

**FALL 2005 RAPTOR MIGRATION STUDIES IN THE
MANZANO MOUNTAINS OF CENTRAL NEW MEXICO**



Hawk WATCH
INTERNATIONAL

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INTRODUCTION

The Manzano Mountains raptor migration study 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). 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 2005 season marked the 21st consecutive count and the 16th consecutive season of trapping and banding conducted at the site by HWI. This report summarizes the 2005 count and banding results.

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 (*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 2005, 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 since 1991, 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 (*sensu* Geyr von Schweppenburg 1963), 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. Official observer Tim Hanks had one previous season of migration counting experience with HWI at this site (see Appendix A for a complete history of observer participation). This was official observer Geoff Gould's first full season of migration counting; he attended a preseason training session at HWI headquarters. Visitors and other crewmembers occasionally assisted with the counts. Weather permitting, observations typically began by 0900 hrs Mountain Standard Time (MST) and ended by 1700 hrs 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 hrs 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 follows Hoffman and Smith (2003). In comparing 2005 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2004 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 hrs 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 45 minutes of capture unless outfitted with a satellite transmitter, which takes longer.

RESULTS AND DISCUSSION

WEATHER

In 2005, inclement weather entirely precluded two full days of potential observation and on two other days reduced observation time to ≤ 4 hours (see Appendix C for daily weather summaries). The number of fully precluded days was well below 1997–2004 average of 6.1 days (range 1–14), and the number of severely hampered days was only slightly below the previous eight-year average of 2.3 days (range 0–5). Skies were more unsettled in 2005 than usual, however, with a relatively low proportion of days featuring predominantly fair skies (39% of the active observation days vs. 1997–2004 average of 50%) and above average proportions of days featuring transitional skies (i.e., changed from fair skies to mostly cloudy or overcast during the day, or vice versa; 39% vs. 1997–2004 average of 33%) and mostly cloudy to overcast skies (22% vs. 1997–2004 average of 17%). In addition, visibility reducing fog and especially haze were considerably more prevalent than usual in 2005, occurring on 53% of the active observation days (1997–2004 average of 29%). This did not translate, however, to marked reductions in

average maximum-visibility ratings to the east (91 km vs. 1997–2004 average of 89 km) and west (87 vs. 90 km). The frequency of rain/snow showers during active observation periods was about average (18% of active days), as was the proportion of days where the observers rated the thermal lift conditions as good to excellent (45%).

Similar to 2004, the proportion of active days where light winds (<12 kph) prevailed was well below average (62% vs. 1997–2004 average of 73%), and the proportions of days with predominantly moderate (12–28 kph) and strong winds (>28 kph) were above average (31 and 7% vs. averages of 24 and 3%, respectively).

In terms of wind directions, the range of conditions seen in 2005 was similar to most years since 1997. As usual, SW-W winds was the most common pattern and S-SW winds the second most common; however, S-SW winds have been much more common during the past four years (prevailing on 20–41% of active days from 2002–2005 vs. 0–18% from 1997–2001). The most notable differences in wind direction patterns for 2005 were the complete absence of days where calm/variable conditions predominated (average 8 days), the near absence of days when W-NW winds prevailed (1 day vs. average of 9 days), and a record high 7 days where conditions shifted markedly sometime during the day from a predominantly SW-W pattern to winds falling somewhere in the N-SE range (average 2 days).

The temperature during active observation periods averaged 15.8°C (the average of daily values, which in turn were averages of hourly readings), ranging from 5.2–27.9°C. The overall daily average was more than two degrees above the 1997–2004 average of 14.6°C; the minimum daily-average was the warmest since 1997, and the maximum daily-average was the second warmest to date. We began recording hourly barometric pressure readings on site in 2001; in 2005, the overall average (30.63 inHg; an average of daily averages, which in turn are averages of hourly readings) and minimum (30.13) and maximum (30.87) daily averages were all the highest yet recorded.

In summary, compared to the previous eight seasons, in 2005 inclement weather had relatively little impact on the observer's ability to conduct daily counts. As has been increasingly true in the past 4–5 years, more frequent high-pressure conditions and a southerly flow pattern resulted in stronger winds, warmer than average temperatures, increased cloudiness, and more fog and especially haze than occurred in the late 1990s.

OBSERVATION EFFORT

The observers worked on 69 of 71 possible days between 27 August and 5 November. The number of observation days was 8% higher than the 1985–2004 average of $64 \pm 95\%$ CI of 2.3 days. The total hours of observation (599.58) also was 19% above the long-term average of 501.97 ± 25.60 hours. The 2005 average of 2.3 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was 3% higher than the 1985–2004 average of $2.2 \pm 95\%$ CI of 0.17 observers/hr.

FLIGHT SUMMARY

The observers counted 5,206 migrant raptors of 17 species during the 2005 season (see Appendix D for daily count records and Appendix E for annual summaries). The flight was composed of 62% accipiters, 17% buteos, 12% falcons, 6% vultures, 1% eagles, and $\leq 1\%$ each of harriers, Ospreys, and unidentified raptors. For the second year in a row, this composition includes significantly lower than average proportions of eagles, falcons, and harriers (Figure 2). In contrast, the proportion of accipiters was significantly above average. Sharp-shinned and Cooper's Hawks were the two most abundant species, followed by Red-tailed Hawks, American Kestrels, and Turkey Vultures (Table 1, Appendix E). No record low or high species-specific counts occurred in 2005.

Adjusted passage rates were significantly above average for four species—Sharp-shinned, Cooper’s and Broad-winged Hawks, and Merlin—and were significantly below average for five species—Northern Harrier, Northern Goshawk, Rough-legged Hawk, Golden and Bald Eagles, and American Kestrel (Table 1, Figures 3–7). Regression analyses 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, a slight recovery, and modest numbers for the past three years (Figure 3). A similar pattern and significant quadratic regression applied to Northern Harriers, except that counts have remained low since crashing from a high peak in 1998 (Figure 3). A significant ($P \leq 0.05$) linear increasing trend was indicated for Ospreys, but more detailed examination shows an accelerating-increase pattern through 1995, followed by a moderate declining pattern since then except for a large spike in 2003 (Figure 3). Among the accipiters, the third highest adjusted passage rate to date in 2005 further accentuated a highly significant ($P \leq 0.01$) long-increasing pattern for Cooper’s Hawks (Figure 4). Among the buteos, significant long-term increases were indicated for Broad-winged and Red-tailed Hawks, whereas a highly significant decrease was indicated for Ferruginous Hawks (Figure 5). However, following a strong slide between 1992 and 2000, the trajectory of Ferruginous Hawk passage rates is now once again showing an upward trend. No significant long-term trends were indicated for Bald or Golden Eagles (Figure 6). Among the falcons, significant quadratic trends were indicated for Merlins and Prairie Falcons, tracking increasing patterns through 1998 and then sharp declines, with the Prairie Falcon decline continuing through 2005 but Merlins rebounding sharply in 2004 and 2005 (Figure 7). A highly significant linear increasing trend was indicated for Peregrine Falcons, but peregrine passage rates have dropped each year subsequent to peaking in 2002 (Figure 7).

Among 10 species with data suited to comparisons, immature : adult ratios were significantly above average for all three accipiters, Broad-winged Hawks (limited value due to low numbers), and Golden Eagles, but were slightly below average for five other species (Table 2). For Sharp-shinned and Cooper’s Hawks, the high 2005 age ratios clearly reflected higher than usual abundance of young birds, where as the high age ratio for goshawks was due to reduced abundance of adults rather than high abundance of young birds. Similarly, young Golden Eagles were only two thirds as abundant as usual but adult eagles were even less common than usual, again resulting in an inflated ratio. We also must consider these data tentatively because in most cases significant variation in the proportions of unaged birds confounds the comparisons (Table 2). Thus, confounding factors reduce the robustness of the comparisons, but for the second year in a row there was some suggestion that productivity and hence fall recruitment may have increased at least for the two smaller accipiters in the central Rocky Mountains.

The 2005 combined-species median passage date of 26 September matched the 1985–2004 average (Table 3), and the overall seasonal distribution of activity followed a typical pattern except for showing a high activity spike in mid-September and other lesser but significant variations from the norm earlier in September and in early October (Figure 8). Species-specific data revealed additional complexity. Median passage dates were significantly later than average for five species (Turkey Vulture, Northern Harrier, Broad-winged Hawk, Golden Eagle, and Peregrine Falcon) and were significantly earlier than average for three species (Sharp-shinned Hawk, Northern Goshawk, and Merlin; Table 3). There were, however, no distinct multi-species patterns of note, and age-specific data revealed no additional noteworthy patterns (Table 4).

RESIDENT RAPTORS

Local birds observed this season included a family of Red-tailed Hawks, most likely including at least two and possibly three offspring. Both adults were seen throughout the season, with sightings of juveniles tapering off by mid-October. Scattered sightings of local Golden Eagles, two adults and a juvenile, were recorded throughout the season, with two sightings of a possible local subadult recorded in October. Up to 10 local Turkey Vultures were recorded early in the season, with 3–5 birds the most

typical number seen regularly through late September. A family group of Peregrine Falcons, including at least two hatch-year birds, made regular appearances in the study area through September. At least two Prairie Falcons also frequented the area throughout the season. At least one and possibly two brown-plumaged Merlins appeared to settle into the area in late October. Three observations of an apparently local female American Kestrel were recorded between late August and late September. At least one immature Cooper's Hawk hunted below the count site regularly through the third week of September. A few sightings of apparently local Sharp-shinned Hawks were recorded in September; then in late October it appeared that a new immature bird settled into the area.

This is a typical resident assemblage for the site, except that American Kestrels have been relatively scarce in the past few years, and Sharp-shinned Hawks also have been more common in the past.

TRAPPING EFFORT

The crews operated at least one banding station on 51 of 53 possible days between 4 September and 28 October 2005, with effort totaling 99 station days and 707.77 station hours (see Appendix F daily trapping records and Appendix G for annual summaries). The number of trapping days was 1% above the long-term average, but the number of station days and hours were 16 and 21% below average, respectively, due to having only two of three traditional blinds in operation (Appendix G).

TRAPPING AND BANDING SUMMARY

The 2005 capture total of 1,154 birds included 10 species, 1,151 newly banded birds, and 3 recaptures of birds previously banded in the Manzanos (Table 5, Appendix G). The 2005 effort raises the total number of birds captured since project inception to 16,236, including 32 recaptures of Manzano-banded birds and 22 foreign recaptures (i.e., birds originally banded elsewhere and subsequently recaptured in the Manzanos; Appendix G). Sharp-shinned and Cooper's Hawks accounted for 49% and 43% of the total captures, respectively, with Red-tailed Hawks (3%) and American Kestrels (3%) the next most abundant species. Each of the remaining species accounted for less than 1% of the total.

The overall combined-species capture total was 16% below average, largely reflecting no operation of the traditional third blind; nevertheless, 2005 capture totals were above average for Sharp-shinned and Cooper's Hawks, as well as Peregrine Falcons (Table 5). The overall capture rate of 163.0 birds per 100 station hours also was significantly above average, although at the species level this was true only for the same three species. Overall capture success was near average at 22%, significantly above average for Prairie and Peregrine Falcons but significantly below average for five species (Table 5). The only commonly captured species for which the 2005 capture totals, rates, and successes were all significantly below average were Red-tailed Hawk and Golden Eagle. The Peregrine Falcon was the only species for which all three metrics were significantly above average in 2005.

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 2005 immature : adult capture ratios for Sharp-shinned and Cooper's Hawk were significantly above average, in both cases due to greater than average abundance of immature birds (Table 6). This is the same pattern as indicated in the count data (Table 2), with the addition of confirming that juveniles of both sexes were more abundant than usual. For both species, but especially for Sharp-shinned Hawks, the count-based age ratios were lower than the capture-based ratios, suggesting that juvenile birds were more susceptible to capture than adults. Female : male capture ratios were slightly below average for both Sharp-shinned and Cooper's Hawks, with both measures near unity (Table 6). Among adults, capture totals were below average for both sexes of Sharp-shinned Hawks, whereas the capture total for adult male Cooper's Hawks was near average and the total for adult females was significantly above average.

