

**FALL 2007 RAPTOR MIGRATION STUDIES AT
COMMISSARY RIDGE IN SOUTHWESTERN WYOMING**



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**HawkWatch International, Inc.
Salt Lake City, Utah**



April 2008

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April 2008

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INTRODUCTION

The Commissary Ridge Raptor Migration Project in southwest Wyoming is an ongoing effort to monitor long-term trends in populations of raptors using the central Rocky Mountain migratory flyway. The Commissary Ridge project was 1 of 14 long-term, annual migration counts and 1 of 6 migration-banding studies conducted or co-sponsored by HWI in North America during 2007. The primary objective of these efforts is to track long-term population trends of diurnal raptors in western North America and around the Gulf Coast region (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 migration counts are one of the most cost effective and efficient methods for monitoring the regional status and trends of multiple raptor species (Zalles and Bildstein 2000, Bildstein et al. 2008).

To be effective for regional monitoring of broadly distributed species, migration monitoring must involve a network of well-distributed, standardized counts that effectively sample all major flyways and known subpopulations (Smith and Hoffman 2000). Before 2002, no long-term raptor migration surveys were being conducted in the state of Wyoming, and coverage of the central Rocky Mountains between Montana and New Mexico was generally sparse. Following two years of exploratory surveys throughout Wyoming, in 2002 HWI initiated the first full-season, fall-migration count at Commissary Ridge in southwestern Wyoming, with annual counts continuing each year since. During fall 2004, HWI also initiated for the first time at the site an exploratory trapping and banding program, which also has continued each year since. This report summarizes the results of the fall 2007 count and banding efforts.

STUDY SITE

The study site is located atop the southern end of Commissary Ridge on the southwestern tip of South Fork Mountain, about 37 km north of Kemmerer, Wyoming, on land managed by the Bureau of Land Management, Kemmerer Field Office (Figures 1 and 2). The site is accessed from Hwy 233 just northeast of Lake Viva Naughton, and is located on the western edge of a broad ridgetop overlooking the Ham's Fork River Valley and Lake Viva Naughton to the west (42°01'29"N 110°35'22"W; T24 R116 S28 SESW; elevation ~2,700 m). The location provides an unobstructed 360° view of the surrounding landscape. The ridgetop features primarily rocky substrates and low growing, desert shrubs and grasses, with scattered stands of mixed-conifer and aspen in sheltered pockets and ravines.

In 2007, we further explored use of two new trapping sites (Figure 2). **Ganths Tooth** station was located ~3.7 km north of the count site at ~2,745 m elevation on a sheltered knoll along the western margin of the ridgetop. **South Bowl** station was located ~2.4 km south of the observation point at ~2,600 m elevation within a sheltered "bowl" along the western margin of the ridgetop. Both of these trapping stations were first used in 2006, but this was the first season that a full-scale blind and trap array were deployed at the South Bowl station. The two trapping arenas generally were used alternately throughout the season, except when the presence of HWI science staff enabled simultaneous operation of both blinds.

METHODS

STANDARDIZED COUNT

Weather permitting, trained observers conducted daily counts from a single, traditional observation post from 27 August through 5 November. This was the first season of migration counting for both official observers Tiffany Russell and Patty Brundage, but both received pre-season and extensive on-site field and protocol training (see Appendix A for a complete history of observer participation). Other crewmembers, especially on-site coordinator Gregor Yanega, also regularly assisted with the counts, especially during the peak of migration activity. Counts did not occur when heavy fog or other severe weather precluded effective counting or safety issues precluded access to the site. Otherwise, counts occurred daily and usually from 0900–1700 H Mountain Standard Time (MST). Data gathering and

recording followed standardized protocols used at all HWI migration sites (Hoffman and Smith 2003). The observers routinely recorded the following data:

1. Species, age, sex, and color morph of each migrant raptor, whenever possible and applicable (Appendix B lists common and scientific names for all species, information about the applicability of age, sex, and color morph distinctions, and two-letter codes used to identify species in some tables and figures).
2. Hour of passage for each migrant; e.g., the 1000–1059 H MST.
3. Wind speed and direction, air temperature, percent cloud cover, predominant cloud type(s), presence or of precipitation, visibility, and an assessment of thermal-lift conditions, recorded for each hour of observation on the half hour.
4. Predominant direction, altitude, and distance from the lookout of the flight during each hour.
5. Total minutes observed and the mean number of observers present during each hour (included designated observers plus volunteers/visitors who actively contributed to the count [active scanning, pointing out birds, recording data, etc.] for more than 10 minutes in a given hour), recorded on the hour.
6. A subjective visitor-disturbance rating (high, moderate, low, none) for each hour, recorded on the hour.
7. Daily start and end times for each official observer.

The seasonal and daily duration of observation effort can greatly affect count statistics (Hussell 1985, Bednarz and Kerlinger 1989, Bednarz et al. 1990). To generally adjust for variation in sampling effort due to inclement weather and other unforeseeable events, and therefore render data from different years and sites comparable, common practice calls for converting counts to annual passage rates: total number of migrants counted / total hours of observation * 100 = birds / 100 hrs (also see Hoffman and Smith 2003). In comparing 2007 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2007 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

Weather permitting, 2–4 trappers, periodically assisted by HWI staff and other crewmembers, typically operated a single trapping station each day, generally between 0900 and 1700 H MST. Capture devices included mist nets, dho-gaza nets, and remotely triggered bow nets. Trappers lured migrating raptors into the capture stations from a camouflaged blind using live, non-native avian lures attached to lines manipulated from the blind. Unless already banded, all captured birds were fitted with a uniquely numbered USGS Biological Resources Division aluminum leg band. Data gathering and recording followed standardized protocols used at all HWI migration-banding sites (Hoffman et al. 2002). All birds were released within 45 minutes of capture, usually much quicker, unless outfitted with a satellite transmitter, which takes longer.

RESULTS AND DISCUSSION

WEATHER

Inclement weather fully precluded 5 days of potential observations in 2007 and reduced observation time to ≤ 4 hours on three other days (see Appendix D for daily weather records). The number of fully precluded days closely matched the 2002–2006 average of 5.4 days, whereas the number of partially precluded days was slightly below the average of 5.0 days. It was noteworthy that a lack of late season snow allowed the camp to be broken down and the count to continue through 5 November in relative comfort. Thirty-eight percent of the active observation days featured predominantly fair skies, 42%

transitional skies (i.e., shifted from fair skies to mostly cloudy or overcast skies during the day, or vice versa), and 20% mostly cloudy to overcast/stormy skies. The 2002–2006 averages for the site are 48% fair, 27% transitional, and 25% mostly cloudy to overcast skies, indicating that the 2007 season was cloudier than usual but not necessarily stormier than usual. In fact, 18% of the active observation days included some rain or snow showers, which essentially matches the 2002–2006 average of 17%. In contrast, 30% of the active days included appreciable, visibility reducing fog and especially haze, which is more than twice the average for the previous five seasons (14%). Most of the hazy conditions occurred during the first three weeks of September. The high prevalence of hazy conditions contributed to below average visibility, estimated to average 58 km to the east and 63 km to the west in 2007, compared to five-year means of 72 and 76 km, respectively.

In 2007, the temperature during active observation periods averaged 12.8°C (average of daily values, which were in turn averages of hourly readings), ranging from 0–24.7°C. The average was similar to the previous five-year mean of 13.1°C and the minimum fell well within the previous range of values, whereas the maximum was the second highest recorded since the project began. Barometric pressure readings during active observation periods averaged 30.16 in Hg (average of daily values, which were in turn averages of hourly readings), ranging from 29.66–30.63 in Hg. The pattern in relation to previous averages and ranges was similar to the case for temperature, with both the maximum daily temperature and maximum daily barometric pressure ranked second highest to date, but the other metrics typical for the site to date.

In 2007, light winds (<12 kph) predominated on 15% of the active observation days, moderate winds (12–28 kph) on 67%, and strong winds (>28 kph) on 18%. This represents a distinct shift away from strong winds in favor of moderate winds compared to the previous five seasons (2002–2006 averages of 11% light, 51% moderate, and 38% strong). W–NW winds prevailed on a record high 83% of the active days (average 60%). SW–W winds, often the second most common pattern, prevailed on only 2% of the active days, compared to the 2002–2006 average of 14.7%. The only other patterns that prevailed on more than 5% of the active days were variable NE–SE winds (5%, average 4.6%) and days where the pattern shifted during the day from the SW–NW quadrant to the NE–SE quadrant, or vice versa (8%, average 7.3%).

Good to excellent thermal-lift conditions, as assessed by the observers, predominated on a below average 22% of the active days (average 31%).

In summary, inclement weather took a near average toll on the observation effort in 2007, with conditions during active observation periods cloudier but not stormier than usual, and winter snow cover not settling in quite as early as usual. Hazy conditions, however, were more common than usual and contributed to reductions in average visibility. In addition, the winds were somewhat lighter and more steadily from the W-NW than usual. The maximum daily-average temperature and barometric pressure values were both above average, but otherwise typical temperature and pressure regimes prevailed.

OBSERVATION EFFORT

Counts occurred on 66 of 71 possible days between 27 August and 5 November 2007, averaging 7.0 hours per active day and encompassing 494.56 total hours of observation (see Appendix D for annual data). The numbers of observation days and hours were both the highest recorded to date (13–14% above average), with 2007 only the second season that the count has continued through the first few days of November. The number of observers averaged 2.3 per hour in 2007, which is the highest to date and 17% higher than the 2002–2005 average of $2.0 \pm 95\%$ CI of 0.10 observers per hour.

FLIGHT SUMMARY

Flight Volume and Composition

The observers tallied only 4,894 migrants of 17 species during the 2007 season, which was 44% higher than the 2002–2006 average (Table 1) and the highest total recorded to date (see Appendix D for 2007 daily count records and Appendix E for annual count summaries). The high 2007 tally stands in particularly stark contrast against the previous season's dismally low count of just over 1,800 birds (Appendix E). The flight was composed of 41% accipiters, 32% buteos, 13% eagles, 6% falcons, 4% vultures, 2% unidentified raptors, and <1% each of Ospreys and harriers (Figure 3). The proportion of vultures was significantly above average and the proportions of falcons and harriers were significantly below average compared to the previous five seasons. The most abundant species were the Red-tailed Hawk (30% of the total count), Sharp-shinned Hawk (25%), Cooper's Hawk (11%), Golden Eagle (7%), Bald Eagle (6%), American Kestrel (5%), Turkey Vulture (4%), and Northern Goshawk (2%). All other species each comprised $\leq 1\%$ of the total.

The 2007 counts and passage rates were both significantly above average for 8 species, with the counts alone significantly above average for two other species (Table 1). In contrast, Swainson's and Ferruginous Hawks were the only species for which the counts were significantly below average, and only the Ferruginous Hawk showed a significantly below average passage rate in 2007. New record high counts were recorded for Turkey Vultures, Northern Goshawks, Red-tailed Hawks, Bald Eagles, and Prairie and Peregrine Falcons, but no record low counts occurred in 2007 (Appendix E).

