FALL 2011 RAPTOR MIGRATION STUDIES IN THE MANZANO MOUNTAINS OF CENTRAL NEW MEXICO

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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 2011 season marked the 27th consecutive count and the 22st consecutive season of trapping and banding conducted at the site by HWI. This report summarizes the 2011 count and banding results.

The Manzanos project was 1 of 6 long-term, annual migration counts and 1 of 4 migration-banding studies conducted or co-sponsored by HWI in North America during 2011. 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, 2008 a, 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 intensive 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 (Manzano Ranger District) near Capilla Peak, approximately 56 km south-southeast of Interstate 40 (34°42.25' N, 106°24.67' W; Figure 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 (Q*uercus 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 2011, two traditional banding stations were operated within 0.25–1 km of the observation point (Figure 1). **North** station, operated every year since 1990, was 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, was located 0.5 km southwest of the observation point at an elevation of 2,684 m. **South** station, operated part to full-time most years between 1991 and 2002, was not operated this year.

Many factors make the Manzano Lookout well suited for observing consistent flights of migrating raptors during fall. Several mountain ranges to the north serve as leading lines (Bildstein 2006), funneling raptors into the Manzanos. The Manzano Mountains also are 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 thermal 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, Tim Hanks is a veteran of the Manzano project with eight previous seasons of migration counting experience, whereas Russell Seeley had one prior season of experience as an Observer at the Manzanos in 2010 (see Appendix A for a complete history of observer participation). Volunteers and other crewmembers occasionally assisted with the counts, particularly seasoned volunteer Roger Grimshaw. 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 2010 data follows Hoffman and Smith (2003). In comparing 2011 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2011 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

Weather permitting; rotating crews of 2–3 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

In 2011, inclement weather entirely precluded two full days of potential observations and hampered (≤ 4 hours observation) observations on two other days (see Appendix C for daily weather summaries). The number of days fully precluded by weather was significantly below the 1997–2010 average of 4.9 days (range 0–14), whereas the number of otherwise severely hampered days nearly matched the average of 1.7 days (range 0–5). Sky conditions during active observation periods were fairer than the 1997–2010 averages for the site: 58% of the active observation days featured predominantly fair skies (average 51%), 13% transitional skies (i.e., changed from fair skies to mostly cloudy or overcast during the day, or vice versa; average 17%), 28% mostly cloudy to overcast skies (average 33%); the prevalence of scattered rain/snow showers during active observation periods was significantly above average in 2011 (49% of active days vs. average of 36%), as was the prevalence of visibility reducing fog and especially haze (55% vs. average of 39%). These factors did not impact the ratings in average maximum-visibility ratings to the east (95 km vs. average of 90 km) and west (95 km vs. average of 90 km), whereas the proportion of days where the observers rated the thermal lift conditions as good to excellent was significantly below average (28% of the active days vs. average of 41%).

Wind speeds at the observation point were consistent with long-term means, with the proportion of active observation days where light winds (<12 kph) prevailed was (63% vs. average of 69%), the proportion of days with predominantly moderate winds (12–28 kph) was (34% vs. average of 28%), strong winds (>28 kph) prevailing on (3% vs. average of 4%) of the active observation days in 2011.

In terms of wind directions, the range of conditions seen in 2011 differed from the long-term average pattern in a few ways, but less so than recent years. As usual, SW–W winds were most common, but well below average in 2011 (25% of the active days vs. 1997–2010 average of 40%). In contrast, the prevalence of SW–NW winds, S–W winds, and more variable S–W winds were significantly higher in 2011 (16% of the active days vs. average of 6%, 10% vs. average of 3%, and 10% vs. average of 4%, respectively), whereas the pattern that averages second-most common, S–SW winds, fell below the long-term mean (10% vs. average of 13%).

The temperature during active observation periods averaged 12.9°C (the average of daily values, which in turn were averages of hourly readings), ranging from -2.8–22.4°C. The overall daily average was well below the 1997–2010 average of 14.2°C. The minimum and maximum daily-average fell within the range of values recorded since 1997. We began recording hourly barometric pressure readings on site in 2001. In 2011, the overall average (30.13 in Hg; the average of daily values, which in turn were averages of hourly readings) and minimum (29.80) and maximum (30.29) daily averages were slightly above average.

In summary, inclement weather had little impact on the observer's ability to conduct daily counts. Cloud cover conditions were clearer than averages for the previous 13 years, but the prevalence of scattered rain/snow showers and fog/haze were significantly above average during active observation periods. Wind speeds werer consistent with those of the long-term mean in 2011. While SW–W winds dominated, they were significantly less common than usual; whereas more variable (SW–NW, S–W, calm/variable, and S–W) wind patterns were much more prevalent than usual, while the S–SW pattern was below average. The subjective nature of rating thermal-lift conditions speaks more to an apparent reduction in favorable thermal-lift conditions, than localized weather variables indicate.

OBSERVATION EFFORT

The observers worked on 68 of 71 possible days between 27 August and 5 November. The number of observation days was a marginally significant 5% higher than the 1985–2010 average of 65 ± 95% CI of 2.0 days. The total hours of observation (535.68) also was a significant 4% above the long-term average of 517.37 ± 24.12 hours. The 2011 average of 2.1 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was a marginally significant 7% below the 1985–2010 average of 2.21 ± 95% CI of 0.13 observers/hr. This difference is due to closure of the access road to visitors and associated hampering of Citizen Science volunteer access.

FLIGHT SUMMARY

The observers counted 4,790 migrant raptors of 18 species during the 2011 season (see Appendix D for daily count records and Appendix E for annual summaries). The flight was composed of 40% buteos, 34% accipiters, 14% vultures, 8% falcons, 3% eagles, and ≤1% each of harriers, Ospreys, and unidentified raptors. This composition includes significantly above-average proportions of buteos and vultures, but significantly below-average proportions of accipiters, falcons, harriers, and Osprey (Figure 2). The Sharp-shinned Hawk was the most abundant species seen in 2011, followed by Swainson's Hawks, Turkey Vultures, Cooper's Hawks, Red-tailed Hawks, and American Kestrels (Table 1, Appendix E). Record high counts were recorded for Zone-tailed Hawks (4) and Mississippi Kites (1; first record), whereas no record lows were occurred in 2011.

Passage Rates and Long-term Trends

Adjusted passage rates were significantly above average for the Peregrine Falcon and Turkey Vulture, but were significantly below average for Osprey, Northern Harrier, Sharp-shinned Hawk, Cooper's Hawk, Red-tailed Hawk, American Kestrel, and Prairie Falcon (Table 1, Figures 3–7). Updated regression analyses (after Hoffman and Smith 2003) indicated a significant ($P \leq 0.05$) quadratic trend for Turkey Vultures, loosely tracking a strong increasing pattern through 1998, followed by a sharp three-year decline but then mostly moderate counts and no real trend since 2001 (Figure 3). A roughly similar pattern applied to Northern Harrier (Figure 3). A significant ($P \leq 0.05$) linear increasing trend was indicated for Ospreys, but more detailed examination shows a strong increasing pattern through 1995, a sharp drop in 1999, a return to a gradual increasing pattern since then with a high spike in 2003, and another sharp drop in the last three years (Figure 3). Among the accipiters, low adjusted passage rates for four of the last six years eliminated a previously significant increasing trend for Sharp-shinned Hawks. Lower passage rates during the several seasons dampened what had been a highly significant ($P \leq 0.01$) long-term increase for Cooper's Hawks, culminating in a significant quadratic trend (Figure 4). Among the buteos, continued highly significant long-term increases were indicated for Broad-winged and Swainson's Hawks (Figure 5). In contrast, a highly significant long-term decrease continues to be indicated for Ferruginous Hawks; however, following a strong slide between 1992 and 2000, passage rates of this species have remained relatively stable for the past ten years (Figure 5). Previously, a long-term increasing pattern had been evident for Red-tailed Hawks; however, after rising to high peak in 1998, passage rates of this species have fluctuated some but have been on a downward trend, with flights in the past five years among the lowest to date and a highly significant third-order regression now tracking the ups-and-downs of this species (Figure 5). No significant long-term trends are currently shown for Golden or Bald Eagles at the species level; however, a significant third-order trend was indicated for adult Golden Eagles, tracking a sharp decline in the late 1980s, a gradual rebound through the late 1990s, and then another recent decline (Figure 6). That said, after having dropped sharply between 2003 and 2006 to near-record lows, passage rates of Golden Eagles rose again in the past 3–4 years, with the flight of non-adult birds, in particular, actually reaching a near-record high in 2008, plummeting again in 2009, and back up the past two years. Overall, the recent ups-and-downs of this species mimic the pattern seen in the late 1980s and early 1990s – roughly tracking the Palmer Drought Severity Index (PDSI) (Figure 6). Among the falcons, a significant long-term decrease continues for

American Kestrels; passage rates generally have been average to below average since the late 1990s and addition of three record-low passage rates in a row from 2006 to 2009 tipped the trend to a significant long-term decline, exacerbated by a near an all-time low passage rate in 2011 (Figure 7). A significant quadratic trend was indicated for Merlins, tracking a strong increasing pattern through about 1996, but a relatively stable increasing pattern since then (Figure 7). Highly significant third-order regressions were indicated for Prairie and Peregrine Falcons, in both cases tracking relatively stable patterns in the late 1980s, then strong increasing patterns through at least the late 1990s, but then very sharp declines for the past 9–12 years (Figure 7). Despite a sharp decline since reaching a high peak in 2002, the 2011 passage rate for Peregrine Falcons was a significant 29% above average, conversely the 2011 passage rate for Prairie Falcons was a significant 30% below average, but significantly higher than the record low passage observed in 2009.

Age Ratios

Among 10 species with data suited to comparisons, immature : adult ratios were not significantly above average for any species, but were significantly below average for Northern Harriers, Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks (Table 2). In the case of Northern Harriers immature birds were less abundant than usual, but adults were as common as usual, suggesting that adult survival was good, but productivity may have been lower in 2011. A similar pattern applied to Northern Goshawks; however, a low total count and a high proportion of unidentified birds limit the utility of this comparison.

For Sharp-shinned Hawks, immature birds were less abundant than usual, suggesting that the low age ratios for these species resulted from low productivity, whereas for Cooper's Hawks both immature and adult birds were less abundant than usual, suggesting low annual productivity and slightly below average over-winter survival for adults. Age ratios differed (high or low) for the remaining species, but hovered closer to long-term means.

Seasonal Timing

The 2011 combined-species median passage date of 1 October was significantly later than the 1985–2010 long-term median date of 26 September (Table 3). The overall seasonal distribution of activity differed from the average pattern, in showing significantly below-average proportional activity levels during the first half of the season (1 – 30 September), followed by a huge spike in seasonal passage (26 September – 3 October), above average counts through 20 October, and then tapering to near average passage rates for the remainder of the count (Figure 8). The spike in passage was driven by significant flights of Sharp-shinned, Cooper's, and Swainson's Hawks. At the species level, all species showed significantly late timing (Table 3). Age- and sex-specific data further confirmed significantly late passage timing; the only exception was that immature Cooper's Hawks median passage fell a non-significant one day later than usual (Table 4).

