SPRING 2003 RAPTOR MIGRATION STUDIES IN THE SANDIA MOUNTAINS OF CENTRAL NEW MEXICO

HawkWatch International, Inc.
Salt Lake City, Utah

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INTRODUCTION

The Sandia Mountains raptor migration study 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 21 species of migratory raptors at the site, with counts typically ranging between 3,000 and 8,000 migrants per season. The 2003 season marked the 19th consecutive count and the 14th season of trapping and banding conducted at the site. This report summarizes the 2003 count and banding results.

The Sandia project was 1 of 14 long-term, annual migration counts (13 fall, 1 spring) and 1 of 7 migration banding studies (6 fall, 1 spring) conducted or co-sponsored by HWI in North America during 2003. The primary objective of these efforts is to track long-term population trends of diurnal raptors throughout primarily western North America (Hoffman and Smith 2003). Raptors feed atop food pyramids, inhabit most ecosystems, occupy large home ranges, and are sensitive to environmental contamination and other human disturbances. Therefore, they serve as important biological indicators of ecosystem health (Bildstein 2001). Moreover, due to the remoteness and widespread distribution of most raptor populations, migration counts likely represent the most cost-effective and efficient method for monitoring the regional status and trends of multiple raptor species (Bednarz and Kerlinger 1989, Titus et al. 1989, Bildstein et al. 1995, Dunn and Hussell 1995, Dixon et al. 1998, Smith and Hoffman 2000, Zalles and Bildstein 2000, Hoffman and Smith 2003).

The intensive counting and banding operations also provide valuable information about breeding and wintering distributions, migratory routes, migratory behavior, population demographics, mortality factors and longevity, morphometric variation, molt sequences and timing, and health assessments. This information enables us to better understand the life histories, ecology, status, and conservation needs of raptor populations in North America. In addition, these migration studies offer unique opportunities for the public to learn about raptors and the natural environment, and providing such opportunities is another important component of HWI's mission. Accordingly, since 1995 the Sandia field crew has included a trained educator dedicated to conducting environmental education programs at the site and facilitating interactions between visitors and the field biologists.

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′ N, 106° 26′ 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 east of the main 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

STANDARDIZED COUNTS

Two official or designated observers conducted standardized daily counts of migrating raptors from a single traditional observation site between 22 February and 5 May 2003. Before this season, primary observer Bob Diebold had four seasons of previous experience counting migratory raptors, and primary observer Teresa Lorenz had a single season of previous experience as a HWI observer (see Appendix A for a complete history of observer participation). Other experienced, local volunteers frequently assisted with the counts, including filling in on days off. Other visitors also frequently assisted with spotting migrants. Weather permitting, observations usually began between 0800 and 0900 hrs Mountain Standard Time (MST) and ended between 1700 and 1800 hrs.

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.

The observers used high quality 7–10x binoculars to assist in spotting and identifying birds. Clark and Wheeler (1987), Dunne et al. (1988), Wheeler and Clark (1995), and Clark (2001) served as primary identification references. Assessments of wind speed, cloud type, cloud cover, and flight altitude followed guidelines provided by the Hawk Migration Association of North America (HMANA). Assessments of thermal lift conditions as poor, fair, good, or excellent involved subjective evaluations of solar intensity, wind speed, and migrant behavior.

The observers classified as residents and excluded from daily counts any raptor that exhibited hunting, territorial display, or perching behaviors for extended periods. The observers occasionally recorded as migrants birds that were not moving in a southerly direction, if such birds otherwise displayed migrant characteristics; i.e., continuous flight without stopping or substantially changing directions for several kilometers. Such birds may be dispersing juveniles or adults dispersing relatively short-distances from their nesting territories to favored wintering grounds in the same general region. However, we also know from band-return studies and satellite tracking that species such as Golden Eagles, Prairie Falcons, and Ferruginous Hawks frequently "migrate" in non-standard directions to take advantage of favored post-breeding and wintering grounds (Steenhof et al. 1984, Watson and Pierce 2000, HWI unpublished data).

For purposes of examining long-term variation in annual count statistics, I manipulated the count data to standardize annual sampling periods and adjust for daily variation in observation effort. The seasonal and daily duration of observation effort can greatly affect count statistics (Hussell 1985, Kerlinger 1989, Bednarz et al. 1990), and both have varied in the Sandias during the course of the study, particularly during the first several years of observations. To generally adjust for variation in sampling effort due to inclement weather and other unforeseeable events, before analyzing population trends I converted counts to annual passage rates for each species (adjusted total count / total hours of observation for a given year * 100 = raptors/100 hrs). To further standardize seasonal sampling effort, I defined a consistent annual sample period following conventions proposed by Bednarz and Kerlinger (1989) and Bednarz et al. (1990). Specifically, I converted counts to passage rates on a daily basis (raptors/10 hours of observation) to adjust for daily variation in sampling effort, summed daily rates by Julian date across all years, and defined standardized passage periods for each species by eliminating approximately 2.5% from each extreme of the cumulative passage-rate distributions. Because entire count days must be either included or excluded, the defined sample period for a given species included between 95–100% of the detected number of migrants. For some species, the sample periods defined in this way encompassed dates earlier or later than periods of continuous observations. In these cases, I further restricted the adjusted sample periods to between mean starting and ending dates of continuous observations for 1985–2002: 24 February – 5 May.

Observers commonly identified distant or otherwise poorly observed migrants only to genus or other common non-specific groupings (e.g., unidentified eagle or buteo, which each can include multiple genera). Such identifications sometimes constituted a sizeable proportion of the birds seen, especially for accipiters, varying with observer experience and weather conditions. Excluding these birds from population trend analyses may render inaccurate assessments of true flight volume. Accordingly, prior to analyzing trends in annual passage rates, I also adjusted the daily counts by distributing incompletely identified birds across relevant species in proportion to the relative abundance of birds identified to each species that day. In this regard, beginning in fall 2001, HWI adopted a new standard for recording information about incompletely identified accipiters and falcons that should improve the accuracy of classifying incompletely identified birds for trend analysis (see Appendix B). Whenever possible, all observers now seek to classify any accipiters or falcons for which a species identification is not certain as small or large, using the simpler classifications of "unknown accipiter" or "unknown falcon" only as a last resort. For falcons, identification debates usually center on distinguishing kestrels and Merlins or prairie falcons and peregrines, and the small and large size classes distinguish which debate applied. For the accipiters, most debates concern distinguishing Sharp-shinned Hawks and Cooper's Hawks, and designation of the small size class confirms this. Occasionally, however, an observer struggles with distinguishing a large female Cooper's Hawk from a goshawk, and designation of the large size class confirms this and enables a more informed adjustment of the data before conducting trend analyses.

Hereafter, I refer to as "adjusted" any data based on counts adjusted for incompletely identified birds and/or truncated to standardized annual sampling periods.

In most cases, I limit the analyses in this report to comparing 2003 annual statistics against means ± 95% confidence intervals (CI) for previous seasons, in which case I equate significance with a 2003 value falling outside of the CI for the associated mean. I also limit most comparisons of age and sex statistics to 2003 values versus means for 1992–2002, because pre-1992 class data have not been fully computerized. To provide additional context, I refer to but do not provide in-depth details concerning analyses of long-term trends in adjusted annual passage rates (see Hoffman and Smith 2003). These analyses involved linear and quadratic regressions examining trends in annual passage rates for 1985–2003. I commonly refer to the results of these analyses as not significant ($P > 0.10$), marginally significant ($P < 0.10$), significant ($P \leq 0.05$), or highly significant ($P < 0.01$).

TRAPPING AND BANDING

This season's trapping and banding operation was accomplished solely by local volunteers and was limited to weekends and organized educational events. One to three trappers operated a single trapping station in a traditional location (Upper Station) on 19 days between mid-March and late April. Due to over-winter vandalism of the previous blind, the trappers operated from a temporary shelter this season, but deployed a typical array of traps and nets. Capture devices included mist nets, remotely triggered bow nets, and dho-gaza nets (Bloom 1987). Trappers lured migrating raptors into the capture station from a camouflaged blind using live, non-native Rock Doves (*Columba livia*; hereafter called pigeons), Ringed Turtle-doves (*Streptopelia risoria*), and House Sparrows (*Passer domesticus*) attached to lure lines manipulated from the blinds. In 2003, Upper Station consisted of 4 standard bow nets, 1 mist net, and 2 dho-gazas, with pigeon, sparrow, and dove lures used. Unless already banded, all captured birds were fitted with a uniquely numbered USGS Biological Resources Division aluminum leg band. Processors identified species, subspecies, sexes, and ages using morphological characteristics described in the U.S. Bird Banding Laboratory (BBL) Manual, Clark and Wheeler (1985), Wheeler and Clark (1995), and Hoffman et al. (1990). Processors also recorded a series of standard morphometric, health, and molt data for each bird. All birds were released usually within 15 minutes, but within a maximum of 45 minutes from the time of capture.

RESULTS AND DISCUSSION

WEATHER SUMMARY

Compared to the last five seasons, inclement weather severely hampered observations on an average number of days: 4 days entirely precluded and 2 days reduced to less than 4 hours (see Appendix C for daily weather summaries). Transitional weather and skies (i.e., conditions changed from fair to mostly cloudy or overcast during the day, or vice versa) were slightly more prevalent on active observation days compared to the last five years (33% versus 25%), whereas fair skies (47% versus 50%) and mostly cloudy to overcast weather (20% versus 25%) were slightly less common than average. However, the number of active observation days that included some rain or snow (29%) was significantly higher than the 1998–2002 average of 19%, and local wisdom confirmed that February and March, especially, were colder and wetter than usual. In addition, 77% of the active observation days featured some visibility-reducing fog or especially haze, which is considerably higher than the previous five-year average of 27%. The high prevalence of haze resulted in a noticeable reduction in average visibility, especially to the west looking towards Albuquerque (West – 66 km versus 1998–2002 average of 90 km; East – 79 versus 94 km).

In 2003, 57% of the active observation days featured predominantly light winds (<12 kph), 38% moderate winds (12–28 kph), and 6% predominantly stronger winds, which compared to the previous five seasons is substantially skewed towards moderate and to a lesser degree strong winds (1998–2002 averages of 74%, 23%, and 3%). Stronger than usual winds were particularly apparent late in the season. In the Sandias, westerly winds usually prevail, but over the last six seasons, there has been a noticeable shift from more northwesterly to more southwesterly winds. In 2003, 81% of the active observation days featured some southwesterly winds, compared to the 1998–2002 average of only 38%.

The temperature during active observation periods averaged 11.3°C (the average of daily values, which in turn were averages of hourly readings), ranging from -1.0–20.3°C, which is close to average compared to the last five years (average 11.5, range -3.3–28.1°C). Similarly, the average barometric pressure of 29.75 in Hg and range of 29.25–30.18 are only slightly below average compared to 2001–2002 (the period of record for this measure; average 29.78, range 29.28–30.74 in Hg).

Good to excellent thermal-lift conditions predominated on 69% of the active observation days, which is slightly higher than the 1998–2002 average of 60%.

In summary, compared to the previous five seasons, 2003 featured relatively variable weather with more frequent than usual bouts of rain and snow, as well as a high prevalence of visibility reducing fog and especially haze, and slightly stronger and proportionately more southwesterly as opposed to northwesterly winds.

OBSERVATION EFFORT

The observers worked on 69 of 73 possible days between 22 February and 5 May (Table 1). The number of observation days and hours (530.41) were 1% lower and 11% higher, respectively, than the 1985–2002 averages of 70 ± 95% CI of 3.2 days and 530.4 ± 95% CI of 25.9 hours. The 2003 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) was a significant 22% higher than the 1985–2002 average of 2.0 ± 95% CI of 0.14 observers/hr, reflecting more extensive participation of local volunteers and visitors.

