FALL 2003 RAPTOR MIGRATION STUDIES IN THE GOSHUTE MOUNTAINS OF NORTHEASTERN NEVADA

HawkWatch International, Inc.
Salt Lake City, Utah

February 2004

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February 2004

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INTRODUCTION

The Goshute Mountains Raptor Migration Project in northeastern Nevada is an ongoing effort to monitor long-term trends in populations of raptors using the Intermountain Flyway (Hoffman et al. 2002, Hoffman and Smith 2003). HWI and its organizational precursors have been studying the fall raptor migration in the Goshute Mountains since 1980 when HWI founder Steve Hoffman and colleagues first began banding at the site. Standardized counts were begun in 1983 and have continued each year since. This is one of the longest running standardized, raptor-migration monitoring efforts in the West, with the 2003 season marking the 24th consecutive season of banding and 21st consecutive annual count at the site. Annual counts have ranged between ~12,000-25,000 migrants of up to 18 species, making this one of the largest concentrations in the western U.S. and Canada. The Goshute project was 1 of 14 long-term, annual migration counts and 1 of 7 migration banding studies 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 (Smith and Hoffman 2000, Hoffman and Smith 2003).

STUDY SITE

The Goshute Mountains form a 100-km ridge that runs north–south along the Utah–Nevada border. The study site is located in the Goshute Wilderness Study Area approximately 40 km southwest of Wendover, Nevada, on land administered by the Elko Field Office of the Bureau of Land Management (40° 25.417' N, 114° 16.276' W; Figure 1). The project site is located near the south end of the Goshute range and is reached via a primitive road that begins near Ferguson Springs and then a primitive trail that ascends Christmas Tree Canyon from the east.

Before 2001, the main count site was located atop the highest point of the ridge in the project area at an elevation of 2,743 m (OP1 in Figure 1). This location provided an expansive 360° view of the surrounding landscape, but poor visibility at or below eye level on the east side. Hence, to address the fact that the view to the east from the main count site was obstructed, in most years after 1983 when easterly winds prevailed, the observers commonly moved about 250 m north to a second observation post (OP2 in Figure 1) that provided an unobstructed view along the lower eastern flanks of the ridge. After considerable deliberation and for reasons describe in detail in Vekasy and Smith (2002), HWI's Science Committee (which includes HWI staff and Board members, experienced HWI field observers, and outside experts) decided to adopt a new standard of using only the latter observation post throughout the season beginning in 2001.

In 2003, four banding stations were located 100–700 m to the north, south, and southeast of the observation post. **North** station, established mid-season in 1989 and modified slightly in 1998, was located about 300 m north-northwest of OP2 on top of the ridge at 2,700 m elevation, and was the first station southbound migrants encountered. **West** station, established in 1980 and modified slightly in 1995 and 2000, was located about 100 m south and slightly west of OP2 on the west flank of the ridge at 2,720 m elevation. **Meadow** station, established in 1987 and modified in 1996, 1998, and 2000, was located about 500 m southeast of OP2 on the east flank of the ridge in a natural sagebrush meadow at 2,620 m elevation. **South** station, established in 1982 and modified in 1998, was located 700 m south and slightly east of OP2 in a topographic saddle at 2,660 m elevation.

METHODS

STANDARDIZED COUNTS

Weather permitting, a rotating team of four experienced observers conducted simultaneous two-observer counts at OP1 and OP2 five days per week throughout September and October. Two-observer counts occurred every day at OP2 and only count data from this site are reported herein. Results of the comparison count will be analyzed and reported separately. Visitors and other crewmembers frequently assisted with spotting migrants, but were not allowed to assist or distract the official observers during periods when comparison counts occurred. The four official observers each had 2–7 full seasons of previous experience counting migratory raptors, with each also having counted at least two seasons for HWI (see Appendix A for a complete history of observer participation).

Weather permitting, observations usually began between 0800 and 0900 hrs Mountain Standard Time (MST) and ended near sunset, usually between 1700 and 1900 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 or of precipitation, visibility, and an assessment of thermal-lift conditions, recorded for each hour of observation on the half hour.
4. Predominant direction, altitude, and distance from the lookout of the flight during each hour.
5. Total minutes observed and the mean number of observers present during each hour (included designated observers plus volunteers/visitors who actively contributed to the count [active scanning, pointing out birds, recording data, etc.] for more than 10 minutes in a given hour), recorded on the hour.
6. A subjective visitor-disturbance rating 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 2003 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2003 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

Weather permitting, rotating crews of 1–3 trappers and processors operated each trapping station, with crew size depending on trapper experience, characteristics of the station, and the flight volume. The crews generally trapped between 0900 and 1700 hrs MST. Capture devices included mist nets, dho-gaza nets, and remotely triggered bow nets. Trappers lured migrating raptors into the capture stations from camouflaged blinds using live, non-native avian lures attached to lines manipulated from the blinds. Unless already banded, all captured birds were fitted with a uniquely numbered USGS Biological Resources Division aluminum leg band. Data gathering and recording followed standardized protocols

used at all HWI migration-banding sites (Hoffman et al. 2002). All birds were released within 45 minutes of capture, usually much quicker.

RESULTS AND DISCUSSION

WEATHER

Inclement weather did not appreciably hamper observations in 2003 until the last week of the season, at which time dense fog and snow entirely precluded (4 days) or severely hampered (≤4 hours observation; 2 days) observations on 5 of the last 7 days of the season (see Appendix C for daily weather records). Scattered thundershowers and rain were common between mid-August and mid-September, but infrequent thereafter. Compared to the last six years, 2003 featured a fairly typical array of overall sky conditions, with fair skies predominating on 49% of the active observation days, transitional skies (i.e., changed from fair skies to mostly cloudy or overcast during the day, or vice versa) on 37%, and mostly cloudy to overcast skies on 14% (1997–2002 averages of 50%, 32%, and 19%, respectively). However, 2003 was unusual in that a much higher than average proportion of days with otherwise fair to transitional skies also included some visibility reducing fog and especially haze (32% versus 1997–2002 average of 7%).

Light winds (<12 kph) prevailed on 73% of the active observation days, moderate winds on 23%, and strong winds (>20 kph) on 4%. These values reflect a higher than average prevalence of light winds (1997–2002 averages of 63% light, 27% moderate, and 10% strong). Steady southwest to westerly winds, which typically have been associated with peak flights, were relatively uncommon in 2003, prevailing on only 13% of the active observation days compared to the 1997–2002 average of 38%. Instead, the most common patterns in 2003 included northwesterly winds (10% of days versus 1997–2002 average of 5%), variable southwesterly to northwesterly winds (36% versus 1997–2002 average of 11%), and days where the wind direction shifted during the day between a southwest-to-northwest pattern and a northeast-to-southeast pattern (22% versus 1997–2002 average of 15%).

Average daily temperatures (averages of hourly readings) ranged from –2.2 to 28.0°C, averaging 15.0°C. This is the warmest maximum and average recorded since 1997. Average daily barometric pressure (averages of hourly readings) ranged from 29.55 to 30.63 in Hg, averaging 30.31 in Hg. This is the highest average since 2001 (the extent of records for this measure). Thermal lift was rated fair to poor on 54% of the active observation days and good to excellent on 46%. Similar to 2002, these values represent a much higher than average proportion of days with good thermal conditions (1997–2002 averages of 69% poor to fair and 31% good to excellent).

In summary, the weather during the 2003 season was warmer than average, hazier than usual, and featured lighter and more variable winds than usual, with northwesterly winds supplanting southwesterly winds as the most common wind direction pattern. This suite of conditions also resulted in stronger than average thermal-lift conditions.

OBSERVATION EFFORT

Counts occurred on 79 of 83 possible observation days between 15 August and 5 November 2003. The number of observation days was a non-significant 4% higher than the 1983–2002 average of 78 ± 95% CI of 2.5 days. The total hours of observation (688.21) was a non-significant 9% higher than the 1983–2002 average of 667.18 ± 95% CI of 33.37 hours. The 2003 average of 2.1 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was significantly lower (20%) than the 1990–2002 (period of full-time two-observer system) average of 2.6 ± 95% CI of 0.29 observers/hr.

