% confidence interval of the 1992-2016 mean values. Species statistically below the mean were the Northern Goshawk and Red-tailed Hawk. The lone raptor species significantly above the mean was the Cooper's Hawk. Golden Eagles had an immature: adult ratio of 1.1, identical to the long-term average (1.1 ∓ 0.15). It is important to note, however, that this does not reflect the true ratio of first-year birds to adult birds, as the immature category included all non-adult age classes (generally birds from 4 months of age to 3.5 years of age).

RESIDENT RAPTORS:

This year the observers recorded nine raptor species that consistently displayed resident behavior around the observation site. These included the Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-tailed Hawk, American Kestrel, Prairie Falcon, Peregrine Falcon and Golden Eagle. One notable difference this year was a flock of approximately 10 Turkey Vultures that were present throughout the early part of the season. In addition, a few non-adult Bald Eagles were seen showing resident-type behavior in early September and thus recorded as "temporary residents." A single immature Northern Harrier was also seen flying north on one day (6 September).

Turkey Vulture – Historically, Turkey Vultures have only rarely been documented as residents on the Bridger Ridge. However, in both 2016 and 2017 flocks of 8 – 12 individuals frequently cruised up and down the ridgeline near the observation point. In 2017, possibly the same flock, averaging about 8 vultures, was seen regularly at the beginning of the season and persisting through the first week of September. The tendency of the resident vultures to stream overhead, north-to-south, only to return hours later from the south made distinguishing migrants from residents difficult. These thermal-loving

scavengers, migrants and residents, were last seen on 13 September, coinciding with the arrival of the season's first winter storm.

Northern Harrier – A single immature Northern Harrier was seen only on 6 September, clearly flying north along the ridgeline before vanishing in the distance. This bird may have hunted the open fields along the lower slopes of the ski resort, using the updrafts along the ridge to efficiently commute to widely-scattered hunting areas north and south of our observation point.

Sharp-shinned Hawk – Resident Sharp-shinned Hawks were regularly seen from the start of the season until the first prolonged storm, which started on 13 September. This storm left a heavy blanket of snow on the Bridgers. A pair of immature birds, presumably siblings, was often seen hunting, playing and mobbing the decoy owl together throughout this time. A single adult was seen sporadically during this same period flying north, hunting, or mobbing the decoy owls.

Cooper's Hawk – A single immature Cooper's Hawk was identified as a resident at the start of the season and was seen regularly until the first snowstorm began on 13 September. A single adult also exhibited resident-like behavior on 11 September. These birds were observed hunting low in the trees around the observation point and/or mobbing the decoy owl.

Northern Goshawk – Observations of resident Northern Goshawks were relatively rare this season. An immature was seen in late August mobbing the owl and flying north along the ridge. A single adult was seen later, on 18 and 30 October. In addition, an unknown goshawk was seen on 29 September and an adult was seen near Jim Bridger Lodge at the base of the Bridgers on 1 September.

Red-tailed Hawk – Resident Red-tailed Hawks were ubiquitous throughout the early part of the season, sometimes making distinguishing migrants from residents difficult. This activity dropped precipitously after the first winter storm on 13 September, but continued sporadically until the latter part of October. At least a trio of adult light-morphs, likely two pairs, were clearly identified as locals, as well as at least three immature light-morphs through the first half of September. The adults were last seen 13 September, and the immatures were last observed on 20 September. In addition, an immature dark-morph showed resident behavior on the first day of the season but was not seen again. A single adult light-morph Red-tailed Hawk was resident on the ridge from 22 – 25 October, but this was likely a stopover migrant. The resident Red-tailed Hawks would often kite above the ridgeline hunting, or escort passing migrants out of their territory before flying back north.

Golden Eagle – Resident Golden Eagles were common throughout the season until the severe winter storm arrived at the end of October. At least one territorial adult pair was confirmed, with two juveniles. A sub-adult was also regularly seen throughout the season until 27 October. The juvenile birds were last regularly observed on 5 October, whereas the adults persisted until 30 October. They often flew as single individuals, as a pair, or in a group of three or four. The adult pair had several regular perches near the observation platform where they were seen together in the evenings. The adults often displayed to passing migrants with their well-known "roller-coaster" maneuver. The younger eagles also gave this territorial display a try on occasion. In addition, the resident Golden Eagles would escort passing migrants, vocalize, hunt, perch and soar together as a family unit.

Bald Eagle – A single pair of non-adult Bald Eagles were seen deliberately flying north, high overhead on 9 September. A juvenile Bald Eagle was also seen for two consecutive days (on 4 & 5 September) acting like a resident. These birds were only seen once, and because the Bridger Mountains are not typical Bald Eagle habitat we concluded that they were not long-term residents.

American Kestrel – At least a single male/female pair of American Kestrels were resident on the ridge until the first winter storm arrived on 13 September. The male was especially conspicuous thought this time period. These birds were often observed mobbing the decoy owl and hunting migrating butterflies and dragonflies. Kestrels were also common throughout the Bridger Bowl Ski Area, often seen on the daily hike up (likely feasting on the abundant grasshoppers thriving in the grassy ski-runs).

Prairie Falcon – On 4 September a resident Prairie Falcon was first seen hunting along the west slope of the ridgeline. After that it was regularly seen slowly heading south or north, periodically kiting in the wind. Sometimes it would actively hunt the west slope of Tilly Peak, mob the decoy owl, or harass a passing migrant raptor. This resident remained in the area until the end of October, when its near-daily occurrence ceased. This coincided with a severe winter storm that deposited more than two feet of snow atop the Bridger Range.

Peregrine Falcon – Single immature and adult Peregrine Falcons were confirmed as residents. These birds hunted the steep slopes and cliff faces around Tilly Peak, frequently mobbing the decoy owl, and treated the hawk watchers to numerous impressive displays. The immature was seen on the first day of the count and regularly thereafter until the first winter storm on 13 September. The adult resident was positively identified on 28 August and 6 September.

PUBLIC VISITATION:

The Bridger Ridge above the Bridger Bowl Ski Area, in addition to the Hawk Watch, hosts a variety of other outdoor activities the Bozeman community regularly engages in, such as hiking, trail running, and skiing. Despite the unusually persistent hot and smoky conditions during the first few weeks of the 2017 count, and the large amount of snowfall thereafter visitation was quite frequent on the ridge. Pre-season skiing began in earnest by 16 September and continued to the end of the count; it became especially active after the large snowfall in early November. Some visitors to the observation site originated from distant parts of the world, including France, Denmark, Spain and Hungary!

Throughout our fall season we witnessed a steady stream of outdoor enthusiasts; weekends on the Bridger Ridge were generally bustling with runners, hikers and birdwatchers alike. One person was seen paragliding down the ski-slopes on 29 August! Of course, most visitors were from Bozeman or Belgrade; of the approximately 90 people who signed our visitor log, several joined us on multiple occasions, eager for a good raptor-viewing day. A few folks hiked to the top almost every weekend to join us in searching the skies for migrating eagles and other raptors. The official observers were always thankful to have the company to share the raptor migration spectacle!

The 21st annual Bridger RaptorFest (6 – 8 October, see www.bridgerraptorfest.org/), run primarily by volunteers, drew a record number of visitors (~5,000). We had good weather on Friday and Saturday, which inspired many visitors to make the challenging hike to the observation point. Some visitors even travelled from as far away as the West Coast, primarily to witness the RaptorFest. Saturday produced the most visitors (~30) to the helipad (we estimated 50-60 visitors for the entire weekend. Friday was an especially productive day for raptor migration, with the highest daily Golden Eagle count for the season to date (135 eagles and a total of 204 migrating raptors! Things slowed down substantially on Saturday, with only 34 Golden Eagles and 54 total raptors; Sunday the flight was unbearably slow with the onset of the next winter-like storm (only 18 raptors counted). Below, at festival headquarters, folks participated in a wide range of raptor-related activities (kestrel box-building, binocular-viewing, raptor identification lectures, and live-raptor demonstrations) throughout the weekend. The festival also drew a standing room-only crowd for the Friday-night showing of *The Eagle Huntress* at the Ellen Theater (in downtown Bozeman).

During the festival (and throughout the season) raffle tickets for two all-season ski passes at Bridger Bowl were sold by Sacajawea Audubon volunteers. The two ski passes, generously donated by Bridger Bowl, generated revenues of more than $2,500. These funds provided critically-needed support for the 2017 Bridger count.

Steve Hoffman made multiple trips to the ridge throughout the season to enjoy the flight (and the view!). On 30 September he brought a five community members as part of a day-long Sacajawea Audubon Society field trip.

Unfortunately, vandalism is occasionally encountered on Bridger Ridge during the Hawk Watch. On 28 August much litter (candy wrappers, etc.) was left on the helipad, and our chairs were tossed downslope. Three motorcyclists also were present on Bridger Ridge that day (which is illegal and most destructive to the mountain's fragile resources). Fortunately these events were isolated incidents; visitors to the ridge were generally respectful and represented their respective communities well.

OTHER WILDLIFE:

Sitting on a prominent ridgetop for eight hours every day throughout the fall is not only a great way to observe large numbers of diurnal raptors in flight, but affords opportunities to enjoy many other wildlife species as well. Several species of mammals along with numerous resident and migrant songbirds were observed throughout the season. Mountain Chickadees, Red-breasted Nuthatches, Clark's Nutcrackers and Steller's Jays were regularly observed near the observation point; the chickadees and nuthatches became so acclimated to our presence they landed on the observers! For complete bird lists taken daily from the observation point please refer to the Bridger Bowl Hawk Watch Hotspot on the eBird website: ebird.org/ebird/hotspot/L2979461.

Early in the season the observers witnessed unusually large swarms of tiny flying insects, which seemed to attract a variety of songbirds to Bridger Ridge. Especially prevalent were Townsend's, Yellow-rumped, Orange-crowned and Wilson's warblers as well as Ruby-crowned Kinglets. Other songbirds attracted to the insect hatch included Mountain Chickadees, Rock Wrens and Red-breasted Nuthatches.

Dragonflies were observed migrating throughout September, and these were preyed upon by several raptor species, especially American Kestrels. A few butterflies were also noted on the ridge during the early, warmer fall days. Early in the season ladybugs were seen emerging from the rocks during especially warm days.

Most ubiquitous among the resident birds observed from the observation point were corvids. Common Ravens and Clark's Nutcrackers were abundant. Ravens would often interact with the migrating raptors, play among themselves, or harass the decoy owls while always engaging in a vast array of vocalizations. Steller's Jays, American Crows (three migrating flocks of 100-150 individuals each were noted in late September through mid-October) and Black-billed Magpies were also observed periodically. Other birds observed along Bridger Ridge included woodpeckers (Northern Flicker, Hairy and Downy woodpeckers, and Red-naped Sapsucker), thrushes (American Robin, Townsend's Solitaire and Swainson's Thrush), Cassin's Finch, Dusky Grouse, Dark-eyed Junco and Chipping Sparrow. A single Pileated Woodpecker was heard on 8 October.

