FALL 2012 RAPTOR MIGRATION STUDIES IN THE MANZANO MOUNTAINS OF CENTRAL NEW MEXICO



HawkWatch International, Inc. Salt Lake City, Utah



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INTRODUCTION

The Manzano Mountains Raptor Migration Project in central New Mexico is an ongoing effort to monitor long-term trends in populations of raptors using the southern portion of the Rocky Mountain migratory flyway (Hoffman et al. 2002, Hoffman and Smith 2003, Smith et al. 2008a). HawkWatch International (HWI) initiated standardized counts of the autumn raptor migration through this region in 1985, and began an extensive trapping and banding program at the project site in 1990. To date, HWI observers have recorded 18 species of migratory raptors at the site, with counts typically ranging between 4,000 and 7,000 migrants per season. The 2012 season marked the 28th consecutive count and the 23rd consecutive season of trapping and banding conducted at the site by HWI. This report summarizes the 2012 count and banding results.

The Manzanos project was 1 of 8 long-term, annual migration counts and 1 of 4 migration-banding studies conducted or co-sponsored by HWI in North America during 2012. 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 and Smith 2003; Smith et al. 2001, 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).

The extensive counting and banding operations, along with related research activities such as satellite tracking of migrants, also provide valuable information about species' ranges, migratory routes and behaviors, and population demographics (e.g., Hoffman et al. 2002, Lott and Smith 2006, Goodrich and Smith 2008), as well as affording rich opportunities for a variety of other biological assessments and studies (e.g., DeLong and Hoffman 2004, McBride et al. 2004). This information helps us understand the life histories, ecology, status, and conservation needs of raptor populations in North America. In addition, these migration studies offer unique opportunities for the public to learn about raptors and the natural environment, and providing such opportunities is another important component of all HWI migration projects.

STUDY SITE

The project site is located in the Manzano Wilderness Area of the Cibola National Forest (Mountainair Ranger District) near Capilla Peak, approximately 56 km south-southeast of Interstate 40 (34°42.25' N, 106°24.67' W; Fig. 1). The observation post is located at an elevation of 2,805 m (9,195 ft) on a northwest-southeast facing outcrop of a limestone ridge. It is reached by walking up a 1.2 km trail from the main road leading up to Capilla Peak (FS 522). The predominant vegetation on the slopes of the ridge consists of Gambel oak (*Quercus gambelli*), Douglas-fir (*Pseudotsuga menziesii*), White fir (*Abies concolor*), Ponderosa pine (*Pinus ponderosa*), Pinyon pine (*Pinus edulis*), New Mexico locust (*Robinia neomexicana*), and Bigtooth maple (*Acer grandidentatum*).

During 2012, two traditional banding stations were operated within 0.25–1 km of the observation point (Fig. 1). **North** station, operated every year since 1990, is located 100 m east and 50 m north of the observation point at an elevation of 2,790 m. **West** station, operated every year since 1991, is located 0.5 km southwest of the observation point at an elevation of 2,684 m.

Many factors make the Manzano Lookout well suited for observing consistent flights of fall migrating raptors. Several mountain ranges to the north serve as leading lines (Bildstein 2006), which cause raptors to funnel into the area. The Manzano Mountains are also a relatively narrow and well-defined north–south range, which creates beneficial updrafts and serves as a distinct flight path for migrating raptors. The Capilla Peak site provides an excellent source of orographic lift, with two other peaks located 10–15 km north of the observation site also attracting southbound migrants that benefit from strong ridge

updrafts. The concentration effect of the Manzano range is further enhanced by the absence of parallel ranges nearby to serve as alternate flight paths.

METHODS

STANDARDIZED COUNTS

Two official or designated observers, relieved or supplemented by other trained volunteers, conducted standardized daily counts of migrating raptors from a single, traditional observation site. Lead Observer Robert Baez is a three year HWI veteran counter with experience at Corpus Christi, Texas; Commissary Ridge in Wyoming; and Bonney Butte in Oregon. Ian Dolly held the multi-task banding and count position at the Manzanos last year and thus is familiar with the local flight lines. During his first year working for HWI, Dan Tempest was hired in both the multi-task count and banding positions. Volunteers and other crewmembers occasionally assisted with the counts, particularly seasoned volunteer Roger Grimshaw, as well as Steve deLaPena who volunteered with both the counting and banding for many years. (See Appendix A for a complete history of observer participation.) Weather permitting, observations began no later than 0900 H Mountain Standard Time (MST) and typically ended by 1700 H 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 A 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.

Calculation of "adjusted" (to standardize sampling periods and adjust for incompletely identified birds) passage rates (migrants counted per 100 hours of observation) and analysis of trends updated through 2012 follows Farmer et al. (2007). In comparing 2012 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2012 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

Weather permitting, rotating crews of two to three trappers and processors operated each trapping station. The crews generally trapped between 0800–0900 and 1600–1700 H MST. Capture devices included mist nets, dho-gaza nets, and remotely triggered bow nets. Trappers lured migrating raptors into the capture stations from camouflaged blinds using live, non-native avian lures attached to lines manipulated from the

blinds. 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 30 minutes of capture.

RESULTS AND DISCUSSION

WEATHER

Inclement weather precluded one full day and shortend (≤ 4 hours observation) two other observation days (see Appendix C for daily weather summaries). For comparison, weather, on an average seasonal basis (i.e., 1997–2011) has demonstrated to preclude 4.7, and severely hamper 1.7 days of observation in any given season.

Sky conditions during active observation periods were recorded as predominantly fair 54% of the time, 16% transitional (i.e., changed from fair skies to mostly cloudy or overcast during the day, or vice versa), and 30% as mostly cloudy to overcast. The averages for the site are 52% fair, 16% transitional, and 32% mostly cloudy to overcast, suggesting, in comparison that this past season's skies conformed well with previous long-term trends but with a slight increase in the percentage of fair days and a slight decrease in the percentage of days that were mostly cloudy to overcast. Average temperature for the season (i.e., 15.2° C) was above the long-term average (i.e., 14.2° C), as was a good to excellent ranking of thermal lift (44% vs. an average of 40.5%), which is favorable to migrating raptors. Visibility, however, was far below the long-term average both towards the east (65 km vs. a 90.2 km average) and west (71km vs. 90.3 km). Poor visibility affected by fog and haze (perhaps caused by local rangeland wildfires) was above average (49% vs. 40%, on average), as was visibility affected by rain and/or snow (41% vs. 36%). In essence, with an above average ranking of thermal lift favorable for raptor migration along with lower than average visibility, some raptors could have migrated through the area without being detected.

As expected given previous data collection, the season's wind speeds were primarily light (<12 kph), but less so compared to the long-term average (57% of active observation days vs. the average of 68.2%), followed by moderate winds (12–28 kph), which were above the long-term average (40% vs. 27.9%). Strong winds (>28 kph) occur the least frequent, and this past season was no exception (3% vs. 3.8%). In general, wind directions primarily prevail from the SW-W, and although winds from this past season conformed to this direction, they did so with less frequency (23% vs. a 38.5% average). Wind directions were for the most part more variable than during previous years. Thus, as a comparison, winds blew from the SW-NW (23% vs. a 6.7% average); SW-W, Calm/Variable (9% vs. 4.4%); S-W (7% vs. 3.8%); SW-NW, Calm/Variable (7% vs. 0.9%); W-NW, Calm/Variable (6% vs. 0.6%); Calm/Variable (6% vs. 2.0%); NE-SE, Calm/Variable (6% vs. 0.9%); W-NW (4% vs. 6.7%); S-SW (3% vs. 13.1%); SE-SW (3% vs. 4.5%); S-SW, Calm/Variable (1% vs. 2.1%); NW-NE, Calm/Variable (1% vs. 0.7%); and finally NE-SE (1% vs. a 5.2% average). How this much wind directional variability affected raptor migratory behavior, is unknown.

In summary, winds blew from quite a wide range of variable directions this past season at more moderate wind speeds than usual. Unfortunately, it is unknown how wind speed and variability affect the behavior of raptors to either concentrate the populations for migration along the Manzano Mountains, or trigger them to choose another path. Observers did record however, above average ranking of good to excellent thermal lift, which is beneficial to raptors for increased lift and energy conservation during migration. Unfortunately, at the same time visibility was lower than average so raptors could have been missed. However, without applying some method of observer detectability bias (e.g., radar), such effects can not been confirmed.

OBSERVATION EFFORT

The crew of observers worked 70 of 71 possible days between 27 August and 5 November (Appendix E), which is significantly above the long-term average of 65 days (\pm 95% CI of 2.1). The total hours of observation (582.42) was also significantly above the long-term average (517.50 \pm 24.12 hours, Appendix E), but the season's average of 2.1 observers per hour (including official and guest observers; value is mean of daily values, which in turn are means of hourly values) was below the long-term average measured over previous years (2.20 \pm 95% CI of 0.13).

FLIGHT SUMMARY

Observers counted 4,248 migrant raptors of 17 species during this past season (see Appendix D for daily count records and Appendix E for annual summaries). The flight was comprised of 56% accipiters, 20% accipiters, 11% vultures, 8% falcons, 3% eagles, 1% harriers, and <1% Ospreys and unidentified raptors. The proportions of buteos, vultures, and eagles were above average, whereas the proportions of accipiters, falcons, harriers, and Ospreys were below average (Fig. 2). The most abundant species counted this past season was the Sharp-shinned Hawk (39% of the total), followed by the Cooper's Hawk (14%), Turkey Vulture (11%), Red-tailed Hawk (10%), Swainson's Hawk (9%), American Kestrel (5%), and Merlin (2%, Table 1). Other species observed at the site each made up around 1% or less of the total (Table 1, Appendix E).

