FALL 2009 RAPTOR MIGRATION STUDIES AT COMMISSARY RIDGE IN SOUTHWESTERN WYOMING

HawkWatch International, Inc.
Salt Lake City, Utah

HAWKWATCH INTERNATIONAL
Conserving Raptors and Our Shared Environment

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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 10 long-term, annual migration counts and 1 of 5 migration-banding studies conducted or co-sponsored by HWI in North America during 2009. 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 2009 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 ridge top 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 ridge top 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 2009, we used a single trapping station (Figure 2). The **Ganth's 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 ridge top.

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 second season of migration counting experience for lead observer Andrew Eberly and first season of experience for official observer Julia Fromfeld (see Appendix A for a complete history of observer participation). Multi-purpose crewmember Andrew Grant served as an official substitute observer two days per week when the other observers took days off; he had gained previous experience observing migrating raptors during a wind-power study. Count efforts 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 or 1800 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 2009 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2009 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

Weather permitting, 2–3 trappers, periodically assisted by HWI staff and other crewmembers, typically operated the single trapping station each day 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.

RESULTS AND DISCUSSION

WEATHER

Inclement weather fully precluded 7 days of potential observations in 2009 and reduced observation time to ≤4 hours on 1 other day (see Appendix D for daily weather records). The number of fully precluded days was slightly higher than the 2002–2008 average of 5.3 days, whereas the number of partially precluded days was a record low (average 4.9 days). Despite some late snow, we were again able to continue the count through 5 November this year. Thirty-six percent of the active observation days featured predominantly fair skies, 36% transitional skies (i.e., shifted from fair skies to mostly cloudy or overcast skies during the day, or vice versa), and 28% mostly cloudy to overcast/stormy skies. The 2002–2008 averages for the site are 46% fair, 30% transitional, and 24% mostly cloudy to overcast skies, indicating that the 2009 season featured more unsettled skies than usual. Moreover, although the

prevalence of visibility reducing fog and haze was at a record low (occurring on only 8% of the active days versus an average of 22%), the proportion of days that included some rain or snow during active observations tied the previous high of 25%. The reduction in foggy/hazy conditions likely contributed to a record-high average visibility rating to the east (82 km vs. average of 71) and an average rating to the west (76 km).

In 2009, the temperature during active observation periods averaged 12.3°C (average of daily values, which were in turn averages of hourly readings), ranging from -3.4–26.8°C. The average was nearly a degree colder than the previous 7-year mean of 13.2°C and ranked as the second coldest to date; however, the low end of the range of values was only moderately low, whereas the high end of the range was the second highest to date behind last year. Barometric pressure readings during active observation periods averaged 30.14 in Hg (average of daily values, which were in turn averages of hourly readings), ranging from 29.71–30.52 in Hg, with the average on the low side but the overall range on the high side.

In 2009, light winds (<12 kph) predominated on 9% of the active observation days, moderate winds (12–28 kph) on 67%, and strong winds (>28 kph) on 23%. The relevant 2002–2008 averages are 11% light, 54% moderate, and 35% strong, indicating that 2009 featured a shift away from strong winds in favor of a record-high prevalence of moderate wind speeds. The season also featured an atypical combination of wind directions. On average, relatively steady W–NW winds prevail on 64% of the active days at this site, SW-W winds on 14%, more variable SW-NW winds on about 10%, and easterly winds on about 5%. In 2009, southwesterly and easterly winds rose to much greater prominence than usual, with W-NW winds prevailing on a record low 17% of the active days, SW-W winds on 36%, SW-NW winds on a record high 14%, SW-NW winds in combination with easterly winds for a significant portion of day on a record-high 21%, and NE-SE winds on a record-high 13% of the active days.

Good to excellent thermal-lift conditions, as subjectively assessed by the observers, predominated on a below average 16% of the active days (average 31%).

In summary, overall, inclement weather kept the observers away from the site slightly less often than usual in 2009, but conditions during active observations were a bit stormier than usual. This suggests that this year's observers may have persevered in the face of inclement weather to a greater degree than usual. In stark contrast to last year, in particular, hazy and especially foggy conditions were, however, much less prevalent than average and this appeared to translate to better than average visibility at least east of the observation ridge. The temperature regime averaged slightly cooler than usual, but the overall range of daily averages spanned a relatively high range of values; i.e., the coldest days were not as extreme as in some years and the warmest days were warmer than usual, but the overall range of daily averages was skewed toward the cool side. Most notably, the wind patterns were highly unusual in 2009, with strong northwesterly winds considerably less prevalent than usual, and moderate southwesterly and easterly winds much more common than usual.

OBSERVATION EFFORT

Counts occurred on 64 of 71 possible days between 27 August and 5 November 2009, averaging 7.5 hours per active day and encompassing a record-high 531.82 total hours of observation (see Appendix D for annual data). The number of observation days was a non-significant 5% above the 2002–2008 average of 61 ± 95% CI of 5.7 days, whereas the number of observation hours was a significant 18% above the 2002–2008 average of 451.50 ± 44.405 hours. The number of observers averaged 2.1 per hour in 2009, which is a non-significant 3% above the 2002–2008 average for the site of 2.0 ± 95% CI of 0.09 observers per hour.

FLIGHT SUMMARY

Flight Volume and Composition

The observers tallied 2,971 migrants of 17 species during the 2009 season, which is a non-significant 21% below the 2002–2008 average (Table 1) and the second lowest full-season count recorded to date (see Appendix D for 2009 daily count records and Appendix E for annual count summaries). The flight was composed of 40% buteos, 39% accipiters, 10% eagles, 7% falcons, 3% vultures, and ≤1% each of Ospreys, harriers, and unidentified raptors (Figure 3). The proportions of buteos, harriers, and Ospreys were significantly above average, whereas the proportions of falcons, vultures, and unidentified raptors were significantly below average. The most abundant species were the Red-tailed Hawk (33% of the total count), Sharp-shinned Hawk (23%), Cooper's Hawk (10%), Swainson's Hawk (4%), Golden Eagle (7%), Bald Eagle (3%), and American Kestrel (5%). All other species each comprised ≤2% of the total.

The Broad-winged Hawk was the only species for which both the count and passage rate were significantly above average in 2009 (Table 1), with the count of 26 birds a new record high for the site (Appendix E). Other species for which the counts along were significantly above average included Northern Harrier, Merlin, and Peregrine Falcon. Conversely, both the counts and passage rates were significantly below average for Turkey Vultures, Cooper's Hawks, Golden and Bald Eagles, American Kestrels, and Prairie Falcons (Table 1), with the kestrel count falling to a new record low for the site (Appendix E). Other species for which the 2009 passage rates were significantly below average included Sharp-shinned Hawk and Red-tailed Hawk.

Eight years is too short a period to support robust analyses of population trends, with 10–15 years typically considered the minimum time frame for conducting analyses of trends in raptor migration counts (Farmer and Hussell 2008) and 20–25 years typically required to yield high-precision trend estimates (Smith et al. 2008a). Therefore, we do yet present herein such analyses. Moreover, casual examination of variation in the annual species-specific counts (Appendix E) and associated passage rates recorded to date reveals few definitive patterns; however, four exceptions warrant mention here: 1) an unsteady declining trend for Cooper's Hawks; 2) an unsteady increasing trend for Northern Goshawks; 3) a strong declining trend for American Kestrels; and 4) a strong increasing trend for Peregrine Falcons. The counts of Northern Goshawks at this site are among the highest across HWI's monitoring network, and most of our other sites currently are showing stable to declining long-term trends for this species. That said, some other sites have shown recent rebounds in the past five years, likely related to the lessening influence of widespread drought in many areas of the interior West. The apparent decline in kestrel numbers is particularly noteworthy, because this species currently is showing declines across the continent (Farmer et al. 2008, Farmer and Smith in press). Conversely, the increasing trend for Peregrine Falcons matches similar trends across the continent (Farmer et al. 2008).

Age Ratios

Among 10 species for which suitable age-specific data were collected, three species showed immature : adult count ratios that were significantly above average in 2009 and two species showed significantly below average age ratios (Table 2). Among the three species with above-average age ratios, the overall counts of aged Ferruginous Hawks were too small to warrant much attention. For Golden Eagles, the counts of identified adults and non-adults both were well below average, but the count of non-adults was proportionately higher (Table 2). This suggests that low overall abundance of migrating adults was the primary cause of the high age ratio for this species, which could reflect relatively low adult survivorship in the northern Rocky Mountains, delayed passage beyond our monitoring period, or perhaps simply that a relatively high number of adults remained farther north than usual in 2009. For Peregrine Falcons, the counts of adults and immatures both were substantially above average in 2009, but also note that the proportion of unaged individuals was much lower than average (Table 2). Nevertheless, the high overall count for the species and a doubling of the age ratio suggest that both productivity and adult survivorship were likely high for this species in the northern Rocky Mountains in 2009. A similar pattern was shown

for the two species with below-average age ratios in 2009; both Sharp-shinned and Red-tailed Hawks showed below average total counts, much lower than average abundances of immature birds, and much higher than average abundances of adult birds (Table 2). This suggests that productivity and juvenile recruitment were not good but recruitment of new adults and/or overall adult survivorship were good for these species in the northern Rocky Mountains in 2009. Again note, however, that for both species the proportions of unaged individuals were well below average in 2009, which may substantially confound these assessments.

Daily and Seasonal Migration Patterns

The diel rhythm of migration at Commissary Ridge in 2009 followed a broadly unimodal distribution, with a steep rise in activity between 0900 and 1100 H, followed by a gradual tapering off of activity through 1600 H, and then a sharp drop-off during the 1700 H (Figure 4). This pattern is similar to the average pattern for the site, although other years have shown more of bimodal pattern with a secondary peak during mid-afternoon.

The overall, combined-species seasonal activity pattern for 2009 was broadly similar to the average pattern for the site, which is roughly bimodal with a major peak in late September, a lull during the first week of October when the first major snow storms usually hit, and then a secondary peak in mid-October when eagle and adult Red-tailed Hawk activity is high (Figure 5). However, despite the fact that the first snow storm did not hit until 30 September (Appendix C), the September peak in activity occurred about 10 days early and the early-October lull was more pronounced and broader in extent than usual. Nine of the 12 days between 30 September and 11 October featured snow events, with complete shut downs occurring on four of those days. Nevertheless, toward the end of this period between snow events, the crew recorded five days of high passage rates, which resulted in significantly above-average proportional activity during the 6–10 October five-day period (Figure 5).