In the first half of the season Mountain Bluebirds migrated along the ridge in flocks of 10-50 birds. During the latter half of the season a completely different suite of migrating songbirds, primarily finches, dominated avian activity. These included Pine Grosbeaks, Pine Siskins and Red Crossbills. Most

impressive were large flocks of Bohemian Waxwings, which started moving south daily in the hundreds in late October. Even more impressive were Gray-crowned Rosy-Finches that migrated by in flocks that sometimes numbered more than a thousand individuals! These birds began migrating steadily through in mid-October. On several occasions the massive rosy-finch flocks landed nearby the observation point, providing spectacular views!

On 4 September a flock of 15 Canada Geese migrated past the observation point far off to the east. Later that day a flock of 18 Double-crested Cormorants migrated over the Bridgers; these crossed west-to-east through Ross Pass. Ring-billed Gulls were observed migrating on two separate occasions: a single individual on 19 October, and a flock of five on 23 October. During the last few days of the count season large flocks of Snow Geese were regularly seen flying over Bridger Ridge and through Gallatin Valley. On 5 November a large flock of about 300 individuals flew over the ridge early in the day. Other notable migrants were a small group of three White-throated Swifts on 27 September, a lone Northern Shrike on 19 October, seven Evening Grosbeaks on 18 October, and 30 Eurasian Starlings on 23 October.

At least one weasel (long-tailed/short-tailed) was observed a few times, and may have resided beneath the heli-platform. It hunted among the surrounding rocks, and on one occasion was observed carrying a freshly-killed vole. The weasel was first seen 19 October, when it showed an interesting transition of brown and white pelage coloration.

Black bear sign was observed throughout September (in the form of scat and tracks) on the ski slopes where there was a plentiful supply of late-season berries. Small herds of mule deer were a common sight around Bridger Bowl, sometimes observed within a few hundred feet of the ridgeline. An elk herd has been resident in the Bridger Canyon for several years, and on 2 September (opening day of archery season) a group of four was seen in the ski-area parking lot. A coyote resided in the area throughout the season, and was seen traveling along the ridgeline on 11 and 18 September, and 27 October; coyote tracks were commonly observed while hiking up and down. Most exciting this year was a lone resident mountain lion; lion tracks were noted frequently on the ridge (and just below) throughout October. A single antlerless moose was observed traversing along the open hillside, midway down the ski-area on 24 October. Throughout the season the local red squirrels were a near-constant source of entertainment as they busily harvested pine cones for their winter caches.

A pair of mountain goats was often seen throughout the season, especially after mid-October. A large, solitary billy goat was also observed during this period. Large groups of goats were less common than previous years; a group of five passed near the observation point on 24 October. At times the goats would occupy the west face of Tilly Peak for days at a time. On a few occasions the goats passed extremely close to the observation site (within 5 meters) on their habitual treks along the ridgeline. An unusual observation was made on 18 October, when a sub-adult Golden Eagle stooped on a full-grown billy goat sleeping on the west side of Tilly. The startled goat reared up and stomped at the eagle, but by that point the eagle had already lost interest and was flying away!

PROJECT PUBLICITY:

The Bridger Bowl Hawk Watch Project received welcome publicity in 2017 in the form of radio interviews and magazine spotlights; it will also be featured in an upcoming wildlife film. Before the season started an article was published in *Alaska Beyond Magazine* (in the August issue), the official publication of *Alaska Airlines*. Bret Davis and Steve Hoffman were interviewed for the article. Multiple radio interviews were given throughout the season. One was done in early September by KGLT, the community radio station that broadcasts throughout southwest Montana. Bret was interviewed by DJ Mikaela Howie; the segment lasted for about 20 minutes! Another interview was given on 10 October by

Nate Hegyi of Yellowstone Public Radio, which broadcasts throughout Montana and northern Wyoming. This interview is accessible on the web via http://ypradio.org/term/golden-eagles#stream/0. Nate came up to Bridger Ridge and conducted his interviews from the observation point, carrying his equipment all the way up on the two-mile hike. As part of a documentary film being produced by Grizzly Creek Films, entitled Birds of Greater Yellowstone, footage was shot on the ridge by Eric Bendick and others over a two-day period. The first day of shooting, despite good weather, was slow for migrating Golden Eagles, (the presumed star of this film segment). The filmmakers returned on 10 October and were rewarded with a strong flight of Golden Eagles (93 birds recorded!) and other raptors, including a close fly-by of a Northern Goshawk. We hope to continue this trend of publicity in the future, since public engagement with the community is a stated objective of the project, and will hopefully help inspire much-needed public awareness and environmental activism.

COLLABORATION WITH MONTANA STATE UNIVERSITY:

This year we made an active effort to further engage the local community in the Bridger Ridge Hawk Watch by reaching out to ecology, wildlife and wildlife-documentary film-making students at Montana State University (MSU). As a result, a total of five energetic and enthusiastic undergraduate students, interested in learning more about the project, as well as birds, bird migration and doing field work made the trek to the ridgetop for at least one day. A graduate student of MSU and substitute hawk counter David Laufenberg contributed substantially by making the Bridger Bowl Hawk Watch dataset one of the options for a class project in his Introductory Ecology class. Several students chose to work with the Bridger dataset, conducting some thoughtful data analysis and interpretation.

RECOMMENDATIONS

The wisdom of initiating the count on 27 August (for the second consecutive season) was clearly borne out by our counts during these first five days of the season. On these first five count days we tallied 128 raptors (4.7% of the seasonal raptor total) of 13 species, including 12 Turkey Vultures (41% of the seasonal total), 31 Red-tailed Hawks (15%), 9 Golden Eagles (0.6%) and 17 American Kestrels (23%). Golden Eagles were recorded migrating four out of the first five days of the count. Since it appears that the migration is already well underway by 27 August ***we recommend initiating the Bridger count EARLIER than 27 August in the coming years (perhaps 5 days earlier, or 22 August)***. There are a growing number of studies showing a trend toward earlier fall raptor movements, presumably due to climate change (see Filippi-Codaccioni et al. 2010, Jean-Francois Therrien et al. 2017). The primary hypothesis is that, with earlier breeding and earlier fledging, and with key prey species becoming less abundant earlier during the late summer period, many raptors may be initiating their migration earlier relative to what has been the norm over the past several decades.

ACKNOWLEDGMENTS

Generous funding for the 2017 field season was provided by NaturEner USA, a wind energy company active in northern Montana (their critically important 2017 support was facilitated by Steve Laufenberg), USDA Forest Service, Custer Gallatin National Forest (2017 funding facilitated by Forest Biologist Randy Scarlett), Sacajawea Audubon Society (SAS), Northwestern Energy (Bozeman Office; support facilitated by Heather Bellamy), Bridger Bowl Ski Area (support facilitated by Doug Wales), CRH, Inc. (which operates the Trident Cement Plant near Three Forks; support facilitated by Greg Gannon), Elizabeth Henderson Wakeman Charitable Trust (support facilitated by Stephen Eshbaugh), and many generous individual contributors to SAS. Randy Elliott and Doug Wales of Bridger Bowl provided

essential logistic support. Of special importance was full-season access to the Bridger Bowl ski-patrol hut on Bridger Ridge for both overnight lodging and shelter from foul weather. Randy Scarlett and Wendy Urie of Custer-Gallatin National Forest coordinated appropriate US Forest Service access permits and portable toilets. We especially wish to thank Martha and Hobart Collins for providing comfortable in-town lodging for Adam Bradley during his weekly day off the mountain. The weekly day off for the observers was facilitated by the following volunteers who generously contributed their expertise during numerous full-day counts: Chris Smith, Matt Keefer, Mikaela Howie, Paulette Epple, Ben Rosemeyer and David Laufenberg. We also wish to thank Mikaela Howie, Nate Hegyi, and Eric Bendick for helping to publicize this important project, actively disseminating information to the general public via major media outlets, and thus helping to spread awareness about the project's importance.

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Table 1. Species-specific average counts (1992 – 2016) versus 2017 count and historic high counts of fall migrating raptors in the Bridger Mountains, MT.

		1992-2016				All-time Historic Records	
	Species	Mean Count	± 95 % CI	2017	% Change	Record Count	Year
	Turkey Vulture	4	± 2	29	217	29	2017
	Osprey	7	± 2	7	78	22	2015
	Northern Harrier	57	± 19	50	-22	230	1998
Accipiters							
	Sharp-shinned Hawk	360	± 51	321	71	658	2015
	Cooper's Hawk	175	± 28	191	13	347	1997
	Northern Goshawk	32	± 8	39	92	96	1992
	TOTAL ACCIPITERS	*613*	± *81*	*596*	*53*	*1096*	*2015*
Buteos							
	Broad-winged Hawk	14	± 5	11	118	48	2013
	Swainson's Hawk	4	± 1	5	6	11	1992
	Red-tailed Hawk	138	± 33	208	56	389	2015
	Ferruginous Hawk	3	± 1	5	-6	8	2014
	Rough-legged Hawk	38	± 9	64	102	96	2015
	TOTAL BUTEOS	*210*	± *45*	*312*	*65*	*552*	*2015*
Eagles							
	Golden Eagle	1330	± 123	1476	8	1871	1996
	Bald Eagle	78	± 10	69	-1	128	2000
	TOTAL EAGLES	*1414*	± *128*	*1549*	*7*	*1966*	*1999*
Falcons							
	American Kestrel	83	± 18	74	7	181	2015
	Merlin	13	± 3	22	164	36	2015
	Prairie Falcon	14	± 2	13	1	22	2006
	Peregrine Falcon	13	± 4	13	134	34	2012
	TOTAL FALCONS	*130*	± *23*	*128*	*31*	*251*	*2015*
	GRAND TOTAL	**2464**	**± 220**	**2696**	**25**	**3532**	**1998**

Table 2. Fall counts by age class and immature[1]: adult ratios for selected species of migrating raptors in the Bridger Mountains, MT: 1992–2016 versus 2017.

	Total and Age-classified Counts						% Unknown Age		Immature : Adult Ratio		
	2017			1992-2016 average							
	Imm	Adult	Total	Imm.	Adult.	Total	1992–2016[2]	2017	1992–2016[1]		2017
Northern Harrier	32	7	50	26	14	56	33 ± 3	22	3.1 ±	2.4	4.6
Sharp-shinned Hawk	81	117	321	74	140	371	43 ± 8	38	0.6 ±	0.1	0.7
Cooper's Hawk	83	47	191	48	58	176	40 ± 8	32	0.9 ±	0.2	1.8
Northern Goshawk	13	13	39	13	12	34	29 ± 7	33	1.8 ±	0.5	1.0
Red-tailed Hawk	46	116	208	44	66	141	22 ± 5	22	0.7 ±	0.2	0.4
Golden Eagle	573	499	1476	508	478	1334	26 ± 4	25	1.1 ±	0.2	1.1
Bald Eagle	27	42	69	27	47	78	5 ± 2	0	0.6 ±	0.1	0.6

[1] Northern Harrier immature counts were only from birds positively identified as being immatures (a "brown" category is recorded when immatures are indistinguishable from adult females and used in this table as "unknown age"), and adult values are the sum of adult males and adult females. For Golden and Bald eagles, values for the "immature" category represent the combined totals for subadult, non-adult, and immature counts.