For American Kestrels, both the immature : adult and female : male capture ratios were well below average, reflecting four times the usual number of adult female captures and twice the usual number of adult male captures, while capture totals for juveniles of both sexes were below average (Table 6). The count data also yielded a sex ratio that was below average, but the value (0.80) was both much higher than the capture-based sex ratio (0.32) and much less different from the relevant average (7% vs. 57% less than average). In combination, the evidence suggests that kestrels were overall less abundant than usual in 2005, with females proportionately less abundant than males, and adults appeared more susceptible than usual to capture while especially juvenile females were either less susceptible than usual to capture or were proportionately especially scarce in 2005. Curiously, males appeared to be in short supply in 2004.

SATELLITE TELEMETRY

We succeeded in deploying one new satellite transmitter on a hatch-year, female Golden Eagle during the 2005 season. We had hoped to outfit three more eagles this season, but did not succeed in capturing any other suitable candidate birds at a time when the transmitters were available. During the first two days after release, the new eagle traveled ~300 km northwest up into the northeast corner of Arizona, then continued north another ~150 km into western Colorado. Except for brief excursions to the west and east, since mid-October she has remained in the vicinity of the western reaches of San Juan National Forest in southwest Colorado ~200 km northwest of Durango.

One male eagle outfitted at the site in 2002 remains alive and active, and is currently wintering in eastern Wyoming just southeast of where he wintered the year before in western South Dakota. He spent the two previous winters in similar areas of southeastern New Mexico and far western Texas, but also spent the summers of 2003–2005 in different areas. In 2005, he summered just south of the Nunavut–Northwest Territories border near Lac de Gras about 200 km (125 mi) northeast of Yellowknife in northern Canada, which was ~100 km (80 mi) south of his 2003 summer range near the Peacock Hills in the Nunavut Province. In 2004, he summered wandering around the Alberta–Saskatchewan border farther south in Canada.

Complete tracking summaries and maps for all of HWI's telemetry birds can be found at www.hawkwatch.org.

IDENTIFYING MIGRANT ORIGINS THROUGH STABLE ISOTOPE ANALYSES

In 2005, we continued to collect feather samples from a variety of species to support our on-going stable-isotope research, which seeks to use analyses of hydrogen stable-isotope ratios to identify the approximate natal origins of migrants monitored at migration sites across the West (e.g., Meehan et al. 2001, Lott et al. 2003, Smith et al. 2003, Lott and Smith in press).

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Recaptures.—The 2005 captures included three recaptures of Cooper's Hawks previously banded in the Manzanos: one male originally banded as an after-hatch-year adult in 2004 (only a 1 day difference between capture dates), one female originally banded as a second-year bird in 2001, and another female originally banded as an after-hatch-year adult in 1998. The 2005 recaptures raise the total number of Manzano recaptures since 1990 to 32 birds (Appendix G).

Foreign Encounters.—Three raptors originally banded in the Manzanos were encountered elsewhere in 2005 (Table 8), which brings the total foreign encounters since 1990 to 99 birds (Appendix G). The 2005 encounters included one male Sharp-shinned Hawk banded as a hatch-year bird in 2004 and two male Cooper's Hawks banded as adults in 1999. The Sharp-shinned Hawk was found dead of unknown causes during May in southeast Wyoming, 586 km north-northeast of the project site. One Cooper's

Hawk was found dead in southwest Colorado (212 km northwest) in late June, suggesting that it may have been on its summer range. The second Cooper's Hawk was found dead in mid-October near Las Cruces, New Mexico, roughly 213 km south-southeast of the project site. These new encounters all fall within the expected range of Rocky Mountain migrants (Hoffman et al. 2002).

SITE VISITATION

In 2005, our ability to encourage visitation at the project site was again hampered for a time by final activities surrounding remodeling of the Capilla Peak campground, which is the base camp for HWI's operation. Unlike last year, however, construction was finalized, the facility opened for use, and all barriers to public access were removed by about the third week of the migration season, just in time for peak activity. In the end, more than 300 individuals visited the project site in 2005. Most originated in New Mexico, but others came from Colorado, Texas, Pennsylvania, Vermont, Oregon, and Florida. A wonderful article about the project on the front page of the Albuquerque Journal drew 70 guests the following weekend, including many first time visitors. The season's visitors included six organized groups: a group of employees from Intel Corporation, a Sandia Prep School group, a group of students from a University of New Mexico ornithology class, and groups from the NM Boys Ranch, NM Mountain Club, a local Audubon society, and a women's church retreat.

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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: 1985–2004 versus 2005.

SPECIES	COUNTS			RAPTORS / 100 HRS ¹		
	1985–2004 ²	2005	% CHANGE	1985–2004 ²	2005	% CHANGE
Turkey Vulture	397 ± 110.0	363	-9	121.4 ± 32.08	92.6	-24
Osprey	30 ± 7.9	35	+19	8.4 ± 2.03	10.0	+19
Northern Harrier	59 ± 11.7	46	-22	12.0 ± 2.18	8.3	-31
Sharp-shinned Hawk	1,471 ± 199.7	1,842	+25	366.6 ± 44.37	413.1	+13
Cooper's Hawk	1,006 ± 160.5	1,486	+48	290.5 ± 37.69	404.1	+39
Northern Goshawk	16 ± 4.2	10	-37	3.6 ± 1.09	2.0	-46
Unknown small accipiter ³	162 ± 51.7	129	-20	–	–	–
Unknown large accipiter ³	3 ± 2.1	5	+67	–	–	–
Unidentified accipiter	90 ± 27.9	1	-99	–	–	–
TOTAL ACCIPITERS	2,616 ± 342.3	3,473	+33	–	–	–
Broad-winged Hawk	6 ± 1.8	13	+105	2.3 ± 0.60	4.1	+79
Swainson's Hawk	578 ± 704.5	52	-91	214.7 ± 260.18	18.3	-91
Red-tailed Hawk	649 ± 79.1	823	+27	143.4 ± 15.24	156.7	+9
Ferruginous Hawk	13 ± 2.4	13	0	2.8 ± 0.53	2.4	-12
Rough-legged Hawk	0.3 ± 0.2	0	-100	0.1 ± 0.04	0.0	-100
Zone-tailed Hawk	1 ± 0.4	1	+67	–	–	–
Unidentified buteo	24 ± 10.8	33	+40	–	–	–
TOTAL BUTEOS	1,271 ± 709.0	934	-26	–	–	–
Golden Eagle	120 ± 14.0	71	-41	26.2 ± 3.09	12.1	-54
Bald Eagle	4 ± 1.2	1	-71	1.2 ± 0.40	0.0	-100
Unidentified Eagle	1 ± 0.5	4	+700	–	–	–
TOTAL EAGLES	124 ± 14.1	76	-39	–	–	–
American Kestrel	564 ± 67.5	520	-8	155.8 ± 17.72	133.9	-14
Merlin	24 ± 6.1	48	+100	6.1 ± 1.46	10.7	+77
Prairie Falcon	21 ± 5.2	16	-23	4.6 ± 1.02	3.8	-18
Peregrine Falcon	48 ± 16.7	61	+27	11.8 ± 4.03	14.1	+20
Unknown small falcon ³	2 ± 1.7	2	+14	–	–	–
Unknown large falcon ³	5 ± 6.8	5	+5	–	–	–
Unidentified falcon	2 ± 1.3	6	+155	–	–	–
TOTAL FALCONS	661 ± 77.0	658	0	–	–	–
Unidentified raptor	48 ± 18.5	37	-23	–	–	–
GRAND TOTAL	5,206 ± 935.2	5,623	+8	–	–	–

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: 1990–2004 versus 2005.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1990–2004 AVERAGE			2005			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1990–2004 ¹	2005	1990–2004 ¹	2005
Northern Harrier	60	29	13	46	17	10	30 ± 11.6	41	2.2 ± 0.53	1.7
Sharp-shinned Hawk	1506	564	635	1842	754	623	23 ± 11.4	25	0.9 ± 0.14	1.2
Cooper's Hawk	1099	366	459	1486	534	517	26 ± 11.4	29	0.8 ± 0.14	1.0
Northern Goshawk	16	7	7	10	7	0	25 ± 25.3	30	1.4 ± 0.78	~7.0
Broad-winged Hawk	7	1	3	13	4	3	43 ± 18.8	46	0.4 ± 0.39	1.3
Red-tailed Hawk	693	215	347	823	259	401	20 ± 11.8	20	0.6 ± 0.13	0.6
Ferruginous Hawk	12	3	2	13	5	4	52 ± 9.7	31	1.9 ± 0.85	1.3
Golden Eagle	120	68	34	71	42	13	18 ± 4.9	23	2.4 ± 0.56	3.2
Bald Eagle	4	2	1	1	1	0	18 ± 19.5	0	2.2 ± 1.23	~1.0
Peregrine Falcon	60	17	25	61	15	32	26 ± 14.9	23	0.8 ± 0.45	0.5

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 2005, with comparisons of 2005 and 1985–2004 average median passage dates.

SPECIES	2005				1985–2004	
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}	
Turkey Vulture	27-Aug	14-Oct	9-Sep – 6-Oct	5-Oct	15-Sep	± 2.6
Osprey	31-Aug	1-Oct	7-Sep – 27-Sep	17-Sep	17-Sep	± 1.7
Northern Harrier	29-Aug	31-Oct	16-Sep – 24-Oct	6-Oct	1-Oct	± 2.0
Sharp-shinned Hawk	27-Aug	5-Nov	13-Sep – 17-Oct	25-Sep	28-Sep	± 1.2
Cooper's Hawk	28-Aug	1-Nov	15-Sep – 13-Oct	25-Sep	25-Sep	± 1.2
Northern Goshawk	16-Sep	20-Oct	16-Sep – 17-Oct	27-Sep	5-Oct	± 4.6
Zone-tailed Hawk	24-Sep	24-Sep	–	–	–	–
Broad-winged Hawk	13-Sep	14-Oct	14-Sep – 12-Oct	1-Oct	25-Sep	± 2.8
Swainson's Hawk	29-Aug	5-Oct	11-Sep – 1-Oct	21-Sep	21-Sep	± 3.4
Red-tailed Hawk	27-Aug	5-Nov	13-Sep – 23-Oct	3-Oct	3-Oct	± 2.2
Ferruginous Hawk	5-Sep	24-Oct	15-Sep – 23-Oct	5-Oct	1-Oct	± 4.6
Golden Eagle	28-Aug	5-Nov	25-Sep – 4-Nov	23-Oct	13-Oct	± 1.5
Bald Eagle	5-Nov	5-Nov	–	–	20-Oct	± 5.5
American Kestrel	27-Aug	26-Oct	10-Sep – 3-Oct	20-Sep	21-Sep	± 1.6
Merlin	13-Sep	28-Oct	20-Sep – 22-Oct	3-Oct	7-Oct	± 3.2
Prairie Falcon	4-Sep	19-Oct	10-Sep – 9-Oct	26-Sep	24-Sep	± 3.4
Peregrine Falcon	27-Aug	22-Oct	9-Sep – 3-Oct	26-Sep	22-Sep	± 1.5
All species	27-Aug	5-Nov	12-Sep – 16-Oct	26-Sep	26-Sep	± 0.9

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: 1985–2004 versus 2005.