MIGRATION SUMMARY

The observers counted 13,770 migrant raptors of 17 species during the 2003 season (see Appendix D for unadjusted daily count records). This count is only 9% below the 1983–2002 long-term average, but is the second lowest count (just ahead of an even lower count in 2001) since 1993. No record low counts occurred this season; however, the count of Swainson's Hawks rose to a new record high (see Appendix E for annual summaries).

The 2003 flight was composed of 44% accipiters, 36% buteos, 13% falcons, 3% vultures, 1% eagles, and <1% each of harriers, Ospreys, and unidentified raptors. The proportions of buteos, vultures, and Ospreys were significantly above average, whereas the proportions of accipiters, eagles, and harriers were significantly below average (Figure 3). The most commonly observed species were the Sharp-shinned Hawk and Red-tailed Hawk (each comprising 27% of the total count), followed by Coopers' Hawk (21%), American Kestrel (13%), Golden Eagle (3%), and Turkey Vultures. No other species comprised more than 2% of the total count.

Adjusted passage rates were more than 10% below average for 11 species, with the difference significant for Northern Harriers, Sharp-shinned Hawks, Coopers' Hawks, Northern Goshawks, Rough-legged Hawks, Golden and Bald Eagles, and Prairie Falcons (Table 1). In contrast, adjusted passage rates were significantly above average for Turkey Vultures and Broad-winged, Swainson's, and Red-tailed Hawks.

For many species, adjusted passage rates show a common pattern of stable to increasing trends through the mid-1990s followed by either stabilizing or more often declining patterns (Figures 3–7). Significant ($P \leq 0.05$) to highly significant ($P \leq 0.01$) quadratic regressions track this pattern for Turkey Vultures, Ospreys, Sharp-shinned Hawks, Cooper's Hawks, Northern Goshawks, Ferruginous Hawks, American Kestrels, Merlins, and Prairie Falcons. The same basic pattern is also evident for Northern Harriers, Golden Eagles, and Peregrine Falcons. To a lesser degree, the same was also true for Swainson's and Red-tailed Hawks until high counts reversed the pattern in 2003 and extended significant long-term increasing trends for these species (Figure 5). Broad-winged Hawks also continue to show a significant long-term increasing trend (Figure 5). Only Bald Eagles (Figure 6) and Rough-legged Hawks (Figure 5) show no significant long-trend linear or quadratic trends at this time; however, passage rates of Rough-legged Hawks have dropped sharply for four consecutive years following a record high in 1999, and in 2003 fell to the lowest passage rate seen since 1983.

The common pattern of increases through the mid-1990s followed by declines likely reflects the effects of variation in regional moisture conditions on productivity and perhaps flyway dynamics in the Intermountain region. In particular, declines since 1998 undoubtedly reflect adverse effects of the prolonged and extensive drought that has plagued much of the interior West since 1998 (Hoffman and Smith 2003). Prior to that, high moisture levels associated with a large-scale El Nino event in the Pacific likely contributed to enhanced productivity across much of the otherwise xeric Great Basin. Most recently, continued sharp declines in the Goshutes but high counts in coastal California and comparatively moderate counts in the Rocky Mountain Flyway suggest that, after five years of extensive drought, some migrants may have shifted their migration routes around the severely parched central Great Basin. It is also important to recognize, however, that two other factors also may have contributed to the reduced counts in 2003. First, constraints on additional visitor/volunteer participation in the counts associated with controlling the comparison count environment may have slightly reduced probabilities of detection. Second, warmer temperatures, lighter winds, and stronger thermal lift conditions, as well as a high prevalence of days with nothing but clear blue skies both dispersed the flight more than usual and made it more difficult to see migrants passing overhead.

Immature : adult ratios were more than 10% below average for 6 of 10 species with data suited to comparisons, significantly so for Sharp-shinned Hawks, Ferruginous Hawks, and Peregrine Falcons (Table 2). Moreover, although Northern Harriers, Northern Goshawks, and Golden Eagles showed

significantly above-average age ratios in 2003, counts of both immature and adult birds were well below average. Among the 10 relevant species, immature birds were more abundant than usual only for Red-tailed Hawks. These data suggest that low productivity likely contributed to the low counts for many species.

The 2003 combined-species median passage date of 26 September was a significant 3 days later than average (Table 3), which the seasonal distribution pattern illustrates as lower than average flight volume through mid-September, then mostly proportionately above average flight volume for the next month (Figure 9). At the species level, 11 of 17 species showed later than average median passage dates in 2003, with the differences significant for 8 species, whereas only 3 species showed significantly earlier than average timing (Ferruginous Hawk, Merlin, and Peregrine Falcon; Table 3). Age-specific timing data revealed additional detail but no markedly different results (Table 4).

TRAPPING EFFORT

The crews operated one or more of the four available banding stations every day between 24 August and 28 October 2003 (see Appendix F for daily capture records and Appendix G for annual summaries). The number of trapping days was 12% higher than the 1980–2002 average for the site, while the number of station hours (1,276) exactly matched the 1980–2002 average (average of 3.7 stations operated per season). However, in comparison to the 1987–2002 averages (average of 4.4 stations operated per season), the number of trapping days was only 1% higher than average and the number of station hours was 23% below average, largely reflecting a one-person reduction in the size of the full-time banding crew in 2003.

TRAPPING SUMMARY

The 2003 capture total of 1,463 raptors included 10 species, 1,460 newly banded birds, 2 recaptures of birds previously banded in the Goshutes, and 1 foreign recapture (i.e., recaptures of birds originally banded elsewhere; Table 5, Appendix G). The 2003 effort raises the total number of birds captured since project inception to 49,308, including 83 Goshute recaptures and 32 foreign recaptures. Sharp-shinned Hawks accounted for 56% of the total captures, followed by Cooper's Hawks (31%), American Kestrels (6%), and Red-tailed Hawks (4%). Each of the remaining species accounted for less than 1% of the total.

The 2003 combined-species capture total was 47% below the 1987–2002 average (Table 5). Capture totals were below average for all species except Broad-winged Hawks, significantly so for all three accipiters, all four falcons, and Golden Eagles, clearly reflecting below average flight volume for these species. Capture rates generally mirrored these results, except that capture rates were slightly above average for Northern Harriers and Red-tailed Hawks (Table 5). Similarly, capture success also was below average for several species, but was 10% or more above average for Northern Harriers, Northern Goshawks, Broad-winged Hawks, and Prairie Falcons (Table 5).

At this site, compared to the counts, banding data yield unique and sufficient sex–age specific data only for the three accipiters and American Kestrels (Table 6). The count and capture data yielded a similar age-ratio pattern for Sharp-shinned Hawks (43% and 37% below average, respectively), but very different results for Cooper's Hawks (34% below and 28% above average, respectively) and to a slightly lesser degree Northern Goshawks (95% and 3% above average). For Cooper's Hawks, the adult count and capture total were both 53–54% below average, whereas the immature count was 70% below average while the immature capture total was only 40% below average. This suggests that immature Cooper's Hawks were more susceptible to capture than usual in 2003. A female : male capture ratio that was 32% above average further suggests that females were proportionately more susceptible to capture than males. For goshawks, the adult count was 90% below average and the adult capture total was 100% below average, whereas for immatures the count was 79% below average while the capture total was only 65%

below average. Again, these data suggest that immature goshawks were more susceptible to capture than usual, while the complete absence of captured adults clearly suggests that they were both relatively uncommon and probably less susceptible to capture than usual. Moreover, in this case a 19% reduction in the female : ratio may seem to suggest that males were more susceptible to capture than usual; however, the capture total for immature males was 71% below average while the capture total for immature females was only 59% below average.