[2] Mean ± 95% confidence interval. For age ratios, note that the long-term mean immature: adult ratio is an average of annual ratios and may differ from the value obtained by dividing long-term total numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in both total numbers and the observed age ratios.

Figure 1. Location of the Bridger Mountains Raptor Migration Project study site.

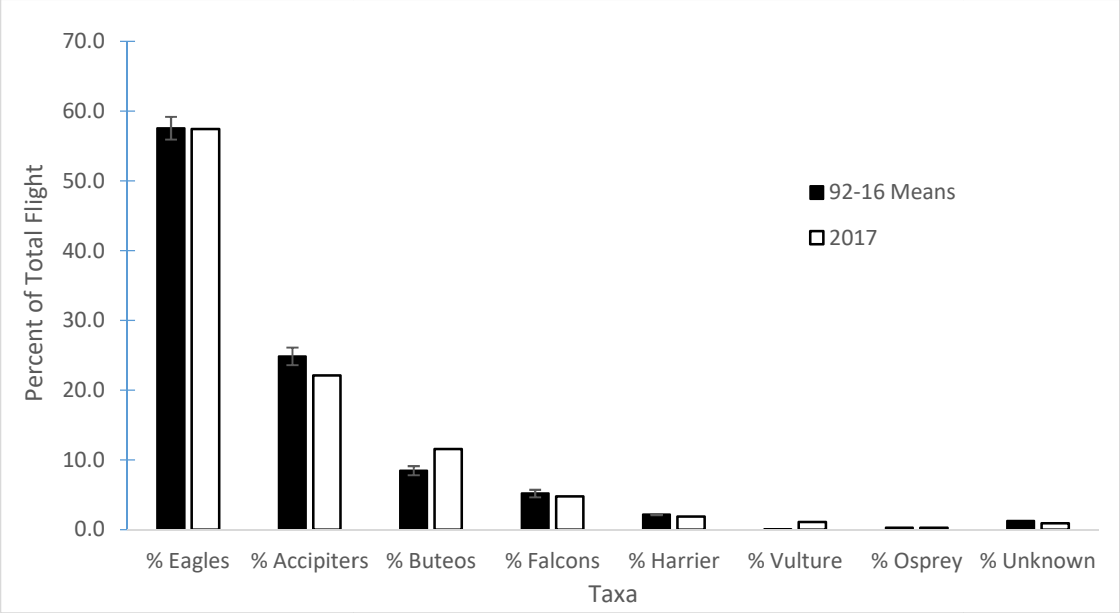


Figure 2. Fall raptor migration flight composition by major species groups in the Bridger Mountains, MT: 2017 versus 1992-2016 mean. (Note: error bars are one standard deviation.)

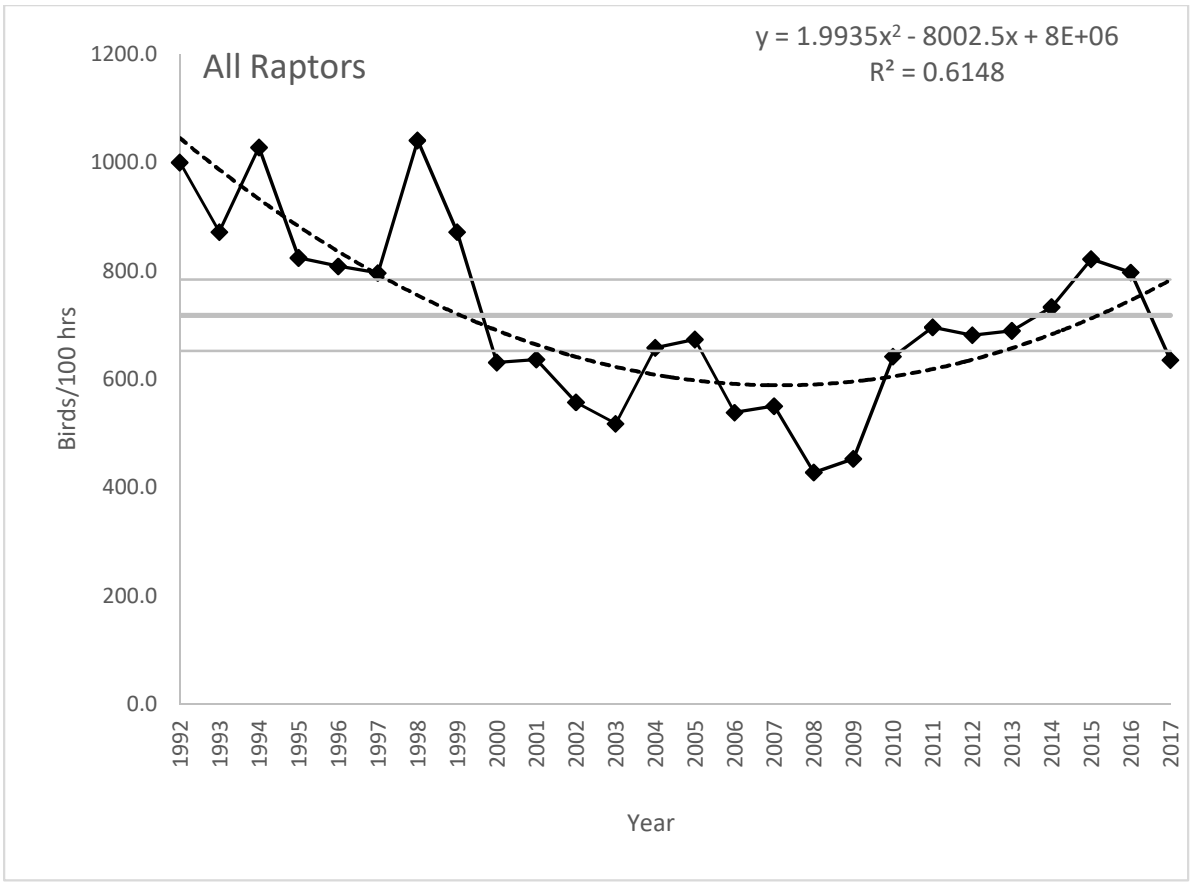


Figure 3a. Effort-adjusted fall migration passage rates for all diurnal raptors in the Bridger Mountains, MT. Dashed line indicates significant ($p < 0.05$) population trend based on quadratic regression. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).

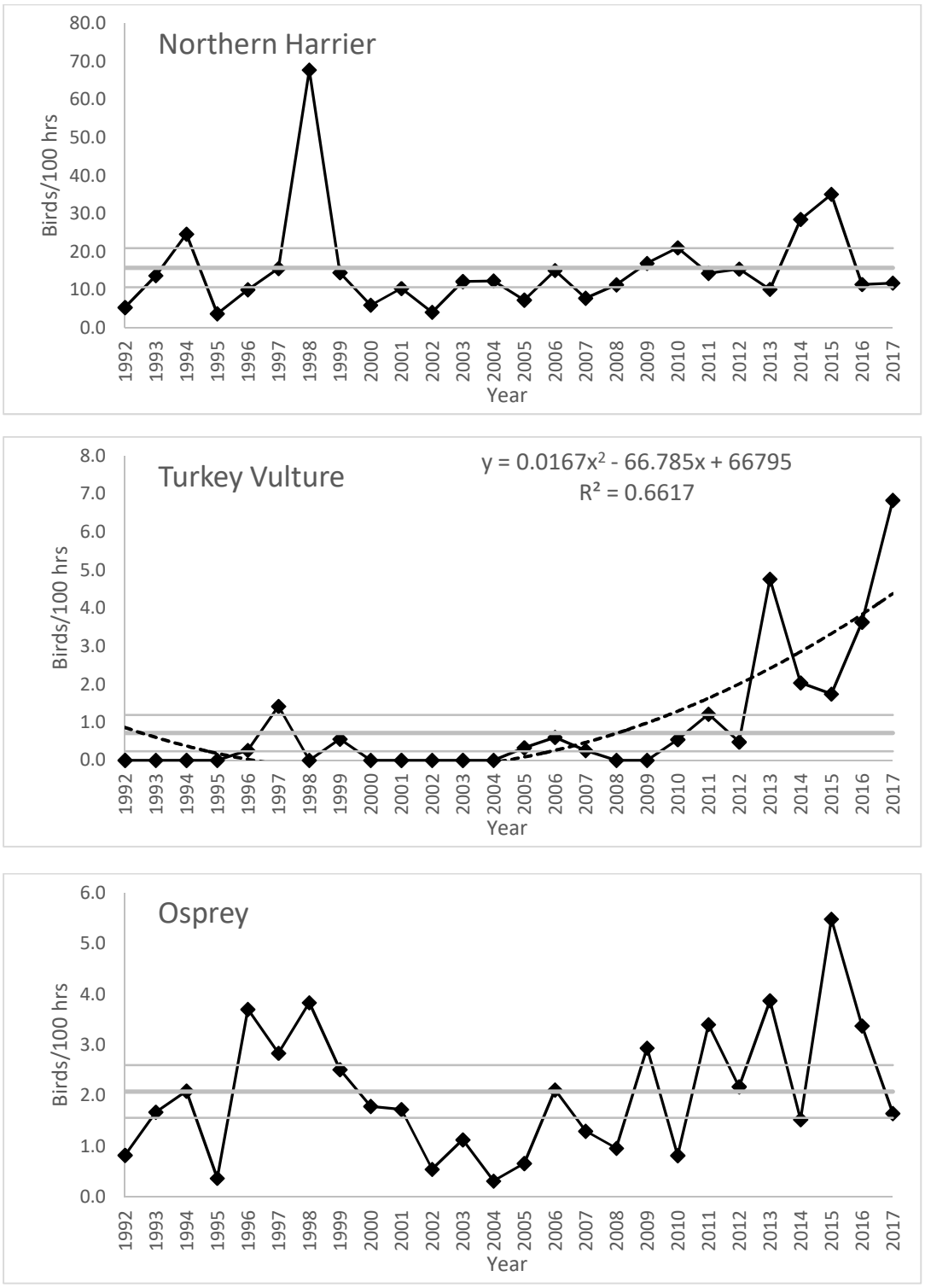


Figure 3b. Effort-adjusted fall migration passage rates for Turkey Vultures, Ospreys and Northern Harriers in the Bridger Mountains, MT. Dashed lines indicate significant ($p < 0.05$) population trend based on quadratic regression. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).