TRAPPING EFFORT

The crews operated at least one banding station on 46 of 58 possible days between 1 September and 28 October 2011, with effort totaling 56 station days and 397.00 station hours (see Appendix F daily trapping records and Appendix G for annual summaries). The number of trapping days was 9% below the long-term average, whereas the number of station days and hours were 41 and 50% below average, respectively, primarily due to low funding levels, minimal crew size and effort (Appendix G).

TRAPPING AND BANDING SUMMARY

The 2011 capture total of 320 birds included 9 species, 1 recapture of birds previously banded at the site (Table 5, Appendix G). The 2011 effort raises the total number of birds captured since project inception to 19,105, including 39 recaptures of Manzano-banded birds and 24 foreign recaptures (i.e., birds originally banded elsewhere and subsequently recaptured in the Manzanos; Appendix G). Sharp-shinned

and Cooper's Hawks accounted for 53% and 33% of the total captures, respectively, with Red-tailed Hawks (8%), American Kestrels (3%), and all other species each comprising less than 1% of the total.

The overall combined-species capture total was 66% below average, the overall capture rate of 80.6 birds per 100 station hours was a significant 29% below average, and the overall capture success of 11% was 47% below average (Table 5), again largely reflecting reduced crew size, experience levels, and effort. With a capture total of 27 birds, the Red-tailed Hawk was the only species for which any (capture rate) metrics were above average in 2011. All three capture metrics were low or significantly low for all other species, except capture rate for Northern Harriers.

Compared to the counts, at this site banding yields unique and substantial sex–age specific data only for Sharp-shinned Hawks, Cooper's Hawks, and American Kestrels. The 2011 immature : adult capture ratio for Sharp-shinned Hawks of 1.3 was a significant 18% below average (Table 6), whereas the count-based age ratio of 0.63 was a significant 28% below average (Table 2). This suggests that immature birds were somewhat less susceptible to capture than usual compared to adults in 2011. The 2011 capture age ratio for Cooper's Hawks of 1.0 matched the average, while the count age ratio of 0.69 was a non-significant 15% below average. This suggests that immature Cooper's Hawks were much more susceptible to capture than usual compared to adults. The banding data also uniquely suggested that the female : male ratio for captured Cooper's Hawks was significantly below average, whereas the sex ratio of captured Sharp-shinned Hawks was significantly above the long-term average (Table 6).

Only seven hatch-year (three female and four male) and one adult male American Kestrels were captured in 2011, which is only 26% of the long-term mean total, but the 2011 female : male capture ratio of 0.6 matched the average (Table 6). Similarly, the count-based sex ratio for kestrels of .78 was a non-significant 8% below the long-term average of 0.85 ± 95% CI of .089. A dearth of adult kestrels again suggests that adult birds were either relatively scarce or much less susceptible to capture than usual in 2011.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Recaptures.—During the season, there was only one recapture of an adult female Cooper's Hawk that was previously banded on 14 April 2004, as an after-hatch-year (AHY) at our historical spring migration monitoring site in the Sandia Mountains in New Mexico. This past season, the bird was recaptured again on 29 September, bringing the total number of recaptures at this site to 39 (Appendix G). These records are important to help understand flyway fidelity, as well as to assist in calculating survivorship.

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 only one recovery; a female Sharp-shinned Hawk that was originally banded in 2006, as an adult after second year (Table 7). This bird was reported as found dead by colliding into an object other than wire within the Rocky Mountain Flyway (see Hoffman et al. 2002), approximately 274 miles from the site, near Durango, Colorado (Table 7). These records are important to understand which flyways raptors are using, and to help us gain insight into the causes of mortality, as well as survivorship and longevity.

RESIDENT RAPTORS

Local birds observed this season included at least one family of Red-tailed Hawks, two adults and two juveniles; although some days, into mid-season, five to six red-tails would be seen at the same time all behaving like residents. These "extras" were likely from a neighboring territory and were only occasionally observed close to the observation point (OP). By seasons end there appeared to be two adults and one juvenile still in the area. Two adult Zone-tailed Hawks, one with a very heavy molt, were seen multiple times over the first two days of the count. A few days later a zone-tails with a very heavy molt, possibly the same individual, was seen multiple times.

Individual, non-migrant Swainson's Hawks were seen occasionally into the third week of September; after which they started to show up in greater numbers as migrants, although some days it did seem as though anywhere from 5-12 individuals would spend the day in the area hawking insects. Their numbers greatly decreased after the third week of September and stopped by the end of the month.

One juvenile and two adult Golden Eagles were sporadically seen throughout the season. They were detected generally far out to the north/northwest, although it was not uncommon to see them much closer and moving from south to north over the OP. After mid-October the adults were seen escorting migrants on occasion. Sub-adults were seen flying a non-migrantory pattern throughout the season as well.

Turkey Vultures were common until the first week of October. The largest groups of resident vultures appeared in groups of ten to twelve. On 4 November an immature Northern Harrier was seen three times in the area, once hunting low west and twice moving in a non-migratory direction. It was last seen flying to the northwest.

Early in the season a pair of Peregrine Falcons was observed, often with two juveniles in attendance, sometimes interfering with migrants around the banding stations. After early October individual juveniles or adults were seen infrequently. An individual non-migrant Prairie Falcon was seen two or three times throughout the season, twice interacting with the local peregrine family. A brown taiga Merlin set up residence for a day or two in mid-October.

Two adult and one juvenile Sharp-shined Hawks were observed frequently through September. After that the sightings were less frequent and the juvenile seemed to have moved on by the second week of October. Two adult and one Cooper's Hawks juvenile were seen frequently throughout September. By mid-October sightings of individual juvenile Cooper's Hawks were infrequent.

For the fifth season in a row resident and migratory raptors were observed foraging or 'hawking" significant swarms of aerial insects. Some of these insects were butterflies, moths, and dragonflies, but most others were unidentified. The species of raptors seen catching these insects included Swainson's and Red-tailed Hawks, American Kestrels, Sharp-shinned and Cooper's Hawks, and Peregrine Falcons. The resident Red-tailed Hawks really seemed to take advantage of the insect flight throughout October when they were frequently seen hawking insects throughout the day. On 20 October a brown Northern Harrier was seen going northeast in the early morning.

This is a typical resident assemblage for the site.

SITE VISITATION

In 2011, Capilla Peak Road (FR 245) was again closed above New Canyon Campground, due to hazardous conditions caused by an extensive wildfire that burned the area during spring of 2008. Thus, access to the project site was restricted to USFS, HWI personnel, and Citizen Science volunteers during the season.

In 2011, 553 hourly assessments of visitor disturbance resulted in the following ratings: 82% none, 12% low, 5% moderate, and < 1% high. These values indicate higher visitor-disturbance ratings than usual for the site. Given the lack of general public visitors, these values reflect the subjective nature of rating "disturbance".

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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: 1985–2010 versus 2011.

	COUNTS			RAPTORS / 100 HRS[1]		
SPECIES	1985–2010[2]	2011	% CHANGE	1985–2010[2]	2011	% CHANGE
Turkey Vulture	367 ± 90.8	668	82	103.8 ± 24.72	192.3	85
Osprey	30 ± 6.6	16	-47	7.7 ± 1.56	4.4	-43
Northern Harrier	60 ± 9.8	35	-42	12.1 ± 1.81	7.2	-40
Sharp-shinned Hawk	1479 ± 172.7	1252	-15	360.9 ± 37.82	297.7	-17
Cooper's Hawk	1010 ± 132.8	602	-40	287.8 ± 31.62	170.2	-41
Northern Goshawk	17 ± 3.5	18	8	3.7 ± 0.89	4.0	7
Unknown small accipiter[3]	122 ± 31.0	28	-77	–	–	–
Unknown large accipiter[3]	6 ± 2.3	8	40	–	–	–
Unidentified accipiter	71 ± 25.3	0	-100	–	–	–
TOTAL ACCIPITERS	2626 ± 289.9	1908	-27	–	–	–
Broad-winged Hawk	8 ± 1.7	5	-33	2.3 ± 0.48	1.7	-27
Swainson's Hawk	896 ± 665.4	1204	34	347.0 ± 256.80	513.1	48
Red-tailed Hawk	629 ± 66.9	410	-35	135.6 ± 13.59	89.2	-34
Ferruginous Hawk	12 ± 1.9	14	15	2.6 ± 0.45	2.8	9
Rough-legged Hawk	0.2 ± 0.2	0	-100	0.0 ± 0.03	0.0	-100
Zone-tailed Hawk	1 ± 0.3	4	643	–	–	–
Unidentified buteo	25 ± 8.8	10	-59	–	–	–
TOTAL BUTEOS	1568 ± 660.4	1643	5	–	–	–
Golden Eagle	116 ± 12.8	113	-3	24.8 ± 2.86	25.2	2
Bald Eagle	4 ± 1.0	2	-43	0.9 ± 0.27	0.5	-44
Unidentified Eagle	1 ± 0.9	5	282	–	–	–
TOTAL EAGLES	121 ± 12.9	120	-1	–	–	–
American Kestrel	517 ± 64.2	288	-44	140.3 ± 17.86	76.7	-45
Merlin	27 ± 5.7	26	-5	6.9 ± 1.30	6.5	-5
Prairie Falcon	19 ± 4.3	13	-30	4.0 ± 0.83	2.8	-30
Peregrine Falcon	48 ± 12.8	58	22	11.5 ± 3.06	14.8	29
Unknown small falcon[3]	2 ± 0.9	2	18	–	–	–
Unknown large falcon[3]	4 ± 2.6	3	-23	–	–	–
Unidentified falcon	2 ± 1.0	0	-100	–	–	–
TOTAL FALCONS	615 ± 70.3	390	-37	–	–	–
Unidentified raptor	42 ± 15.0	5	-88	–	–	–
GRAND TOTAL	5431 ± 808.8	4790	-12	–	–	–

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

[2] Mean ± 95% CI.

[3] Designations used for the first time in 2001.

Table 2. Annual raptor migration counts by age classes and immature : adult ratios for selected species in the Manzano Mountains, NM: 1990–2010 versus 2011.

	Total and Age-classified Counts								Immature : Adult	
	1990–2010 Average			2011			% Unknown Age		Ratio	
	Total	Imm.	Adult	Total	Imm.	Adult	1990–2010[1]	2011	1990–2010[1]	2011
Northern Harrier	63	32	16	35	13	14	26 ± 5.4	23	2.1 ± 0.40	0.93
Sharp-shinned Hawk	1575	586	684	1252	347	555	20 ± 3.5	28	0.9 ± 0.12	0.63
Cooper's Hawk	1110	384	477	602	155	226	23 ± 4.2	37	0.8 ± 0.11	0.69
Northern Goshawk	17	8	7	18	3	9	13 ± 5.3	33	1.7 ± 0.75	0.33
Broad-winged Hawk	9	1	4	5	1	3	39 ± 13.1	20	0.5 ± 0.31	0.33
Red-tailed Hawk	676	216	354	410	135	210	16 ± 3.3	16	0.6 ± 0.10	0.64
Ferruginous Hawk	11	3	3	14	4	2	48 ± 7.0	57	1.7 ± 0.64	2.00
Golden Eagle	116	63	31	113	66	33	17 ± 3.5	12	2.3 ± 0.43	2.00
Bald Eagle	4	2	1	2	2	0	8 ± 11.9	0	1.9 ± 0.90	1.00
Peregrine Falcon	61	17	28	58	15	37	23 ± 8.1	10	0.7 ± 0.34	0.41

[1] Mean ± 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.