The overall combined-species median passage date of 29 September was the same as last year and a non-significant 2 days later than average (Table 3). At the species level, only the Osprey and Ferruginous Hawk showed significantly earlier than average median passage dates, and only the Turkey Vulture and Swainson's Hawk showed significantly delayed passage in 2009 (Table 3); however, age and sex-specific data revealed greater complexity and more significant differences (Table 4). Although no significant difference was evident at the species level for Northern Harriers, nor for adult birds, the median passage date for immature birds was a significant 15 days later than average. Similarly, although no significant species-level differences were evident, passage of adult Sharp-shinned Hawks, immature Northern Goshawks, and non-adult Golden Eagles was significantly late, while passage of adult Cooper's Hawks, Northern Goshawks, and Broad-winged Hawks was significantly early.

TRAPPING AND BANDING SUMMARY

Trapping occurred on 55 of 62 possible days between 28 August and 28 October 2009, with effort totaling 398.99 station hours (see Appendix F for 2009 daily trapping records and Appendix G for annual trapping summaries). The number of trapping days matched the previous high and the number of station hours was 8% above average.

The crew captured and banded a record-high 228 raptors of 10 species in 2009 (Table 5). The most commonly captured species were the Sharp-shinned Hawk (58% of all captures), Cooper's Hawk (21%), Red-tailed Hawk (10%), Northern Goshawk (3%), Merlin (3%), and American Kestrel (2%). All other species each comprised ≤1% of the total. The capture totals for Sharp-shinned Hawks, Red-tailed Hawks, and Merlins rose to new record highs for the site (Appendix G).

The 2009 combined-species capture rate of 5.7 captures per 10 station hours was a significant 33% above average (Table 5). The capture totals, rates, and estimates of capture success all were significantly above average for Sharp-shinned Hawks, Red-tailed Hawks, Golden Eagles, and Merlins, and the capture total

and capture success were significantly above average for Prairie Falcons. No species-specific capture total was significantly below average, but the capture total for Northern Goshawks was less than half the average and the capture rate for this species was significantly below average due. Although the capture total and rate were near average for Cooper's Hawks, capture success was significantly above average (i.e., we caught a similar number of birds despite the fact that overall flight volume was 13% below average).

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 2009 count- and capture-based age ratios for Sharp-shinned Hawks were 63% and 32% below average, respectively. The two ratios differed markedly in terms of magnitude (0.4 and 1.7, respectively), but this is typical at this site as well as most other HWI banding sites where immature birds tend to be more susceptible to capture than adults. In combination, these data suggest that immature Sharp-shinned Hawks were proportionately less abundant and more susceptible to capture (hungrier) than usual compared to adults of the same species. For Cooper's Hawks, the count and capture age ratios were similarly below average (22% and 23%, respectively) and of the same magnitude (0.8). At this site, the count age ratio for Cooper's Hawks (1.0) averages slightly lower than the capture age ratio (1.1), again suggesting that immature birds generally are at least slightly more susceptible to capture than adults. Thus, in combination the 2009 statistics again suggest that immature Cooper's Hawks were proportionately less abundant than usual compared to adults, but in this case were, if anything, a little less susceptible to capture compared to adults of the same species. For Northern Goshawks, the 2009 count and capture age ratios again were both below average (16% and 34%, respectively), but in this case the differences resulted in atypically matched ratios (1.5; averages 1.8 vs. 2.3), suggesting that in 2009 immature goshawks were both relatively scarce and less susceptible to capture than usual compared to adults.

Unlike the counts, banding also yields useful data on accipiter sex ratios, or at least sex-related susceptibility to capture. In 2009, female Sharp-shinned Hawks were captured 1.1 times more often than males of the same species, but this sex ratio was 37% below average (Table 6). Similarly, female Cooper's Hawks were captured 1.7 times more often than males of the species, but this sex ratio was 62% below average (Table 6). These statistics suggest that, as usual, females of both species were caught at least slightly more often than males of the same species, but to a lesser degree than usual. Similar to the case for the two smaller accipiters, on average at this site, female Northern Goshawks are captured slightly more often than males (average sex ratio of 1.2) and 2009 was no exception; however, the 2009 capture ratio of 2.5 was 103% above average, suggesting that either males were particularly scarce or females were particularly susceptible capture this year.

We caught five immature American Kestrels this year and no adults. The average age ratio is 3.1 immatures for each adult (Table 6). The 2009 female : male capture ratio was 0.25 or 69% below average (Table 6). In contrast, the 2009 count-based sex ratio for American Kestrels was 1.7 or 81% above average (Table 2). Together these data suggest that females, though proportionately much more abundant than usual compared to males, were relatively much less susceptible to capture this year.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

In 2009, we achieved our first same-site recapture of a bird banded at Commissary Ridge, involving a female Sharp-shinned Hawk banded in 2008 as a hatch-year bird. The recapture occurred 7 days later than the original capture and the bird weighed 26 g less upon recapture (13% of its original mass); however, at first capture the bird had limited fat stores but a ¾-full crop, whereas this year it had an empty crop but much better fat stores.

This year we also recaptured a female Cooper's Hawk banded as a second-year bird at Commissary Ridge in 2004, but in this case at our Manzano Mountains migration research site in central New Mexico! The

recapture in New Mexico occurred four days later than the original capture. Over this five-year span, the bird added 57 g in mass (12% gain) and at the time of recapture had healthy keel and robust fat stores.

Since our last year's report when we documented the first foreign encounter of a bird banded at Commissary Ridge, we also obtained a second report of a bird found elsewhere in 2008. We banded this female Cooper's Hawk as an after-second-year adult during fall 2007 and it was reported as killed during a "control operation other than pesticide use" during February 2008 ~1044 km to the south in northwestern Chihuahua, Mexico.

SATELLITE TRACKING

We did not outfit any new birds with satellite transmitters at the site in 2009, but up until recently continued to track the male Golden Eagle we outfitted in 2008. After release, this bird initially spent about 10 days wandering north ~100 km along Commissary Ridge and into the Salt River Range, but then returned to the project area where he remained until early January 2009. He then traveled northwest up into southeastern Idaho and spent the rest of the winter though early April 2009 wandering around the Bear River Valley and in the northern Bear River Range. Then on 6 April he set out on a broader loop up toward Idaho Falls, only to return to his primary winter haunt 10 days later. He remained there for another week, then set out in earnest to the northwest around 24 April, travelling back up through Idaho Falls then north into southwest Montana near Yellowstone National Park, then northwest again along the Rocky Mountains through the top of Idaho and along the western flank of the Rockies into northern British Columbia. He continued on up through the northwest corner of British Columbia along the Coast Ranges to near Whitehorse in the Yukon Territory, then into the southeastern corner of mainland Alaska by 18 May. Initially, he continued out to the coast near Cordova, Alaska, but then returned inland and spent two weeks in the vicinity of the Wrangell-St. Elias National Park and Preserve. He then continued northeast and then northwest up along the Alaska Range to an area just east of Denali National Park near Healy, Alaska. He spent the rest of June through early August in this area. He began his return journey south around 11 August and by 17 August was located in the southwest corner of the Yukon Territory, to this point having largely retraced his spring pathway except for not returning to the coast. His travel pace slowed considerably after this and it was not until late September that he finally dropped back down into northern British Columbia. Unfortunately, after September the transmission of location data became highly intermittent and of generally poor quality. Two additional location signals received in October suggested that the bird continued moving and made it to the southern end of Williston Lake near Prince George, BC, but the reliability of these location data was too poor to be confident of the indicator. Sensor data provided no conformation of a possible mortality, but unless this solar-powered transmitter somehow gets exposed to the sun again we will most likely never be able to confirm what happened to the bird because we simply have not received enough consistent, high-quality location data of late to be sure where it is.

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.

From the first day of counting on 27 August through about the end of September, a persistent suite of local raptors resided in the area with only small changes taking place. That changed when the first major low-pressure system of the season brought snow and colder temperatures to the area at the end of September.

Six Turkey Vultures regularly worked the area atop and along both sides of the ridge, sometimes travelling together and at other times in two groups of three. These birds were not seen after the first major snow storm of the season hit at the end of September.

Two immature Northern Harriers spent most of the season frequenting the flatter terraces along the ridge both east and west of the observation point. These two birds were seen throughout the day on most days and often provided quite a show as they hunted low over the sagebrush or masterfully stooped other raptors in the area. On 6 September, an adult male harrier was spotted flying down toward the Ham's Fork River valley from the ridge to the north. This bird was rarely seen after this date but was likely a resident of the valley and occasionally explored the ridgetop. On 16 September, three different brown harriers were spotted hunting together along the ridge to the north, most likely the two regular residents and a transient resident. The last sighting of the two regular immature residents occurred on 10 October.

Resident immature Cooper's and Sharp-shinned Hawks were active in the area throughout the month of September. At least three immature Sharp-shinned Hawks often came up from the forested areas to the west to harass the owl or other resident birds. At least two immature Cooper's Hawks were often seen near the forested area to the northeast known as the quills, which in past years has been more of a sharp-shin area. From 26 October through the end of the count, two Northern Goshawks, one adult and one immature, were seen regularly making quick appearances around both the observation site and the trapping blind hunting or mobbing other raptors before disappearing. On 3 November, two adult goshawks were spotted at the same time. Typically, resident goshawks are much more apparent throughout the season, suggesting that no breeding happened in the project area in 2009 and that at least the late-season immature bird probably moved into the area from elsewhere.