In the nearby Wellsville Mountains of northern Utah, ~150 km to the west, the 2007 count was 14% above the 2001–2006 average for that site, and similar to Commissary Ridge, was almost twice as high as in 2006 when counts at both sites were roughly 50% below average (Smith and Neal 2008a). Thus, at least for the past couple of years, the overall counts at the two sites appear to have followed similar patterns. The same applies to 11 species-level comparisons; however, for six other species (Northern Goshawks, Red-tailed Hawks, Bald Eagles, American Kestrels, Merlins, and Prairie Falcons), the relative changes in counts in 2007 compared to previous 5–6-year averages followed dissimilar patterns at the two sites. Farther north in the Bridger Mountains of southwestern Montana, where Golden Eagles comprise the bulk of the migration, the 2006 combined-species count also was well below average (a record low), and then the 2007 count was again at least slightly above average (2%) compared to the past six years (Smith and Neal 2008b). Moreover, although the lists of species differed slightly, again 11 species showed similar patterns of change in 2007 at Commissary Ridge and in the Bridgers compared averages for the past 5–6 years. Six species showed common patterns of change at all three of the aforementioned sites: Turkey Vulture, Osprey, Northern Harrier, Cooper's Hawk, Broad-winged Hawk, and Golden Eagle.

Age Ratios

Among nine species for which age-specific data were collected, three species showed immature : adult count ratios that were significantly above average in 2007, and five species showed significantly below average age ratios (Table 2). Among species with high age ratios, counts of immature Sharp-shinned Hawks and immature/subadult Golden Eagles clearly were above average, suggesting good productivity. In contrast, the high age ratio for Cooper's Hawks reflected a significant reduction in the number of identified adults rather than high abundance of immature birds, suggesting that adult survival during the previous year may have been low. However, here it is important to note that significant variation in the proportions of unaged birds may confound these comparisons, especially for the two accipiters (Table 2). Among the five species with low age ratios in 2007, all except Red-tailed Hawks showed reduced counts of immature birds, suggesting that low productivity in 2007 may have been a factor for these species (Northern Harrier, Northern Goshawk, Broad-winged Hawk, and Peregrine Falcon). That said, at least for Northern Goshawks and Peregrine Falcons, this possibility seems unlikely given high overall counts and atypically low proportions of aged birds. For Red-tailed Hawks, one of the few species for which the

proportion of unaged birds was not significantly different from average, the count of identified immatures was above average but the count of adults was way above average (hence the low age ratio), suggesting that both productivity and adult survival were strong for this species in 2007.

Daily and Seasonal Migration Patterns

The diel rhythm of migration at Commissary Ridge in 2007 followed a slightly bi-modal distribution, with a steep rise in activity between 0900 and 1200 H, followed by a slight “noon lull,” then a modest secondary peak during the 1400 H, and finally a gradual tapering off of activity through the 1700 H (Figure 4). This pattern is similar to the average pattern for the site except that the activity peaks were shifted roughly one hour later than usual.

The overall, combined-species seasonal activity pattern for 2007 differed from the average pattern in showing an unusually high activity spike in mid-September and unusually low activity levels during the first three weeks of October (Figure 5). The high mid-September spike directly preceded the first major rain/snow event of the season, and the generally below-average activity levels during early October coincided with occurrence of four other snow events, which collectively resulted in four missed days and four other days of substantially reduced observation time (Appendix C). The overall combined-species median passage date of 22 September was a significant 6 days earlier than average (Table 3). At the species level, however, median passage dates were significantly earlier than average for only five species (Sharp-shinned Hawk, Broad-winged Hawk, Red-tailed Hawk, American Kestrel, and Merlin), and were significantly later than average for Rough-legged Hawks, and Golden and Bald Eagles (Table 3). Age and sex-specific data revealed additional complexities for some species (Table 4). In particular, adults of Sharp-shinned, Cooper’s and Red-tailed Hawks showed significantly early timing, whereas passage timing for immatures of all three species did not differ significantly from average.

TRAPPING AND BANDING SUMMARY

Trapping occurred on 48 of 63 possible days between 29 August and 30 October 2007, with effort totaling 366.43 station hours (see Appendix F for daily trapping records and Appendix G for annual trapping summaries). The number of trapping days matched the 2004–2006 average, whereas the number of station hours was 6% above average. Trapping occurred at the Ganths Tooth (GT) station on 34 days (209.3 hrs) and at the South Bowl (SB) station on 25 days (166.0 hrs).

The crew captured and banded a record-high 209 raptors of 10 species in 2007 (Table 5). The most commonly captured species were the Sharp-shinned Hawk (41% of all captures), Cooper's Hawk (29%), Northern Goshawk (14%), Red-tailed Hawk (9%), and American Kestrel (2%). All other species each comprised 1% or less of the total. The capture totals of 2 Northern Harriers, 30 Northern Goshawks, 19 Red-tailed Hawks, and 2 Golden Eagles comprised new record highs for the site (Appendix G). The intensive involvement of HWI full-time staff during the first five weeks of trapping undoubtedly contributed to this season’s high capture total; however, lighter than usual winds combined with record-high flight volume also were important factors.

Both trapping stations served well this season and resulted in solid trapping efficiency, despite the continual problem of high winds, with each offering unique characteristics and successes. Despite 21% fewer trapping hours, the SB station yielded 13% more captures and hence a 43% higher overall capture rate than the GT station (6.7 vs. 4.7 captures/10 station hrs), as well as the only captures of the three larger falcon species. However, the GT station yielded the highest capture totals for Sharp-shinned Hawks, Northern Goshawks, and American Kestrels, as well as both of the Golden Eagles captured this season. This suggests that continuing to operate both stations should yield a particularly rich combination of trapping successes.

Compared to the counts, banding data yield unique and useful sex-age specific data only for the three accipiters and American Kestrels (Table 6). The 2007 count- and capture-based immature : adult ratios

for Sharp-shinned Hawks were of a similar magnitude (1.8 and 1.7, respectively), indicating that immature and adult birds were caught in proportion their abundance; however, the count ratio was 98% above average, whereas the capture ratio was 46% below average. This suggests that immature Sharp-shinned Hawks were both much more abundant than usual and substantially less susceptible to capture than usual (i.e., healthier—less hungry—than average) compared to adults. A slightly different pattern applied to Cooper's Hawks. The 2007 count- and capture-based age ratios differed markedly in terms of magnitude (2.2 and 0.8, respectively), suggesting that adult Cooper's Hawks were caught disproportionate to their abundance. Otherwise though, similar to the case for Sharp-shinned Hawks, the count ratio was 140% above average for Cooper's Hawks, whereas the capture ratio was 39% below average. Thus, the overall conclusions for the two species were similar, suggesting that immature birds were both much more abundant than usual and much less susceptible to capture compared to adults in 2007. For Northern Goshawks, again a different pattern applied. Similar to Sharp-shinned Hawks, the 2007 count and capture age ratios were of a similar magnitude (1.8 and 1.5, respectively), indicating captures of each age group in proportion to their abundance; however, both the count and capture ratios were similarly and substantially below average (55 and 49%). Given that goshawks were much more abundant than usual in 2007, these data suggest that, compared to adults, immature goshawks were much less abundant (recall that the unusually low proportion of birds aged during the count [Table 2] confounds this assessment) and/or much less susceptible to capture than usual in 2007.

Unlike the counts, banding also yields useful data on accipiter sex ratios, or at least sex-related susceptibility to capture. In 2007, female Sharp-shinned and Cooper's Hawks were both captured 2.6–2.7 times more often than males of each species; however, for Sharp-shinned Hawks the 2007 sex ratio was 77% above average, whereas for Cooper's Hawks the 2007 ratio was 53% below average (Table 6). These statistics suggest that, as usual, females of both species were caught more often than males in 2007, but female Sharp-shinned Hawks were proportionately more susceptible to capture than usual compared to males of the species, whereas female Cooper's Hawks were proportionately less susceptible to capture than usual compared to males. For Northern Goshawks, the capture sex ratio did not differ significantly from average and, as is typical, unlike for the two smaller accipiters, females were caught about 30% less often than males.

The capture totals for immature female and male American Kestrels exactly matched the previous averages for the site, but with no adults captured, the estimated age ratio was above average (albeit non-significantly due to low sample sizes; Table 6). The count-based sex ratio for American Kestrels, which averages near 1, was 42% below average in 2007 (Table 6), suggesting that females were substantially under-represented in this season's flight. However, though confounded by small sample sizes, the 2007 capture-based sex ratio matched the previous average of 0.30. Together these data suggest that female kestrels were relatively scarce in 2007 compared to males and, given that, maintenance of a stable capture-based sex ratio suggests that females were more susceptible to capture than usual compared to males.

SATELLITE TRACKING

The 2007 crew outfitted one adult, probable female Red-tailed Hawk and one second-year, female Golden Eagle with satellite transmitters, comprising the second individuals of both species outfitted at this site. Both birds were outwardly healthy and outfitted with battery powered PTTs using a backpack-style Teflon harness, and with the transmitter package weighing $\leq 3\%$ of the bird's body mass. The Red-tailed Hawk transmitter is expected to transmit for 1.5–2.5 years, and the eagle unit for up to 4 years.

After release, the 2007 Red-tailed Hawk immediately set out to the south and southwest, following the Wasatch Range down through central and southwestern Utah, then continued southwest through western Arizona and southeastern California to the Baja California peninsula. By mid-October it appeared to have settled for the winter near the southern end of the Baja peninsula. This is the fourth Red-tailed Hawk we have tracked to a winter range in southern Baja California, with the three previous birds outfitted in the

Goshute Mountains, Nevada. This bird then began its return, northbound journey around 25 March 2008, and as of the third week of April had returned to near the California–Baja California border area.

After being released in late October, the 2007 Golden Eagle stayed on Commissary Ridge for a couple of days, wandering a short ways north, but then traveled ~100 km southeast to near Rock Springs, Wyoming. She remained in this general area for the winter and appeared to be doing fine until we got a call from a Wyoming Game and Fish officer in February 2008 indicating that she had been found dead from electrocution under a power line. She was killed in the midst of a large oil field on a power line servicing industry infrastructure, within a sagebrush steppe habitat matrix. This is the second young Golden Eagle we have tracked (~10% of 21 total) that has died from electrocution; the other mortality occurred in Texas where we found a second young eagle dead along with our bird.

Up until November 2007, we also continued to track the other adult, probable female Red-tailed Hawk that we outfitted at the site during fall 2006. After release, this bird headed south-southeast across the southwest corner of Colorado and down through central New Mexico, more less following the Rio Grande River and I-25 corridor. She continued south through central Chihuahua and Durango, Mexico, and by 13 November 2006 had settled for the winter in southern Jalisco, just north of the Colima border (a 2,600 km journey). She began her return spring journey around 14 March, followed a slightly more westerly path than in the fall, traveling north up along the western flanks of the Sierra Madre Occidental, up through central Arizona, across southwest Utah and then most likely up through the Goshute Mountains in northeastern Nevada, up through the center of Idaho, and finally arrived on her summer range in Lolo National Forest east of Rock Creek in western Montana by early April. She set out south again in late September and by early November 2007 it appeared she was still on the move after having largely retraced her previous fall pathway back down through western Wyoming and Colorado into northern New Mexico. To this point, she appeared to be taking her time returning south, having stopped in several locations along the way for several days each. Unfortunately, shortly thereafter the signals from this unit ceased altogether. Sensor data from the unit did not conclusively indicate mortality, but strange temperature readings suggested that possibility. Unfortunately, because the signals have ceased entirely, we will not be able to recover the unit and determine the fate of the bird.

Complete tracking summaries and maps for all of HWI's satellite-tracked raptors can be found at <http://www.hawkwatch.org>.