Table 3. First and last observed, bulk passage, and median passage dates by species for migrating raptors in the Manzano Mountains, NM in 2011, with comparisons of 2011 and 1985–2010 average median passage dates.

	2011				1985–2010
Species	First Observed	Last Observed	Bulk Passage Dates[1]	Median Passage Date[2]	Median Passage Date[2,3]
Turkey Vulture	28-Aug	20-Oct	27-Sep – 9-Oct	9-Oct	18-Sep ± 2.9
Osprey	31-Aug	12-Oct	3-Sep – 6-Oct	16-Sep	18-Sep ± 1.4
Northern Harrier	5-Sep	28-Oct	21-Sep – 28-Oct	14-Oct	3-Oct ± 1.9
Sharp-shinned Hawk	28-Aug	4-Nov	14-Sep – 14-Oct	30-Sep	28-Sep ± 1.2
Cooper's Hawk	28-Aug	30-Oct	18-Sep – 11-Oct	30-Sep	25-Sep ± 1.1
Northern Goshawk	18-Sep	26-Oct	22-Sep – 23-Oct	10-Oct	6-Oct ± 4.1
Broad-winged Hawk	27-Aug	8-Sep	–		±
Swainson's Hawk	21-Sep	11-Oct	21-Sep – 11-Oct	25-Sep	26-Sep ± 2.3
Red-tailed Hawk	30-Aug	17-Oct	26-Sep – 4-Oct	30-Sep	21-Sep ± 2.6
Ferruginous Hawk	27-Aug	2-Nov	15-Sep – 24-Oct	9-Oct	3-Oct ± 2.0
Rough-legged Hawk	29-Aug	28-Oct	17-Sep – 15-Oct	26-Sep	3-Oct – 3.9
Golden Eagle	0-Jan	0-Jan	–		±
Bald Eagle	28-Aug	2-Nov	17-Sep – 31-Oct	18-Oct	14-Oct ± 1.7
American Kestrel	31-Oct	31-Oct	–		23-Oct ± 5.1
Merlin	28-Aug	31-Oct	11-Sep – 11-Oct	24-Sep	21-Sep ± 1.4
Prairie Falcon	19-Sep	26-Oct	22-Sep – 25-Oct	13-Oct	8-Oct ± 2.8
Peregrine Falcon	18-Sep	24-Oct	20-Sep – 17-Oct	7-Oct	26-Sep ± 3.1
All species	9-Sep	23-Oct	16-Sep – 9-Oct	1-Oct	22-Sep ± 1.4

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

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

[3] Mean of annual values ± 95% CI 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 in the Manzano Mountains, NM: 1985–2010 versus 2011.

	ADULT		IMMATURE / SUBADULT	
SPECIES	1985–2010[1]	2011	1985–2010[1]	2011
Northern Harrier	9-Oct ± 3.4	14-Oct	2-Oct ± 2.4	12-Oct
Sharp-shinned Hawk	5-Oct ± 1.2	7-Oct	19-Sep ± 1.4	20-Sep
Cooper's Hawk	29-Sep ± 1.8	4-Oct	21-Sep ± 1.6	24-Sep
Northern Goshawk	9-Oct ± 4.6	15-Oct	4-Oct ± 5.7	
Broad-winged Hawk	23-Sep ± 4.7		±	
Red-tailed Hawk	8-Oct ± 1.8	12-Oct	26-Sep ± 2.2	30-Sep
Ferruginous Hawk	7-Oct ± 7.9		25-Sep ± 5.0	
Golden Eagle	16-Oct ± 2.2	19-Oct	14-Oct ± 1.7	19-Oct
Bald Eagle	10-Oct ±		21-Oct ± 10.9	
Peregrine Falcon	26-Sep ± 2.0	29-Sep	17-Sep ± 2.3	1-Oct

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

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

[2] Data for 2003 only.

Table 5. Capture totals, rates, and successes for migrating raptors in the Manzano Mountains, NM: 1991–2010 versus 2011.

	Capture Total		Capture Rate[1]		Capture Success (%)[2]	
Species	1991–2010[3]	2011	1991–2010[3]	2011	1991–2010[3]	2011
Northern Harrier	4 ± 1.5	2	0.5 ± 0.13	0.5	7 ± 2.4	6
Sharp-shinned Hawk	468 ± 88.2	171	57.2 ± 5.76	43.1	29 ± 3.8	13
Cooper's Hawk	351 ± 62.9	105	43.7 ± 4.93	26.4	30 ± 3.6	17
Northern Goshawk	5 ± 1.6	1	0.7 ± 0.24	0.3	29 ± 8.6	6
Broad-winged Hawk	0.3 ± 0.21	0	0.04 ± 0.031	0.0	3 ± 2.3	0
Swainson's Hawk	0.3 ± 0.31	0	0.03 ± 0.034	0.0	0 ± 0.2	0
Red-tailed Hawk	47 ± 10.6	27	5.7 ± 0.94	6.8	7 ± 1.3	7
Zone-tailed Hawk	0.1 ± 0.10	0	0.004 ± 0.007	0.0	5 ± 9.8	0
Golden Eagle	4 ± 1.0	1	0.5 ± 0.15	0.3	3 ± 0.6	1
American Kestrel	33 ± 10.5	8	3.8 ± 0.99	2.0	6 ± 1.3	3
Merlin	5 ± 1.6	3	0.6 ± 0.19	0.8	15 ± 5.8	12
Prairie Falcon	4 ± 1.2	0	0.5 ± 0.10	0.0	18 ± 2.7	0
Peregrine Falcon	6 ± 1.8	2	0.7 ± 0.22	0.5	9 ± 2.5	3
All Species	927 ± 168.7	320	114.0 ± 11.31	80.6	21 ± 2.5	11

[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 ± 95% confidence interval.

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: 1990–2010 averages versus 2011.

		Female		Male		Female : Male	Immature : Adult
Species	Year	HY	AHY	HY	AHY	Ratio[1]	Ratio[1]
Sharp-shinned Hawk	1990-2010	140	108	133	70	1.2 ± 0.08	1.6 ± 0.22
	2011	53	47	44	27	1.4	1.3
Cooper's Hawk	1990-2010	82	94	85	78	1.1 ± 0.08	1.0 ± 0.15
	2011	29	22	24	30	0.9	1.0
American Kestrel	1990-2010	8	1	14	6	0.6 ± 0.17	3.4 ± 0.94
	2011	2	0	3	0	0.6	7.0

[1] Long-term value: mean ± 95% confidence interval.

Table 7. Foreign encounters with raptors originally banded in the Manzano Mountains, NM: 2011.

BAND #	SPECIES[1]	SEX	BANDING AGE[1]	BANDING DATE	ENCOUNTER DATE	ENCOUNTER AGE[2]	ENCOUNTER LOCATION	DISTANCE (KM)	STATUS
1593 – 94874	SS	F	ASY	26-Sep-06	01-May-11	ATY	Durango, CO	274	Found dead – collision with unknown object, not wire

[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.

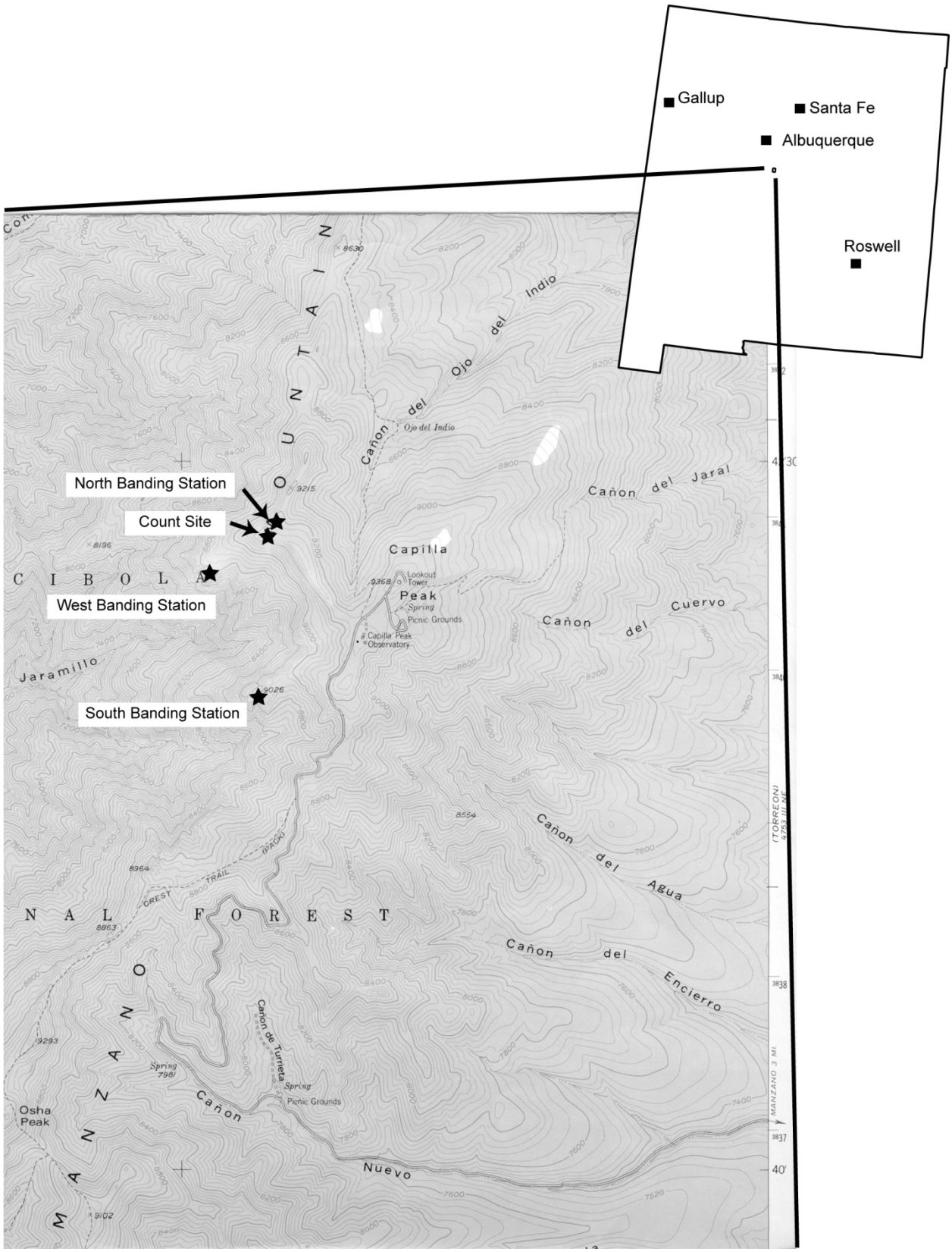

Figure 1. Map of the Manzano Mountains raptor-migration study site in central New Mexico.