For most of the first month about 10 Red-tailed Hawks regularly used the meadows and ridge lift around the observation point for hunting. These birds were seen throughout the day on most days with activity peaks in the morning and late afternoon. Focal points of activity for these birds seemed to be a forested area to the southwest of the observational point and along the crest of the ridge to the north. These two spots seemed to host different individuals with only occasional crossover, usually resulting in some sort of display or harassment, and likely reflected the territory locations of a least two different family groups. Most of the birds coming from the south were heavily marked immatures, one of which was probably an intermediate morph. One known, perennially active nest is located about 2 km south of the observation point along the main access road. Two adult, light-morph birds and an adult dark morph also often were seen to the south, suggesting the possibility of two family groups in the area. In past years, a dark-morph adult has been seen arising from the southeast side of the ridge. The north population also included a mix of adults and immatures, with at least two light-morph adults and 2–3 light-morph immatures regularly seen by the banders hunting the hillsides just north of Ganth's Tooth station. At one point in October, the banders saw an adult light-morph perch in a tree just north of the blind that appeared to have a nest structure in it.

On the first day of the count, the observers recorded two light-morph, adult Swainson's Hawks that appeared to residents. They regularly saw them for about two weeks crossing the ridge from west to east and occasionally pausing to hunt on the east ridge or farther north. The birds hunted over the ridge using the same kiting technique as the Red-tailed Hawks and often intermingled with both the northern and southern groups of red-tails. The observers also saw a dark-morph Swainson's Hawk on 31 August that hunted in the meadows north of the observation site for at least two days after that. This apparent resident activity waned after 6 September as more migrants began to move through.

The first definite resident Rough-legged Hawk showed up on 13 October. After this, resident Rough-legged Hawks were seen almost every day. At first a few individuals were seen making late afternoon trips back to the north, presumably after hunting in the Ham's Fork Valley to the south during the day. This phenomenon has been a regular occurrence for the past several years. By 22 October, at least five

individuals were regularly seen around obs, often kiting in the same place for up to 10 minutes or lifting high into the sky before making a bee line toward flatter areas in the Ham's Fork Valley.

At least two adult, several subadult, and one immature Golden Eagles frequented the area, making daily trips between the northern forested areas near the trapping blind and the flatter sagebrush country around Lake Viva Naughton to the west and southwest of the observation point. There were also scattered non-adult Bald Eagle sightings during the month of September, following the same flight paths as the Golden Eagles. This level of activity persisted until around 12 October, when migrant Bald and Golden Eagles began arriving and using the lake and areas to the north for several days at a time. All age classes of both species were present, with an increase in adult Bald Eagles toward the end of the season. Also, toward the end of the season, carcasses left by hunters north of the banding station became focal points for eagle activity. The constant exchange of birds between the lake and areas to the north made determining migrants versus temporary residents quite challenging.

At least 8 American Kestrels resided in the area around the observation point through the end of September. These individuals were a mix of male and female birds and may have represented more than one family group, though a single family of that size is possible for kestrels. One male and one female were often seen perched on the ridgetop just north of the observation point, while other birds were seen either to the east or west harassing other raptors. All of the local kestrels routinely appeared around 1600 H on a daily basis to hunt in the area. All resident kestrel activity ceased after the first snowstorm at the end of September. On 25 October, an adult male Merlin was seen contouring the ridge heading north, and was later seen several more times by the banders. Prairie Falcons thought to be at least temporary residents were spotted on 10 and 27 September and 15 October mostly along the east ridge. The observers spotted two immature Peregrine Falcons on 7 September heading northward, which the banders later saw as well. On 20 September, an adult female Peregrine Falcon was seen flycatching high overhead before heading north and then returning to the south later in the day. Another adult peregrine was seen heading north on 26 September.

Except for the apparent lack of successful goshawk breeding in the immediate area, this is a fairly typical assemblage of resident species for the project area. Unlike last year, however, it appeared that 2009 generally was a good year for productivity, with a relatively high number of juvenile accipiters (except goshawks), Red-tailed Hawks, kestrels, harriers, and peregrines particularly apparent.

SITE VISITATION AND PUBLIC OUTREACH

Public awareness of HWI's newest migration-monitoring project is still developing. Public visitation was similar to last year, with nine visitors recorded on our visitor log. Two visitors were reporters for Wyoming papers and wrote articles about the project and its participants. Other visitors hailed from Wyoming, California, and Oregon, and all came specifically to visit the site and crewmembers.

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Table 1. Annual raptor migration counts and passage rates by species at Commissary Ridge, Wyoming: 2002–2008 versus 2009.

	COUNTS			RAPTORS/100 HOURS		
SPECIES	2002–2008[1]	2009	% CHANGE	2002–2008[1]	2009	% CHANGE
Turkey Vulture	116.4 ± 39.4	50	-57	25.8 ± 8.1	9.4	-64
Osprey	30.9 ± 12.6	34	+10	6.7 ± 2.6	6.4	-4
Northern Harrier	31.3 ± 3.5	38	+21	7.1 ± 1.2	7.1	1
Sharp-shinned Hawk	933.7 ± 366.2	690	-26	205.2 ± 73.6	129.7	-37
Cooper's Hawk	431.4 ± 84.9	298	-31	97.0 ± 20.7	56.0	-42
Northern Goshawk	39.9 ± 19.8	32	-20	8.6 ± 3.8	6.0	-30
Unknown small accipiter	58.3 ± 15.0	92	+58	13.5 ± 4.6	17.3	+29
Unknown large accipiter	14.1 ± 7.5	17	+20	3.1 ± 1.6	3.2	+3
Unknown accipiter	42.6 ± 26.6	15	-65	9.1 ± 5.4	2.8	-69
TOTAL ACCIPITERS	1,520.0 ± 452.4	1,144	-25	336.5 ± 91.6	215.1	-36
Broad-winged Hawk	9.6 ± 4.7	26	+172	2.1 ± 1.0	4.9	+128
Swainson's Hawk	94.1 ± 85.2	119	+26	20.7 ± 17.2	22.4	+8
Red-tailed Hawk	1,045.0 ± 223.4	987	-6	231.0 ± 40.5	185.6	-20
Ferruginous Hawk	7.0 ± 3.0	9	+29	1.6 ± 0.7	1.7	+7
Rough-legged Hawk	11.9 ± 7.7	7	-41	2.5 ± 1.5	1.3	-48
Unidentified buteo	64.4 ± 30.9	43	-33	13.7 ± 6.0	8.1	-41
TOTAL BUTEOS	1,232.0 ± 272.1	1,191	-3	271.7 ± 47.9	223.9	-18
Golden Eagle	276.1 ± 57.3	211	-24	63.0 ± 17.9	39.7	-37
Bald Eagle	168.4 ± 69.7	86	-49	38.4 ± 17.1	16.2	-58
Unidentified eagle	13.4 ± 8.6	0	-100	2.9 ± 1.7	0.0	-100
TOTAL EAGLES	458.0 ± 127.8	297	-35	104.3 ± 34.6	55.8	-46
American Kestrel	276.7 ± 63.6	151	-45	62.3 ± 15.2	28.4	-54
Merlin	15.9 ± 6.5	23	+45	3.5 ± 1.3	4.3	+25
Prairie Falcon	10.7 ± 4.9	4	-63	2.3 ± 1.0	0.8	-68
Peregrine Falcon	10.3 ± 4.2	16	+56	2.2 ± 0.8	3.0	+37
Unknown small falcon	4.0 ± 2.2	1	-75	0.8 ± 0.5	0.2	-78
Unknown large falcon	3.1 ± 1.8	1	-68	0.7 ± 0.4	0.2	-72
Unknown falcon	2.6 ± 2.3	1	-61	0.6 ± 0.5	0.2	-67
TOTAL FALCONS	323.3 ± 60.9	197	-39	72.4 ± 13.9	37.0	-49
Unidentified raptor	52.6 ± 23.9	20	-62	11.7 ± 5.1	3.8	-68
GRAND TOTAL	3,764.4 ± 821.6	2,971	-21	836.0 ± 164.5	558.6	-33

[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: 2002–2008 versus 2009.

	Total and Age-classified Counts								Immature : Adult	
	2002–2008 Average			2009			% Unknown Age		Ratio	
Species	Total	Imm.	Adult	Total	Imm.	Adult	2002–2008[1]	2009	2002–2008[1]	2009
Northern Harrier	31	8	11	38	9	12	39 ± 6.5	45	0.8 ± 0.2	0.8
Sharp-shinned Hawk	934	247	287	690	134	366	43 ± 2.8	28	1.0 ± 0.2	0.4
Cooper's Hawk	431	118	126	298	82	102	44 ± 5.3	38	1.0 ± 0.3	0.8
Northern Goshawk	40	12	9	32	15	10	33 ± 14.4	22	1.8 ± 0.9	1.5
Broad-winged Hawk	10	2	3	26	4	8	53 ± 13.5	54	0.5 ± 0.2	0.5
Red-tailed Hawk	1045	239	532	987	117	726	26 ± 2.4	15	0.5 ± 0.1	0.2
Ferruginous Hawk	7	2	1	9	3	1	59 ± 14.0	56	1.3 ± 0.5	3.0
Golden Eagle	276	143	95	211	118	60	14 ± 3.0	16	1.5 ± 0.1	2.0
Bald Eagle	168	58	109	86	28	55	1 ± 0.4	3	0.5 ± 0.0	0.5
Peregrine Falcon	10	1	3	16	7	6	52 ± 13.8	19	0.5 ± 0.3	1.2

[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 2009, with comparisons of 2009 and 2002–2008 average median passage dates.