Passage Rates and Long-term Trends

For multiple species (i.e., Turkey Vultures, Ospreys, Cooper's Hawks, Red-tailed Hawks, and Prairie Falcons), adjusted passage rates showed a common quadratic pattern of increasing trends through the late 1990's followed by various curvatures of decline (Figs. 3-7). American Kestrels, however, were overall significantly declining following a quadratic pattern (Fig. 7), and trends for Ferruginous Hawks were at a significant linear decline (Fig. 5). Some of these quadratic trends may correspond with patterns of wet and dry cycles (Hoffman and Smith 2003, Smith et al. 2008a) but continued monitoring will need to be conducted to for further proof. Evidence of recent American Kestrel declines have been widespread throughout North America (see Journal of Raptor Research 2009, Vol. 43, No. 4), and investigations are underway to help understand potential reasons (see, for example, the Peregrine Fund's American Kestrel Partnership; http://kestrel.peregrinefund.org/). Although Ferruginous Hawks were showing a significant decline (Fig. 5), the trends in the species are difficult to monitor because of overall low count numbers at ridge-top migration sites in general (see, Appendix E, for example). This species is currently listed as Category 2 Species by the U.S. Fish and Wildlife Service and Sensitive Species by the Bureau of Land Management (Bechard et al. 1995). It demonstrates that further monitoring for Ferruginous Hawks remains important. Recent population trends for Golden Eagles have also been of concern (cf. Farmer et al. 2008, Katzner et al. 2012), but at the Manzanos they were showing no significant population decrease or increase (Fig. 6). On a positive note, Broad-winged and Swainson's Hawks (Fig. 5), as well as Merlins (Fig. 7) were showing significant increases. The Broad-winged Hawk is a species that inhabits the eastern half of North America, but extends to western ranges well into Alberta, Canada, and beyond, utilizing primarily deciduous forest patches where available (Wheeler 2003). As habitat changes from grassland to deciduous forest patches due to human planting of forest wind breaks and the creation of edge habitat as byproduct from timber harvesting in the west, it will be interesting to see if the distribution of this species continues to expand and migration count numbers in the west continue to increase. Lastly, Peregrine Falcons are showing a significant quadratic increase, but numbers appear to be leveling off (Fig. 7).

Age Ratios

Immature : adult age ratios were below average for Golden Eagles and Peregrine Falcons, but above average for the rest of the species where ages could be identified, except for maybe the Bald Eagle (Table 2). In contrast to our expectations, the counters tallied more immature Cooper's Hawks than adults this past season; whereas, usually adults outnumber the young (Table 2). However, the crews are often not

able to age many of migratory raptors during the season (see Table 2, % unknown age column). Thus, the immature : adult ratio is just a relative sample and results need to be treated with caution when assessing and comparing age ratios and year-to-year reproductive output. Nevertheless, it is still important to age and sex raptors as best as possible to be implemented in regression analyses potentially revealing trends in age or gender groups of various raptor species.

Seasonal Timing

The combined-species median passage date of 29 September was a significant three days later compared to the long-term median date average (Table 3). Normally, the seasonal distribution of activity follows an approximate bell-shaped pattern, where peak occurs near the end of September, extending into the first 5-day period into October, but with a slight slowdown during the last 5-day period in September (Fig. 8). The pattern from this past season followed a similar bell-shaped pattern but with peak significantly above average during the last 5-day period in September followed by a relatively steady decline (Fig. 8).

Similar to the combined-species passage date being late this past season, most species-level median passage dates were also later, anywhere from one to eighteen days (Table 3). Ospreys and Broad-winged Hawks arrived seven and four days early, respectively, and the overall arrival date for Golden Eagles was on par compared to previous long-term trends (Table 3). Compared to these overall median dates (Table 3), age-specific passage dates sometimes showed different, or contradictory trends (Table 4). Both age groups for Northern Harriers passed through early, for example, as did immature Sharp-shinned Hawks and adult Red-tailed Hawks (Table 4). Again, recall that for a high number of these species crews were unable obtain adequate age estimates (Table 2), which may help to explain these discrepancies. Also one noteworthy observation was the early arrival of adult Golden Eagles compared to the later arrival of immatures, as well as the arrival dates of immature Cooper's Hawks and adult Peregrine Falcons being on par with expected dates (Table 4).

TRAPPING EFFORT

The crew operated at least one banding station on 56 of 59 possible days between 1 September and 28 October 2012, totaling 76 station days and 495.25 station hours between the two stations (see Appendix F daily trapping records and Appendix G for annual summaries).

TRAPPING AND BANDING SUMMARY

A total of 602 raptors representing ten different species were captured and newly banded (Table 5, Appendix G). Sharp-shinned Hawks accounted for 60% of the total captured, followed by Cooper's Hawks (28%), Red-tailed Hawks (7%), American Kestrels (1%), Merlins (1%), and Golden Eagles (1%), while the remaining species each comprised of <1% (Appendix G). The north blind crew also recaptured (Appendix G) a hatch-year male Sharp-shinned Hawk on 11 September that was originally banded by the west blind crew two days earlier on 09 September. Throughout the year, a total of four foreign encounter recovery birds were reported (Table 7, Appendix G). (See also below for further information regarding these foreign encounter and recapture birds). Since inception, a total of 19,707 raptors have been captured and newly banded, along with 40 recaptures, 24 foreign recaptures, and 129 foreign encounters of birds recovered by someone else (Appendix G).

The season's capture total of 602 birds was significantly below average, and the overall percentage of capture success is also below average (Table 5). However, the overall capture rate is above average suggesting that even though fewer birds are being captured, due primarily to a recent reduction in volunteer staff the past few years, trapping efficiency is still being maintained. For all but three species (i.e., the Broad-winged Hawk, Golden Eagle, and American Kestrel), the capture totals were also below average (Table 5).

One purpose of banding is to be able to separate age, gender, and other morphological/physiological characteristics, especially for accipiters and falcons. Similar to the count data, for some species, banding

offers annual comparisons to see how gender and age related differences in ratios may change on an annual basis, as well as to monitor for the possibility of major changes over time. Typically with Sharp-shinned Hawks and American Kestrels, more young are captured than adults but with Cooper's Hawks, on average, immatures and adults are captured in about equal proportions (Table 6). This past season, more young Cooper's Hawks were captured than adults, but in American Kestrels, more adults were captured (Table 6). In Sharp-shinned Hawks, the immature : adult ratio pattern stayed consistent to the norm at reduced numbers compared to previous years, especially for young birds (Table 6). When comparing sex ratios, for accipiters, usually more females Cooper's Hawk are captured but this past season the opposite occurred (Table 6). Typically more male than female American Kestrels are captured, but this past season more females were captured for once (Table 6). Tracking deviations in annual sex and age ratios, and especially monitoring long term through banding may help better track changes in reproductive effort (e.g., major changes in sex ratios, or the lack of young being produced) or migratory behavior (e.g., major changes in adult gender being captured or observed).

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Recaptures.—As stated above, during the season there was only one recapture of a hatch-year male Sharp-shinned Hawk originally banded only a few days earlier. This bird lost four grams during the two day transition period but maintained the same level of physiological fat and keel muscle tone. Both times, however, the crop was empty. For a small accipiter with high metabolism, losing 4 grams can be costly, but it is unknown how this could impact a bird over the two day period. Presumably, given the high metabolism of Sharp-shinned Hawks, this bird was able to successfully find food given that the other physiological indices stayed approximately the same. However we assume that the bird digested the food resources immediately given that its crop was empty both times. If this bird was not able to find food during the two day transition period, one would assume poorer weight or physiological conditioning.

This bird may have been a local resident, but if it was stopping over during its migratory track, these types of records are important to help understand how long birds may be staying in the area and using it as a migratory stopover site.

Foreign Recaptures.— For a second straight season, no birds were recaptured that were originally banded elsewhere.

Foreign Encounters.— Throughout this past year, we received notification of four recoveries; three female Cooper's Hawks and one Red-tailed Hawk (Table 7). All four were found dead of unknown causes, which is fairly normal. Interestingly, the female Cooper's Hawk recovered near Janos, Mexico traveled approximately 414 km in 26 days (Table 7), at a rate of 16.55 km per day, assuming that the bird was found the same day it died. The other interesting record was a Red-tailed Hawk recovered in Juarez, Colima, Mexico in the fall at the approximate age of 11 years (Table 7). How long this bird had been dead before it was recovered is unknown. Thus, it is unknown whether this bird had arrived at its wintering range, or was breeding in the southern area. All birds were recovered within the confines of the Rocky Mountain Flyway, except for the Red-tailed Hawk, which was reported in a location of overlap between the Rocky Mountain and Intermountain Flyways (cf. Hoffman et al. 2002). These records are important to understand flyway uses by migratory raptors, how long birds stay alive, and survivorship or causes of mortality.

RESIDENT RAPTORS

From the beginning through the end of the season, resident Red-tailed Hawks were seen on most days, comprised of an adult and immature bird, although the last time an immature was seen was on 29 October. At least four residents were documented based on the 14 September record of observers mentioning two adults and two immatures on that day. On most days, morphology or plumage

characteristics were not recorded except on the first day, 27 August, when the observers recorded that the immature had a "white rump." On 30 August, the observers recorded the adult as being a light morph bird. The only other resident buteos seen were resident Swainson's Hawks; one bird of unknown age seen on 27 August and that of an immature seen on 06 September.

Resident Golden Eagles were recorded on eighteen days throughout the season beginning on the first day, 27 August through 03 November. On many days an adult and non-adult were observed. Two immatures were recorded on 18 October, however. On 02 November, the observers recorded a Golden Eagle of unknown age "in the northwest chasing intruders." They indicated that they first began noticing the bird around 15 September but didn't record it at the time since it was never of concern that it was counted as a migrant. Lastly, on 04 September, the observers recorded that the adult seen was missing a tail feather. That was the only day with any notes regarding aberrant plumage so whether this was the same adult seen throughout the season, is unknown. Regardless, a total of two non-adults and at least one adult were noted as being residents. The bird of unknown age recorded on 02 November could add to the resident total, but that isn't altogether clear.

An immature resident Cooper's Hawk was seen on six days at the beginning of the season from 27 August through 05 September. Similarly, an immature resident Sharp-shinned Hawk was also seen on nine separate days beginning 28 August through 09 September. An adult Sharp-shinned Hawk was seen on three separate occasions, 15 September, as well as 01 and 03 November. On 03 November, an immature Sharp-shinned Hawk was again recorded as a resident. These later two birds (one adult and one immature) may be different from those that were recorded earlier in the season because of the extensive one and a half month time lag where there was no resident Sharp-shinned Hawks recorded at all. However, this could not be confirmed because the birds did not have distinguishable plumage, nor were they marked.

Resident Peregrine Falcons were recorded regularly from 30 August through 05 October. An adult and an immature were seen on five separate days; 01, 04, 23, 24, and 25 September, thus concluding that a local nest produced at least one young. An interesting observation for resident Prairie Falcons was that of immature birds recorded early in the season on two separate occasions in August; the 29th and 30th, and a bird of unknown age was recorded on 02 September. Then, towards the end of the season, the observers started to record resident Prairie Falcons again. Adults were recorded on 18 and 20 October, and another individual Prairie Falcon was recorded on nine separate days through 04 November. Whether these later birds were always local or came through and decided to settle for winter location is unknown.

Finally, groups of resident Turkey Vultures were recorded on six separate days at the beginning of the season from 27 August through 05 September. The fewest that were recorded were two birds on 27 August and the largest group consisted of fifteen individuals observed on 30 August.

SITE VISITATION

Due to construction and maintenance of the road leading up to the site, access to the project site was again restricted to folks with special permission to pass through the gate. Nevertheless, to increase donor participation and involvement in the science of our migration sites, this past season we organized special trips for a select group of donors to the site. Through this program, HWI invited 10 people spread out over four separate weekends during the migration peak to join the crews at Capilla Peak. Otherwise, there was only one other organized field trip led by HWI staff that included approximately 2 to 5 local birders from the Albuquerque area.