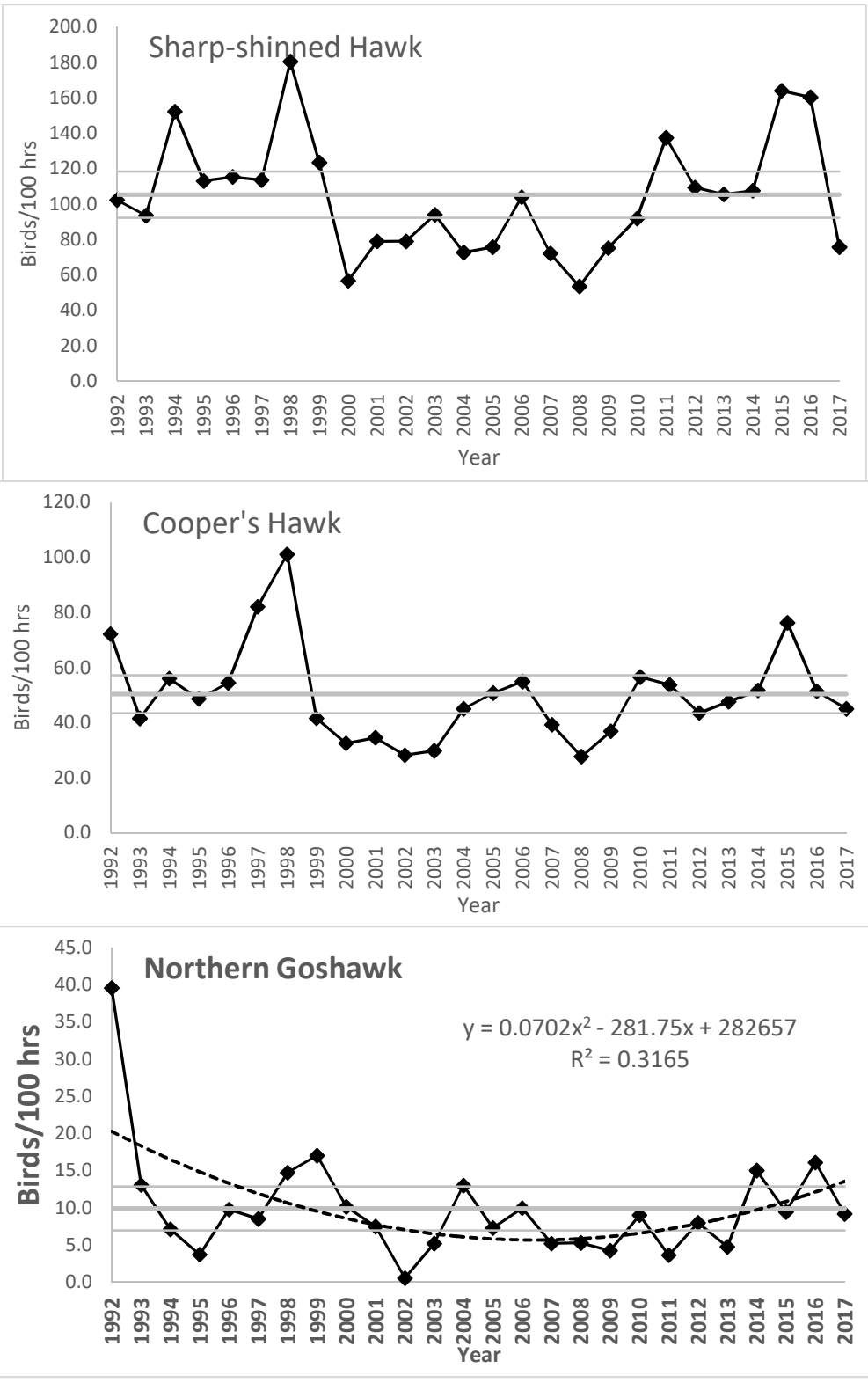


Figure 3c. Effort-adjusted fall migration passage rates for Sharp-Shinned Hawks, Cooper's Hawks and Northern Goshawks in the Bridger Mountains, MT. Dashed line indicates significant ($p < 0.05$) population trend based on quadratic regressions. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).

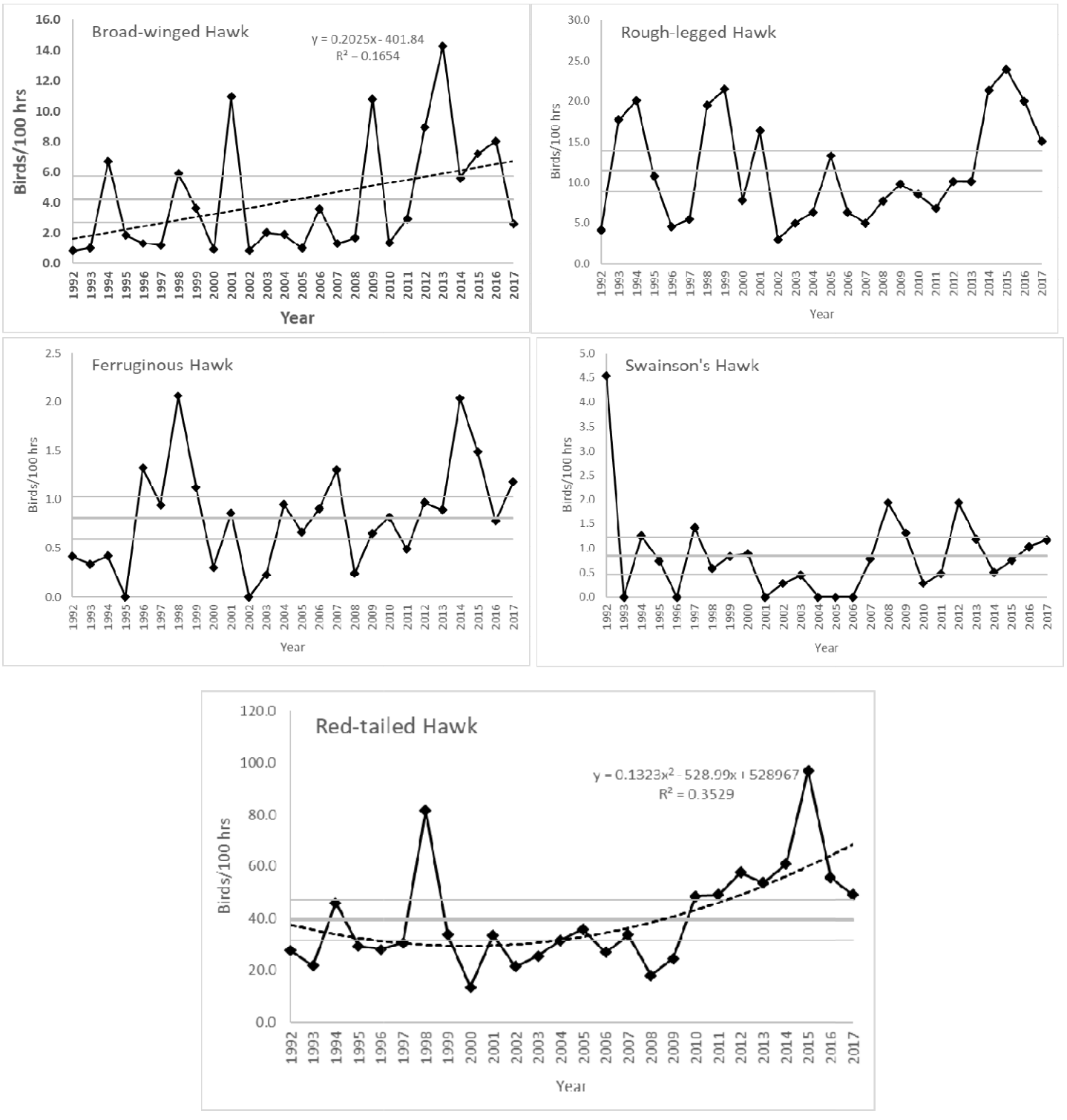


Figure 3d. Effort-adjusted fall migration passage rates for Red-tailed, Broad-winged, Rough-legged, Ferruginous and Swainson's hawks in the Bridger Mountains, MT. Dashed line indicates significant ($p < 0.05$) population trend based on quadratic (Red-tailed Hawk) and linear (Broad-winged Hawk) regression analyses. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).

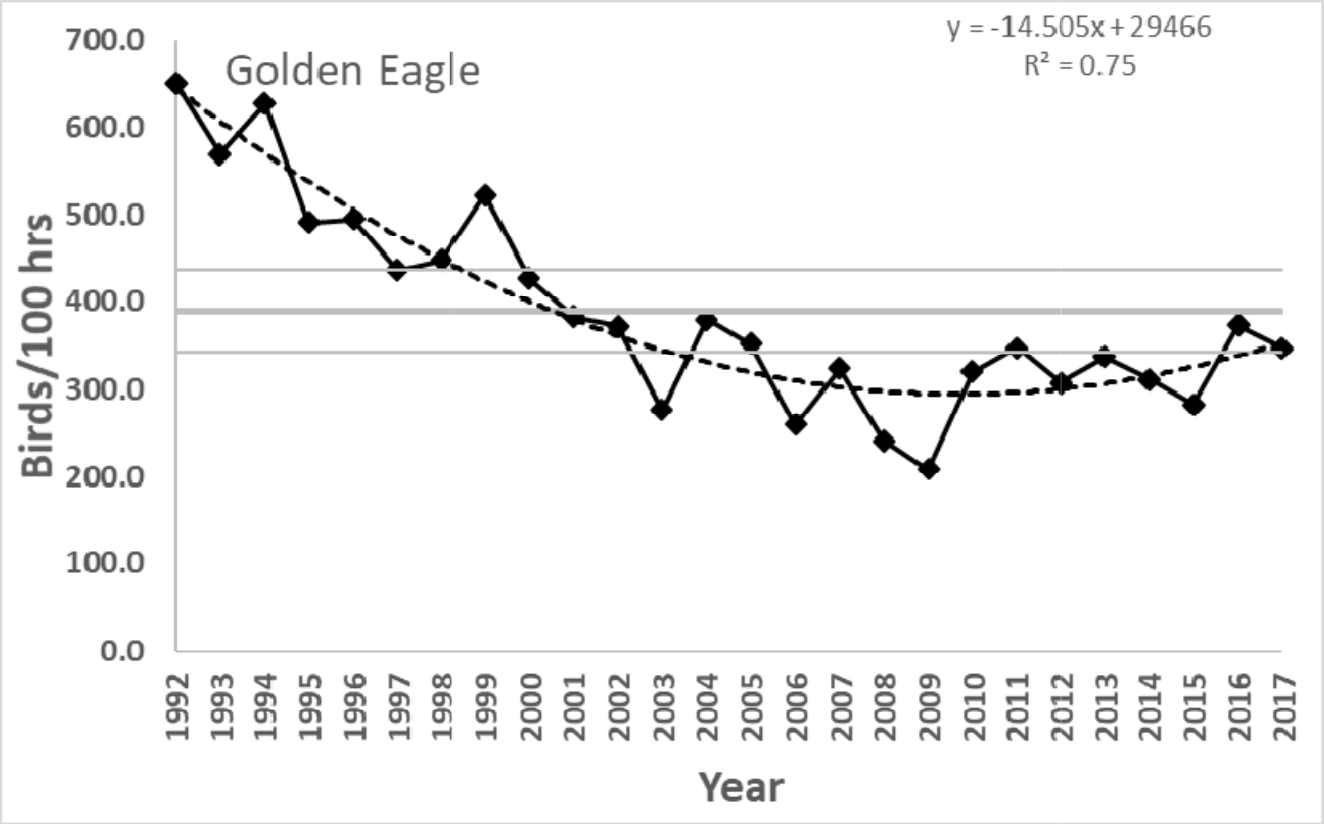


Figure 3e. Effort-adjusted fall migration passage rates for all Golden Eagles in the Bridger Mountains, MT. Dashed line indicates significant ($p < 0.05$) population trend based on quadratic regressions. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).