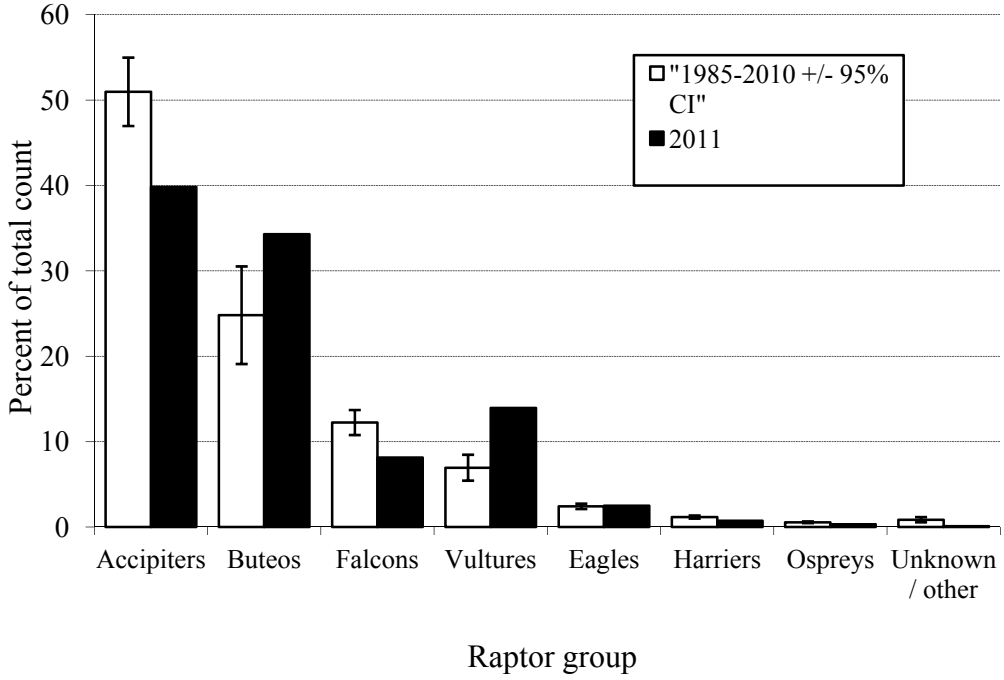

Figure 2. Fall raptor-migration flight composition by major species groups in the Manzano Mountains, NM: 1985–2010 versus 2011.

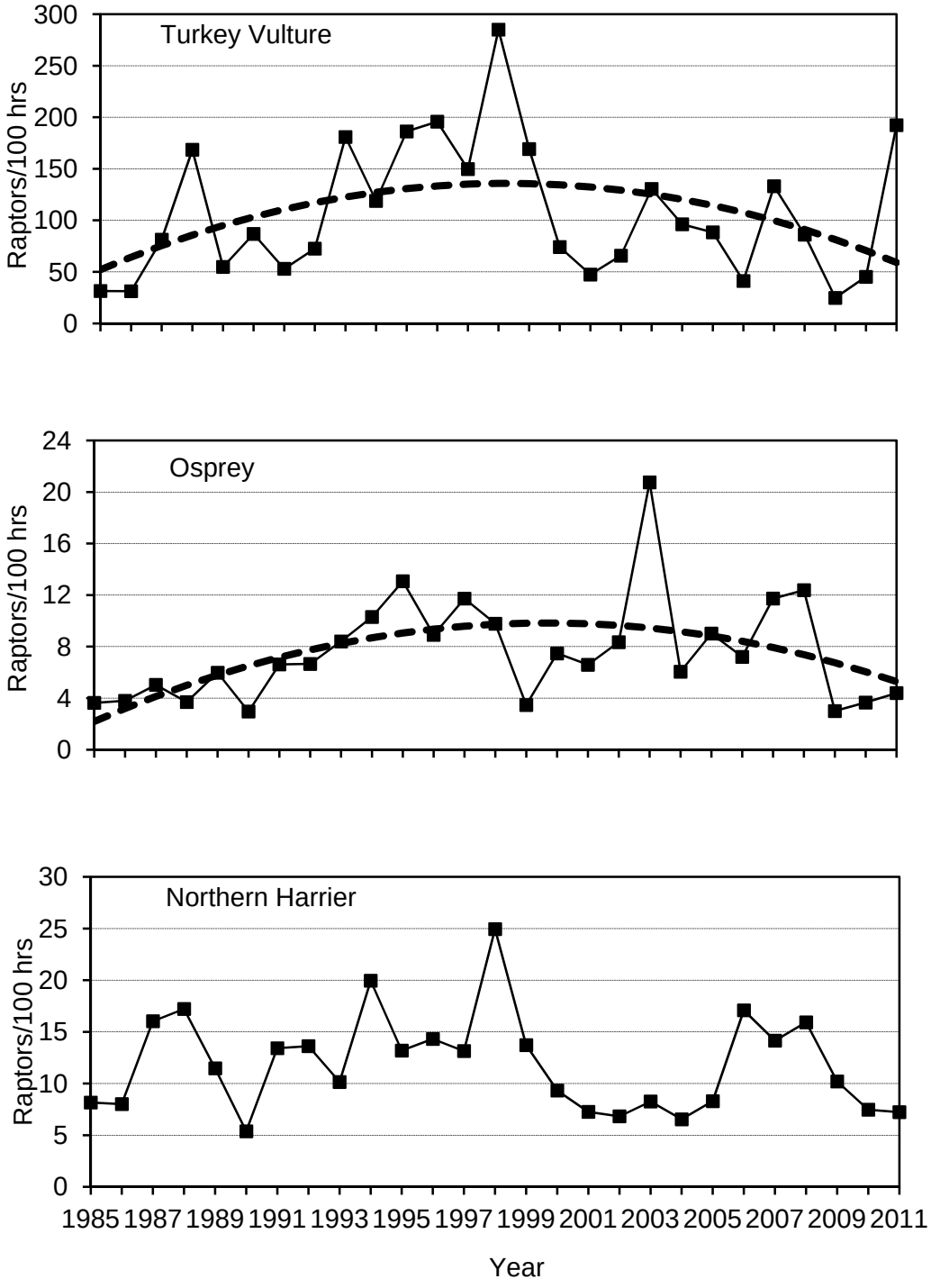

Figure 3. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers in the Manzano Mountains, NM: 1985–2011. Dashed lines indicate significant ($P \leq 0.10$) regressions.

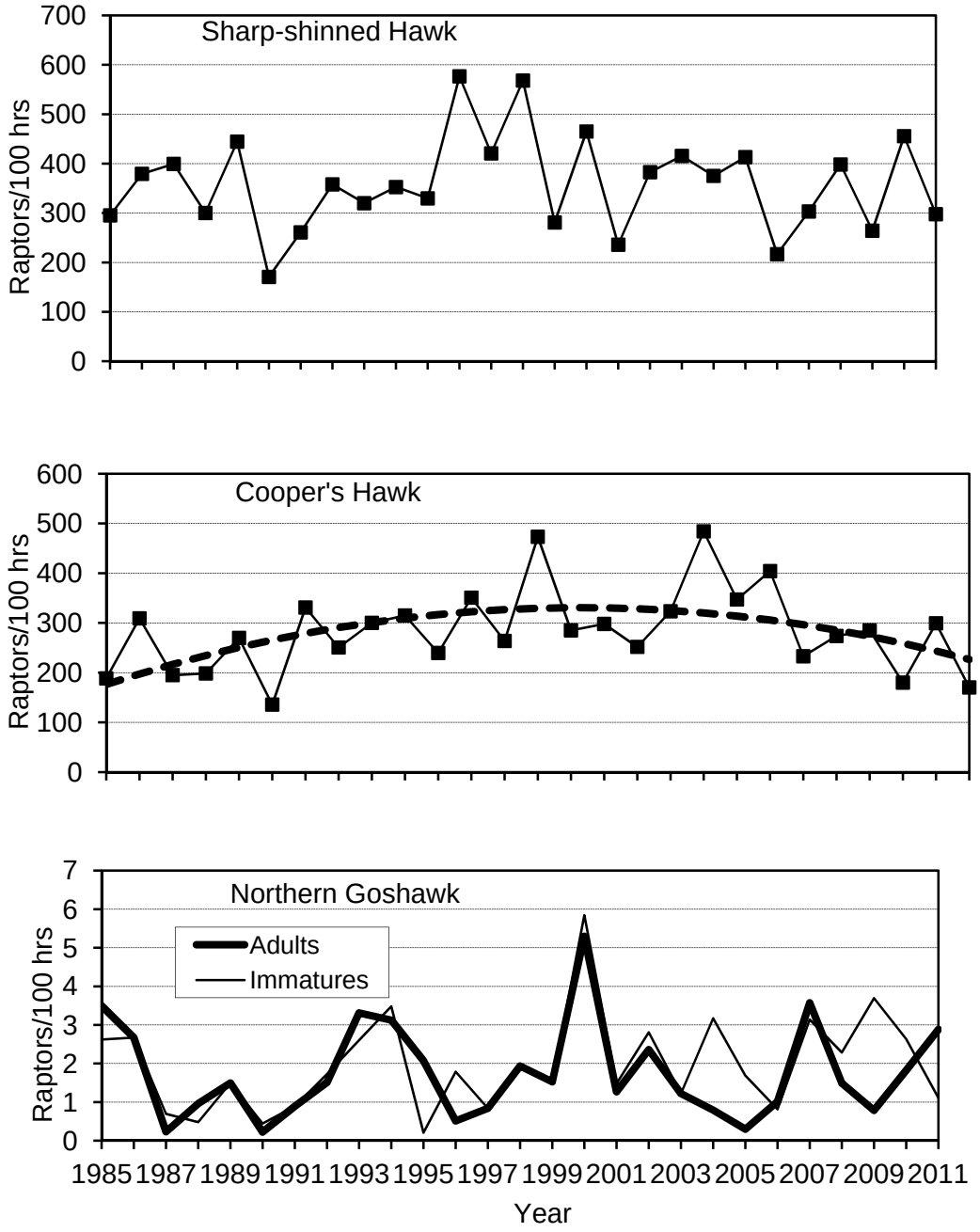

Figure 4. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks in the Manzano Mountains, NM: 1985–2011. Dashed lines indicate significant ($P \leq 0.10$) regressions.