RESIDENT RAPTORS

Though not the focus of this study, carefully tracking the occurrence and movements of resident raptors around the site during the migration count, both assists the counters in distinguishing resident from migrating birds and provides useful information over time concerning the status and productivity of the local raptor community.

In 2007, the crew observed no resident Ospreys in the Ham's Fork Valley during migration observations; however, they did occasionally observe local birds in the area during drives through the valley. The closest known Osprey nest is ~13 km (8 mi) south of the count site along the Ham's Fork River and another active nest site is located on the north end of Kemmerer, ~ 35 km south of the count site.

At least two immature Northern Harriers were present on the ridge in 2007. During the morning hours, and later in the day, the locals were often seen hunting on both sides of the ridge, most often between the western ridgeline and main road just north of the observation post. At the beginning of the season, they were seen a few times a day, but less frequently as the season progressed. One immature was last seen on 3 October. Their territory was thought to be located near the wetland complexes directly east or west of Commissary Ridge.

Turkey Vulture activity was common through the end of September. Four juvenile Turkey Vultures were most often seen together, kettling on thermals near the quills and around the observation point, or flying

to the reservoir. Only a few sightings of an adult occurred, once flying west to east with a juvenile. The last sighting of the Turkey Vultures occurred on 18 September.

Some of the Northern Goshawks captured this season were believed to be local birds because they were not seen by the observation team. Only two sightings of unknown-age goshawks exhibiting resident behavior were confirmed in 2007. One adult Sharp-shinned Hawk and two immature Cooper's Hawks were recorded as resident birds.

Red-tailed Hawks are the most abundant residents at Commissary Ridge. At least four adults and three immatures were frequently observed this season. These included one rufous-morph adult, which may have been a resident breeder since at least 2000. Three light-morph adults and three immatures were typically seen along the north ridge, where they often intercepted and escorted migrants. Resident red-tails were active along the ridge until early October, but the adults from the north ridge were still present at season's end. Two Red-tailed Hawk nests are known in the area, one to the south of the observation post and one down in the valley to the west of the lookout, but there may well be others farther north. Commissary Ridge also appears to provide critical stopover habitat for red-tails, as birds often originated from the surrounding forest to migrate in the morning.

No resident Swainson's Hawk activity was observed in 2007, even though one known Swainson's Hawk nest is located near a rural RV park in the valley to the southwest of the ridge. Rough-legged Hawks were only seen moving north once in a group of 15, just west of the observation point, at the end of the day (likely commuting back to a communal night roost).

At least two family groups of Golden Eagles, including at least three adults, two immature birds, and an associated subadult bird, frequented the north ridge in 2007. These two groups were regularly seen coursing low to the west of the ridge and atop the ridge a few kilometers north of the project area. These birds were often seen foraging around the Ham's Fork River and often rose to meet migrating eagles. Resident Golden Eagles were often observed coursing along the east-slope of South Fork Mountain, but it is unclear with which territory they may have been associated. Suitable nesting cliffs are found in this area, and the presence of birds may be indicative of a third territory.

At least one adult Bald Eagle was regularly observed after 1 October and would travel in a circuit, where it either traveled south and then West, or came back North and then continued west. According to the BLM, one resident Bald Eagle lives on Lake Viva Naughton and along the Ham's Fork River. After mid September, two adults and three younger eagles also were regularly observed. The young included one first-year bird, one S1 subadult, and one S2 subadult (see Appendix B for plumage class descriptions). These birds would often play in the updrafts and intercept migrating eagles that were adding to the burgeoning winter population.

At least two pairs of American Kestrels resided on the ridge this season. They were seen from 27 August to 4 October and frequently moved down to lower elevations during inclement weather. The proximate pair held a territory on the northwest slope of Commissary Ridge and often foraged just north of the project area. Foraging behavior and low flights from south to north by adult Peregrine Falcons were recorded twice on the ridge, but no activity could be tied directly to territory use. Resident Prairie Falcons also were observed frequently in the sagebrush flats south of the project camp. According to BLM data, a nest site is located to the northwest of Commissary Ridge, but activity in this area was only observed until mid-September. During the peak migration period for Merlins, the crew observed a few birds that displayed resident behavior, possibly reflecting the presence of transient birds that stayed in the area for a few days at a time.

SITE VISITATION AND PUBLIC OUTREACH

Public awareness of HWI's newest migration monitoring project is still developing, but we were pleased to host 8 visitors from two states (Wyoming and Utah) at the project site during the 2007 season. All the

visitors came specifically to visit the project, and two visitors included a BBC film crew making a documentary on the change of seasons in the Greater Yellowstone Ecosystem.

ACKNOWLEDGMENTS

Funding for the 2007 project was provided by the Bureau of Land Management – Kemmerer Field Office, the USDI Fish and Wildlife Service – Neotropical Migratory Birds Conservation Act grant program, the Walbridge Fund, and HWI private donors and members. The Bureau of Land Management–Kemmerer Field Office also provided essential logistical support. In particular, we thank Wildlife Biologists Lara Oles and Chris Crews for their continued assistance. We thank Einstein Bagels of Salt Lake City for providing bagels for the crew, Salt Lake City Roasting Company for providing coffee, and Paul Dutson, Neil Pace, and Barry Herbert for providing lure birds.

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Table 1. Annual raptor migration counts and passage rates by species at Commissary Ridge, Wyoming: 2002–2006 versus 2007.

SPECIES	COUNTS			RAPTORS/100 HOURS		
	2002–2006 ¹	2007	% CHANGE	2002–2006 ¹	2007	% CHANGE
Turkey Vulture	96.0 ± 41.8	185	+93	22.6 ± 9.9	37.4	+66
Osprey	29.6 ± 17.5	41	+39	6.6 ± 3.7	8.3	+26
Northern Harrier	31.4 ± 5.1	30	-4	7.4 ± 1.7	6.1	-18
Sharp-shinned Hawk	842.6 ± 502.6	1,214	+44	193.2 ± 104.1	245.5	+27
Cooper's Hawk	420.6 ± 111.7	535	+27	98.7 ± 28.2	108.2	+10
Northern Goshawk	27.6 ± 13.7	89	+222	6.4 ± 2.9	18.0	+181
Unknown small accipiter	64.4 ± 14.8	61	-5	15.4 ± 5.1	12.3	-20
Unknown large accipiter	14.0 ± 10.2	21	+50	3.2 ± 2.2	4.2	+35
Unknown accipiter	30.2 ± 27.2	98	+225	6.8 ± 5.8	19.8	+190
TOTAL ACCIPITERS	1,399.4 ± 605.0	2,018	+44	323.6 ± 128.3	408.0	+26
Broad-winged Hawk	9.4 ± 6.5	7	-26	2.2 ± 1.4	1.4	-35
Swainson's Hawk	54.2 ± 17.4	36	-34	13.3 ± 6.4	7.3	-45
Red-tailed Hawk	941.6 ± 244.1	1,459	+55	217.8 ± 50.0	295.0	+35
Ferruginous Hawk	7.8 ± 3.9	3	-62	1.8 ± 0.8	0.6	-67
Rough-legged Hawk	7.2 ± 3.1	13	+81	1.6 ± 0.6	2.6	+60
Unidentified buteo	48.8 ± 23.6	63	+29	10.8 ± 4.6	12.7	+18
TOTAL BUTEOS	1,069.0 ± 254.6	1,581	+48	247.6 ± 53.0	319.7	+29
Golden Eagle	252.8 ± 70.9	324	+28	61.1 ± 25.6	65.5	+7
Bald Eagle	123.6 ± 57.6	299	+142	31.0 ± 20.6	60.5	+95
Unidentified eagle	7.0 ± 2.9	25	+257	1.7 ± 0.9	5.1	+196
TOTAL EAGLES	383.4 ± 124.7	648	+69	93.8 ± 46.4	131.0	+40
American Kestrel	297.8 ± 83.6	229	-23	69.0 ± 18.1	46.3	-33
Merlin	12.4 ± 6.9	24	+94	2.9 ± 1.5	4.9	+69
Prairie Falcon	9.6 ± 5.0	21	+119	2.2 ± 1.0	4.2	+94
Peregrine Falcon	7.8 ± 4.0	18	+131	1.7 ± 0.8	3.6	+108
Unknown small falcon	3.2 ± 2.1	3	-6	0.7 ± 0.5	0.6	-13
Unknown large falcon	2.2 ± 2.0	6	+173	0.5 ± 0.4	1.2	+150
Unknown falcon	2.0 ± 2.6	7	+250	0.5 ± 0.6	1.4	+193
TOTAL FALCONS	335.0 ± 85.1	308	-8	77.5 ± 17.7	62.3	-20
Unidentified raptor	49.2 ± 31.3	83	+69	11.4 ± 6.8	16.8	+48
GRAND TOTAL	3,393.0 ± 968.7	4,894	+44	790.4 ± 221.9	989.6	+25

¹ Mean ± 95% confidence interval.

Table 2. Annual raptor migration counts by age classes and immature : adult ratios for selected species at Commissary Ridge, Wyoming: 2002–2006 versus 2007.

SPECIES	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	2002–2006 AVERAGE			2007			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	2002–2006 ¹	2006	2002–2006 ¹	2007
Northern Harrier	31	11	12	30	5	9	35 ± 7.7	50	0.9 ± 0.2	0.6
Sharp-shinned Hawk	843	229	280	1214	375	206	41 ± 3.0	52	0.9 ± 0.2	1.8
Cooper's Hawk	421	129	139	535	120	55	38 ± 3.2	67	0.9 ± 0.2	2.2
Northern Goshawk	28	15	8	89	5	5	16 ± 8.8	89	2.2 ± 1.2	1.0
Broad-winged Hawk	9	2	4	7	0	2	44 ± 17.0	71	0.6 ± 0.3	0.0
Red-tailed Hawk	942	246	457	1459	292	759	25 ± 3.3	28	0.6 ± 0.1	0.4
Ferruginous Hawk	8	2	2	3	0	0	51 ± 16.4	100	1.1 ± 0.6	–
Golden Eagle	253	128	86	324	189	107	15 ± 4.1	9	1.5 ± 0.1	1.8
Bald Eagle	124	41	81	299	100	195	1 ± 0.6	1	0.5 ± 0.0	0.5
Peregrine Falcon	8	2	3	18	0	2	39 ± 14.2	89	0.8 ± 0.4	0.0

¹ Mean ± 95% confidence interval. For age ratios, note that long-term mean immature : adult ratios are averages of annual ratios and may differ from values obtained by dividing average numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in the observed age ratio.

Table 3. First and last observed, bulk passage, and median passage dates by species for migrating raptors at Commissary Ridge, Wyoming in 2007, with comparisons of 2007 and 2002–2006 average median passage dates.

