

**SPRING 2006 RAPTOR MIGRATION STUDY IN THE  
SANDIA MOUNTAINS OF CENTRAL NEW MEXICO**



*Hawk*WATCH  
INTERNATIONAL

**HawkWatch International, Inc.  
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# **SPRING 2006 RAPTOR MIGRATION STUDY IN THE SANDIA MOUNTAINS OF CENTRAL NEW MEXICO**

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## INTRODUCTION

The Sandia Mountains Raptor Migration Project in north-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 spring raptor migration through this region in 1985, and began a trapping and banding program at the project site in 1990. To date, HWI observers have recorded 22 species of migratory raptors at the site, with counts typically ranging between 3,000 and 5,000 migrants per season. The 2006 season marked the 22<sup>st</sup> consecutive migration count and the 16<sup>th</sup> season of trapping and banding conducted at the site. This report summarizes the 2006 count and banding results.

## STUDY SITE

The Sandia Mountains form a 41-km long ridge that runs north–south just east of Albuquerque in north–central New Mexico (35°05'12" N, 106°25'57" W; Figure 1). The study site is located at the southern end of the range within the Sandia Wilderness Area of the Cibola National Forest (Sandia Ranger District). The site is about 3 km north of Interstate 40 and Tijeras Canyon, and 18 km east of downtown Albuquerque. The site is reached by a steep, 2.5-km spur trail that originates at the U.S. Forest Service Tres Pistolas Canyon fence. The observation post, located at 2,196 m elevation, provides an expansive view of the Manzano Mountains to the south, the western plains, and northern Tres Pistolas Canyon. This season, one banding station (Upper Station) was situated ~1.0 km northeast of the observation post.

One-seeded juniper (*Juniperus monosperma*), mountain mahogany (*Cercocarpus montanus*), shrub live oak, (*Quercus turbinella*), tree cholla (*Opuntia imbricata*), and banana yucca (*Yucca baccata*) are the predominant plant species near the lookout, which is typical of the Upper Sonoran life zone. Ponderosa pine (*Pinus ponderosa*) and Gambel oak (*Quercus gambelii*) also occur at higher elevations.

## METHODS

Two official or designated observers conducted standardized daily counts of migrating raptors from a single traditional observation site between 24 February and 5 May 2006. Before this season, primary observers Alberto Martinez and Ingrid Verhoeckx had three and zero full-seasons of previous experience counting migratory raptors for HWI or its partners (see Appendix A for a complete history of observer participation). Devon Batley, who served as the on-site education specialist for the project and through two prior seasons of such work for HWI at other sites had gained considerable counting and ID experience, also routinely assisted with the counts. Other local volunteers and visitors also occasionally assisted with the counts, particularly Ken Babcock, with four seasons of prior HWI migration counting experience. Weather permitting, observations usually began between 0800 and 0900 hrs Mountain Standard Time (MST) and ended between 1700 and 1800 hrs.

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

1. Species, age, sex, and color morph of each migrant raptor, whenever possible and applicable (Appendix B lists common and scientific names for all species, information about the applicability of age, sex, and color morph distinctions, and two-letter codes used to identify species in some tables and figures).
2. Hour of passage for each migrant; e.g., the 1000–1059 hrs MST.
3. Wind speed and direction, air temperature, percent cloud cover, predominant cloud type(s), presence 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 (none, low, moderate, high) 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 2006 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2006 value falling outside the bounds of the confidence interval for the associated mean.

## **RESULTS AND DISCUSSION**

### **WEATHER SUMMARY**

Compared to the last several seasons, inclement weather severely hampered observations less often than usual in 2006 (see Appendix C for daily weather summaries), with only 2 potential days of observation entirely precluded and 2 days reduced to less than 4 hours of observation (1998–2005 averages of 4.3 and 3.3 days, respectively). The proportions of active observation days that featured some rain/snow or visibility reducing fog/haze also were noticeably below average (rain/snow: 15% vs. 20%; fog/haze: 14% vs. 39%). The proportion of active observation days where fair skies prevailed was well below average (30% versus average of 46%), however, whereas transitional weather (i.e., conditions changed from fair to mostly cloudy or overcast during the day, or vice versa) prevailed on a record-high 42% of the active observation days (average 27%), and mostly cloudy to overcast skies prevailed on a slightly above-average 28% of the active days (average 26%). The low prevalence of fog/haze and general storminess resulted in significantly increased estimates of average visibility to the west (96 km, compared to 1998–2005 average of 76 km), but estimates of visibility to the east were confounded by unacceptable variation in recording protocols.

Wind speed was moderate in 2006, with the proportion of days featuring predominantly light winds (<12 kph) being close to average (66%, average 68%), the proportion featuring predominantly moderate winds (12–28 kph) slightly above average (33%, average 29%), and a slightly below average proportion of days featuring predominantly stronger winds (1%, average 3%). In the Sandias, westerly winds usually prevail; in 2006 W–NW winds prevailed on an above-average 32% of the active observation days (average 26%), with another 6% featuring such winds during a significant portion of the day (average 2%). In addition, a substantially above-average proportion of the active days featured no prevailing wind direction (i.e., either highly variable or mostly calm; 19%, average 10%). In contrast, days where variable SW–NW winds prevailed were considerably less common than usual (10%, average 20%).

The temperature during active observation periods averaged 15.1°C (the average of daily values, which in turn were averages of hourly readings), with hourly readings ranging from -5.0 to 23.5°C. The overall mean was above average (1985–2005 average 12.0°C; range of annual means 9.1–15.5°C) and the maximum hourly reading was the third highest annual maximum recorded since 1998; however, the minimum hourly reading was the lowest recorded since 1998.

Good to excellent thermal-lift conditions predominated on only 36% of the active observation days, compared to the 1998–2005 average of 52%.

In summary, compared to the last eight seasons, 2006 featured a broader than usual range of hourly temperature readings but overall mild to warm weather, with more overall cloudiness but less fog/haze and rain/snow than usual. Wind speeds followed a typical scenario, but wind directions, though still largely constrained to the SW–NW quadrant, were more variable than usual. The variable winds and a higher than usual prevalence of cloudy days resulted in poorer than usual thermal lift conditions during the season.

## **OBSERVATION EFFORT**

The observers worked on 70 of 71 possible days between 24 February and 5 May, which is the standard count period for the project. The number of observation days matched the 1985–2005 average of  $70 \pm 95\%$  CI of 2.8 days, but the number of observation hours (621.42) was a significant 15% above average ( $538.18 \pm 95\%$  CI of 23.95 hrs). The 2006 average of 2.5 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) also was a significant 18% above average ( $2.1 \pm 95\%$  CI of 0.13 observers/hr).

## **FLIGHT SUMMARY**

The observers counted 3,709 migrant raptors of 17 species during the 2006 season, with the total count a non-significant 8% below the 1985–2005 average (Table 1; and see Appendix D for daily count records and Appendix E for annual summaries). No record low or high counts occurred for commonly encountered species; however, the counts of Merlins, Prairie Falcons, and Peregrine Falcons were all the second highest yet recorded (Appendix E).

The 2006 flight consisted of 35% accipiters, 31% vultures, 11% buteos, 10% eagles, 10% falcons, 2% Ospreys, 2% harriers, and <1% unidentified raptors. These values represent a significantly below average proportion of vultures and significantly above average proportions of falcons, Ospreys, and Harriers (Figure 2). The Turkey Vulture was the most commonly encountered species, followed by the Cooper's Hawk, Sharp-shinned Hawk, Golden Eagle, Red-tailed Hawk, and American Kestrel; all other species comprised <3% each of the total count (Table 1).

## **Passage Rate Trends**

Among 17 species seen in most years, adjusted passage rates were significantly above average only for Swainson's Hawks, Merlins, Prairie Falcons, and Peregrine Falcons, whereas passage rates were significantly below average for 10 species (Table 1, Figures 3–7). The 1985–2006 regression analyses of adjusted passage rates indicated highly significant ( $P \leq 0.01$ ) linear increasing trends for Swainson's Hawks (Figure 5) and Peregrine Falcons (Figure 7), and marginally ( $P \leq 0.10$ ) to highly significant quadratic trends for Turkey Vultures and Ospreys (Figure 3), Cooper's Hawks (Figure 4), Broad-winged and Ferruginous Hawks (Figure 5), and Merlins (Figure 7). These quadratic trends consistently track increasing patterns through the mid-to-late 1990s followed by recent stabilization or more commonly declines. Although not captured by significant regressions, passage rates of Northern Harriers, Bald Eagles, and American Kestrels also have shown declining trajectories since passage rates climbed to high peaks for these and several other species in 1997/98 following a wet El Niño period. The recent declines shown by many species correlate with the onset of widespread drought throughout much of the interior West after 1998 (Hoffman and Smith 2003). Age-specific analyses also revealed a significant ( $P \leq 0.05$ ) linear decline for adult Northern Goshawks but no long-term trend for immature goshawks (Figure 4), which further translated to a highly significant increasing trend in annual goshawk immature : adult ratios.

## **Age Ratios**

Immature: adult ratios were above average in 2006 for only 2 of 10 species with data suited to comparisons, and significantly so only for Red-tailed Hawks (Table 2). For this species, the high age ratio was due to a proportionally greater reduction in the number of adults tallied rather than to high abundance of young birds. In contrast to Red-tailed Hawks, Golden Eagles and Sharp-shinned Hawks showed significantly below average age ratios in 2006 (Table 2). For Sharp-shinned Hawks, the number of identified juveniles was about average, whereas the number of identified adults was much higher than average. In contrast, the number of identified immature/subadult Golden Eagles was less than half the long-term average, while the opposite was true for identified adults. For this species, increasing migration activity among adults at lower latitudes in the interior West and attendant decreases in abundance of younger birds may be a sign of declining habitat quality and productivity among populations wherein adult eagles typically are largely sedentary (Hoffman and Smith 2003).

In evaluating age ratios, it is also important to recognize that this year's comparisons for all species except Northern Harriers, Northern Goshawks, and Peregrine Falcons are confounded by significant variation in the proportion of unaged birds (Table 2).

## **Seasonal Timing**

The overall combined-species median passage date of 4 April was a marginally significant 2 days earlier than average, but 11 of 17 species for which a comparison was possible showed significantly earlier than average timing in 2006 (Table 3). Only the Northern Goshawk, Red-tailed Hawk, and Prairie Falcon showed significantly later than average median passage dates in 2006. The combined-species distribution of seasonal activity illustrates the general pattern that applied to most species, with generally above average relative activity levels in March and generally below average activity levels in April (Figure 8).

## **TRAPPING EFFORT**

The trapping crew operated Upper Station on 50 days (366.1 hrs) between 12 March and 2 May (see Appendix F for daily effort and capture totals by species). This level of effort is significantly higher than the long-term averages for the site ( $44 \pm 5.9$  days and  $314.5 \pm 48.15$  hrs; see Appendix G for annual summaries).

## **TRAPPING AND BANDING SUMMARY**

The 2006 capture total of 185 birds included five species and one previously banded Cooper's Hawk (Table 5, Appendix G). The 2006 effort raises the capture total since project inception to 3,551 birds of 12 species, including 25 Sandia recaptures and 31 foreign recaptures (i.e., birds originally banded elsewhere and subsequently recaptured in the Sandias; Appendix G). Captured species included the Cooper's Hawk (76% of all captures), Sharp-shinned Hawk (17%), Peregrine Falcon (3%), Red-tailed Hawk (2%), and American Kestrel (2%).

Except for Peregrine Falcons, all 2006 species-specific capture totals, rates, and successes were below average, with mostly significant reductions shown for all commonly captured species. The measures for Peregrine Falcons stood in stark contrast to those all other species, with the capture total (5) and capture rate (1.4 birds / 100 station hrs) both significantly above average and capture success (5% of those observed) a non-significant 4% above average (Table 5). The primary cause of this year's low trapping success was unusual variation in the wind patterns, which made it more difficult to attract migrants down to the trapping arena.

Among four of the five species captured in 2006, birds with empty or nearly empty crops were far more prevalent than average (Table 5). Cooper's Hawks were the exception, but also showed at least a slight



shift toward birds with less-full crops. Moreover, all five species averaged poorer than average body condition, as measured by comparison of wing-pit fat loads and keel-muscle thickness.