	2009				2002–2008
Species	First Observed	Last Observed	Bulk Passage Dates[1]	Median Passage Date[2]	Median Passage Date[2, 3]
Turkey Vulture	5-Sep	8-Oct	18-Sep – 3-Oct	27-Sep	22-Sep ± 1.8
Osprey	29-Aug	1-Oct	31-Aug – 22-Sep	12-Sep	17-Sep ± 2.9
Northern Harrier	30-Aug	29-Oct	3-Sep – 20-Oct	25-Sep	27-Sep ± 6.5
Sharp-shinned Hawk	27-Aug	5-Nov	14-Sep – 17-Oct	29-Sep	27-Sep ± 2.3
Cooper's Hawk	27-Aug	19-Oct	6-Sep – 7-Oct	20-Sep	22-Sep ± 2.7
Northern Goshawk	9-Sep	2-Nov	17-Sep – 25-Oct	3-Oct	07-Oct ± 5.1
Broad-winged Hawk	19-Sep	8-Oct	20-Sep – 6-Oct	24-Sep	24-Sep ± 2.8
Swainson's Hawk	28-Aug	8-Oct	1-Sep – 1-Oct	26-Sep	20-Sep ± 5.0
Red-tailed Hawk	27-Aug	5-Nov	20-Sep – 19-Oct	8-Oct	04-Oct ± 5.8
Ferruginous Hawk	27-Aug	20-Oct	27-Aug – 20-Oct	19-Sep	26-Sep ± 6.8
Rough-legged Hawk	29-Sep	1-Nov	29-Sep – 1-Nov	22-Oct	21-Oct ± 3.0
Golden Eagle	27-Aug	5-Nov	7-Sep – 31-Oct	16-Oct	13-Oct ± 4.6
Bald Eagle	6-Sep	5-Nov	8-Oct – 2-Nov	22-Oct	21-Oct ± 4.5
American Kestrel	27-Aug	19-Oct	7-Sep – 27-Sep	20-Sep	22-Sep ± 2.7
Merlin	15-Sep	31-Oct	19-Sep – 20-Oct	7-Oct	04-Oct ± 6.8
Prairie Falcon	8-Sep	12-Oct	–	–	24-Sep ± 2.8
Peregrine Falcon	31-Aug	8-Oct	1-Sep – 8-Oct	17-Sep	26-Sep ± 1.2
Total	27-Aug	5-Nov	10-Sep – 18-Oct	29-Sep	27-Sep ± 2.0

[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: 2002–2008 versus 2009.

	ADULT		IMMATURE / SUBADULT	
SPECIES	2002–2008[1]	2009	2002–2008[1]	2009
Northern Harrier	06-Oct ± 12.6	8-Oct	30-Sep ± 2.7	15-Oct
Sharp-shinned Hawk	03-Oct ± 3.4	8-Oct	23-Sep ± 4.5	19-Sep
Cooper's Hawk	24-Sep ± 2.1	20-Sep	19-Sep ± 3.5	19-Sep
Northern Goshawk[2]	23-Oct ± 7.1	6-Oct	26-Sep ± 9.3	16-Oct
Broad-winged Hawk	25-Sep ± 2.9	20-Sep	26-Sep ± 0.0	–
Red-tailed Hawk	08-Oct ± 5.4	12-Oct	29-Sep ± 5.5	26-Sep
Golden Eagle	18-Oct ± 5.2	17-Oct	09-Oct ± 3.6	16-Oct
Bald Eagle	21-Oct ± 4.3	25-Oct	22-Oct ± 4.6	18-Oct
Peregrine Falcon	19-Sep ± 2.9	20-Sep	–	7-Sep

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: 2004–2008 versus 2009.

	Capture Total		Capture Rate[1]		Capture Success (%)[2]	
Species	2004–2008[3]	2009	2004–2008[3]	2009	2004–2008[3]	2009
Northern Harrier	0.6 ± 0.8	1	0.2 ± 0.20	0.3	2.1 ± 2.7	2.6
Sharp-shinned Hawk	73.0 ± 25.2	132	19.9 ± 7.11	33.1	7.4 ± 2.4	17.3
Cooper's Hawk	45.8 ± 18.3	48	12.7 ± 4.63	12.0	9.0 ± 3.3	13.9
Northern Goshawk	15.2 ± 8.6	7	4.2 ± 2.25	1.8	27.5 ± 11.5	20.6
Red-tailed Hawk	11.2 ± 5.9	23	3.0 ± 1.59	5.8	0.9 ± 0.3	2.2
Golden Eagle	1.0 ± 0.9	2	0.3 ± 0.22	0.5	0.4 ± 0.3	0.9
Bald Eagle	0.2 ± 0.4	0	0.0 ± 0.08	0.0	0.1 ± 0.1	0.0
American Kestrel	5.4 ± 4.0	5	1.4 ± 0.91	1.3	1.9 ± 1.2	3.3
Merlin	2.8 ± 1.7	7	0.8 ± 0.52	1.8	15.0 ± 12.1	30.4
Prairie Falcon	1.2 ± 0.7	2	0.3 ± 0.22	0.5	10.8 ± 8.5	50.0
Peregrine Falcon	1.0 ± 1.1	1	0.2 ± 0.22	0.3	5.9 ± 5.9	5.9
All Species	157.4 ± 58.0	228	43.0 ± 14.05	57.1	4.0 ± 0.6	8.0

[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: 2004–2008 versus 2009.

		Female		Male		Female : Male	Imm. : Adult
Species	Years	HY	AHY	HY	AHY	Ratio	Ratio
Sharp-shinned Hawk	Avg. 2004–2008[1]	29	17	20	8	1.78 ± 0.29	2.5 ± 0.62
	2009	47	23	51	11	1.13	1.7
Cooper's Hawk	Avg. 2004–2008[1]	16	20	6	3	4.38 ± 0.88	1.1 ± 0.28
	2009	20	10	12	6	1.67	0.8
Northern Goshawk	Avg. 2004–2008[1]	4	3	6	3	1.23 ± 0.69	2.3 ± 0.78
	2009	2	3	2	0	2.50	1.5
American Kestrel	Avg. 2004–2008[1]	1	0	3	1	0.81 ± 0.61	3.1 ± 1.06
	2009	1	0	4	0	0.25	5.0

[1] For ratios: mean ± 95% CI.

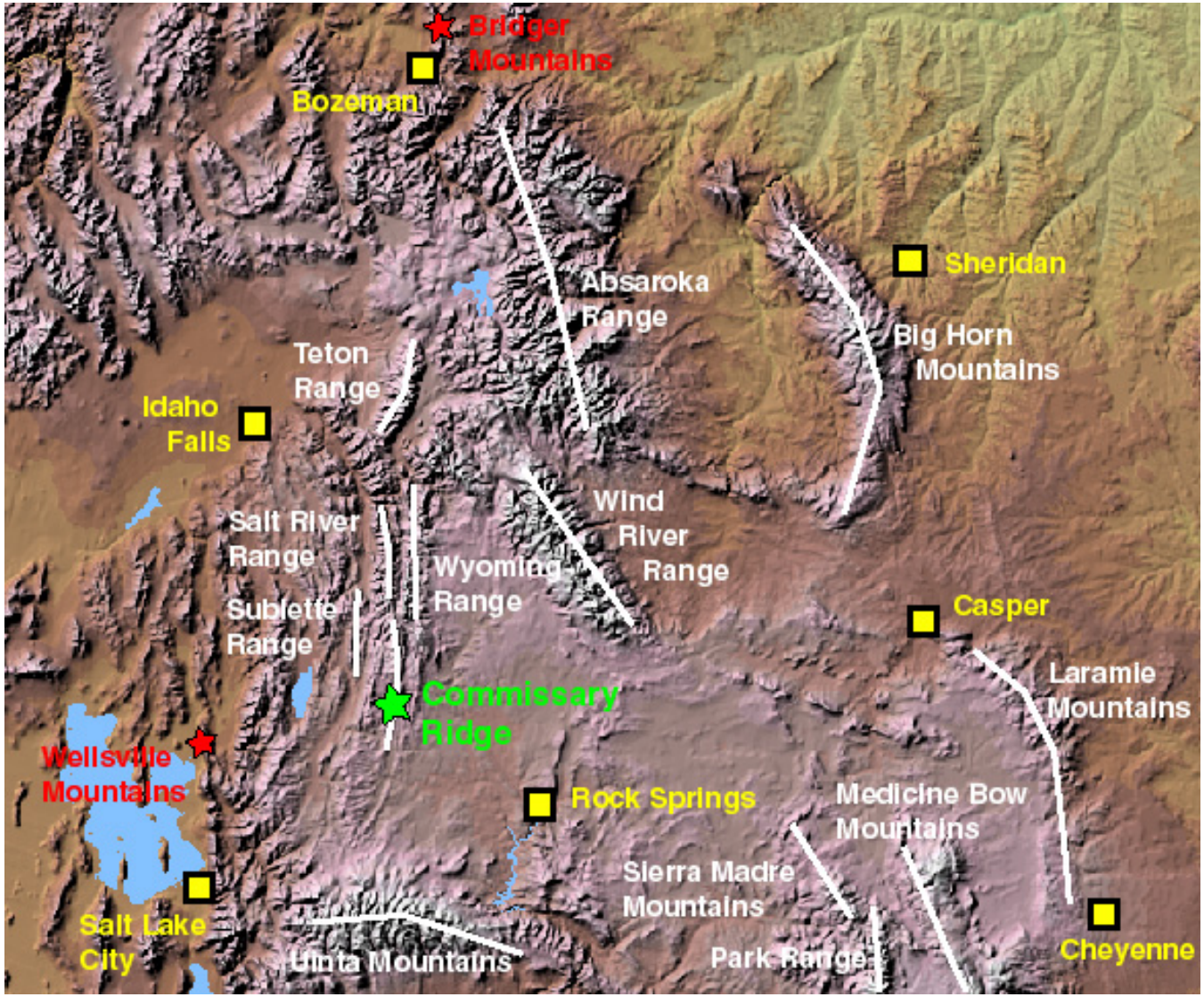

Figure 1. Location of Commissary Ridge Raptor Migration Project site in southwestern Wyoming. Red stars indicate other nearby HWI fall migration monitoring sites in Utah and Montana.