SPECIES	2007				2002–2006
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	27-Aug	8-Oct	13-Sep – 26-Sep	20-Sep	22-Sep ± 2.2
Osprey	8-Sep	26-Oct	8-Sep – 26-Sep	16-Sep	16-Sep ± 2.8
Northern Harrier	27-Aug	31-Oct	8-Sep – 24-Oct	20-Sep	28-Sep ± 8.5
Sharp-shinned Hawk	27-Aug	5-Nov	13-Sep – 10-Oct	21-Sep	28-Sep ± 1.8
Cooper's Hawk	27-Aug	26-Oct	9-Sep – 2-Oct	20-Sep	22-Sep ± 3.4
Northern Goshawk	8-Sep	5-Nov	20-Sep – 29-Oct	11-Oct	06-Oct ± 7.1
Broad-winged Hawk	10-Sep	23-Oct	10-Sep – 23-Oct	20-Sep	25-Sep ± 3.2
Swainson's Hawk	7-Sep	14-Oct	8-Sep – 11-Oct	20-Sep	19-Sep ± 6.3
Red-tailed Hawk	27-Aug	5-Nov	9-Sep – 15-Oct	22-Sep	05-Oct ± 4.7
Ferruginous Hawk	27-Sep	8-Oct	–	–	27-Sep ± 8.6
Rough-legged Hawk	12-Sep	5-Nov	20-Sep – 5-Nov	28-Oct	20-Oct ± 2.5
Golden Eagle	27-Aug	5-Nov	12-Sep – 4-Nov	25-Oct	09-Oct ± 1.3
Bald Eagle	15-Sep	5-Nov	10-Oct – 4-Nov	31-Oct	19-Oct ± 4.2
American Kestrel	27-Aug	27-Oct	8-Sep – 28-Sep	17-Sep	22-Sep ± 2.7
Merlin	15-Sep	24-Oct	15-Sep – 16-Oct	26-Sep	03-Oct ± 7.7
Prairie Falcon	10-Sep	28-Oct	13-Sep – 11-Oct	23-Sep	24-Sep ± 3.5
Peregrine Falcon	8-Sep	10-Oct	13-Sep – 10-Oct	26-Sep	25-Sep ± 1.3
Total	27-Aug	5-Nov	9-Sep – 27-Oct	22-Sep	28-Sep ± 1.1

¹ Dates between which the central 80% of the flight passed the lookout.

² Date by which 50% of the flight had passed the lookout.

³ Mean ± 95% confidence interval in days; calculated using only data for years with counts ≥5 birds.

Table 4. Median passage dates by age classes for selected species of migrating raptors at Commissary Ridge, Wyoming: 2002–2006 versus 2007.

SPECIES	ADULT		IMMATURE / SUBADULT	
	2002–2006 ¹	2007	2002–2006 ¹	2007
Northern Harrier	04-Oct ± 13.2	20-Sep	30-Sep ± 3.3	2-Oct
Sharp-shinned Hawk	04-Oct ± 3.7	28-Sep	23-Sep ± 6.4	21-Sep
Cooper's Hawk	24-Sep ± 2.2	20-Sep	17-Sep ± 3.6	20-Sep
Northern Goshawk ²	21-Oct ± 10.2	31-Oct	22-Sep ± 8.2	27-Sep
Red-tailed Hawk	10-Oct ± 2.7	23-Sep	28-Sep ± 6.6	26-Sep
Golden Eagle	15-Oct ± 3.9	31-Oct	07-Oct ± 3.2	14-Oct
Bald Eagle	19-Oct ± 4.1	30-Oct	20-Oct ± 4.5	31-Oct

Note: Median passage dates are dates by which 50% of the flight had passed the lookout; values were calculated based only on counts of ≥5 birds per year.

¹ Mean ± 95% confidence interval in days; unless otherwise indicated, values were calculated only for species with ≥3 years of counts ≥5 birds per year.

Table 5. Capture totals, rates, and successes for migrating raptors at Commissary Ridge, Wyoming: 2004–2006 versus 2007.

SPECIES	CAPTURE TOTAL		CAPTURE RATE ¹		CAPTURE SUCCESS (%) ²	
	2004–2006 ³	2007	2004–2006 ³	2007	2004–2006 ³	2007
Northern Harrier	0.3 ± 0.7	2	0.1 ± 0.30	0.5	3.5 ± 4.4	2.5
Sharp-shinned Hawk	61.7 ± 38.5	86	18.1 ± 8.75	23.5	14.4 ± 21.7	5.1
Cooper's Hawk	41.3 ± 30.5	61	12.3 ± 7.46	16.6	9.4 ± 9.7	7.7
Northern Goshawk	10.7 ± 8.0	30	3.2 ± 3.39	8.2	48.6 ± 65.9	16.0
Red-tailed Hawk	6.3 ± 1.3	19	1.9 ± 1.91	5.2	1.4 ± 1.8	0.6
Golden Eagle	0.3 ± 0.7	2	0.1 ± 0.31	0.5	0.5 ± 0.5	0.2
American Kestrel	5.7 ± 7.3	5	1.6 ± 1.50	1.4	1.3 ± 1.6	2.3
Merlin	2.3 ± 2.4	2	0.7 ± 0.56	0.5	10.5 ± 11.4	9.0
Prairie Falcon	1.3 ± 1.3	1	0.4 ± 0.34	0.3	10.6 ± 14.6	5.0
Peregrine Falcon	0.3 ± 0.7	1	0.1 ± 0.18	0.3	5.4 ± 5.4	2.4
All Species	130.3 ± 86.7	209	38.4 ± 21.85	57.0	5.7 ± 6.7	3.5

¹ Captures / 100 station hours.

² Number of birds captured / number of birds observed * 100, with birds identified only to the generic group level (i.e., unknown accipiter, buteo, falcon, or eagle) allocated to relevant species in proportion to their occurrence. For calculating the “all species” values, non-trappable species and distant birds not identified at least to the generic group level were excluded.

³ Mean ± 95% confidence interval in days; unless otherwise indicated, values were calculated only for species with ≥3 years of counts ≥5 birds per year.

Table 6. Capture totals by sex and age (HY = hatching year; AHY = after hatching year), female : male capture ratios, and immature : adult capture ratios for selected species of migrating raptors at Commissary Ridge, Wyoming: 2004–2006 versus 2007.

SPECIES	YEARS	FEMALE		MALE		FEMALE : MALE RATIO	IMM. : ADULT RATIO
		HY	AHY	HY	AHY		
Sharp-shinned Hawk	Avg. 2004–2006 ¹	26	10	19	7	1.5 ± 0.37	3.1 ± 1.47
	2007	35	28	19	4	2.7	1.7
Cooper's Hawk	Avg. 2004–2006 ¹	18	17	5	2	5.6 ± 1.27	1.4 ± 0.63
	2007	18	26	10	7	2.6	0.8
Northern Goshawk	Avg. 2004–2006 ¹	3	1	5	2	0.6 ± 0.54	2.9 ± 2.04
	2007	8	4	10	8	0.7	1.5
American Kestrel	Avg. 2004–2006 ¹	1	0	4	1	0.3 ± 0.29	3.2 ± 2.58
	2007	1	0	4	0	0.3	5.0

¹ Mean ± 95% CI.

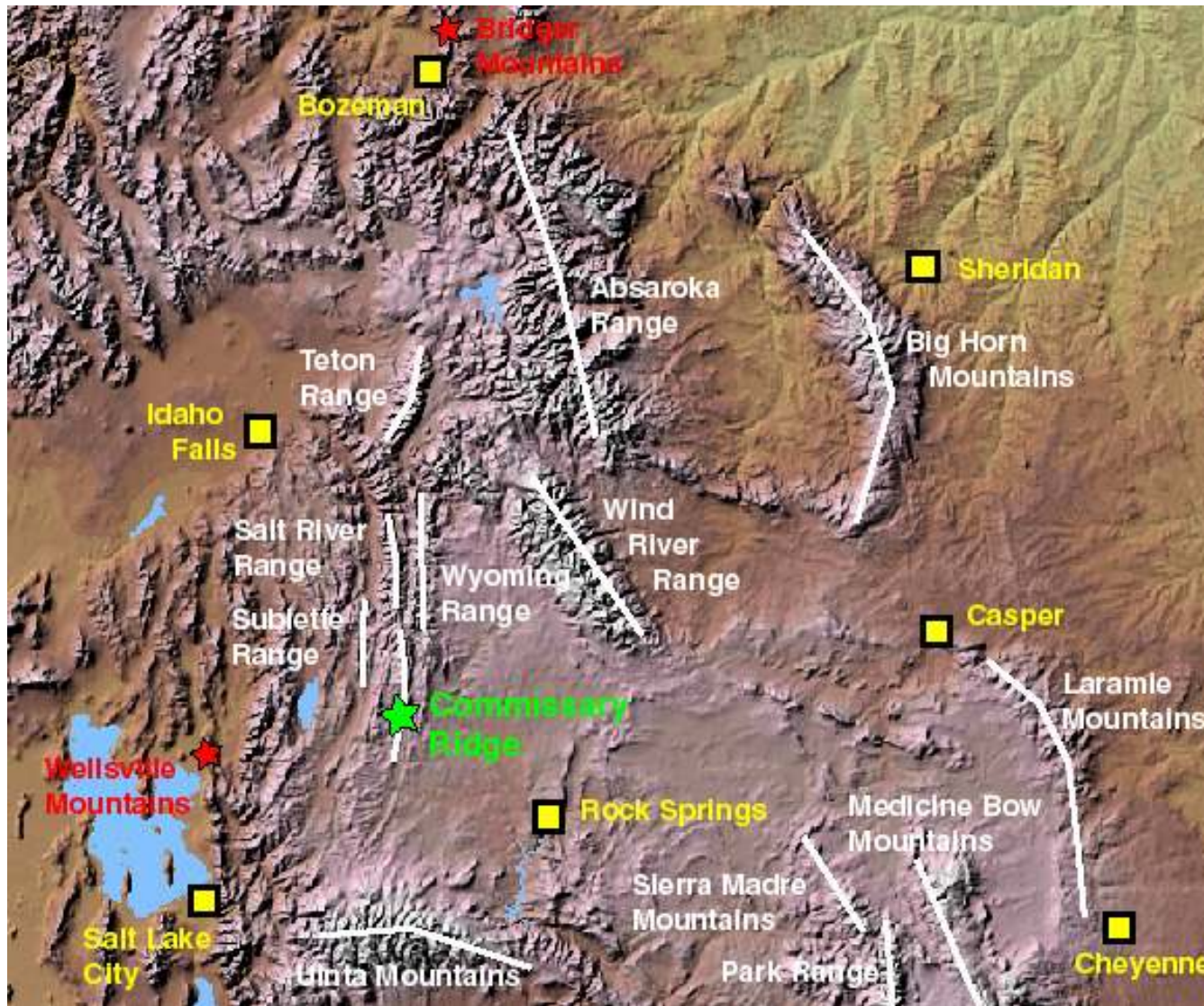


Figure 1. Location of Commissary Ridge Raptor Migration Project site in southwestern Wyoming. Red stars indicate other nearby HWI fall migration monitoring sites in Utah and Montana.