SPECIES	ADULT		IMMATURE / SUBADULT	
	1985–2004 ¹	2005	1985–2004 ¹	2005
Northern Harrier	8-Oct ± 4.3	8-Oct	30-Sep ± 2.3	11-Oct
Sharp-shinned Hawk	5-Oct ± 1.5	3-Oct	19-Sep ± 1.5	19-Sep
Cooper's Hawk	28-Sep ± 2.3	1-Oct	21-Sep ± 2.1	20-Sep
Northern Goshawk	5-Oct ± 4.1	–	2-Oct ± 6.9	2-Oct
Red-tailed Hawk	7-Oct ± 2.3	9-Oct	26-Sep ± 1.9	20-Sep
Ferruginous Hawk	4-Oct ± 8.6	–	25-Sep ± 6.1	25-Sep
Golden Eagle	15-Oct ± 2.4	17-Oct	12-Oct ± 1.7	21-Oct
Peregrine Falcon	25-Sep ± 2.3	25-Sep	17-Sep ± 3.4	21-Sep

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

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

Table 5. Capture totals, rates, and successes for migrating raptors in the Manzano Mountains, NM: 1991–2004 versus 2005.

SPECIES	CAPTURE TOTAL		CAPTURE RATE ¹		CAPTURE SUCCESS (%) ²	
	1991–2004 ³	2005	1991–2004 ³	2005	1991–2004 ³	2005
Northern Harrier	4 ± 2.1	3	0.4 ± 0.18	0.4	7 ± 3.3	7
Sharp-shinned Hawk	540 ± 96.0	562	58.1 ± 6.79	79.4	33 ± 3.1	29
Cooper's Hawk	393 ± 69.2	495	42.8 ± 5.55	69.9	33 ± 3.6	32
Northern Goshawk	6 ± 2.1	3	0.6 ± 0.27	0.4	32 ± 11.4	30
Broad-winged Hawk	0.3 ± 0.25	0	0.03 ± 0.030	0.0	3 ± 2.8	0
Swainson's Hawk	0.3 ± 0.43	0	0.03 ± 0.045	0.0	0 ± 0.3	0
Red-tailed Hawk	56 ± 11.9	35	6.1 ± 1.10	4.9	8 ± 1.5	4
Zone-tailed Hawk	0.1 ± 0.14	0	0.01 ± 0.010	0.0	6 ± 12.3	0
Golden Eagle	4 ± 0.9	2	0.5 ± 0.13	0.3	3 ± 0.6	3
American Kestrel	41 ± 12.1	37	4.4 ± 1.16	5.2	7 ± 1.4	7
Merlin	5 ± 2.1	3	0.5 ± 0.23	0.4	17 ± 7.9	6
Prairie Falcon	4 ± 1.6	4	0.5 ± 0.13	0.6	17 ± 3.2	24
Peregrine Falcon	6 ± 2.1	10	0.6 ± 0.23	1.4	8 ± 2.1	15
All Species	1060 ± 182.7	1154	114.7 ± 13.07	163.0	23 ± 2.3	22

¹ Captures / 100 station hours.

² Number of birds captured / number of birds observed. The combined-species value was calculated excluding Ospreys, Turkey Vultures, Swainson's Hawks, 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: 1990–2004 averages versus 2005.

SPECIES	YEAR	FEMALE		MALE		FEMALE : MALE	IMMATURE : ADULT
		HY	AHY	HY	AHY	RATIO ¹	RATIO ¹
Sharp-shinned Hawk	1990-2004	158	125	149	80	1.3±0.10	1.5 ± 0.25
	2005	196	103	198	65	1.1	2.3
Cooper's Hawk	1990-2004	88	104	91	89	1.1±0.10	0.9 ± 0.17
	2005	118	135	156	86	1.0	1.2
American Kestrel	1990-2004	10	1	17	6	0.7±0.21	4.4 ± 1.13
	2005	5	4	15	12	0.3	1.3

¹ Long-term value – mean ± 95% CI.

Table 7. Recaptures of previously banded raptors in the Manzano Mountains, NM: 2005.

BAND #	SPECIES	SEX	BANDING SITE	BANDING DATE	BANDING AGE ¹	RECAPTURE DATE	RECAPTURE AGE ¹
1705 – 41396	Cooper's Hawk	F	Manzano Mts., NM	24-Oct-98	AHY	20-Sep-05	≥8 th yr
0804 – 31719	Cooper's Hawk	M	Manzano Mts., NM	15-Oct-04	AHY	14-Oct-05	ASY
1005 – 11265	Cooper's Hawk	F	Manzano Mts., NM	7-Oct-01	SY	26-Oct-05	5 th yr

¹ HY = hatch year; SY = second year; TY = third year; AHY = after hatch year; ASY = after second year; ATY = after third year.

Table 8. Foreign encounters with raptors originally banded in the Manzano Mountains, NM: 2005.

BAND #	SPECIES	SEX	BANDING AGE ¹	BANDING DATE	ENCOUNTER DATE	ENCOUNTER AGE ¹	ENCOUNTER LOCATION	DISTANCE (KM)	STATUS
1212 – 72157	SS	M	HY	24-Sep-04	13-May-05	SY	Centennial, WY	586	found dead
0804 – 04367	CH	M	AHY	07-Oct-99	24-Jun-05	≥7th yr	Pagosa Springs, CO	212	found dead
0804 – 04175	CH	M	ASY	27-Sep-99	15-Oct-05	≥8th yr	Las Cruces, NM	213	found dead

¹ HY = hatch year; SY = second year; TY = third year; AHY = after hatch year; ASY = after second year; ATY = after third year.

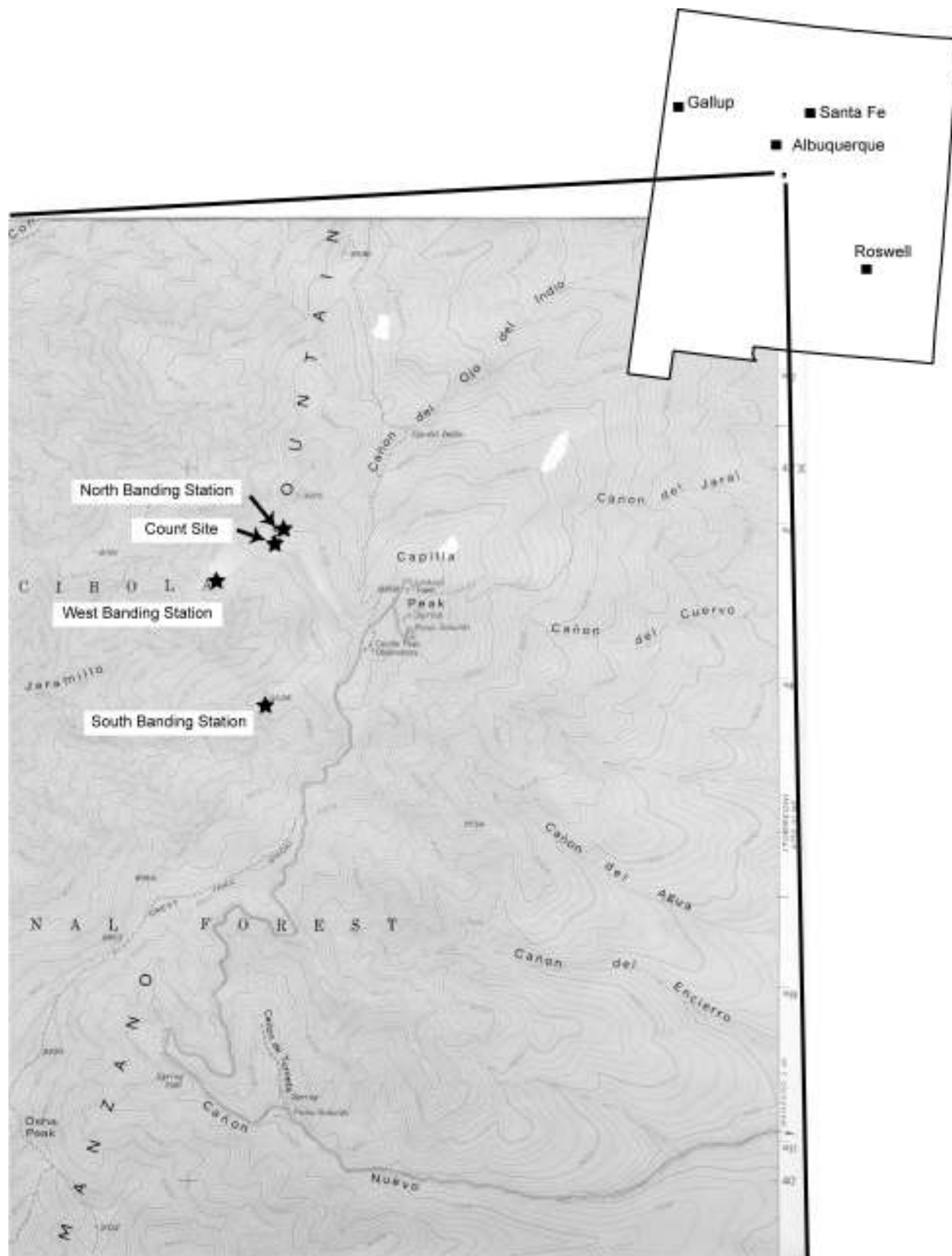


Figure 1. Map of the Manzano Mountains raptor-migration study site in central New Mexico.

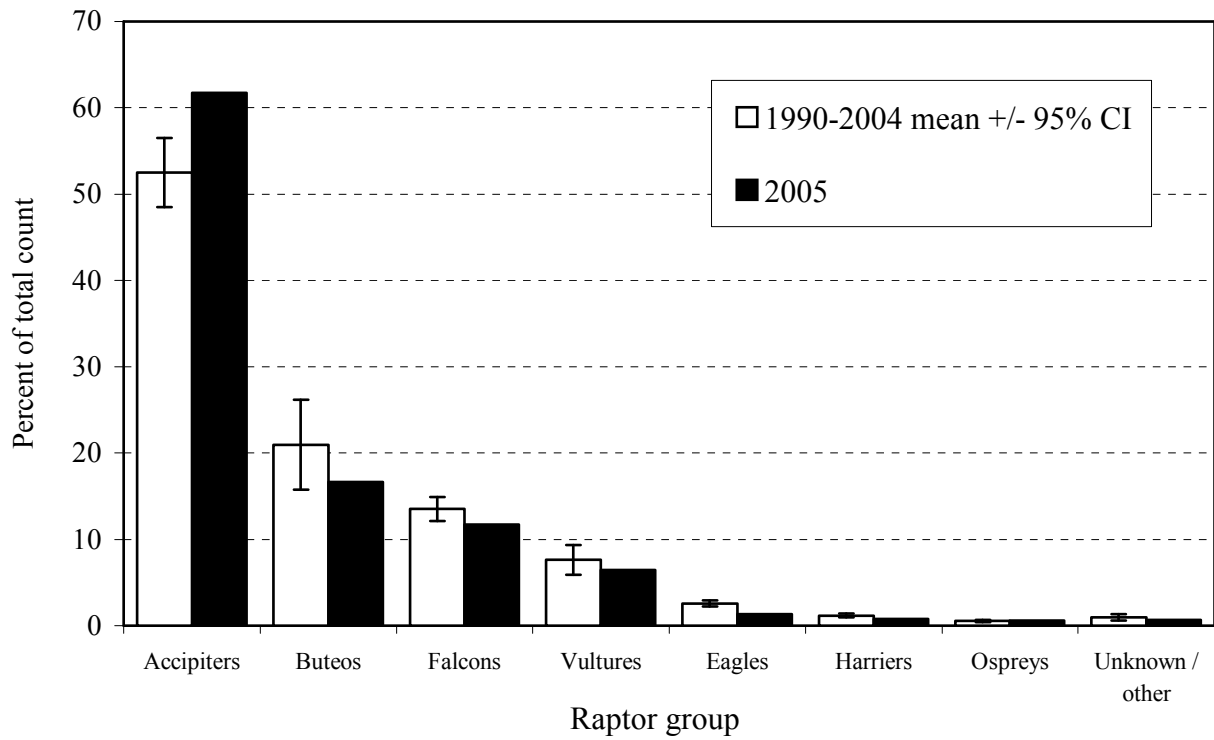


Figure 2. Fall raptor-migration flight composition by major species groups in the Manzano Mountains, NM: 1985–2004 versus 2005.