FLIGHT SUMMARY

The observers counted 5,533 migrant raptors of 18 species during the 2003 season (see Appendix D for daily count records and Appendix E for annual summaries). Counts reached record highs for Northern Goshawks (31), Red-tailed Hawks (663), Rough-legged Hawks (2), and Peregrine Falcons (105; Appendix E).

The 2003 flight was composed of 38% vultures, 23% accipiters, 15% buteos, 13% eagles, 8% falcons, 1% Ospreys, 1% harriers, and <1% unidentified raptors. These values represent significantly lower than average proportions of accipiters and harriers, and significantly above-average proportions of vultures, buteos, eagles, and falcons (Figure 2). The Turkey Vulture was the most abundant species, followed by Cooper's Hawk, Golden Eagle, Red-tailed Hawk, Sharp-shinned Hawk, and American Kestrel (Table 1).

Adjusted passage rates were significantly above average for 11 of 18 species seen this season, significantly below average for Sharp-shinned Hawks and Prairie Falcons, and not significantly different from average for the remaining 5 species (Osprey, Northern Harrier, Cooper's Hawk, Ferruginous Hawk, and Zone-tailed Hawk; Table 1, Figures 3–7). The 1985–2003 regression analyses indicated significant to highly significant linear increasing trends in adjusted passage rates for Turkey Vultures (Figure 3), Broad-winged Hawks, Swainson's Hawks, Red-tailed Hawks (Figure 5), Merlins, and Peregrine Falcons (Figure 7). For Golden Eagles, a marginally significant increase was indicated, reflecting primarily a significant increase among non-adults as a result of recent high counts in 1998, 2000, and now 2003 (Figure 6). For Ospreys, a highly significant quadratic trend was indicated, tracking a strong increasing trend through 1998 but a decline thereafter (Figure 3). For Northern Goshawks, a significant linear decline was indicated for adults only; however, the adult count has risen each year since 1999 (Figure 4).

Most species appeared to show some degree of downturn after 1998 in response to the onset of widespread drought (Figures 3–7; Hoffman and Smith 2003). The prevalence of above-average passage rates in the Sandias this year seems to suggest a degree of recovery. The overall, combined-species passage rate was only average in the nearby Manzano Mountains during the previous fall (Smith 2003); nevertheless, most species showed a similar count trend in both seasons (e.g., counts of Northern Goshawks, Red-tailed Hawks, and Golden Eagles were significantly above average in both seasons). Severe drought continues to plague much of the Great Basin and central and southern Rocky Mountains, however, so it seems more likely that low, rather than high, productivity would have been the rule for many of the breeding populations that typically use the Sandia flyway. In fact, reports of limited Northern Goshawk productivity in many areas of the interior West during the past two years, and

expectation of a cyclical southward invasion of northern birds during 2002/2003 (10–11 yr cycle, last irruption in 1992/1993; see Hoffman and Smith 2003) suggest that the gradual increasing trend since 1999 in the Sandias, which corresponds closely to the onset of drought conditions, and the sudden upswing in 2003 (Figure 4) probably reflect primarily increasing migration activity rather than increasing productivity.

For Golden Eagles, as well, reports of minimal productivity in Alaska and northern Canada during 2002 due to cyclical prey crashes (C. McIntyre personal communication) probably resulted in proportionately more northern birds migrating farther south for the winter than usual. In fact, for the first time since HWI began its satellite-tracking program in 1999, all of nine eagles outfitted during fall 2002 in New Mexico and Nevada that survived the winter are currently summering in Canada or Alaska (see www.hawkwatch.org). Thus, high Golden Eagle migration counts in New Mexico during the past year also may reflect primarily increasing migration activity. Without further careful analysis and better understanding of Golden Eagle migration dynamics, however, it is difficult to be certain about the meaning of recent trends in the Sandia Mountains. The three highest Golden Eagle counts recorded to date occurred during the past six years, with a record-high 1998 count involving increases in both adults and non-adults, whereas highs in 2000 and 2003 involved primarily non-adults (Figure 6).

It is also possible that higher migration counts in the Rocky Mountains this past year partly reflect a diversion of migration activity away from the relatively xeric Intermountain Flyway and Great Basin region where the negative effect of prolonged drought is particularly severe. In addition, stronger winds and more cloud cover tend to cause migrants to hug the ridge more tightly and be more detectable to the observers; therefore, weather conditions also may have contributed to the higher than average counts in the Sandias in 2003. Thus, although in the absence of more detailed analyses these hypotheses are speculative, there are reasons to believe that for some species above-average passage rates in the Sandias in 2003 reflected primarily altered migration activity rather than higher productivity. However, Turkey Vultures, Broad-winged Hawks, Swainson's Hawks, Red-tailed Hawks, Merlins, and Peregrine Falcons are showing long-term increasing trends across the West (Hoffman and Smith 2003), so for these species the high 2003 Sandia counts probably do reflect, at least in part, continuance of positive trends.

Eight of 16 species common enough to allow for comparisons showed earlier than average median passage dates in 2003, with the differences significant for six species (Cooper's Hawk, Red-tailed Hawk, Ferruginous Hawk, Golden Eagle, Merlin, and Peregrine Falcon). Conversely, only Broad-winged Hawks showed significantly late timing (Table 3). The combined-species median passage date of 6 April matched the long-term average (Table 3), but although plotting flight volume by five-day periods revealed a similar overall pattern compared to the average, activity was highly variable from one period to the next (Figure 8), likely due to the effects of more variable than usual weather patterns. The tendency for early passage may be a response to mild winter conditions allowing earlier access to breeding habitats.

TRAPPING EFFORT

The trapping and banding crew operated Upper Station for 115.5 hours on 19 days between 16 March and 21 April (see Appendix F for daily effort and capture totals by species). This is about half the usual banding effort for the project (see Appendix G for annual summaries).

TRAPPING AND BANDING SUMMARY

The 2003 capture total of 61 birds included six species and one recaptured Cooper's Hawk (Table 5, Appendix G). The 2003 effort raises the total number of birds captured since project inception to 3,222 birds of 12 species, including 24 Sandia recaptures and 28 foreign recaptures (i.e., birds originally banded elsewhere and subsequently recaptured in the Sandias; Appendix G). Captured species included the

Cooper's Hawk (79% of all captures), Sharp-shinned Hawk (7%), Red-tailed Hawk (7%), Northern Goshawk (3%), Peregrine Falcon (3%), and American Kestrel (2%).

Due to the limited effort this season, the 2003 combined-species capture total, rate, and success were well below average; however, the capture of two Northern Goshawks and two Peregrine Falcons matched the long-term averages for these species (Table 5). Most birds captured in 2003 had empty or nearly empty crops; however, keel muscle and wing-pit fat ratings were generally good.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

The 2003 trappers captured one previously banded adult male Cooper's Hawk. HWI trappers originally banded this bird in 1999 during fall migration in the nearby Manzano Mountains as a hatch-year bird. During fall 2002, three Sandia-banded female Cooper's Hawks, two originally banded in 1993 and one in 1998, were recaptured in the Manzano Mountains. This brings the total number of Sandia–Manzano exchanges to 40, all involving Sharp-shinned and Cooper's Hawks.

To date, 9 Sandia-banded Cooper's Hawks, 3 Sharp-shinned Hawks, 1 Red-tailed Hawk, and 1 Prairie Falcon have subsequently been encountered elsewhere outside of the Manzano Mountains. Two new encounters occurred subsequent to the 2002 Sandia season. The first involved a female Cooper's Hawk originally banded as an adult in April 2002 and recovered dead (no details provided) five months later, ~215 km southeast near Roswell, New Mexico. The second involved a female Cooper's Hawk originally banded as a third-year bird in April 1999 and recovered dead (cause unknown) in June 2003, ~326 km southeast near Nathrop, Colorado.

RESIDENT BIRDS

The 2003 resident raptor community included a typical assemblage for the site. A territorial 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), with their territory centered on the Sandia "shields", was present throughout the season. The pair was seen copulating early in the season, but no definitive evidence of nest initiation or success was recorded.

At least five different apparently resident adult Red-tailed Hawks were seen in the area during the season. As is typical for the site, a pair of light-morph birds was frequently seen hunting below and to the east of the observation site in the Tijeras Canyon area. A pair of dark-morph birds was seen farther southeast over the "south" gravel pit displaying early in the season, but then never again. One rufous-morph bird was seen on occasion near the "north" gravel pit.

At least one adult Cooper's Hawk was seen regularly after 10 April around the shields area, and at least one immature bird was seen in the area frequently after mid-April. Beginning 2 April, a pair of Peregrine Falcons were seen regularly around the shields area and farther north. From mid-to-late April on, a male American Kestrel was seen almost daily hunting in the afternoons along the ridgeline to the east of observation. Up to 3 Turkey Vultures were seen regularly patrolling the ridge to the west and southwest of observation after 13 April.

SITE VISITATION

On-site educator Julie Diebold estimated that at least 525 individuals visited the project site during the 2003 season, with most signing our visitor logs. With repeat visits included, the number climbed to more than 600 visits. Visitors included 10 organized school and community groups, and originated in 17 states besides New Mexico, plus Washington D.C., Japan, Great Britain, and New Foundland, Canada. HWI received several letters during the season from visitors wishing to thank this year's crew for a particularly enjoyable and enriching educational experience.

In 2003, 625 hourly assessments of visitor disturbance resulted in the following ratings: 76% none, 20% low, 3% moderate, and 1% high. We consider this strong additional proof that educator Julie Diebold 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.

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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 Sandia Mountains, NM: 1985–2001 versus 2003.

	COUNTS			RAPTORS / 100 HOURS[1]		
SPECIES	1985–2001[2]	2003	% CHANGE	1985–2002[2]	2003	% CHANGE
Turkey Vulture	1413 ± 290.1	2128	+51	452.7 ± 90.96	608.4	+34
Osprey	63 ± 13.9	79	+25	21.9 ± 4.65	23.6	+8
Northern Harrier	59 ± 7.1	59	0	13.2 ± 1.59	11.6	-12
White-tailed Kite	0.1 ± 0.11	0	-100	0.01 ± 0.02	0.0	-100
Mississippi Kite	0.2 ± 0.18	0	-100	0.03 ± 0.04	0.0	-100
TOTAL KITES	0.2 ± 0.25	0	-100	–	–	–
Sharp-shinned Hawk	526 ± 122.4	459	-13	126.0 ± 26.50	95.2	-24
Cooper's Hawk	802 ± 139.9	797	-1	231.1 ± 36.00	199.3	-14
Northern Goshawk	11 ± 2.9	31	+183	2.3 ± 0.61	5.3	+135
Unknown small accipiter[3]	4 ± 7.8	6	+50	–	–	–
Unknown large accipiter[3]	1 ± 0.0	1	0	–	–	–
Unknown accipiter	75 ± 19.9	3	-96	–	–	–
TOTAL ACCIPITERS	1414 ± 213.7	1297	-8	–	–	–
Broad-winged Hawk	6 ± 3.0	12	+95	1.4 ± 0.65	2.4	+80
Swainson's Hawk	50 ± 8.4	111	+122	18.5 ± 2.76	33.3	+79
Red-tailed Hawk	341 ± 52.1	663	+94	76.5 ± 9.85	131.2	+71
Ferruginous Hawk	13 ± 2.0	17	+34	2.7 ± 0.45	3.0	+12
Rough-legged Hawk	0.4 ± 0.28	2	+350	0.2 ± 0.13	0.8	+347
Zone-tailed Hawk	2.3 ± 1.11	3	+29	0.5 ± 0.24	0.5	+10
Unidentified buteo	12 ± 4.8	3	-74	–	–	–
TOTAL BUTEOS	424 ± 61.9	811	+91	–	–	–
Golden Eagle	352 ± 73.8	689	+96	71.0 ± 13.75	125.3	+77
Bald Eagle	15 ± 3.7	23	+50	4.2 ± 0.97	5.7	+34
Unidentified eagle	0.8 ± 0.62	0	-100	–	–	–
TOTAL EAGLES	368 ± 75.9	712	+94	–	–	–
American Kestrel	206 ± 43.1	299	+45	54.0 ± 10.28	70.1	+30
Merlin	9 ± 3.4	17	+91	2.0 ± 0.77	3.6	+79
Prairie Falcon	23 ± 4.8	20	-13	4.5 ± 0.90	3.3	-26
Peregrine Falcon	35 ± 11.6	105	+196	7.1 ± 2.33	19.3	+171
Aplomado Falcon	0.1 ± 0.11	0	-100	0.01 ± 0.02	0.0	-100
Unknown small falcon[3]	0.3 ± 0.5	0	-100	–	–	–
Unknown large falcon[3]	0.0 ± 0.0	0	–	–	–	–
Unknown falcon	3 ± 1.0	0	-100	–	–	–
TOTAL FALCONS	277 ± 55.2	441	+59	–	–	–
Unidentified raptor	45 ± 16.0	6	-87	–	–	–
GRAND TOTAL	4064 ± 616.2	5533	+36	–	–	–

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

[2] Mean ± 95% CI.