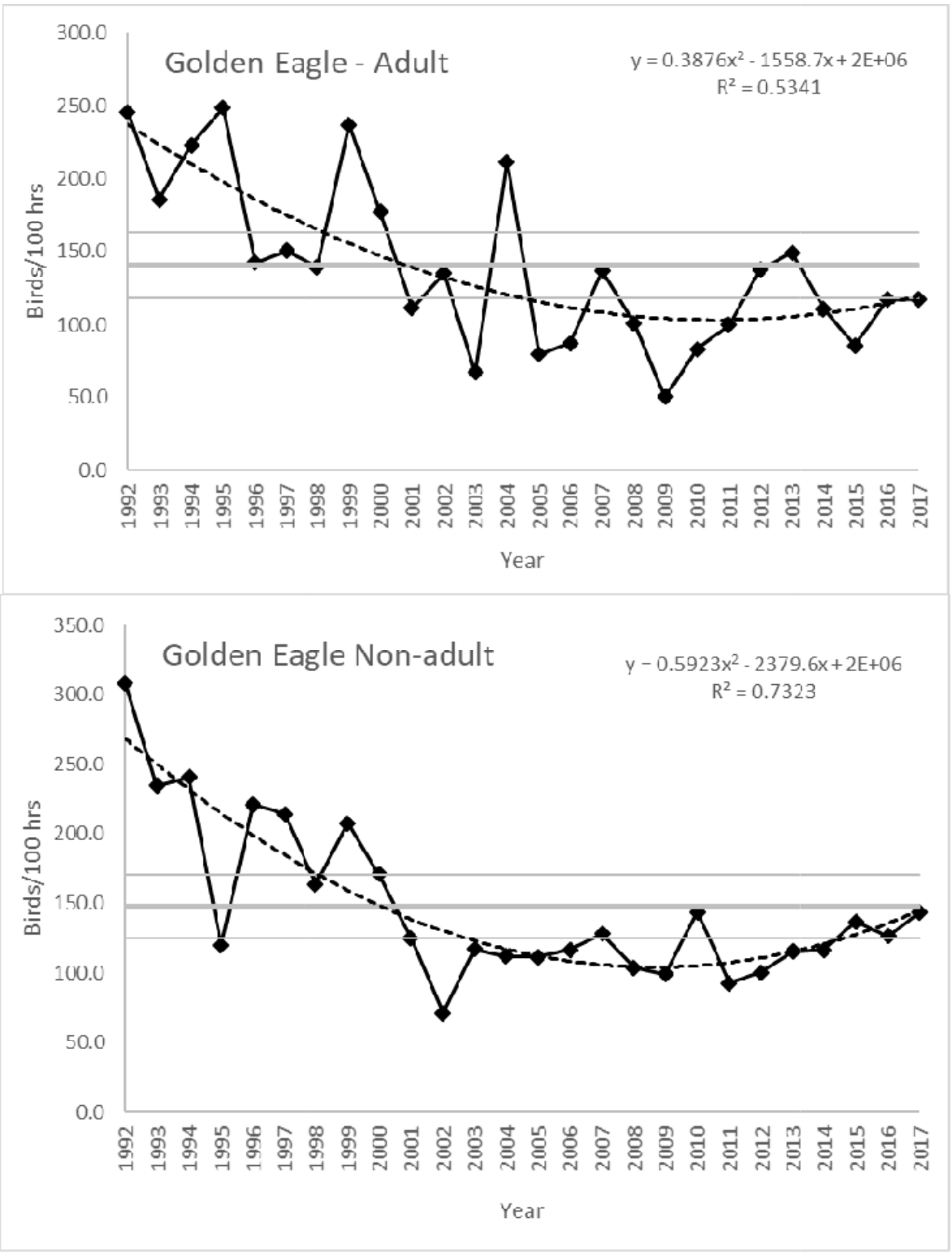


Figure 3f. Effort-adjusted fall migration passage rate comparison for adult vs. non-adult Golden Eagles (includes subadult, immature and non-adult birds) in the Bridger Mountains, MT. Dashed line indicates significant ($p < 0.05$) population trend based on quadratic regressions. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).

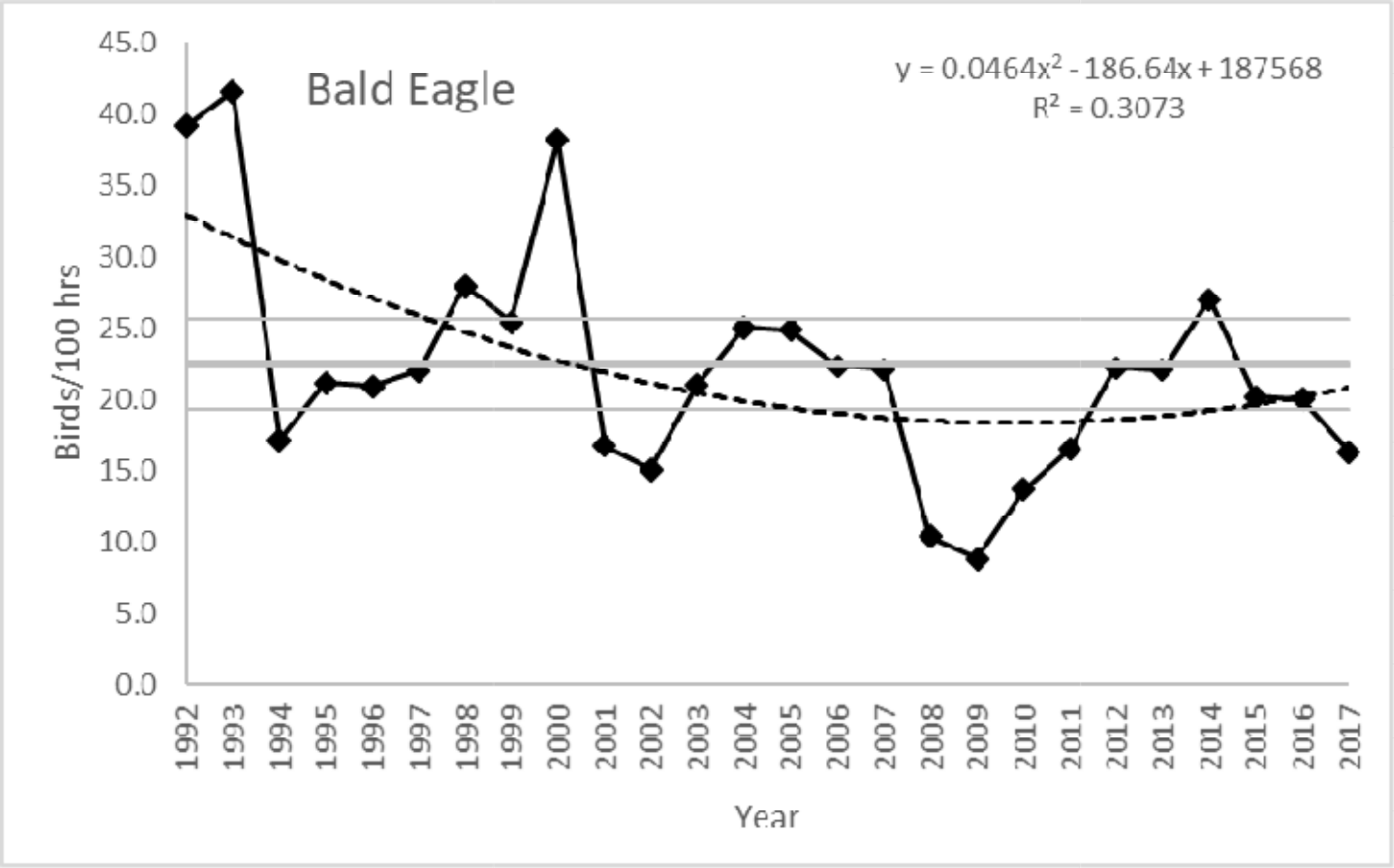
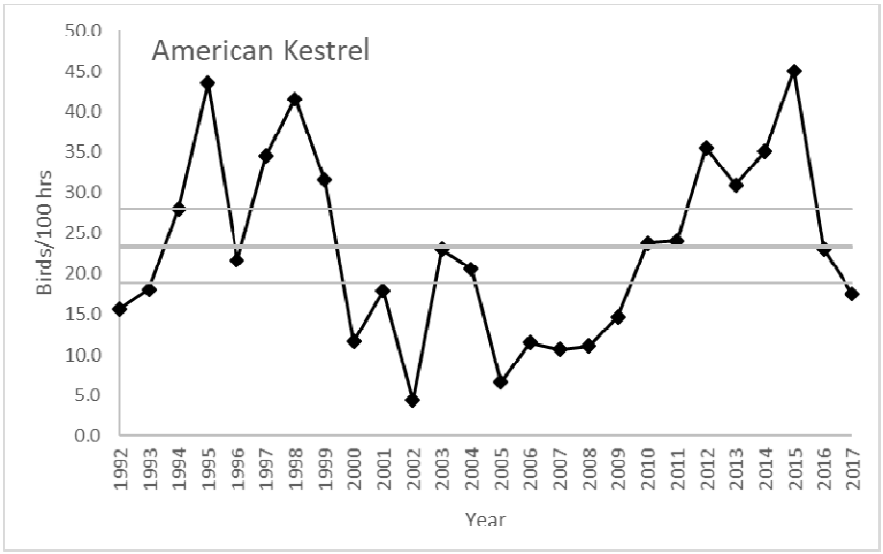
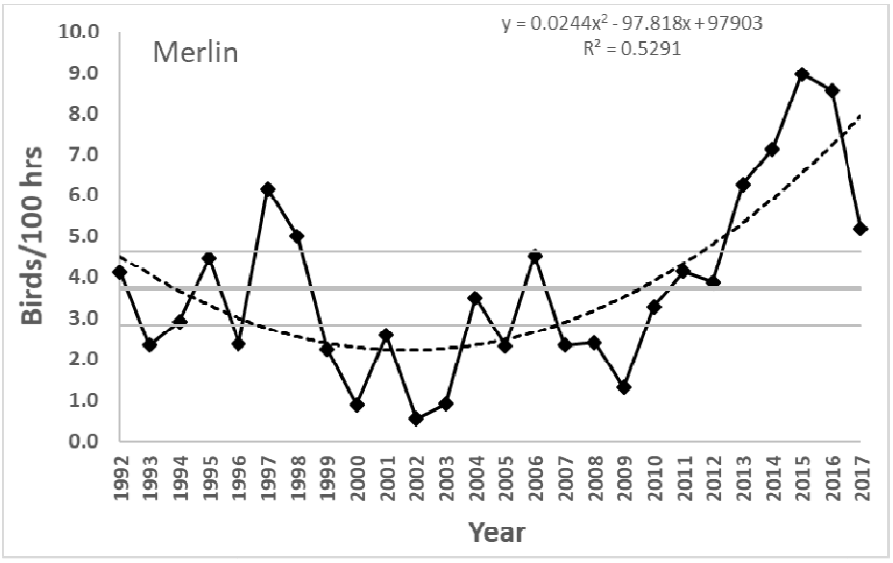
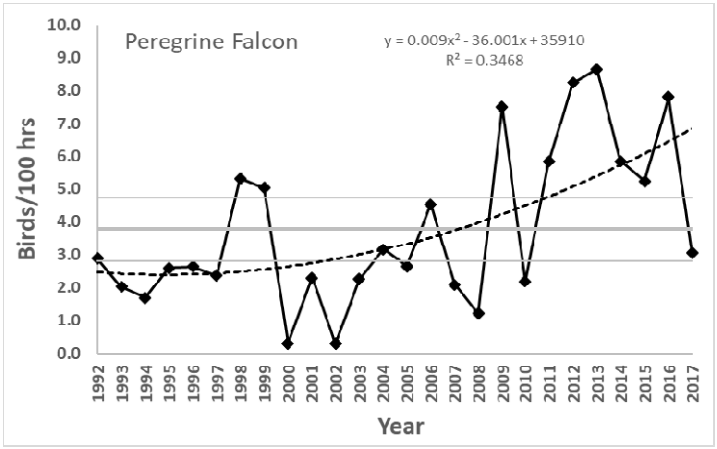


Figure 3g. Effort-adjusted fall migration passage rates for Bald Eagles in the Bridger Mountains, MT. Dashed line indicates significant ($p < 0.05$) population trend based on quadratic regression. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).