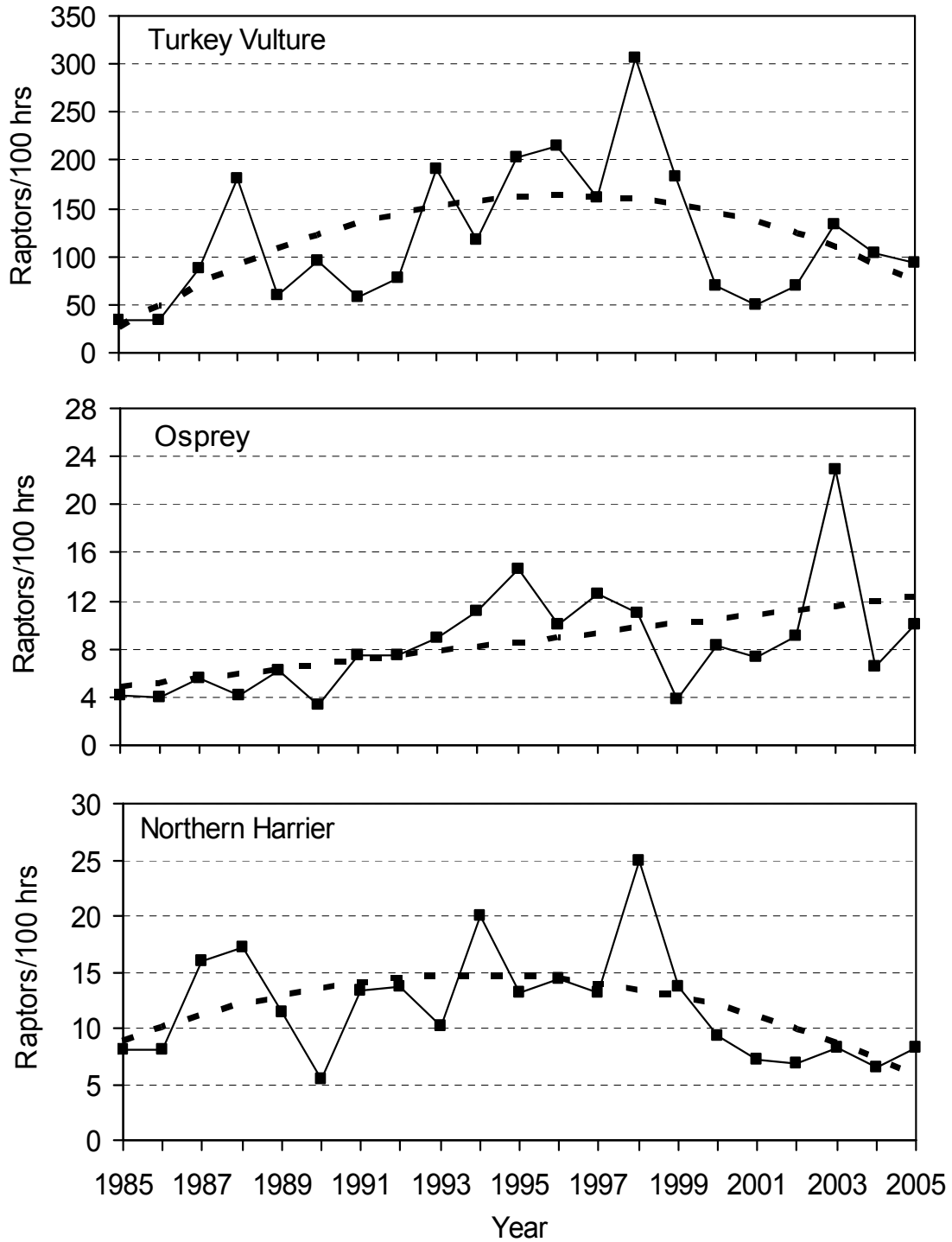


Figure 3. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers in the Manzano Mountains, NM: 1985–2005. Dashed lines indicate significant ($P \leq 0.10$) regressions.

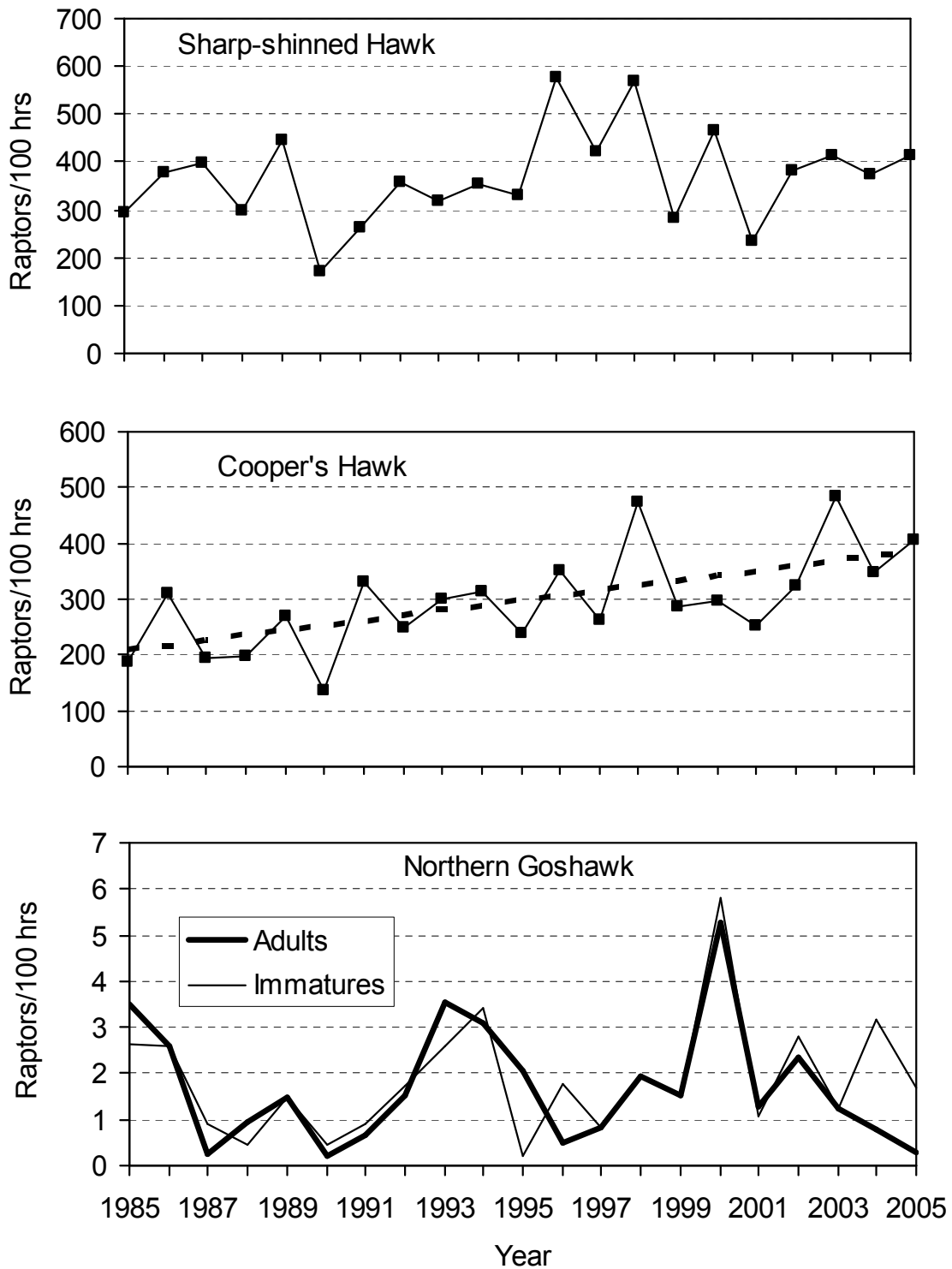


Figure 4. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks in the Manzano Mountains, NM: 1985–2005. Dashed lines indicate significant ($P \leq 0.10$) regressions.

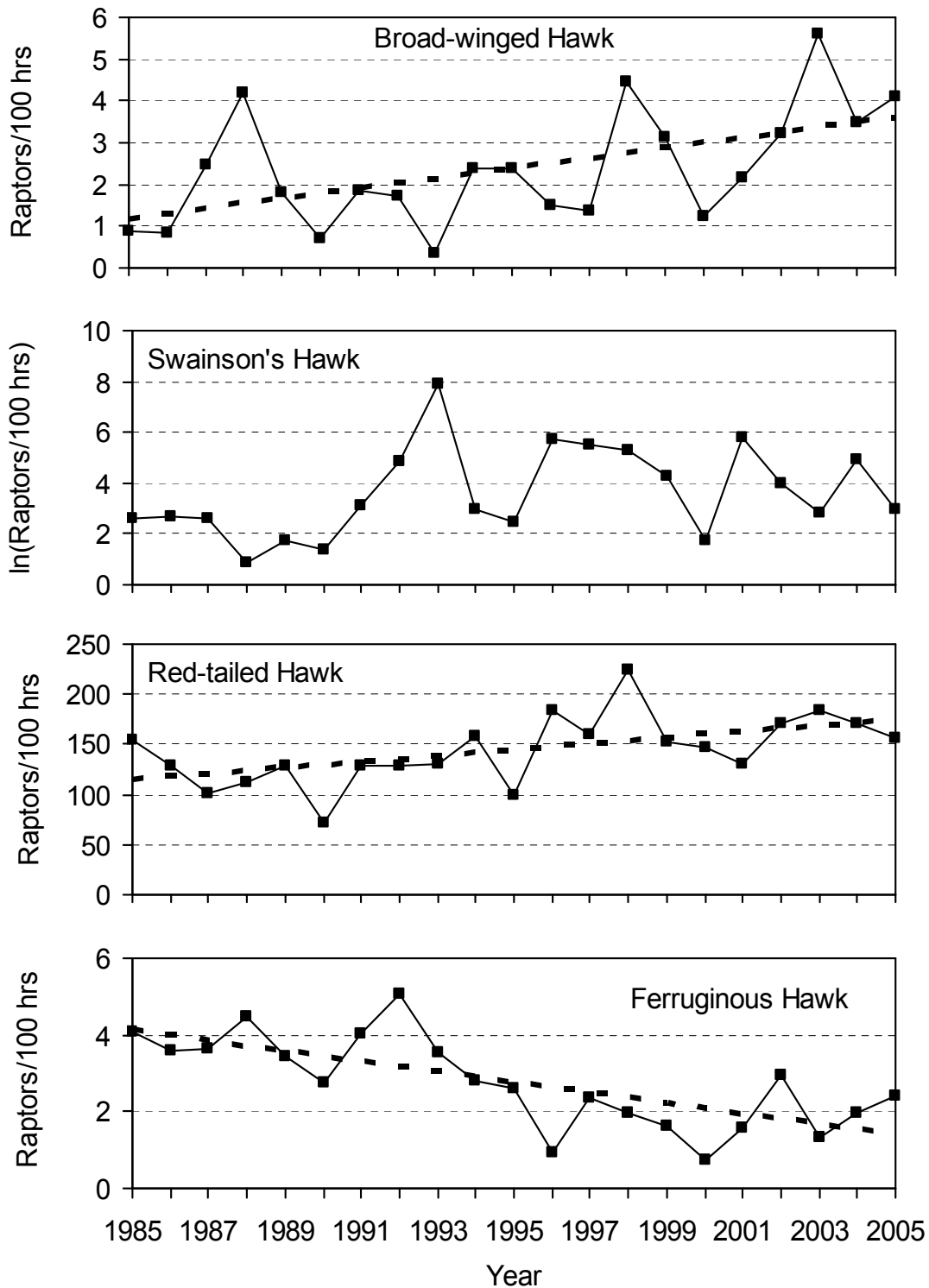


Figure 5. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Broad-winged, Swainson's, Red-tailed and Ferruginous Hawks in the Manzano Mountains, NM: 1985–2005. Dashed lines indicate significant ($P \leq 0.10$) regressions.