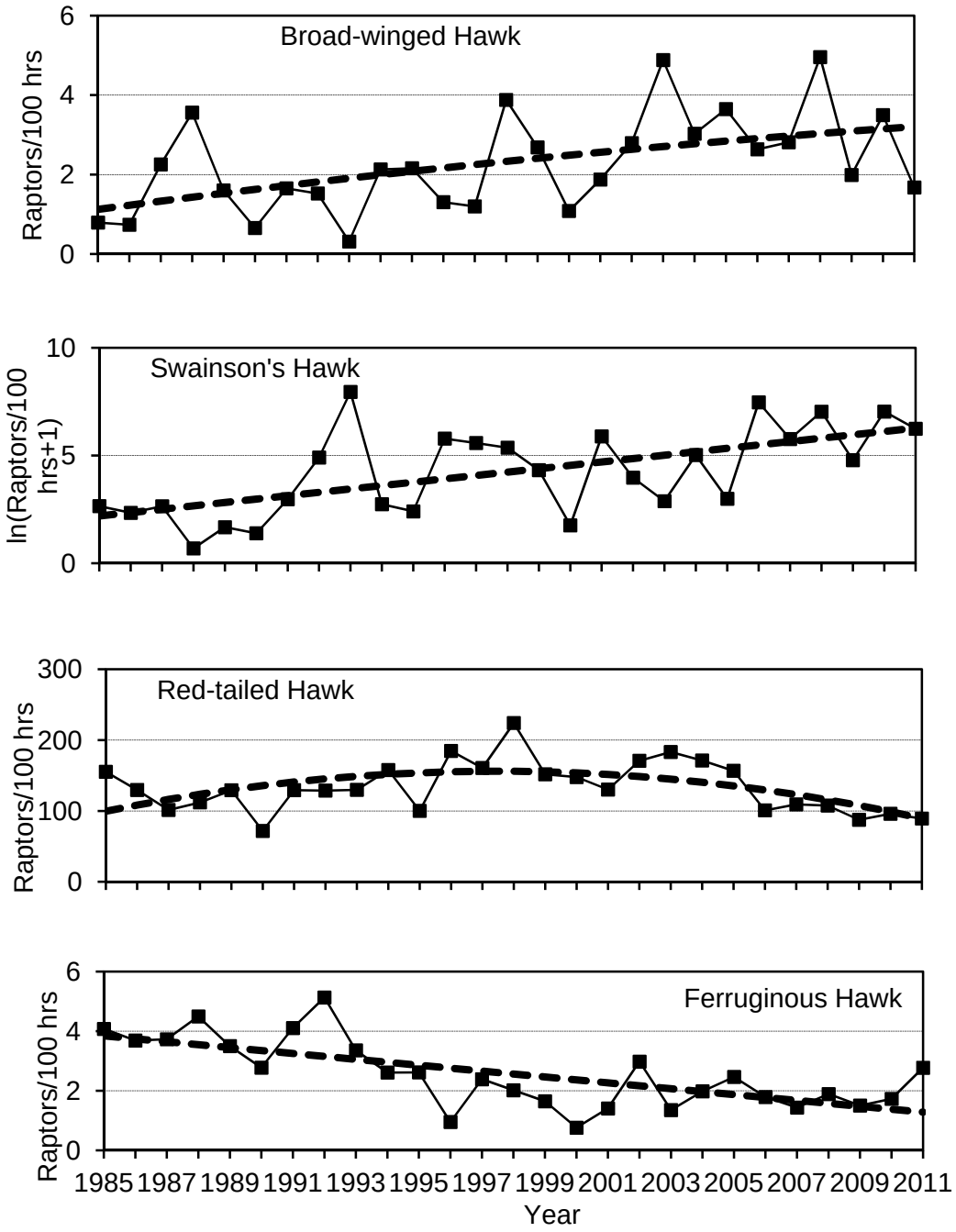

Figure 5. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Broad-winged, Swainson's, Red-tailed and Ferruginous Hawks in the Manzano Mountains, NM: 1985–2011. Dashed lines indicate significant ($P \leq 0.10$) regressions.

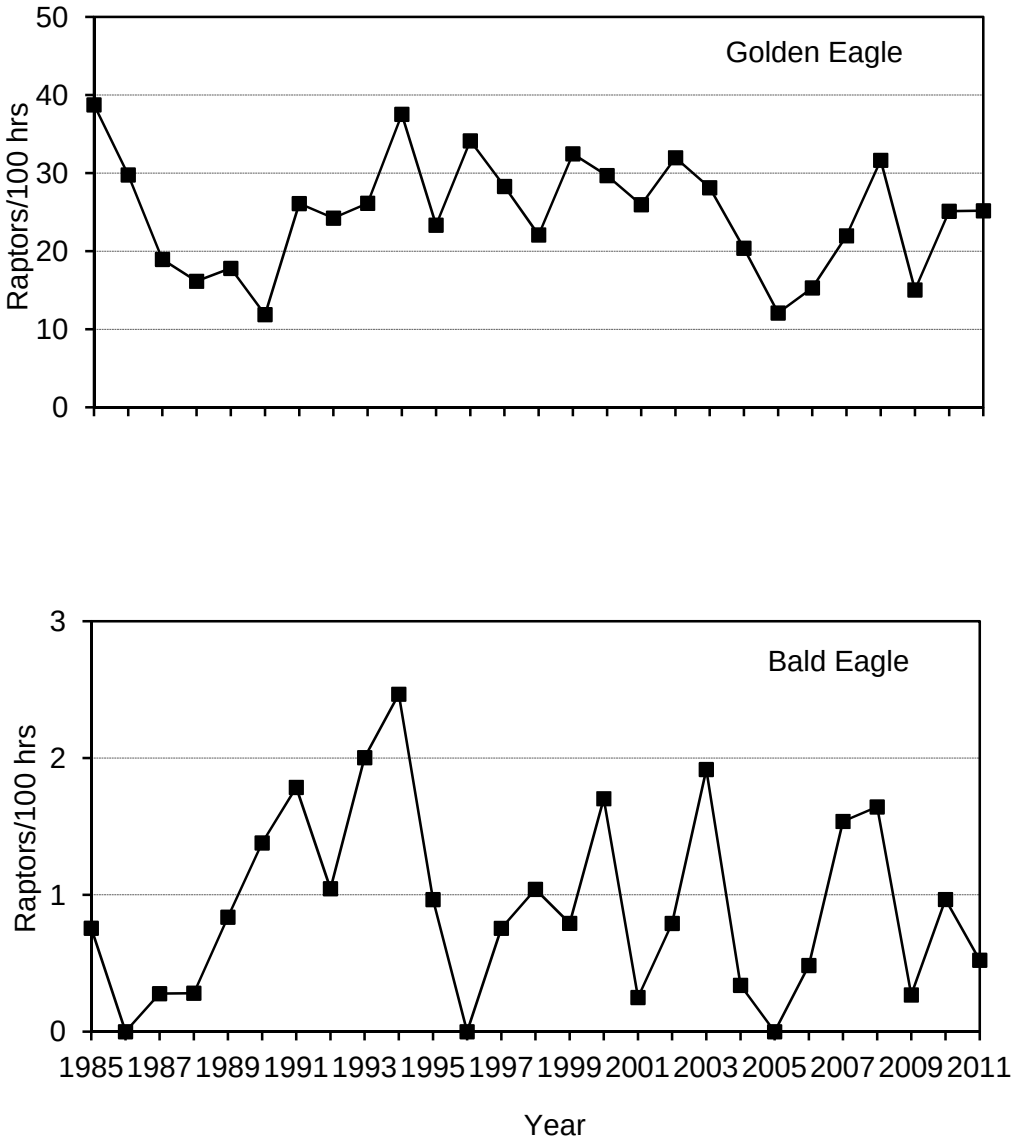

Figure 6. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Golden and Bald Eagles in the Manzano Mountains, NM: 1985–2011. Dashed lines indicate significant ($P \leq 0.10$) regressions.

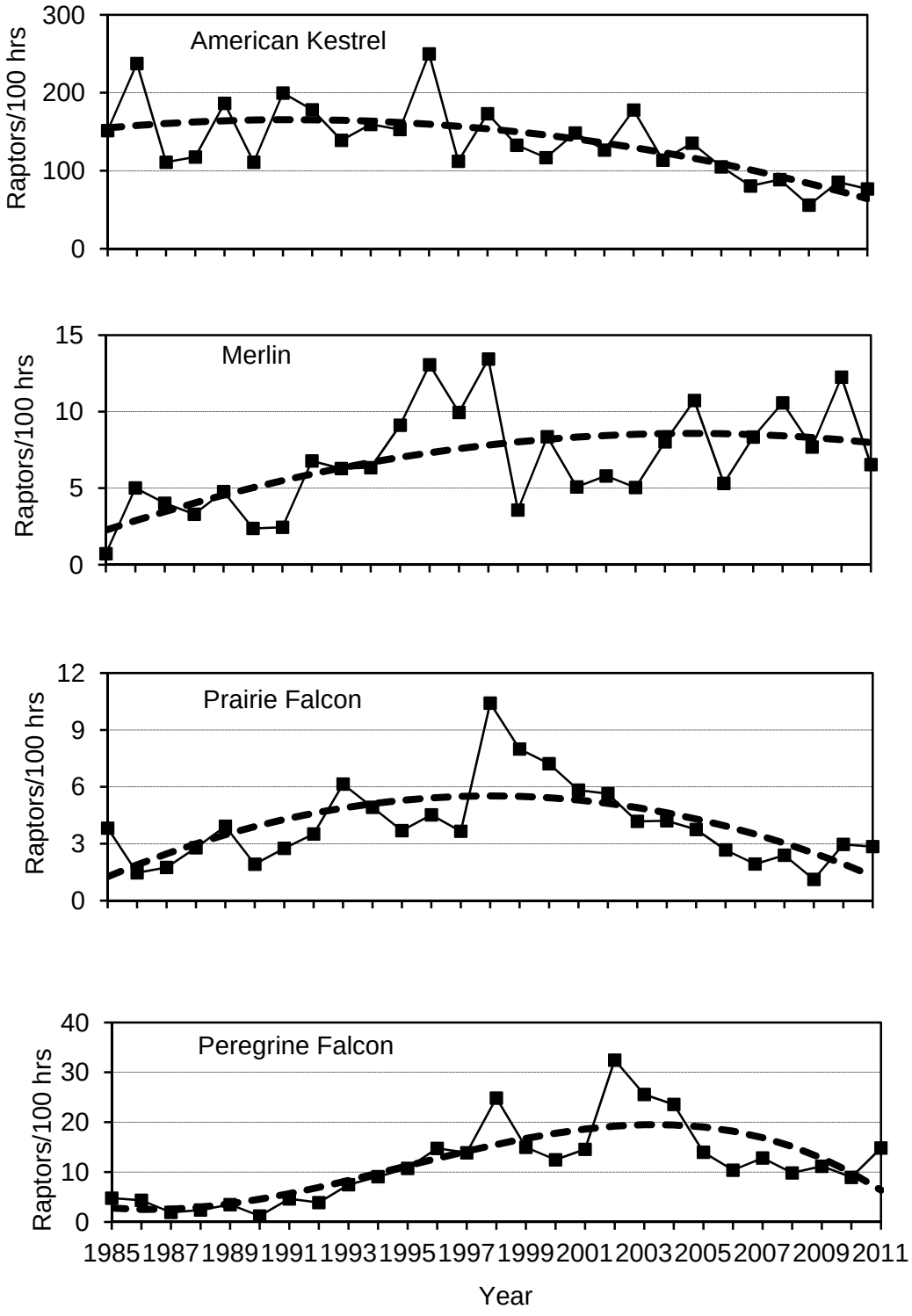

Figure 7. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons: 1985–2011. Dashed lines indicate significant ($P \leq 0.10$) regressions.