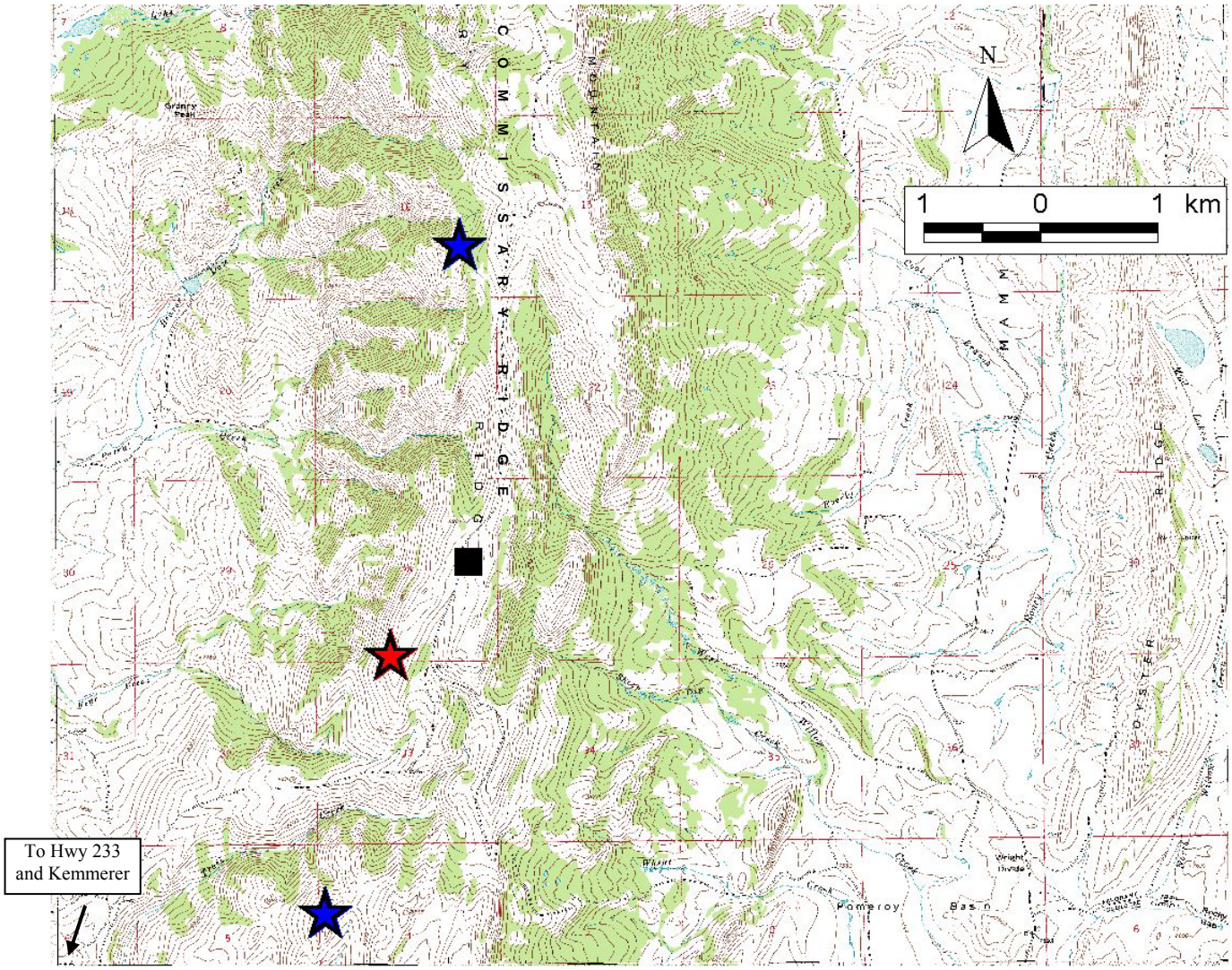

Figure 2. Close-up of Commissary Ridge Raptor Migration Project study site in southwestern Wyoming showing locations of the observation post (red star), the trapping locations (blue stars; only north station used in 2009), and base camp (black square).

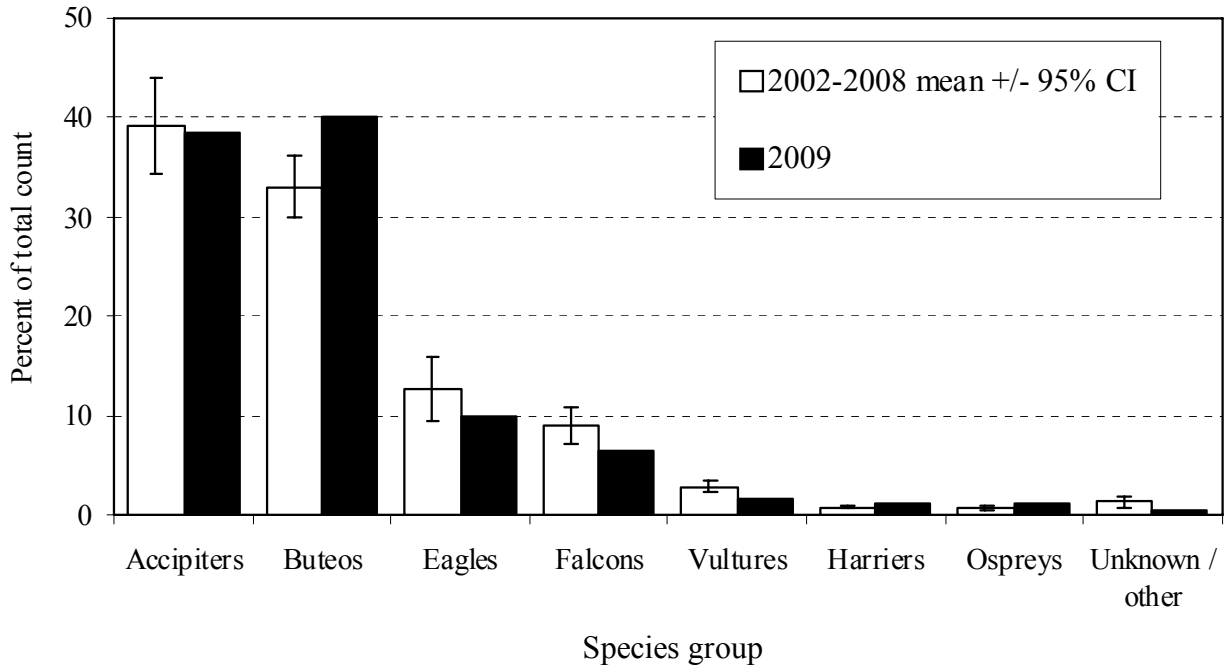

Figure 3. Composition by major species groups of the fall raptor migration at Commissary Ridge, Wyoming: 2002–2008 versus 2009.

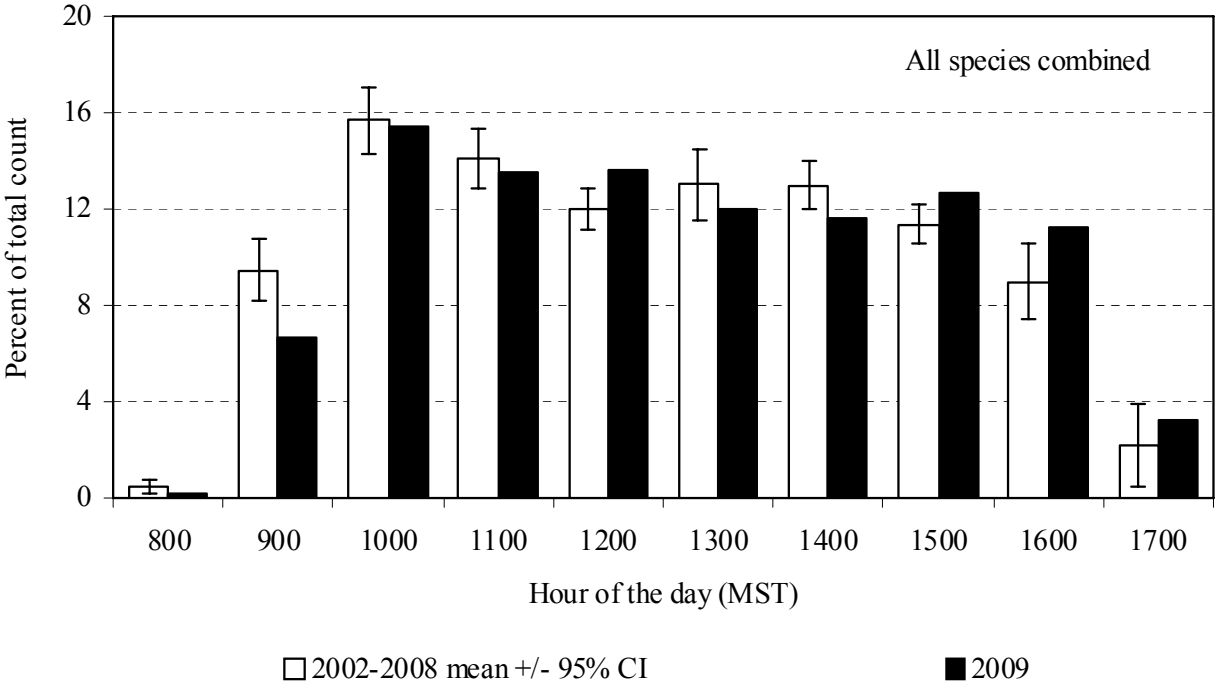

Figure 4. Daily rhythm of the fall raptor migration at Commissary Ridge, Wyoming: 2002–2008 versus 2009.