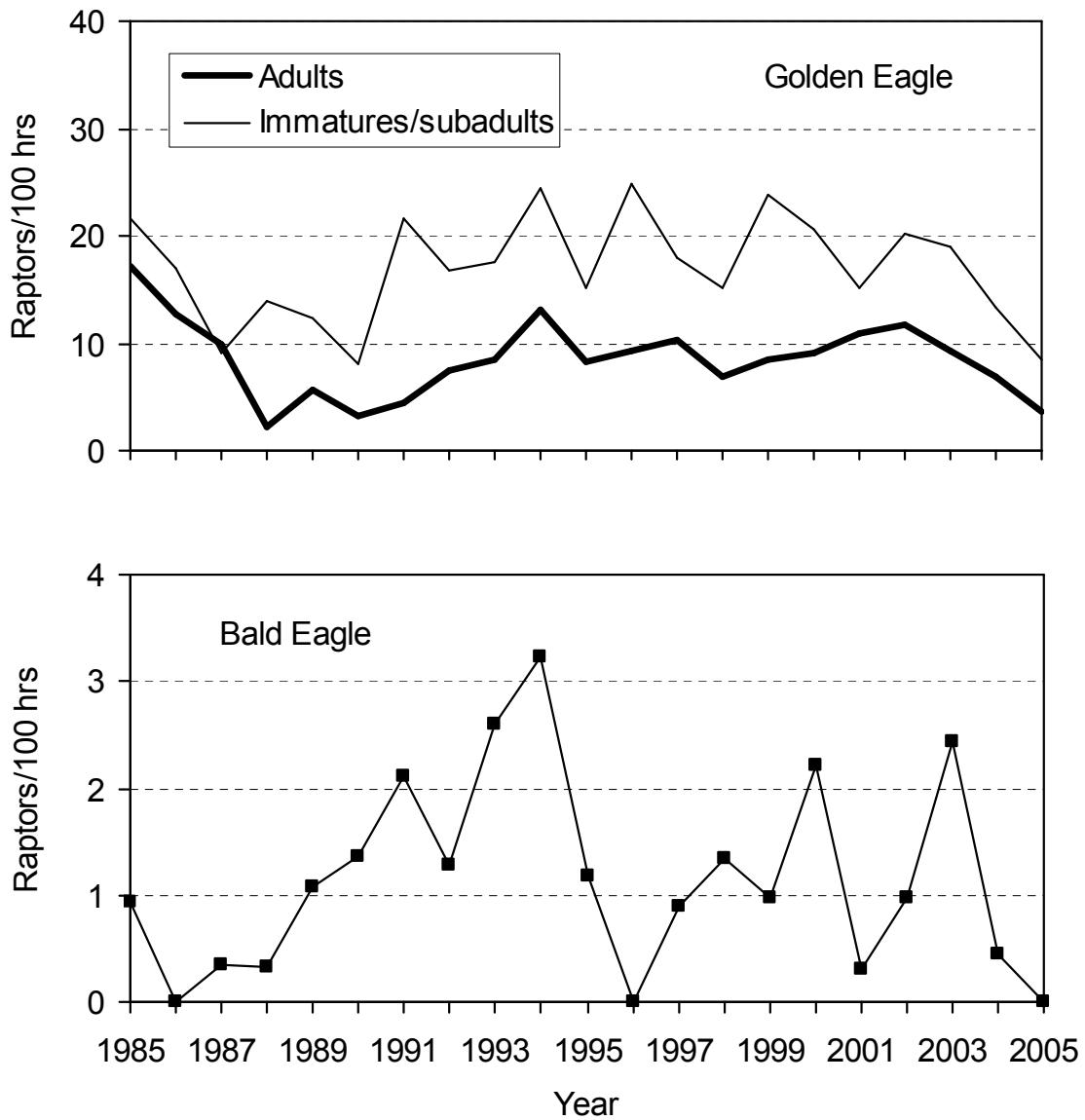


Figure 6. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for Golden and Bald Eagles in the Manzano Mountains, NM: 1985–2005. Dashed lines indicate significant ($P \leq 0.10$) regressions.

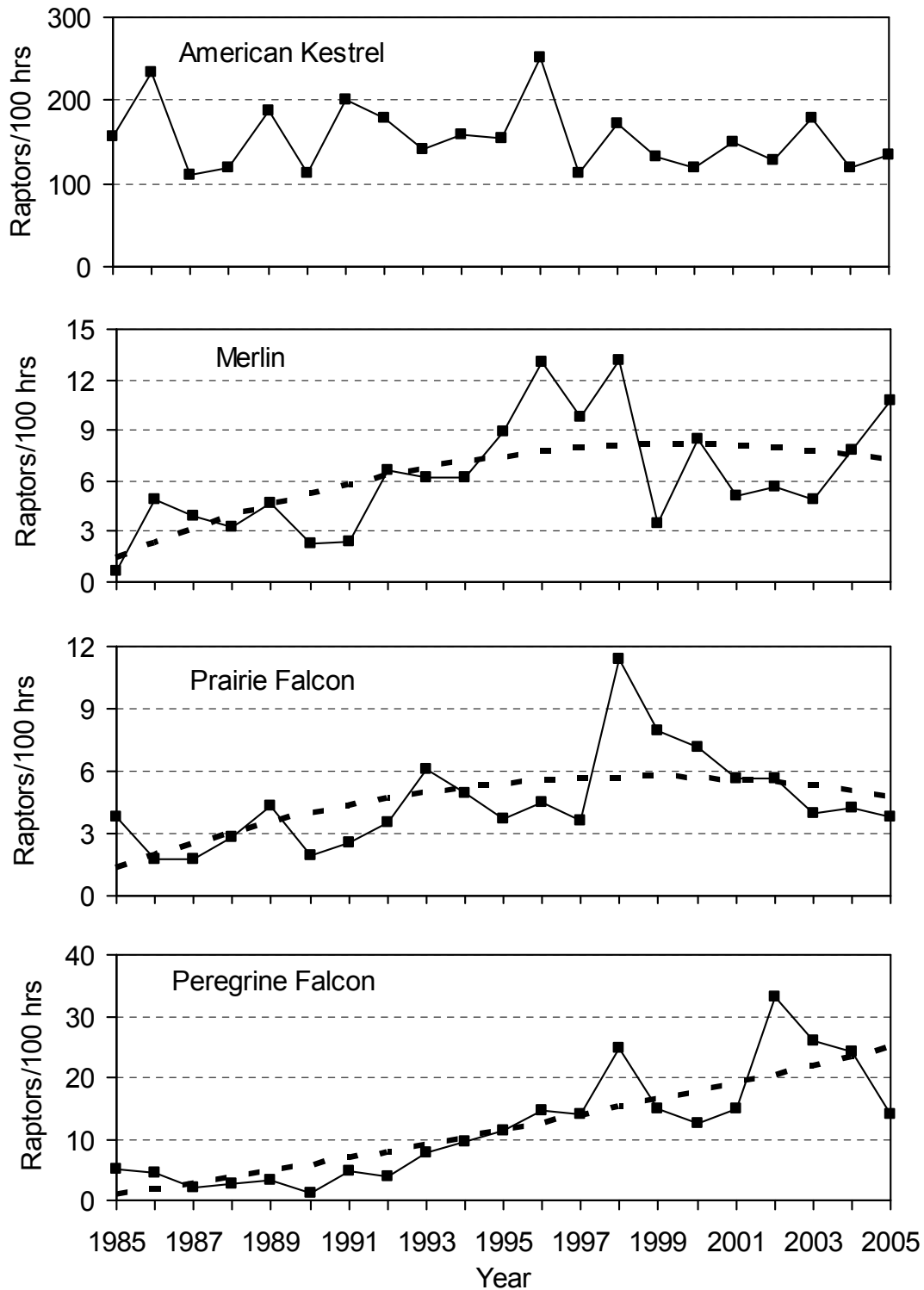


Figure 7. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons: 1985–2005. Dashed lines indicate significant ($P \leq 0.10$) regressions.

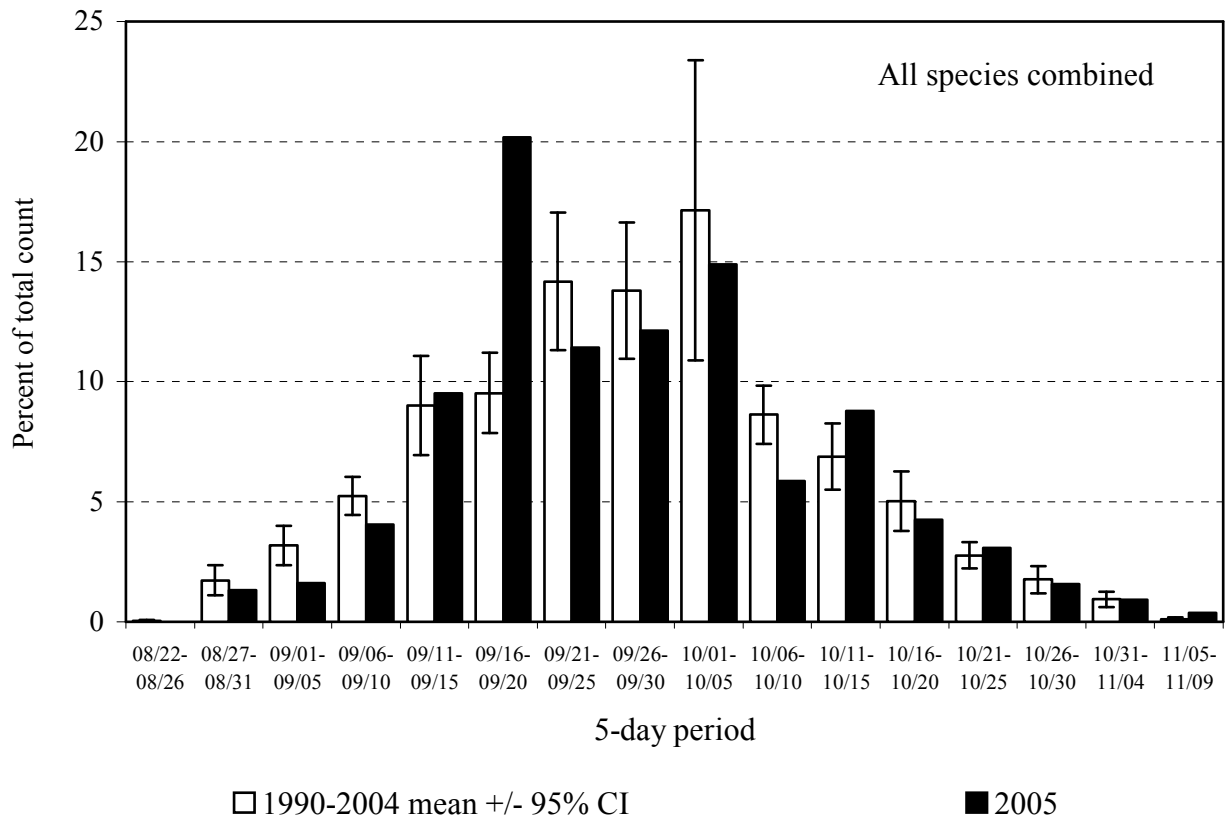


Figure 8. Combined-species, fall-migration passage volume by five-day periods for raptors in the Manzano Mountains, NM: 1985–2004 versus 2005.

Appendix A. History of official observer participation in the Manzano Mountains Raptor Migration Project: 1985–2005.

- 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 (0)
- 2004** Two observers throughout: Paula Shannon (3), Frank Mayer (2)
- 2005** Two observers throughout: Tim Hanks (1), Geoff Gould (0)

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

¹ Age codes: A = adult, I = immature (HY), Br = brown (adult female or immature), U = unknown age.

² Sex codes: M = male, F = female, U = unknown.

³ Color morph codes: D = dark or rufous, L = light, U – unknown, NA = not applicable.

⁴ Golden Eagle age codes: I = Immature: juvenile or first-year bird, bold white wing patch visible below, bold white in tail, no molt; S = Subadult: white wing patch variable or absent, obvious white in tail and molt or tawny bar visible on upper wing; NA = Not adult: unknown age immature/subadult; A = Adult: no white in wings or tail; U = Unknown.