[3] 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: 1992–2002 versus 2003.

	Total and Age-classified Counts								Imm : Adult	
	1992–2001 Average			2003			% Unknown Age		Ratio	
	Total	Imm.	Ad.	Total	Imm.	Ad.	1992–2002[1]	2003	1992–2002[1]	2003
Northern Harrier	60	11	32	59	7	40	27 ± 5.4	19	0.38 ± 0.208	0.18
Sharp-shinned Hawk	577	61	309	459	42	254	35 ± 5.4	36	0.20 ± 0.057	0.17
Cooper's Hawk	876	74	564	797	129	425	29 ± 7.5	30	0.14 ± 0.039	0.30
Northern Goshawk	11	3	7	31	14	13	22 ± 11.9	13	0.40 ± 0.145	1.08
Broad-winged Hawk	9	0.1	6	12	4	2	25 ± 14.2	50	0.02 ± 0.045	2.00
Red-tailed Hawk	387	63	266	663	93	369	14 ± 3.5	30	0.26 ± 0.096	0.25
Ferruginous Hawk	13	1	5	17	0	9	56 ± 10.8	47	0.57 ± 0.872	0.00
Golden Eagle	397	207	127	689	326	130	15 ± 3.3	34	1.78 ± 0.535	2.51
Bald Eagle	15	8	6	23	13	7	6 ± 6.8	13	1.50 ± 0.556	1.86
Peregrine Falcon	51	12	28	105	25	61	19 ± 9.7	18	0.47 ± 0.179	0.41

[1] 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 2003, with a comparison of 2003 and 1985–2002 average median passage dates.

	2003				1985–2002
Species	First Observed	Last Observed	Bulk Passage Dates[1]	Median Passage Date[2]	Median Passage Date[2, 3]
Turkey Vulture	11-Mar	3-May	24-Mar – 24-Apr	4-Apr	4-Apr ± 1.6
Osprey	22-Mar	3-May	31-Mar – 1-May	11-Apr	12-Apr ± 1.5
Northern Harrier	7-Mar	5-May	12-Mar – 27-Apr	6-Apr	6-Apr ± 1.8
Sharp-shinned Hawk	25-Feb	5-May	30-Mar – 29-Apr	19-Apr	17-Apr ± 2.0
Cooper's Hawk	3-Mar	5-May	26-Mar – 26-Apr	9-Apr	10-Apr ± 1.0
Northern Goshawk	24-Feb	3-May	9-Mar – 27-Apr	6-Apr	3-Apr ± 3.8
Broad-winged Hawk	22-Mar	3-May	22-Mar – 3-May	26-Apr	22-Apr ± 2.9
Swainson's Hawk	12-Mar	3-May	6-Apr – 1-May	16-Apr	16-Apr ± 1.7
Red-tailed Hawk	27-Feb	5-May	11-Mar – 22-Apr	23-Mar	25-Mar ± 1.5
Ferruginous Hawk	1-Mar	30-Apr	2-Mar – 27-Apr	13-Mar	19-Mar ± 5.3
Rough-legged Hawk	7-Mar	30-Mar	–	–	–
Zone-tailed Hawk	3-Apr	4-May	–	–	5-Apr ± 9.8
Golden Eagle	22-Feb	4-May	3-Mar – 17-Apr	16-Mar	21-Mar ± 3.4
Bald Eagle	22-Feb	14-Apr	4-Mar – 8-Apr	12-Mar	9-Mar ± 4.6
American Kestrel	25-Feb	5-May	25-Mar – 28-Apr	10-Apr	11-Apr ± 1.7
Merlin	4-Mar	26-Apr	5-Mar – 21-Apr	3-Apr	9-Apr ± 4.8
Prairie Falcon	22-Feb	2-May	24-Feb – 17-Apr	30-Mar	17-Mar ± 4.4
Peregrine Falcon	1-Mar	4-May	21-Mar – 26-Apr	7-Apr	11-Apr ± 2.8
All species	22-Feb	5-May	14-Mar – 26-Apr	6-Apr	6-Apr ± 1.4

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

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

[3] 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: 1990–2002 versus 2003.

	Capture Totals		Capture Rate[1]		% Capture Success[2]	
Species	1990–2002[3]	2003	1990–2002[3]	2003	1990–2002[3]	2003
Northern Harrier	1 ± 0.7	0	0.2 ± 0.21	0.0	1.2 ± 1.07	0.0
Sharp-shinned Hawk	54 ± 23.4	4	16.2 ± 5.72	3.5	9.5 ± 1.35	0.9
Cooper's Hawk	177 ± 32.8	48	57.3 ± 11.57	41.5	22.1 ± 5.55	6.0
Northern Goshawk	2 ± 0.7	2	0.5 ± 0.24	1.7	15.5 ± 8.41	6.7
Broad-winged Hawk	0.1 ± 0.16	0	0.0 ± 0.07	0.0	2.1 ± 4.08	0.0
Swainson's Hawk	0.3 ± 0.28	0	0.1 ± 0.09	0.0	0.6 ± 0.55	0.0
Red-tailed Hawk	9 ± 3.4	4	2.9 ± 1.18	3.5	2.3 ± 0.87	0.6
Zone-tailed Hawk	0.2 ± 0.22	0	0.1 ± 0.07	0.0	9.3 ± 12.31	0.0
American Kestrel	8 ± 4.5	1	2.4 ± 1.21	0.9	3.3 ± 1.51	0.3
Merlin	1 ± 0.7	0	0.3 ± 0.20	0.0	6.5 ± 4.27	0.0
Prairie Falcon	2 ± 0.8	0	0.5 ± 0.25	0.0	8.8 ± 4.50	0.0
Peregrine Falcon	2 ± 1.3	2	0.7 ± 0.38	1.7	5.4 ± 2.79	1.9
Total	256 ± 55.2	61	81.3 ± 15.30	52.8	10.2 ± 1.91	1.9

[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.

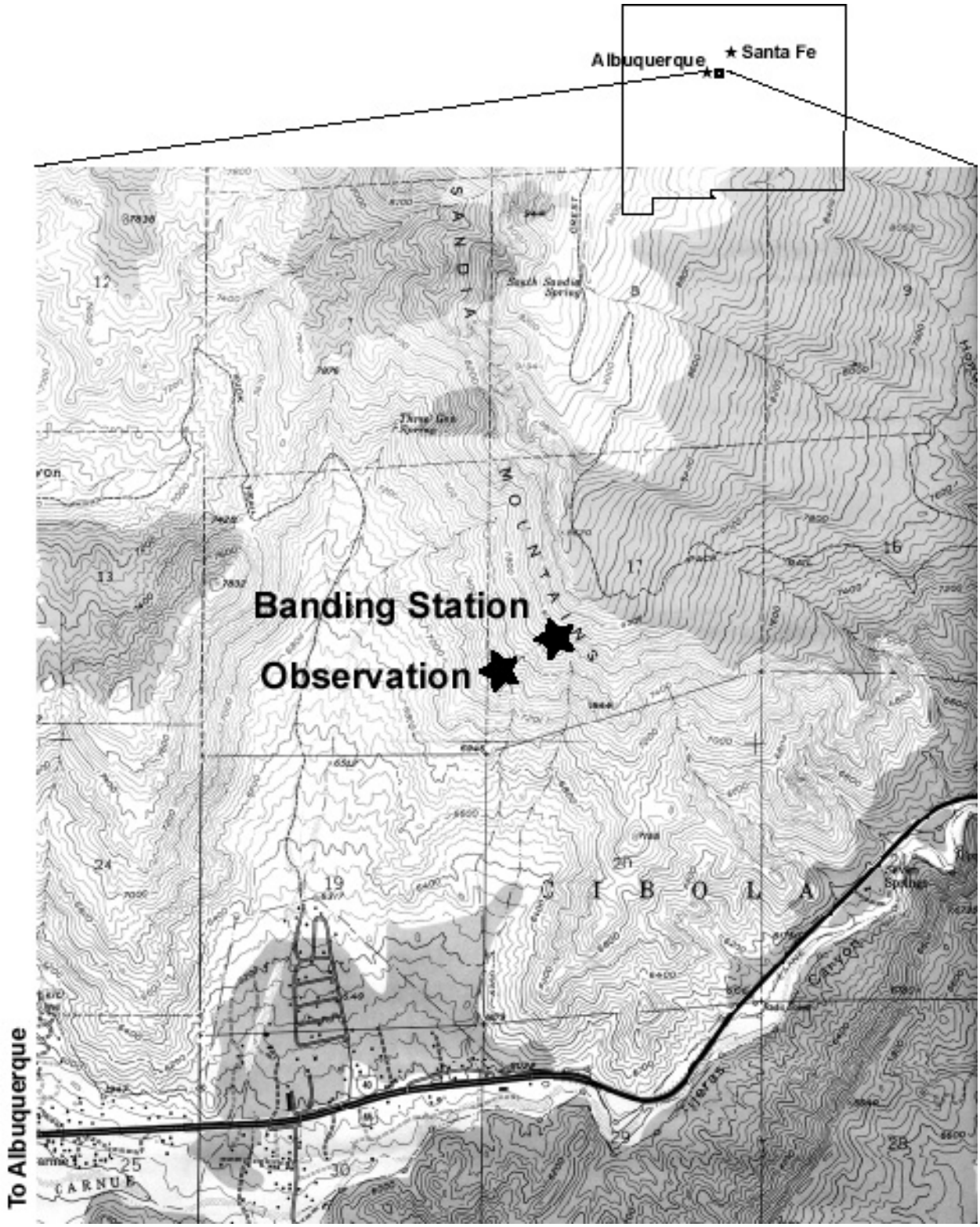

Figure 1. Map of Sandia Mountains Raptor Migration Project study site.