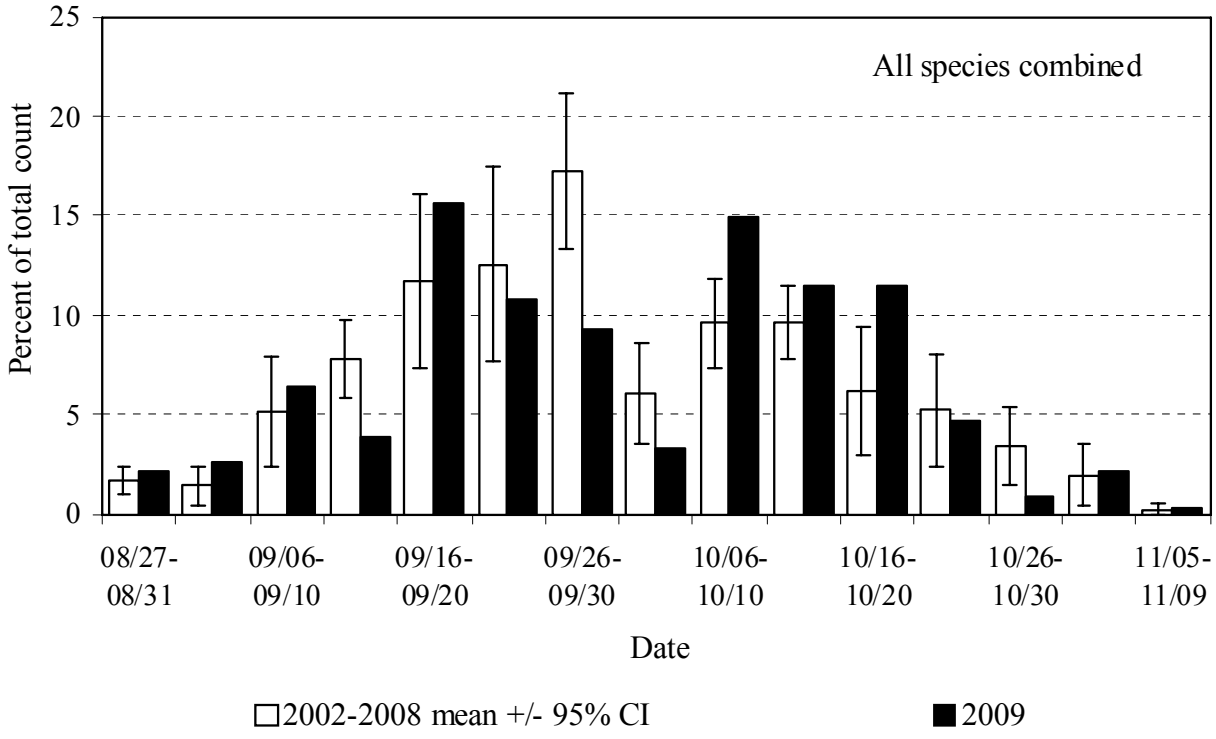

Figure 5. Combined-species seasonal distribution of activity by five-day periods for raptors during fall migration at Commissary Ridge, Wyoming: 2002–2008 versus 2009.

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 Donnovan (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.

2008: Two observers throughout: Sue Bruner (4), Sedona Maniak (0), Chase Cammarota (0); assisted by other trained crewmembers and staff.

2009: Two observers throughout: Andrew Eberly (1), Julia Fromfeld (0), Andrew Grant (+).

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[1] Numbers in parentheses indicate the number of seasons 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	*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
Swanson'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 peregrinus*	PG	A I U	U	NA
Unknown small falcon	*F. sparverius* or *columbarius*	SF	U	U	NA
Unknown large falcon	*F. mexicanus* or *peregrinus*	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 (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: 2009.

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	8.92	2.4	0	clr-pc	13.1	e/calm, sw-wsw	26.8	30.52	2	81	81	3	0.7
28-Aug	9.00	2.0	0	clr-mc	14.0	e, sw-wsw	23.3	30.49	3	84	84	2	0.3
29-Aug	9.00	2.0	0	ovc	13.8	e, w-wnw	22.9	30.32	3	76	75	2	1.8
30-Aug	9.00	2.4	0	pc-ovc, PM ts/rain	17.8	e, sw-wnw	23.9	30.16	3	45	36	2	1.4
31-Aug	9.00	2.0	0	pc-mc	35.5	sw-w	20.2	30.16	3	64	66	2	2.9
01-Sep	9.00	2.0	0	mc-pc	24.4	wsw-w	21.7	30.32	3	69	85	2	2.1
02-Sep	9.00	2.0	0	pc-mc	14.5	wsw-nw	23.2	30.41	2	75	76	3	2.1
03-Sep	9.00	2.0	0	mc-ovc, scat rain	8.6	ese, w-wnw, calm/var	24.0	30.36	2	65	67	2	1.9
04-Sep	9.00	2.0	0	clr-mc, scat rain	9.3	wsw-wnw	22.0	30.29	2	63	65	2	1.0
05-Sep	9.00	2.0	0	mc-ovc	16.0	sw-w	21.8	30.24	3	60	60	2	1.4
06-Sep	8.40	2.0	0	ovc-pc, scat ts/rain	22.5	sw-wsw	19.8	30.20	4	59	68	1	2.3
07-Sep	9.00	2.0	0	pc-mc	37.5	wsw-w	21.2	30.09	3	54	60	2	5.9
08-Sep	9.00	2.0	0	clr	33.1	wsw-w	18.5	30.16	4	91	75	2	3.7
09-Sep	9.00	2.0	0	clr-pc	25.5	wsw-w	22.4	30.29	3	93	80	1	4.7
10-Sep	9.00	2.0	0	pc	29.1	wsw-w	24.4	30.31	3	83	73	2	5.0
11-Sep	9.00	2.0	0	clr-pc	15.6	ene-ese/calm, wsw-w	20.4	30.39	3	75	85	2	3.8
12-Sep	9.00	2.0	0	clr-mc	26.0	ene-ese	14.5	30.13	4	85	85	2	3.0
13-Sep	9.00	2.0	0	mc-ovc	41.5	sw-wsw	16.5	29.96	4	62	72	2	3.7
14-Sep	4.50	2.0	0	pc, PM ts	18.0	sw, ene-ese	16.3	30.15	3	95	87	2	3.1
15-Sep	8.00	2.0	0	ovc/fog-pc, scat rain	20.8	ne-ese	12.7	30.32	4	67	57	3	0.8
16-Sep	9.00	2.0	0	pc-mc	25.6	ene-ese	15.8	30.40	4	85	65	2	1.2
17-Sep	9.00	2.0	0	clr	17.6	ene-ese	17.9	30.31	4	58	56	2	2.0
18-Sep	9.00	2.0	0	clr-pc	9.3	ene-ese	19.6	30.33	2	95	67	2	3.3
19-Sep	9.08	3.0	0	clr-ovc, PM rain	16.6	w-nw, wsw	19.0	30.26	2	84	73	2	14.0
20-Sep	9.25	2.8	0	clr-pc	43.8	wsw-wnw	13.8	30.09	4	77	75	2	29.9
21-Sep	9.00	2.0	0	clr-pc	19.1	w-nw	9.2	30.34	4	100	100	2	10.9
22-Sep	9.00	2.0	0	clr	12.3	ene, wsw	13.5	30.41	3	88	87	2	10.6
23-Sep	9.00	2.0	0	clr-pc	15.0	e	15.3	30.41	3	100	97	2	6.9
24-Sep	9.00	2.0	0	clr-pc	6.5	wnw-nw, ne-se	15.8	30.28	2	98	96	2	5.1
25-Sep	9.00	1.7	0	clr-pc	19.0	w-nw	18.9	30.28	3	97	65	2	2.4
26-Sep	9.00	2.0	0	clr/haze	33.6	w-wnw	17.5	30.30	4	45	46	2	13.2
27-Sep	9.00	2.0	0	clr	26.5	w-wnw	16.4	30.19	4	70	76	2	6.2
28-Sep	9.00	2.3	0	clr-mc, haze	15.5	ene-se	15.1	30.12	3	60	58	2	3.6
29-Sep	9.00	2.2	0	mc-ovc	20.9	sw-wsw	19.8	29.94	4	65	73	2	7.8
30-Sep	0.00			weather day: snow									
01-Oct	7.67	2.0	0	ovc/snow-pc	37.6	sw-wnw	0.3	30.07	4	100	60	2	5.6
02-Oct	9.00	2.0	0	clr-mc	12.5	ese, wsw-wnw	3.5	29.98	2	95	100	3	0.7
03-Oct	9.00	3.0	0	ovc, snow	18.8	ene-ese	5.9	29.71	4	96	86	3	5.3
04-Oct	0.00			weather day: snow									
05-Oct	0.00			weather day: snow									
06-Oct	8.75	2.0	0	clr-pc	20.1	wsw-w	0.1	30.00	4	96	69	2	11.2
07-Oct	8.75	2.0	1	clr, AM fog	27.0	w	2.5	29.81	3	100	100	2	17.0
08-Oct	8.75	2.0	0	mc-ovc, scat ts/snow	27.3	wsw-wnw	1.7	29.85	4	51	79	2	11.5
09-Oct	5.25	2.0	0	ovc, AM fog, snow	48.7	sw-wsw	1.0	29.77	4	30	29	-	0.0
10-Oct	8.75	2.0	0	mc-ovc, AM snow	23.7	sw-w	-0.5	29.81	4	66	68	2	10.9
11-Oct	0.00			weather day: snow									
12-Oct	8.33	2.0	0	clr-ovc	17.1	wsw-wnw	5.3	29.76	4	91	84	2	15.4

Appendix C. continued

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
13-Oct	8.75	2.0	0	mc-ovc	18.2	sw-wsw	6.4	29.81	4	99	62	1	4.8
14-Oct	4.00	3.0	0	mc-ovc	26.6	w	5.0	29.96	4	100	74	2	1.0
15-Oct	8.50	2.0	0	mc-ovc	30.6	wsw-wnw	6.9	30.21	4	93	88	2	19.8
16-Oct	8.50	2.0	0	clr-pc	16.0	w-wnw	6.7	30.36	3	100	100	2	8.0
17-Oct	8.75	2.0	0	clr	10.8	se-s, wsw-w	12.1	30.31	2	99	80	2	18.1
18-Oct	7.67	2.0	0	mc-ovc	19.4	wsw-wnw	13.8	30.13	3	100	70	2	8.7
19-Oct	7.75	2.0	0	mc-ovc, PM rain	29.7	wsw-w	8.7	29.81	4	100	67	2	5.8
20-Oct	5.00	2.0	0	ovc-pc, scat snow	12.7	ne, w-wnw	4.3	29.90	4	30	24	1	0.8
21-Oct	8.00	2.0	0	ovc-pc	9.4	e, calm, wsw-wnw	3.7	30.03	4	77	60	2	3.8
22-Oct	8.50	2.0	0	mc-ovc, scat snow	19.6	w	4.1	30.03	4	96	76	2	2.8
23-Oct	8.00	2.0	0	ovc	28.1	w	2.4	29.98	4	100	68	2	3.6
24-Oct	6.50	2.8	0	mc-ovc	50.5	w	2.6	29.76	4	99	79	1	4.2
25-Oct	8.00	2.0	0	clr	21.1	wsw-w	-0.3	30.07	4	99	100	2	3.9
26-Oct	7.50	2.0	0	ovc	24.8	wsw-w	1.9	30.01	4	100	72	2	2.3
27-Oct	0.00			weather day: snow									
28-Oct	0.00			weather day: snow									
29-Oct	5.50	2.0	0	ovc-pc, blowing snow	25.1	w	-3.4	29.71	4	90	87	2	1.5
30-Oct	0.00			weather day: snow									
31-Oct	8.00	2.0	0	ovc-pc	32.3	wsw-w	3.3	30.14	4	97	96	2	1.0
01-Nov	6.50	2.0	0	pc-mc	36.3	wsw	6.1	30.13	4	100	89	2	1.4
02-Nov	8.00	2.0	0	clr	26.7	wsw	6.0	30.28	4	100	100	2	4.4
03-Nov	8.00	2.0	0	pc-ovc	34.7	wsw-w	7.2	30.21	4	100	100	2	1.4
04-Nov	8.00	2.0	0	pc-mc	12.4	wsw-w	13.2	30.32	2	100	98	-	0.0
05-Nov	8.00	2.0	0	clr-pc	17.0	wsw	12.5	30.23	3	100	97	2	1.0

[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: 2009.