### **ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS**

The 2006 captures included one previously banded Cooper's Hawk. This male was originally banded as a hatch-year bird in 2003 at HWI's fall-migration site in the nearby Manzano Mountains. This is the 43 exchange of banded birds between the two sites since 1990.

Excluding encounters in the Manzano Mountains, to date 14 Sandia-banded Cooper's Hawks, 4 Sharp-shinned Hawks, 1 Red-tailed Hawk, and 1 Prairie Falcon have subsequently been encountered elsewhere.

Three new such encounters occurred since we last reported on the 2004 banding season. A female Sharp-shinned Hawk originally banded as a second-year bird in March 2003 was found dead of unknown causes in Albuquerque during November 2004. Two Cooper's Hawks were then recovered in January 2006. A male originally banded as an after-second-year adult in April 2000 was brought in injured to the Rio Grande Nature Center in Albuquerque and later died. Seven days later, a female originally banded as a second-year bird in March 2001 died when it collided with a car ~264 km southwest of the project site near Las Cruces, New Mexico.

### **RESIDENT BIRDS**

The 2006 resident raptor community included a typical assemblage for the site.

The usual resident pair of Golden Eagles (dubbed "Fred" and "Ethel", with Ethel easily identified from year to year by several white or partially white secondaries and wing/tail coverts) was present throughout the season. Fred and Ethel were routinely observed acting territorial and "escorting" other migrants through the territory. They were observed together throughout the season and were seen copulating as late as 8 April.

At least three different resident, light-morph Red-tailed Hawks (two adults and one immature-plumage second-year bird) were seen throughout the season in the Tijeras Canyon area below and south of the project site. These birds were frequently seen escorting other migrants through the area. Unlike in 2004, no obvious resident dark or rufous-morph birds were seen farther southeast over the gravel pits.

At least two probable resident Cooper's Hawks (one adult and one second-year bird) were seen regularly after 13 March. One possible resident Sharp-shinned Hawk was seen on 1 March moving southeast through the project area; unlike in some years, however, no regular pattern of local Sharp-shinned Hawk activity was documented this season.

Prairie Falcons have not been regular, or at least not readily apparent, members of the resident community for the past several years. Beginning in early March, one or two birds were seen regularly acting territorial around a plastic owl erected near the count site. Once a pair of local Peregrine Falcons arrived on the scene in mid-April, however, sightings of apparently local Prairie Falcons mostly ceased, with only one additional sighting in late April.

Beginning on 8 April, two Turkey Vultures were seen regularly patrolling the area, primarily along the ridge to the west of the project site.

### **SITE VISITATION AND PUBLIC OUTREACH**

HWI celebrated its' 20<sup>th</sup> year since incorporation in 2006 and special events were planned around the spring migration at the Sandias. A total of 481 individuals signed the site visitor log during the season, excluding numerous within-season returnees. This year's visitors hailed from 13 states (NM, AZ, CA, UT, CO, WA, FL, IN, MD, NC, GA, VA, NY) and New Zealand. Field Educator, Devon Batley, and

NM Education Intern, Jennifer Good, chaperoned 11 organized groups at the site during the season, including students from Bosque Prep School (5 classes), local Cub Scout Pack 142, a University of New Mexico (UNM) Graduate Sociology class, a high-school class from Temple Baptist School, and a special group organized around an open-house weekend that HWI hosted in April. Two unscheduled groups, one from the NM Mountain Club and another from UNM also joined the crew on-site.

Many of the groups that visited the site this season had previously participated in classroom or other community programs that HWI educators hosted in the Albuquerque area. After learning about raptor ecology and conservation through classroom presentations, many students in particular derive great benefit from a follow-up visit to the project site where they can experience live, wild raptors up close and in person before our banders release the birds to continue their migratory journey. Such experiences frequently galvanize the interest of young students to continue studying and appreciating raptors, ultimately contributing to development of a life-long passion for conservation. Aside from continuing a typical array of classroom and other community programs, this year HWI provided a series of raptor identification and ecology presentations in Albuquerque, called “Hawk Talks,” which resulted in four new visitors to the site.

In 2006, 631 hourly assessments of visitor disturbance resulted in the following ratings: 90% none, 9% low, <1% moderate, and <1% high. We consider this strong additional proof that educator Devon Batley, often assisted by a cadre of local volunteers, did an excellent job of chaperoning visitors in a way that both provided them with a rich experience and largely precluded unnecessary distraction of the observers.

Two newspaper articles were written about the project in 2006, including “Rush hour on hawk highway” by Wes Smalling of the *New Mexican*, and another article by Wally Gordon of the *Edgewood Independent*.

## **ACKNOWLEDGMENTS**

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## **LITERATURE CITED**

- Hoffman, S. W., and J. P. Smith. 2003. Population trends of migratory raptors in western North America, 1977–2001. *Condor* 105:397–419.
- Hoffman, S. W., J. P. Smith, and T. D. Meehan. 2002. Breeding grounds, winter ranges, and migratory routes of raptors in the Mountain West. *Journal of Raptor Research* 36:97–110.

**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 Sandia Mountains, NM: 1985–2005 versus 2006.**

SPECIES	COUNTS			RAPTORS / 100 HOURS <sup>1</sup>		
	1985–2005 <sup>2</sup>	2006	% CHANGE	1985–2005 <sup>2</sup>	2006	% CHANGE
Turkey Vulture	1419 ± 261.3	1151	-19	448.5 ± 81.52	316.8	-29
Osprey	65 ± 12.0	70	+8	21.1 ± 3.75	19.1	-10
Northern Harrier	58 ± 6.2	69	+19	12.9 ± 1.46	13.4	+4
White-tailed Kite	0.05 ± 0.09	0	-100	0.01 ± 0.02	0.0	-100
Mississippi Kite	0.2 ± 0.17	0	-100	0.04 ± 0.03	0.0	-100
TOTAL KITES	0.2 ± 0.23	0	-100	–	–	–
Sharp-shinned Hawk	508 ± 106.7	540	+6	119.8 ± 23.27	110.8	-8
Cooper's Hawk	772 ± 125.3	677	-12	217.6 ± 32.97	169.8	-22
Northern Goshawk	12 ± 3.1	8	-32	2.4 ± 0.62	1.4	-43
Unknown small accipiter <sup>3</sup>	12 ± 15.9	29	+142	–	–	–
Unknown large accipiter <sup>3</sup>	3 ± 2.5	9	+200	–	–	–
Unknown accipiter	68 ± 19.2	35	-49	–	–	–
TOTAL ACCIPITERS	1364 ± 191.9	1298	-5	–	–	–
Common Black Hawk	0.01 ± 0.1	0	-100	0.01 ± 0.02	0.0	-100
Broad-winged Hawk	6 ± 2.7	5	-18	1.3 ± 0.59	1.0	-28
Swainson's Hawk	54 ± 9.2	68	+25	20.0 ± 2.85	22.9	+15
Zone-tailed Hawk	2.3 ± 1.00	4	+75	0.5 ± 0.22	0.6	+36
Red-tailed Hawk	348 ± 55.4	296	-15	76.8 ± 10.45	55.1	-28
Ferruginous Hawk	12 ± 2.0	6	-51	2.6 ± 0.44	1.1	-59
Rough-legged Hawk	0.5 ± 0.29	0	-100	0.2 ± 0.12	0.0	-100
Unidentified buteo	11 ± 4.2	20	+74	–	–	–
TOTAL BUTEOS	435 ± 65.4	399	-8	–	–	–
Golden Eagle	366 ± 70.5	351	-4	71.9 ± 12.77	58.8	-18
Bald Eagle	15 ± 3.6	7	-52	4.0 ± 0.91	1.8	-55
Unidentified eagle	0.7 ± 0.55	0	-100	–	–	–
TOTAL EAGLES	381 ± 72.6	358	-6	–	–	–
American Kestrel	205 ± 38.8	181	-12	52.3 ± 9.19	41.1	-21
Merlin	10 ± 3.2	22	+129	2.1 ± 0.69	3.7	+74
Prairie Falcon	24 ± 4.3	47	+100	4.6 ± 0.81	8.3	+81
Peregrine Falcon	42 ± 12.4	97	+132	8.3 ± 2.42	16.9	+103
Aplomado Falcon	0.05 ± 0.09	0	-100	0.01 ± 0.02	0.0	-100
Unknown small falcon <sup>3</sup>	1.4 ± 2.7	1	-29	–	–	–
Unknown large falcon <sup>3</sup>	1.2 ± 1.4	4	+233	–	–	–
Unknown falcon	2 ± 1.0	3	+31	–	–	–
TOTAL FALCONS	283 ± 49.7	355	+25	–	–	–
Unidentified raptor	42 ± 14.8	9	-78	–	–	–
GRAND TOTAL	4047 ± 558.1	3709	-8	–	–	–

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

<sup>2</sup> Mean ± 95% CI.

<sup>3</sup> Designations used regularly for the first time in 2002.

**Table 2. Annual raptor migration counts by age classes and immature (second-year birds for most species, all non-adults for eagles) : adult age ratios for selected species in the Sandia Mountains, NM: 1990–2005 versus 2006.**

	TOTAL AND AGE-CLASSIFIED COUNTS						IMM. : ADULT			
	1990–2005 AVERAGE			2006			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	AD.	TOTAL	IMM.	AD.	1990–2005 <sup>1</sup>	2006	1990–2005 <sup>1</sup>	2006
Northern Harrier	57	11	30	69	13	35	29 ± 5.3	30	0.45 ± 0.215	0.37
Sharp-shinned Hawk	508	57	267	540	61	402	36 ± 4.3	14	0.24 ± 0.074	0.15
Cooper's Hawk	798	74	498	677	81	497	30 ± 6.1	15	0.18 ± 0.081	0.16
Northern Goshawk	12	3	6	8	2	4	22 ± 9.7	25	0.94 ± 0.722	0.50
Broad-winged Hawk	7	0.4	5	5	0	3	24 ± 11.8	40	0.22 ± 0.265	0.00
Red-tailed Hawk	379	59	256	296	67	205	16 ± 3.4	8	0.25 ± 0.068	0.33
Ferruginous Hawk	13	1	5	6	2	4	48 ± 11.3	0	0.76 ± 0.735	0.50
Golden Eagle	384	182	121	351	95	237	22 ± 8.3	5	1.69 ± 0.511	0.40
Bald Eagle	14	7	6	7	4	3	9 ± 7.1	0	1.43 ± 0.484	1.33
Peregrine Falcon	52	12	29	97	23	51	20 ± 6.8	24	0.44 ± 0.125	0.45

<sup>1</sup> Mean ± 95% confidence interval. 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 long-term average numbers of immature and adult birds. 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 Sandia Mountains, NM in 2006 with a comparison of 2006 and 1985–2005 average median passage dates.**

SPECIES	2006				1985–2005
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES <sup>1</sup>	MEDIAN PASSAGE DATE <sup>2</sup>	MEDIAN PASSAGE DATE <sup>2,3</sup>
Turkey Vulture	16-Mar	4-May	25-Mar – 12-Apr	1-Apr	04-Apr ± 1.3
Osprey	24-Mar	5-May	31-Mar – 21-Apr	10-Apr	13-Apr ± 1.7
Northern Harrier	3-Mar	3-May	14-Mar – 22-Apr	3-Apr	06-Apr ± 1.9
Sharp-shinned Hawk	24-Feb	5-May	25-Mar – 24-Apr	14-Apr	19-Apr ± 2.1
Cooper's Hawk	26-Feb	5-May	27-Mar – 24-Apr	8-Apr	11-Apr ± 1.0
Northern Goshawk	28-Mar	27-Apr	28-Mar – 27-Apr	19-Apr	04-Apr ± 5.2
Broad-winged Hawk	8-Mar	2-May	8-Mar – 2-May	20-Apr	23-Apr ± 3.0
Swainson's Hawk	29-Mar	4-May	4-Apr – 27-Apr	13-Apr	17-Apr ± 1.6
Red-tailed Hawk	26-Feb	5-May	10-Mar – 25-Apr	29-Mar	25-Mar ± 1.2
Ferruginous Hawk	27-Feb	25-Apr	27-Feb – 25-Apr	8-Mar	19-Mar ± 5.5
Golden Eagle	26-Feb	5-May	28-Feb – 14-Apr	15-Mar	21-Mar ± 3.6
Bald Eagle	25-Feb	14-Mar	25-Feb – 14-Mar	1-Mar	08-Mar ± 4.0
American Kestrel	24-Feb	5-May	27-Mar – 22-Apr	9-Apr	12-Apr ± 1.7
Merlin	6-Mar	5-May	8-Mar – 2-May	10-Apr	08-Apr ± 4.2
Prairie Falcon	24-Feb	4-May	5-Mar – 10-Apr	28-Mar	19-Mar ± 3.7
Peregrine Falcon	26-Feb	4-May	15-Mar – 23-Apr	11-Apr	12-Apr ± 3.0
All species	24-Feb	5-May	16-Mar – 22-Apr	4-Apr	06-Apr ± 1.4

<sup>1</sup> Dates between which the central 80% of the flight passed the lookout; calculated only for species with counts ≥5 birds.