Every hour, observers assess the disturbance level of visitors to quantify how visitation may affect detectibility. During the 2012 season, 566 hourly assessments of visitor disturbance resulted in the following ratings: 92% of the time no disturbance occurred, 7% the disturbance was low, and 2% the crew had to deal with moderate disturbance by other people at the site.

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LITERATURE CITED

- Bechard, M. J., and J. K. Schmutz. 1995. Ferruginous Hawk (Buteo regalis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America. Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/172
- Bildstein, K. L. 2001. Why migratory birds of prey make great biological indicators. Pages 169–179 *in*K. L. Bildstein and D. Klem (Editors). Hawkwatching in the Americas. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.
- DeLong, J. P., and S. W. Hoffman. 2004. Fat stores of migrating Sharp-shinned and Cooper's Hawks in New Mexico. Journal of Raptor Research 38:163–168.
- Farmer, C. J., L. J. Goodrich, E. Ruelas Inzunza, and J. P. Smith. 2008. Conservation status of North America's birds of prey. Pages 303–420 *in* K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Farmer, C. J., D. J. T. Hussell, and D. Mizrahi. 2007. Detecting population trends in migratory birds of prey. Auk 124:1047–1062.
- Goodrich, L. J., and J. P. Smith. 2008. Raptor migration in North America. Pages 37–150 in K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Hoffman, S. W., and J. P. Smith. 2003. Population trends of migratory raptors in western North America, 1977–2001. Condor 105:397–419.
- Hoffman, S. W., J. P. Smith, and T. D. Meehan. 2002. Breeding grounds, winter ranges, and migratory routes of raptors in the Mountain West. Journal of Raptor Research 36:97–110.
- Katzner, T., B.W. Smith, T.A. Miller, D. Brandes, J. Cooper, M. Lanzone, D. Brauning, C. Farmer, S. Harding, D.E. Kramar, C. Koppie, C. Maisonneuve, M. Martell, E.K. Mojica, C. Todd, J.A. Tremblay, M. Wheeler, D.F. Brinker, T.E. Chubbs, R. Gubler, K. O'Malley, S. Mehus, B. Porter, R.P. Brooks, R.D. Watts, and K.L. Bildstein. 2012. Status, biology, and conservation priorities for North America's eastern Golden Eagle (*Aquila chrysaetos*) population. Auk 129:168-176.
- Lott, C. A., and J. P. Smith. 2006. A geographic-information-system approach to estimating the origin of migratory raptors in North America using hydrogen stable isotope ratios in feathers. The Auk 123:822–835.

- McBride, T. J., J. P. Smith, H. P. Gross, and M. Hooper. 2004. Blood-lead and ALAD activity levels of Cooper's Hawks (*Accipiter cooperii*) migrating through the southern Rocky Mountains. Journal of Raptor Research 38:118–124.
- Smith, J. P., C. J. Farmer, S. W. Hoffman, G. S. Kaltenecker, K. Z. Woodruff, and P. Sherrington. 2008a. Trends in autumn counts of migratory raptors in western North America. Pages 217–252 in K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Smith, J. P., C. J. Farmer, S. W. Hoffman, C. A. Lott, L. J. Goodrich, J. Simon, C. Riley, and E. Ruelas Inzunza. 2008b. Trends in autumn counts of migratory raptors around the Gulf of Mexico, 1995– 2005. Pages 253–278 in K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Smith, J. P., P. Grindrod, and S. W. Hoffman. 2001. Migration counts indicate Broad-winged Hawks are increasing in the West: evidence of breeding range expansion? Pages 93–106 *in* K. L. Bildstein and D. Klem (Editors), Hawkwatching in the Americas. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.
- Wheeler, B. K. 2003. Raptors of western North America: The Wheeler guide. Princeton University Press. Princeton, New Jersey, USA
- Zalles, J. I., and K. L. Bildstein (Editors). 2000. Raptor watch: a global directory of raptor migration sites. BirdLife Conservation Series No. 9. BirdLife International, Cambridge, United Kingdom, and Hawk Mountain Sanctuary Association, Kempton, Pennsylvania, USA.

	Со	UNTS		RAPTORS / 100 HRS ¹				
SPECIES	1985–2011 ²	2012	% CHANGE	1985–2011 ²	2012	% CHANGE		
Turkey Vulture	378 ± 90.0	481	+27	107.1 ± 24.64	136.9	+28		
Osprey	30 ± 6.4	29	-2	7.7 ± 1.53	7.5	-3		
Northern Harrier	59 ± 9.6	50	-16	11.9 ± 1.77	9.0	-25		
Sharp-shinned Hawk	1471 ± 167.0	1665	+13	358.5 ± 36.68	379.2	+6		
Cooper's Hawk	995 ± 131.2	603	-39	283.5 ± 31.60	161.0	-43		
Northern Goshawk	17 ± 3.4	18	8	3.7 ± 0.85	3.6	-5		
Unknown small accipiter ³	114 ± 32.7	71	-38	_	_	_		
Unknown large accipiter ³	6 ± 2.2	0	-100	_	_	_		
Unidentified accipiter	69 ± 24.9	2	-97	_	_	_		
TOTAL ACCIPITERS	2600 ± 283.7	2359	-9	_	_	-		
Broad-winged Hawk	7 ± 1.7	19	+157	2.3 ± 0.47	6.2	+170		
Swainson's Hawk	$907~\pm~640.7$	371	-59	353.1 ± 247.40	153.6	-57		
Red-tailed Hawk	620 ± 66.3	435	-30	133.9 ± 13.50	85.9	-36		
Ferruginous Hawk	12 ± 1.9	8	-35	2.6 ± 0.43	1.2	-54		
Rough-legged Hawk	0.2 ± 0.2	1	+350	0.0 ± 0.03	0.2	+327		
Zone-tailed Hawk	1 ± 0.4	0	-100	_	_	_		
Unidentified buteo	24 ± 8.5	9	-62	_	_	-		
TOTAL BUTEOS	1571 ± 635.5	843	-46	_	_	—		
Golden Eagle	116 ± 12.3	119	+2	25.1 ± 2.78	22.5	-10		
Bald Eagle	3 ± 0.9	3	-14	0.9 ± 0.26	0.5	-48		
Unidentified Eagle	1 ± 0.9	0	-100	_	_	-		
TOTAL EAGLES	121 ± 12.4	122	+1	_	_	_		
American Kestrel	508 ± 64.0	224	-56	136.2 ± 17.43	56.4	-59		
Merlin	$27~\pm~5.5$	64	+134	6.8 ± 1.26	13.9	+103		
Prairie Falcon	18 ± 4.2	12	-35	4.0 ± 0.81	2.5	-38		
Peregrine Falcon	48 ± 12.4	57	+18	11.6 ± 2.96	12.5	+8		
Unknown small falcon ³	2 ± 0.8	2	+16	_	_	-		
Unknown large falcon ³	4 ± 2.4	1	-74	_	_	-		
Unidentified falcon	2 ± 1.0	0	-100		_	_		
TOTAL FALCONS	$607~\pm~69.6$	360	-41	_	_	_		
Unidentified raptor	40 ± 14.7	4	-90			_		
GRAND TOTAL	5407 ± 779.6	4248	-21	_	_	_		

Table 1. Annual raptor migration counts and adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) annual passage rates by species in the Manzano Mountains, NM: 1985–2011 versus 2012.

¹ Based on data truncated to standardized, species-specific sampling periods and adjusted for incompletely identified birds.

² Mean \pm 95% CI.

³ Designations used for the first time in 2001.

	Тс	TAL AN	ND AGE-C	LASSIFIEI			IMMATURE : A	Adult			
	1990–2	011 A	VERAGE	2012			% Unknown	N AGE	RATIO		
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1990–2011 ¹	2012	1990–2011 ¹	2012	
Northern Harrier	62	31	16	50	24	9	26 ± 5.2	34	2.1 ± 0.40	2.67	
Sharp-shinned Hawk	1559	574	678	1665	649	705	20 ± 3.4	19	0.9 ± 0.11	0.92	
Cooper's Hawk	1085	372	465	603	265	224	23 ± 4.2	19	$0.8~\pm~0.10$	1.18	
Northern Goshawk	17	8	7	18	12	3	14 ± 5.4	17	$1.6~\pm~0.72$	4.00	
Broad-winged Hawk	8	1	4	19	4	7	38 ± 12.6	42	$0.5~\pm~0.29$	0.57	
Red-tailed Hawk	662	212	347	435	166	214	16 ± 3.2	13	0.6 ± 0.09	0.78	
Ferruginous Hawk	11	3	3	8	2	2	48 ± 6.7	50	1.6 ± 0.66	2.00	
Golden Eagle	116	63	31	119	44	35	17 ± 3.4	34	2.3 ± 0.42	1.26	
Bald Eagle	4	2	1	3	3	0	8 ± 11.3	0	1.9 ± 0.96	_	
Peregrine Falcon	61	17	28	57	8	34	22 ± 7.8	26	0.7 ± 0.32	0.24	

 Table 2. Annual raptor migration counts by age classes and immature : adult ratios for selected species in the Manzano Mountains, NM: 1990–2011 versus 2012.

¹ Mean \pm 95% CI. For age ratios, note that the long-term mean immature : adult ratio is an average of annual ratios and may differ from the value obtained by dividing average numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in the observed age ratio.