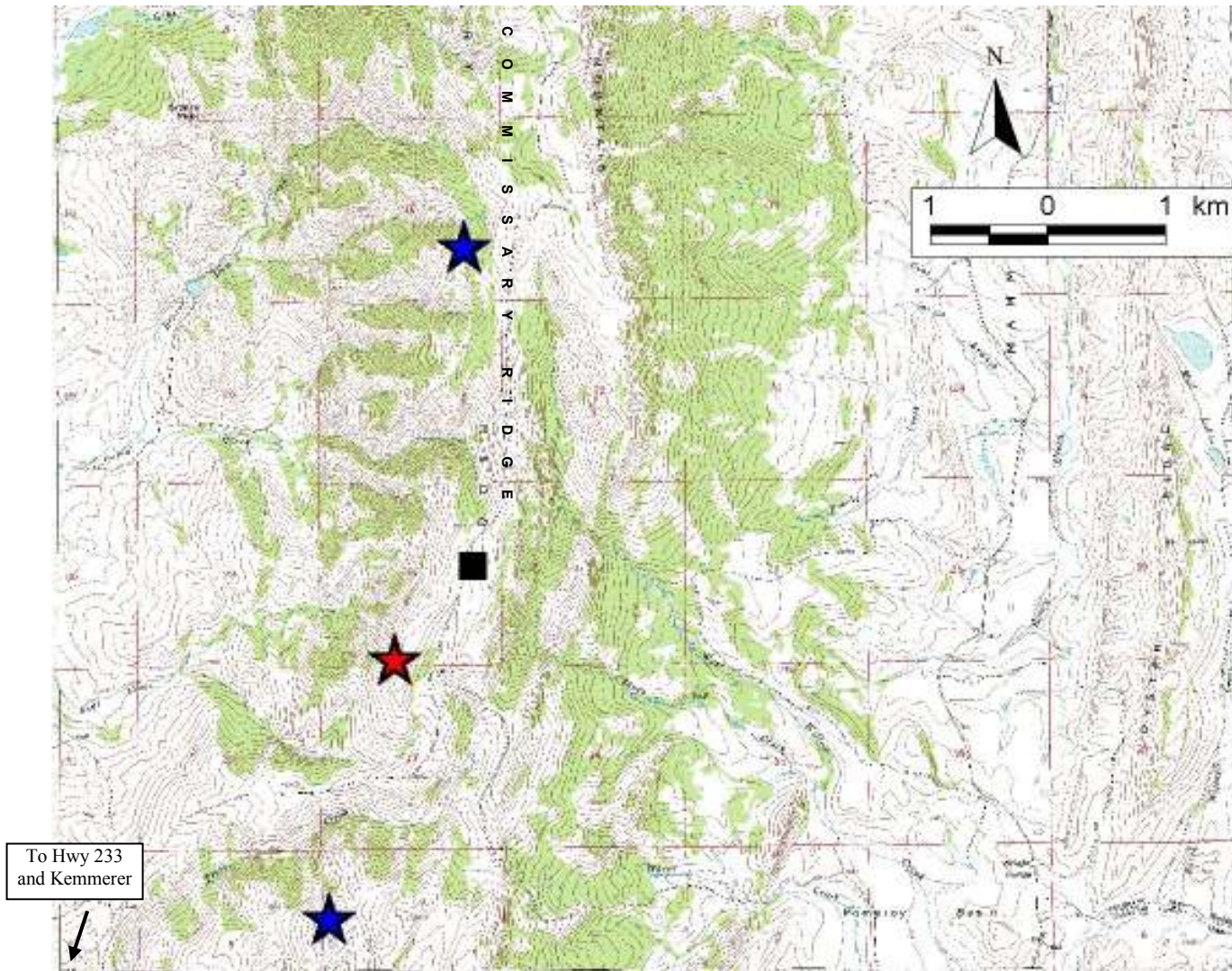


Figure 2. Close-up of Commissary Ridge Raptor Migration Project study site in southwestern Wyoming showing locations of the observation post (red star), the 2007 trapping locations (blue stars), and base camp (black square).

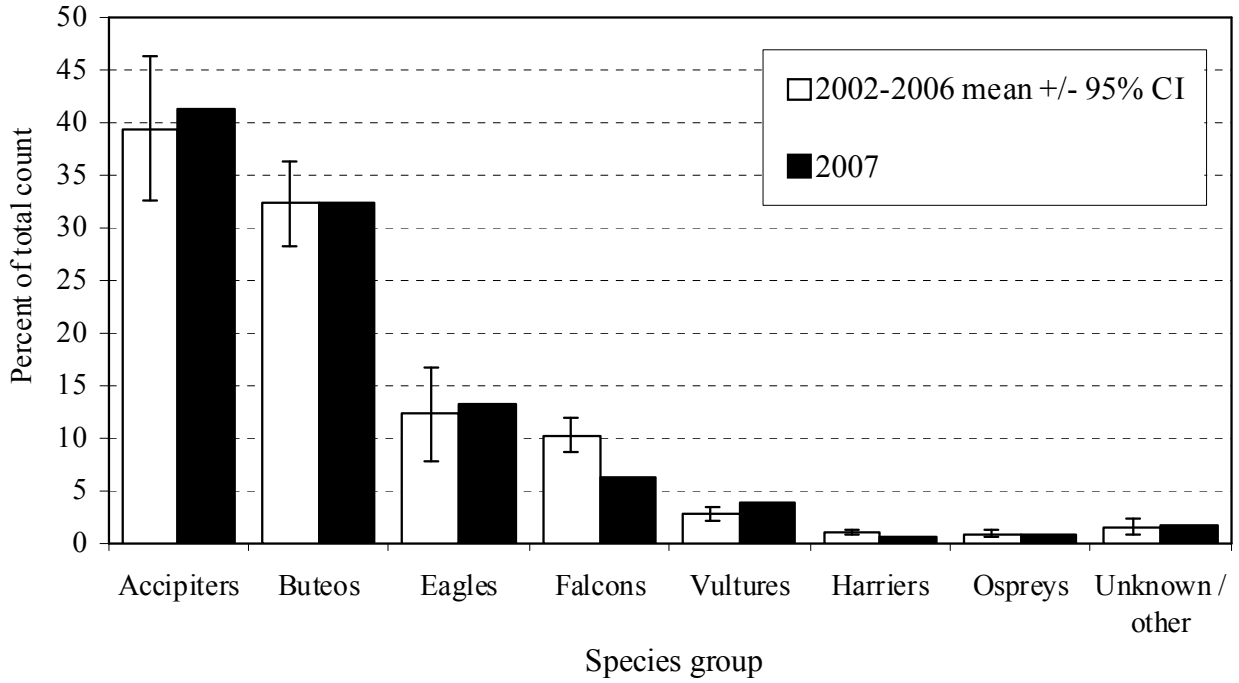


Figure 3. Composition by major species groups of the fall raptor migration at Commissary Ridge, Wyoming: 2002–2006 versus 2007.

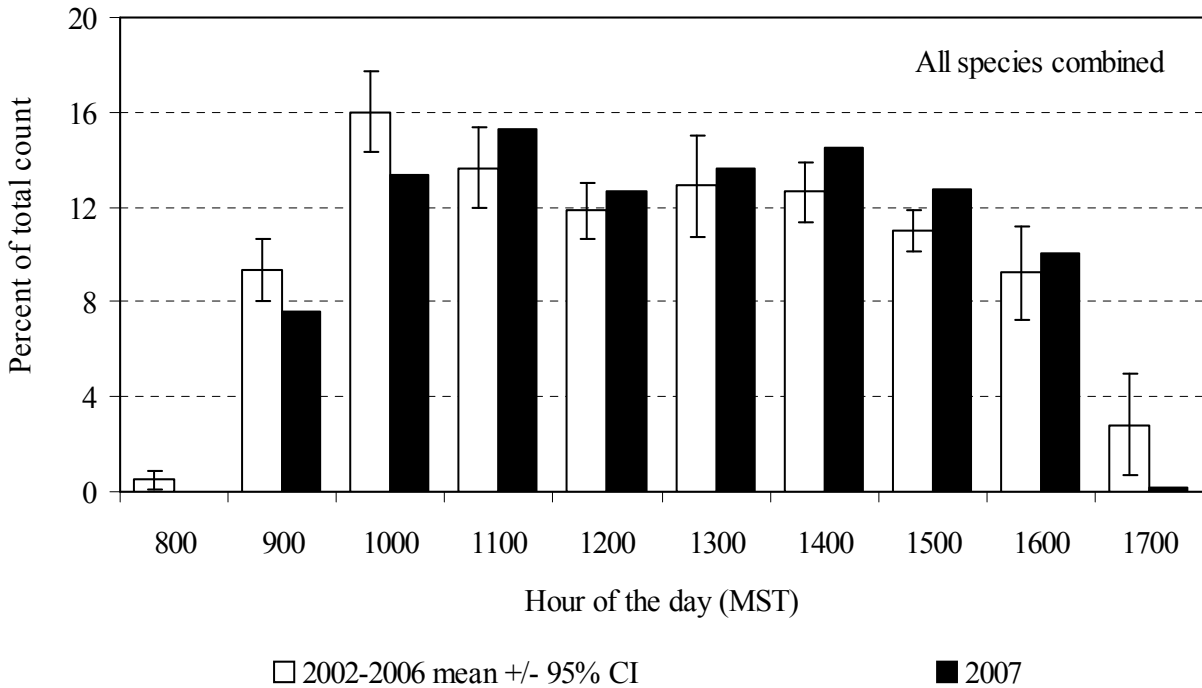


Figure 4. Daily rhythm of the fall raptor migration at Commissary Ridge, Wyoming: 2002–2006 versus 2007.

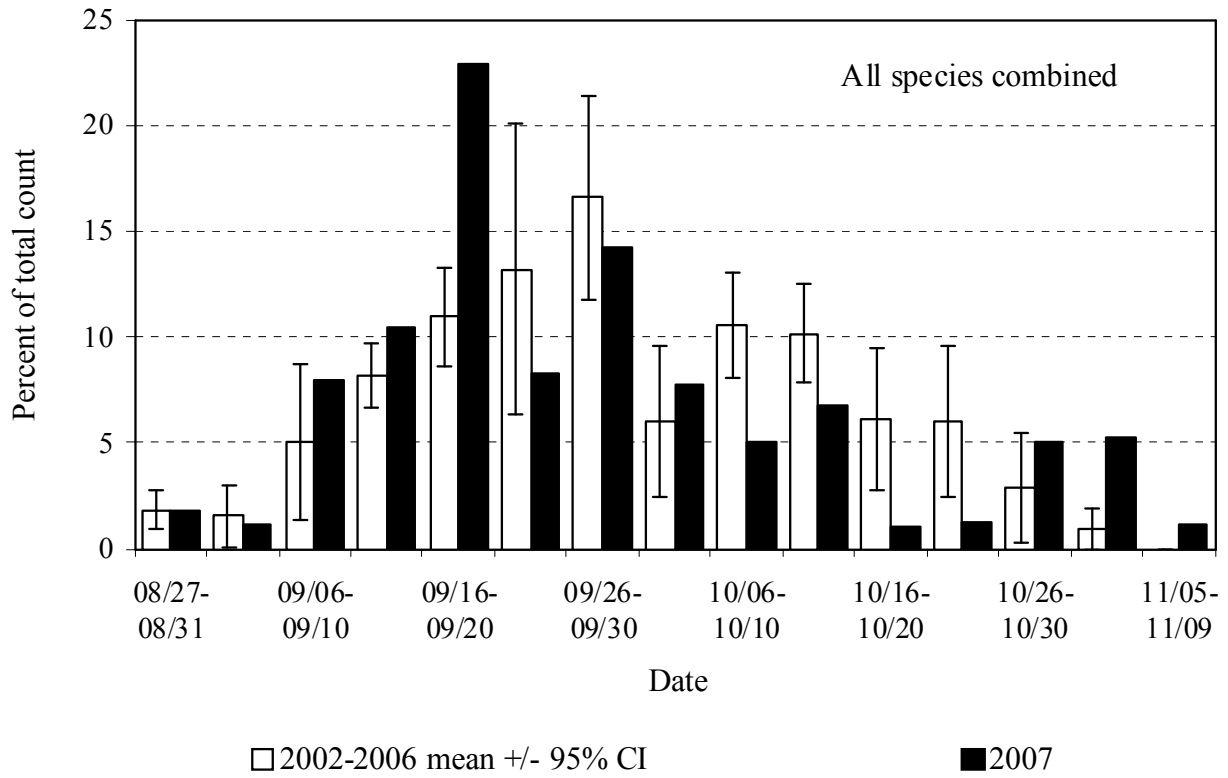


Figure 5. Combined-species seasonal distribution of activity by five-day periods for raptors during fall migration at Commissary Ridge, Wyoming: 2002–2006 versus 2007.