<sup>2</sup> Date by which 50% of the flight passed the lookout; calculated only for species with counts ≥5 birds.

<sup>3</sup> Mean of annual values ± 95% confidence interval in days; calculated using only data for years with counts ≥5 birds.

**Table 4. Capture totals, rates, and successes for migrating raptors in the Sandia Mountains, NM, excluding Lower Station capture results from 1998 and 1999: 1990–2004<sup>4</sup> versus 2006.**

SPECIES	CAPTURE TOTALS		CAPTURE RATE <sup>1</sup>		% CAPTURE SUCCESS <sup>2</sup>	
	1990–2004 <sup>3</sup>	2006	1990–2004 <sup>3</sup>	2006	1990–2004 <sup>3</sup>	2006
Northern Harrier	1 ± 0.6	0	0.2 ± 0.18	0.0	1.0 ± 0.94	0.0
Sharp-shinned Hawk	48 ± 21.5	31	14.6 ± 5.33	8.5	8.6 ± 1.74	5.5
Cooper's Hawk	164 ± 34.1	141	54.7 ± 10.45	38.5	20.8 ± 5.24	19.6
Northern Goshawk	2 ± 0.6	0	0.6 ± 0.27	0.0	14.4 ± 7.32	0.0
Broad-winged Hawk	0.1 ± 0.14	0	0.0 ± 0.06	0.0	1.8 ± 3.50	0.0
Swainson's Hawk	0.3 ± 0.25	0	0.1 ± 0.08	0.0	0.5 ± 0.48	0.0
Red-tailed Hawk	8 ± 3.0	4	2.9 ± 1.01	1.1	2.2 ± 0.79	1.3
Zone-tailed Hawk	0.1 ± 0.19	0	0.0 ± 0.06	0.0	8.3 ± 11.16	0.0
American Kestrel	7 ± 4.1	4	2.2 ± 1.09	1.1	2.9 ± 1.39	2.2
Merlin	1 ± 0.6	0	0.3 ± 0.18	0.0	5.6 ± 3.84	0.0
Prairie Falcon	2 ± 0.8	0	0.5 ± 0.23	0.0	7.8 ± 4.10	0.0
Peregrine Falcon	2 ± 1.2	5	0.8 ± 0.37	1.4	4.8 ± 2.53	5.0
Total	234 ± 56.0	185	76.8 ± 14.37	50.5	9.4 ± 2.01	7.7

<sup>1</sup> Captures / 100 station hours.

<sup>2</sup> 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.

<sup>3</sup> Mean of annual values ± 95% confidence interval.

<sup>4</sup> No trapping and banding occurred in 2005.

**Table 5. Comparisons by species of crop-fullness, wing-pit-fat, and keel-muscle-thickness ratings for migrating raptors trapped in the Sandia Mountains, NM: 1991–2004<sup>4</sup> versus 2006.**

SPECIES	PERIOD	CROP <sup>1,2</sup>					KEEL MUSCLE <sup>1,3</sup>			WING-PIT FAT <sup>1,4</sup>			
		EMPTY	1/4	1/2	3/4	FULL	0	1	2	0	1	2	3
Sharp-shinned Hawk	1991–04 avg	73	7	6	5	10	2	53	46	4	21	40	35
Hawk	2006	81	19	0	0	0	3	77	19	0	45	39	16
Cooper’s Hawk	1991–04 avg	87	4	3	2	3	5	66	30	7	31	30	33
Hawk	2006	90	4	4	1	0	4	78	18	7	33	37	23
Red-tailed Hawk	1991–04 avg	92	1	6	0	0	18	72	10	57	37	5	1
Hawk	2006	100	0	0	0	0	50	50	0	25	75	0	0
American Kestrel	1991–04 avg	95	5	0	0	0	1	67	32	7	23	30	40
Kestrel	2006	100	0	0	0	0	25	75	0	0	75	0	25
Peregrine Falcon	1991–04 avg	85	8	2	2	3	8	50	42	39	33	21	8
Falcon	2006	100	0	0	0	0	20	80	0	60	40	0	0

<sup>1</sup> Values are percentages of birds trapped.

<sup>2</sup> Subjective visual and tactile assessment of relative crop fullness.

<sup>3</sup> Subjective visual and tactile assessment of the relative thickness of the keel muscle, with 0 = skinny – “sharp” keel bone; 1 = average – moderately padded keel bone; and 2 = robust – keel bone solidly padded with muscle.

<sup>4</sup> Subjective visual assessment of the relative volume of fat deposited in the “wing-pit” area, with 0 = none; 1 = light deposit; 2 = moderate deposit – wing pit approaching or more than half full; and 3 = heavy deposit – bulging from wing-pit area.

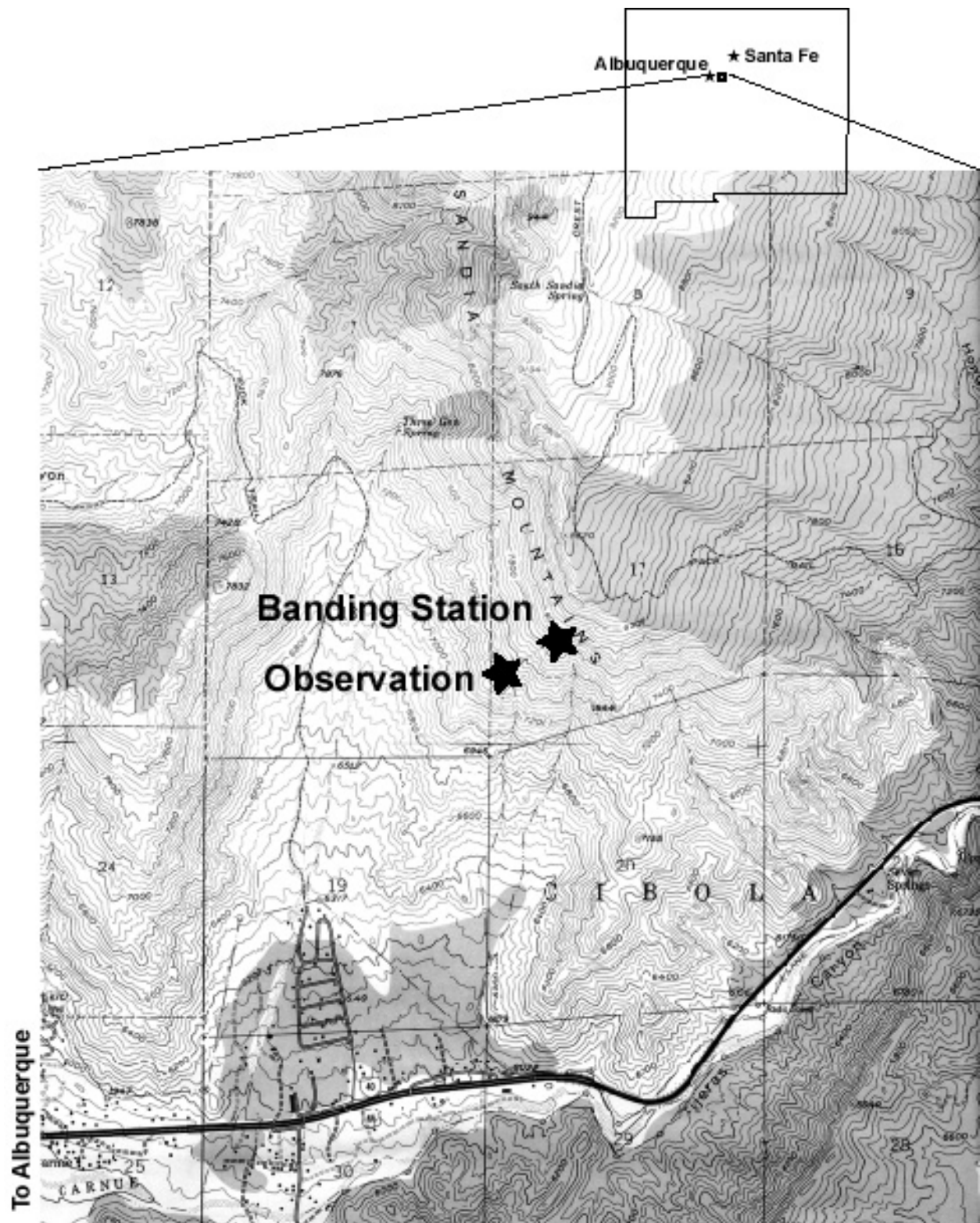
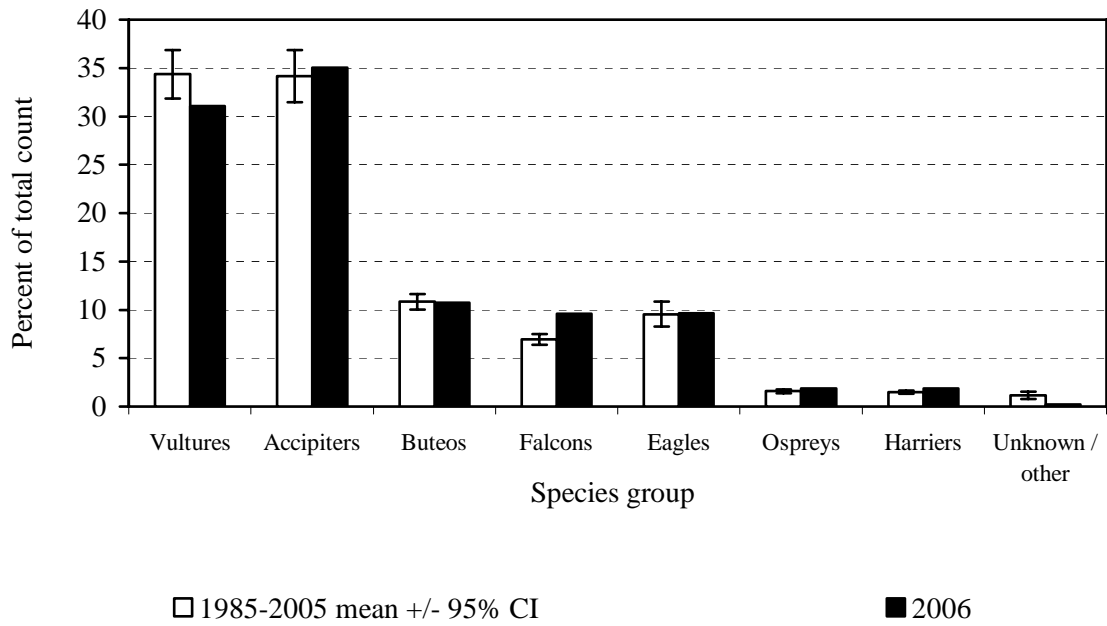
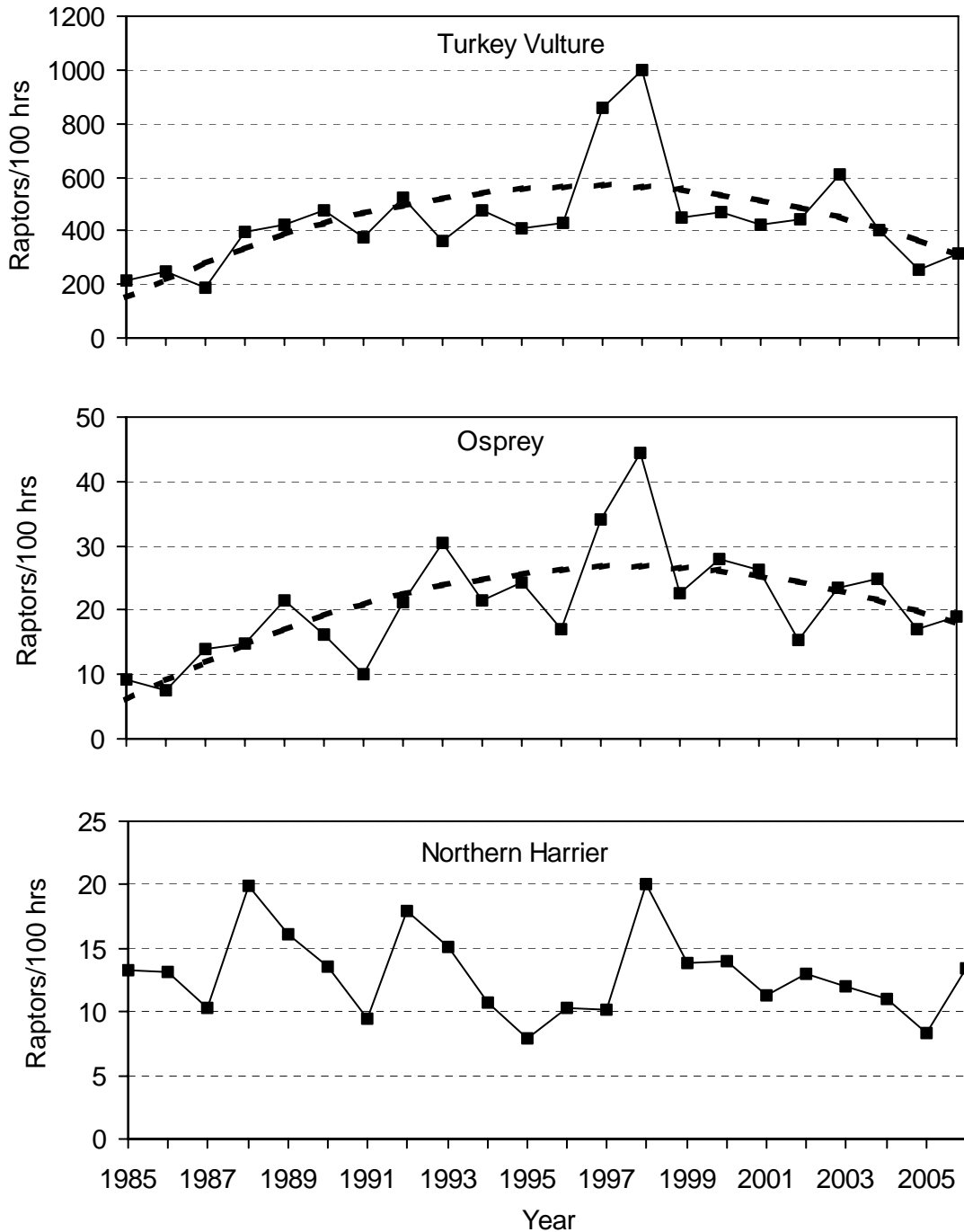