			2012		1985–2011
	First	LAST	BULK	MEDIAN	MEDIAN
SPECIES	OBSERVED	OBSERVED	PASSAGE DATES ¹	PASSAGE DATE ²	PASSAGE DATE ^{2,3}
Turkey Vulture	27-Aug	11-Oct	20-Sep – 28-Sep	29-Sep	19-Sep ± 3.1
Osprey	27-Aug	4-Oct	8-Sep – 28-Sep	10-Sep	17-Sep ± 1.3
Northern Harrier	6-Sep	5-Nov	11-Sep - 29-Oct	5-Oct	$3-Oct \pm 2.0$
Sharp-shinned Hawk	28-Aug	3-Nov	9-Sep – 14-Oct	29-Sep	28-Sep ± 1.1
Cooper's Hawk	27-Aug	3-Nov	9-Sep - 10-Oct	28-Sep	25-Sep ± 1.0
Northern Goshawk	29-Aug	27-Oct	9-Sep – 18-Oct	9-Oct	6-Oct ± 3.9
Broad-winged Hawk	16-Sep	30-Sep	16-Sep – 29-Sep	22-Sep	26-Sep ± 2.2
Swainson's Hawk	27-Aug	11-Oct	17-Sep – 4-Oct	26-Sep	21-Sep ± 2.6
Red-tailed Hawk	27-Aug	5-Nov	16-Sep – 24-Oct	5-Oct	$3-Oct \pm 1.9$
Ferruginous Hawk	24-Sep	5-Nov	24-Sep –	21-Oct	3-Oct ± 3.8
Rough-legged Hawk	29-Oct	29-Oct	_		±
Golden Eagle	1-Sep	4-Nov	29-Sep - 31-Oct	15-Oct	$15-Oct \pm 1.6$
Bald Eagle	18-Oct	4-Nov	_		$23-Oct \pm 5.1$
American Kestrel	27-Aug	3-Nov	4-Sep – 5-Oct	24-Sep	21-Sep ± 1.4
Merlin	3-Sep	5-Nov	17-Sep – 28-Oct	13-Oct	8-Oct ± 2.7
Prairie Falcon	27-Aug	24-Oct	31-Aug – 23-Oct	5-Oct	26-Sep ± 3.1
Peregrine Falcon	28-Aug	24-Oct	9-Sep – 20-Oct	28-Sep	23-Sep ± 1.4
All species	27-Aug	5-Nov	10-Sep – 14-Oct	29-Sep	26-Sep ± 0.9

Table 3. First and last observed, bulk passage, and median passage dates by species for migrating raptors in the Manzano Mountains, NM in 2012, with comparisons of 2012 and 1985–2011 average median passage dates.

¹ Dates between which the central 80% of the flight passed; calculated only for species with counts \geq 5 birds.

² Date by which 50% of the flight had passed; calculated only for species with counts \geq 5 birds.

³ Mean of annual values \pm 95% CI in days; calculated using only data for years with counts \geq 5 birds.

	Adult		Immature / su	Immature / subadult			
SPECIES	1985–2011 ¹	2012	1985–2011 ¹	2012			
Northern Harrier	9-Oct \pm 3.3	5-Oct	$2\text{-Oct} \pm 2.4$	1-Oct			
Sharp-shinned Hawk	5-Oct \pm 1.2	6-Oct	$19-\text{Sep} \pm 1.3$	17-Sep			
Cooper's Hawk	29-Sep ± 1.8	3-Oct	21-Sep ± 1.5	21-Sep			
Northern Goshawk	9-Oct ± 4.4		4-Oct \pm 5.7				
Broad-winged Hawk	23-Sep ± 4.7	22-Sep	±				
Red-tailed Hawk	8-Oct ± 1.7	7-Oct	$26\text{-}Sep~\pm~2.1$	3-Oct			
Ferruginous Hawk	7-Oct ± 7.9		$25\text{-}\text{Sep} \pm 5.0$				
Golden Eagle	16-Oct \pm 2.1	11-Oct	14-Oct \pm 1.6	20-Oct			
Bald Eagle	10-Oct ±		$21\text{-}Oct ~\pm~ 10.9$				
Peregrine Falcon	26-Sep ± 1.9	26-Sep	$18-\text{Sep} \pm 2.6$	4-Oct			

Table 4. Median passage dates by age classes for selected species of migrating raptors in theManzano Mountains, NM: 1985–2011 versus 2012.

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

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

² Data for 2003 only.

	CAPTURE TOTAL CAPTURE RATE ¹		ATE ¹	CAPTURE SUCCESS $(\%)^2$		
SPECIES	1991–2011 ³	2012	1991–2011 ³	2012	1991–2011 ³	2012
Northern Harrier	4 ± 1.4	2	0.5 ± 0.13	0.4	7 ± 2.2	6
Sharp-shinned Hawk	454 ± 88.3	362	56.5 ± 5.63	73.1	28 ± 3.9	21
Cooper's Hawk	340 ± 64.1	171	42.9 ± 4.96	34.5	30 ± 3.7	27
Northern Goshawk	5 ± 1.6	2	0.7 ± 0.23	0.4	28 ± 8.5	11
Broad-winged Hawk	0.3 ± 0.20	1	0.04 ± 0.030	0.2	3 ± 2.2	5
Swainson's Hawk	0.2 ± 0.30	0	0.03 ± 0.032	0.0	0 ± 0.2	0
Red-tailed Hawk	46 ± 10.2	41	5.8 ± 0.90	8.3	7 ± 1.2	9
Zone-tailed Hawk	0.0 ± 0.09	0	0.004 ± 0.007	0.0	5 ± 8.9	0
Golden Eagle	4 ± 1.0	4	0.5 ± 0.15	0.8	3 ± 0.6	3
American Kestrel	32 ± 10.2	9	3.8 ± 0.96	1.8	6 ± 1.3	4
Merlin	4 ± 1.5	8	0.6 ± 0.18	1.6	15 ± 5.5	13
Prairie Falcon	4 ± 1.2	0	0.4 ± 0.11	0.0	17 ± 3.1	0
Peregrine Falcon	5 ± 1.7	2	0.7 ± 0.21	0.4	9 ± 2.5	3
All Species	898 ± 170.2	602	112.4 ± 11.20	121.6	20 ± 2.6	18

 Table 5. Capture totals, rates, and successes for migrating raptors in the Manzano Mountains,

 NM: 1991–2011 versus 2012.

¹ Captures / 100 station hours.

² Number of birds captured / number of birds observed. The combined-species value was calculated excluding Ospreys, Turkey Vultures, Rough-legged Hawks, Ferruginous Hawks, and unknown raptors from the count totals. Species-specific values were calculated after birds identified only to genus were allocated across possible species in proportion to the relative abundance of birds identified to those species.

³ Mean of annual values \pm 95% confidence interval.

		Female		MALE		FEMALE : MALE	IMMATURE : ADULT	
SPECIES	ECIES YEAR HY		AHY	HY	AHY	RATIO ¹	RATIO ¹	
Sharp-shinned Hawk	1990-2011	136	106	129	68	1.3 ± 0.08	1.6 ± 0.21	
	2012	109	85	96	72	1.2	1.3	
Cooper's Hawk	1990-2011	80	91	82	76	1.1 ± 0.08	1.0 ± 0.15	
	2012	42	34	55	37	0.8	1.4	
American Kestrel	1990-2011	8	1	13	6	0.6 ± 0.17	3.6 ± 0.96	
	2012	1	1	3	4	3.6	0.96	

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 in the Manzano Mountains, NM: 1990–2011 averages versus 2012.

¹ Long-term value: mean \pm 95% confidence interval.

BAND #	SPECIES ¹	SEX	BANDING AGE ¹	BANDING DATE	Encounter Date	ENCOUNTER AGE ²	Encounter Location	DISTANCE (KM)	STATUS
1005 - 23404	СН	F	HY	07-Sep-06	01-May-12	ATY	Angel Fire, NM	203	found dead – cause unknown
1005 - 02423	СН	F	HY	09-Sep-12	04-Oct-12	HY	Janos, Chihuahua, Mexico	414	found dead – cause unknown
1005 - 02065	СН	F	ASY	30-Sep-08	21-Dec-12	ATY	Clint, TX	290	found dead – cause unknown
1807 - 81712	RT	U	HY	16-Oct-01	Oct-13	ATY	Juarez, Colima, Mexico	1425	found dead – cause unknown

Table 7. Foreign encounters with raptors originally banded in the Manzano Mountains, NM: 2012.

¹ See Appendix B for explanation of species codes.

 2 HY = hatch year; SY = second year; TY = third year; AHY = after hatch year; ASY = after second year; ATY = after third year.



Figure 1. Map of the Manzano Mountains raptor-migration study site in central New Mexico.



Raptor group

Figure 2. Fall raptor-migration flight composition by major species groups in the Manzano Mountains, NM: 1985–2011 versus 2012.



Figure 3. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers in the Manzano Mountains, NM: 1985–2012. Dashed lines indicate significant ($P \le 0.10$) regressions.



Figure 4. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks in the Manzano Mountains, NM: 1985–2012. Dashed lines indicate significant ($P \le 0.10$) regressions.



Figure 5. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Broad-winged, Swainson's, Red-tailed and Ferruginous Hawks in the Manzano Mountains, NM: 1985–2012. Dashed lines indicate significant ($P \le 0.10$) regressions.



Figure 6. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Golden and Bald Eagles in the Manzano Mountains, NM: 1985–2012. Dashed lines indicate significant ($P \le 0.10$) regressions.



Figure 7. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons: 1985–2012. Dashed lines indicate significant ($P \le 0.10$) regressions.



5-day period

Figure 8. Combined-species, fall-migration passage volume by five-day periods for raptors in the Manzano Mountains, NM: 1985–2011 versus 2012.

Appendix A. History of official observer participation in the Manzano Mountains Raptor Migration Project: 1985–2012.

- **1985** Single observer throughout, shared duty: Gary Cress $(0)^1$, Jim Daly (1), Allen Hale (1)
- Single observer throughout: Jim Daly (2)
- Single observer throughout: Jim Daly (3)
- Single observer throughout: Gordon Vickrey (1)
- Two observers during peak 3/4 of the season, one observer otherwise: Brett Ewald (2), Tim Menard (0)
- Two observers during peak 3/4 of the season, one observer otherwise: David Curson (0), Gary Cress (1)
- Two observers throughout: Eric Meyer (1), Tylan Dean (0)
- Two observers throughout: Eric Meyer (3), Jessie Jewell (0)
- Two observers throughout: Jessie Jewell (2), John Haskell (0)
- Two observers throughout: Jessie Jewell (4), Jeff Ogburn (1)
- Two observers throughout: Jessie Jewell (6), Jeff Ogburn (2)
- Two observers throughout: Jessie Jewell (8), Sean O'Connor (3)
- Two observers throughout: Jeff Ogburn (4), Sean O'Connor (4)
- Two observers throughout: Dan Rossman (1), Lawry Sager (0)
- Two observers throughout: Jason Beason (4), Lawry Sager (1)
- Two observers throughout: Jorge Canaca (1), Laura Lutz (1)
- Two observers throughout: Tim Meehan (1), Carrie Hisaoka (0)
- Two observers throughout: Carrie Hisaoka (1), Richard Sim (0)
- Two observers throughout: Carrie Hisaoka (2), Tim Hanks (1)
- Two observers throughout: Paula Shannon (3), Frank Mayer (2)
- 2005 Two observers throughout: Tim Hanks (2), Geoff Gould (0)
- 2006 Two observers throughout: Tim Hanks (3), Greg Levandoski (3)
- 2007 Two observers throughout: Tim Hanks (4), Aldo Raul Coutreras Reyes (4)
- 2008 Two observers throughout: Tim Hanks (5), Aldo Raul Coutreras Reyes (5), Roger Grimshaw (1)
- Two observers throughout: Kimberly Cullen (1), Amber Wingert (1), Roger Grimshaw (2)
- Two observers throughout: Tim Hanks (6+), Russell Seeley (0), Roger Grimshaw (3+)
- Two observers throughout: Tim Hanks (7+), Russell Seeley (1), Roger Grimshaw (4+)
- Two observers throughout: Robert Baez (3), Ian Dolly (+), Dan D. Tempest (0), Roger Grimshaw (5+), Steve deLaPena (+)
- ¹ Numbers in parentheses indicate previous full seasons of observation experience.