The count data do not yield age-specific data for American Kestrels, so the banding data for this species are particularly useful. The banding data yielded an immature : adult ratio that was 26% above average, which reflects a proportionately greater reduction in the abundance of adults rather than an increase in the capture total for immature birds (Table 6). The count data indicated a 7% below average female : male ratio for kestrels, whereas the capture data indicated a sex ratio that was 24% below average, suggesting that female kestrels were proportionately less susceptible to capture than usual in 2003.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Recaptures

The 2003 captures included a female Sharp-shinned Hawk originally banded in the Goshutes in 1997 as a hatch-year bird, and a female Cooper's Hawk originally banded in the Goshutes in 2000 as an after-second-year adult (Table 7). This brings the total number of Goshute recaptures since 1980 to 84 birds, all accipiters (Appendix G).

Foreign Recaptures

The 2003 captures included one foreign recapture of a hatch-year Red-tailed Hawk of as yet unknown origin (Table 7). This was the 33rd foreign recapture at the site.

Foreign Encounters

Ten raptors originally banded in the Goshutes were encountered elsewhere in 2003, which is close to the long-term average of 12 per year (Table 8, Appendix G). The recoveries included one Sharp-shinned Hawk, six Cooper's Hawks, and three Red-tailed Hawks, and raise the total foreign encounters since 1980 to 286 birds. With one unusual exception, the recovery locations all lie within expected bounds of the Intermountain Flyway or otherwise conform to known dispersal patterns (Hoffman et al. 2002). The exception involved a female Cooper's Hawk banded in 2001 as a hatch-year bird and found dead two years later in east-central New York! This is the third recovery we have documented for Cooper's Hawks banded in the Intermountain and Rocky Mountain flyways and later recovered much farther east (MA, NY, and Ontario). Another recovery of particular interest was a research recapture of a Red-tailed Hawk breeding in southern California 11 years after HWI banded it as a hatch-year bird in the Goshutes. Extensive northward movements following dispersal from natal areas have been demonstrated for several Red-tailed Hawks born in southern California (Hoffman et al. 2002). Also noteworthy was the second recapture in 13 months of a Goshute banded Cooper's Hawk by a raptor biologist and falconer in northwestern Montana who captured and re-released both birds after they invaded his pigeon cage! Both cases involved mature adult (5+ years old) females recaptured during the breeding season. Lastly, documentation of a mature adult female Cooper's Hawk killed by a cat in Arizona is the third such event recorded in HWI's recovery records.

SATELLITE TRACKING OF MIGRANTS

Our goal was to outfit two adult Northern Goshawks and 2–3 Golden Eagles with satellite transmitters during the 2003 season. Unfortunately, no adult goshawks were captured and the only eagle was captured before the telemetry equipment arrived on site.

As of late January 2004, 3 of 4 Red-tailed Hawks and 2 of 6 Golden Eagles outfitted during fall 2002 were still alive and actively transmitting. One of the red-tails has now returned to the same basic wintering area in southeastern Arizona two years in a row, after having summered in the northern Blue Mountains of northeastern Oregon and southeastern Washington. After being outfitted during fall 2002, the other two active red-tails settled for the winter in southern California and northern Baja California, and have remained there ever since. This suggests that these birds are now permanent residents in these areas, probably having undertaken late summer/fall northward ventures in 2002 before returning south for the winter. What is unusual about this is that, although such movements have been documented previously for first-year red-tails born in southern California, such activity as not been well documented for adult birds.

One of the still active Golden Eagles from 2002 has now returned for the second winter to southwest Utah, after having summered in northeastern Nevada. Similarly, the other active eagle has now returned for the second winter to an area along the northern border of Sonora and Chihuahua, Mexico, after having summered in south-central Idaho. Another of the 2002 eagles, after having wintered in west-central Texas, ended up in the far northwestern Northwest Territories for the summer, but unfortunately appears to have died there in mid-November. Two other 2002 eagles survived through August and September 2003, but at that point both signals ceased abruptly; whether due to mortality or a technical problem is unknown. One of the these birds wintered in southwestern Utah and then spent the summer making a huge wandering loop up into the Rocky Mountains of Canada and then out onto the plains of Alberta and Saskatchewan. The other wintered in central Nevada, then spent the summer making a large wandering loop up through northeastern Oregon and Idaho before returning to northern Nevada.

Tracking summaries and maps for all of HWI's satellite-tracked raptors can be found at www.hawkwatch.org.

IDENTIFYING MIGRANT ORIGINS THROUGH STABLE ISOTOPE ANALYSES

During the 2003 season, HWI continued to collect feather samples to contribute to two Boise State University graduate student studies designed to use analyses of stable-isotope ratios to identify the origins of migrant Red-tailed Hawks and Northern Goshawks in western North America. This technique has already yielded valuable insight concerning the origins and migration ecology (relative passage timing of different subpopulations) of migrants sampled at HWI migration project sites in Florida (Meehan et al. 2001, Lott et al. 2003) and New Mexico (Smith et al. 2003, DeLong 2003). Compared to complimentary satellite-tracking studies, the stable-isotope technique can be applied to any size bird.

In 2003, HWI received a new grant from the National Fish and Wildlife Foundation that is enabling us to greatly expand our involvement in application of this technique to western migratory raptors. This grant supported sampling and analysis of feathers from migrant Sharp-shinned Hawks, Cooper's Hawks, and American Kestrels captured at nine migration-trapping sites in western North America from Alaska to Mexico, including the Goshutes. The results of this investigation will be known by summer 2004.

RESIDENT RAPTORS

At least 2 immature Sharp-shinned Hawks displayed non-resident behavior at the site early in the season, seen most frequently around North and West trapping stations. At least one immature Cooper's Hawk suspected to be a resident was seen several times moving north toward Goshute peak early in the season. Two adult and two juvenile Northern Goshawks were observed throughout season, with a known nest location. At least one immature (with slightly heavy mottling) and two adult Red-tailed Hawks (1 chocolate dark morph and the other a light morph bird) were seen around the project area throughout the season. At least one immature Golden Eagle and a pair of territorial adults were seen throughout the season frequenting the Goshute ridgeline and the adjacent Dolly Varden valley. Early in the season, two

pairs of American Kestrels were observed in the area. Tail chasing and kecking were common as the pairs disputed a possible territory boundary between North banding station and OP2. At least one juvenile Prairie Falcon frequented the site throughout the season, occasionally stooping plastic owls and making runs at the trapping stations. An adult Peregrine Falcon seemed to be holding a territory on the flanks of the ridge throughout the season, seen repeatedly perching on the canyon walls and chasing interloping Prairie Falcons and goshawks from the area.

This is a typical resident assemblage for the site, except that adult Prairie Falcons are often more evident and the lengthy and highly territorial presence of the adult peregrine was unusual (in fact these two variations may be related). HWI recently documented (1999–2003) the first productive Peregrine Falcon eyries in northwestern Utah in the past ~30 years roughly 50 km north of the Goshutes (Smith 2003). Peregrine populations are expanding throughout many areas of the country as the species continues to rebound from the DDT era (Hoffman and Smith 2003).

SITE VISITATION

In 2003, 323 individuals signed the HWI Goshute visitor logs. Utah and Nevada represented the most common points of origin, with additional visitors originating in Arizona, Oregon, California, Washington, Wyoming, the United Kingdom, and Ontario, Canada. The visitors included 128 members of five organized groups, including school groups from Wendover, Nevada and Taylorsville, Utah, and three scout groups. A front-page article on the project in the Utah section of the *Salt Lake Tribune* drew many visitors to the site in October.

In 2003 at the Goshutes, 721 hourly assessments of visitor disturbance resulted in the following ratings: 98% none and 2% low. This very low level of visitor disturbance of the official observers primarily reflects the success of our efforts to control the environment for conducting the simultaneous comparison count.