Figure 1. Map of Sandia Mountains Raptor Migration Project study site.





**Figure 2. Spring raptor-migration flight composition by major species groups in the Sandia Mountains, NM: 1985–2005 versus 2006.**



**Figure 3. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers in the Sandia Mountains, NM: 1985–2006. Dashed lines indicate significant ( $P \leq 0.10$ ) linear or quadratic regressions.**

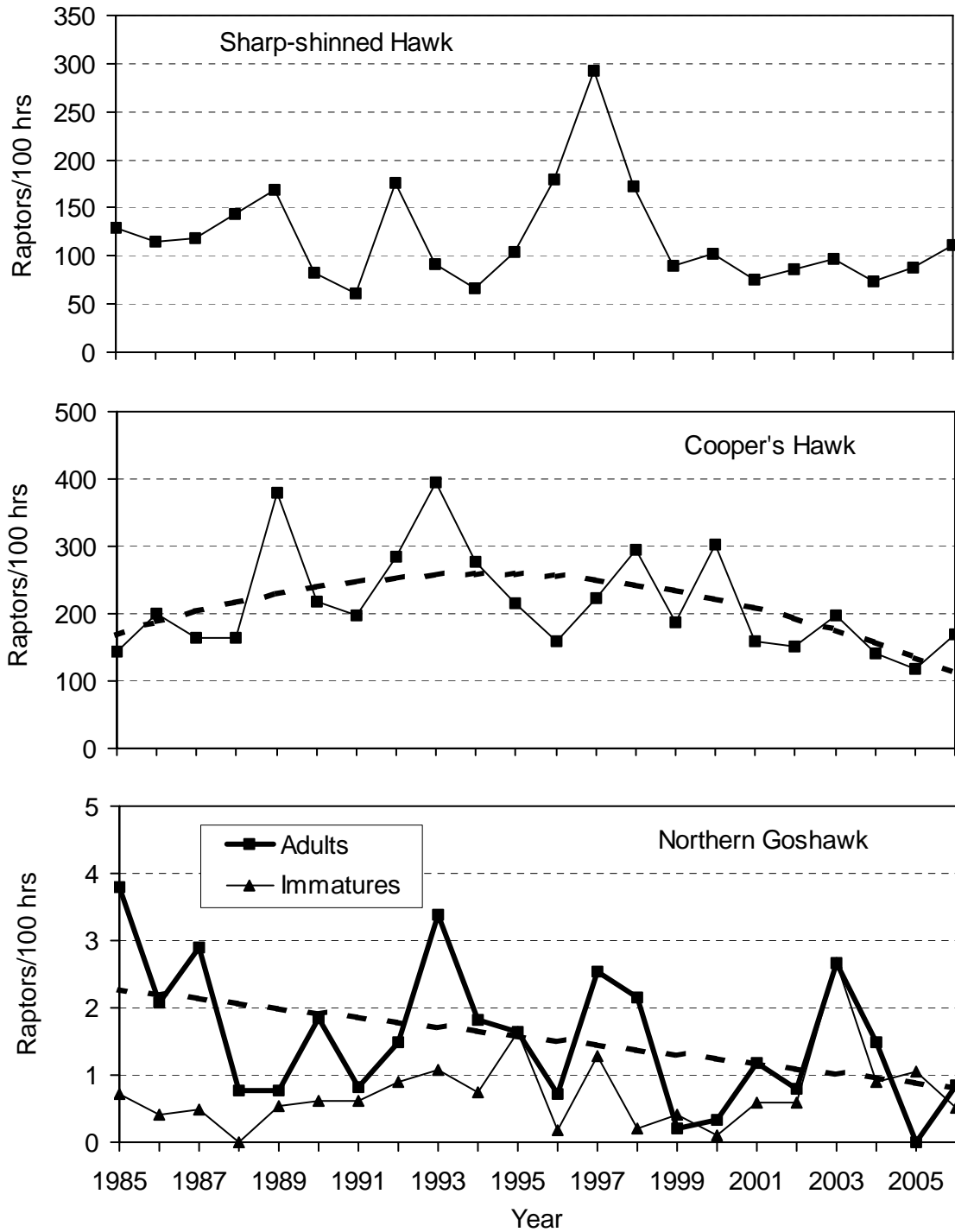
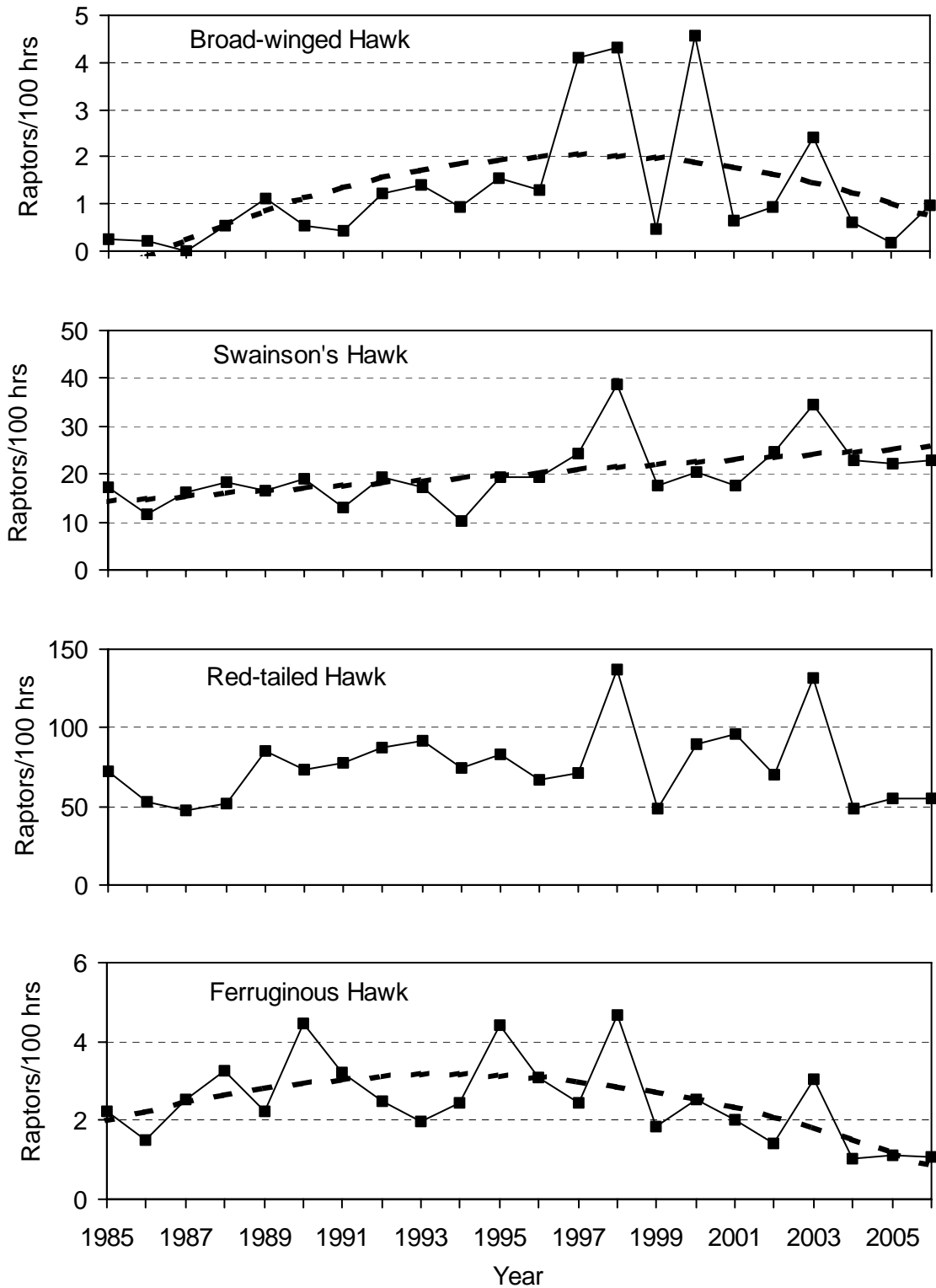
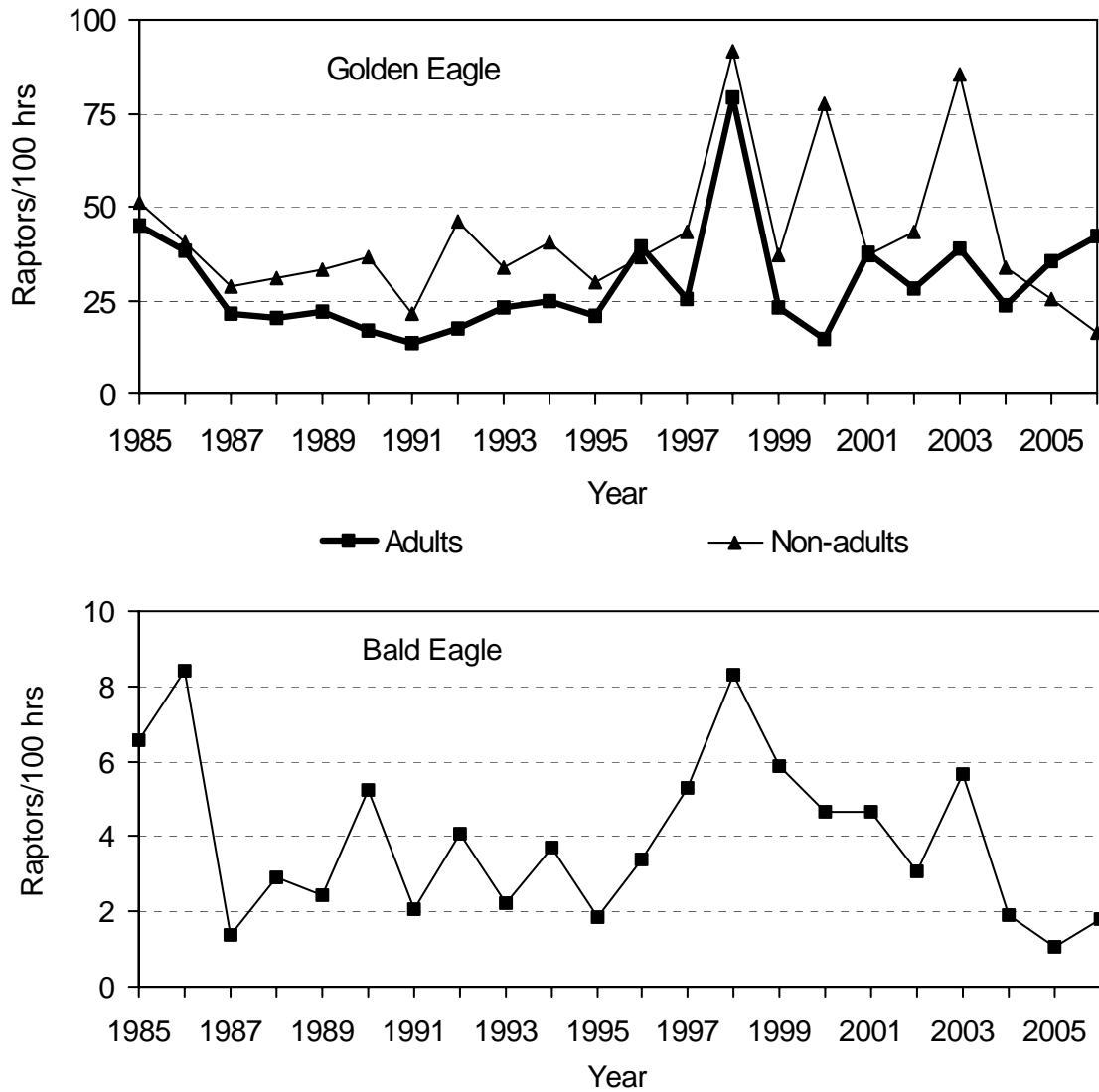