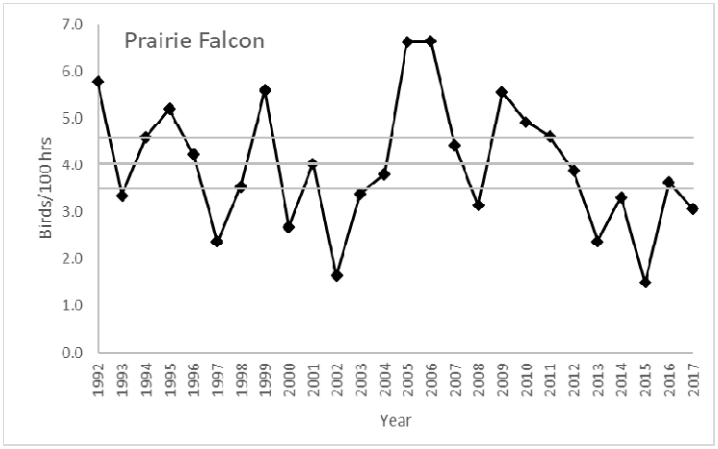


Figure 3h. Effort-adjusted fall migration passage rates for Merlins, Peregrine Falcons, Prairie Falcons and American Kestrels in the Bridger Mountains, MT. Dashed line indicates significant ($p < 0.10$) population trend based on quadratic regressions. Solid grey lines represent mean (thick) and upper and lower 95% confidence intervals (thin) of historical counts (1992-2017).

Appendix A. Common and scientific names, species codes, and age, sex and color-morph classifications for all diurnal raptor species observed during fall migration in the Bridger Mountains, MT.

Common Name	Scientific Name	Species Code	Age[1]	Sex[2]	Color Morph[3]
Turkey Vulture	*Cathartes aura*	TV	U	U	NA
Osprey	*Pandion haliaetus*	OS	U	U	NA
Northern Harrier	*Circus cyaneus*	NH	A I Br U	M F U	NA
Sharp-shinned Hawk	*Accipiter striatus*	SS	A I U	U	NA
Cooper's Hawk	*Accipiter cooperii*	CH	A I U	U	NA
Northern Goshawk	*Accipiter gentilis*	NG	A I U	U	NA
Unknown small accipiter	*A. striatus* or *cooperii*	SA	U	U	NA
Unknown large accipiter	*A. cooperii* or *gentilis*	LA	U	U	NA
Unknown accipiter	*Accipiter* spp.	UA	U	U	NA
Broad-winged Hawk	*Buteo platypterus*	BW	A I U	U	D L U
Swainson's Hawk	*Buteo swainsoni*	SW	U	U	D L U
Red-tailed Hawk	*Buteo jamaicensis*	RT	A I U	U	D L U
Ferruginous Hawk	*Buteo regalis*	FH	A I U	U	D L U
Rough-legged Hawk	*Buteo lagopus*	RL	U	U	D L U
Unknown buteo	*Buteo* spp.	UB	U	U	D L U
Golden Eagle	*Aquila chrysaetos*	GE	I, S, NA, A, U[4]	U	NA
Bald Eagle	*Haliaeetus leucocephalus*	BE	I, S1, S2, NA, A, U[5]	U	NA
Unknown eagle	*Aquila* or *Haliaeetus spp.*	UE	U	U	NA
American Kestrel	*Falco sparverius*	AK	U	M F U	NA
Merlin	*Falco columbarius*	ML	AM Br	AM U	NA
Prairie Falcon	*Falco mexicanus*	PR	U	U	NA
Peregrine Falcon	*Falco peregrines*	PG	A I U	U	NA
Gyrfalcon	*Falco rusticolus*	GY	A I U	U	W G D
Unknown small falcon	*F. sparverius* or *columbarius*	SF	U	U	NA
Unknown large falcon	*F. mexicanus* or *peregrines*	LF	U	U	NA
Unknown falcon	*Falco* spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

[1] Age codes: A = adult, I = immature, Br = brown (adult female or immature), U = unknown age.
[2] Sex codes: M = male, F = female, U = unknown.
[3] Color morph codes: D = dark or rufous, G = gray; L = light, W = white; U = unknown, NA = not applicable.
[4] Golden Eagle age codes: I = Immature: juvenile or first-year bird, bold white wing patch visible below, bold white in tail, no molt; S = Subadult: white wing patch weak or absent, obvious white in tail and molt or tawny bar visible on upper wing; NA = Not adult: unknown age immature/subadult; A = Adult: no white in wings or tail; U = Unknown.
[5] Bald Eagle age codes: I = Immature: juvenile or first-year bird, dark breast and tawny belly; S1 = young Subadult: Basic I and II plumages, light belly, upside-down triangle on back; S2 = older Subadult: Basic III plumage, head mostly white with osprey-like dark eye line and usually a dark terminal band on tail; NA = Not adult: unknown age immature/subadult; A = Adult: includes near adult with dark flecks in head and weak dark tail tip, and adult with completely white head and tail; U = Unknown.

Appendix B. A complete history of primary observers for the Bridger Mountains Raptor Migration Project (1991-2017). Numbers given in parentheses indicate the number of full seasons of previous raptor migration counting experience.

1991: Variable teams throughout: Kristian Shawn Omland (0), Phil West (1), LisaBeth Daly (2), Craig Limpach (1)
1992: Two observers throughout: Emily Teachout (1), Phil West (2)
1993: Two observers throughout: Adam Kaufman (0), Anne-Marie Gillesberg (0)
1994: Two observers throughout: Chris Gill (0), Stephanie Schmidt (1)
1995: Two observers throughout: Scott Harris (0), Sue Thomas (0)
1996: Two observers throughout: Jason Beason (0), Niels Maumenee (0)
1997: Two observers throughout: Jason Beason (1), Patty Scifres (0)
1998: Two observers throughout: Jason Beason (2), Mike Neal (0)
1999: Two observers throughout: Mike Neal (2), Greg Levandoski (1)
2000: Two observers throughout: Ryan Wagner (1), Tracy Elsey (0)
2001: Two observers throughout: Ryan Wagner (2), Jeff Maurer (4)
2002: Two observers throughout: Matt Proett (0), Marg Lomow (2; half-season), Maureen Essen (0; half-season)
2003: Two observers throughout: Samantha Burrell (0), Carl Bullock (0)
2004: Two observers throughout: Allison Peterson (0), John Bell (0)
2005: Two observers throughout: Corey Michell (0), Beau Fairchild (0)
2006: Two observers throughout: Brian Cook (0), Jamie Granger (0)
2007: Two observers throughout: Jody Vogeler (0), Brenden McGugin (0)
2008: Two observers throughout: Amy Seaman (0), Michaela Hitchcock (0), John Bell (2)
2009: Two observers throughout: Caitlin Kroeger (0), Jason Minné (0)
2010: Two observers throughout: Jamie Hogberg (0), David Laufenberg (0)
2011: Two observers throughout: Brian Connelly (3), John Martineau (0)
2012: Two observers throughout: Bret Davis (0), Kalon Baughan (0)
2013: Two observers throughout: Bret Davis (1), Kalon Baughan (1)
2014: Two observers throughout: Bret Davis (2), Mikaela Howie (0)
2015: Two observers throughout: Andrew Eberly (2), Bridget Bradshaw (1)
2016: Two observers throughout: Bret Davis (5), Jess Cosentino (3)
2017: Two observers throughout: Bret Davis (6), Adam Bradley (0)

Appendix C. Daily observation effort and raptor migration counts by species in the Bridger Mountains, MT, Fall 2017. (see Appendix A for species codes)[1]

Date	Obs. Hours	TV	OS	BE	NH	SS	CH	NG	BW	RT	RL	SW	FH	GE	AK	ML	PG	PR	UA	UB	UF	UE	UU	Grand Total	Birds per Hour
27-Aug	8.0	1	0	2	3	6	4	0	0	4	0	0	0	3	7	1	0	0	1	0	0	0	2	34	4.3
28-Aug	8	0	0	0	0	3	3	0	0	3	0	0	0	2	2	0	0	1	0	0	0	0	0	14	1.8
29-Aug	8	1	0	0	0	4	3	1	0	4	0	0	1	0	4	0	0	1	0	0	0	0	0	19	2.4
30-Aug	7.8	0	0	0	1	4	1	0	0	7	0	0	1	1	1	0	1	0	1	2	0	0	1	21	2.7
31-Aug	8	10	0	0	1	3	3	0	0	13	0	0	0	3	3	0	0	1	2	1	0	0	0	40	5.0
1-Sep	8	1	0	0	0	4	3	0	0	1	0	0	0	2	1	0	1	0	0	1	0	0	0	14	1.8
2-Sep	8	1	1	0	0	1	1	0	0	3	0	0	0	2	0	0	1	0	0	1	0	0	0	11	1.4
3-Sep	8	2	0	0	0	2	2	0	0	3	0	1	0	2	0	0	0	1	0	0	0	0	3	16	2.0
4-Sep	8	0	2	1	5	5	3	0	0	8	0	2	0	4	5	1	0	0	1	0	0	0	0	37	4.6
5-Sep	8	0	0	1	3	3	13	0	0	5	0	0	0	2	6	0	0	0	1	0	1	0	0	35	4.4
6-Sep	8	0	0	0	0	11	16	0	0	4	0	0	0	2	5	0	0	0	2	0	0	0	0	40	5.0
7-Sep	8	1	0	0	2	5	13	0	0	3	0	0	0	3	6	0	1	0	1	0	0	0	2	37	4.6
8-Sep	8	3	0	0	3	11	12	0	0	9	0	0	0	3	6	0	0	0	2	0	0	0	0	49	6.1
9-Sep	7	4	0	0	0	7	6	0	0	7	0	0	0	1	4	0	0	0	0	0	0	0	3	32	4.6
10-Sep	8	3	0	1	0	11	7	1	0	13	0	0	0	3	3	0	1	0	2	0	0	0	0	45	5.6
11-Sep	8	0	0	0	1	3	10	2	0	8	0	1	0	4	3	0	0	0	4	0	0	0	1	37	4.6
12-Sep	8	0	0	0	3	9	12	0	0	7	0	0	0	5	4	0	1	1	4	1	2	0	3	52	6.5
13-Sep	5.5	1	1	0	0	7	11	0	1	4	0	0	0	4	4	0	1	0	0	0	0	0	0	34	6.2
14-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
15-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
16-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
17-Sep	8	0	0	1	0	1	1	0	1	4	0	1	0	9	0	0	0	0	0	1	0	0	0	19	2.4
18-Sep	4	0	0	0	1	1	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	6	1.5
19-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
20-Sep	4	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	3	0.8
21-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
22-Sep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
23-Sep	1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	1.3
24-Sep	7.5	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0.5
25-Sep	8	0	1	1	1	5	8	1	0	4	0	0	0	10	1	1	2	1	1	0	1	0	1	39	4.9
26-Sep	5	0	0	0	0	3	3	0	0	1	0	0	0	14	0	0	0	0	0	0	0	0	0	21	4.2