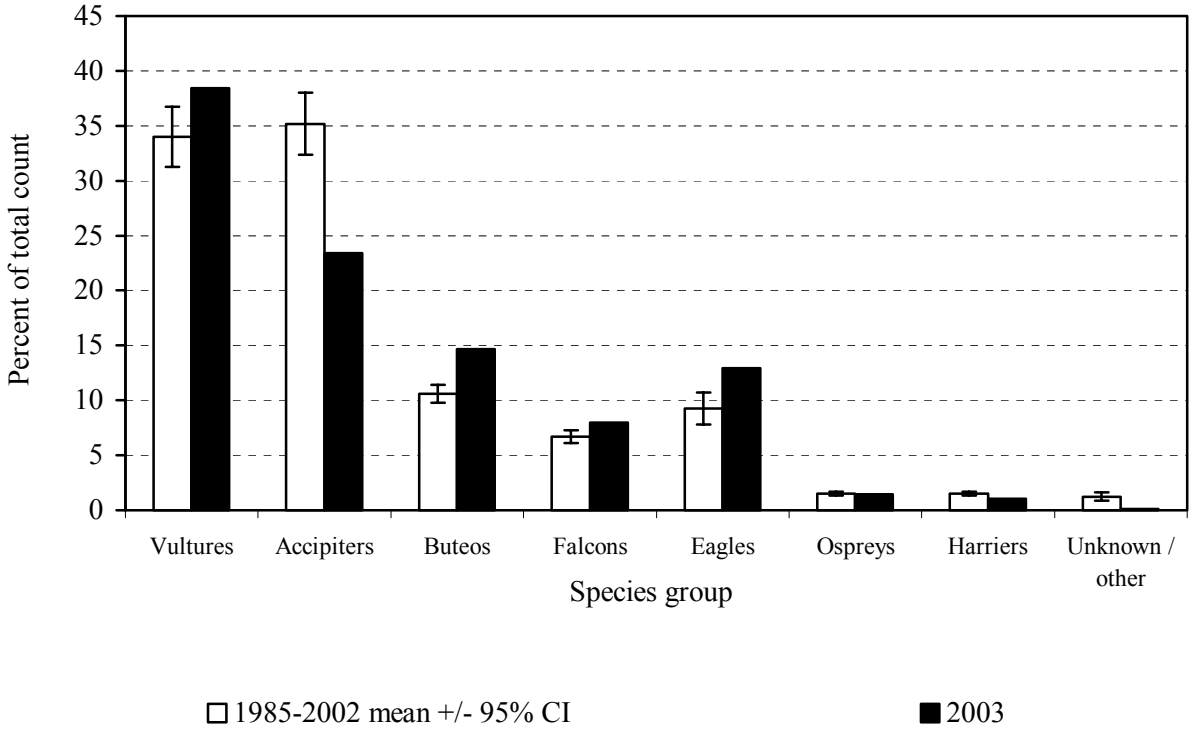

Figure 2. Spring raptor-migration flight composition by major species groups in the Sandia Mountains, NM: 1985–2002 versus 2003.

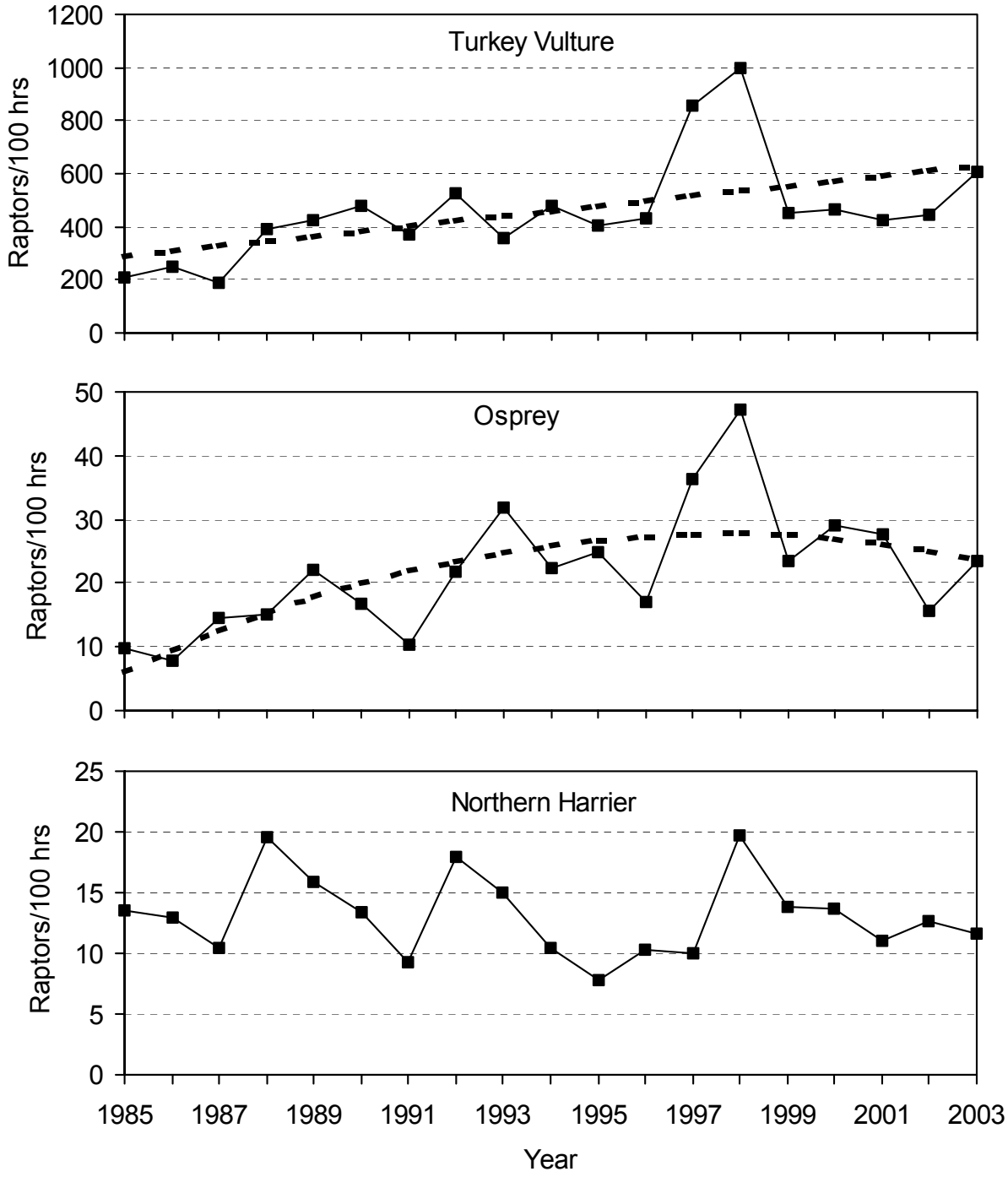

Figure 3. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers in the Sandia Mountains, NM: 1985–2003. Dashed lines indicate significant ($P \leq 0.10$) regressions.

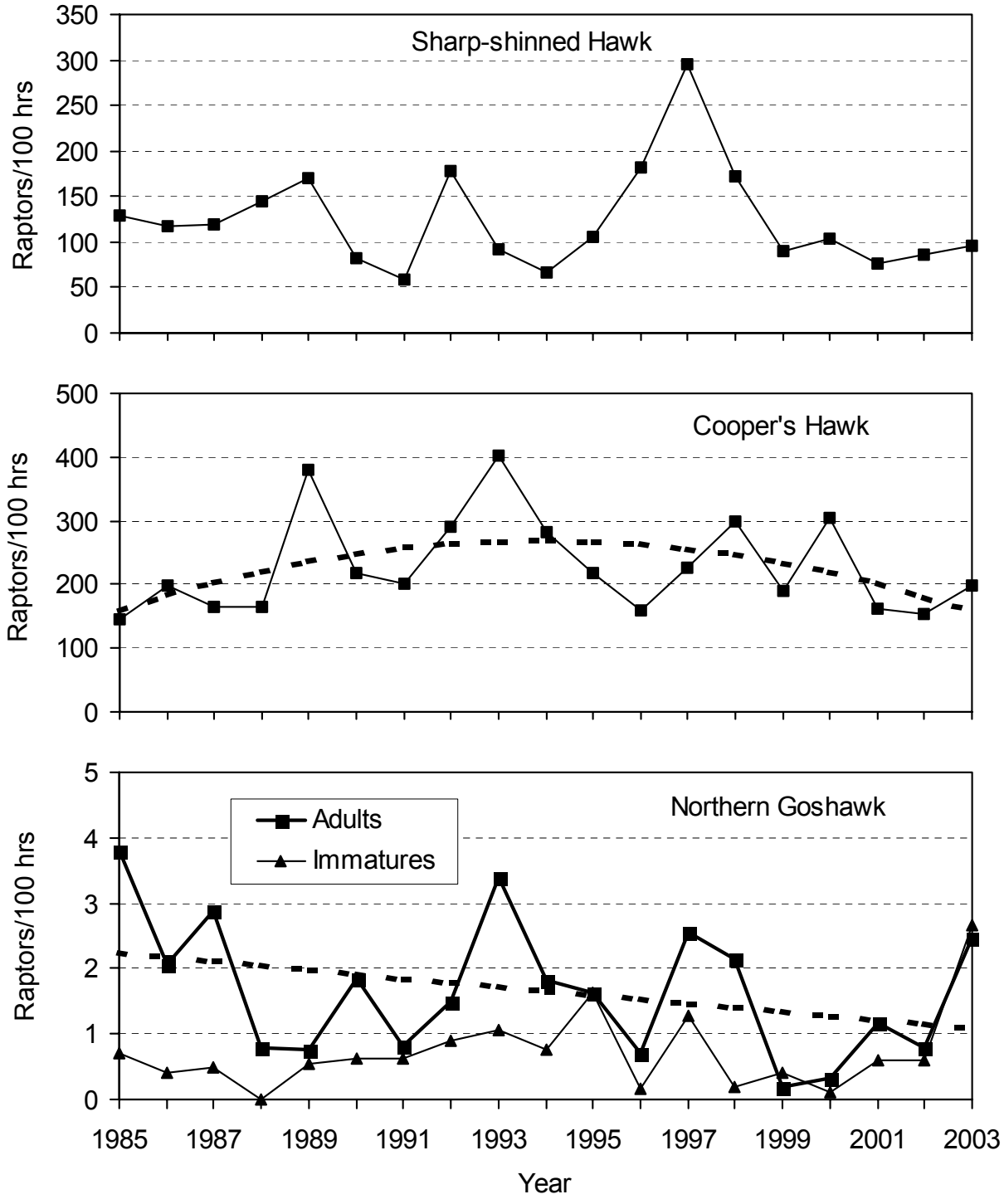

Figure 4. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks in the Sandia Mountains, NM: 1985–2003. Dashed lines indicate significant ($P \leq 0.10$) regressions.