⁵ Bald Eagle age codes: I = Immature: juvenile or first-year bird, dark breast and tawny belly; S1 = young Subadult: Basic I and II plumages, light belly, upside-down triangle on back; S2 = older Subadult: Basic III plumage, head mostly white with osprey-like dark eye line and dark band on tail; NA = Not adult: unknown age immature/subadult; A = Adult: includes near adult with dark flecks in head and dark tail tip, and adult with white head and tail; U = Unknown.

Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Manzano Mountains Raptor Migration Project: 2005.

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN	PREDOMINANT WEATHER ³	WIND	TEMP (°C) ¹	BAROM.	MEDIAN	VISIB.	VISIB.	MEDIAN	BIRDS	
			VISITOR DISTURB ²		SPEED (KPH) ¹		WIND DIRECTION	PRESS. (IN HG) ¹	THERMAL LIFT ⁴	WEST (KM) ¹	EAST (KM) ¹		FLIGHT DISTANCE ⁵ / HOUR
27-Aug	6.25	1.9	0	pc	9.3	ssw-sw	27.9	30.65	2	100	100	2	4.0
28-Aug	8.25	1.9	0	pc-ovc, scat rain	4.6	sw-nw, ne	18.4	30.61	4	96	98	2	1.0
29-Aug	8.50	1.9	0	clr-mc	1.5	sw-wnw/var	20.0	30.62	2	100	100	2	1.1
30-Aug	8.00	1.6	0	clr-pc	8.1	sw-w	23.9	30.57	2	100	97	1	1.6
31-Aug	8.00	2.7	0	pc-mc	6.3	sw/calm, e-sse	22.3	30.64	3	91	97	2	2.5
1-Sep	7.25	1.8	0	pc-ovc, haze, PM ts	5.9	calm, sw-w, se	21.2	30.69	3	52	53	1	2.1
2-Sep	7.25	1.5	0	mc-ovc, PM ts/rain	1.6	wsw-w/calm, se	17.8	30.75	4	88	73	2	1.0
3-Sep	8.50	2.7	0	mc-ovc, haze, scat ts/rain	5.1	s-sw	17.9	30.78	4	79	63	2	1.3
4-Sep	8.25	2.4	0	ovc-pc, haze	8.5	sw	20.6	30.74	2	83	67	1	2.5
5-Sep	8.75	1.9	0	mc-ovc, scat ts/rain	5.3	sw	20.0	30.72	4	95	88	2	4.2
6-Sep	5.00	1.7	0	mc-ovc, haze/fog/rain/ts	2.1	sw/calm-var	17.8	30.75	4	81	72	2.5	1.6
7-Sep	5.25	1.8	0	ovc, AM fog, ts/rain	4.4	sw-w/calm, se-s	15.9	30.78	4	60	47	1	1.3
8-Sep	9.25	1.8	0	pc-mc, haze	5.7	ese-sw	20.2	30.74	2	85	56	2.5	7.8
9-Sep	9.00	1.9	0	clr-mc, haze	10.3	s-wsw	19.5	30.59	2	72	53	2	5.9
10-Sep	9.50	1.8	0	clr-mc	12.2	sw	19.0	30.57	2	100	95	2	9.3
11-Sep	8.50	3.2	0	clr-ovc, AM haze, PM ts/rain	12.8	sw	16.3	30.60	4	97	89	1	8.0
12-Sep	9.50	2.2	0	pc-mc	19.5	sw	18.7	30.58	3	98	100	1	11.5
13-Sep	9.00	2.2	0	clr	15.1	sw	19.1	30.55	2	100	100	2	13.4
14-Sep	8.50	1.9	0	clr	15.2	s-wnw	18.3	30.56	2	98	100	1	11.3
15-Sep	8.75	1.8	0	clr	5.3	ene-se, sw	17.8	30.66	1	100	100	2	16.1
16-Sep	10.25	1.8	3	clr	13.7	s-sw	20.3	30.65	2	100	100	1	16.5
17-Sep	10.25	2.1	0	pc	17.8	sw	21.1	30.57	3	100	100	1	24.4
18-Sep	10.25	3.0	0	clr-ovc, scat rain	11.7	sw-w	20.5	30.64	2	100	100	2	19.8
19-Sep	10.25	2.6	0	mc-ovc	6.6	sw-nw	21.3	30.81	3	100	100	2	16.1
20-Sep	10.25	2.8	0	pc-ovc	4.0	e-s/var	22.8	30.87	2	100	100	2	33.9
21-Sep	9.75	2.6	0	clr-ovc	8.0	sw	21.3	30.78	2	98	87	1.5	12.4
22-Sep	8.25	1.7	0	ovc, PM ts/rain	5.8	sw	21.0	30.71	4	92	83	2	7.4
23-Sep	9.25	1.7	1.5	clr-ovc, haze, PM ts/rain	8.1	sse-sw	19.6	30.65	3	78	90	2	15.6
24-Sep	10.25	3.0	0	clr-mc	17.3	sse-sw	19.9	30.56	3	99	100	1.5	17.8
25-Sep	10.25	3.2	1	clr-pc	12.8	sw-wsw	19.1	30.68	3	100	100	2	13.2
26-Sep	10.00	2.3	0	clr-pc	3.8	calm, se	21.4	30.87	1	100	100	3	25.7
27-Sep	9.25	2.1	0	pc-ovc, haze, PM ts	13.8	s-ssw	21.2	30.80	2	86	70	2	30.6
28-Sep	6.75	1.4	0	ovc, PM fog/ts	5.5	sw/calm-var	19.1	30.70	4	63	66	2	9.6
29-Sep	0.00			weather day									
30-Sep	10.00	1.8	0	clr-pc, AM fog, PM haze	11.8	sw-wnw	12.2	30.55	3	94	81	2	7.7
1-Oct	10.25	3.6	3	clr-pc	8.8	sw-wsw	16.2	30.58	2	100	100	1	17.7
2-Oct	10.00	5.2	2	mc-ovc	10.0	sw/calm-var	17.3	30.62	4	100	98	2	18.6
3-Oct	10.25	3.5	1	pc-ovc, PM haze, scat ts	10.8	s-sw	17.9	30.64	3	100	97	2	17.0
4-Oct	10.00	3.2	0	ovc-pc, haze	18.2	ssw-sw	19.5	30.54	3	92	76	1	18.5
5-Oct	9.25	2.3	0	ovc-pc, haze	3.1	ssw-sw	20.4	30.64	2	90	72	2	12.0
6-Oct	6.75	1.6	0	ovc-pc, fog, scat rain	12.6	s-sw	14.0	30.63	4	55	68	1.5	21.0
7-Oct	9.50	1.6	1	clr, fog/haze	10.9	s-ssw, w-nw	13.2	30.58	4	96	76	2	4.1
8-Oct	10.00	2.3	0	clr-ovc, haze, PM ts	13.5	sw-nw	15.3	30.43	3	88	91	1.5	11.8
9-Oct	3.00	1.0	0	pc-ovc, ts	16.7	sw-wsw	9.5	30.13	4	83	68	1	10.3
10-Oct	0.00			weather day									
11-Oct	5.75	1.7	0	ovc-clr	14.7	sw-wsw	7.6	30.45	4	97	93	1	8.0
12-Oct	10.00	3.5	0	clr-pc, AM haze	6.0	sw/calm	11.0	30.58	1	100	100	2	6.2
13-Oct	9.75	3.1	0	clr-ovc, haze	6.4	ne-ese/calm	11.6	30.80	3	85	87	2	15.2
14-Oct	9.50	3.9	1	clr, haze	2.0	ene-ese, calm	12.2	30.81	1	100	98	2	25.1
15-Oct	1.00	1.7	0	ovc, fog	6.3	e-se	9.0	30.63	4	27	17	-	0.0
16-Oct	9.50	2.6	0	mc-pc, AM fog, PM haze	8.3	ssw-sw	11.9	30.66	3	89	73	2	4.0
17-Oct	9.25	3.6	0	clr, haze	6.1	sw-wsw	12.4	30.73	2	98	90	2	6.2

Appendix C. continued

DATE	OBS. HOURS	MEDIAN		PREDOMINANT WEATHER ³	WIND		TEMP (°C) ¹	BAROM. PRESS. (IN HG) ¹	MEDIAN THERMAL LIFT ⁴	VISIB. WEST (KM) ¹	VISIB. EAST (KM) ¹	MEDIAN	
		OBSRVR / HOUR ¹	VISITOR DISTURB ²		SPEED (KPH) ¹	WIND DIRECTION						FLIGHT DISTANCE ⁵	BIRDS / HOUR
18-Oct	8.75	3.1	0	clr-ovc, haze, PM ts/rain	12.1	s-sw	16.9	30.60	3	86	62	3	9.7
19-Oct	7.17	1.8	0	ovc-clr	20.9	wsw-w	8.6	30.47	3	100	100	1	4.7
20-Oct	9.50	2.4	0	clr, PM haze	5.1	calm/var, s-sw	11.6	30.58	2	100	100	2	2.6
21-Oct	9.50	1.6	1	mc	1.9	sw	13.5	30.69	3	100	100	1	2.5
22-Oct	10.00	3.0	1	clr	10.9	ssw-w	12.5	30.55	2	100	100	2	3.8
23-Oct	9.25	2.5	1	clr, haze	10.8	ene-se	5.2	30.54	3	90	88	2	3.4
24-Oct	9.00	2.9	0	clr, fog/haze	7.3	w-nw/calm	9.6	30.71	2	100	97	2	3.0
25-Oct	9.33	2.2	0	clr, haze	3.7	s-sw	12.1	30.66	2	100	97	1	5.7
26-Oct	8.75	1.9	0	clr-pc, haze	9.3	wsw-wnw	9.5	30.44	2	96	93	1	2.1
27-Oct	9.00	1.9	0	pc, haze	8.6	ene-se	9.5	30.57	2	75	99	1	2.7
28-Oct	9.00	1.8	0	ovc, haze	14.5	s-sw	11.6	30.58	3	83	88	2	2.4
29-Oct	8.67	1.2	1	ovc-pc, scat fog	15.5	sw	10.0	30.56	4	91	91	1	2.0
30-Oct	9.00	2.2	1	clr	17.2	sw-w	8.7	30.62	3	100	100	2	0.9
31-Oct	8.67	1.9	0	clr-pc, PM haze	7.0	ene-e, sw-w	5.7	30.80	2	93	98	1.5	2.2
1-Nov	9.00	1.9	0	clr, haze	5.9	wnw/calm, s-sw	12.1	30.80	2	100	100	3	1.1
2-Nov	9.00	1.9	0	mc-ovc	19.1	sw-wsw	11.6	30.68	4	100	100	1	0.3
3-Nov	9.00	1.9	0	ovc, haze	31.2	sw	11.1	30.56	4	100	91	2	1.1
4-Nov	8.75	1.9	0	clr, AM haze	35.7	sw-wsw	8.9	30.36	3	100	97	2	1.1
5-Nov	8.25	1.9	0	clr-pc	21.8	sw	7.9	30.39	3	100	100	2	2.5

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.

Appendix D. Daily observation effort and fall raptor migration counts by species in the Manzano Mountains, NM: 2005.