		Species[1]																										Birds
Date	Hours	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	8.92	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	6	0.7
28-Aug	9.00	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.3
29-Aug	9.00	0	2	0	0	1	0	1	0	0	0	4	2	0	0	1	5	0	0	0	0	0	0	0	0	0	0	16	1.8
30-Aug	9.00	0	1	1	2	2	0	0	0	1	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	13	1.4
31-Aug	9.00	0	2	0	0	1	0	0	0	0	0	5	6	0	0	1	6	0	0	4	0	0	1	0	0	0	0	26	2.9
01-Sep	9.00	0	1	1	2	1	0	0	0	0	0	2	6	0	0	1	1	0	0	2	0	0	1	0	0	0	1	19	2.1
02-Sep	9.00	0	1	1	1	6	0	1	0	1	0	1	5	0	0	0	1	0	0	0	0	0	1	0	0	0	0	19	2.1
03-Sep	9.00	0	2	1	3	4	0	0	1	0	0	3	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	17	1.9
04-Sep	9.00	0	0	1	1	5	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1.0
05-Sep	9.00	1	1	1	0	2	0	1	0	0	0	0	2	0	0	0	3	0	0	1	0	0	0	0	1	0	0	13	1.4
06-Sep	8.40	0	2	0	0	6	0	2	0	0	0	3	1	0	0	0	1	3	0	1	0	0	0	0	0	0	0	19	2.3
07-Sep	9.00	0	2	0	6	11	0	1	2	1	0	2	11	0	0	0	3	0	0	12	0	0	2	0	0	0	0	53	5.9
08-Sep	9.00	0	2	1	8	9	0	1	0	0	0	0	4	0	0	0	1	0	0	5	0	1	1	0	0	0	0	33	3.7
09-Sep	9.00	0	0	0	13	11	1	0	0	0	0	1	5	0	0	0	4	0	0	7	0	0	0	0	0	0	0	42	4.7
10-Sep	9.00	1	0	1	10	13	0	3	1	0	0	0	2	0	0	1	2	0	0	9	0	0	1	0	0	0	1	45	5.0
11-Sep	9.00	0	0	0	13	7	1	2	2	1	0	1	2	0	0	0	0	0	0	4	0	0	0	0	0	0	1	34	3.8
12-Sep	9.00	1	1	1	6	5	0	2	0	0	0	0	4	0	0	3	1	1	0	0	0	0	0	0	0	0	2	27	3.0
13-Sep	9.00	0	1	0	1	8	1	3	3	0	0	0	5	0	0	0	6	0	0	3	0	1	0	0	0	0	1	33	3.7
14-Sep	4.50	0	0	2	3	6	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	14	3.1
15-Sep	8.00	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	6	0.8
16-Sep	9.00	0	0	0	0	2	0	2	2	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	1	11	1.2
17-Sep	9.00	0	0	0	4	4	1	0	0	0	0	1	2	0	0	2	0	0	0	1	0	0	1	0	0	0	2	18	2.0
18-Sep	9.00	2	0	2	15	6	0	0	0	1	0	0	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0	30	3.3
19-Sep	9.08	0	2	1	42	21	1	5	1	3	2	0	18	4	0	5	1	0	0	19	1	0	0	0	0	0	1	127	14.0
20-Sep	9.25	5	9	1	46	54	2	9	0	1	3	15	80	0	0	4	3	0	0	37	1	0	2	0	0	1	4	277	29.9
21-Sep	9.00	8	0	1	37	16	0	6	0	1	1	0	17	0	0	2	1	0	0	3	4	0	0	0	0	0	1	98	10.9
22-Sep	9.00	1	1	1	37	25	2	12	1	1	0	0	10	0	0	2	1	0	0	1	0	0	0	0	0	0	0	95	10.6
23-Sep	9.00	1	0	1	21	8	1	3	0	0	2	0	14	1	0	4	3	0	0	2	0	0	0	0	0	0	1	62	6.9
24-Sep	9.00	0	0	0	9	6	1	6	0	1	7	0	8	0	0	1	3	0	0	3	0	0	1	0	0	0	0	46	5.1
25-Sep	9.00	1	0	1	7	1	1	0	0	0	2	0	7	0	0	1	1	0	0	0	0	0	0	0	0	0	0	22	2.4
26-Sep	9.00	0	0	0	30	5	1	5	0	0	1	35	21	0	0	2	4	0	0	13	0	1	0	0	0	0	1	119	13.2
27-Sep	9.00	4	0	0	15	6	2	6	0	0	0	0	11	0	0	0	2	0	0	8	0	0	2	0	0	0	0	56	6.2
28-Sep	9.00	0	0	1	8	4	0	1	0	1	1	6	9	0	0	0	0	0	0	0	0	0	1	0	0	0	0	32	3.6
29-Sep	9.00	0	2	0	24	8	0	3	0	0	1	2	25	0	1	1	0	0	0	2	0	0	0	0	0	0	1	70	7.8
01-Oct	7.67	0	1	0	0	1	0	0	0	0	1	31	6	0	0	0	0	0	0	3	0	0	0	0	0	0	0	43	5.6
02-Oct	9.00	0	0	0	0	0	0	1	0	0	0	2	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	6	0.7
03-Oct	9.00	23	0	0	2	1	1	1	0	0	0	1	7	0	0	3	9	0	0	0	0	0	0	0	0	0	0	48	5.3
04-Oct	0.00																												
05-Oct	0.00																												
06-Oct	8.75	0	0	0	9	0	1	4	0	0	3	0	74	0	0	0	2	3	0	1	1	0	0	0	0	0	0	98	11.2
07-Oct	8.75	0	0	0	63	1	0	1	0	0	1	2	75	1	0	0	1	0	0	1	3	0	0	0	0	0	0	149	17.0
08-Oct	8.75	2	0	2	28	1	1	2	0	0	1	1	44	0	0	3	10	2	0	1	0	0	2	0	0	0	1	101	11.5
09-Oct	5.25	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

Appendix D. continued

		Species[1]																										Birds
Date	Hours	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
10-Oct	8.75	0	0	1	41	5	1	0	1	1	0	0	33	0	0	1	5	2	0	2	1	0	0	0	0	0	1	95	10.9
11-Oct	0.00																												
12-Oct	8.33	0	0	0	37	1	0	0	0	0	0	0	74	1	0	2	7	1	0	1	2	1	0	1	0	0	0	128	15.4
13-Oct	8.75	0	0	0	18	2	0	1	0	0	0	0	19	0	0	0	2	0	0	0	0	0	0	0	0	0	0	42	4.8
14-Oct	4.00	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1.0
15-Oct	8.50	0	0	2	32	4	0	3	0	0	0	0	109	0	1	1	10	3	0	0	3	0	0	0	0	0	0	168	19.8
16-Oct	8.50	0	0	5	6	2	3	0	2	0	0	0	43	0	0	0	5	2	0	0	0	0	0	0	0	0	0	68	8.0
17-Oct	8.75	0	0	3	36	5	1	1	0	0	0	0	73	0	1	0	26	12	0	0	0	0	0	0	0	0	0	158	18.1
18-Oct	7.67	0	0	0	19	3	3	0	0	0	0	0	27	0	0	0	10	5	0	0	0	0	0	0	0	0	0	67	8.7
19-Oct	7.75	0	0	1	5	5	0	0	0	0	0	0	17	0	0	0	9	5	0	1	2	0	0	0	0	0	0	45	5.8
20-Oct	5.00	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	4	0.8
21-Oct	8.00	0	0	1	4	0	1	0	0	0	0	0	16	0	0	0	5	2	0	0	1	0	0	0	0	0	0	30	3.8
22-Oct	8.50	0	0	0	0	0	1	0	0	0	0	0	13	0	1	0	6	3	0	0	0	0	0	0	0	0	0	24	2.8
23-Oct	8.00	0	0	1	4	0	0	0	0	0	0	0	18	0	1	0	5	0	0	0	0	0	0	0	0	0	0	29	3.6
24-Oct	6.50	0	0	0	6	0	0	0	0	0	0	0	18	0	1	0	2	0	0	0	0	0	0	0	0	0	0	27	4.2
25-Oct	8.00	0	0	0	5	0	1	0	0	0	0	0	9	0	0	0	5	11	0	0	0	0	0	0	0	0	0	31	3.9
26-Oct	7.50	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	3	3	0	0	0	0	0	0	0	0	0	17	2.3
27-Oct	0.00																												
28-Oct	0.00																												
29-Oct	5.50	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	8	1.5
30-Oct	0.00																												
31-Oct	8.00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	1	0	0	0	0	0	0	8	1.0
01-Nov	6.50	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	4	2	0	0	0	0	0	0	0	0	0	9	1.4
02-Nov	8.00	0	0	0	1	0	1	0	0	0	0	0	4	0	0	0	10	19	0	0	0	0	0	0	0	0	0	35	4.4
03-Nov	8.00	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	2	3	0	0	0	0	0	0	0	0	0	11	1.4
04-Nov	8.00	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
05-Nov	8.00	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	3	1	0	0	0	0	0	0	0	0	0	8	1.0
Total	531.82	50	34	38	690	298	32	92	17	15	26	119	987	9	7	43	211	86	0	151	23	4	16	1	1	1	20	2971	344.3