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	AIU	U	NA
Cooper's Hawk	Accipiter cooperii	CH	AIU	U	NA
Northern Goshawk	Accipiter gentilis	NG	AIU	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	AIU	U	DLU
Swanson's Hawk	Buteo swainsoni	SW	U	U	DLU
Red-tailed Hawk	Buteo jamaicensis	RT	AIU	U	DLU
Ferruginous Hawk	Buteo regalis	FH	AIU	U	DLU
Rough-legged Hawk	Buteo lagopus	RL	U	U	DLU
Zone-tailed Hawk	Buteo albonotus	ZT	AIU	U	NA
Unknown buteo	Buteo spp.	UB	U	U	DLU
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	AIU	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

Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications for all diurnal raptor species observed during fall migration in the Manzano Mountains, NM.

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.

			MEDIAN		WIND			BAROM.	MEDIAN	VISIB.	VISIB.	MEDIAN	
	OBS.	OBSRVR	VISITOR	PREDOMINANT	Speed	WIND	TEMP	PRESS.	THERMAL	WEST	EAST	FLIGHT	Birds
DATE	HOURS	/ HOUR ¹	DISTURB ²	WEATHER ³	$(KPH)^1$	DIRECTION	$(^{\circ}C)^{1}$	(IN HG) ¹	$LIFT^4$	$(KM)^1$	$(KM)^1$	DISTANCE ⁵	/ HOUR
27-Aug	8.75	2.6	0	clr, haze	4.6	nw, ene, ne, e	23.8	30.28	2	62	62	2	1.3
28-Aug	9.00	2.7	0	clr, haze	5.2	ene, ne	25.4	30.28	2	79	74	2	1.3
29-Aug	9.00	2.8	0	clr AM, pc PM, haze	3.6	nw, ene	21.7	30.20	2	70	58	2	2.7
30-Aug	10.00	1.9	0	clr, haze	2.4	n, ne, ene	23.0	30.16	1.5	70	50	1	1.6
31-Aug	9.00	3.7	0	clr AM, pc PM, haze	7.5	wsw, w	22.6	30.20	1	70	64	3	4.3
1-Sep	9.00	1.7	0	clr AM, pc-mc PM, haze	5.8	nw, w, s	21.9	30.23	3	70	52	2	3.2
2-Sep	9.00	1.9	0	pc	5.7	w	24.1	30.21	1	70	59	2	2.3
3-Sep	9.00	2.0	0	clr early AM, mc PM, haze	4.5	w	22.9	30.22	2	67	65	1	2.2
4-Sep	9.00	1.9	0	ovc early AM, mc	6.1	wsw, w, wnw	24.3	30.23	2	92	77	2.5	5.3
5-Sep	9.00	1.9	0	ovc, haze	2.4	w, wsw	22.9	30.18	2	71	77	1	3.3
6-Sep	9.00	1.9	0	mc, pc Mid-day, haze t-storms PM	6.8	sw, wsw	22.8	30.17	1.5	50	37	2	3.7
7-Sep	3.00	2.0	0	pc	2.8	wnw	19.5	30.20	3	70	60	1	8.7
8-Sep	6.75	1.9	0	ovc, fog	13.4	e	8.4	30.25	4	64	55	2	2.1
9-Sep	8.50	1.9	0	mc, pc PM	3.8	ene	14.6	30.24	3	53	33	1	11.2
10-Sep	9.00	1.9	0	pc, ovc late PM	10.7	w	15.3	30.18	4	73	67	1	5.4
11-Sep	7.50	2.0	0	clr-pc AM, mc-ovc-rain PM	11.7	sw, w, ssw	15.2	30.14	3	72	44	1	10.8
12-Sep	1.25	2.0	0	ovc, rain, fog	4.0	SW	12.0	30.14	4	27	20	-	0.0
13-Sep	0.00	2.0	0	Weather Day	0.0		5.0	20.27		25	24	2	0.0
14-Sep	9.00	2.8	0	pc early AM, mc	9.0	nne, e	5.0	30.27	4	35	34	2	8.9
15-Sep	8.75	3.0	0	cir, haze	4.6	wnw, w	9.6	30.22	2	62	20	2	12.3
10-Sep	8.25 9.75	2.0	0	CIF	17.5	w	12.8	30.17	2	60	0/	2	8.5 7.9
17-Sep	0.75 9.75	1.0	0	linc alr baza	14.9	W DW OW	0.5	20.22	2.5	40	22	2	7.8 20.0
10 Sep	8.75 8.02	1.9	0	cir, haze	3.1 77	w, liw, sw	13.2	30.22	2	40	25	1	20.9
20 Sep	0.92	1.0	0	cit, naze	0.3	wiiw, w, iiw	17.9	30.22	25	52	30	1	0.8
20-Sep	9.00 8.75	1.9	0	clr haze	5.9	w w wnw	16.9	30.19	2.5	56	26	2	9.6
21-Sep	8 50	33	1	clr early AM pc & haze PM	5.) 77	w, wiiw	21.2	30.25	2	53	20 64	2	10.0
22-Sep 23-Sep	9.00	2.5	0	pc AM me-ove PM	9.8	w w wsw	19.4	30.25	25	62	43	1	97
23 Sep 24-Sep	8.00	1.6	0		117	w, wsw	18.3	30.15	4	52	58	1	10.1
25-Sen	8.92	1.0	0	clr & haze early AM nc-mc PM	16.2	wsw w sw	15.0	30.06	3	52 67	47	1	14.6
26-Sep	8.25	2.8	Ő	mc. pc Mid-day	9.1	wsw	18.6	30.11	2	65	66	2	14.9
27-Sep	8.83	3.3	0	pc early AM, mc-rain mid-day	3.7	se, wsw	16.7	30.15	1	69	59	2	17.9
28-Sep	4.00	2.8	0	ovc. haze	4.5	ese, e	14.0	30.15	4	53	45	2	92.0
29-Sep	9.50	2.7	2.5	pc, mc mid-day	6.3	W	14.6	30.14	1.5	86	65	2	16.7
30-Sep	9.75	2.9	0	clr early AM, pc, rain mid-day	6.7	w, wsw	17.8	30.12	1	94	53	1.5	18.2
1-Oct	9.00	1.8	0	clr haze early AM, pc, mc mid-day	6.7	SW	16.9	30.19	2	44	25	2	19.4
2-Oct	4.75	1.8	0	clr, haze AM	11.3	wsw, sw	13.7	30.10	3	60	38	1	16.6
3-Oct	9.00	2.6	0	pc, haze PM	14.1	nw, w, wsw	17.2	30.10	3	73	34	1	11.6
4-Oct	9.50	2.4	0	pc, haze	18.7	wsw, sw, ssw	16.9	30.18	3	48	30	1	14.1
5-Oct	9.50	2.0	0	clr haze early AM, pc, mc	24.5	w, sw	14.7	30.09	3	88	62	2	12.1
6-Oct	9.25	2.7	0	mc, ovc late PM	18.3	w, sw	14.9	30.02	3	59	63	1	12.3
7-Oct	9.25	2.3	1	clr	15.6	sw, wsw	11.4	30.02	3	53	61	2	7.8
8-Oct	9.75	2.1	0	pc, mc mid-day	14.7	sw, wsw, w	15.0	30.05	2	90	100	1	9.3
9-Oct	9.50	2.2	0	pc	15.4	sw, wsw	13.3	30.07	4	72	63	1	7.8
10-Oct	9.25	2.0	0	clr	7.9	SW	15.8	30.12	2.5	76	59	1	7.5
11-Oct	7.75	2.0	0	mc, rain late PM	14.0	S	17.0	30.12	4	78	74	1	6.6
12-Oct	4.00	1.0	0	mc, ovc, rain	23.8	S	17.6	30.02	3	24	37	1	4.3
13-Oct	9.25	2.5	0	mc AM, pc mid-day, clr PM	27.8	W	5.3	29.98	4	96	100	1	4.0
14-Oct	8.75	2.2	1	clr	6.4	sw, w	14.5	30.03	2.5	97	100	1	5.0
15-Oct	9.50	1.6	0	clr, pc early PM	15.2	ssw, sw, wsw	14.0	29.97	2	98	100	1	4.7
16-Oct	9.00	2.4	0	clr	18.7	w, wsw	15.1	29.84	2.5	95	96	1	5.0
17-Oct	8.50	2.9	0	clr, haze	26.9	w, nw, wnw	10.2	29.81	3	56	66	2	4.5
18-Oct	8.58	2.3	0	clr, haze late PM	23.2	w, wsw	11.9	29.91	3	95	91	1	3.3
19-Oct	8.50	1.5	0	clr, haze	9.1	s, wsw	15.1	29.92	3	93	53	1	2.1
20-Oct	8.50	2.5	0	pc	14.3	w, wsw	13.5	29.84	3	87	98	2	2.8

Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Manzano Mountains Raptor Migration Project: 2012.

			MEDIAN		WIND			BAROM.	MEDIAN	VISIB.	VISIB.	MEDIAN	
	OBS.	OBSRVR	VISITOR	PREDOMINANT	SPEED	WIND	TEMP	PRESS.	THERMAL	WEST	EAST	FLIGHT	BIRDS
DATE	HOURS	/ HOUR ¹	DISTURB ²	WEATHER ³	$(KPH)^1$	DIRECTION	$(^{\circ}C)^{1}$	(IN HG) ¹	$LIFT^4$	$(KM)^1$	$(KM)^1$	DISTANCE ⁵	/ Hour
21-Oct	8.25	2.4	0	clr	23.9	W	12.7	29.83	2.5	100	100	1	3.3
22-Oct	9.00	1.5	0	clr	15.4	W	12.1	29.85	2.5	100	100	1	2.5
23-Oct	8.75	1.8	0	clr, pc-mc PM	23.4	SW	15.9	29.87	2	93	99	2	2.9
24-Oct	8.25	1.9	0	mc early AM, pc AM, clr PM	31.6	ssw, sw, s	13.1	29.77	4	81	86	1	3.0
25-Oct	8.33	2.3	0	clr AM, pc PM	16.2	W	7.0	29.84	3	91	100	1	1.6
26-Oct	8.00	2.0	0	pc fog AM, clr haze PM	2.5	ne	4.5	29.93	3	73	40	1.5	2.8
27-Oct	8.00	2.8	0	clr, haze	14.9	wsw	5.5	29.86	3	55	100	1.5	2.0
28-Oct	8.00	2.2	0	mc AM, clr PM	13.8	w, wnw	8.3	29.94	3	100	100	1	1.3
29-Oct	8.50	1.6	0	clr, haze	17.6	W	9.2	29.98	2	93	100	1	1.8
30-Oct	8.00	1.9	0	clr, haze PM	7.1	W	13.4	29.97	2.5	93	100	2	1.3
31-Oct	8.00	1.8	0	clr, haze	8.0	W	14.7	29.97	2	98	100	1	0.9
1-Nov	8.00	1.8	0	pc, mc PM, haze	16.3	ssw, sw	14.8	29.94	3	23	59	1	1.1
2-Nov	8.00	1.8	0	pc, mc late PM	11.0	wnw, wsw	14.6	29.91	2	86	87	1	0.9
3-Nov	8.00	1.8	0	mc	4.6	s, sw	12.5	29.95	2	48	85	1.5	1.0
4-Nov	7.83	1.5	0	clr, pc PM	16.6	wsw, w	10.4	30.00	3	97	100	1	1.3
5-Nov	7.75	1.1	0	clr	10.8	sw, w	11.4	30.02	3	100	100	2	0.5

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 = thunderstorms.