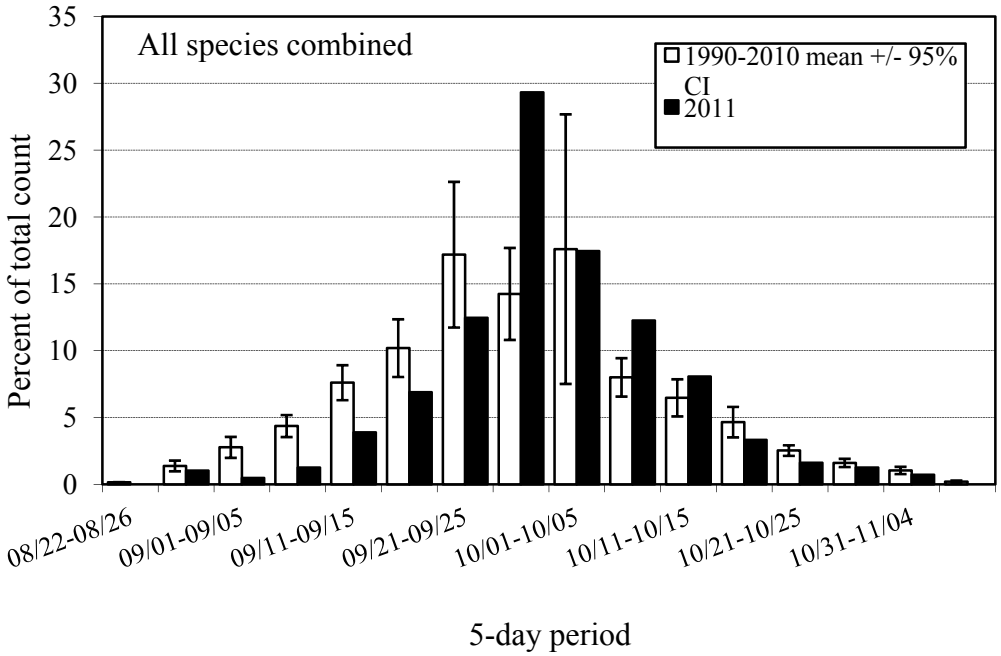

Figure 8. Combined-species, fall-migration passage volume by five-day periods for raptors in the Manzano Mountains, NM: 1985–2010 versus 2011.

Appendix A. History of official observer participation in the Manzano Mountains Raptor Migration Project: 1985–2011.

1985 Single observer throughout, shared duty: Gary Cress (0)[1], Jim Daly (1), Allen Hale (1)

1986 Single observer throughout: Jim Daly (2)

1987 Single observer throughout: Jim Daly (3)

1988 Single observer throughout: Gordon Vickrey (1)

1989 Two observers during peak 3/4 of the season, one observer otherwise: Brett Ewald (2), Tim Menard (0)

1990 Two observers during peak 3/4 of the season, one observer otherwise: David Curson (0), Gary Cress (1)

1991 Two observers throughout: Eric Meyer (1), Tylan Dean (0)

1992 Two observers throughout: Eric Meyer (3), Jessie Jewell (0)

1993 Two observers throughout: Jessie Jewell (2), John Haskell (0)

1994 Two observers throughout: Jessie Jewell (4), Jeff Ogburn (1)

1995 Two observers throughout: Jessie Jewell (6), Jeff Ogburn (2)

1996 Two observers throughout: Jessie Jewell (8), Sean O'Connor (3)

1997 Two observers throughout: Jeff Ogburn (4), Sean O'Connor (4)

1998 Two observers throughout: Dan Rossman (1), Lawry Sager (0)

1999 Two observers throughout: Jason Beason (4), Lawry Sager (1)

2000 Two observers throughout: Jorge Canaca (1), Laura Lutz (1)

2001 Two observers throughout: Tim Meehan (1), Carrie Hisaoka (0)

2002 Two observers throughout: Carrie Hisaoka (1), Richard Sim (0)

2003 Two observers throughout: Carrie Hisaoka (2), Tim Hanks (1)

2004 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)

2009 Two observers throughout: Kimberly Cullen (1), Amber Wingert (1), Roger Grimshaw (2)

2010 Two observers throughout: Tim Hanks (6+), Russell Seeley (0), Roger Grimshaw (3+)

2011 Two observers throughout: Tim Hanks (7+), Russell Seeley (1), Roger Grimshaw (4+)

[1] Numbers in parentheses indicate previous full seasons of observation experience.

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.

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
Zone-tailed Hawk	*Buteo albonotus*	ZT	A I U	U	NA
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 Manzano Mountains Raptor Migration Project: 2011.

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. West (km)[1]	Visib. East (km)[1]	Median Flight Distance[5]	Birds / Hour
27-Aug	6.25	2.0	0	pc, mc, haze, t-storm	6.1	sw-w	22.4	30.29	3	85	85	0	0.5
28-Aug	8.00	2.0	0	clr, pc, haze	9.8	s-w	22.2	30.21	2	92	88	0	1.9
29-Aug	7.00	2.0	0	pc, t-stroms pm	9.5	s-w	21.5	30.19	2.5	100	100	0.5	1.1
30-Aug	8.00	1.6	0	clr, pc, haze am	10.7	sw-w	22.4	30.17	3	96	96	1	1.5
31-Aug	8.00	1.2	0	pc, mc, haze am, rain ts	8.1	s-sw	22.1	30.17	2	97	97	0.5	1.4
1-Sep	7.50	1.8	0	mc, pc	9.3	ne-se, sw-nw	19.4	30.19	2	99	99	0.5	0.7
2-Sep	8.00	2.6	0	pc	7.2	sw-w	20.4	30.17	2	100	100	0	0.6
3-Sep	7.50	2.7	0	pc, mc, ts	3.6	var	19.8	30.16	3	100	100	0	0.5
4-Sep	0.00			Weather Day									
5-Sep	8.00	1.5	0	clr, pc, haze	5.0	sw-w	17.1	30.22	2	96	96	1	1.1
6-Sep	7.00	2.0	0	pc, ovc, haze, ts	7.9	sw-w	17.3	30.21	4	97	91	1	2.0
7-Sep	6.50	2.7	0	pc, mc, ts	7.1	var	16.3	30.25	4	98	98	1	1.8
8-Sep	8.50	2.0	0	pc, mc, haze	7.0	e-s, var	15.1	30.26	2	98	93	1	3.2
9-Sep	5.50	1.7	0	ovc, haze	6.7	e-s, var	13.0	30.17	4	77	76	2	1.1
10-Sep	2.50	1.0	0	ovc, haze, ts	4.8	e-s	14.8	30.19	4	53	88	0	0.4
11-Sep	8.67	2.0	2	pc, mc	9.7	s-w	15.8	30.25	3	100	100	1	4.4
12-Sep	8.00	1.8	0	mc, ovc	13.0	s-w	13.4	30.29	4	100	100	1	4.8
13-Sep	8.50	1.8	0	pc, ts pm	9.6	sw-w	14.3	30.21	3	100	96	1	4.2
14-Sep	6.00	2.0	0	pc	14.3	sw-w	14.1	30.14	4	100	97	1	6.7
15-Sep	8.50	3.0	0	mc, pc, fog am	11.2	se-sw	12.8	30.10	4	77	81	1	4.0
16-Sep	8.25	1.9	0	pc, mc	18.2	s-w	12.2	30.11	4	100	100	1	4.8
17-Sep	8.00	1.8	1	mc, pc, haze, ts	16.8	sw-w	12.1	30.13	4	98	100	1	4.6
18-Sep	9.00	2.0	1	clr, pc, haze	9.3	sw-nw	13.4	30.22	3	99	99	1	4.9
19-Sep	9.00	1.8	0	clr, pc, mc, haze	12.1	s-w	15.9	30.23	3	99	99	1	13.0
20-Sep	9.25	2.4	0	clr, pc, haze am	10.0	sw-nw	15.8	30.16	3	100	100	2	9.9
21-Sep	8.25	2.0	0	pc	11.2	s-sw	15.9	30.17	2.5	100	100	1	18.5
22-Sep	8.33	2.7	0	clr, haze am	6.5	sw-w	14.3	30.22	2.5	97	100	2	10.8
23-Sep	9.25	2.4	0	clr, pc	8.1	sw-w	16.6	30.26	2.5	100	100	2	11.7
24-Sep	9.00	2.7	2	clr, haze	11.1	sw-w	17.1	30.17	3	100	100	2	9.9
25-Sep	9.75	3.5	2.5	clr, pc	9.8	sw-nw	17.3	30.10	2	100	100	2	16.1
26-Sep	9.25	2.0	0	clr, pc, haze	8.8	sw-nw	17.4	30.11	2.5	100	100	1	37.6
27-Sep	7.75	1.5	0	pc, mc, ovc, ts, rain	5.5	sw-w	16.9	30.20	2.5	86	97	1	20.9
28-Sep	9.25	2.0	0	clr, pc, haze am	7.6	sw-w	17.1	30.24	2	100	100	2	36.6
29-Sep	8.00	2.0	0	clr, pc, mc, ovc, rain	6.2	ne-se	17.5	30.22	2	96	98	2	49.4
30-Sep	8.75	2.0	0	clr, pc, haze	6.3	ne-se, sw-nw	13.6	30.26	2	95	95	2	18.4
1-Oct	9.00	3.4	1	pc, haze	5.5	sw-w	16.9	30.23	2	94	93	2	14.7
2-Oct	6.67	2.7	1	pc, ovc, haze	11.6	sw-w	14.4	30.23	4	93	88	2	16.8
3-Oct	8.67	2.3	0	mc, ovc, ts pm	3.8	s-w	14.4	30.19	3	91	100	2	41.4
4-Oct	5.50	2.0	0	ovc, fog, haze pm	9.9	se-sw	9.2	30.10	4	49	41	1	22.0
5-Oct	7.42	1.2	0	ovc, mc, fog/haze	19.5	s-sw	7.0	29.95	4	68	66	1	15.0
6-Oct	9.00	1.9	0	clr, pc, snow/dust	28.5	se-sw	10.5	29.80	4	98	100	2	7.8
7-Oct	6.00	2.0	0	ovc, rain, fog	20.0	s-sw	5.0	29.89	4	49	59	1	5.8
8-Oct	5.50	3.2	1.5	pc, mc	10.3	sw-nw	1.0	29.92	3	100	100	1	36.0
9-Oct	6.00	3.7	1	pc, mc	6.3	sw-w	6.4	30.02	2	93	100	2	35.2
10-Oct	8.50	1.9	0	clr	12.8	s-w	8.3	30.02	3	100	100	1	8.5
11-Oct	8.75	2.0	0	clr	18.4	sw-nw	9.7	29.96	3	100	100	2	15.7
12-Oct	9.00	1.7	0	clr	7.9	sw-nw	9.9	30.08	3	100	100	1	5.7
13-Oct	8.75	2.5	0	clr	10.8	sw-w	11.5	30.11	2	100	100	2	9.1
14-Oct	9.00	2.2	0	clr	15.8	w-nw	11.9	30.10	3	100	100	1	6.2
15-Oct	8.50	2.3	0	mc, pc	4.5	sw-nw	15.5	30.17	2	100	100	1	7.3
16-Oct	9.17	2.1	1.5	clr, haze am	11.5	sw-nw	14.8	30.16	3	100	100	1	3.1
17-Oct	8.25	2.1	0	clr, dust/snow	28.2	sw-nw	9.6	30.04	4	92	86	1	3.9
18-Oct	8.25	1.6	0	clr	7.8	sw-nw	7.5	30.15	3	100	100	1	5.9
19-Oct	8.75			Weather Day									3.0
20-Oct	8.00	1.9	0	clr, haze am	14.8	w-nw	9.1	30.08	3	100	100	1	3.1