[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: 2001–2009.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	Mean
Start date	3-Sep	27-Aug	27-Aug	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	5-Nov	5-Nov	1-Nov
Observation days	22	45	63	65	64	56	66	66	64	61
Observation hours	145.88	322.67	474.85	452.67	478.83	443.58	494.56	493.33	531.82	461.54
Raptors/100 hrs	1,156	991	644	917	985	415	990	911	559	801
SPECIES					RAPTOR COUNTS					
Turkey Vulture	67	97	66	164	114	39	185	150	50	108
Osprey	16	11	31	59	36	11	41	27	34	31
Northern Harrier	40	32	25	38	36	26	30	32	38	32
Sharp-shinned Hawk	303	675	516	1,118	1,687	217	1,214	1,109	690	903
Cooper's Hawk	256	409	329	614	462	289	535	382	298	415
Northern Goshawk	11	21	7	49	35	26	89	52	32	39
Unknown small accipiter	11	78	75	75	55	39	61	25	92	63
Unknown large accipiter	4	6	13	34	11	6	21	8	17	15
Unknown accipiter	29	16	58	69	2	6	98	49	15	39
TOTAL ACCIPITERS	614	1,205	998	1,959	2,252	583	2,018	1,625	1,144	1,473
Broad-winged Hawk	1	8	5	22	9	3	7	13	26	12
Swainson's Hawk	18	82	28	62	52	47	36	352	119	97
Red-tailed Hawk	323	823	1,042	961	1,319	563	1,459	1,148	987	1,038
Ferruginous Hawk	7	6	3	15	8	7	3	7	9	7
Rough-legged Hawk	20	5	5	8	13	5	13	34	7	11
Unidentified buteo	19	17	87	63	42	35	63	144	43	62
TOTAL BUTEOS	388	941	1,170	1,131	1,443	660	1,581	1,698	1,191	1,227
Golden Eagle	279	352	233	152	316	211	324	345	211	268
Bald Eagle	72	233	90	76	137	82	299	262	86	158
Unidentified eagle	5	10	7	10	2	6	25	34	0	12
TOTAL EAGLES	356	595	330	238	455	299	648	641	297	438
American Kestrel	166	258	355	403	317	156	229	219	151	261
Merlin	7	9	6	26	11	10	24	25	23	17
Prairie Falcon	1	6	5	6	18	13	21	6	4	10
Peregrine Falcon	5	3	3	11	13	9	18	15	16	11
Unknown small falcon	2	0	3	6	2	5	3	9	1	4
Unknown large falcon	5	0	0	5	2	4	6	5	1	3
Unknown falcon	0	2	0	1	0	7	7	1	1	2
TOTAL FALCONS	186	278	372	458	363	204	308	280	197	308
Unidentified raptor	19	38	68	102	19	19	83	39	20	49
ALL SPECIES	1,686	3,197	3,060	4,149	4,718	1,841	4,894	4,492	2,971	3,665

Appendix F. Raptor capture totals by day and species during fall migration at Commissary Ridge, Wyoming: 2009.

	STN.	SPECIES[1]											CAPTURES /
DATE	HOURS	NH	SS	CH	NG	RT	GE	BE	AK	ML	PR	PG	TOTAL	HOUR
28-Aug	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0.0
29-Aug	7.50	0	0	0	0	1	0	0	1	0	0	0	2	0.3
30-Aug	7.83	0	1	0	0	0	0	0	0	0	0	0	1	0.1
31-Aug	2.75	0	0	0	0	1	0	0	0	0	0	0	1	0.4
01-Sep	8.25	0	0	1	0	1	0	0	1	0	0	0	3	0.4
02-Sep	8.83	0	4	0	0	0	0	0	0	0	0	0	4	0.5
03-Sep	8.08	1	4	1	0	1	0	0	0	0	0	0	7	0.9
04-Sep	9.00	0	2	0	0	0	0	0	0	0	0	0	2	0.2
05-Sep	8.33	0	4	1	0	0	0	0	0	0	0	0	5	0.6
06-Sep	8.25	0	9	0	0	0	0	0	0	0	0	0	9	1.1
07-Sep	8.08	0	3	2	0	1	0	0	2	0	0	1	9	1.1
08-Sep	8.58	0	2	2	1	1	0	0	0	0	0	0	6	0.7
09-Sep	8.92	0	5	2	0	0	0	0	0	0	0	0	7	0.8
10-Sep	8.00	0	4	1	0	1	0	0	0	0	0	0	6	0.8
11-Sep	9.00	0	6	4	0	0	0	0	0	0	0	0	10	1.1
12-Sep	8.00	0	0	2	0	0	0	0	0	0	0	0	2	0.3
13-Sep	8.50	0	5	1	1	0	0	0	0	0	0	0	7	0.8
14-Sep	5.50	0	1	2	0	0	0	0	0	1	0	0	4	0.7
15-Sep	3.75	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16-Sep	8.00	0	1	0	0	0	0	0	0	0	0	0	1	0.1
17-Sep	8.50	0	9	1	0	0	0	0	0	0	0	0	10	1.2
18-Sep	8.00	0	8	3	0	0	0	0	1	1	0	0	13	1.6
19-Sep	7.92	0	2	1	0	0	0	0	0	0	0	0	3	0.4
20-Sep	8.17	0	2	3	0	0	0	0	0	0	0	0	5	0.6
21-Sep	8.75	0	12	3	1	1	0	0	0	1	0	0	18	2.1
22-Sep	8.25	0	4	7	0	0	0	0	0	1	0	0	12	1.5
23-Sep	8.25	0	4	1	0	0	0	0	0	0	0	0	5	0.6
24-Sep	8.50	0	3	0	0	2	0	0	0	1	1	0	7	0.8
25-Sep	8.25	0	1	2	0	1	0	0	0	0	0	0	4	0.5
26-Sep	8.25	0	0	2	0	2	0	0	0	0	0	0	4	0.5
27-Sep	8.25	0	6	2	0	0	0	0	0	0	0	0	8	1.0
28-Sep	8.00	0	3	0	0	0	0	0	0	1	1	0	5	0.6
29-Sep	8.08	0	5	3	0	2	1	0	0	0	0	0	11	1.4
30-Sep	0.00													
01-Oct	4.50	0	0	0	0	0	0	0	0	0	0	0	0	0.0
02-Oct	7.75	0	2	0	0	0	0	0	0	0	0	0	2	0.3
03-Oct	7.50	0	1	0	0	0	0	0	0	0	0	0	1	0.1
04-Oct	0.00													
05-Oct	0.00													

Appendix F. continued

	STN.	SPECIES[1]											CAPTURES /
DATE	HOURS	NH	SS	CH	NG	RT	GE	BE	AK	ML	PR	PG	TOTAL	HOUR
06-Oct	5.50	0	1	0	1	0	0	0	0	1	0	0	3	0.5
07-Oct	7.50	0	4	1	0	1	1	0	0	0	0	0	7	0.9
08-Oct	8.00	0	5	0	0	0	0	0	0	0	0	0	5	0.6
09-Oct	3.75	0	0	0	0	0	0	0	0	0	0	0	0	0.0
10-Oct	8.00	0	1	0	0	1	0	0	0	0	0	0	2	0.3
11-Oct	0.00													
12-Oct	4.00	0	2	0	0	2	0	0	0	0	0	0	4	1.0
13-Oct	6.25	0	0	0	1	1	0	0	0	0	0	0	2	0.3
14-Oct	0.00													
15-Oct	7.75	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16-Oct	7.50	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17-Oct	8.00	0	4	0	0	0	0	0	0	0	0	0	4	0.5
18-Oct	8.00	0	1	0	1	1	0	0	0	0	0	0	3	0.4
19-Oct	8.00	0	1	0	1	1	0	0	0	0	0	0	3	0.4
20-Oct	3.42	0	0	0	0	0	0	0	0	0	0	0	0	0.0
21-Oct	7.25	0	0	0	0	0	0	0	0	0	0	0	0	0.0
22-Oct	7.75	0	0	0	0	1	0	0	0	0	0	0	1	0.1
23-Oct	6.92	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24-Oct	3.83	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25-Oct	8.00	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26-Oct	5.50	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Total	398.99	1	132	48	7	23	2	0	5	7	2	1	228	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: 2004–2009.

	2004	2005	2006	2007	2008	2009	MEAN	TOTAL
First trapping day	2-Sep	29-Aug	28-Aug	29-Aug	28-Aug	28-Aug		
Last trapping day	17-Oct	27-Oct	30-Oct	30-Oct	30-Oct	26-Oct		
Number of stations	2	1	2	2	2	1	1.7	
Trapping days	46	55	43	48	55	55	50.3	
Station hours	287.50	383.58	346.25	366.51	436.41	398.99	369.9	
Captures / 10 stn. hrs.	4.7	5.3	1.5	5.7	4.3	5.7	4.5	
SPECIES	RAPTOR CAPTURES							
Northern Harrier	0	0	1	2	0	1	0.7	4
Sharp-shinned Hawk	61	96	28	86	94	132	82.8	497
Cooper's Hawk	47	65	12	61	44	48	46.2	277
Northern Goshawk	12	17	3	30	14	7	13.8	83
Red-tailed Hawk	7	7	5	19	18	23	13.2	79
Golden Eagle	1	0	0	2	2	2	1.2	7
Bald Eagle	0	0	0	0	1	0	0.2	1
American Kestrel	3	13	1	5	5	5	5.3	32
Merlin	3	4	0	2	5	7	3.5	21
Prairie Falcon	2	2	0	1	1	2	1.3	8
Peregrine Falcon	0	0	1	1	3	1	1.0	6
All species	136	204	51	209	187	228	169.2	1015
Recaptures[1]	0	0	0	0	0	1	0.2	1
Foreign Recaptures[2]	0	0	0	0	0	0	0.0	0
Foreign Encounters[3]	0	0	0	0	2	1	0.5	3

[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.