ACKNOWLEDGMENTS

The Goshute project receives tremendous support from many individuals and organizations. For financial support in 2003, we enthusiastically thank the Bureau of Land Management–Elko Field Office, National Fish and Wildlife Foundation, Bureau of Reclamation–Upper Colorado Region, Ezekiel R. and Edna Wattis Dumke Foundation, George Perkins, Jr., Barrick Goldstrike Mines, Dr. Kay Millar, and HWI members. The BLM Elko Field Office also provided helicopter airlift and other essential logistical support; special thanks to Ray Lister and Tamara Hawthorne for their assistance and oversight. We are also grateful for discounted hotel accommodations provided to our field crews on their days off by Stateline Casino Resorts of Wendover, Nevada; for logistical support of the West Wendover Waste Water Treatment Plant and West Wendover Public Water Works; and for generous donations provided by Einstein's Bagels in Salt Lake City and Salt Lake Roasting Company. Lastly, special thanks to Stephen Wilson, Leo Chidester, and Mark Vekasy for volunteering their time to assist our field crews, and to Leigh Greenwood for sharing her satellite telemetry experience with the banding crew.

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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 Goshute Mountains, NV: 1983–2002 versus 2003.

	COUNTS			RAPTORS/100 HOURS[1]		
SPECIES	1983–2000[2]	2001	% CHANGE	1983–2000[2]	2001	% CHANGE
Turkey Vulture	312 ± 68.7	466	+50	90.4 ± 17.70	134.0	+48
Osprey	92 ± 20.8	96	+5	20.7 ± 4.17	21.2	+2
Northern Harrier	180 ± 33.5	127	-29	28.0 ± 4.56	19.6	-30
Sharp-shinned Hawk	4849 ± 909.3	3460	-29	1052.7 ± 161.69	726.6	-31
Cooper's Hawk	3328 ± 669.7	2281	-31	811.2 ± 136.93	552.0	-32
Northern Goshawk	115 ± 25.0	16	-86	18.8 ± 3.92	2.7	-85
Unknown small accipiter[3]	123 ± 241.1	268	+118	–	–	–
Unknown large accipiter[3]	2 ± 3.9	3	+50	–	–	–
Unknown accipiter	342 ± 91.4	0	-100	–	–	–
TOTAL ACCIPITERS	8646 ± 1532.3	6028	-30	–	–	–
Red-shouldered Hawk	0.3 ± 0.3	0	-100	–	–	–
Broad-winged Hawk	42 ± 15.4	58	+37	15.6 ± 5.21	21.7	+39
Swainson's Hawk	199 ± 62.2	908	+355	49.3 ± 14.99	226.2	+359
Red-tailed Hawk	2996 ± 430.4	3903	+30	491.4 ± 55.71	623.9	+27
Ferruginous Hawk	17 ± 3.0	20	+20	2.8 ± 0.49	3.1	+12
Rough-legged Hawk	15 ± 4.7	1	-93	7.5 ± 2.07	0.5	-93
Unidentified buteo	71 ± 21.9	57	-20	–	–	–
TOTAL BUTEOS	3340 ± 473.7	4947	+48	–	–	–
Golden Eagle	273 ± 25.4	181	-34	43.0 ± 3.44	27.5	-36
Bald Eagle	13 ± 3.1	9	-32	2.7 ± 0.59	1.9	-29
Unidentified eagle	1 ± 0.6	0	-100	–	–	–
TOTAL EAGLES	287 ± 27.1	190	-34	–	–	–
American Kestrel	2030 ± 415.8	1768	-13	421.4 ± 79.21	362.7	-14
Merlin	41 ± 12.3	33	-19	7.7 ± 2.33	6.4	-17
Prairie Falcon	30 ± 6.3	14	-53	4.8 ± 0.95	2.2	-53
Peregrine Falcon	11 ± 4.2	9	-19	1.9 ± 0.72	1.4	-27
Unknown small falcon[3]	0.0 ± 0.0	10	–	–	–	–
Unknown large falcon[3]	2 ± 3.9	1	-50	–	–	–
Unknown falcon	7 ± 2.2	2	-72	–	–	–
TOTAL FALCONS	2118 ± 433.4	1837	-13	–	–	–
Unidentified raptor	127 ± 42.6	79	-38	–	–	–
GRAND TOTAL	15101 ± 2423.7	13770	-9	–	–	–

[1] Adjusted for incompletely identified birds and to standardized, species-specific sampling periods.

[2] Mean ± 95% confidence interval.

[3] These categories represent new distinctions initiated as standard practice in 2001 (see Appendix B for classification details).

Table 2. Annual raptor migration counts by age classes and immature : adult ratios for selected species in the Goshute Mountains, NV: 1992–2002 versus 2003.

	Total and Age-classified Counts								Immature : Adult	
	1992–2002 Average			2003			% Unknown Age		Ratio	
Species	Total	Imm.	Adult	Total	Imm.	Adult	1992–2002[1]	2003	1992–2002[1]	2003
Northern Harrier	237	74	72	127	49	27	40 ± 11.9	40	1.18 ± 0.341	1.81
Sharp-shinned Hawk	6214	2220	1770	3460	619	859	35 ± 5.4	57	1.27 ± 0.338	0.72
Cooper's Hawk	4368	1057	1258	2281	319	581	47 ± 4.4	61	0.83 ± 0.326	0.55
Northern Goshawk[2]	120	58	39	16	12	3	19 ± 5.1	6	2.05 ± 0.728	4.00
Broad-winged Hawk	58	15	24	58	17	28	35 ± 8.5	22	0.67 ± 0.225	0.61
Red-tailed Hawk	3630	755	2041	3903	856	2083	23 ± 5.6	25	0.37 ± 0.077	0.41
Ferruginous Hawk	19	6	5	20	4	7	44 ± 14.7	45	1.51 ± 0.807	0.57
Golden Eagle[2]	270	137	78	181	90	27	20 ± 3.5	35	2.07 ± 0.461	3.33
Bald Eagle	15	7	7	9	2	7	4 ± 3.8	0.0	1.10 ± 0.468	0.29
Peregrine Falcon	17	5	7	9	0	6	32 ± 15.8	33	0.69 ± 0.346	0.00

[1] Mean ± 95% confidence interval. For age ratios, note that long-term mean immature : adult ratios are averages of annual ratios and may differ from values obtained by dividing average numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in the observed age ratio.

[2] Long-term averages based on data for 1983–2002.

Table 3. First and last observed, bulk passage, and median passage dates by species for migrating raptors in the Goshute Mountains, NV in 2003, with comparisons of 2003 and 1983–2002 average median passage dates.

	2003				1983–2002
Species	First Observed	Last Observed	Bulk Passage Dates[1]	Median Passage Date[2]	Median Passage Date[2, 3]
Turkey Vulture	19-Aug	21-Oct	14-Sep – 2-Oct	23-Sep	21-Sep ± 1.5
Osprey	26-Aug	23-Oct	31-Aug – 6-Oct	15-Sep	14-Sep ± 1.4
Northern Harrier	18-Aug	29-Oct	26-Aug – 22-Oct	28-Sep	24-Sep ± 3.1
Sharp-shinned Hawk	15-Aug	4-Nov	14-Sep – 20-Oct	4-Oct	24-Sep ± 2.0
Cooper's Hawk	15-Aug	25-Oct	14-Sep – 9-Oct	24-Sep	21-Sep ± 1.5
Northern Goshawk	30-Aug	26-Oct	1-Sep – 24-Oct	5-Oct	7-Oct ± 3.3
Broad-winged Hawk	14-Sep	9-Oct	21-Sep – 30-Sep	26-Sep	22-Sep ± 1.8
Swainson's Hawk	15-Aug	15-Oct	19-Sep – 28-Sep	26-Sep	18-Sep ± 3.1
Red-tailed Hawk	15-Aug	4-Nov	9-Sep – 24-Oct	13-Oct	3-Oct ± 2.1
Ferruginous Hawk	20-Aug	25-Oct	26-Aug – 22-Oct	19-Sep	26-Sep ± 2.5
Rough-legged Hawk	22-Oct	22-Oct	–	–	22-Oct ± 1.8
Golden Eagle	16-Aug	4-Nov	2-Sep – 26-Oct	7-Oct	6-Oct ± 1.9
Bald Eagle	15-Oct	2-Nov	15-Oct – 2-Nov	25-Oct	20-Oct ± 4.3
American Kestrel	15-Aug	24-Oct	1-Sep – 6-Oct	20-Sep	15-Sep ± 1.7
Merlin	12-Sep	26-Oct	19-Sep – 20-Oct	28-Sep	2-Oct ± 2.2
Prairie Falcon	16-Aug	18-Oct	18-Aug – 15-Oct	23-Sep	12-Sep ± 2.9
Peregrine Falcon	18-Aug	24-Oct	18-Aug – 24-Oct	19-Sep	24-Sep ± 3.3
Total	15-Aug	4-Nov	9-Sep – 20-Oct	26-Sep	23-Sep ± 1.6

[1] Dates between which the central 80% of the flight passed the lookout.