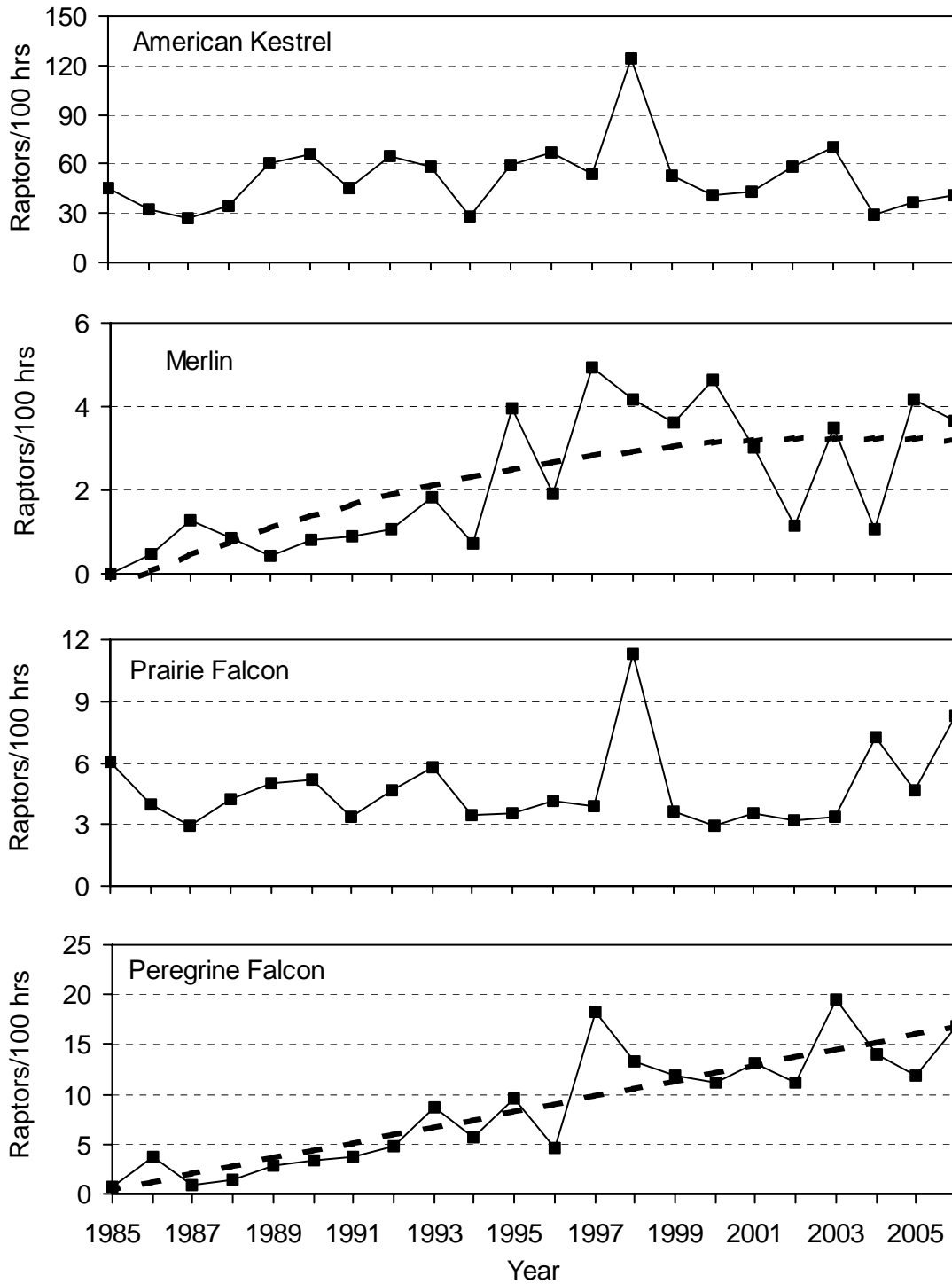
Figure 4. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks in the Sandia Mountains, NM: 1985–2006. Dashed lines indicate significant ( $P \leq 0.10$ ) linear or quadratic regressions.



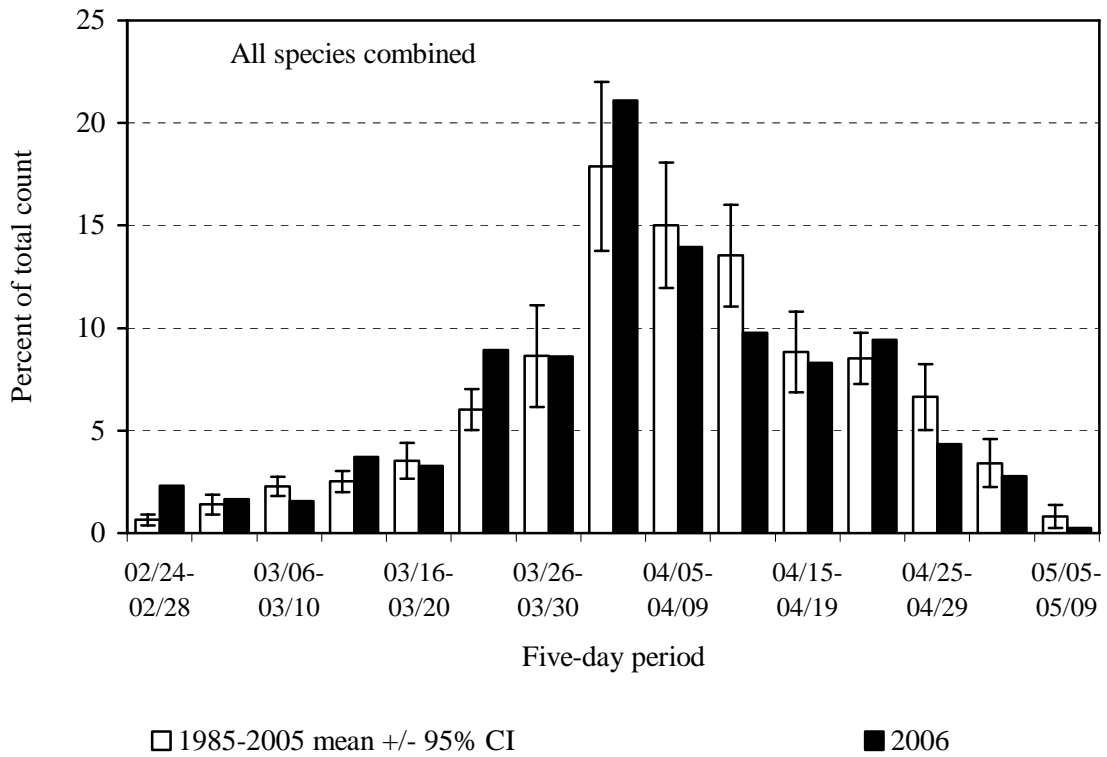
**Figure 5. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Broad-winged, Swainson's, Red-tailed, and Ferruginous Hawks in the Sandia Mountains, NM: 1985–2006. Dashed lines indicate significant ( $P \leq 0.10$ ) linear or quadratic regressions.**



**Figure 6.** Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Golden and Bald Eagles in the Sandia Mountains, NM: 1985–2006. Dashed lines indicate significant ( $P \leq 0.10$ ) linear or quadratic regressions.