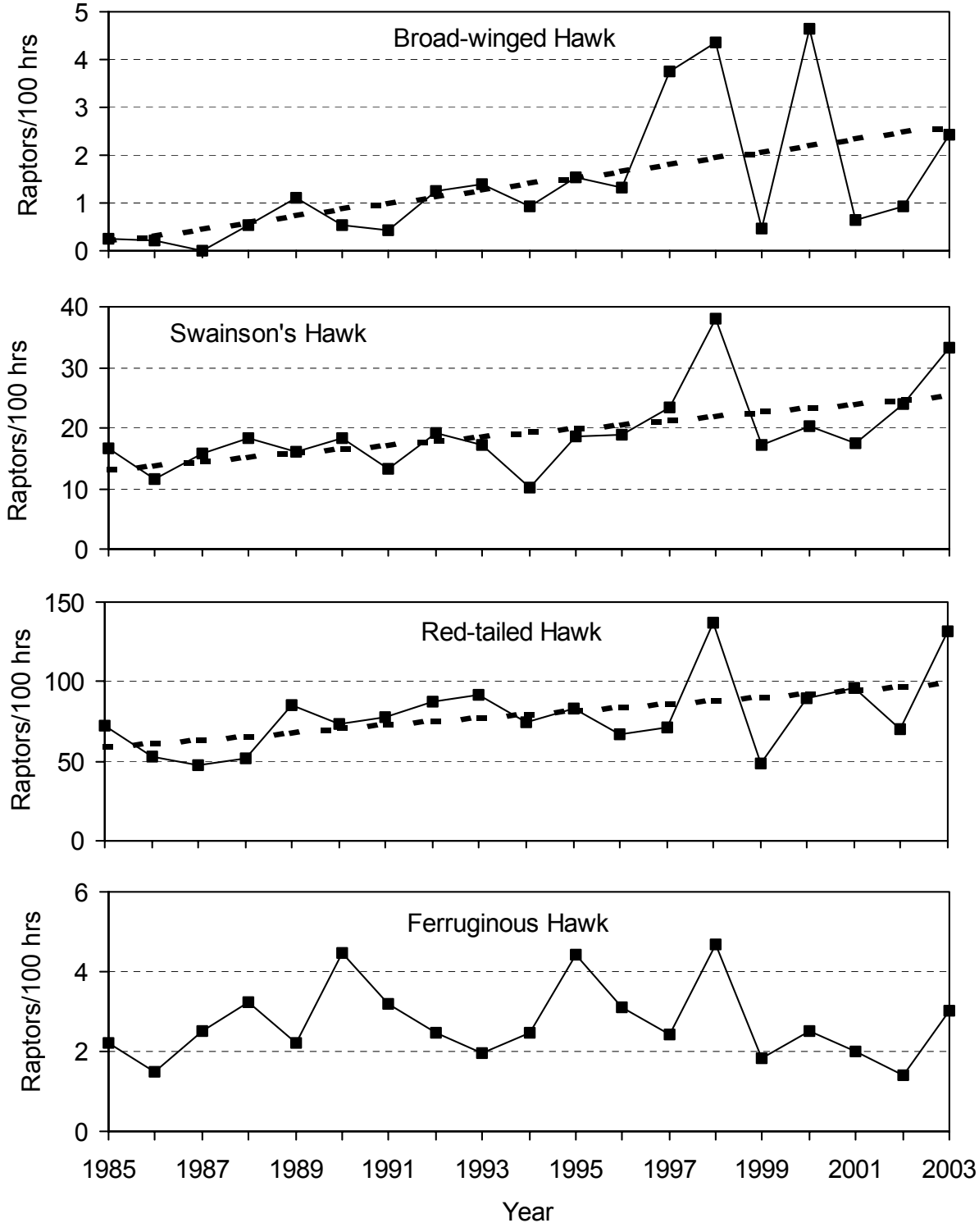

Figure 5. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Broad-winged, Swainson's, Red-tailed, and Ferruginous Hawks in the Sandia Mountains, NM: 1985–2003. Dashed lines indicate significant ($P \leq 0.10$) regressions.

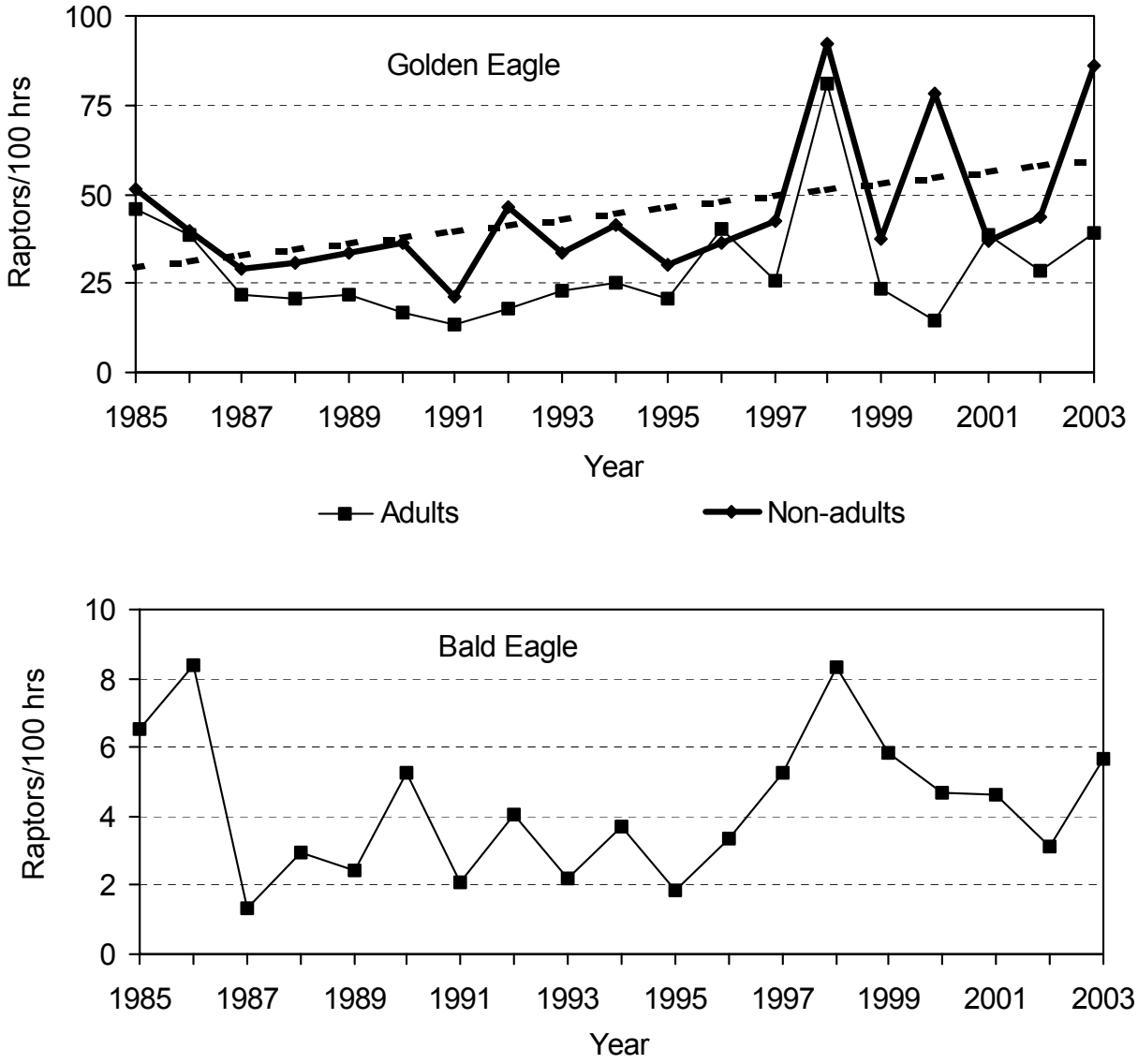

Figure 6. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for Golden and Bald Eagles in the Sandia Mountains, NM: 1985–2003. Dashed lines indicate significant ($P \leq 0.10$) regressions.

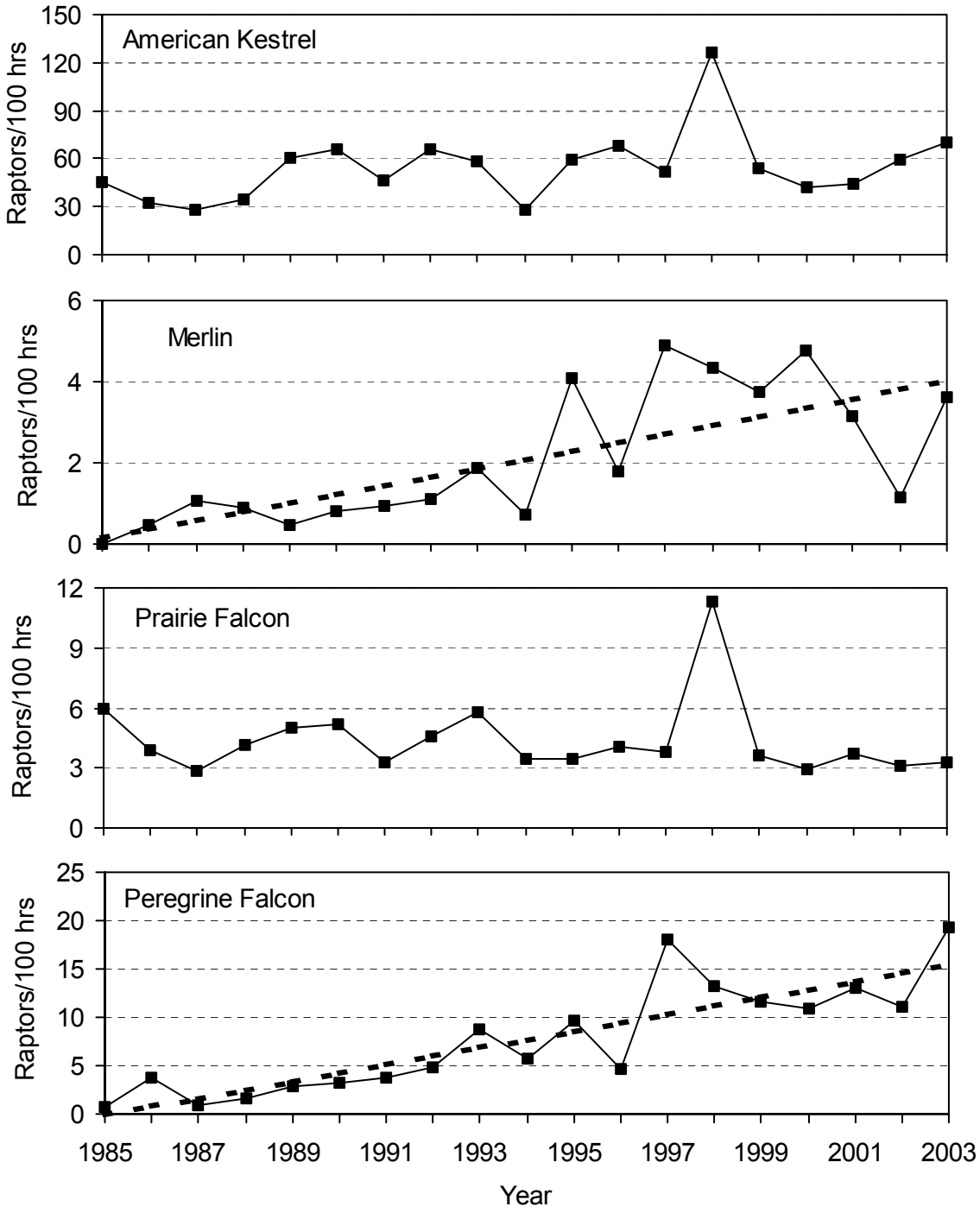

Figure 7. Adjusted (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) spring-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons in the Sandia Mountains, NM: 1985–2003. Dashed lines indicate significant ($P \leq 0.10$) regressions.