Appendix C. (continued)

Date	Obs. Hours	TV	OS	BE	NH	SS	CH	NG	BW	RT	RL	SW	FH	GE	AK	ML	PG	PR	UA	UB	UF	UE	UU	Grand Total	Birds per Hour
27-Sep	8	0	0	5	7	17	11	0	0	6	1	0	1	15	2	2	1	1	3	1	0	0	0	73	9.1
28-Sep	8	1	2	4	8	25	18	0	5	13	0	0	1	40	0	1	0	0	3	1	0	0	1	123	15.4
29-Sep	8	0	0	3	4	8	9	0	0	9	0	0	0	43	2	0	1	0	2	1	0	0	0	82	10.3
30-Sep	5.5	0	0	1	1	10	10	3	1	7	1	0	0	31	2	1	0	2	2	1	0	0	0	73	13.3
1-Oct	5.8	0	0	2	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	12	2.1
2-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
3-Oct	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
4-Oct	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
5-Oct	8	0	0	1	0	2	0	0	0	3	0	0	0	6	0	0	0	0	0	0	0	0	0	12	1.5
6-Oct	8.8	0	0	2	1	22	7	8	2	13	2	0	0	135	2	1	0	1	3	2	1	0	2	204	23.3
7-Oct	8	0	0	3	0	7	0	0	0	5	1	0	0	34	1	0	0	1	1	0	0	0	1	54	6.8
8-Oct	5.5	0	0	0	0	0	0	0	0	1	1	0	1	12	0	1	0	0	0	0	0	1	1	18	3.3
9-Oct	8.8	0	0	2	1	3	0	0	0	4	2	0	0	213	0	1	0	0	0	0	0	0	2	228	26.1
10-Oct	8.8	0	0	3	2	30	0	1	0	2	9	0	0	93	0	0	0	1	5	0	0	0	0	146	16.7
11-Oct	8.5	0	0	0	0	18	0	1	0	1	5	0	0	77	0	1	0	0	2	0	0	0	0	105	12.4
12-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
13-Oct	4.5	0	0	0	0	1	0	1	0	2	3	0	0	3	0	0	0	0	0	0	0	0	0	10	2.2
14-Oct	5.5	0	0	0	0	2	0	0	0	1	1	0	0	18	0	0	0	0	0	0	0	0	1	23	4.2
15-Oct	9	0	0	2	1	8	0	0	0	3	0	0	0	28	0	1	0	0	1	1	0	0	0	45	5.0
16-Oct	9	0	0	3	0	8	0	1	1	4	1	0	0	157	0	1	0	0	0	0	1	0	0	177	19.7
17-Oct	9.3	0	0	1	0	5	0	0	0	2	0	0	0	136	0	3	0	0	0	0	0	1	0	148	16.0
18-Oct	8.5	0	0	0	0	11	1	1	0	2	1	0	0	29	0	2	0	0	0	0	0	0	0	47	5.5
19-Oct	8.3	0	0	0	0	5	0	2	0	3	2	0	0	19	0	2	0	0	1	2	0	0	0	36	4.4
20-Oct	5.8	0	0	0	0	6	0	0	0	0	0	0	0	26	0	1	0	0	0	1	0	0	0	34	5.9
21-Oct	8	0	0	0	0	0	0	0	0	0	2	0	0	10	0	0	0	0	0	1	0	0	0	13	1.6
22-Oct	6	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	5	0.8
23-Oct	8.3	0	0	1	0	0	0	3	0	1	1	0	0	33	0	1	0	0	0	1	0	0	0	41	5.0
24-Oct	9	0	0	6	0	6	0	3	0	2	9	0	0	61	0	0	0	0	0	0	0	0	0	87	9.7
25-Oct	8.5	0	0	5	0	9	0	3	0	2	4	0	0	51	0	0	0	0	0	0	0	1	1	76	8.9
26-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
27-Oct	7.8	0	0	0	0	1	0	1	0	0	3	0	0	9	0	0	0	0	0	0	0	0	0	14	1.8
28-Oct	8	0	0	2	0	3	0	1	0	0	4	0	0	14	0	0	0	0	0	0	0	0	0	24	3.0
29-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-

Appendix C. (continued)

Date	Obs. Hours	TV	OS	BE	NH	SS	CH	NG	BW	RT	RL	SW	FH	GE	AK	ML	PG	PR	UA	UB	UF	UE	UU	Grand Total	Birds per Hour
30-Oct	8	0	0	3	0	5	0	4	0	1	7	0	0	24	0	0	0	0	0	0	0	0	0	44	5.5
31-Oct	5	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	14	2.8
1-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
2-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
3-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
4-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
5-Nov	6	0	0	6	0	0	0	1	0	0	1	0	0	24	0	0	0	0	0	0	0	1	0	33	5.5
6-Nov	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
7-Nov	7.5	0	0	1	0	0	0	0	0	1	0	0	0	18	0	0	0	0	0	0	0	0	0	20	2.7
8-Nov	5	0	0	4	0	0	0	0	0	0	1	0	0	9	0	0	0	0	0	0	0	0	0	14	2.8
TOTAL	**424.3**	**29**	**7**	**69**	**50**	**321**	**191**	**39**	**11**	**208**	**64**	**5**	**5**	**1476**	**74**	**22**	**13**	**13**	**45**	**19**	**6**	**4**	**25**	**2696**	**6.4**

[1] Species code UA is combined Unknown Accipiter, Small Accipiter, and Large Accipiter totals. (UF is combined Unknown Falcon, Small Falcon, and Large Falcon totals.)

Appendix D. Daily weather summary in the Bridger Mountains, MT: 2017[1]

Date	cloud cover	wind dir.	wind spd	high temp	low temp	rain/snow	notes
27-Aug	0	wsw	1	25	17		
28-Aug	0	wsw	0	25	15		
29-Aug	3	var	1	25	15		
30-Aug	3	var	0	24	19		
31-Aug	1	wsw	1	24	14		
1-Sep	0	w	3	21	10		
2-Sep	0	w	2	25	13		
3-Sep	0	w	3	27	15		
4-Sep	0	e	4	15	3		cold front coming through
5-Sep	0	e	2	14	9		
6-Sep	0	w	2	20	13		
7-Sep	0	var	1	20	15		
8-Sep	0	sw	1	26	14		
9-Sep	2	wsw	2	21	14	brief t-storm/rain in afternoon	brief thunderstorm in afternoon improved air quality some
10-Sep	1	sw	2	20	12		haze returned after clearing previous night
11-Sep	0	w	2	18	9		haze showing signs of clearing - settled in valley floor
12-Sep	1	w	2	22	14		
13-Sep	3	w	-	21	16	t-storm in afternoon/rain	quit early for t-storm
14-Sep	-	-	-	-	-	heavy snow	snow storm - no count
15-Sep	-	-	-	-	-	heavy snow	snow storm - no count
16-Sep	-	-	-	-	-	heavy snow	snow storm - no count
17-Sep	2	w	3	6	1		mild fire smoke to NE, storm helped air quality
18-Sep	3	ssw	4	10	6	afternoon rain	another wave of front approaching - quit early
19-Sep	-	-	-	-	-	snow/hail/thunder	no count – storm
20-Sep	3	ssw	3	0	-1	some snow in afternoon	quit early for snow storm
21-Sep	-	-	-	-	-	heavy snow	no count - snow storm
22-Sep	-	-	-	-	-	heavy snow	no count - snow storm
23-Sep	2	var	1	1	0	trace overnight	1.5 hour count in morning - quit for zero visibility
24-Sep	3	e	2	6	3		storm breaking

Appendix D. (continued)

Date	cloud cover	wind dir.	wind spd.	high temp	low temp	rain/snow	notes
25-Sep	1	wsw	2	7	-1	some in evening	
26-Sep	1	w	2	7	3		start at 1200 - low cloud cover
27-Sep	1	var - s,e	2	11	2		clouds develop quickly at noon, wind dies and resumes on east side hour later
28-Sep	0	e	3	12	6		
29-Sep	0	w	1	13	5		lots of visitors/assistant counters
30-Sep	3	sw	2	14	5	rain in afternoon	quit early rain / visibility
1-Oct	3	wsw	3	9	1	rain/snow in afternoon	quit early for snow storm
2-Oct	3	w	1	3	3		no count – fog
3-Oct	2	s	2	0	-1		storm breaking. counted 1 hour in late afternoon, no birds
4-Oct	2	e	7	4	-1	light snow in morning	no birds counted - quit early for lack of flight and severe winds
5-Oct	3	w	3	1	-3		inversion layer on west side, low clouds building on ridge in early afternoon
6-Oct	1	w	6	2	-2	wind driven snow	
7-Oct	3	w	4	4	2		
8-Oct	3	var - n,e	3	-2	-4	snow	called count early for zero visibility
9-Oct	0	w	6	0	-7	wind driven snow in morning	storm breaking - clear by afternoon
10-Oct	1	wsw	4	7	2		
11-Oct	1	wsw	7	7	3		
12-Oct	-	-	-	-	-	snow	no count - snow storm and zero vis, although brief moments of clear through day
13-Oct	3	w	5	-3	-7	snow	remnants of storm breaking up
14-Oct	1	w	7	-3	-9	wind driven snow	remnants of storm breaking up
15-Oct	0	wnw	5	5	-5		
16-Oct	0	w	5	8	0		
17-Oct	2	w	6	9	4		huge drop in barometric pressure through day
18-Oct	2	wnw	7	8	2		
19-Oct	1	w	5	12	7		
20-Oct	3	sw	5	7	0	wind driven snow in afternoon	called count early for fog/hail
21-Oct	3	w	5	-4	-7	light snow in morning	snow breaking in morning
22-Oct	3	w	8	3	1	wind driven snow in early afternoon	storm rolling in early afternoon
23-Oct	2	w	5	1	-4		
24-Oct	1	w	6	6	0		