Appendix A. History of official observer participation at the Commissary Ridge Raptor Migration Project.

2000: Exploratory count, single observer throughout, rotating observers: Mike Neal (3)¹ and Margarite Lomow (0).

2001: Exploratory count, single observer throughout: Mike Neal (4)

2002: Single observer throughout, two observers for peak: Mike Neal (5), Nick Meyer (1), assisted by other trained crewmembers and staff.

2003: Two observers throughout: Chadette Pfaff (+), Don Higgins (0), Jason Farrell (0), assisted by Mike Neal (6).

2004: Two observers throughout: Mark Vukovich (1), Jennifer Nagy (0), assisted by other trained crewmembers and staff.

2005: Two observers throughout: Rob Spaul (1), Mary Ann Donovan (0), assisted by other trained crewmembers and staff.

2006: Two observers throughout: David Jansen (0), Tiara Westcott (0), assisted by other trained crewmembers and staff.

2007: Two observers throughout: Tiffany Russell (0), Patty Brundage (0), assisted by other trained crewmembers and staff.

¹ Numbers in parentheses indicate the number of years of previous experience conducting season-long migratory raptor counts.

Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications for all raptors observed on migration at Commissary Ridge, Wyoming.

COMMON NAME	SCIENTIFIC NAME	SPECIES CODE	AGE ¹	SEX ²	COLOR MORPH ³
Turkey Vulture	<i>Cathartes aura</i>	TV	U	U	NA
Osprey	<i>Pandion haliaetus</i>	OS	U	U	NA
Northern Harrier	<i>Circus cyaneus</i>	NH	A I Br U	M F U	NA
Sharp-shinned Hawk	<i>Accipiter striatus</i>	SS	A I U	U	NA
Cooper's Hawk	<i>Accipiter cooperii</i>	CH	A I U	U	NA
Northern Goshawk	<i>Accipiter gentilis</i>	NG	A I U	U	NA
Unknown small accipiter	<i>A. striatus</i> or <i>cooperii</i>	SA	U	U	NA
Unknown large accipiter	<i>A. cooperii</i> or <i>gentilis</i>	LA	U	U	NA
Unknown accipiter	<i>Accipiter</i> spp.	UA	U	U	NA
Broad-winged Hawk	<i>Buteo platypterus</i>	BW	A I U	U	D L U
Swanson's Hawk	<i>Buteo swainsoni</i>	SW	U	U	D L U
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RT	A I U	U	D L U
Ferruginous Hawk	<i>Buteo regalis</i>	FH	A I U	U	D L U
Rough-legged Hawk	<i>Buteo lagopus</i>	RL	U	U	D L U
Unknown buteo	<i>Buteo</i> spp.	UB	U	U	D L U
Golden Eagle	<i>Aquila chrysaetos</i>	GE	I, S, NA, A, U ⁴	U	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BE	I, S1, S2, NA, A, U ⁵	U	NA
Unknown eagle	<i>Aquila</i> or <i>Haliaeetus</i> spp.	UE	U	U	NA
American Kestrel	<i>Falco sparverius</i>	AK	U	M F U	NA
Merlin	<i>Falco columbarius</i>	ML	AM Br	AM U	NA
Prairie Falcon	<i>Falco mexicanus</i>	PR	U	U	NA
Peregrine Falcon	<i>Falco peregrinus</i>	PG	A I U	U	NA
Unknown small falcon	<i>F. sparverius</i> or <i>columbarius</i>	SF	U	U	NA
Unknown large falcon	<i>F. mexicanus</i> or <i>peregrinus</i>	LF	U	U	NA
Unknown falcon	<i>Falco</i> spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

¹ Age codes: A = adult, I = immature (HY), 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, L = light, 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 variable 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 dark band on tail; NA = Not adult: unknown age immature/subadult; A = Adult: includes near adult with dark flecks in head and dark tail tip, and adult with white head and tail; U = Unknown.

Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the fall raptor migration at Commissary Ridge, Wyoming: 2007.

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN VISITOR DISTURB ²	PREDOMINANT WEATHER ³	WIND SPEED (KPH) ¹	WIND DIRECTION	TEMP (°C) ¹	BAROM. PRESS. (IN HG) ¹	MEDIAN THERMAL LIFT ⁴	VISIB. EAST (KM) ¹	VISIB. WEST (KM) ¹	MEDIAN FLIGHT DISTANCE ⁵	BIRDS / HOUR
27-Aug	7.50	3.0	0	pc	28.3	w	23.3	30.18	3	64	79	0	3.2
28-Aug	8.17	2.9	0	clr	24.6	w	21.9	30.31	3	58	72	0	1.7
29-Aug	7.83	3.0	0	clr	15.3	w	24.7	30.44	1	72	70	0	1.8
30-Aug	7.83	3.0	0	clr-mc, scat haze/rain	12.8	w	24.0	30.45	3	49	68	0	2.7
31-Aug	7.83	2.0	0	ovc	16.7	w	22.3	30.38	3	41	67	0	1.5
1-Sep	8.00	2.0	0	clr-pc	20.0	w	23.0	30.37	3	70	59	0	0.9
2-Sep	8.00	3.0	0	mc-ovc	7.8	w	24.4	30.39	3	66	53	0	1.4
3-Sep	8.00	3.0	0	pc-ovc, AM scat rain, PM haze	15.1	w	23.4	30.36	3	48	74	0	1.6
4-Sep	8.00	3.0	0	pc-ovc, PM scat rain	15.2	w	23.0	30.11	3	47	63	0	2.9
5-Sep	3.50	1.6	0	mc-ovc, PM scat ts/fog	20.3	ese-se, w	14.3	30.00	4	42	37	0	0.0
6-Sep	7.25	2.0	0	ovc, fog	29.3	w	12.3	30.17	3	42	43	0	0.8
7-Sep	8.00	2.0	0	clr-mc, haze	20.4	w	16.3	30.25	3	46	48	0	1.8
8-Sep	8.33	2.6	0	clr-ovc, haze	30.6	w	17.1	30.24	3	71	64	0	24.1
9-Sep	7.75	2.0	0	clr-mc, PM haze	22.2	w	13.6	30.15	3	51	61	0	17.5
10-Sep	7.83	2.0	0	clr, haze	7.8	ese, wnw	14.1	30.44	2	52	54	0	4.1
11-Sep	8.00	2.0	0	clr, PM haze	21.0	w	17.9	30.34	2	46	53	0	6.0
12-Sep	8.00	3.0	0	clr-pc, haze	23.1	w	18.6	30.21	3	50	60	0	13.4
13-Sep	8.00	3.0	0	clr-mc, haze	16.7	w	20.0	30.20	3	57	59	0	20.5
14-Sep	5.58	2.9	0	pc-mc, PM scat ts	19.1	e	19.1	30.22	3	60	70	0	5.0
15-Sep	7.83	3.0	0	clr-mc	15.8	sw-w	18.3	30.24	3	60	77	0	21.1
16-Sep	8.00	3.0	0	mc, haze	33.8	wnw	18.3	30.07	3	45	51	0	50.5
17-Sep	8.00	3.0	0	pc-ovc	22.2	w	15.5	29.94	3	55	73	0	22.1
18-Sep	8.00	3.0	0	pc-ovc	25.1	w	11.5	30.06	3	63	81	0	11.3
19-Sep	8.00	3.0	0	mc	12.2	e	18.2	29.98	2	50	60	0	5.4
20-Sep	8.00	3.0	0	clr	27.1	w	18.5	30.02	3	72	83	0	51.3
21-Sep	8.00	2.0	0	clr, haze	29.0	w	16.3	30.27	3	77	79	0	24.4
22-Sep	8.00	3.0	0	pc-ovc, PM scat rain	14.1	wnw	18.2	30.06	3	59	59	0	16.0
23-Sep	8.00	3.3	0	mc-ovc, PM scat rain	20.7	w	9.7	29.79	3	73	67	0	9.6
24-Sep	0.00			weather day: snow									
25-Sep	7.50	3.0	0	pc-mc, AM scat fog	14.3	wnw	6.6	30.22	3	60	49	0	0.7
26-Sep	8.17	3.0	0	clr-pc	20.8	wnw	8.1	30.23	3	60	58	0	27.1
27-Sep	7.83	2.4	0	clr	13.0	ene, wsw	13.7	30.27	3	78	80	0	8.8
28-Sep	8.00	2.0	0	ovc	19.3	ssw-wnw	15.8	29.87	3	60	60	0	24.1
29-Sep	8.00	2.0	0	ovc, AM scat snow/rain	20.3	w	6.0	29.73	3	47	44	0	8.0
30-Sep	7.75	3.0	0	clr	8.4	w	8.3	30.25	2	60	60	0	19.6
1-Oct	7.67	2.0	0	clr-ovc, PM scat rain	32.6	w	13.0	30.23	3	61	68	0	27.1
2-Oct	7.75	2.0	0	clr-mc	37.1	w	7.1	30.17	3	68	72	0	10.1
3-Oct	7.75	2.0	0	clr-mc	26.0	w	11.3	29.85	4	60	50	0	3.5
4-Oct	7.25	2.0	0	clr-ovc, PM scat rain	20.1	w	14.1	29.77	3	58	63	0	9.5
5-Oct	0.00			weather day: snow									
6-Oct	0.00			weather day: snow									
7-Oct	2.00	1.5	0	ovc	30.7	w	1.7	30.06	3	37	43	0	1.5
8-Oct	7.50	2.0	0	clr	6.6	w	7.4	30.28	2	60	60	0	2.5
9-Oct	7.75	2.0	0	clr	26.1	e	12.0	30.27	3	60	60	0	0.6
10-Oct	7.50	2.0	0	clr	18.2	e, s, w	14.4	30.02	2	59	60	0	29.6
11-Oct	8.00	2.0	0	clr-mc	14.4	w	9.0	30.10	3	66	83	0	21.0