DATE	HOURS	SPECIES ¹																									BIRDS			
		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
27-Aug	6.25	11	0	0	4	0	0	1	0	0	0	0	4	0	0	0	0	0	0	0	4	0	0	1	0	0	0	0	25	4.0
28-Aug	8.25	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	2	0	0	0	0	0	0	8	1.0	
29-Aug	8.50	0	0	1	1	4	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	9	1.1		
30-Aug	8.00	2	0	0	3	3	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	1	0	0	0	13	1.6		
31-Aug	8.00	8	1	0	0	2	0	0	0	0	0	3	0	0	0	0	1	0	0	4	0	0	0	0	0	1	20	2.5		
1-Sep	7.25	4	1	1	0	2	0	0	0	0	1	2	0	0	0	1	1	0	0	2	0	0	0	0	0	0	15	2.1		
2-Sep	7.25	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	7	1.0		
3-Sep	8.50	2	1	0	0	1	0	0	0	0	0	5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	11	1.3		
4-Sep	8.25	0	0	0	8	8	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	1	0	0	0	1	21	2.5		
5-Sep	8.75	0	0	0	21	5	0	0	0	0	0	6	1	0	0	0	0	0	0	4	0	0	0	0	0	0	37	4.2		
6-Sep	5.00	1	0	0	2	1	0	2	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	8	1.6		
7-Sep	5.25	0	1	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1.3		
8-Sep	9.25	2	3	0	28	12	0	4	0	0	0	1	12	0	0	1	0	0	0	7	0	0	2	0	0	0	72	7.8		
9-Sep	9.00	10	1	0	16	10	0	0	0	0	1	9	0	0	0	0	0	0	4	0	0	2	0	0	0	0	53	5.9		
10-Sep	9.50	1	2	0	33	16	0	1	0	0	0	1	5	0	0	0	1	0	0	25	0	1	1	0	0	1	88	9.3		
11-Sep	8.50	0	0	1	32	17	0	0	0	0	1	4	0	0	0	0	0	0	13	0	0	0	0	0	0	0	68	8.0		
12-Sep	9.50	3	2	0	26	18	0	3	0	0	0	23	0	0	0	1	2	0	0	27	0	1	2	0	0	1	109	11.5		
13-Sep	9.00	17	0	0	39	27	0	1	0	0	1	7	0	0	0	0	1	0	0	24	1	0	0	0	0	3	121	13.4		
14-Sep	8.50	0	1	0	44	17	0	1	0	0	1	7	0	0	0	0	0	0	25	0	0	0	0	0	0	0	96	11.3		
15-Sep	8.75	15	1	0	49	45	0	7	0	1	0	2	10	1	0	1	0	0	8	0	0	0	0	0	0	1	141	16.1		
16-Sep	10.25	5	3	2	52	52	1	3	0	0	0	3	22	0	0	1	0	0	21	0	0	3	0	0	0	1	169	16.5		
17-Sep	10.25	4	1	1	73	63	0	11	0	0	2	4	32	0	0	3	0	0	45	0	0	7	0	0	1	3	250	24.4		
18-Sep	10.25	4	2	0	89	60	0	4	0	0	0	1	9	0	0	0	0	0	26	2	0	5	0	1	0	0	203	19.8		
19-Sep	10.25	5	1	0	50	65	1	4	1	0	0	2	25	0	0	1	0	0	7	1	0	0	1	0	0	1	165	16.1		
20-Sep	10.25	4	3	1	126	143	0	12	0	0	0	3	29	0	0	4	0	0	17	2	0	0	0	1	0	2	347	33.9		
21-Sep	9.75	1	0	1	41	29	0	3	0	0	1	6	10	0	0	0	0	0	24	2	1	2	0	0	0	0	121	12.4		
22-Sep	8.25	0	0	1	27	23	0	3	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	61	7.4		
23-Sep	9.25	10	1	0	55	46	1	5	0	0	0	15	0	0	0	0	0	5	2	1	2	0	0	1	0	144	15.6			
24-Sep	10.25	4	1	1	74	41	0	5	0	0	0	11	1	0	1	1	0	0	35	0	1	3	0	0	0	3	182	17.8		
25-Sep	10.25	1	2	0	36	38	0	2	0	0	0	3	16	2	0	0	1	1	0	24	3	1	4	0	0	1	135	13.2		
26-Sep	10.00	41	1	2	62	85	1	12	1	0	0	3	29	0	0	2	0	0	12	1	1	3	0	0	0	1	257	25.7		
27-Sep	9.25	7	4	2	95	109	1	7	1	0	1	4	27	0	0	1	1	0	15	2	0	5	0	0	1	0	283	30.6		
28-Sep	6.75	2	0	0	22	26	0	2	0	0	0	0	3	0	0	0	0	0	7	1	0	1	0	0	1	0	65	9.6		
29-Sep	0.00																													
30-Sep	10.00	1	1	1	13	17	0	1	0	0	0	8	11	0	0	1	1	0	14	1	0	5	0	1	0	1	77	7.7		
1-Oct	10.25	0	1	4	48	51	0	4	1	0	1	3	20	0	0	2	0	0	33	1	0	3	0	0	0	9	181	17.7		
2-Oct	10.00	0	0	3	59	64	1	2	0	0	0	0	33	1	0	1	1	0	15	3	2	1	0	0	0	0	186	18.6		
3-Oct	10.25	2	0	0	83	41	1	3	0	0	0	1	31	0	0	0	0	0	7	2	0	2	0	0	0	1	174	17.0		

Appendix D. continued

DATE	HOURS	SPECIES ¹																								BIRDS				
		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
4-Oct	10.00	12	0	0	68	61	0	3	1	0	0	2	31	0	0	0	0	1	0	0	0	2	2	2	0	0	0	0	185	18.5
5-Oct	9.25	28	0	0	39	26	0	1	0	0	2	1	9	1	0	0	1	0	0	0	1	1	0	0	0	0	1	0	111	12.0
6-Oct	6.75	125	0	1	4	7	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	1	1	0	0	0	142	21.0	
7-Oct	9.50	0	0	0	9	13	1	2	0	0	0	0	8	1	0	0	0	1	0	0	2	1	0	1	0	0	0	39	4.1	
8-Oct	10.00	5	0	2	41	27	0	2	0	0	0	0	26	0	0	0	0	3	0	0	10	0	1	0	1	0	0	118	11.8	
9-Oct	3.00	0	0	0	6	4	0	0	0	0	0	0	17	0	0	0	0	0	0	0	3	0	1	0	0	0	0	31	10.3	
10-Oct	0.00																													
11-Oct	5.75	20	0	2	9	4	0	2	0	0	2	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0	0	46	8.0	
12-Oct	10.00	1	0	1	22	14	0	1	0	0	1	0	15	0	0	0	0	3	0	0	3	0	0	0	0	0	1	0	62	6.2
13-Oct	9.75	2	0	4	44	47	0	2	0	0	0	0	41	0	0	0	1	1	0	0	4	1	0	0	0	0	0	1	148	15.2
14-Oct	9.50	3	0	2	72	71	0	7	0	0	1	0	60	0	0	0	2	4	0	0	8	4	0	0	0	0	0	4	238	25.1
15-Oct	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16-Oct	9.50	0	0	2	10	7	0	2	0	0	0	0	12	0	0	0	3	0	0	0	1	1	0	0	0	0	0	0	38	4.0
17-Oct	9.25	0	0	1	22	7	1	1	0	0	0	0	17	0	0	0	0	4	0	0	2	2	0	0	0	0	0	0	57	6.2
18-Oct	8.75	0	0	0	27	16	0	1	0	0	0	0	36	0	0	0	0	1	0	0	2	1	0	0	0	0	0	1	85	9.7
19-Oct	7.17	0	0	1	17	5	0	1	0	0	0	0	5	0	0	0	0	3	0	0	1	0	1	0	0	0	0	0	34	4.7
20-Oct	9.50	0	0	0	8	4	1	0	0	0	0	0	10	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	25	2.6
21-Oct	9.50	0	0	1	12	2	0	0	0	0	0	0	6	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	24	2.5
22-Oct	10.00	0	0	1	18	5	0	0	0	0	0	0	5	1	0	0	0	1	0	0	1	5	0	1	0	0	0	0	38	3.8
23-Oct	9.25	0	0	1	4	3	0	0	0	0	0	0	16	2	0	0	1	3	0	0	0	1	0	0	0	0	0	0	31	3.4
24-Oct	9.00	0	0	2	10	3	0	0	0	0	0	0	8	1	0	0	0	2	0	0	0	1	0	0	0	0	0	0	27	3.0
25-Oct	9.33	0	0	0	30	5	0	0	0	0	0	0	6	0	0	0	1	5	0	2	3	0	0	0	0	1	0	0	53	5.7
26-Oct	8.75	0	0	1	8	3	0	0	0	0	0	0	2	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	18	2.1
27-Oct	9.00	0	0	1	8	3	0	0	0	0	0	0	11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	24	2.7
28-Oct	9.00	0	0	0	9	1	0	0	0	0	0	0	7	0	0	0	0	4	0	0	0	1	0	0	0	0	0	0	22	2.4
29-Oct	8.67	0	0	0	7	1	0	0	0	0	0	0	7	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	17	2.0
30-Oct	9.00	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0.9
31-Oct	8.67	0	0	1	5	0	0	0	0	0	0	0	10	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	19	2.2
1-Nov	9.00	0	0	0	6	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	10	1.1
2-Nov	9.00	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.3
3-Nov	9.00	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	10	1.1
4-Nov	8.75	0	0	0	1	0	0	0	0	0	0	0	6	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	10	1.1
5-Nov	8.25	0	0	0	1	0	0	0	0	0	0	0	11	0	0	0	0	7	1	1	0	0	0	0	0	0	0	0	21	2.5
Total	599.58	363	35	46	1842	1486	10	129	5	1	13	52	823	13	0	1	33	71	1	4	520	48	16	61	2	5	6	37	5623	9.4

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: 1985–2005.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Start date	6-Sep	23-Aug	25-Aug	30-Aug	28-Aug	27-Aug	27-Aug	25-Aug	25-Aug	25-Aug	27-Aug
End date	2-Nov	31-Oct	4-Nov	31-Oct	31-Oct	31-Oct	5-Nov	5-Nov	5-Nov	2-Nov	8-Nov
Days of observation	50	63	65	60	63	62	67	70	68	66	70
Hours of observation	343.33	464.50	517.92	453.08	489.75	510.75	524.58	537.25	489.67	508.75	560.00
Raptors / 100 hours	843.2	863.9	758.6	772.3	955.4	494.6	825.6	946.3	2429.2	966.5	832.9
SPECIES	RAPTOR COUNTS										
Turkey Vulture	74	118	283	466	178	295	176	268	601	430	636
Osprey	10	14	19	13	22	12	24	26	31	38	53
Northern Harrier	28	36	78	78	59	27	66	69	48	97	72
Sharp-shinned Hawk	956	1300	1622	1118	1834	688	1080	1540	1193	1415	1519
Cooper's Hawk	531	881	679	604	929	471	1105	961	944	1054	907
Northern Goshawk	21	20	7	6	14	3	8	16	27	30	11
Unknown small accipiter ¹	-	-	-	-	-	-	-	-	-	-	-
Unknown large accipiter ¹	-	-	-	-	-	-	-	-	-	-	-
Unknown accipiter	78	104	119	111	121	120	156	117	266	118	44
TOTAL ACCIPITERS	1586	2305	2427	1839	2898	1282	2349	2634	2430	2617	2481
Broad-winged Hawk	2	2	7	10	5	2	5	5	1	7	7
Swainson's Hawk	27	33	44	3	16	9	58	344	7301	67	32
Red-tailed Hawk	513	527	457	486	604	329	577	667	566	707	519
Ferruginous Hawk	14	15	17	20	16	13	19	25	17	13	13
Rough-legged Hawk	0	0	0	1	1	0	0	0	0	0	0
Zone-tailed Hawk	0	0	0	0	0	0	0	2	0	1	1
Unknown buteo	21	12	11	16	4	19	30	11	31	22	9
TOTAL BUTEOS	577	589	536	536	646	372	689	1054	7916	817	581
Golden Eagle	133	123	86	67	85	52	124	119	120	172	136
Bald Eagle	2	0	1	1	3	4	7	4	7	9	4
Unknown Eagle	0	0	0	4	0	4	0	0	0	0	0
TOTAL EAGLES	135	123	87	72	88	60	131	123	127	181	140
American Kestrel	421	755	426	385	677	409	728	704	520	582	584
Merlin	2	16	17	12	18	9	10	28	24	24	42
Prairie Falcon	13	7	8	12	19	9	14	17	27	22	18
Peregrine Falcon	14	15	7	10	15	5	21	18	31	37	49
Unknown small falcon ¹	-	-	-	-	-	-	-	-	-	-	-
Unknown large falcon ¹	-	-	-	-	-	-	-	-	-	-	-
Unknown falcon	4	0	1	0	3	5	3	1	0	1	0
TOTAL FALCONS	454	793	459	419	732	437	776	768	602	666	693
Unknown raptor	31	35	40	76	56	41	120	142	140	71	8
TOTAL	2895	4013	3929	3499	4679	2526	4331	5084	11895	4917	4664

¹ New designations used for the first time in 2001.