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. West (km)[1]	Visib. East (km)[1]	Median Flight Distance[5]	Birds / Hour
21-Oct	7.25	1.9	0	clr, haze	14.2	sw-w	9.3	30.16	3	100	100	1	1.8
22-Oct	7.00	2.0	1	clr, pc	18.7	sw-nw	9.1	30.14	4	100	100	1.5	1.7
23-Oct	7.50	2.2	1.5	clr	6.3	sw-w	10.1	30.17	2	100	100	0	2.4
24-Oct	6.50	2.0	0	pc	24.5	sw-w	13.3	30.15	4	100	100	1	1.7
25-Oct	7.33	2.1	1.5	mc, ovc, haze	22.1	sw-w	10.1	30.06	4	94	93	1	3.3
26-Oct	7.75	1.9	0	mc, pc, ovc, rain pm	31.9	s-sw	10.7	29.89	3	92	97	1	2.1
27-Oct	0.00			Weather Day									
28-Oct	7.75	2.9	0	clr, pc, haze	4.7	var	2.7	30.11	3	100	100	1.5	3.4
29-Oct	7.00	2.2	0	pc, haze am	19.0	sw-w	3.9	30.04	4	100	100	1	2.0
30-Oct	6.00	1.5	0	clr, haze am	7.1	sw-w	6.9	30.14	2	100	100	1	0.8
31-Oct	6.75	2.0	0	pc	19.4	sw-w	9.6	30.09	4	100	100	1	1.9
1-Nov	7.50	1.7	0	pc	21.4	s-sw	10.1	29.98	4	100	100	1	1.9
2-Nov	7.50	1.0	0	clr	11.8	w-nw	-2.8	30.05	4	100	100	1	0.7
3-Nov	5.75	1.2	0	clr, pc	11.6	s-sw	4.0	30.12	3	100	100	0	0.2
4-Nov	1.75	1.3	0	mc, haze	11.3	se-sw	10.3	29.98	3	90	90	0.5	0.6
5-Nov	0.00			not worked									0.0

[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 = 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.

Appendix D. Daily observation effort and fall raptor migration counts by species in the Manzano Mountains, NM: 2011.

		Species[1]																												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	6.25	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	6.25
28-Aug	8.00	6	0	0	0	3	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	15	8.00
29-Aug	7.00	0	0	0	0	2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	8	7.00
30-Aug	8.00	0	0	0	0	5	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	12	8.00
31-Aug	8.00	0	1	0	0	4	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	11	8.00
1-Sep	7.50	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	7.50
2-Sep	8.00	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	5	8.00
3-Sep	7.50	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	4	7.50
4-Sep	0.00																														0.00
5-Sep	8.00	0	0	1	0	5	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	9	8.00
6-Sep	7.00	0	0	0	0	5	2	0	0	0	0	0	0	2	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	14	7.00
7-Sep	6.50	0	2	0	0	8	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	12	6.50
8-Sep	8.50	3	1	0	0	6	8	0	0	0	0	0	0	5	0	0	2	0	0	0	0	1	0	0	0	1	0	0	0	27	8.50
9-Sep	5.50	0	0	0	0	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	6	5.50
10-Sep	2.50	0	1	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	1	2.50
11-Sep	8.67	0	0	0	0	12	7	0	0	0	0	0	3	6	0	0	0	0	1	0	0	9	0	0	0	0	0	0	0	38	8.67
12-Sep	8.00	0	0	0	0	15	6	0	0	0	0	0	0	10	0	0	0	0	1	0	0	4	0	0	2	0	0	0	0	38	8.00
13-Sep	8.50	0	0	0	0	19	4	0	0	0	0	0	1	7	0	0	0	0	1	0	0	3	0	0	1	0	0	0	0	36	8.50
14-Sep	6.00	0	0	0	0	30	5	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	40	6.00
15-Sep	8.50	3	1	0	0	16	3	0	0	0	0	0	0	6	0	0	0	1	1	0	0	2	0	0	1	0	0	0	0	34	8.50
16-Sep	8.25	5	1	1	0	12	6	0	0	1	0	0	0	5	0	0	0	0	0	0	0	7	0	0	2	0	0	0	0	40	8.25
17-Sep	8.00	0	2	0	0	12	1	0	1	0	0	0	1	7	1	0	0	1	2	0	0	7	0	0	2	0	0	0	0	37	8.00
18-Sep	9.00	1	0	0	0	23	6	1	0	1	0	0	0	5	0	0	0	0	0	0	0	5	0	1	1	0	0	0	0	44	9.00
19-Sep	9.00	8	0	0	0	54	20	0	0	0	0	0	4	6	0	0	0	1	1	0	0	21	1	0	1	0	0	0	0	117	9.00
20-Sep	9.25	8	0	1	0	36	11	0	0	1	0	0	5	10	0	0	0	0	0	0	0	15	0	1	4	0	0	0	0	92	9.25
21-Sep	8.25	17	1	1	0	75	30	0	0	0	0	2	4	5	1	0	0	2	0	0	0	12	1	1	1	0	0	0	0	153	8.25
22-Sep	8.33	5	0	1	0	45	11	1	1	0	0	0	2	7	1	0	0	0	0	0	0	14	1	0	1	0	0	0	0	90	8.33
23-Sep	9.25	0	0	0	0	41	20	0	0	0	0	0	4	5	2	0	0	2	2	0	0	27	1	1	2	0	1	0	0	108	9.25
24-Sep	9.00	0	0	0	0	27	18	1	0	1	0	1	11	7	1	0	0	3	5	0	0	11	1	0	2	0	0	0	0	89	9.00
25-Sep	9.75	0	0	1	0	29	24	1	0	0	0	0	78	9	1	0	0	0	0	0	0	11	0	0	1	0	1	0	1	157	9.75
26-Sep	9.25	3	0	0	0	23	13	0	0	0	0	0	285	10	0	0	0	0	0	0	0	12	0	1	1	0	0	0	0	348	9.25
27-Sep	7.75	33	0	1	0	22	9	0	0	1	0	0	90	3	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	162	7.75
28-Sep	9.25	124	0	0	1	24	16	1	1	1	0	0	141	11	1	0	0	0	0	0	0	14	0	0	4	0	0	0	0	339	9.25
29-Sep	8.00	6	1	2	0	151	80	0	7	0	0	0	124	14	0	0	0	0	1	0	0	6	1	0	1	0	0	0	1	395	8.00
30-Sep	8.75	8	0	1	0	58	36	1	4	1	0	0	27	12	0	0	0	0	1	0	0	5	0	0	7	0	0	0	0	161	8.75
1-Oct	9.00	21	0	1	0	39	20	1	1	0	0	0	27	6	0	0	0	0	3	0	0	11	1	0	1	0	0	0	0	132	9.00
2-Oct	6.67	12	0	0	0	35	25	0	0	0	0	0	28	3	0	0	0	0	3	0	0	4	0	1	1	0	0	0	0	112	6.67
3-Oct	8.67	49	0	0	0	69	54	1	6	0	0	0	159	11	0	0	0	0	4	0	0	4	0	0	2	0	0	0	0	359	8.67
4-Oct	5.50	0	0	0	0	6	2	0	0	0	0	0	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	121	5.50
5-Oct	7.42	0	1	0	0	18	9	1	0	0	0	0	77	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	111	7.42

Appendix D. continued

		Species[1]																											Birds
Date	Hours	TV	OS	NH	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	9.00	13	1	0	0	14	9	0	1	0	0	0	9	9	0	0	0	0	0	0	0	1	2	2	9	0	0	0	0	70
7-Oct	6.00	0	0	0	0	30	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	35
8-Oct	5.50	152	0	1	0	19	5	0	0	0	0	0	0	16	1	0	0	0	1	0	0	1	1	0	1	0	0	0	0	198
9-Oct	6.00	151	0	1	0	18	23	3	0	0	0	0	0	6	0	0	0	0	3	0	0	2	1	0	2	0	1	0	0	211
10-Oct	8.50	3	0	0	0	26	24	0	0	0	0	1	2	12	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	72
11-Oct	8.75	0	1	3	0	40	22	0	2	1	0	1	3	29	1	0	0	0	2	0	0	30	0	1	0	1	0	0	0	137
12-Oct	9.00	19	1	1	0	5	12	0	1	0	0	0	1	5	0	0	0	0	1	0	0	3	2	0	0	0	0	0	0	51
13-Oct	8.75	16	0	2	0	18	5	0	1	0	0	0	1	23	1	0	0	0	2	0	0	6	3	0	2	0	0	0	0	80
14-Oct	9.00	0	0	1	0	26	4	1	0	0	0	0	0	13	0	0	0	0	5	0	0	4	2	0	0	0	0	0	0	56
15-Oct	8.50	0	0	2	0	12	13	1	1	0	0	0	1	23	1	0	0	0	4	0	0	2	1	1	0	0	0	0	0	62
16-Oct	9.17	0	0	0	0	13	2	0	0	0	0	0	0	4	0	0	0	0	4	0	0	3	1	0	1	0	0	0	0	28
17-Oct	8.25	0	0	1	0	6	6	2	0	0	0	0	1	6	0	0	0	0	2	0	1	2	2	2	0	0	0	0	1	32
18-Oct	8.25	0	0	2	0	16	3	0	0	0	0	0	0	19	0	0	0	0	8	0	0	0	1	0	0	0	0	0	0	49
19-Oct	8.75	0	0	0	0	10	2	0	0	0	0	0	0	5	0	0	0	0	7	0	0	2	0	0	0	0	0	0	0	26
20-Oct	8.00	2	0	1	0	6	2	0	0	0	0	0	0	7	0	0	0	0	5	0	0	2	0	0	0	0	0	0	0	25
21-Oct	7.25	0	0	1	0	6	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	13
22-Oct	7.00	0	0	1	0	4	0	0	1	0	0	0	0	2	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	12
23-Oct	7.50	0	0	2	0	4	1	1	0	0	0	0	0	2	0	0	0	0	4	0	2	0	0	0	1	0	0	0	1	18
24-Oct	6.50	0	0	0	0	2	0	0	0	0	0	0	0	5	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	11
25-Oct	7.33	0	0	1	0	7	3	0	0	0	0	0	0	10	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	24
26-Oct	7.75	0	0	0	0	4	0	1	0	0	0	0	0	6	0	0	0	0	3	0	0	0	1	0	0	0	0	0	1	16
27-Oct	0.00																													
28-Oct	7.75	0	0	4	0	9	5	0	0	0	0	0	0	5	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	26
29-Oct	7.00	0	0	0	0	5	0	0	0	0	0	0	0	4	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	14
30-Oct	6.00	0	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5
31-Oct	6.75	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	5	2	0	1	0	0	0	0	0	0	0	13
1-Nov	7.50	0	0	0	0	4	0	0	0	0	0	0	0	6	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	14
2-Nov	7.50	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	5
3-Nov	5.75	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4-Nov	1.75	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5-Nov	0.00																													
Total	521.00	668	16	35	1	1252	602	18	28	8	0	5	1204	410	14	0	4	10	113	2	5	288	26	13	58	2	3	0	5	4790

[1] See Appendix B for explanation of species codes.