[2] Date by which 50% of the flight had passed the lookout.

[3] Mean ± 95% confidence interval in days; calculated using only data for years with counts ≥5 birds.

Table 4. Median passage dates by age classes for selected species of migrating raptors in the Goshute Mountains, NV: 1992–2002 versus 2003.

	ADULT		IMMATURE / SUBADULT	
SPECIES	1992–2002[1]	2003	1992–2002[1]	2003
Northern Harrier	26-Sep ± 6.0	29-Sep	18-Sep ± 7.5	26-Sep
Sharp-shinned Hawk	6-Oct ± 2.2	8-Oct	14-Sep ± 1.3	20-Sep
Cooper's Hawk	25-Sep ± 2.6	26-Sep	16-Sep ± 1.6	21-Sep
Northern Goshawk[2]	14-Oct ± 4.2	–	2-Oct ± 4.1	5-Oct
Broad-winged Hawk	22-Sep ± 2.0	25-Sep	23-Sep ± 3.5	26-Sep
Red-tailed Hawk	7-Oct ± 2.3	14-Oct	15-Sep ± 5.1	25-Sep
Ferruginous Hawk	8-Oct ± 5.0	26-Sep	26-Sep ± 12.9	–
Golden Eagle[2]	11-Oct ± 2.8	10-Oct	5-Oct ± 2.3	5-Oct
Bald Eagle	19-Oct ± 5.8	25-Oct	24-Oct ± 3.0	–
Peregrine Falcon	23-Sep ± 6.0	31-Aug	21-Sep ± 3.3	–

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

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

[2] Average for 1983–2002.

Table 5. Capture totals, rates, and successes for migrating raptors in the Goshute Mountains, NM: 1987–2002 versus 2003.

	CAPTURE TOTAL		CAPTURE RATE[1]		CAPTURE SUCCESS (%)[2]	
SPECIES	1987–2000[3]	2001	1987–2000[3]	2001	1987–2000[3]	2001
Northern Harrier	7 ± 2.6	7	0.5 ± 0.18	0.5	4.4 ± 1.54	5.5
Sharp-shinned Hawk	1,625 ± 234.2	825	99.3 ± 7.64	64.7	30.0 ± 4.96	22.8
Cooper's Hawk	800 ± 139.0	460	48.6 ± 4.79	36.0	20.8 ± 3.19	19.3
Northern Goshawk	33 ± 11.4	9	2.0 ± 0.52	0.7	30.2 ± 5.82	56.3
Broad-winged Hawk	1 ± 0.5	2	0.1 ± 0.03	0.2	2.5 ± 1.22	3.4
Swainson's Hawk	0.3 ± 0.3	0	0.0 ± 0.01	0.0	0.1 ± 0.15	0.0
Red-tailed Hawk	78 ± 14.8	63	4.8 ± 0.66	4.9	2.4 ± 0.34	1.6
Rough-legged Hawk	0.1 ± 0.2	0	0.0 ± 0.01	0.0	0.5 ± 1.07	0.0
Golden Eagle	5 ± 1.5	1	0.4 ± 0.12	0.1	1.9 ± 0.57	0.6
American Kestrel	199 ± 50.3	88	11.5 ± 2.24	6.9	8.6 ± 2.23	4.9
Merlin	12 ± 3.2	5	0.7 ± 0.20	0.4	22.8 ± 4.84	15.2
Prairie Falcon	6 ± 1.8	3	0.4 ± 0.10	0.2	19.6 ± 4.61	21.4
Peregrine Falcon	1 ± 0.6	0	0.1 ± 0.04	0.0	10.3 ± 5.58	0.0
All Species	2,768 ± 413.4	1,463	168.2 ± 11.26	114.7	17.7 ± 2.52	12.0

[1] Captures / 100 station hours.

[2] Number of birds captured / number of birds observed * 100, with birds identified only to the generic group level (i.e., unknown accipiter, buteo, falcon, or eagle) allocated to relevant species in proportion to their occurrence. For calculating the "all species" values, non-trappable species and distant birds not identified at least to the generic group level were excluded.

[3] Mean of annual values ± 95% confidence interval. Limited to years when at least three trapping blinds were operated.

Table 6. Capture totals by sex and age (HY = hatching year; AHY = after hatching year), female : male capture ratios, and immature : adult capture ratios for selected species of migrating raptors in the Goshute Mountains, NM: 1992–2002 averages versus 2003.

	Female			Male			Female : Male	HY : AHY
	AHY	HY	Unk.	AHY	HY	Unk.	Ratio[1]	Ratio[1]
Sharp-shinned Hawk								
1992–2002 mean	307.6	528.9	–	254.3	644.8	–	0.91	2.19
2003	171	223	–	176	255	–	1.40	1.38
Cooper's Hawk								
1992–2002 mean	279.1	220.7	–	156.6	207.7	–	1.40	0.98
2003	151	147	–	53	109	–	1.84	1.25
Northern Goshawk								
1992–2002 mean	5.8	12.2	–	2.5	13.7	–	1.54	8.78
2003	0	5	–	0	4	–	1.25	9.00
American Kestrel								
1992–2002 mean	8.5	78.5	27.3	28.3	88.4	2.8	0.96	5.95
2003	1	37	2	9	38	1	0.83	7.50

[1] Long-term mean ratios are averages of annual ratios and may differ from values obtained by dividing long-term average numbers of relevant sex or age classes. Discrepancies between the two values reflect high annual variability in the observed age ratio.

Table 7. Recaptures of previously banded raptors in the Goshute Mountains, Nevada during fall 2003.

Species	Sex	Band #	Banding Site	Banding Date	Banding Age[1]	Recapture Date	Recapture Age[1]	Distance (km)
Sharp-shinned Hawk	F	2003 – 77886	Goshute Mts., NV	17-Sep-97	HY	28-Sep-03	>7th yr	–
Red-tailed Hawk	U	1177 – 37061	*	*	HY	29-Sep-03	HY	*
Cooper's Hawk	F	1005 – 01950	Goshute Mts., NV	06-Oct-00	ASY	08-Oct-03	>5th yr	–

[1] HY = hatching year; ASY = after second year; otherwise self-explanatory.

* Awaiting report from Bird Banding Lab.

Table 8. Foreign encounters during 2003 with raptors banded in the Goshute Mountains, NV.