**Figure 7. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons in the Sandia Mountains, NM: 1985–2006. Dashed lines indicate significant ( $P \leq 0.10$ ) linear or quadratic regressions.**



**Figure 8. Combined-species, spring-migration passage volume by five-day periods for raptors in the Sandia Mountains, NM: 1985–2005 versus 2006.**

**Appendix A. History of official observer participation in the Sandia Mountains Raptor Migration Project: 1985–2006.**

- 1985 Single observer throughout: Jim Daly–primary (1), Penny Rodefer (0)<sup>1</sup>
- 1986 Single observer throughout: Jim Daly (3)
- 1987 Single observer throughout, rotating crew: LisaBeth Daly (2), Tom Davis (0), Bill Howe (0), Gordon Vickrey (0), Ann Cole (0)
- 1988 Single observer throughout: Gordon Vickrey (1)
- 1989 Single observer throughout, two observers during 30-day peak period: Rick Watson–primary (0), Rich Besser (0), Ann Cole (1), LisaBeth Daly (2), Gordon Vickrey (3)
- 1990 Single observer throughout, two observers during 30-day peak period: LisaBeth Daly–primary (3), Joe Kelly (0)
- 1991 Single observer throughout, two observers during 30-day peak period: LisaBeth Daly–primary (4), Eric Meyer (0)
- 1992 Two observers throughout: LisaBeth Daly (5), Mark Cantrell (1), Eric Meyer (2)
- 1993 Two observers throughout: LisaBeth Daly (6), Jessie Jewell (1), Daniel Perry (1)
- 1994 Two observers throughout: Jessie Jewell (3), Daniel Perry (3)
- 1995 Two observers throughout: Jessie Jewell (5), Tim Meehan (0), Sherry Swanson (0)
- 1996 Two observers throughout: Jessie Jewell (7), Sherry Swanson (1), Aaron Barna (0)
- 1997 Two observers throughout: Aaron Barna (2), Sean O’Connor (3)
- 1998 Two observers throughout: Jerry Liguori (11), Brian Sullivan (10)
- 1999 Two observers throughout: Jason Beason (3), Nikos Vulgares (2)
- 2000 Two observers throughout: Nikos Vulgares (3), Sue Vulgares (1)
- 2001 Two observers throughout: Craig Fosdick (4), Allison Cebula Benedict (0)
- 2002 Two observers throughout: Craig Fosdick (6; full season), Geoff Evans (1; first two weeks and later substitute), Rigo Mendoza-Rebolledo (2; full-time after first two weeks)
- 2003 Two observers throughout: Bob Diebold (4), Teresa Lorenz (1)
- 2004 Two observers throughout: Ken Babcock (1), Dane Ferrell (1)
- 2005 Two observers throughout: Ken Babcock (3), Eileen Müller (1), Octavio Cruz (2)
- 2006 Two observers throughout: Alberto Martinez (3), Ingrid Verhoeckx (0), and Ken Babcock (4; substitute throughout)

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<sup>1</sup> Numbers in parentheses indicate previous full seasons of raptor migration 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 spring migration in the Sandia Mountains, NM.**

COMMON NAME	SCIENTIFIC NAME	SPECIES CODE	AGE <sup>1</sup>	SEX <sup>2</sup>	COLOR MORPH <sup>3</sup>
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
White-tailed Kite	<i>Elanus caeruleus</i>	WK	U	U	NA
Mississippi Kite	<i>Ictinia mississippiensis</i>	MK	A I U	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
Common Black Hawk	<i>Buteogallus anthracinus</i>	CB	A I 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 <sup>4</sup>	U	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BE	I, S1, S2, NA, A, U <sup>5</sup>	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
Aplomado Falcon	<i>Falco femoralis</i>	AF	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

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

<sup>2</sup> Sex codes: M = male, F = female, U = unknown.

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

<sup>4</sup> 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 or older immature: 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.

<sup>5</sup> 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 Sandia Mountains Raptor Migration Project: 2006.**

DATE	OBS. HOURS	OBSRVR / HOUR <sup>1</sup>	MEDIAN	PREDOMINANT WEATHER <sup>3</sup>	WIND		TEMP (°C) <sup>1</sup>	BAROM.	MEDIAN	VISIB.	VISIB.	MEDIAN	BIRDS / HOUR
			VISITOR DISTURB <sup>2</sup>		SPEED (KPH) <sup>1</sup>	WIND DIRECTION		PRESS. (IN HG) <sup>1</sup>	THERMAL LIFT <sup>4</sup>	WEST (KM) <sup>1</sup>	EAST (KM) <sup>1</sup>	FLIGHT DISTANCE <sup>5</sup>	
24-Feb	9.00	2.9	0	pc-clr, am fog	4.7	nnw, calm-var.	17.0		1	20	100	3	9.00
25-Feb	9.00	2.0	0	clr	6.8	calm-var.	18.2		1	20	100	2	9.00
26-Feb	9.00	2.9	0	mc-ovc	4.2	nw	19.4		3	20	100	2	9.00
27-Feb	9.00	2.0	0	clr-mc	9.6	wnw	19.5		2	20	100	2	9.00
28-Feb	9.00	2.1	0	pc-mc	14.7	wnw	19.2		3	20	100	2	9.00
1-Mar	9.00	2.0	0	pc-ovc	15.1	w-wnw	15.4		3	20	100	2	9.00
2-Mar	9.00	2.6	0	pc-mc	6.6	e-ese	18.5	30.11	3	20	100	2	9.00
3-Mar	9.00	3.0	0	mc-ovc	9.4	e-ese	17.4	30.08	3	20	100	2	9.00
4-Mar	9.00	2.0	0	mc	4.7	ws, w	16.9	30.03	3	20	100	1	9.00
5-Mar	9.00	2.3	0	clr-pc	2.7	w, wnw	18.9	30.27	3	20	100	1	9.00
6-Mar	9.00	2.0	0	pc-mc	3.0	w	23.1	30.22	2	20	100	2	9.00
7-Mar	9.00	2.0	0	ovc	4.1	w, wnw	14.8	30.03	4	20	100	2	9.00
8-Mar	9.00	2.0	0	mc-ovc	18.7	w, wnw	9.0	29.58	4	20	100	1	9.00
9-Mar	9.00	2.0	0	ovc	12.7	w	3.6	29.56	4	19	96	1	9.00
10-Mar	9.00	2.0	0	pc-ovc, pm snow	15.8	w	9.7	29.47	4	20	93	1	9.00
11-Mar	9.00	2.6	0	ovc, scat snow	7.5	w, se	4.6	29.63	4	20	100	2	9.00
12-Mar	0.00			snow – weather day									0.00
13-Mar	9.00	2.0	0	clr	14.1	nw	0.0		3	20	100	2	9.00
14-Mar	9.50	2.8	0	clr-mc	2.8	calm-var.	11.3		3	20	100	2	9.50
15-Mar	8.75	2.1	0	clr-mc	13.5	w	14.9		3	20	100	1	8.75
16-Mar	9.00	2.6	1	clr-pc	2.1	ese	14.2		2	20	100	2	9.00
17-Mar	9.00	2.0	0	ovc	5.7	ese	14.5		3	20	100	2	9.00
18-Mar	9.00	2.9	0	ovc	18.7	se	10.3		4	20	100	2	9.00
19-Mar	9.25	2.8	0	mc-ovc, scat snow	4.9	calm, se, sw	8.9		4	12	8	1	9.25
20-Mar	2.67	3.0	0	clr, ovc, scat snow	28.2	nw	-2.0		4	20	100	1	2.67
21-Mar	9.00	2.4	0	ovc, scat snow	5.0	se	12.1		2	20	100	1	9.00
22-Mar	1.00	2.0	0	pc-mc, haze	43.7	calm-var.	-5.0		4	0	0	-	1.00
23-Mar	9.00	2.0	1	clr-pc	2.5	nw	9.9		3	20	80	2	9.00
24-Mar	9.00	3.4	1	pc-mc	4.8	se, nw	13.3		2	20	100	2	9.00
25-Mar	9.67	3.1	0	pc-ovc	0.6	w-wnw	16.1		2	20	100	3	9.67
26-Mar	9.00	4.0	1	mc-ovc	20.6	ese, nw, calm	16.2	29.96	2	20	100	1	9.00
27-Mar	9.00	2.0	0	ovc	2.0	ese, nw, calm	16.1	30.18	4	20	100	2	9.00
28-Mar	9.00	2.0	0	mc-ovc	3.5	calm-var.	12.7	30.15	4	20	100	2	9.00
29-Mar	9.00	2.0	0	pc-mc	6.8	nw	17.5	29.95	3	20	100	2	9.00
30-Mar	9.00	2.0	0	pc-mc	24.5	se, w, nw	9.1	29.99	3	20	100	1	9.00
31-Mar	9.50	2.3	1.5	pc-ovc, scat fog/rain	4.7	calm-var.	16.3	30.14	2	20	100	2	9.50
1-Apr	9.50	3.2	0	pc-ovc, scat fog/rain	12.4	calm-var.	12.8	30.01	4	19	93	1	9.50
2-Apr	10.00	5.3	0	clr	18.6	wnw	13.3	30.17	3	20	100	1	10.00
3-Apr	9.50	2.2	0	mc-ovc	14.9	ene, calm	13.8	30.33	3	20	90	2	9.50
4-Apr	9.00	2.0	0	pc-ovc	6.7	w-wnw	20.2	30.21	3	20	100	2	9.00
5-Apr	9.00	2.0	0	pc-ovc, scat rain/snow	6.2	w-nw, se	14.8	29.95	4	16	81	2	9.00
6-Apr	8.00	2.4	0	mc-ovc, am rain	21.2	w-sw	2.7	29.76	4	20	100	1	8.00
7-Apr	9.50	2.8	0	clr	13.7	w-sw	14.1	30.05	3	20	100	1	9.50
8-Apr	10.75	4.0	0	clr	4.6	e, sw	18.4	30.27	2	20	100	2	10.75
9-Apr	10.75	3.3	0	clr-ovc, am fog	5.5	se, nw	17.2	30.09	3	15	87	2	10.75
10-Apr	9.00	2.0	0	clr-ovc	2.6	sw, nw	17.3		2	20	100	2	9.00
11-Apr	9.00	2.3	0	clr-pc	10.7	w	14.9	30.12	2	20	100	2	9.00
12-Apr	9.50	1.9	0	clr	4.5	sw-w	22.0	30.43	1	20	100	2	9.50

Appendix C. continued

DATE	OBS. HOURS	OBSRVR / HOUR <sup>1</sup>	MEDIAN	PREDOMINANT WEATHER <sup>3</sup>	WIND	TEMP (°C) <sup>1</sup>	BAROM. PRESS. (IN HG) <sup>1</sup>	MEDIAN	VISIB. WEST (KM) <sup>1</sup>	VISIB. EAST (KM) <sup>1</sup>	MEDIAN	BIRDS / HOUR	
			VISITOR DISTURB <sup>2</sup>		SPEED (KPH) <sup>1</sup>			WIND DIRECTION			THERMAL LIFT <sup>4</sup>		FLIGHT DISTANCE <sup>5</sup>
13-Apr	9.50	2.2	0	clr-mc	4.7	calm-var.	23.5	30.27	3	20	100	2	9.50
14-Apr	9.00	2.0	0	mc-ovc	8.5	se, sw-nw	18.9	30.14	3	20	100	1	9.00
15-Apr	9.67	6.3	0	clr, fog	15.3	w-nw	17.0	29.90	2	20	100	2	9.67
16-Apr	10.00	4.9	0	clr	8.8	sw-wnw	18.4	30.04	2	20	100	2	10.00
17-Apr	9.00	2.0	0	clr, pm fog	16.3	w	18.5	30.00	2	20	100	2	9.00
18-Apr	9.00	2.0	0	clr	27.8	w-wnw	11.6	30.07	3	20	100	1	9.00
19-Apr	9.00	2.1	0	clr	3.7	e, nw	19.3	30.08	2	20	100	2	9.00
20-Apr	9.00	2.0	0	pc-mc	14.1	e, nw	17.8	30.04	2	20	100	2	9.00
21-Apr	9.00	3.5	0	clr-ovc	4.0	sw-w	21.9	30.15	3	20	100	2	9.00
22-Apr	9.00	2.5	0	mc-ovc	3.6	calm-var.	20.3	30.14	3	20	100	2	9.00
23-Apr	9.75	3.0	0	clr-mc	19.9	se-s, w	22.2	30.07	3	19	97	2	9.75
24-Apr	9.00	2.0	0	clr	14.8	w	17.6	30.07	3	20	100	2	9.00
25-Apr	9.00	3.0	0	clr	7.5	e-se	18.5	30.12	2	20	100	2	9.00
26-Apr	9.00	2.0	0	clr	3.4	calm-var.	22.1	30.13	2	20	100	2	9.00
27-Apr	9.00	2.0	0	clr-ovc	6.5	calm-var.	19.9	30.04	2	20	100	2	9.00
28-Apr	7.50	1.9	0	pc-ovc, pm rain	19.0	calm, e-se	13.4	29.92	3	20	100	2	7.50
29-Apr	9.00	2.4	0	pc-ovc, am fog	6.4	calm, w-nw	11.5	30.13	4	20	69	1	9.00
30-Apr	9.67	2.5	0	clr, am fog	5.0	w-nw	18.9	30.04	3	19	96	3	9.67
1-May	9.00	1.2	0	clr-mc	1.0	calm, nw	20.1	30.24	3	20	100	2	9.00
2-May	9.00	1.6	0	clr-mc	6.7	w-nw	20.5	30.21	3	20	100	2	9.00
3-May	9.00	1.2	0	clr-ovc	4.7	w	21.5	30.15	3	20	100	2	9.00
4-May	7.50	1.0	0	clr-pc, pm haze		calm			2	20	100	2	7.50
5-May	7.00	1.0	0	mc-ovc	6.3	ese	18.7	30.09	3	20	100	2	7.00

<sup>1</sup> Average of hourly records.