Appendix C. continued

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN		WIND			BAROM.	MEDIAN	VISIB.	VISIB.	MEDIAN	BIRDS / HOUR
			VISITOR DISTURB ²	PREDOMINANT WEATHER ³	SPEED (KPH) ¹	WIND DIRECTION	TEMP (°C) ¹	PRESS. (IN HG) ¹	THERMAL LIFT ⁴	EAST (KM) ¹	WEST (KM) ¹	FLIGHT DISTANCE ⁵	
12-Oct	7.83	2.0	0	ovc	3.8	calm, e, sw	11.5	29.85	3	53	60	0	2.0
13-Oct	8.00	2.0	0	ovc, scat snow	6.8	w	9.3	29.86	3	51	63	0	3.4
14-Oct	8.00	2.0	0	pc-ovc	14.8	wnw	9.0	30.06	3	60	60	0	4.8
15-Oct	8.00	2.0	0	clr	23.6	w	10.4	29.92	2	73	79	0	10.0
16-Oct	8.00	2.0	0	pc-mc	13.7	w	9.7	29.66	3	60	60	0	5.5
17-Oct	0.00			weather day: fog/snow									
18-Oct	4.67	2.6	0	pc-ovc	29.0	ene, w	0.8	29.82	2	45	40	0	1.1
19-Oct	4.00	2.0	0	ovc	62.4	w	7.2	29.83	3	70	72	0	0.8
20-Oct	0.00			weather day: fog/snow									
21-Oct	5.75	1.5	0	pc-mc	29.1	w	0.0	30.25	3	70	80	0	0.3
22-Oct	6.25	1.8	0	pc-mc	23.9	w	1.7	30.51	3	70	64	0	1.4
23-Oct	7.50	2.0	0	clr-pc, PM haze	15.9	w	10.1	30.63	3	67	77	0	1.3
24-Oct	7.75	2.0	0	clr	8.7	w	14.4	30.48	2	60	60	0	1.4
25-Oct	8.00	2.0	0	clr-pc	13.1	w	12.5	30.21	3	60	78	0	3.5
26-Oct	7.67	2.6	0	pc	7.3	w	12.4	30.26	2	60	60	0	7.0
27-Oct	7.50	2.0	0	pc-mc, PM haze	9.1	w	8.0	30.41	3	51	63	0	8.4
28-Oct	7.83	2.0	0	clr, haze	12.1	w	9.9	30.52	3	40	40	0	6.3
29-Oct	7.75	2.0	0	pc-mc, haze	16.8	w	13.6	30.31	3	42	54	0	7.7
30-Oct	7.83	2.0	0	pc-ovc, PM rain/snow	25.6	w	7.6	30.03	3	60	46	0	2.4
31-Oct	8.00	2.0	0	clr-pc, AM scat fog	11.7	w	4.2	30.25	3	53	52	0	3.8
01-Nov	7.75	2.0	0	pc-mc	16.2	w	3.3	30.13	3	60	60	0	9.8
02-Nov	7.83	2.0	0	clr-mc	19.2	w	4.2	30.23	3	67	68	0	4.7
03-Nov	8.00	1.8	0	clr-pc	31.3	w	6.0	30.28	2	64	64	0	6.8
04-Nov	8.00	2.0	0	clr	30.0	w	6.2	30.17	2	62	62	1	7.3
05-Nov	7.00	1.6	0	clr, haze	24.9	w	9.0	30.26	3	62	88	1	7.7

¹ Average of hourly records.

² Median hourly visitor-disturbance rating (subjective assessment by observers): 0 = none, 1 = low, 2 = moderate, 3 = high.

³ Predominant sky condition during day: clr = clear (0-15% cloud cover); pc = partly cloudy (16-50% cover); mc = mostly cloudy (51-75% cover); ovc = overcast (76-100% cover); ts = thunder storms.

⁴ Median hourly rating concerning prevalence of lift-generating thermals, based on subjective assessments of solar intensity, wind speeds, and migrant behavior: 1 = excellent, 2 = good, 3 = fair, 4 = poor.

⁵ Median hourly rating concerning line-of-sight distance of flight from observation site: 1 = close, detection and identification possible with naked eye; 2 = moderate, detection possible with naked eye, but binoculars needed for identification; 3 = far, binoculars needed for both detection and identification; 4 = distant, birds detected and identified only with excellent binoculars or spotting scope and by experienced observers.

Appendix D. Raptor counts by day and species during fall migration at Commissary Ridge, Wyoming: 2007.

DATE	HOURS	SPECIES ¹																							BIRDS				
		TV	OS	NH	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/HOUR
27-Aug	7.50	4	0	1	4	2	0	2	1	0	0	0	4	0	0	0	3	0	0	1	0	0	0	0	0	0	2	24	3.2
28-Aug	8.17	1	0	0	2	1	0	1	0	0	0	0	5	0	0	0	2	0	0	1	0	0	0	0	0	0	1	14	1.7
29-Aug	7.83	1	0	0	0	0	0	1	1	1	0	0	6	0	0	0	2	0	0	2	0	0	0	0	0	0	0	14	1.8
30-Aug	7.83	2	0	0	0	3	0	0	0	0	0	0	12	0	0	1	1	0	0	0	0	0	0	0	0	0	2	21	2.7
31-Aug	7.83	0	0	0	0	1	0	0	1	0	0	0	7	0	0	2	1	0	0	0	0	0	0	0	0	0	0	12	1.5
1-Sep	8.00	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	7	0.9
2-Sep	8.00	1	0	0	2	3	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	1	11	1.4
3-Sep	8.00	0	0	0	2	2	0	0	0	0	0	0	4	0	0	2	1	0	0	1	0	0	0	0	0	0	1	13	1.6
4-Sep	8.00	3	0	0	1	4	0	0	2	2	0	0	10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	23	2.9
5-Sep	3.50	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	0	0	0.0
6-Sep	7.25	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	6	0.8
7-Sep	8.00	0	0	0	2	0	0	1	3	0	0	1	5	0	0	1	0	0	0	0	0	0	0	0	0	1	0	14	1.8
8-Sep	8.33	0	12	5	31	31	1	3	1	1	0	5	81	0	0	0	7	0	0	19	0	0	1	0	0	0	3	201	24.1
9-Sep	7.75	2	3	2	27	24	1	5	0	3	0	3	57	0	0	2	1	0	0	1	0	0	0	0	0	0	5	136	17.5
10-Sep	7.83	0	2	0	3	0	0	0	0	1	1	1	20	0	0	0	0	0	0	1	0	1	0	0	0	0	2	32	4.1
11-Sep	8.00	1	1	0	7	11	0	1	2	0	0	0	19	0	0	4	1	0	0	1	0	0	0	0	0	0	0	48	6.0
12-Sep	8.00	3	0	0	33	11	0	0	0	4	0	0	35	0	1	0	10	0	0	8	0	1	0	0	0	0	1	107	13.4
13-Sep	8.00	2	0	1	23	21	1	3	1	5	0	4	64	0	0	2	4	0	0	30	0	1	1	0	0	0	1	164	20.5
14-Sep	5.58	3	0	0	6	6	0	1	0	1	0	0	5	0	0	0	4	0	0	1	0	0	0	0	0	0	1	28	5.0
15-Sep	7.83	11	1	1	57	25	0	2	1	0	1	1	47	0	0	0	3	2	0	5	3	2	1	0	1	1	0	165	21.1
16-Sep	8.00	24	9	0	151	37	0	0	1	10	1	1	130	0	0	0	6	1	0	29	1	0	0	0	0	1	2	404	50.5
17-Sep	8.00	3	0	2	36	22	4	2	0	10	0	1	46	0	0	1	2	0	0	33	3	1	2	0	0	0	9	177	22.1
18-Sep	8.00	3	0	1	44	7	0	0	0	0	0	0	25	0	0	0	3	1	0	4	1	0	0	0	0	0	1	90	11.3
19-Sep	8.00	7	1	0	12	1	1	0	0	0	0	0	9	0	0	0	5	1	0	1	0	0	0	0	0	0	5	43	5.4
20-Sep	8.00	30	2	4	133	96	4	3	1	18	1	1	65	0	1	0	7	2	0	35	2	0	1	0	2	0	2	410	51.3
21-Sep	8.00	33	1	0	63	15	2	6	0	6	0	0	47	0	0	2	1	0	0	9	1	4	1	0	1	0	3	195	24.4
22-Sep	8.00	1	4	0	38	20	0	0	0	1	2	0	41	0	0	1	3	0	0	2	0	0	1	0	1	0	13	128	16.0
23-Sep	8.00	1	0	0	34	9	0	3	1	4	0	0	18	0	0	1	1	0	1	1	0	1	0	0	0	0	2	77	9.6
24-Sep	0.00																												
25-Sep	7.50	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5	0.7
26-Sep	8.17	35	1	1	54	24	3	2	1	9	0	1	51	0	0	2	6	2	0	11	2	2	3	1	0	1	9	221	27.1
27-Sep	7.83	0	0	0	19	12	3	7	0	2	0	0	14	1	0	0	1	0	0	7	0	1	0	0	0	0	2	69	8.8
28-Sep	8.00	4	1	0	48	24	1	4	1	5	0	0	76	1	0	7	7	3	1	4	0	0	1	1	0	0	4	193	24.1
29-Sep	8.00	0	0	1	20	14	5	2	0	1	0	2	15	0	0	2	1	0	0	0	0	0	0	0	0	1	0	64	8.0
30-Sep	7.75	0	0	0	57	23	4	2	0	0	0	3	53	0	0	2	1	4	0	2	0	0	0	0	0	0	1	152	19.6

Appendix D. continued

DATE	HOURS	SPECIES ¹																							BIRDS				
		TV	OS	NH	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/HOUR
1-Oct	7.67	9	0	0	57	28	7	3	0	6	0	8	54	0	0	18	7	0	3	2	1	0	2	0	1	1	1	208	27.1
2-Oct	7.75	0	0	1	29	9	1	0	0	1	0	0	26	0	0	0	2	2	0	3	0	1	0	0	0	0	3	78	10.1
3-Oct	7.75	0	0	0	8	3	2	0	0	2	0	0	7	0	0	0	1	1	2	0	0	0	0	1	0	0	0	27	3.5
4-Oct	7.25	0	1	0	36	11	0	3	0	0	0	0	7	0	0	0	3	2	2	2	0	1	1	0	0	0	0	69	9.5
5-Oct	0.00																												
6-Oct	0.00																												
7-Oct	2.00	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	1.5
8-Oct	7.50	1	0	0	1	2	0	0	0	0	0	0	12	1	0	0	2	0	0	0	0	0	0	0	0	0	0	19	2.5
9-Oct	7.75	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0.6
10-Oct	7.50	0	0	0	55	4	3	0	0	0	0	0	128	0	0	0	4	11	0	8	5	1	3	0	0	0	0	222	29.6
11-Oct	8.00	0	0	1	29	9	1	0	1	1	0	1	82	0	1	0	17	21	0	2	0	1	0	0	0	0	1	168	21.0
12-Oct	7.83	0	0	0	9	2	1	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	16	2.0
13-Oct	8.00	0	0	0	9	3	7	1	0	1	0	2	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	27	3.4
14-Oct	8.00	0	0	1	5	3	1	2	0	1	0	1	13	0	0	1	5	3	1	1	0	0	0	0	0	0	0	38	4.8
15-Oct	8.00	0	0	0	9	4	6	0	0	0	0	0	34	0	0	1	13	11	1	0	0	0	0	0	0	0	1	80	10.0
16-Oct	8.00	0	0	2	5	2	2	0	1	0	0	0	18	0	0	1	7	4	0	0	2	0	0	0	0	0	0	44	5.5
17-Oct	0.00																												
18-Oct	4.67	0	1	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1.1
19-Oct	4.00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	0.8
20-Oct	0.00																												
21-Oct	5.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2	0.3
22-Oct	6.25	0	0	1	2	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	0	0	0	0	0	0	9	1.4
23-Oct	7.50	0	0	1	0	0	3	0	0	0	1	0	1	0	1	0	2	1	0	0	0	0	0	0	0	0	0	10	1.3
24-Oct	7.75	0	0	1	1	0	0	0	0	0	0	0	6	0	0	0	2	0	0	0	1	0	0	0	0	0	0	11	1.4
25-Oct	8.00	0	0	1	3	0	4	0	0	0	0	0	12	0	0	2	2	4	0	0	0	0	0	0	0	0	0	28	3.5
26-Oct	7.67	0	1	1	13	1	5	1	0	0	0	0	17	0	1	1	9	3	1	0	0	0	0	0	0	0	0	54	7.0
27-Oct	7.50	0	0	0	9	0	3	0	0	2	0	0	21	0	1	4	8	10	0	2	0	1	0	0	0	0	2	63	8.4
28-Oct	7.83	0	0	0	2	0	1	0	0	0	0	0	8	0	1	0	14	19	2	0	0	1	0	0	0	0	1	49	6.3
29-Oct	7.75	0	0	0	4	0	3	0	0	0	0	0	9	0	0	2	14	27	1	0	0	0	0	0	0	0	0	60	7.7
30-Oct	7.83	0	0	0	3	0	0	0	0	0	0	0	2	0	1	0	7	5	1	0	0	0	0	0	0	0	0	19	2.4
31-Oct	8.00	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	6	20	0	0	0	0	0	0	0	0	0	30	3.8
01-Nov	7.75	0	0	0	3	0	1	0	0	0	0	0	9	0	0	0	19	37	6	0	0	0	0	0	0	0	1	76	9.8
02-Nov	7.83	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	8	27	0	0	0	0	0	0	0	0	0	37	4.7
03-Nov	8.00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	29	22	2	0	0	0	0	0	0	0	0	54	6.8
04-Nov	8.00	0	0	0	1	0	2	0	0	0	0	0	2	0	2	0	27	24	0	0	0	0	0	0	0	0	0	58	7.3
05-Nov	7.00	0	0	0	4	0	1	0	0	0	0	0	2	0	3	0	20	24	0	0	0	0	0	0	0	0	0	54	7.7
Total	494.56	185	41	30	1214	535	89	61	21	98	7	36	1459	3	13	63	324	299	25	229	24	21	18	3	6	7	83	4894	9.9