Species	Sex	Band #	Banding date	Banding age	Encounter Date	Encounter Age[1]	Encounter Location	Distance (km)	Status
SS	F	1593 – 34488	21-Oct-02	AHY	13-Jan-03	ASY	Laveen, AZ	681	found dead
RT	U	1177 – 25304	09-Oct-02	HY	23-Jan-03	SY	Lake Havasu City, AZ	548	found dead
CH	F	1005 – 18684	17-Oct-02	ASY	14-Feb-03	ATY	Camp Verde, AZ	600	found dead
CH	F	1005 – 10585	14-Sep-02	HY	04-Jun-03	SY	Salmon, ID	430	found dead
RT	U	1807 – 39991	18-Oct-93	HY	12-Jun-03	11th yr	Irvine, CA	735	research recapture
CH	M	1204 – 13171	05-Oct-99	AHY	22-Jun-03	>5th yr	Prince George, BC	1593	found dead
CH	F	1005 – 05195	22-Sep-99	AHY	18-Jul-03	>5th yr	Stevensville, MT	548	caught in pigeon cage, released
CH	F	0745 – 17098	09-Oct-98	ASY	18-Oct-03	>7th yr	Yucca, AZ	504	killed by cat
CH	F	1005 – 10553	29-Sep-01	HY	20-Dec-03	TY	Cobleskill, NY	4509	found dead
RT	U	1177 – 06700	15-Oct-02	HY	30-Dec-03	SY	Phoenix, AZ	688	injured / died

[1] L = local or nestling; HY = hatching year; SY = second year; TY = third year; AHY = after hatching year; ASY = after second year; ATY = after third year; otherwise self-explanatory.

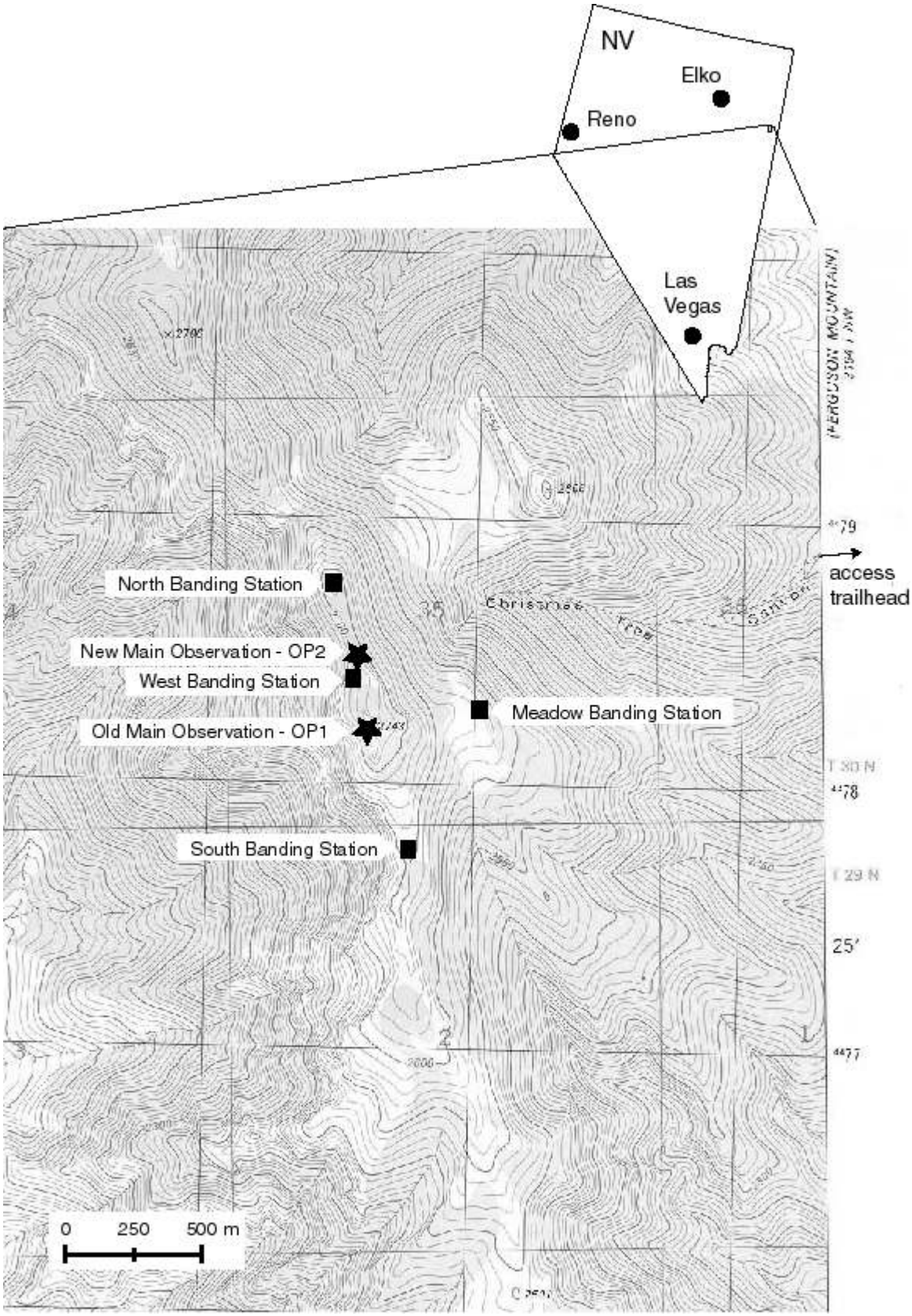

Figure 1. Location of the Goshute Mountains Raptor Migration Project study site.

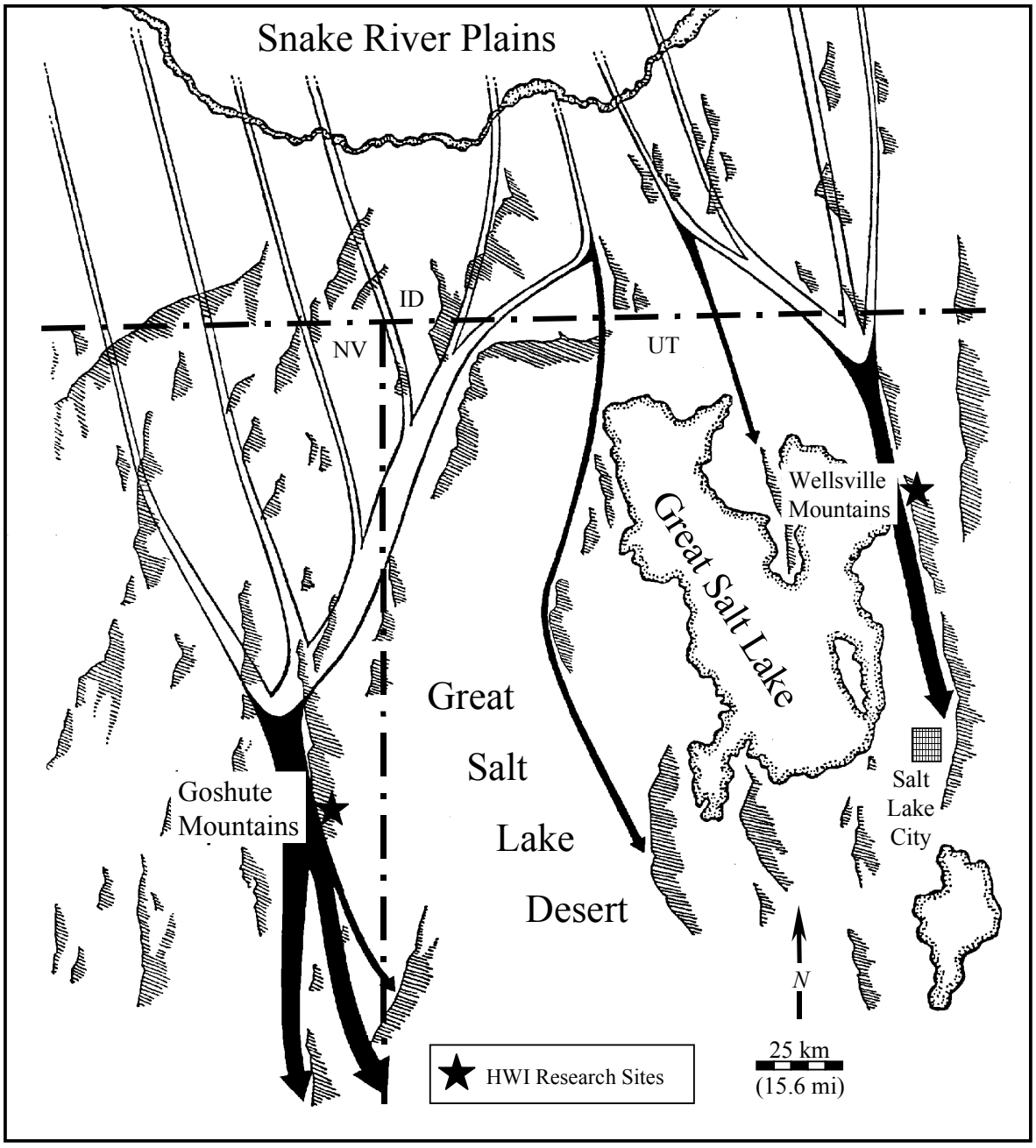

Figure 2. Location of the Goshute Mountains Raptor Migration Project study site in relation to regional raptor flyways and the Great Salt Lake and Desert region.