Appendix E. Annual observation effort and fall raptor migration counts by species (unadjusted data) in the Manzano Mountains, NM: 1985–2011.

	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. continued

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Start date	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	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

Appendix E. continued

	2005	2006	2007	2008	2009	2010	2011	Mean
Start date	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	2-Nov
Days of observation	69	68	63	69	68	70	68	65
Hours of observation	599.58	566.41	553.58	579.00	535.68	578.00	521.00	517.50
Raptors / 100 hours	937.8	1433.4	883.2	1327.5	577.0	1327.7	919.4	1042.0
SPECIES	RAPTOR COUNTS							
Turkey Vulture	363	150	499	315	82	189	668	378
Osprey	35	30	47	50	12	17	16	30
Northern Harrier	46	90	75	89	49	41	35	59
Mississippi Kite	–	–	–	–	–	–	1	1
Sharp-shinned Hawk	1842	958	1283	1836	1051	2067	1252	1471
Cooper's Hawk	1486	865	922	1084	620	1162	602	995
Northern Goshawk	10	10	30	21	21	23	18	17
Unknown small accipiter[1]	129	119	74	57	94	102	28	114
Unknown large accipiter[1]	5	2	7	10	12	9	8	6
Unknown accipiter	1	6	10	16	12	3	0	69
TOTAL ACCIPITERS	3473	1960	2326	3024	1810	3366	1908	2600
Broad-winged Hawk	13	9	10	17	6	13	5	7
Swainson's Hawk	52	4695	841	2952	274	2906	1204	907
Red-tailed Hawk	823	534	537	575	398	491	410	620
Ferruginous Hawk	13	9	8	10	8	9	14	12
Rough-legged Hawk	0	0	0	1	0	0	0	0
Zone-tailed Hawk	1	0	0	0	0	1	4	1
Unknown buteo	33	23	19	11	57	22	10	24
TOTAL BUTEOS	935	5270	1415	3566	743	3442	1647	1572
Golden Eagle	71	87	99	167	70	130	113	116
Bald Eagle	1	3	6	7	1	4	2	3
Unknown Eagle	4	1	9	2	4	4	5	1
TOTAL EAGLES	76	91	114	176	75	138	120	121
American Kestrel	520	412	298	350	216	359	288	508
Merlin	48	23	34	47	28	54	26	27
Prairie Falcon	16	13	10	11	6	13	13	18
Peregrine Falcon	61	43	51	42	43	40	58	48
Unknown small falcon[1]	2	1	0	1	4	2	2	2
Unknown large falcon[1]	5	3	2	2	3	5	3	4
Unknown falcon	6	1	1	1	2	0	0	2
TOTAL FALCONS	658	496	396	454	302	473	390	607
Unknown raptor	37	32	17	12	18	8	5	40
TOTAL	5623	8119	4889	7686	3091	7674	4790	5407

[1] New designations used for the first time in 2001.

Appendix F. Daily trapping effort and capture totals of migrating raptors by species in the Manzano Mountains, NM: 2011.

	STN.	SPECIES[1]													CAPTURES
DATE	HOURS	NH	SS	CH	NG	BW	SW	RT	ZT	GE	AK	ML	PR	PG	TOTAL	/ STN HR
1-Sep	3.50	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.3
6-Sep	5.50	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0.5
7-Sep	5.00	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0.4
8-Sep	7.00	0	2	1	0	0	0	2	0	0	0	0	0	0	5	0.7
11-Sep	14.75	0	4	3	0	0	0	1	0	0	0	0	0	0	8	0.5
12-Sep	6.00	0	3	1	0	0	0	3	0	0	0	0	0	0	7	1.2
13-Sep	7.50	0	6	2	0	0	0	0	0	0	0	0	0	0	8	1.1
14-Sep	5.25	0	7	1	0	0	0	0	0	0	1	0	0	0	9	1.7
15-Sep	4.00	0	3	1	0	0	0	0	0	0	0	0	0	0	4	1.0
16-Sep	6.50	0	1	0	0	0	0	0	0	0	2	0	0	0	3	0.5
17-Sep	14.50	0	4	1	0	0	0	1	0	0	0	0	0	0	6	0.4
18-Sep	14.00	0	5	0	0	0	0	0	0	0	1	0	0	0	6	0.4
19-Sep	7.50	0	11	3	0	0	0	0	0	0	1	1	0	0	16	2.1
20-Sep	7.50	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0.5
21-Sep	7.00	0	11	5	0	0	0	1	0	0	0	0	0	0	17	2.4
23-Sep	7.75	0	2	2	0	0	0	0	0	0	0	0	0	1	5	0.6
24-Sep	14.00	0	6	6	0	0	0	0	0	0	0	0	0	0	12	0.9
25-Sep	12.75	0	5	8	0	0	0	4	0	0	1	0	0	0	18	1.4
27-Sep	6.00	0	3	0	0	0	0	1	0	0	1	0	0	0	5	0.8
28-Sep	7.50	0	3	3	0	0	0	0	0	0	0	0	0	0	6	0.8
29-Sep	5.00	0	6	16	0	0	0	1	0	0	0	0	0	0	23	4.6
30-Sep	7.50	1	6	3	0	0	0	1	0	0	1	0	0	0	12	1.6
1-Oct	15.00	0	10	6	0	0	0	0	0	0	0	0	0	0	16	1.1
2-Oct	12.00	0	8	6	0	0	0	0	0	0	0	0	0	0	14	1.2
3-Oct	7.50	0	10	4	0	0	0	0	0	0	0	0	0	0	14	1.9
5-Oct	7.00	0	1	3	0	0	0	1	0	0	0	0	0	0	5	0.7
6-Oct	8.00	0	2	3	0	0	0	0	0	0	0	0	0	1	6	0.8
7-Oct	5.50	0	5	1	0	0	0	0	0	0	0	0	0	0	6	1.1
8-Oct	3.50	0	3	1	0	0	0	1	0	0	0	0	0	0	5	1.4
9-Oct	5.00	0	5	1	0	0	0	0	0	0	0	0	0	0	6	1.2
10-Oct	13.50	0	4	2	0	0	0	2	0	0	0	0	0	0	8	0.6
11-Oct	12.50	0	1	6	0	0	0	1	0	0	0	0	0	0	8	0.6
12-Oct	14.50	1	1	4	0	0	0	0	0	0	0	0	0	0	6	0.4
13-Oct	7.50	0	3	0	0	0	0	0	0	0	0	1	0	0	4	0.5

Appendix F. continued

Date	Stn. Hours	Species[1] NH	SS	CH	NG	BW	SW	RT	ZT	GE	AK	ML	PR	PG	Captures Total	Captures / stn hr
14-Oct	7.00	0	3	0	0	0	0	0	0	1	0	1	0	0	5	0.7
15-Oct	7.50	0	1	4	0	0	0	1	0	0	0	0	0	0	6	0.8
16-Oct	7.00	0	2	1	0	0	0	0	0	0	0	0	0	0	3	0.4
17-Oct	7.50	0	0	1	0	0	0	1	0	0	0	0	0	0	2	0.3
18-Oct	7.00	0	2	3	0	0	0	2	0	0	0	0	0	0	7	1.0
19-Oct	7.00	0	4	1	0	0	0	0	0	0	0	0	0	0	5	0.7
20-Oct	3.00	0	3	0	0	0	0	0	0	0	0	0	0	0	3	1.0
22-Oct	14.00	0	1	0	0	0	0	1	0	0	0	0	0	0	2	0.1
23-Oct	11.00	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0.2
25-Oct	6.00	0	1	1	0	0	0	1	0	0	0	0	0	0	3	0.5
26-Oct	6.00	0	1	0	1	0	0	1	0	0	0	0	0	0	3	0.5
28-Oct	4.00	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.3
Total	374.50	2.00	171.00	105.00	1.00	0.00	0.00	27.00	0.00	1.00	8.00	3.00	0.00	2.00	320.00	42.54

[1] See Appendix B for explanation of species codes.

Appendix G. Annual trapping and banding effort and capture totals of migrating raptors by species in the Manzano Mountains, NM: 1990–2011.

	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

[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	TOTAL	MEAN
Start date	3-Sep	3-Sep	2-Sep	1-Sep		1-Sep
End date	30-Oct	27-Oct	27-Oct	28-Oct		25-Oct
Blinds in operation	2	2	2	2		2.7
Trapping days	56	48	52	46		50.2
Station days	80	61	61	58		95.9
Station hours	586.04	390.25	408.67	397.00		776.3
Captures / 100 stn hrs	104.8	133.8	93.5	80.6		109.5
SPECIES			RAPTOR CAPTURES			
Northern Harrier	4	2	2	2	85	3.9
Sharp-shinned Hawk	315	255	184	171	9660	439.1
Cooper's Hawk	247	201	160	105	7229	328.6
Northern Goshawk	3	8	2	1	101	4.6
Broad-winged Hawk	0	0	0	0	6	0.3
Swainson's Hawk	0	0	0	0	5	0.2
Red-tailed Hawk	20	34	22	27	973	44.2
Zone-tailed Hawk	0	0	0	0	1	0.0
Golden Eagle	9	1	1	1	79	3.6
American Kestrel	4	16	5	8	677	30.8
Merlin	8	2	2	3	95	4.3
Prairie Falcon	1	1	3	0	78	3.5
Peregrine Falcon	3	2	1	2	116	5.3
All Species	614	522	382	320	19105	868.4
Recaptures[1]	1	1	2	1	39	1.8
Foreign recaptures[2]	0	1	0	0	24	1.1
Foreign encounters[3]	5	5	2	1	125	5.7

[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.