Appendix D. (continued)

Date	cloud cover	wind dir.	wind spd.	high temp	low temp	rain/snow	notes
25-Oct	2	wnw	7	8	5		
26-Oct	-	-	-	-	-	heavy snow	no count - snow storm
27-Oct	3	w	4	1	-5		still snowing in surrounding mountain ranges
28-Oct	0	w	4	7	1		
29-Oct	-	-	-	-	-		no count - low cloud cover
30-Oct	0	se	2	-6	-12		
31-Oct	3	w	8	-4	-5	snow in afternoon	count called at 1400 for storm
1-Nov	-	-	-	-	-	snow	severe winter storm
2-Nov	-	-	-	-	-	snow	severe winter storm
3-Nov	-	-	-	-	-	snow	severe winter storm
4-Nov	-	-	-	-	-	snow	severe winter storm
5-Nov	1	w	1	-1	-9	light snow in afternoon	north Bridgers in clouds
6-Nov	2	w	2	-10	-10	snow	1 hour of counting during brief relief from storm
7-Nov	0	sw	3	-7	-12		heavy blanket of snow covering Bridgers
8-Nov	3	sw	2	-1	-4		

[1] Dashes indicate days where the count was not conducted and weather observations were not taken. Cloud cover codes are given as 0 (clear, <10% cloud cover), 1 (partly cloudy, 10 – 50% cloud cover), 2 (mostly cloudy, 50 – 75% cloud cover), and 3 (overcast, >75% cloud cover). Wind speed codes refer to the Beaufort Scale: 0: calm, <1 kph, 1: light air 1 – 5 kph, 2: light breeze 6 – 11 kph, 3: gentle breeze 12 – 19 kph, 4: moderate breeze 20 – 28 kph, 5: fresh breeze 29 – 38 kph, 6: strong breeze 39 – 49 kph, 7: high wind 50 – 61 kph, 8: gale 62 – 74 kph, 9: severe gale 75 – 88 kph. Temperatures are given in Celsius.

Appendix E. Annual observation effort and fall raptor migration counts by species in the Bridger Mountains, MT: 1991–2017.

	1991	1992	1993	1994	1995	1996	1997
Start date	15-Sep	6-Sep	9-Sep	13-Sep	10-Sep	1-Sep	27-Aug
End date	3-Nov	28-Oct	31-Oct	30-Oct	2-Nov	30-Oct	31-Oct
Observation days	32	39	46	36	42	53	62
Observation hours	191.1	242.58	298.50	239.25	269.17	378.25	422.92
Raptors / 100 hours	926.7	1000.1	871.7	1027.8	824.0	808.5	796.1
SPECIES			RAPTOR COUNTS				
Turkey Vulture	3	0	0	0	0	1	6
Osprey	2	2	5	5	1	14	12
Northern Harrier	19	13	41	59	10	38	66
Sharp-shinned Hawk	88	248	279	364	304	436	480
Cooper's Hawk	87	175	124	134	131	206	347
Northern Goshawk	27	96	39	17	10	37	36
Unidentified Accipiter	70	35	27	20	33	51	53
Total Accipiters	272	554	469	535	478	730	916
Broad-winged Hawk	0	2	3	16	5	5	5
Swainson's Hawk	1	11	0	3	2	0	6
Red-tailed Hawk	26	67	65	110	79	106	130
Ferruginous Hawk	3	1	1	1	0	5	4
Rough-legged Hawk	9	10	53	48	29	17	23
Unidentified Buteo	14	8	19	15	18	13	20
Total Buteos	53	99	141	193	133	146	188
Golden Eagle	1280	1579	1699	1500	1322	1871	1844
Bald Eagle	43	95	124	41	57	79	93
Unidentified Eagle	5	2	17	0	25	14	0
Total Eagles	1328	1676	1840	1541	1404	1964	1937
American Kestrel	33	38	54	67	117	82	146
Merlin	2	10	7	7	12	9	26
Prairie Falcon	9	14	10	11	14	16	10
Peregrine Falcon	1	7	6	4	7	10	10
Gyrfalcon	0	0	0	0	0	0	0
Unidentified Falcon	5	3	2	4	2	5	17
Total Falcons	50	72	79	93	152	122	209
Unidentified Raptor	44	10	27	33	40	43	33
Grand Total	1771	2426	2602	2459	2218	3058	3367

Appendix E. (continued)

	1998	1999	2000	2001	2002	2003	2004
Start date	28-Aug	29-Aug	29-Aug	27-Aug	27-Aug	27-Aug	27-Aug
End date	31-Oct	31-Oct	29-Oct	31-Oct	27-Oct	31-Oct	27-Oct
Obs. Days	56	57	52	58	52	64	48
Obs. Hours	339.33	358.24	335.40	347.49	365.84	443.18	316.70
Raptors/100 hrs	1040.9	871.8	630.9	636.3	556.0	517.6	655.2
SPECIES			RAPTOR COUNTS				
Turkey Vulture	0	2	0	0	0	0	0
Osprey	13	9	6	6	2	5	1
Northern Harrier	230	52	20	36	15	54	39
Sharp-shinned Hawk	612	442	190	274	288	416	229
Cooper's Hawk	343	149	109	120	103	132	142
Northern Goshawk	50	61	34	26	2	23	41
Unidentified Accipiter	49	39	35	27	20	33	48
Total Accipiters	1054	691	368	447	413	604	460
Broad-winged Hawk	20	13	3	38	3	9	6
Swainson’s Hawk	2	3	3	0	1	2	0
Red-tailed Hawk	277	121	45	117	78	113	100
Ferruginous Hawk	7	4	1	3	0	1	3
Rough-legged Hawk	66	77	26	57	11	22	20
Unidentified Buteo	13	3	8	6	9	6	18
Total Buteos	385	221	86	221	102	153	147
Golden Eagle	1516	1870	1429	1330	1359	1226	1196
Bald Eagle	95	91	128	58	55	93	79
Unidentified Eagle	15	5	3	2	15	4	2
Total Eagles	1626	1966	1560	1390	1429	1323	1277
American Kestrel	141	113	39	62	16	102	65
Merlin	17	8	3	9	2	4	11
Prairie Falcon	12	20	9	14	6	15	12
Peregrine Falcon	18	18	1	8	1	10	10
Gyrfalcon	0	1	0	0	0	0	0
Unidentified Falcon	8	6	4	3	5	4	15
Total Falcons	196	166	56	96	30	135	113
Unidentified Raptor	28	16	20	15	43	20	38
Grand Total	3532	3123	2116	2211	2034	2294	2075

Appendix E. (continued)

	2005	2006	2007	2008	2009	2010	2011
Start date	27-Aug	27-Aug	27-Aug	27-Aug	6-Sep	28-Aug	2-Sep
End date	31-Oct	29-Oct	29-Oct	31-Oct	31-Oct	1-Nov	4-Nov
Observation days	48	45	56	56	44	54	57
Observation hours	300.83	331.25	384.59	415.49	306.25	366.00	411.42
Raptors / 100 hours	674.8	538.3	550.5	427.7	453.2	641.8	695.9
SPECIES			RAPTOR COUNTS				
Turkey Vulture	1	2	1	0	0	2	5
Osprey	2	7	5	4	9	3	14
Northern Harrier	22	50	30	47	52	77	59
Sharp-shinned Hawk	228	344	277	222	230	336	565
Cooper's Hawk	153	182	151	115	113	207	221
Northern Goshawk	22	33	20	22	13	33	15
Unidentified Accipiter	123	10	29	56	19	87	37
Total Accipiters	526	569	477	415	375	663	838
Broad-winged Hawk	3	12	5	7	33	5	12
Swainson's Hawk	0	0	3	8	4	1	2
Red-tailed Hawk	108	89	130	75	75	178	202
Ferruginous Hawk	2	3	5	1	2	3	2
Rough-legged Hawk	40	21	19	32	30	31	28
Unidentified Buteo	27	2	11	10	10	20	4
Total Buteos	180	127	173	133	154	238	250
Golden Eagle	1061	859	1247	1003	638	1171	1431
Bald Eagle	75	74	85	43	27	50	68
Unidentified Eagle	1	1	0	10	4	1	0
Total Eagles	1137	934	1332	1056	669	1222	1499
American Kestrel	20	38	41	46	45	87	99
Merlin	7	15	9	10	4	12	17
Prairie Falcon	20	22	17	13	17	18	19
Peregrine Falcon	8	15	8	5	23	8	24
Gyrfalcon	0	0	0	0	0	0	0
Unidentified Falcon	53	1	7	10	10	5	2
Total Falcons	108	91	82	84	99	130	161
Unidentified Raptor	54	3	17	38	30	14	37
Grand Total	2030	1783	2117	1777	1388	2349	2863

Appendix E. (continued)

	2012	2013	2014	2015	2016	2017	Mean
Start date	1-Sep	1-Sep	1-Sep	29-Aug	27-Aug	27-Aug	31-Aug
End date	5-Nov	5-Nov	8-Nov	2-Nov	5-Nov	8-Nov	1-Nov
Observation days	58	50	57	55	54	60	52
Observation hours	414.38	335.76	399.67	401.33	385.2	424.3	354.7
Raptors / 100 hours	680.0	688.9	720.4	822.0	798.1	635.5	714.7
SPECIES				RAPTOR COUNTS			
Turkey Vulture	2	16	8	7	14	29	3
Osprey	9	13	6	22	13	7	8
Northern Harrier	64	34	112	141	44	50	56
Sharp-shinned Hawk	452	354	422	658	617	321	370
Cooper's Hawk	180	160	203	306	198	191	175
Northern Goshawk	33	16	59	38	62	39	34
Unidentified Accipiter	58	35	66	94	61	45	36
Total Accipiters	723	565	750	1096	938	596	592
Broad-winged Hawk	37	48	22	29	31	11	15
Swainson's Hawk	8	4	2	3	4	5	3
Red-tailed Hawk	238	180	239	389	215	208	140
Ferruginous Hawk	4	3	8	6	3	5	3
Rough-legged Hawk	42	34	84	96	77	64	40
Unidentified Buteo	12	17	37	29	16	19	14
Total Buteos	341	286	392	552	346	312	195
Golden Eagle	1272	1131	1222	1138	1437	1476	1333
Bald Eagle	92	74	106	81	77	69	78
Unidentified Eagle	12	3	11	2	1	4	6
Total Eagles	1376	1208	1339	1221	1515	1549	1422
American Kestrel	147	104	138	181	89	74	83
Merlin	16	21	28	36	33	22	13
Prairie Falcon	16	8	13	6	14	13	14
Peregrine Falcon	34	29	23	21	30	13	14
Gyrfalcon	0	0	0	0	0	0	0.05
Unidentified Falcon	13	3	7	7	8	6	7
Total Falcons	226	165	209	251	174	128	125
Unidentified Raptor	77	28	63	9	30	25	20
Grand Total	2818	2315	2879	3299	3074	2696	2428