Appendix E. continued

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Mean
Start date	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	28-Aug	27-Aug	26-Aug
End date	5-Nov	5-Nov	5-Nov	5-Nov	2-Nov	4-Nov	3-Nov	5-Nov	30-Oct	5-Nov	2-Nov
Days of observation	59	68	65	70	57	68	65	69	57	69	64
Hours of observation	461.67	565.08	559.58	553.77	434.33	545.47	518.50	577.25	424.08	599.58	506.61
Raptors / 100 hours	1545.9	1044.8	1594.2	873.1	991.6	855.8	972.0	1126.4	1039.9	937.8	1031.7
SPECIES	RAPTOR COUNTS										
Turkey Vulture	640	563	1116	637	241	164	239	468	289	363	396
Osprey	33	47	44	14	25	26	32	86	20	35	30
Northern Harrier	64	69	133	69	38	37	33	50	27	46	58
Sharp-shinned Hawk	2174	1872	2585	1212	1698	1032	1524	1861	1268	1842	1489
Cooper's Hawk	1205	1018	2025	1069	984	913	1149	1758	964	1486	1029
Northern Goshawk	9	9	19	14	42	13	23	12	15	10	16
Unknown small accipiter ¹	-	-	-	-	-	86	188	205	169	129	155
Unknown large accipiter ¹	-	-	-	-	-	0	3	5	4	5	3
Unknown accipiter	147	76	107	51	29	0	11	5	28	1	86
TOTAL ACCIPITERS	3535	2975	4736	2346	2753	2044	2898	3846	2448	3473	2657
Broad-winged Hawk	4	5	14	12	3	6	9	16	6	13	7
Swainson's Hawk	867	679	572	194	19	815	139	53	291	52	553
Red-tailed Hawk	771	803	1151	733	591	632	778	924	636	823	657
Ferruginous Hawk	4	13	10	8	3	10	14	7	8	13	13
Rough-legged Hawk	0	0	1	1	0	1	0	0	0	0	0
Zone-tailed Hawk	0	1	2	0	3	1	1	0	0	1	1
Unknown buteo	11	3	28	5	2	106	32	30	69	33	24
TOTAL BUTEOS	1657	1504	1778	953	621	1571	973	1030	1010	935	1255
Golden Eagle	151	145	115	159	115	128	149	146	79	71	118
Bald Eagle	0	3	4	3	5	1	3	8	1	1	3
Unknown Eagle	0	0	0	0	1	0	0	1	0	4	1
TOTAL EAGLES	151	148	119	162	121	129	152	155	80	76	122
American Kestrel	905	455	742	525	397	560	470	686	362	520	562
Merlin	48	42	56	14	27	21	22	22	26	48	25
Prairie Falcon	19	19	58	38	30	28	24	20	18	16	21
Peregrine Falcon	60	67	116	64	49	63	127	112	82	61	49
Unknown small falcon ¹	-	-	-	-	-	0	4	2	1	2	2
Unknown large falcon ¹	-	-	-	-	-	0	15	3	1	5	5
Unknown falcon	1	0	12	2	1	5	2	1	5	6	3
TOTAL FALCONS	1033	583	984	643	504	677	664	846	495	658	661
Unknown raptor	24	15	11	11	4	20	49	21	41	37	47
TOTAL	7137	5904	8921	4835	4307	4668	5040	6502	4410	5623	5226

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: 2005.

DATE	STN.	SPECIES ¹													CAPTURES	
	HOURS	NH	SS	CH	NG	BW	SW	RT	ZT	GE	AK	ML	PR	PG	TOTAL	/STN HR
4-Sep	11.50	0	3	1	0	0	0	0	0	0	0	0	0	0	4	0.3
5-Sep	11.00	0	12	2	0	0	0	3	0	0	0	0	0	0	17	1.5
6-Sep	5.25	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.2
7-Sep	6.50	0	3	1	0	0	0	0	0	0	0	0	0	0	4	0.6
8-Sep	15.25	0	15	1	0	0	0	2	0	0	1	0	0	1	20	1.3
9-Sep	15.41	0	5	9	0	0	0	1	0	0	0	0	0	0	15	1.0
10-Sep	14.25	0	11	5	0	0	0	3	0	0	1	0	0	1	21	1.5
11-Sep	13.75	0	16	5	0	0	0	1	0	0	2	0	0	0	24	1.7
12-Sep	15.16	0	9	8	0	0	0	1	0	1	0	0	0	0	19	1.3
13-Sep	15.00	0	21	9	0	0	0	0	0	0	6	0	1	1	38	2.5
14-Sep	15.66	0	28	7	0	0	0	2	0	0	3	0	0	2	42	2.7
15-Sep	15.50	0	20	8	0	0	0	0	0	0	0	0	0	1	29	1.9
16-Sep	16.00	0	12	26	0	0	0	1	0	0	0	0	0	0	39	2.4
17-Sep	16.00	0	17	20	0	0	0	2	0	0	1	0	0	0	40	2.5
18-Sep	16.00	0	30	22	0	0	0	0	0	0	2	0	0	0	54	3.4
19-Sep	16.00	0	9	15	0	0	0	1	0	0	0	0	1	0	26	1.6
20-Sep	16.25	0	25	47	0	0	0	2	0	0	1	0	0	0	75	4.6
21-Sep	14.50	0	23	13	0	0	0	1	0	0	3	0	1	0	41	2.8
22-Sep	13.00	0	15	11	0	0	0	0	0	0	1	0	0	0	27	2.1
23-Sep	12.60	0	21	20	0	0	0	0	0	0	2	0	0	0	43	3.4
24-Sep	15.83	0	23	22	0	0	0	1	0	0	0	0	0	0	46	2.9
25-Sep	14.80	0	5	10	0	0	0	0	0	0	1	0	0	1	17	1.1
26-Sep	15.66	0	11	25	1	0	0	2	0	0	0	0	0	0	39	2.5
27-Sep	15.50	0	24	58	0	0	0	2	0	0	1	0	0	0	85	5.5
28-Sep	13.00	0	12	5	0	0	0	0	0	0	1	0	0	1	19	1.5
29-Sep	0.00															
30-Sep	15.50	0	5	4	0	0	0	0	0	0	1	0	0	1	11	0.7
1-Oct	15.50	1	14	14	0	0	0	1	0	0	2	0	0	1	33	2.1
2-Oct	16.00	0	28	21	0	0	0	0	0	0	3	0	1	0	53	3.3
3-Oct	16.16	0	25	27	1	0	0	2	0	0	0	0	0	0	55	3.4
4-Oct	15.50	0	23	23	0	0	0	0	0	0	0	0	0	0	46	3.0

Appendix F. continued

DATE	STN.	SPECIES ¹													CAPTURES	
	HOURS	NH	SS	CH	NG	BW	SW	RT	ZT	GE	AK	ML	PR	PG	TOTAL	/STN HR
5-Oct	16.00	0	14	9	0	0	0	2	0	0	0	0	0	0	25	1.6
6-Oct	6.75	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0.3
7-Oct	16.00	0	3	5	1	0	0	0	0	0	0	0	0	0	9	0.6
8-Oct	16.00	0	8	4	0	0	0	1	0	0	0	0	0	0	13	0.8
9-Oct	0.00															
10-Oct	0.00															
11-Oct	8.00	0	4	1	0	0	0	1	0	0	0	0	0	0	6	0.8
12-Oct	14.75	0	9	4	0	0	0	1	0	1	1	0	0	0	16	1.1
13-Oct	15.75	0	8	6	0	0	0	0	0	0	1	0	0	0	15	1.0
14-Oct	15.75	1	10	16	0	0	0	0	0	0	0	1	0	0	28	1.8
15-Oct	0.00															
16-Oct	14.75	0	4	0	0	0	0	0	0	0	1	0	0	0	5	0.3
17-Oct	15.25	0	5	1	0	0	0	0	0	0	0	0	0	0	6	0.4
18-Oct	13.50	0	5	2	0	0	0	0	0	0	0	0	0	0	7	0.5
19-Oct	10.83	0	1	0	0	0	0	1	0	0	0	0	0	0	2	0.2
20-Oct	15.25	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.1
21-Oct	15.50	0	7	0	0	0	0	0	0	0	0	0	0	0	7	0.5
22-Oct	15.25	1	2	1	0	0	0	0	0	0	0	1	0	0	5	0.3
23-Oct	14.91	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.1
24-Oct	15.00	0	1	2	0	0	0	0	0	0	0	0	0	0	3	0.2
25-Oct	14.75	0	14	2	0	0	0	0	0	0	2	0	0	0	18	1.2
26-Oct	14.50	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0.1
27-Oct	7.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28-Oct	3.75	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.3
Total	707.77	3	562	495	3	0	0	35	0	2	37	3	4	10	1154	1.6

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: 1990–2005.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	TOTAL	MEAN
Start date	28-Aug	5-Sep	31-Aug	3-Sep	1-Sep	4-Sep	2-Sep	31-Aug	29-Aug	31-Aug	2-Sep	1-Sep	3-Sep	7-Sep	5-Sep	4-Sep		1-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		25-Oct
Blinds in operation	1	3	3	3	3	4	4	4	3	3	3	3	3	2	2	2		3.0
Trapping days	47	54	57	50	48	53	45	54	58	46	50	55	51	45	45	51		50.7
Station days	47	95	131	120	121	136	132	151	165	94	119	145	131	84	84	99		117.2
Station hours	511	693	967	889	926	1041	1030	1211	1352	664	791	1037	957	633	756.15	707.77		885.4
SPECIES	RAPTOR COUNTS																	
Northern Harrier	1	2	2	3	9	2	1	8	14	0	5	7	6	3	0	3	66	4.1
Sharp-shinned Hawk	124	262	589	430	502	493	778	612	987	321	495	426	635	458	566	562	8240	515.0
Cooper's Hawk	95	195	335	374	353	310	460	427	772	323	330	337	510	400	378	495	6094	380.9
Northern Goshawk	1	7	6	6	7	1	5	3	6	6	16	1	10	1	2	3	81	5.1
Broad-winged Hawk	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	4	0.3
Swainson's Hawk	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	4	0.3
Red-tailed Hawk	8	18	61	55	83	50	50	46	112	56	76	39	56	38	43	35	826	51.6
Zone-tailed Hawk	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0.1
Golden Eagle	1	3	4	4	4	4	6	4	5	2	4	5	7	8	2	2	65	4.1
American Kestrel	10	13	42	14	59	28	92	32	75	44	25	56	37	43	18	37	625	39.1
Merlin	1	0	2	4	1	1	11	6	7	2	8	2	12	3	10	3	73	4.6
Prairie Falcon	1	1	3	5	3	1	3	5	13	6	3	7	5	4	3	4	67	4.2
Peregrine Falcon	2	1	2	1	4	2	5	7	12	8	1	10	13	7	5	10	90	5.6
All Species	244	502	1046	896	1025	892	1411	1150	2005	768	963	891	1295	966	1028	1154	16236	1014.8
Captures / 100 hours	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	1816.1	113.5
Recaptures ¹	0	0	1	1	2	2	1	2	4	4	3	2	3	2	2	3	32	2.0
Foreign recaptures ²	2	1	1	1	2	0	5	1	2	2	0	0	3	2	0	0	22	1.4
Foreign encounters ³	0	2	2	3	6	6	7	8	13	12	6	7	10	7	5	3	99	6.2

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.