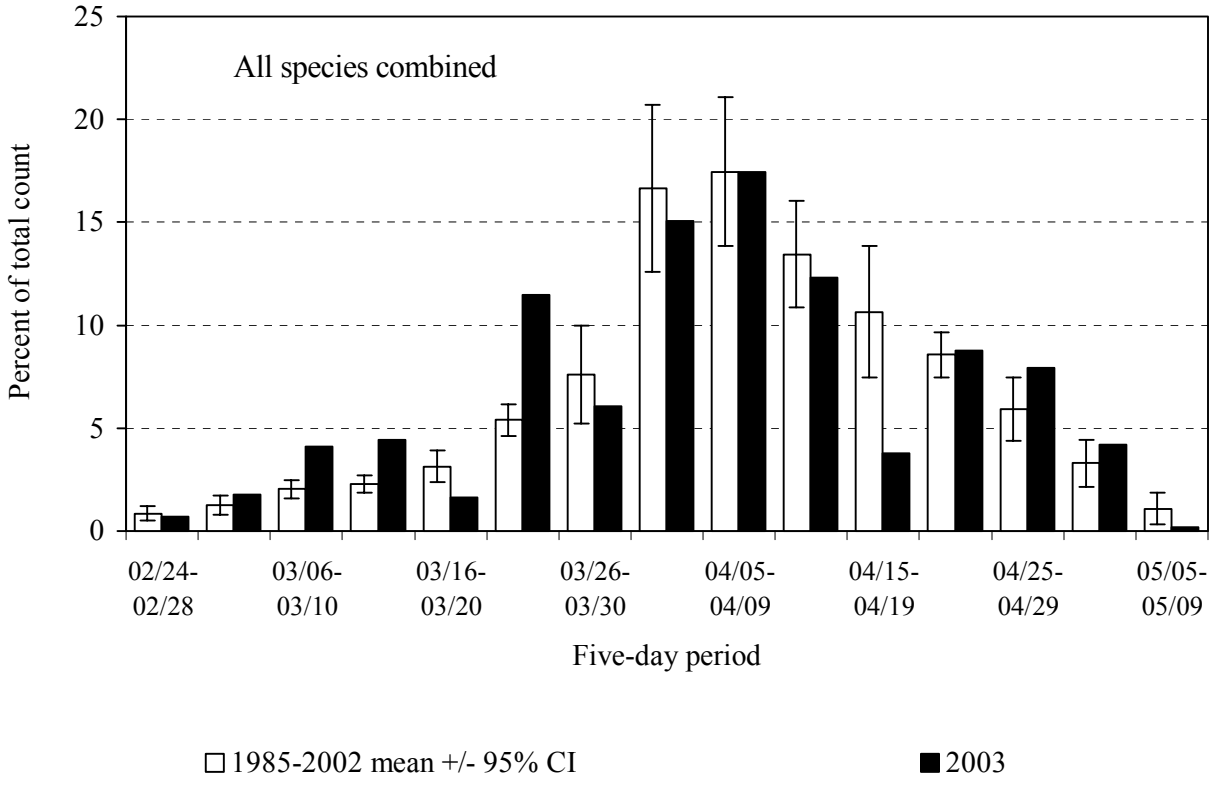

Figure 8. Combined-species, spring-migration passage volume by five-day periods for raptors in the Sandia Mountains, NM: 1985–2002 versus 2003.

Appendix A. History of official observer participation in the Sandia Mountains Raptor Migration Project: 1985–2003.

1985 Single observer throughout: Jim Daly–primary (1), Penny Rodefer (0)[1]

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)

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[1] 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[1]	Sex[2]	Color Morph[3]
Turkey Vulture	*Cathartes aura*	TV	U	U	NA
Osprey	*Pandion haliaetus*	OS	U	U	NA
Northern Harrier	*Circus cyaneus*	NH	A I Br U	M F U	NA
White-tailed Kite	*Elanus caeruleus*	WK	U	U	NA
Mississippi Kite	*Ictinia mississippiensis*	MK	A I U	U	NA
Sharp-shinned Hawk	*Accipiter striatus*	SS	A I U	U	NA
Cooper's Hawk	*Accipiter cooperii*	CH	A I U	U	NA
Northern Goshawk	*Accipiter gentilis*	NG	A I U	U	NA
Unknown small accipiter	*A. striatus* or *cooperii*	SA	U	U	NA
Unknown large accipiter	*A. cooperii* or *gentilis*	LA	U	U	NA
Unknown accipiter	*Accipiter* spp.	UA	U	U	NA
Broad-winged Hawk	*Buteo platypterus*	BW	A I U	U	D L U
Swanson's Hawk	*Buteo swainsoni*	SW	U	U	D L U
Red-tailed Hawk	*Buteo jamaicensis*	RT	A I U	U	D L U
Ferruginous Hawk	*Buteo regalis*	FH	A I U	U	D L U
Rough-legged Hawk	*Buteo lagopus*	RL	U	U	D L U
Zone-tailed Hawk	*Buteo albonotus*	ZT	A I U	U	NA
Unknown buteo	*Buteo* spp.	UB	U	U	D L U
Golden Eagle	*Aquila chrysaetos*	GE	I, S, NA, A, U[4]	U	NA
Bald Eagle	*Haliaeetus leucocephalus*	BE	I, S1, S2, NA, A, U[5]	U	NA
Unknown eagle	*Aquila* or *Haliaeetus spp.*	UE	U	U	NA
American Kestrel	*Falco sparverius*	AK	U	M F U	NA
Merlin	*Falco columbarius*	ML	AM Br	AM U	NA
Prairie Falcon	*Falco mexicanus*	PR	U	U	NA
Peregrine Falcon	*Falco peregrinus*	PG	A I U	U	NA
Aplomado Falcon	*Falco femoralis*	AF	A I U	U	NA
Unknown small falcon	*F. sparverius* or *columbarius*	SF	U	U	NA
Unknown large falcon	*F. mexicanus* or *peregrinus*	LF	U	U	NA
Unknown falcon	*Falco* spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

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

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

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

[4] Golden Eagle age codes: I = Immature: juvenile or first-year bird, bold white wing patch visible below, bold white in tail, no molt; S = Subadult 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.

[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 Sandia Mountains Raptor Migration Project: 2003.

Date	Obs. Hours	Obsrvr / Hour[1]	Median Visitor Disturb[2]	Predominant Weather[3]	Wind Speed (kph)[1]	Wind Direction	Temp (°C)[1]	Barom. Press. (in Hg)[1]	Median Thermal Lift[4]	Visib. West (km)[1]	Visib. East (km)[1]	Median Flight Distance[5]	Birds / Hour
22-Feb	7.00	2.0	0	clr, haze	8.5	sw-wsw	13.9	29.49	2	101.3	93.8	1	1.3
23-Feb	7.50	2.0	0	clr-pc, haze	13.9	sw-nw	12.9	29.54	3	100.0	100.0	-	0.0
24-Feb	7.00	2.0	0	ovc, fog/snow	4.9	e-sse	6.9	29.56	3	44.7	43.6	2	0.9
25-Feb	6.00	2.0	0	ovc, fog/snow	4.0	nw/var	3.8	29.55	4	30.9	9.0	3	1.0
26-Feb	0.00			mc-ovc, fog/snow/ts									
27-Feb	9.00	1.0	0	pc-ovc, AM/PM snow	10.6	sw-w	3.9	29.45	2	91.0	85.5	1	2.6
28-Feb	8.50	2.0	0	mc-ovc, snow	3.6	sw	5.5	29.45	3	74.6	37.1	1	0.4
1-Mar	8.00	2.0	0	mc-ovc, snow	6.0	sw-w	6.3	29.48	2	56.5	42.0	2	2.1
2-Mar	8.25	2.8	0	pc, PM haze/scat snow	7.1	ese, ssw-sw	4.2	29.61	2	84.0	80.5	3	3.3
3-Mar	8.00	1.0	0	clr-pc, haze	18.7	nw, wsw	2.9	29.51	3	100.0	94.4	1	0.9
4-Mar	8.00	2.8	0	ovc-pc, scat snow	21.4	sw-nw	3.2	29.40	3	90.6	79.4	1	3.6
5-Mar	7.50	2.7	0	ovc-pc, snow	22.4	sw-w, nw	2.8	29.50	3	85.6	63.9	1	2.4
6-Mar	8.00	2.0	0	clr, haze	16.4	ssw-wsw	4.9	29.67	2	100.0	93.0	1	3.6
7-Mar	8.50	2.7	0	clr, PM haze	7.7	ssw-wsw	9.2	29.76	1	99.0	89.0	1	6.2
8-Mar	8.25	1.9	0	clr, haze	20.2	wnw-nw	8.7	29.84	1	100.0	93.0	3	4.4
9-Mar	9.00	2.0	1	clr, haze	11.1	sw-wnw	12.0	30.00	2	96.4	92.7	2	6.3
10-Mar	8.25	1.8	0	clr, PM haze	10.5	sw-w	13.2	29.87	1	100.0	91.0	2	6.2
11-Mar	8.00	3.0	0	clr-pc	10.9	w-nw	12.4	29.78	2	93.5	89.5	-	6.4
12-Mar	8.50	1.0	0	clr-pc, haze	6.8	sw-nw	12.3	29.82	2	90.5	90.0	2	4.4
13-Mar	8.50	2.3	0	clr, haze	2.5	se, sw	14.9	30.07	1	93.0	80.0	3	4.1
14-Mar	8.50	2.0	0	mc-ovc, haze/PM rain	11.7	sw-nw	15.5	29.85	2	74.5	47.3	3	7.9
15-Mar	9.00	3.8	1	clr-ovc, haze	6.4	sw-w	14.5	29.72	2	89.0	75.5	3	6.1
16-Mar	8.50	2.6	1	ovc, PM rain	12.8	sw-w/var	10.8	29.50	3	78.5	63.0	3	2.6
17-Mar	8.50	1.9	0	mc-ovc, snow	22.0	sw-wnw	5.0	29.25	4	52.5	52.0	1	1.5
18-Mar	0.00			ovc, fog/snow									
19-Mar	0.00			ovc, fog/snow									
20-Mar	9.50	2.3	0	pc-ovc, PM haze	8.6	sw-wnw	5.7	29.73	2	85.7	48.5	2	5.7
21-Mar	3.00	1.8	3	ovc, fog/snow	4.4	wnw	1.6	29.69	4	12.0	2.8	3	1.3
22-Mar	9.75	3.9	0	pc, haze	4.2	var	8.3	29.94	2	78.2	50.0	2	12.2
23-Mar	10.50	4.7	1	clr, haze	7.1	sw-wsw	11.6	29.84	1	100.0	98.8	2	31.6
24-Mar	10.00	2.4	0	clr-mc, scat rain	7.6	sw, e-se	12.1	29.69	2	99.1	88.3	-	15.0
25-Mar	8.50	1.4	0	ovc-clr, haze	5.6	ese, sw-w	10.7	29.95	2	71.5	56.0	3	3.1
26-Mar	9.25	2.5	0	pc, haze	9.4	wsw-nw	11.5	29.86	2	89.1	83.6	2	7.4
27-Mar	2.00	2.0	0	ovc, snow	32.0	wsw-w	4.7	29.53	4	38.7	23.0	-	1.0
28-Mar	5.00	2.5	0	mc-ovc, snow	19.1	ne-se	-1.0	29.85	4	48.7	30.1	3	1.6
29-Mar	9.00	3.0	0	clr-pc, haze	10.3	sw-w	2.8	30.13	2	85.5	72.0	3	8.3
30-Mar	10.50	4.4	1	clr, PM haze	15.3	sw-wnw	6.9	30.13	3	85.8	70.8	2	17.1
31-Mar	10.00	2.7	2	clr, haze	5.1	sw-w	11.8	30.02	1	94.9	82.5	2	30.5
1-Apr	6.00	3.7	0	clr, haze	11.8	sw-w	16.1	29.84	1	100.0	90.0	2	13.3
2-Apr	9.00	2.0	2	mc-ovc, PM ts/rain	15.4	sw	16.5	29.73	3	90.9	80.9	2	13.9
3-Apr	9.00	2.4	0	clr-mc, haze	20.5	sw-wsw/var	10.8	29.63	2	90.5	73.2	2	14.1
4-Apr	10.00	2.7	1	clr, haze	15.5	sw-w	7.8	29.68	2	74.6	46.3	2	19.5
5-Apr	10.00	3.0	0	clr-mc, haze	14.9	sw-w	10.0	29.54	3	74.6	45.8	1	11.9
6-Apr	9.00	3.1	1.5	clr-ovc, haze	15.7	sw-w	8.3	29.65	2	86.0	89.0	2	6.9
7-Apr	10.50	2.5	0	clr-ovc, ts/snow	17.3	sw-wnw	8.0	29.87	3	94.6	80.0	2	21.1
8-Apr	10.00	2.6	0	clr, haze	6.5	e-sse, sw	8.8	30.18	2	56.3	32.9	3	38.1
9-Apr	10.50	2.0	0	clr-pc, haze	3.7	sw-wsw	12.5	30.08	2	70.9	65.0	2	17.0
10-Apr	9.50	3.2	0	clr-ovc, haze	5.5	sw-wsw/var	15.5	29.92	2	55.9	37.3	2	12.9
11-Apr	9.50	2.8	1	clr-mc, haze	8.4	sw-wnw	17.8	29.87	1	66.4	42.3	3	11.2