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.

	Species ¹ Bit														Birds																
DATE	HOURS	TV	OS	NH	MK	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	ZT	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/ Hour
27-Aug	8.75	1	1	0	0	0	3	0	0	0	0	0	2	1	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	11	1.3
28-Aug	9.00	1	0	0	0	3	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	12	1.3
29-Aug	9.00	3	0	0	0	8	5	1	1	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	24	2.7
30-Aug	10.00	1	0	0	0	7	3	0	1	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	16	1.6
31-Aug	9.00	11	0	0	0	11	9	0	2	0	0	0	2	1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	39	4.3
1-Sep	9.00	0	0	0	0	9	6	0	2	0	0	0	1	4	0	0	0	0	2	0	0	4	0	0	1	0	0	0	0	29	3.2
2-Sep	9.00	3	0	0	0	6	5	0	1	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	21	2.3
3-Sep	9.00	8	0	0	0	7	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	20	2.2
4-Sep	9.00	8	0	0	0	19	7	0	0	0	0	0	7	4	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	48	5.3
5-Sep	9.00	3	0	0	0	13	7	0	0	0	0	0	4	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	30	3.3
6-Sep	9.00	5	0	1	0	15	1	0	1	0	0	0	3	3	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	33	3.7
7-Sep	3.00	0	0	0	0	18	2	0	0	0	0	0	1	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	26	8.7
8-Sep	6.75	1	8	0	0	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	2.1
9-Sep	8.50	5	5	0	0	54	20	1	1	0	0	0	1	3	0	0	0	0	1	0	0	2	0	1	1	0	0	0	0	95	11.2
10-Sep	9.00	1	0	2	0	27	4	1	1	0	0	0	0	8	0	0	0	0	0	0	0	3	0	0	1	0	0	0	1	49	5.4
11-Sep	7.50	1	0	3	0	48	7	0	0	0	0	0	1	5	0	0	0	0	0	0	0	14	1	0	1	0	0	0	0	81	10.8
12-Sep	1.25																														
13-Sep	0.00																														
14-Sep	9.00	10	7	0	0	39	15	2	1	0	1	0	0	2	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	80	8.9
15-Sep	8.75	2	0	1	0	58	24	0	3	0	1	0	3	3	0	0	0	0	0	0	0	11	0	0	2	0	0	0	0	108	12.3
16-Sep	8.25	3	0	1	0	18	8	0	0	0	0	6	11	9	0	0	0	1	0	0	0	12	1	0	0	0	0	0	0	70	8.5
17-Sep	8.75	1	2	0	0	30	15	0	2	0	0	0	4	3	0	0	0	0	0	0	0	8	2	0	0	0	0	0	1	68	7.8
18-Sep	8.75	4	1	1	0	68	17	0	0	0	0	1	74	7	0	0	0	1	0	0	0	8	0	1	0	0	0	0	0	183	20.9
19-Sep	8.92	2	0	1	0	13	7	0	0	0	0	0	12	6	0	0	0	0	1	0	0	4	0	0	1	0	0	0	0	47	5.3
20-Sep	9.00	41	0	0	0	20	8	1	0	0	0	0	2	8	0	0	0	0	0	0	0	5	1	0	2	0	0	0	0	88	9.8
21-Sep	8.75	12	0	1	0	10	14	0	2	0	0	6	29	6	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	84	9.6
22-Sep	8.50	1	0	0	0	38	11	0	2	0	0	1	12	7	0	0	0	1	0	0	0	9	1	0	1	0	0	0	1	85	10.0
23-Sep	9.00	3	0	2	0	34	23	0	2	0	0	1	2	9	0	0	0	0	2	0	0	5	1	0	2	1	0	0	0	87	9.7
24-Sep	8.00	1	0	0	0	46	16	0	1	0	0	0	3	2	1	0	0	0	0	0	0	9	0	0	2	0	0	0	0	81	10.1
25-Sep	8.92	2	1	1	0	47	30	0	3	0	0	0	27	8	0	0	0	0	0	0	0	8	0	0	3	0	0	0	0	130	14.6
26-Sep	8.25	7	0	1	0	79	15	0	2	0	0	0	2	4	0	0	0	0	3	0	0	7	0	0	3	0	0	0	0	123	14.9
27-Sep	8.83	8	1	3	0	83	29	1	2	0	0	1	9	14	0	0	0	0	2	0	0	3	1	0	1	0	0	0	0	158	17.9
28-Sep	4.00	256	1	0	0	48	25	1	2	0	0	0	31	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	368	92.0
29-Sep	9.50	25	1	3	0	65	18	0	8	0	0	2	6	10	0	0	0	2	4	0	0	13	2	0	0	0	0	0	0	159	16.7
30-Sep	9.75	4	0	2	0	69	33	0	1	0	0	1	22	18	1	0	0	1	3	0	0	18	3	0	1	0	0	0	0	177	18.2
1-Oct	9.00	24	0	1	0	50	39	0	0	0	0	0	17	35	0	0	0	0	0	0	0	6	1	1	1	0	0	0	0	175	19.4
2-Oct	4.75	2	0	0	0	46	13	0	2	0	0	0	1	3	0	0	0	0	1	0	0	7	3	1	0	0	0	0	0	79	16.6
3-Oct	9.00	10	0	1	0	35	11	0	0	0	0	0	24	11	0	0	0	0	2	0	0	7	0	0	2	1	0	0	0	104	11.6
4-Oct	9.50	3	1	3	0	51	17	0	3	0	0	0	30	18	0	0	0	0	5	0	0	1	0	1	1	0	0	0	0	134	14.1
5-Oct	9.50	7	0	1	0	40	20	0	2	0	0	0	14	16	0	0	0	0	5	0	0	9	0	0	1	0	0	0	0	115	12.1

Appendix D. Daily observation effort and fall raptor migration counts by species in the Manzano Mountains, NM: 2012.

Append	lix D.	continued
rippene	$\mu n \nu$.	continueu

	SPECIES ¹ BIRDS														Birds																
DATE	HOURS	TV	OS	NH	MK	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	ZT	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/ HOUR
6-Oct	9.25	0	0	0	0	43	16	0	1	0	0	0	12	28	1	0	0	0	5	0	0	3	3	0	2	0	0	0	0	114	12.3
7-Oct	9.25	0	0	0	0	38	8	0	3	0	0	0	0	7	0	0	0	1	4	0	0	5	3	0	3	0	0	0	0	72	7.8
8-Oct	9.75	0	0	1	0	57	10	2	6	0	0	0	0	4	0	0	0	1	2	0	0	4	2	0	1	0	0	0	1	91	9.3
9-Oct	9.50	0	0	1	0	41	11	2	4	0	0	0	0	7	0	0	0	0	3	0	0	1	2	0	2	0	0	0	0	74	7.8
10-Oct	9.25	0	0	2	0	29	18	1	3	0	0	0	0	8	0	0	0	0	7	0	0	0	0	0	1	0	0	0	0	69	7.5
11-Oct	7.75	1	0	0	0	21	10	1	1	0	0	0	1	10	0	0	0	0	2	0	0	0	1	0	3	0	0	0	0	51	6.6
12-Oct	4.00	0	0	2	0	0	0	0	0	0	0	0	0	12	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	17	4.3
13-Oct	9.25	0	0	0	0	13	9	0	1	0	0	0	0	2	0	0	0	0	5	0	0	2	4	0	1	0	0	0	0	37	4.0
14-Oct	8.75	0	0	2	0	26	5	0	0	0	0	0	0	6	1	0	0	0	2	0	0	2	0	0	0	0	0	0	0	44	5.0
15-Oct	9.50	0	0	2	0	25	5	0	1	0	0	0	0	9	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	45	4.7
16-Oct	9.00	0	0	0	0	21	3	2	0	0	0	0	0	5	0	0	0	0	7	0	0	2	2	1	2	0	0	0	0	45	5.0
17-Oct	8.50	0	0	0	0	15	2	0	0	0	0	0	0	16	0	0	0	0	4	0	0	0	1	0	0	0	0	0	0	38	4.5
18-Oct	8.58	0	0	0	0	13	2	1	0	0	0	0	0	9	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	28	3.3
19-Oct	8.50	0	0	1	0	9	0	0	0	0	0	0	0	5	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	18	2.1
20-Oct	8.50	0	0	0	0	6	2	0	0	0	0	0	0	5	2	0	0	0	4	0	0	0	3	0	2	0	0	0	0	24	2.8
21-Oct	8.25	0	0	1	0	5	3	0	2	0	0	0	0	9	0	0	0	0	1	0	0	1	4	0	1	0	0	0	0	27	3.3
22-Oct	9.00	0	0	1	0	7	1	0	0	0	0	0	0	6	0	0	0	0	3	0	0	1	2	0	1	0	0	0	0	22	2.4
23-Oct	8.75	0	0	0	0	9	1	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	3	1	1	0	0	0	0	25	2.9
24-Oct	8.25	0	0	0	0	8	2	0	0	0	0	0	0	9	0	0	0	0	2	0	0	0	2	1	1	0	0	0	0	25	3.0
25-Oct	8.33	0	0	0	0	7	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	13	1.6
26-Oct	8.00	0	0	1	0	3	0	0	0	0	0	0	0	16	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	22	2.8
27-Oct	8.00	0	0	1	0	6	0	1	0	0	0	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	16	2.0
28-Oct	8.00	0	0	0	0	4	1	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	10	1.3
29-Oct	8.50	0	0	2	0	7	0	0	0	0	0	0	0	1	0	1	0	0	3	0	0	0	1	0	0	0	0	0	0	15	1.8
30-Oct	8.00	0	0	0	0	5	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	10	1.3
31-Oct	8.00	0	0	0	0	4	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	7	0.9
1-Nov	8.00	0	0	1	0	3	1	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	9	1.1
2-Nov	8.00	0	0	1	0	2	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	7	0.9
3-Nov	8.00	0	0	1	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	8	1.0
4-Nov	7.83	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	6	1	0	0	0	0	0	0	0	0	0	10	1.3
5-Nov	7.75	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4	0.5
Total	582.42	481	29	50	0	1665	603	18	71	0	2	19	371	435	8	1	0	9	119	3	0	224	64	12	57	2	1	0	4	4248	7.3