¹ See Appendix B for explanation of species codes.

Appendix E. Annual observation effort and raptor counts by species during fall migration at Commissary Ridge, Wyoming: 2001–2007.

	Year							Mean
	2001	2002	2003	2004	2005	2006	2007	
Start date	3-Sep	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	26-Aug
End date	23-Oct	29-Oct	29-Oct	3-Nov	31-Oct	31-Oct	5-Nov	30-Oct
Observation days	22	45	63	65	64	56	66	60
Observation hours	145.88	322.67	474.85	452.67	478.83	443.58	494.56	444.53
Raptors/100 hrs	1155.7	990.8	644.4	916.6	985.3	415.0	990	824
SPECIES	RAPTOR COUNTS							
Turkey Vulture	67	97	66	164	114	39	185	111
Osprey	16	11	31	59	36	11	41	32
Northern Harrier	40	32	25	38	36	26	30	31
Sharp-shinned Hawk	303	675	516	1,118	1,687	217	1,214	905
Cooper's Hawk	256	409	329	614	462	289	535	440
Northern Goshawk	11	21	7	49	35	26	89	38
Unknown small accipiter	11	78	75	75	55	39	61	64
Unknown large accipiter	4	6	13	34	11	6	21	15
Unknown accipiter	29	16	58	69	2	6	98	42
TOTAL ACCIPITERS	614	1,205	998	1,959	2,252	583	2,018	1,503
Broad-winged Hawk	1	8	5	22	9	3	7	9
Swainson's Hawk	18	82	28	62	52	47	36	51
Red-tailed Hawk	323	823	1,042	961	1,319	563	1,459	1,028
Ferruginous Hawk	7	6	3	15	8	7	3	7
Rough-legged Hawk	20	5	5	8	13	5	13	8
Unidentified buteo	19	17	87	63	42	35	63	51
TOTAL BUTEOS	388	941	1,170	1,131	1,443	660	1,581	1,154
Golden Eagle	279	352	233	152	316	211	324	265
Bald Eagle	72	233	90	76	137	82	299	153
Unidentified eagle	5	10	7	10	2	6	25	10
TOTAL EAGLES	356	595	330	238	455	299	648	428
American Kestrel	166	258	355	403	317	156	229	286
Merlin	7	9	6	26	11	10	24	14
Prairie Falcon	1	6	5	6	18	13	21	12
Peregrine Falcon	5	3	3	11	13	9	18	10
Unknown small falcon	2	0	3	6	2	5	3	3
Unknown large falcon	5	0	0	5	2	4	6	3
Unknown falcon	0	2	0	1	0	7	7	3
TOTAL FALCONS	186	278	372	458	363	204	308	331
Unidentified raptor	19	38	68	102	19	19	83	55
ALL SPECIES	1,686	3,197	3,060	4,149	4,718	1,841	4,894	3,643

Appendix F. Raptor capture totals by day and species during fall migration at Commissary Ridge, Wyoming: 2007.

DATE	STN.		SPECIES ¹										CAPTURES /	
	HOURS	NH	SS	CH	NG	RT	GE	AK	ML	PR	PG	TOTAL	HOUR	
29-Aug	7.25	0	0	0	0	0	0	0	0	0	0	0	0.0	
30-Aug	5.50	0	0	0	0	0	0	0	0	0	0	0	0.0	
31-Aug	0.00													
1-Sep	2.50	0	0	0	0	0	0	0	0	0	0	0	0.0	
2-Sep	4.50	0	1	1	1	0	0	0	0	0	0	3	0.7	
3-Sep	3.75	0	0	0	0	0	0	0	0	0	0	0	0.0	
4-Sep	0.00													
5-Sep	0.00													
6-Sep	4.00	0	0	0	0	0	0	0	0	0	0	0	0.0	
7-Sep	0.00													
8-Sep	7.00	0	3	3	0	1	0	0	0	0	0	7	1.0	
9-Sep	15.08	0	4	6	0	4	0	1	0	0	0	15	1.0	
10-Sep	7.75	0	3	5	0	1	0	0	0	0	0	9	1.2	
11-Sep	7.50	0	4	3	0	1	0	1	0	1	0	10	1.3	
12-Sep	6.25	0	2	1	1	1	0	0	0	0	0	5	0.8	
13-Sep	0.00													
14-Sep	0.00													
15-Sep	0.00													
16-Sep	0.00													
17-Sep	7.00	0	1	1	0	1	0	0	0	0	0	3	0.4	
18-Sep	7.50	0	3	2	1	1	0	0	0	0	0	7	0.9	
19-Sep	7.00	0	0	2	0	0	0	0	0	0	0	2	0.3	
20-Sep	7.00	0	8	12	1	0	0	0	0	0	0	21	3.0	
21-Sep	13.00	0	4	10	2	1	0	0	0	0	1	18	1.4	
22-Sep	13.75	0	3	5	0	2	0	1	0	0	0	11	0.8	
23-Sep	13.42	1	5	1	1	0	0	0	0	0	0	8	0.6	
24-Sep	0.00													
25-Sep	6.50	0	2	0	0	0	0	0	0	0	0	2	0.3	
26-Sep	7.50	0	3	0	1	0	0	0	0	0	0	4	0.5	
27-Sep	7.33	0	1	2	0	2	0	0	0	0	0	5	0.7	
28-Sep	7.67	0	8	2	2	1	0	0	0	0	0	13	1.7	
29-Sep	7.50	0	7	1	1	0	0	0	0	0	0	9	1.2	
30-Sep	6.75	0	5	1	0	0	0	0	0	0	0	6	0.9	
1-Oct	6.92	0	2	0	0	0	0	0	0	0	0	2	0.3	
2-Oct	7.42	0	2	0	0	0	0	0	0	0	0	2	0.3	
3-Oct	7.50	0	1	0	0	0	0	0	0	0	0	1	0.1	

Appendix F. continued

DATE	STN.		SPECIES ¹									CAPTURES /	
	HOURS	NH	SS	CH	NG	RT	GE	AK	ML	PR	PG	TOTAL	HOURL
4-Oct	6.75	0	4	1	0	0	0	0	0	0	0	5	0.7
5-Oct	0.00												
6-Oct	0.00												
7-Oct	0.00												
8-Oct	5.75	0	1	0	0	0	1	0	0	0	0	2	0.3
9-Oct	7.00	0	1	0	0	0	0	0	0	0	0	1	0.1
10-Oct	6.50	0	0	2	0	1	0	0	0	0	0	3	0.5
11-Oct	7.00	0	0	0	0	0	0	0	0	0	0	0	0.0
12-Oct	8.00	0	2	0	0	0	0	1	0	0	0	3	0.4
13-Oct	7.00	0	0	0	1	0	0	0	0	0	0	1	0.1
14-Oct	14.58	0	2	0	3	0	0	0	1	0	0	6	0.4
15-Oct	7.17	0	0	0	0	0	0	0	0	0	0	0	0.0
16-Oct	7.17	0	0	0	0	0	0	0	0	0	0	0	0.0
17-Oct	0.00												
18-Oct	0.00												
19-Oct	3.25	0	0	0	0	0	0	0	0	0	0	0	0.0
20-Oct	0.00												
21-Oct	4.00	0	0	0	0	0	0	0	0	0	0	0	0.0
22-Oct	6.00	0	0	0	2	0	0	0	0	0	0	2	0.3
23-Oct	6.50	0	0	0	0	0	0	0	0	0	0	0	0.0
24-Oct	6.50	0	0	0	2	1	0	0	0	0	0	3	0.5
25-Oct	7.25	0	2	0	0	0	0	0	1	0	0	3	0.4
26-Oct	7.50	0	1	0	5	0	0	0	0	0	0	6	0.8
27-Oct	11.50	0	1	0	2	0	0	0	0	0	0	3	0.3
28-Oct	13.50	0	0	0	1	0	0	0	0	0	0	1	0.1
29-Oct	14.00	1	0	0	1	1	1	0	0	0	0	4	0.3
30-Oct	4.67	0	0	0	1	0	0	0	0	0	0	1	0.2
Total	366.43	2	86	61	29	19	2	4	2	1	1	207	0.6

¹ See Appendix B for explanation of species codes.

Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Commissary Ridge, Wyoming: 2004–2007.

	2004	2005	2006	2007	MEAN	TOTAL
First trapping day	2-Sep	29-Aug	28-Aug	29-Aug		
Last trapping day	17-Oct	27-Oct	30-Oct	30-Oct		
Number of stations	1	1	2	2	1.5	
Trapping days	46	55	43	48	48.0	
Station hours	287.43	383.50	346.12	366.43	345.9	
Captures / stn. hour	4.7	5.3	1.5	5.7	4.3	
SPECIES	RAPTOR CAPTURES					
Northern Harrier	0	0	1	2	0.8	3
Sharp-shinned Hawk	61	96	28	86	67.8	271
Cooper's Hawk	47	65	12	61	46.3	185
Northern Goshawk	12	17	3	30	15.5	62
Red-tailed Hawk	7	7	5	19	9.5	38
Golden Eagle	1	0	0	2	0.8	3
American Kestrel	3	13	1	5	5.5	22
Merlin	3	4	0	2	2.3	9
Prairie Falcon	2	2	0	1	1.3	5
Peregrine Falcon	0	0	1	1	0.5	2
All species	136	204	51	209	150.0	600
Recaptures ¹	0	0	0	0	0.0	0
Foreign Recaptures ²	0	0	0	0	0.0	0
Foreign Encounters ³	0	0	0	0	0.0	0

¹ Recaptures at Commissary Ridge of birds originally banded at Commissary Ridge.

² Recaptures at Commissary Ridge of birds originally banded elsewhere.

³ Birds originally banded at Commissary Ridge and subsequently encountered elsewhere.