Appendix C. continued

Date	Obs. Hours	Obsrvr / Hour[1]	Median Visitor Disturb[2]	Predominant Weather[3]	Wind Speed (kph)[1]	Wind Direction	Temp (°C)[1]	Barom. Press. (in Hg)[1]	Median Thermal Lift[4]	Visib. West (km)[1]	Visib. East (km)[1]	Median Flight Distance[5]	Birds / Hour
12-Apr	9.75	2.9	1	pc-mc, haze	3.5	sw-wnw	17.9	29.95	2	73.3	46.7	3	21.7
13-Apr	10.25	3.4	0	clr, haze	4.8	sw-w	18.9	29.92	2	75.4	49.6	2	11.2
14-Apr	10.25	2.5	0	mc-ovc, haze/PM rain	12.5	sw	17.3	29.90	2	68.8	63.3	2	11.9
15-Apr	0.00			ovc, rain									
16-Apr	9.50	1.5	0	clr	18.3	w-nw	12.3	29.85	3	99.2	99.2	1	5.1
17-Apr	9.50	1.9	0	clr-mc, haze	16.9	e-se	19.1	29.69	2	75.0	49.1	2	5.4
18-Apr	10.00	3.2	0	clr-pc, haze	13.0	sw-wnw	11.8	29.59	2	67.1	57.5	2	6.4
19-Apr	8.00	2.0	1	pc/haze - ovc/snow	16.5	sw-w	10.5	29.70	3	25.9	35.8	1	5.6
20-Apr	10.75	3.7	1	clr-pc, haze	5.9	se-sse, nw	14.2	30.00	2	89.1	77.5	2	18.0
21-Apr	9.00	3.0	0	clr-mc	24.2	e-sse	13.8	29.84	3	74.0	64.5	2	16.2
22-Apr	9.00	1.9	0	clr, haze	17.9	e, sse	14.6	29.60	2	76.4	54.1	3	9.6
23-Apr	5.00	1.0	0	ovc, rain/snow	33.4	wsw-nw	4.3	29.52	4	43.6	42.9	1	0.2
24-Apr	8.50	3.0	0	clr	32.4	wnw-nw	13.5	29.68	3	99.5	94.0	2	6.6
25-Apr	8.50	2.8	0	clr, haze	8.9	var, sw-wnw	14.4	29.79	1	88.0	88.0	2	8.1
26-Apr	10.25	3.5	0	clr, haze	14.2	sw-wnw	16.9	29.75	2	87.9	75.4	2	17.3
27-Apr	10.50	2.6	0	pc-mc, haze	11.2	sw-nw	17.3	29.83	2	84.2	73.8	2	10.0
28-Apr	9.00	2.3	0	clr-pc, haze	8.8	sw-wnw	18.5	29.83	1	85.0	70.5	2	9.1
29-Apr	7.50	2.0	1	clr-mc, haze	10.7	sw-wsw/var	18.4	29.75	1	75.6	57.8	2	3.6
30-Apr	8.50	2.0	0	clr-ovc, haze	22.7	sw-nw	16.9	29.69	2	86.5	65.5	2	5.4
1-May	8.50	2.0	0	clr-mc, haze	16.3	sw-w	16.8	29.83	2	76.5	55.0	2	6.6
2-May	9.00	3.5	0	clr-ovc, haze	4.1	se, sw-w	20.3	29.88	1	74.5	68.0	2	7.3
3-May	9.00	3.8	0	ovc, haze	7.8	sw-w	19.3	29.76	3	49.0	24.5	1	6.0
4-May	7.50	2.3	0	ovc-pc, AM haze/snow	32.4	wsw-w	14.6	29.64	3	81.1	75.0	2	1.1
5-May	6.00	2.7	0	clr	6.5	sw-wnw	17.5	29.68	2	88.8	90.0	1	1.8

[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 spring raptor migration counts by species in the Sandia Mountains, NM: 2003.

	Obs.	Species[1]																										Birds
Date	Hours	TV	OS	NH	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	ZT	UB	GE	BE	AK	ML	PR	PG	SF	LF	UF	UU	Total	/ hour
22-Feb	7.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1	0	0	1	0	0	0	0	0	9	1.3
23-Feb	7.50	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
24-Feb	7.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	1	0	0	1	0	0	0	0	0	6	0.9
25-Feb	6.00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	6	1.0
26-Feb	0.00																												
27-Feb	9.00	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	21	0	0	0	0	0	0	0	0	0	23	2.6
28-Feb	8.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0.4
01-Mar	8.00	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	1	9	0	1	0	1	1	0	0	0	0	17	2.1
02-Mar	8.25	0	0	0	0	0	0	1	1	0	0	0	5	1	0	0	0	19	0	0	0	0	0	0	0	0	0	27	3.3
03-Mar	8.00	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	1	0	0	0	0	7	0.9
04-Mar	8.00	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	20	3	0	1	0	0	0	0	0	0	29	3.6
05-Mar	7.50	0	0	0	1	1	0	0	0	0	0	0	3	0	0	0	0	10	2	0	1	0	0	0	0	0	0	18	2.4
06-Mar	8.00	0	0	0	0	1	0	0	0	0	0	0	4	1	0	0	0	22	0	1	0	0	0	0	0	0	0	29	3.6
07-Mar	8.50	0	0	1	2	1	1	0	0	0	0	0	6	1	1	0	0	38	1	1	0	0	0	0	0	0	0	53	6.2
08-Mar	8.25	0	0	0	0	1	0	0	0	0	0	0	12	0	0	0	0	19	0	2	0	1	1	0	0	0	0	36	4.4
09-Mar	9.00	0	0	1	2	3	3	0	0	0	0	0	10	0	0	0	0	34	2	1	1	0	0	0	0	0	0	57	6.3
10-Mar	8.25	0	0	0	2	3	1	0	0	0	0	0	9	2	0	0	0	31	1	1	1	0	0	0	0	0	0	51	6.2
11-Mar	8.00	2	0	3	3	10	0	0	0	0	0	0	16	0	0	0	0	16	0	0	0	1	0	0	0	0	0	51	6.4
12-Mar	8.50	0	0	1	1	0	0	0	0	0	0	1	8	2	0	0	0	22	0	0	0	2	0	0	0	0	0	37	4.4
13-Mar	8.50	0	0	0	1	5	2	0	0	0	0	0	10	0	0	0	0	14	1	0	0	0	1	0	0	0	1	35	4.1
14-Mar	8.50	0	0	1	3	6	0	0	0	0	0	0	40	1	0	0	0	14	0	0	0	0	2	0	0	0	0	67	7.9
15-Mar	9.00	3	0	3	2	3	1	0	0	0	0	0	14	0	0	0	0	24	0	4	0	0	1	0	0	0	0	55	6.1
16-Mar	8.50	0	0	1	0	1	0	0	0	0	0	0	10	1	0	0	0	7	0	0	1	0	1	0	0	0	0	22	2.6
17-Mar	8.50	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	8	0	0	0	0	0	0	0	0	0	13	1.5
18-Mar	0.00																												
19-Mar	0.00																												
20-Mar	9.50	5	0	1	0	3	0	0	0	0	0	1	25	1	0	0	0	12	2	1	1	0	2	0	0	0	0	54	5.7
21-Mar	3.00	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	4	1.3
22-Mar	9.75	11	1	2	4	6	0	0	0	0	3	0	39	0	0	0	0	42	0	7	0	0	2	0	0	0	2	119	12.2
23-Mar	10.50	188	0	3	7	6	2	0	0	0	0	0	77	1	0	0	0	38	2	3	0	1	4	0	0	0	0	332	31.6
24-Mar	10.00	39	1	1	5	14	0	0	0	0	0	2	56	0	0	0	1	22	0	3	1	0	5	0	0	0	0	150	15.0
25-Mar	8.50	2	0	0	0	6	0	0	0	0	0	0	7	0	0	0	0	7	0	3	0	0	1	0	0	0	0	26	3.1
26-Mar	9.25	20	0	2	3	7	0	0	0	0	0	1	17	1	0	0	0	14	1	1	0	0	1	0	0	0	0	68	7.4
27-Mar	2.00	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1.0
28-Mar	5.00	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	4	0	2	0	0	0	0	0	0	0	8	1.6
29-Mar	9.00	40	0	0	1	5	2	0	0	0	0	0	10	0	0	0	0	12	0	0	1	0	4	0	0	0	0	75	8.3
30-Mar	10.50	102	3	2	7	24	0	0	0	0	0	1	17	0	1	0	0	11	0	4	0	1	7	0	0	0	0	180	17.1
31-Mar	10.00	237	4	0	9	17	1	1	0	0	0	1	21	0	0	0	0	9	0	3	0	1	1	0	0	0	0	305	30.5