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

<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> 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 spring raptor migration counts by species in the Sandia Mountains, NM: 2006.**

DATE	OBSERV.		SPECIES <sup>1</sup>																									BIRDS							
	HOURS	TV	OS	NH	WK	MK	SS	CH	NG	SA	LA	UA	CB	BW	SW	ZT	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	AF	SF	LF	UF	UU	TOTAL	/HOUR	
24-Feb	9.00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	4	0.4
25-Feb	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	4	0.4	
26-Feb	9.00	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	3	0	0	0	11	0	0	0	0	1	0	0	1	0	0	20	2.2		
27-Feb	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	6	0	0	0	0	0	0	0	0	0	0	9	1.0		
28-Feb	9.00	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0	0	0	40	2	0	0	0	1	0	0	0	0	0	49	5.4		
01-Mar	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	14	2	0	0	0	1	0	0	0	0	2	21	2.3		
02-Mar	9.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	7	0	0	1	0	0	0	0	0	0	0	12	1.3		
03-Mar	9.00	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	13	1.4		
04-Mar	9.00	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	5	0.6			
05-Mar	9.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	8	0	0	0	0	1	0	0	0	0	0	10	1.1		
06-Mar	9.00	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	7	0	0	0	7	0	0	0	1	0	0	0	0	0	0	20	2.2		
07-Mar	9.00	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	9	1.0			
08-Mar	9.00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	6	1	0	0	2	0	0	0	0	1	0	0	13	1.4		
09-Mar	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	4	0.4			
10-Mar	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5	0	0	0	5	0	0	0	0	1	0	0	0	0	0	12	1.3		
11-Mar	9.00	0	0	0	0	0	2	2	0	0	0	0	1	0	0	5	0	0	0	1	0	0	0	0	0	1	0	0	0	0	12	1.3			
12-Mar	0.00																																		
13-Mar	9.00	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3	0	0	0	21	0	0	0	0	0	0	0	0	0	0	26	2.9		
14-Mar	9.50	0	0	6	0	0	1	1	0	0	0	0	0	0	0	15	0	0	0	29	1	0	0	1	4	3	0	0	0	1	0	62	6.5		
15-Mar	8.75	0	0	0	0	0	3	1	0	0	0	0	0	0	0	18	0	0	0	12	0	0	1	0	0	3	0	0	0	0	0	38	4.3		
16-Mar	9.00	18	0	7	0	0	4	0	0	0	0	0	0	0	0	8	0	0	0	14	0	0	2	0	2	1	0	0	0	0	0	56	6.2		
17-Mar	9.00	12	0	2	0	0	5	5	0	0	0	0	0	0	0	11	1	0	0	5	0	0	3	1	0	0	0	0	0	0	0	45	5.0		
18-Mar	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	1	3	0	0	0	0	1	0	0	0	0	0	9	1.0			
19-Mar	9.25	0	0	1	0	0	2	2	0	1	0	0	0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	0	0	0	10	1.1			
20-Mar	2.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0.8		
21-Mar	9.00	1	0	1	0	0	0	4	0	0	0	0	0	0	0	1	0	0	0	5	0	0	1	0	3	0	0	0	0	0	16	1.8			
22-Mar	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	0	0	0.0	
23-Mar	9.00	0	0	0	0	0	7	9	0	0	0	0	0	0	0	3	0	0	0	8	0	0	0	0	1	0	0	0	0	0	28	3.1			
24-Mar	9.00	11	2	0	0	0	9	9	0	0	0	0	0	0	0	6	0	0	0	7	0	0	2	0	1	0	0	0	0	0	47	5.2			
25-Mar	9.67	196	0	1	0	0	5	6	0	2	0	2	0	0	0	20	0	0	2	2	0	0	1	0	1	2	0	0	0	0	240	24.8			
26-Mar	9.00	41	2	0	0	0	7	15	0	1	0	0	0	0	0	9	0	0	0	7	0	0	3	0	2	2	0	0	0	0	89	9.9			
27-Mar	9.00	37	0	4	0	0	10	13	0	0	0	0	0	0	0	5	0	0	0	6	0	0	10	0	2	3	0	0	1	0	91	10.1			
28-Mar	9.00	31	1	1	0	0	7	17	1	0	0	0	0	0	0	9	0	0	1	5	0	0	0	0	2	0	0	0	0	0	75	8.3			
29-Mar	9.00	15	1	0	0	0	6	9	0	0	0	0	0	0	1	0	3	0	0	0	1	0	0	0	2	2	0	0	0	0	40	4.4			
30-Mar	9.00	3	0	0	0	0	1	5	0	0	0	1	0	0	0	6	0	0	0	5	0	0	0	1	0	2	0	0	0	0	24	2.7			
31-Mar	9.50	204	1	4	0	0	6	20	0	0	0	0	0	0	0	3	0	0	1	10	0	0	8	1	2	1	0	0	0	0	261	27.5			
01-Apr	9.50	37	1	1	0	0	12	35	0	0	0	0	0	0	0	8	0	0	0	5	0	0	0	1	0	0	0	0	0	100	10.5				

Appendix D. continued

DATE	OBSERV.		SPECIES <sup>1</sup>																								BIRDS							
	HOURS	TV	OS	NH	WK	MK	SS	CH	NG	SA	LA	UA	CB	BW	SW	ZT	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	AF	SF	LF	UF	UU	TOTAL	/ HOUR
02-Apr	10.00	83	2	0	0	0	6	43	0	2	0	0	0	0	0	6	0	0	0	1	0	0	3	0	2	1	0	0	0	0	1	150	15.0	
03-Apr	9.50	65	2	7	0	0	5	13	0	0	0	2	0	0	4	0	2	0	0	0	7	0	0	15	0	1	3	0	0	0	0	126	13.3	
04-Apr	9.00	47	5	3	0	0	19	42	0	0	0	3	0	0	5	0	10	0	0	1	4	0	0	4	0	0	3	0	0	0	0	146	16.2	
05-Apr	9.00	110	4	4	0	0	11	31	0	0	2	2	0	0	0	12	0	0	1	0	0	0	10	0	1	2	0	0	0	0	0	190	21.1	
06-Apr	8.00	4	1	0	0	0	5	4	0	0	0	0	0	0	0	2	0	0	0	4	0	0	1	0	0	2	0	0	0	0	0	23	2.9	
07-Apr	9.50	41	1	0	0	0	14	16	0	0	0	1	0	0	0	2	0	0	0	5	0	0	1	0	0	1	0	0	0	0	1	83	8.7	
08-Apr	10.75	3	1	0	0	0	30	28	1	1	1	10	0	0	1	0	2	0	0	9	11	0	0	17	0	8	5	0	0	1	0	129	12.0	
09-Apr	10.75	23	7	3	0	0	5	22	0	4	0	0	0	0	6	0	3	0	0	0	2	0	0	11	1	1	4	0	0	0	0	1	93	8.7
10-Apr	9.00	3	10	0	0	0	23	15	0	1	1	3	0	0	5	0	4	0	0	0	1	0	0	1	1	1	2	0	0	0	0	0	71	7.9
11-Apr	9.00	11	0	0	0	0	13	9	0	0	0	0	0	0	2	0	0	0	0	0	4	0	0	0	0	2	6	0	0	0	0	0	47	5.2
12-Apr	9.50	41	2	2	0	0	17	19	1	0	0	0	0	0	9	1	4	0	0	1	4	0	0	9	0	0	0	1	0	0	0	111	11.7	
13-Apr	9.50	5	0	1	0	0	10	22	0	2	3	0	0	0	7	0	7	0	0	0	2	0	0	6	1	0	1	0	0	0	2	69	7.3	
14-Apr	9.00	0	2	2	0	0	25	14	0	0	0	1	0	0	2	0	1	1	0	0	5	0	0	4	0	0	7	0	0	0	0	64	7.1	
15-Apr	9.67	8	3	0	0	0	22	12	0	0	0	3	0	0	0	6	0	0	1	1	0	0	0	0	0	6	0	0	0	0	2	64	6.6	
16-Apr	10.00	14	1	1	0	0	22	27	0	1	0	2	0	0	2	1	4	0	0	0	3	0	0	1	0	0	4	0	0	0	0	83	8.3	
17-Apr	9.00	5	2	1	0	0	23	16	0	0	0	0	0	0	2	0	2	0	0	0	5	0	0	3	0	0	6	0	0	0	0	65	7.2	
18-Apr	9.00	2	5	0	0	0	18	11	0	0	0	0	0	0	0	4	0	0	0	7	0	0	2	0	0	2	0	0	0	0	0	51	5.7	
19-Apr	9.00	0	1	4	0	0	6	12	1	1	0	0	0	0	2	0	1	0	0	0	1	0	0	15	0	0	1	0	0	0	0	45	5.0	
20-Apr	9.00	5	3	2	0	0	34	24	1	0	0	0	0	1	0	1	4	0	0	0	2	0	0	11	1	0	2	0	0	0	0	91	10.1	
21-Apr	9.00	8	3	2	0	0	30	31	0	1	0	3	0	0	3	0	4	0	0	0	2	0	0	7	0	0	3	0	0	0	2	99	11.0	
22-Apr	9.00	1	1	5	0	0	33	27	0	0	0	0	0	0	3	1	11	0	0	0	3	0	0	9	2	0	2	0	0	0	0	98	10.9	
23-Apr	9.75	9	2	0	0	0	6	9	0	4	0	1	0	1	1	0	3	0	0	1	0	0	0	0	1	2	0	0	0	0	0	40	4.1	
24-Apr	9.00	0	0	0	0	0	4	9	0	0	0	0	0	0	0	5	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	22	2.4	
25-Apr	9.00	33	1	2	0	0	15	18	1	0	0	0	0	0	1	0	6	1	0	0	1	0	0	5	1	0	1	0	0	0	0	86	9.6	
26-Apr	9.00	0	0	0	0	0	8	9	0	0	0	1	0	0	3	0	1	0	0	0	1	0	0	2	0	0	0	0	0	0	0	25	2.8	
27-Apr	9.00	13	1	0	0	0	6	7	2	0	0	0	0	0	3	0	3	0	0	0	1	0	0	3	0	0	1	0	0	0	0	40	4.4	
28-Apr	7.50	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.5	
29-Apr	9.00	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	6	0.7	
30-Apr	9.67	2	0	0	0	0	1	6	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	14	1.4	
01-May	9.00	1	0	0	0	0	4	2	0	2	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	14	1.6	
02-May	9.00	0	0	0	0	0	9	8	0	0	0	0	0	1	1	0	5	0	0	0	2	0	0	3	1	0	0	0	0	0	0	30	3.3	
03-May	9.00	0	0	1	0	0	6	5	0	0	0	0	0	0	2	0	4	0	0	0	2	0	0	2	1	0	1	0	0	0	0	24	2.7	
04-May	7.50	8	0	0	0	0	0	1	0	4	1	0	0	0	1	0	3	0	0	0	0	0	0	1	0	1	1	0	0	0	0	21	2.8	
05-May	7.00	0	1	0	0	0	2	1	0	0	0	0	0	0	0	2	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	9	1.3	
Total	621.42	1151	70	69	0	0	540	677	8	29	9	35	0	5	68	4	296	6	0	20	351	7	0	181	22	47	97	0	1	4	3	9	3709	6.0

<sup>1</sup> See Appendix B for explanations of species codes.