¹ See Appendix B for explanation of species codes.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Start date	06-Sep	23-Aug	25-Aug	30-Aug	28-Aug	27-Aug	27-Aug	25-Aug	25-Aug	25-Aug
End date	02-Nov	31-Oct	04-Nov	31-Oct	31-Oct	31-Oct	05-Nov	05-Nov	05-Nov	02-Nov
Days of observation	50	63	65	60	63	62	67	70	68	66
Hours of observation	343.33	464.50	517.92	453.08	489.75	510.75	524.58	537.25	489.67	508.75
Raptors / 100 hours	843.2	863.9	758.6	772.3	955.4	494.6	825.6	946.3	2429.2	966.5
SPECIES					RAPTOR	COUNTS				
Turkey Vulture	74	118	283	466	178	295	176	268	601	430
Osprey	10	14	19	13	22	12	24	26	31	38
Northern Harrier	28	36	78	78	59	27	66	69	48	97
Sharp-shinned Hawk	956	1300	1622	1118	1834	688	1080	1540	1193	1415
Cooper's Hawk	531	881	679	604	929	471	1105	961	944	1054
Northern Goshawk	21	20	7	6	14	3	8	16	27	30
Unknown small accipiter ¹	-	-	-	-	-	-	-	-	-	-
Unknown large accipiter ¹	-	-	-	-	-	-	-	-	-	-
Unknown accipiter	78	104	119	111	121	120	156	117	266	118
TOTAL ACCIPITERS	1586	2305	2427	1839	2898	1282	2349	2634	2430	2617
Broad-winged Hawk	2	2	7	10	5	2	5	5	1	7
Swainson's Hawk	27	33	44	3	16	9	58	344	7301	67
Red-tailed Hawk	513	527	457	486	604	329	577	667	566	707
Ferruginous Hawk	14	15	17	20	16	13	19	25	17	13
Rough-legged Hawk	0	0	0	1	1	0	0	0	0	0
Zone-tailed Hawk	0	0	0	0	0	0	0	2	0	1
Unknown buteo	21	12	11	16	4	19	30	11	31	22
TOTAL BUTEOS	577	589	536	536	646	372	689	1054	7916	817
Golden Eagle	133	123	86	67	85	52	124	119	120	172
Bald Eagle	2	0	1	1	3	4	7	4	7	9
Unknown Eagle	0	0	0	4	0	4	0	0	0	0
TOTAL EAGLES	135	123	87	72	88	60	131	123	127	181
American Kestrel	421	755	426	385	677	409	728	704	520	582
Merlin	2	16	17	12	18	9	10	28	24	24
Prairie Falcon	13	7	8	12	19	9	14	17	27	22
Peregrine Falcon	14	15	7	10	15	5	21	18	31	37
Unknown small falcon ¹	-	-	-	-	-	-	-	-	-	-
Unknown large falcon ¹	-	-	-	-	-	-	-	-	-	-
Unknown falcon	4	0	1	0	3	5	3	1	0	1
TOTAL FALCONS	454	793	459	419	732	437	776	768	602	666
Unknown raptor	31	35	40	76	56	41	120	142	140	71
TOTAL	2895	4013	3929	3499	4679	2526	4331	5084	11895	4917

Appendix E. Annual observation effort and fall raptor migration counts by species (unadjusted data) in the Manzano Mountains, NM: 1985–2012.

Appendix E. co	ontinued
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	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Start date	27-Aug	28-Aug								
End date	08-Nov	05-Nov	5-Nov	5-Nov	5-Nov	2-Nov	4-Nov	3-Nov	5-Nov	30-Oct
Days of observation	70	59	68	65	70	57	68	65	69	57
Hours of observation	560.00	461.67	565.08	559.58	553.77	434.33	545.47	518.50	577.25	424.08
Raptors / 100 hours	832.9	1545.9	1044.8	1594.2	873.1	991.6	855.8	972.0	1126.4	1039.9
Species					RAPTOR	COUNTS				
Turkey Vulture	636	640	563	1116	637	241	164	239	468	289
Osprey	53	33	47	44	14	25	26	32	86	20
Northern Harrier	72	64	69	133	69	38	37	33	50	27
Sharp-shinned Hawk	1519	2174	1872	2585	1212	1698	1032	1524	1861	1268
Cooper's Hawk	907	1205	1018	2025	1069	984	913	1149	1758	964
Northern Goshawk	11	9	9	19	14	42	13	23	12	15
Unknown small accipiter ¹	-	-	-	-	-	-	86	188	205	169
Unknown large accipiter ¹	-	-	-	-	-	-	0	3	5	4
Unknown accipiter	44	147	76	107	51	29	0	11	5	28
TOTAL ACCIPITERS	2481	3535	2975	4736	2346	2753	2044	2898	3846	2448
Broad-winged Hawk	7	4	5	14	12	3	6	9	16	6
Swainson's Hawk	32	867	679	572	194	19	815	139	53	291
Red-tailed Hawk	519	771	803	1151	733	591	632	778	924	636
Ferruginous Hawk	13	4	13	10	8	3	10	14	7	8
Rough-legged Hawk	0	0	0	1	1	0	1	0	0	0
Zone-tailed Hawk	1	0	1	2	0	3	1	1	0	0
Unknown buteo	9	11	3	28	5	2	106	32	30	69
TOTAL BUTEOS	581	1657	1504	1778	953	621	1571	973	1030	1010
Golden Eagle	136	151	145	115	159	115	128	149	146	79
Bald Eagle	4	0	3	4	3	5	1	3	8	1
Unknown Eagle	0	0	0	0	0	1	0	0	1	0
TOTAL EAGLES	140	151	148	119	162	121	129	152	155	80
American Kestrel	584	905	455	742	525	397	560	470	686	362
Merlin	42	48	42	56	14	27	21	22	22	26
Prairie Falcon	18	19	19	58	38	30	28	24	20	18
Peregrine Falcon	49	60	67	116	64	49	63	127	112	82
Unknown small falcon ¹	-	-	-	-	-	-	0	4	2	1
Unknown large falcon ¹	-	-	-	-	-	-	0	15	3	1
Unknown falcon	0	1	0	12	2	1	5	2	1	5
TOTAL FALCONS	693	1033	583	984	643	504	677	664	846	495
Unknown raptor	8	24	15	11	11	4	20	49	21	41
TOTAL	4664	7137	5904	8921	4835	4307	4668	5040	6502	4410

	2005	2006	2007	2008	2009	2010	2011	2012	Mean
Start date	27- Aug	27- Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	26-Aug
End date	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	4-Nov	4-Nov	5-Nov	2-Nov
Days of observation	69	68	63	69	68	70	68	70	65
Hours of observation	599.58	566.41	553.58	579.00	535.68	578.00	521.00	582.42	519.82
Raptors / 100 hours	937.8	1433.4	883.2	1327.5	577.0	1327.7	919.4	729.4	1030.8
Species					RAP	TOR COU	NTS		
Turkey Vulture	363	150	499	315	82	189	668	481	378
Osprey	35	30	47	50	12	17	16	29	30
Northern Harrier	46	90	75	89	49	41	35	50	59
Mississippi Kite	_	_	_	_	_	_	1	_	1
Sharp-shinned Hawk	1842	958	1283	1836	1051	2067	1252	1665	1478
Cooper's Hawk	1486	865	922	1084	620	1162	602	603	981
Northern Goshawk	10	10	30	21	21	23	18	18	17
Unknown small accipiter ¹	129	119	74	57	94	102	28	71	110
Unknown large accipiter ¹	5	2	7	10	12	9	8	0	5
Unknown accipiter	1	6	10	16	12	3	0	2	66
TOTAL ACCIPITERS	3473	1960	2326	3024	1810	3366	1908	2359	2591
Broad-winged Hawk	13	9	10	17	6	13	5	19	8
Swainson's Hawk	52	4695	841	2952	274	2906	1204	371	888
Red-tailed Hawk	823	534	537	575	398	491	410	435	614
Ferruginous Hawk	13	9	8	10	8	9	14	8	12
Rough-legged Hawk	0	0	0	1	0	0	0	1	0
Zone-tailed Hawk	1	0	0	0	0	1	4	0	1
Unknown buteo	33	23	19	11	57	22	10	9	23
TOTAL BUTEOS	935	5270	1415	3566	743	3442	1647	843	1546
Golden Eagle	71	87	99	167	70	130	113	119	116
Bald Eagle	1	3	6	7	1	4	2	3	3
Unknown Eagle	4	1	9	2	4	4	5	0	1
TOTAL EAGLES	76	91	114	176	75	138	120	122	121
American Kestrel	520	412	298	350	216	359	288	224	498
Merlin	48	23	34	47	28	54	26	64	29
Prairie Falcon	16	13	10	11	6	13	13	12	18
Peregrine Falcon	61	43	51	42	43	40	58	57	48
Unknown small falcon ¹	2	1	0	1	4	2	2	2	2
Unknown large falcon ¹	5	3	2	2	3	5	3	1	4
Unknown falcon	6	1	1	1	2	0	0	0	2
TOTAL FALCONS	658	496	396	454	302	473	390	360	598
Unknown raptor	37	32	17	12	18	8	5	4	39
TOTAL	5623	8119	4889	7686	3091	7674	4790	4248	5366

¹ New designations used for the first time in 2001.