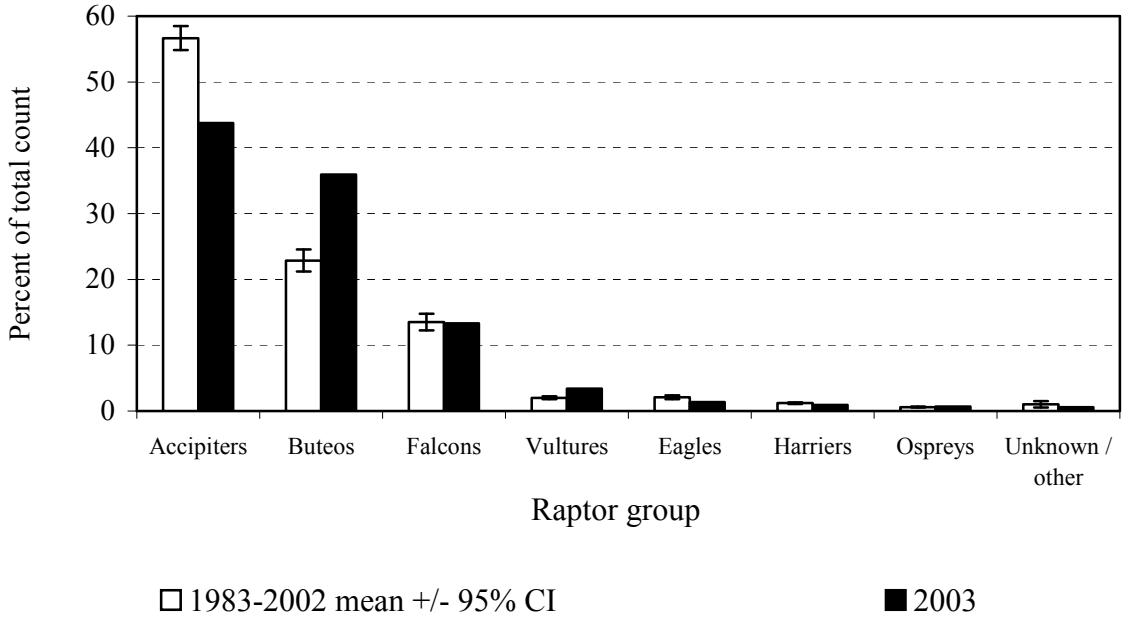

Figure 3. Fall migration flight composition by major species groups in the Goshute Mountains, Nevada: 1983–2002 versus 2003.

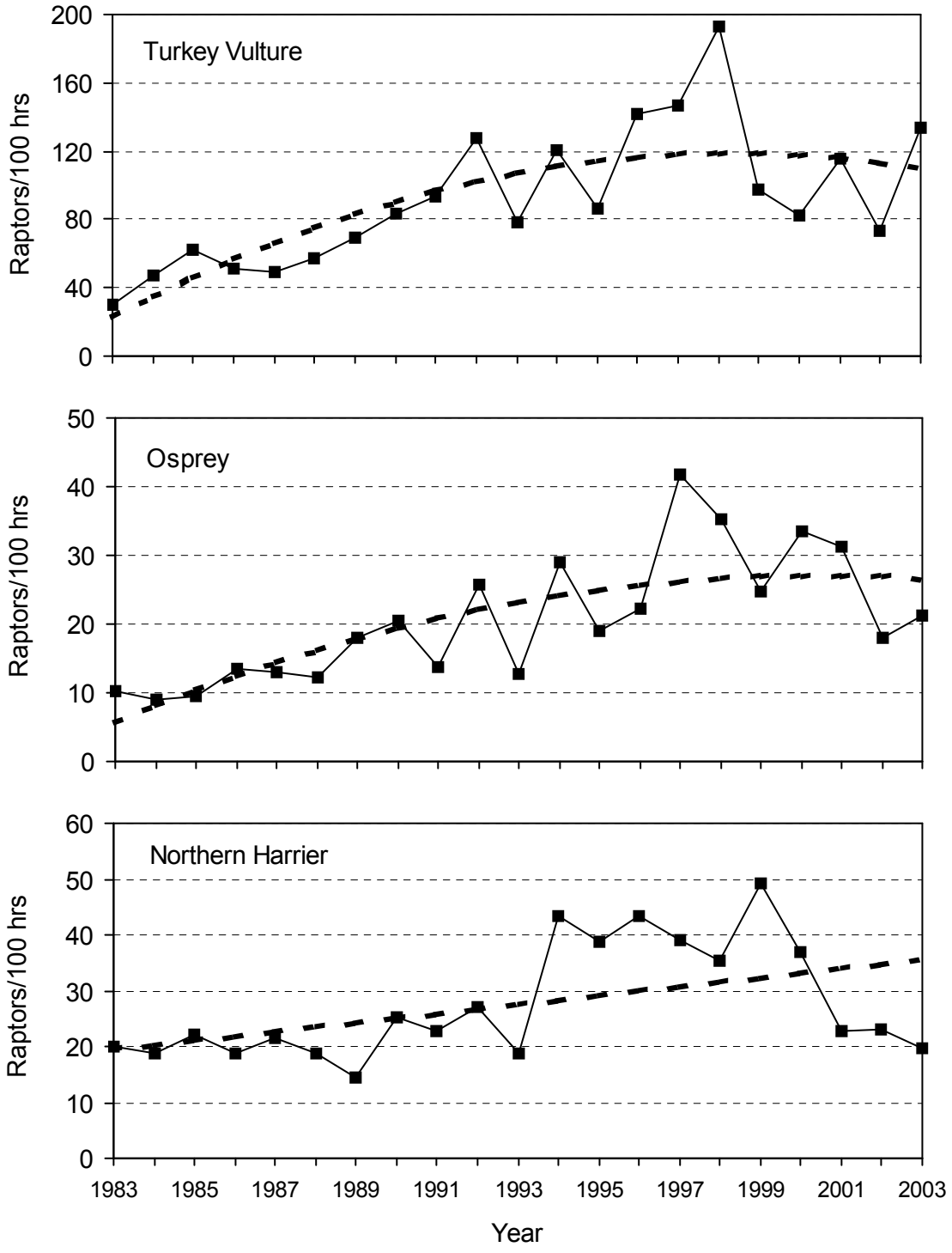

Figure 4. Adjusted fall-migration passage rates in the Goshute Mountains, Nevada for Turkey Vultures, Ospreys, and Northern Harriers: 1983–2003. Dashed lines indicate significant linear or quadratic regressions.