**Appendix E. Annual observation effort and raptor migration counts by species (unadjusted data) in the Sandia Mountains, NM: 1985–2006.**

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Mean
Start date	17-Feb	11-Feb	15-Feb	16-Feb	2-Mar	24-Feb	14-Feb	11-Feb	7-Feb	19-Feb	22-Feb	25-Feb	10-Feb	24-Feb	24-Feb	23-Feb	22-Feb	22-Feb	22-Feb	26-Feb	24-Feb	24-Feb	14-Dec
End date	13-May	9-May	10-May	9-May	30-Apr	6-May	10-May	11-May	5-May	5-May	5-May	5-May	7-May	5-May	3-May	5-May	5-May	3-May	5-May	5-May	8-May	5-May	28-Feb
Days of observation	73	78	69	65	56	61	83	84	75	69	67	68	70	68	66	67	67	67	69	65	73	70	70
Hours of observation	540.28	581.47	501.40	452.57	459.92	411.33	614.00	601.08	582.50	511.17	524.17	604.75	551.33	547.00	516.92	476.50	543.17	527.75	590.00	552.92	611.51	621.42	541.96
Raptors / 100 hours	518.2	535.2	467.9	642.1	1011.7	799.4	542.5	889.7	829.2	736.0	707.8	762.5	1103.5	1430.7	688.9	832.7	685.1	624.0	937.8	586.2	508.7	596.9	746.6
SPECIES	RAPTOR COUNTS																						
Turkey Vulture	641	814	559	1070	1380	1322	1246	1785	1327	1463	1217	1552	2531	3245	1427	1305	1328	1227	2128	1285	921	1151	1407
Osprey	27	24	39	38	64	38	34	70	100	67	71	62	103	138	67	76	81	38	79	77	64	70	65
Northern Harrier	55	59	42	71	72	50	46	85	75	46	35	55	47	94	62	56	52	55	59	55	44	69	58
White-tailed Kite	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mississippi Kite	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
TOTAL KITES	0	0	2	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Sharp-shinned Hawk	473	476	435	498	664	283	294	807	428	280	448	905	1280	772	386	391	311	337	459	372	390	540	509
Cooper's Hawk	454	709	521	498	1277	620	718	1050	1562	956	771	655	836	1157	670	922	556	506	797	561	486	677	768
Northern Goshawk	22	14	14	4	6	10	7	12	24	12	16	5	18	12	3	2	9	7	31	12	8	8	12
Unknown small accipiter <sup>1</sup>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	8	6	2	44	29	15
Unknown large accipiter <sup>1</sup>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	5	7	9	4
Unknown accipiter	90	56	88	70	123	65	59	201	95	55	61	73	70	5	30	96	90	16	3	6	82	35	67
TOTAL ACCIPITERS	1039	1255	1058	1070	2070	978	1078	2070	2109	1303	1296	1638	2204	1946	1089	1411	967	875	1297	958	1017	1298	1361
Common Black-Hawk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Broad-winged Hawk	1	1	0	2	5	2	2	6	7	4	7	7	19	20	2	19	3	4	12	4	2	5	6
Swainson's Hawk	47	32	41	43	38	40	42	60	52	30	50	61	59	114	45	50	43	54	111	62	66	68	55
Zone-tailed Hawk	1	2	0	3	5	4	2	3	1	0	0	0	3	2	2	10	1	3	3	0	4	4	2
Red-tailed Hawk	280	241	183	182	357	289	353	390	461	325	377	356	338	662	220	353	451	321	663	224	282	296	346
Ferruginous Hawk	11	8	11	13	9	18	16	12	11	12	20	17	11	23	7	11	12	7	17	5	6	6	12
Rough-legged Hawk	0	2	0	1	1	0	0	0	1	0	0	0	0	1	0	1	0	1	2	0	1	0	1
Unidentified buteo	6	4	10	9	40	3	15	32	5	5	14	9	6	2	15	21	10	1	3	14	16	20	12
TOTAL BUTEOS	346	290	245	253	455	356	430	503	538	376	468	450	436	824	291	465	520	391	811	309	378	399	434
Golden Eagle	441	432	213	205	255	218	198	338	300	310	255	441	352	897	304	417	391	366	689	307	348	351	365
Bald Eagle	20	37	5	7	7	13	18	17	9	12	7	14	22	27	18	13	18	12	23	6	4	7	14
Unidentified Eagle	4	0	0	1	0	0	4	2	0	0	0	0	0	0	2	0	1	0	0	0	0	0	1
TOTAL EAGLES	465	469	218	213	262	231	220	357	309	322	262	455	374	924	324	430	410	378	712	313	352	358	380
American Kestrel	147	127	96	118	225	209	182	275	250	112	226	308	233	497	198	143	165	205	299	128	163	181	204
Merlin	0	2	5	3	2	3	4	5	9	3	18	10	24	19	15	19	14	5	17	5	20	22	10
Prairie Falcon	29	27	17	16	23	21	21	28	33	16	17	23	19	59	18	13	20	16	20	35	21	47	25
Peregrine Falcon	5	18	6	7	13	13	20	25	47	26	47	27	91	72	56	49	64	52	105	73	62	97	44
Apomado Falcon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Unknown small falcon <sup>1</sup>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	0	7	1	1
Unknown large falcon <sup>1</sup>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	3	3	4	2
Unknown falcon	2	0	5	2	5	2	5	3	3	0	0	1	7	1	4	0	6	2	0	0	0	3	2
TOTAL FALCONS	183	174	129	146	268	248	232	336	342	157	308	369	374	648	291	225	269	280	441	244	276	355	286
Unidentified raptor	44	27	54	45	82	65	45	142	29	28	53	30	14	7	10	0	94	49	6	0	58	9	40
ALL SPECIES	2800	3112	2346	2906	4653	3288	3331	5348	4830	3762	3710	4611	6084	7826	3561	3968	3721	3293	5533	3241	3111	3709	4032

<sup>1</sup> Designations used regularly for the first time in 2002.

**Appendix F. Daily trapping effort and capture totals of migrating raptors by species in the Sandia Mountains, NM: 2006.**

DATE	HOURS	SS <sup>1</sup>	CH	RT	AK	PG	TOTAL	CAPTURES/HR
13-Mar	6.00	0	0	0	0	0	0	0.0
14-Mar	7.25	0	0	0	0	0	0	0.0
15-Mar	7.50	0	0	0	0	0	0	0.0
16-Mar	6.50	2	1	0	0	0	3	0.5
17-Mar	7.25	1	0	0	0	0	1	0.1
18-Mar	5.30	0	0	0	0	0	0	0.0
19-Mar	7.50	0	1	0	0	0	1	0.1
20-Mar	0.00							
21-Mar	8.00	0	0	0	0	0	0	0.0
22-Mar	0.00							
23-Mar	6.00	0	0	0	0	0	0	0.0
24-Mar	8.00	0	3	1	0	0	4	0.5
25-Mar	8.00	1	3	1	0	0	5	0.6
26-Mar	7.00	1	6	0	0	0	7	1.0
27-Mar	7.50	0	1	0	0	0	1	0.1
28-Mar	7.50	0	4	0	0	0	4	0.5
29-Mar	8.00	0	0	1	0	0	1	0.1
30-Mar	7.25	0	0	0	0	0	0	0.0
31-Mar	8.25	1	6	0	0	0	7	0.8
1-Apr	4.75	0	6	0	0	0	6	1.3
2-Apr	7.75	0	6	0	0	0	6	0.8
3-Apr	8.00	0	2	0	0	0	2	0.3
4-Apr	8.25	0	7	0	0	0	7	0.8
5-Apr	8.00	0	3	0	1	0	4	0.5
6-Apr	4.50	0	0	0	0	0	0	0.0
7-Apr	7.50	1	6	0	0	0	7	0.9
8-Apr	8.50	1	13	0	0	1	15	1.8
9-Apr	8.00	1	7	0	1	0	9	1.1
10-Apr	7.50	1	2	0	0	0	3	0.4
11-Apr	8.25	0	3	0	0	0	3	0.4
12-Apr	8.25	0	5	0	1	0	6	0.7
13-Apr	8.00	0	6	0	0	0	6	0.8
14-Apr	8.00	0	4	0	0	2	6	0.8
15-Apr	8.00	2	5	1	0	0	8	1.0
16-Apr	8.50	0	12	0	0	0	12	1.4
17-Apr	8.00	0	4	0	0	0	4	0.5
18-Apr	7.75	0	3	0	0	0	3	0.4
19-Apr	7.50	0	3	0	1	0	4	0.5
20-Apr	7.50	2	1	0	0	0	3	0.4
21-Apr	7.00	5	4	0	0	0	9	1.3
22-Apr	7.75	1	3	0	0	0	4	0.5
23-Apr	8.00	1	0	0	0	1	2	0.3
24-Apr	8.00	0	0	0	0	0	0	0.0
25-Apr	7.50	2	3	0	0	0	5	0.7
26-Apr	8.50	3	0	0	0	0	3	0.4
27-Apr	8.00	1	4	0	0	1	6	0.8
28-Apr	6.00	0	1	0	0	0	1	0.2
29-Apr	6.00	0	0	0	0	0	0	0.0
30-Apr	7.75	1	2	0	0	0	3	0.4
1-May	7.00	2	0	0	0	0	2	0.3
2-May	7.00	1	1	0	0	0	2	0.3
<b>Total</b>	<b>363.80</b>	<b>31</b>	<b>141</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>185</b>	<b>0.5</b>

<sup>1</sup> 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 Sandia Mountains, NM: 1990–2006.**

	1990	1991	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006 <sup>4</sup>	TOTAL	MEAN
First day	21-Mar	17-Mar	14-Mar	10-Mar	10-Mar	10-Mar	10-Mar	10-Mar	10-Mar	12-Mar	10-Mar	10-Mar	16-Mar	13-Mar	12-Mar		11-Mar
Last day	8-May	7-May	3-May	26-Apr	28-Apr	29-Apr	5-May	3-May	2-May	28-Apr	27-Apr	27-Apr	21-Apr	28-Apr	2-May		29-Apr
Number of stations	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1		1
Trapping days	36	45	43	34	40	46	48	46	47	41	53	41	19	41	50	625	42
Station days	36	45	43	34	40	46	48	65	63	41	44	45	19	41	50	660	44
Station hours	249.42	269.05	300.03	235.60	319.83	372.58	377.58	486.28	453.33	278.65	314.92	320.76	115.54	309.57	366.05	4769.19	317.95
SPECIES	RAPTOR CAPTURES																
Northern Harrier	0	0	0	0	3	0	1	3	2	0	0	0	0	0	0	9	1
Sharp-shinned Hawk	21	22	33	32	44	132	139	100	56	30	28	32	4	20	31	723	48
Cooper's Hawk	83	66	211	243	197	259	195	200	165	164	206	194	48	114	141	2487	166
Northern Goshawk	2	0	1	3	2	2	4	1	0	0	1	3	2	1	0	22	1
Broad-winged Hawk	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.1
Swainson's Hawk	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	4	0.3
Red-tailed Hawk	3	3	9	16	13	16	5	9	2	3	20	8	4	7	4	122	8
Zone-tailed Hawk	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2	0.1
American Kestrel	2	0	3	2	2	26	14	22	10	5	4	14	1	1	4	110	7
Merlin	0	0	0	0	2	2	3	3	2	1	0	0	0	0	0	13	1
Prairie Falcon	0	0	1	1	2	3	3	2	0	2	5	2	0	1	0	22	1
Peregrine Falcon	1	0	0	2	6	4	7	2	2	1	4	0	2	0	5	36	2
All species	113	91	258	300	271	444	372	344	239	206	269	254	61	144	185	3551	222
Captures / 100 stn hrs	45.3	33.8	86.0	127.3	84.7	119.2	98.5	70.7	52.7	73.9	85.4	79.2	52.8	46.5	50.5	74.5	73.8
Recaptures <sup>1</sup>	0	1	1	2	3	4	2	3	3	2	4	0	0	1	0	25	2
Foreign recaptures <sup>2</sup>	0	0	2	3	0	4	2	6	5	1	3	1	1	2	1	31	2
Foreign encounters <sup>3</sup>	2	1	0	2	0	5	2	3	3	1	3	5	4	2	2	37	2

<sup>1</sup> Birds banded and later recaptured in the Sandias—totals included in capture tally above.

<sup>2</sup> Birds banded elsewhere and later recaptured in the Sandias—totals included in capture tally above.

<sup>3</sup> Birds banded in the Sandias and later recaptured or otherwise recovered elsewhere.

<sup>4</sup> No trapping and banding operations in 2005.