	Stn.						S	PECIE	s^1							CAPTURES
DATE	HOURS	NH	SS	СН	NG	BW	SW	RT	ZT	GE	AK	ML	PR	PG	TOTAL	/ STN HR
31-Aug	7.50	0	5	4	0	0	0	1	0	0	0	0	0	0	10	1.3
1-Sep	11.00	0	6	3	0	0	0	0	0	0	0	0	0	1	10	0.9
2-Sep	13.50	0	3	2	0	0	0	1	0	0	0	0	0	0	6	0.4
3-Sep	7.00	0	4	1	0	0	0	0	0	0	1	0	0	0	6	0.9
4-Sep	7.50	0	2	1	0	0	0	2	0	0	0	0	0	0	5	0.7
5-Sep	7.00	0	4	2	0	0	0	0	0	0	0	0	0	0	6	0.9
6-Sep	7.00	0	3	1	0	0	0	0	0	0	0	0	0	0	4	0.6
7-Sep	5.50	0	3	2	0	0	0	2	0	0	1	0	0	0	8	1.5
8-Sep	9.75	0	2	1	0	0	0	1	0	0	0	0	0	0	4	0.4
9-Sep	14.50	0	17	7	0	0	0	1	0	0	0	0	0	0	25	1.7
10-Sep	7.50	0	10	1	0	0	0	1	0	0	0	0	0	0	12	1.6
11-Sep	7.00	0	19	0	0	0	0	1	0	0	0	0	0	0	20	2.9
12-Sep	3.00	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.3
13-Sep	0.00															
14-Sep	7.00	0	4	6	0	0	0	1	0	0	0	0	0	0	11	1.6
15-Sep	14.75	0	23	10	0	0	0	1	0	0	2	0	0	0	36	2.4
16-Sep	13.50	0	6	1	0	0	0	0	0	0	0	0	0	0	7	0.5
17-Sep	6.00	0	6	3	0	0	0	0	0	0	0	0	0	0	9	1.5
18-Sep	6.00	0	11	2	0	0	0	0	0	0	0	0	0	0	13	2.2
19-Sep	6.00	0	3	3	0	0	0	0	0	0	0	0	0	0	6	1.0
20-Sep	7.25	0	5	2	0	0	0	0	0	0	0	0	0	1	8	1.1
21-Sep	6.50	0	2	4	0	0	0	1	0	0	0	0	0	0	7	1.1
22-Sep	14.00	0	12	6	0	1	0	2	0	0	0	0	0	0	21	1.5
23-Sep	11.75	0	5	10	0	0	0	1	0	0	0	1	0	0	17	1.4
24-Sep	6.75	0	12	8	0	0	0	1	0	0	2	0	0	0	23	3.4
25-Sep	7.00	0	10	8	0	0	0	0	0	0	1	0	0	0	19	2.7
26-Sep	4.50	0	11	2	0	0	0	0	0	0	0	0	0	0	13	2.9
27-Sep	5.00	0	6	5	1	0	0	1	0	0	0	0	0	0	13	2.6
28-Sep	3.00	0	4	4	0	0	0	0	0	0	0	0	0	0	8	2.7
29-Sep	15.00	0	14	11	0	0	0	1	0	0	0	0	0	0	26	1.7
30-Sep	14.75	0	11	10	0	0	0	1	0	0	0	0	0	0	22	1.5
1-Oct	7.00	0	10	9	0	0	0	1	0	0	0	0	0	0	20	2.9
2-Oct	11.00	0	16	4	0	0	0	0	0	0	0	0	0	0	20	1.8
3-Oct	6.00	0	2	4	0	0	0	1	0	0	0	0	0	0	7	1.2

Appendix F. Daily trapping effort and capture totals of migrating raptors by species in the Manzano Mountains, NM: 2012.

Appendix F. continued

	Stn.						SPEC	IES ¹								CAPTURES
DATE	HOURS	NH	SS	СН	NG	BW	SW	RT	ZT	GE	AK	ML	PR	PG	TOTAL	/ STN HR
4-Oct	7.00	1	11	6	0	0	0	1	0	0	0	0	0	0	19	2.7
5-Oct	7.75	0	11	3	0	0	0	1	0	0	0	0	0	0	15	1.9
6-Oct	14.00	0	11	7	0	0	0	4	0	1	0	0	0	0	23	1.6
7-Oct	13.75	0	10	5	0	0	0	0	0	1	1	0	0	0	17	1.2
8-Oct	7.00	0	13	3	0	0	0	1	0	0	0	1	0	0	18	2.6
9-Oct	7.00	0	4	2	1	0	0	1	0	0	0	0	0	0	8	1.1
10-Oct	7.00	0	6	2	0	0	0	0	0	0	0	0	0	0	8	1.1
11-Oct	5.50	0	4	2	0	0	0	2	0	0	0	0	0	0	8	1.5
12-Oct	0.00															
13-Oct	13.50	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.1
14-Oct	14.25	0	9	0	0	0	0	1	0	0	0	1	0	0	11	0.8
15-Oct	7.25	0	1	0	0	0	0	1	0	0	0	0	0	0	2	0.3
16-Oct	6.00	0	3	1	0	0	0	0	0	0	0	0	0	0	4	0.7
17-Oct	0.00															
18-Oct	6.50	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0.3
19-Oct	7.00	0	3	0	0	0	0	0	0	1	0	0	0	0	4	0.6
20-Oct	14.00	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.1
21-Oct	7.75	0	0	2	0	0	0	1	0	0	1	0	0	0	4	0.5
22-Oct	10.50	0	3	0	0	0	0	0	0	1	0	2	0	0	6	0.6
23-Oct	7.50	0	3	0	0	0	0	1	0	0	0	1	0	0	5	0.7
24-Oct	7.00	0	3	0	0	0	0	1	0	0	0	0	0	0	4	0.6
25-Oct	7.50	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0.5
26-Oct	7.00	0	1	0	0	0	0	2	0	0	0	0	0	0	3	0.4
27-Oct	13.00	1	5	0	0	0	0	2	0	0	0	0	0	0	8	0.6
28-Oct	10.50	0	3	0	0	0	0	0	0	0	0	1	0	0	4	0.4
Total	488.75	2	362	171	2	1	0	41	0	4	9	8	0	2	602	1.3 Avg

¹ See Appendix B for explanation of species codes.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Start date	28-Aug	05-Sep	31-Aug	03-Sep	01-Sep	04-Sep	02-Sep	31-Aug	29-Aug	31-Aug	02-Sep	01-Sep	03-Sep	07-Sep	05-Sep	04-Sep	04-Sep	02-Sep
End date	27-Oct	29-Oct	30-Oct	24-Oct	25-Oct	31-Oct	19-Oct	28-Oct	29-Oct	16-Oct	27-Oct	25-Oct	25-Oct	24-Oct	28-Oct	28-Oct	24-Oct	27-Oct
Blinds in operation	1	3	3	3	3	4	4	4	3	3	3	3	3	2	2	2	2	2
Trapping days	47	54	57	50	48	53	45	54	58	46	50	55	51	45	45	51	48	47
Station days	47	95	131	120	121	136	132	151	165	94	119	145	131	84	84	99	94	105
Station hours	511	693	967	889	926	1041	1030	1211	1352	664	791	1037	957	633	756.15	707.77	677.67	452.97
Captures / 100 stn hrs	47.7	72.4	108.2	100.8	110.7	85.7	137.0	95.0	148.2	115.7	121.7	85.9	135.3	152.7	136.0	163.0	96.5	83.2
Species	RAPTOR CAPTURES																	
Northern Harrier	1	2	2	3	9	2	1	8	14	0	5	7	6	3	0	3	6	3
Sharp-shinned Hawk	124	262	589	430	502	493	778	612	987	321	495	426	635	458	566	562	299	196
Cooper's Hawk	95	195	335	374	353	310	460	427	772	323	330	337	510	400	378	495	280	142
Northern Goshawk	1	7	6	6	7	1	5	3	6	6	16	1	10	1	2	3	3	3
Broad-winged Hawk	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	1	1
Swainson's Hawk	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	1	0
Red-tailed Hawk	8	18	61	55	83	50	50	46	112	56	76	39	56	38	43	35	35	9
Zone-tailed Hawk	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Golden Eagle	1	3	4	4	4	4	6	4	5	2	4	5	7	8	2	2	1	1
American Kestrel	10	13	42	14	59	28	92	32	75	44	25	56	37	43	18	37	10	9
Merlin	1	0	2	4	1	1	11	6	7	2	8	2	12	3	10	3	2	5
Prairie Falcon	1	1	3	5	3	1	3	5	13	6	3	7	5	4	3	4	4	2
Peregrine Falcon	2	1	2	1	4	2	5	7	12	8	1	10	13	7	5	10	12	6
All Species	244	502	1046	896	1025	892	1411	1150	2006	768	963	891	1295	966	1028	1154	654	377
Recaptures ¹	0	0	1	1	2	2	1	2	4	4	3	2	3	2	2	3	2	0
Foreign recaptures ²	2	1	1	1	2	0	5	1	2	2	0	0	3	2	0	0	1	0
Foreign encounters ³	0	2	2	3	6	6	7	8	13	12	6	7	10	7	5	3	4	6

Appendix G. Annual trapping and banding effort and capture totals of migrating raptors by species in the Manzano Mountains, NM: 1990–2012.

¹ Recaptures in the Manzanos of birds originally banded in the Manzanos. ² Recaptures in the Manzanos of birds originally banded elsewhere.

³ Birds originally banded in the Manzanos and subsequently encountered elsewhere.

Appendix G. continued

	2008	2009	2010	2011	2012	TOTAL	MEAN				
Start date	3-Sep	3-Sep	2-Sep	1-Sep	31-Aug		1-Sep				
End date	30-Oct	27-Oct	27-Oct	28-Oct	28-Oct		25-Oct				
Blinds in operation	2	2	2	2	2		2.7				
Trapping days	56	48	52	46	56		50.5				
Station days	80	61	61	58	76		95.0				
Station hours	586.04	390.25	408.67	397.00	495.25		764.1				
Captures / 100 stn hrs	104.8	133.8	93.5	80.6	121.6		110.0				
SPECIES				RAPTOR CAPTURES							
Northern Harrier	4	2	2	2	2	87	3.8				
Sharp-shinned Hawk	315	255	184	171	362	10022	435.7				
Cooper's Hawk	247	201	160	105	171	7400	321.7				
Northern Goshawk	3	8	2	1	2	103	4.5				
Broad-winged Hawk	0	0	0	0	1	7	0.3				
Swainson's Hawk	0	0	0	0	0	5	0.2				
Red-tailed Hawk	20	34	22	27	41	1014	44.1				
Zone-tailed Hawk	0	0	0	0	0	1	0.0				
Golden Eagle	9	1	1	1	4	83	3.6				
American Kestrel	4	16	5	8	9	686	29.8				
Merlin	8	2	2	3	8	103	4.5				
Prairie Falcon	1	1	3	0	0	78	3.4				
Peregrine Falcon	3	2	1	2	2	118	5.1				
All Species	614	522	382	320	602	19707	856.8				
Recaptures ¹	1	1	2	1	1	40	1.7				
Foreign recaptures ²	0	1	0	0	0	24	1.0				
Foreign encounters ³	5	5	2	1	4	129	5.6				

¹ Recaptures in the Manzanos of birds originally banded in the Manzanos. ² Recaptures in the Manzanos of birds originally banded elsewhere.

³ Birds originally banded in the Manzanos and subsequently encountered elsewhere.