Appendix D. continued

Date	Obs. Hours	Species[1]																										Total	Birds / hour
		TV	OS	NH	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	ZT	UB	GE	BE	AK	ML	PR	PG	SF	LF	UF	UU		
01-Apr	6.00	56	1	0	4	9	0	0	0	0	0	0	1	0	0	0	0	6	0	2	0	1	0	0	0	0	0	80	13.3
02-Apr	9.00	74	1	1	6	23	0	0	0	0	1	0	6	0	0	0	0	6	0	1	0	2	4	0	0	0	0	125	13.9
03-Apr	9.00	94	1	0	7	12	0	0	0	0	0	0	7	0	0	1	0	3	0	2	0	0	0	0	0	0	0	127	14.1
04-Apr	10.00	156	0	0	3	14	0	0	0	0	0	0	9	0	0	0	0	7	0	3	1	0	2	0	0	0	0	195	19.5
05-Apr	10.00	52	5	1	6	17	0	0	0	0	0	3	8	0	0	0	0	8	0	14	0	1	4	0	0	0	0	119	11.9
06-Apr	9.00	22	2	3	1	15	0	0	0	0	0	4	8	0	0	0	0	6	0	0	0	0	1	0	0	0	0	62	6.9
07-Apr	10.50	128	5	3	9	43	1	1	0	0	0	0	8	1	0	0	0	16	2	1	0	0	4	0	0	0	0	222	21.1
08-Apr	10.00	208	4	5	15	57	0	1	0	1	0	0	10	0	0	0	0	16	2	58	1	0	3	0	0	0	0	381	38.1
09-Apr	10.50	83	2	1	8	53	0	0	0	0	0	0	18	0	0	0	0	5	0	6	0	0	2	0	0	0	0	178	17.0
10-Apr	9.50	39	4	4	9	39	0	1	0	0	0	3	7	0	0	0	0	7	0	7	0	0	3	0	0	0	0	123	12.9
11-Apr	9.50	18	2	3	16	28	0	1	0	2	0	1	6	0	0	0	1	5	0	18	1	1	2	0	0	0	1	106	11.2
12-Apr	9.75	51	5	5	22	52	0	0	0	0	0	12	21	0	0	0	0	10	0	28	0	0	6	0	0	0	0	212	21.7
13-Apr	10.25	45	5	0	9	24	0	0	0	0	0	7	5	0	0	0	0	2	1	9	1	2	5	0	0	0	0	115	11.2
14-Apr	10.25	20	4	0	12	52	1	0	0	0	0	8	13	1	0	0	0	1	1	6	2	0	1	0	0	0	0	122	11.9
15-Apr	0.00																												
16-Apr	9.50	14	3	1	5	12	0	0	0	0	0	2	2	0	0	0	0	1	0	2	0	0	5	0	0	0	1	48	5.1
17-Apr	9.50	11	0	0	4	8	1	0	0	0	0	15	4	0	0	0	0	4	0	2	0	2	0	0	0	0	0	51	5.4
18-Apr	10.00	9	2	0	14	25	0	0	0	0	0	7	4	0	0	0	0	3	0	0	0	0	0	0	0	0	0	64	6.4
19-Apr	8.00	12	1	1	3	20	0	0	0	0	0	1	0	0	0	0	0	4	0	0	0	0	3	0	0	0	0	45	5.6
20-Apr	10.75	46	4	0	42	22	1	0	0	0	0	7	12	0	0	0	0	10	0	44	1	0	5	0	0	0	0	194	18.0
21-Apr	9.00	62	0	2	26	30	1	0	0	0	0	5	10	0	0	0	0	3	0	4	1	0	1	0	0	0	1	146	16.2
22-Apr	9.00	51	0	0	13	7	0	0	0	0	0	2	4	0	0	1	0	3	0	2	0	0	3	0	0	0	0	86	9.6
23-Apr	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0.2
24-Apr	8.50	29	1	0	9	5	1	0	0	0	0	0	8	0	0	0	0	0	0	1	0	0	2	0	0	0	0	56	6.6
25-Apr	8.50	22	1	0	14	15	1	0	0	0	0	1	4	0	0	0	0	6	0	3	0	0	2	0	0	0	0	69	8.1
26-Apr	10.25	61	3	1	49	16	5	0	0	0	0	2	16	0	0	0	0	12	0	8	1	0	3	0	0	0	0	177	17.3
27-Apr	10.50	21	4	3	26	17	2	0	0	0	5	3	8	1	0	0	0	3	0	8	0	0	4	0	0	0	0	105	10.0
28-Apr	9.00	21	0	0	22	7	1	0	0	0	0	5	11	0	0	0	0	3	0	11	0	0	1	0	0	0	0	82	9.1
29-Apr	7.50	6	1	0	6	6	0	0	0	0	0	1	0	0	0	0	0	5	0	2	0	0	0	0	0	0	0	27	3.6
30-Apr	8.50	15	0	1	10	6	0	0	0	0	0	4	5	1	0	0	0	3	0	1	0	0	0	0	0	0	0	46	5.4
01-May	8.50	11	3	0	17	12	0	0	0	0	0	4	4	0	0	0	0	3	0	1	0	0	1	0	0	0	0	56	6.6
02-May	9.00	22	3	1	8	6	1	0	0	0	0	4	5	0	0	0	0	6	0	8	0	1	1	0	0	0	0	66	7.3
03-May	9.00	20	3	0	4	11	1	0	0	0	3	3	4	0	0	0	0	1	0	4	0	0	0	0	0	0	0	54	6.0
04-May	7.50	0	0	0	0	5	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	8	1.1
05-May	6.00	0	0	1	4	2	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	11	1.8
Total	590.00	2128	79	59	459	797	31	6	1	3	12	111	663	17	2	3	3	689	23	299	17	20	105	0	0	0	6	5533	9.4

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

Appendix E. Annual observation effort and spring raptor migration counts by species (unadjusted data) in the Sandia Mountains, NM: 1985–2003.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	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	18-Feb
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
Days of observation	73	78	69	65	56	61	83	84	75	69	67	68	70	68	66	67	67	67	69	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	533.54
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	776.0
SPECIES	RAPTOR COUNTS																			
Turkey Vulture	641	814	559	1070	1380	1322	1246	1785	1327	1463	1217	1552	2531	3245	1427	1305	1328	1227	2128	1451
Osprey	27	24	39	38	64	38	34	70	100	67	71	62	103	138	67	76	81	38	79	64
Northern Harrier	55	59	42	71	72	50	46	85	75	46	35	55	47	94	62	56	52	55	59	59
White-tailed Kite	0	0	1	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
TOTAL KITES	0	0	2	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Sharp-shinned Hawk	473	476	435	498	664	283	294	807	428	280	448	905	1280	772	386	391	311	337	459	522
Cooper's Hawk	454	709	521	498	1277	620	718	1050	1562	956	771	655	836	1157	670	922	556	506	797	802
Northern Goshawk	22	14	14	4	6	10	7	12	24	12	16	5	18	12	3	2	9	7	31	12
Unknown small accipiter[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	8	6	5
Unknown large accipiter[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1	1
Unknown accipiter	90	56	88	70	123	65	59	201	95	55	61	73	70	5	30	96	90	16	3	71
TOTAL ACCIPITERS	1039	1255	1058	1070	2070	978	1078	2070	2109	1303	1296	1638	2204	1946	1089	1411	967	875	1297	1408
Broad-winged Hawk	1	1	0	2	5	2	2	6	7	4	7	7	19	20	2	19	3	4	12	6
Swainson's Hawk	47	32	41	43	38	40	42	60	52	30	50	61	59	114	45	50	43	54	111	53
Red-tailed Hawk	280	241	183	182	357	289	353	390	461	325	377	356	338	662	220	353	451	321	663	358
Ferruginous Hawk	11	8	11	13	9	18	16	12	11	12	20	17	11	23	7	11	12	7	17	13
Rough-legged Hawk	0	2	0	1	1	0	0	0	1	0	0	0	0	1	0	1	0	1	2	1
Zone-tailed Hawk	1	2	0	3	5	4	2	3	1	0	0	0	3	2	2	10	1	3	3	2
Unidentified buteo	6	4	10	9	40	3	15	32	5	5	14	9	6	2	15	21	10	1	3	11
TOTAL BUTEOS	346	290	245	253	455	356	430	503	538	376	468	450	436	824	291	465	520	391	811	445
Golden Eagle	441	432	213	205	255	218	198	338	300	310	255	441	352	897	304	417	391	366	689	370
Bald Eagle	20	37	5	7	7	13	18	17	9	12	7	14	22	27	18	13	18	12	23	16
Unidentified Eagle	4	0	0	1	0	0	4	2	0	0	0	0	0	0	2	0	1	0	0	1
TOTAL EAGLES	465	469	218	213	262	231	220	357	309	322	262	455	374	924	324	430	410	378	712	386
American Kestrel	147	127	96	118	225	209	182	275	250	112	226	308	233	497	198	143	165	205	299	211
Merlin	0	2	5	3	2	3	4	5	9	3	18	10	24	19	15	19	14	5	17	9
Prairie Falcon	29	27	17	16	23	21	21	28	33	16	17	23	19	59	18	13	20	16	20	23
Peregrine Falcon	5	18	6	7	13	13	20	25	47	26	47	27	91	72	56	49	64	52	105	39
Aplomado Falcon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Unknown small falcon[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	0
Unknown large falcon[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	0
Unknown falcon	2	0	5	2	5	2	5	3	3	0	0	1	7	1	4	0	6	2	0	2
TOTAL FALCONS	183	174	129	146	268	248	232	336	342	157	308	369	374	648	291	225	269	280	441	285
Unidentified raptor	44	27	54	45	82	65	45	142	29	28	53	30	14	7	10	0	94	49	6	43
ALL SPECIES	2800	3112	2346	2906	4653	3288	3331	5348	4830	3762	3710	4611	6084	7826	3561	3968	3721	3293	5533	4141

[1] 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: 2003.

DATE	HOURS	SS[1]	CH	NG	RT	AK	PG	TOTAL	CAPTURES/HR
16-Mar	4.50	0	1	0	0	0	0	1	0.2
17-Mar	0.00								
18-Mar	0.00								
19-Mar	0.00								
20-Mar	0.00								
21-Mar	1.00	0	0	0	0	0	0	0	0.0
22-Mar	7.00	1	1	0	1	1	0	4	0.6
23-Mar	7.25	0	1	1	0	0	0	2	0.3
24-Mar	8.25	0	1	0	0	0	1	2	0.2
25-Mar	0.00								
26-Mar	0.00								
27-Mar	0.00								
28-Mar	3.00	0	0	0	0	0	0	0	0.0
29-Mar	7.00	0	2	1	2	0	0	5	0.7
30-Mar	6.00	1	6	0	0	0	1	8	1.3
31-Mar	7.50	0	2	0	0	0	0	2	0.3
1-Apr	4.75	0	0	0	0	0	0	0	0.0
2-Apr	6.30	0	6	0	0	0	0	6	1.0
3-Apr	0.00								
4-Apr	0.00								
5-Apr	7.75	0	5	0	0	0	0	5	0.6
6-Apr	7.50	0	4	0	0	0	0	4	0.5
7-Apr	0.00								
8-Apr	0.00								
9-Apr	0.00								
10-Apr	0.00								
11-Apr	0.00								
12-Apr	7.75	0	6	0	0	0	0	6	0.8
13-Apr	7.66	0	2	0	0	0	0	2	0.3
14-Apr	8.00	1	10	0	0	0	0	11	1.4
15-Apr	0.00								
16-Apr	0.00								
17-Apr	0.00								
18-Apr	0.00								
19-Apr	4.33	0	1	0	0	0	0	1	0.2
20-Apr	7.00	1	0	0	0	0	0	1	0.1
21-Apr	3.00	0	0	0	1	0	0	1	0.3
Total	115.54	4	48	2	4	1	2	61	0.5

[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 Sandia Mountains, NM: 1990–2003.

	1990	1991	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	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		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		29-Apr
Number of stations	1	1	1	1	1	1	1	2	2	1	1	1	1		1
Trapping days	36	45	43	34	40	46	48	46	47	41	53	41	19	534	41
Station days	36	45	43	34	40	46	48	65	63	41	44	45	19	569	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	4093.57	314.89
SPECIES	RAPTOR CAPTURES														
Northern Harrier	0	0	0	0	3	0	1	3	2	0	0	0	0	9	1
Sharp-shinned Hawk	21	22	33	32	44	132	139	100	56	30	28	32	4	672	52
Cooper's Hawk	83	66	211	243	197	259	195	200	165	164	206	194	48	2232	172
Northern Goshawk	2	0	1	3	2	2	4	1	0	0	1	3	2	21	2
Broad-winged Hawk	0	0	0	1	0	0	0	0	0	0	0	0	0	1	<1
Swainson's Hawk	1	0	0	0	0	0	1	1	0	0	1	0	0	4	<1
Red-tailed Hawk	3	3	9	16	13	16	5	9	2	3	20	8	4	111	9
Zone-tailed Hawk	0	0	0	0	0	0	0	1	0	0	0	1	0	2	<1
American Kestrel	2	0	3	2	2	26	14	22	10	5	4	14	1	105	8
Merlin	0	0	0	0	2	2	3	3	2	1	0	0	0	13	1
Prairie Falcon	0	0	1	1	2	3	3	2	0	2	5	2	0	21	2
Peregrine Falcon	1	0	0	2	6	4	7	2	2	1	4	0	2	31	2
All species	113	91	258	300	271	444	372	344	239	206	269	254	61	3222	248
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	78.7	77.7
Recaptures[1]	0	1	1	2	3	4	2	3	3	2	4	0	1	25	2
Foreign recaptures[2]	0	0	2	3	0	4	2	6	5	1	3	1	0	27	2
Foreign encounters[3]	2	1	0	2	0	5	2	3	3	0	1	2	1	28	2

[1] Birds banded and later recaptured in the Sandias—totals included in capture tally above.

[2] Birds banded elsewhere and later recaptured in the Sandias—totals included in capture tally above.

[3] Birds banded in the Sandias and later recaptured or otherwise recovered elsewhere.