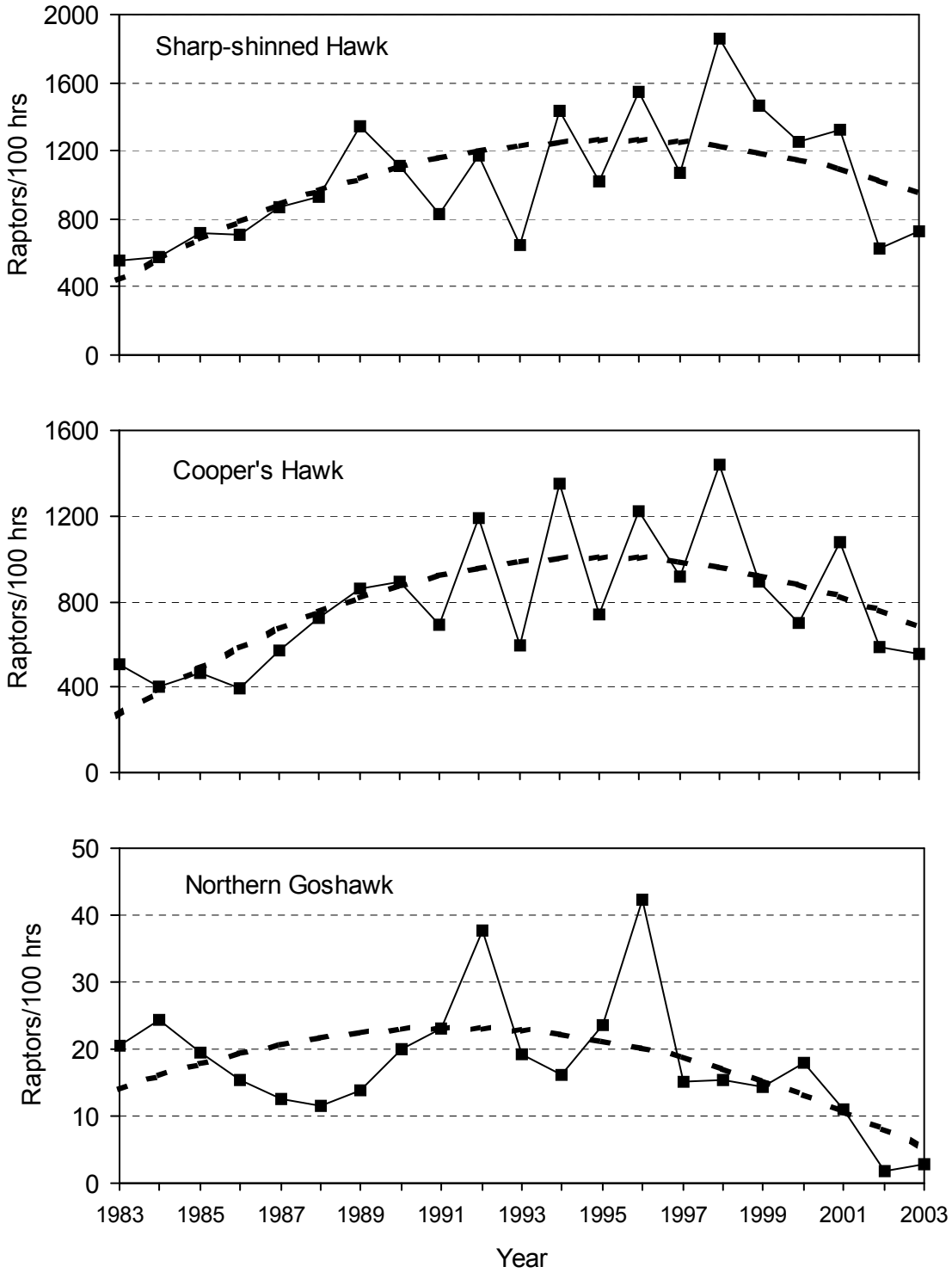

Figure 5. Adjusted fall-migration passage rates in the Goshute Mountains, Nevada for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks: 1983–2003. Dashed lines indicate significant linear or quadratic regressions.

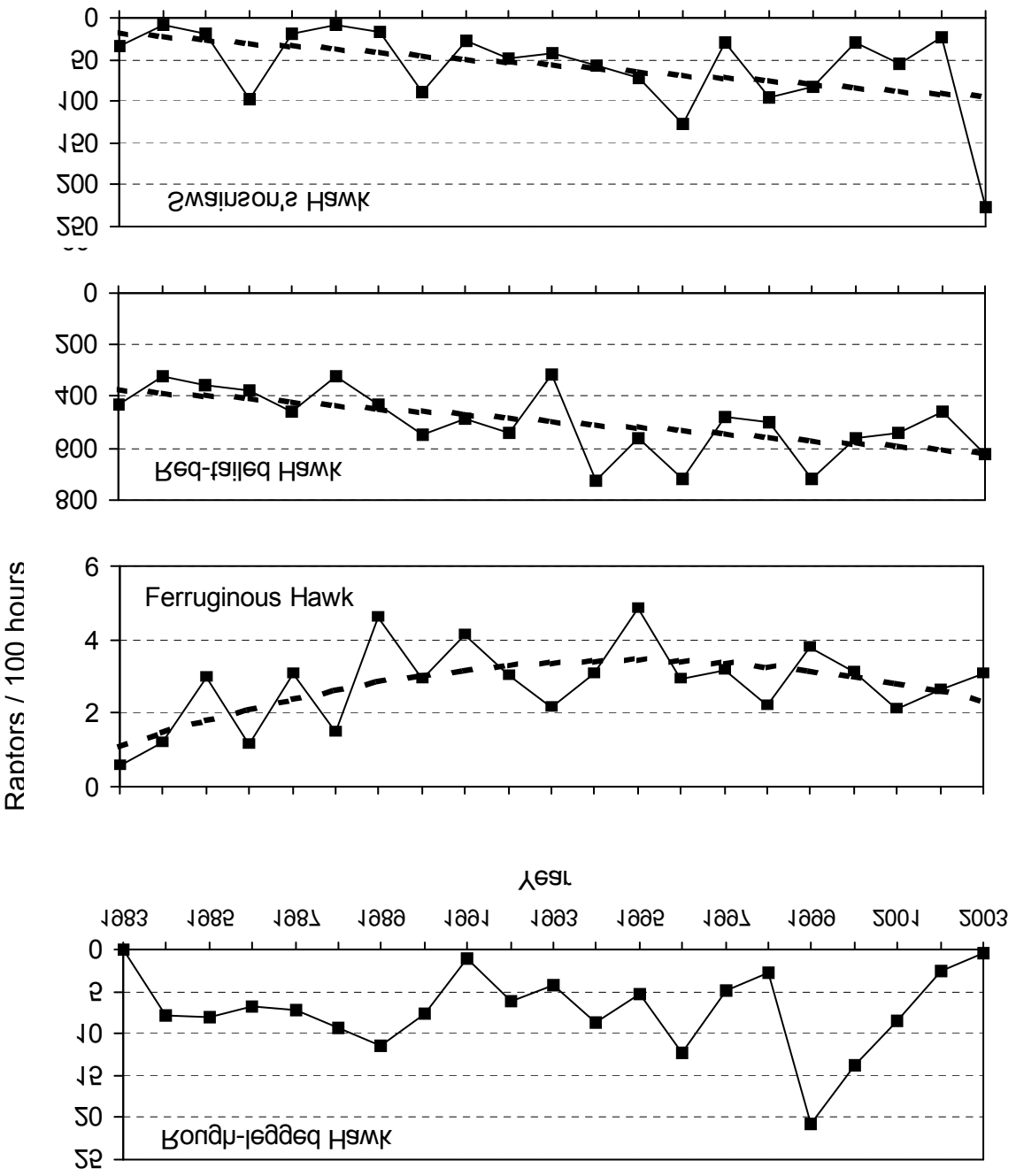

Figure 6. Adjusted fall-migration passage rates in the Goshute Mountains, Nevada for Broad-winged, Swainson's, Red-tailed, Ferruginous, and Rough-legged Hawks: 1983–2003. Dashed lines indicate significant linear or quadratic regressions.

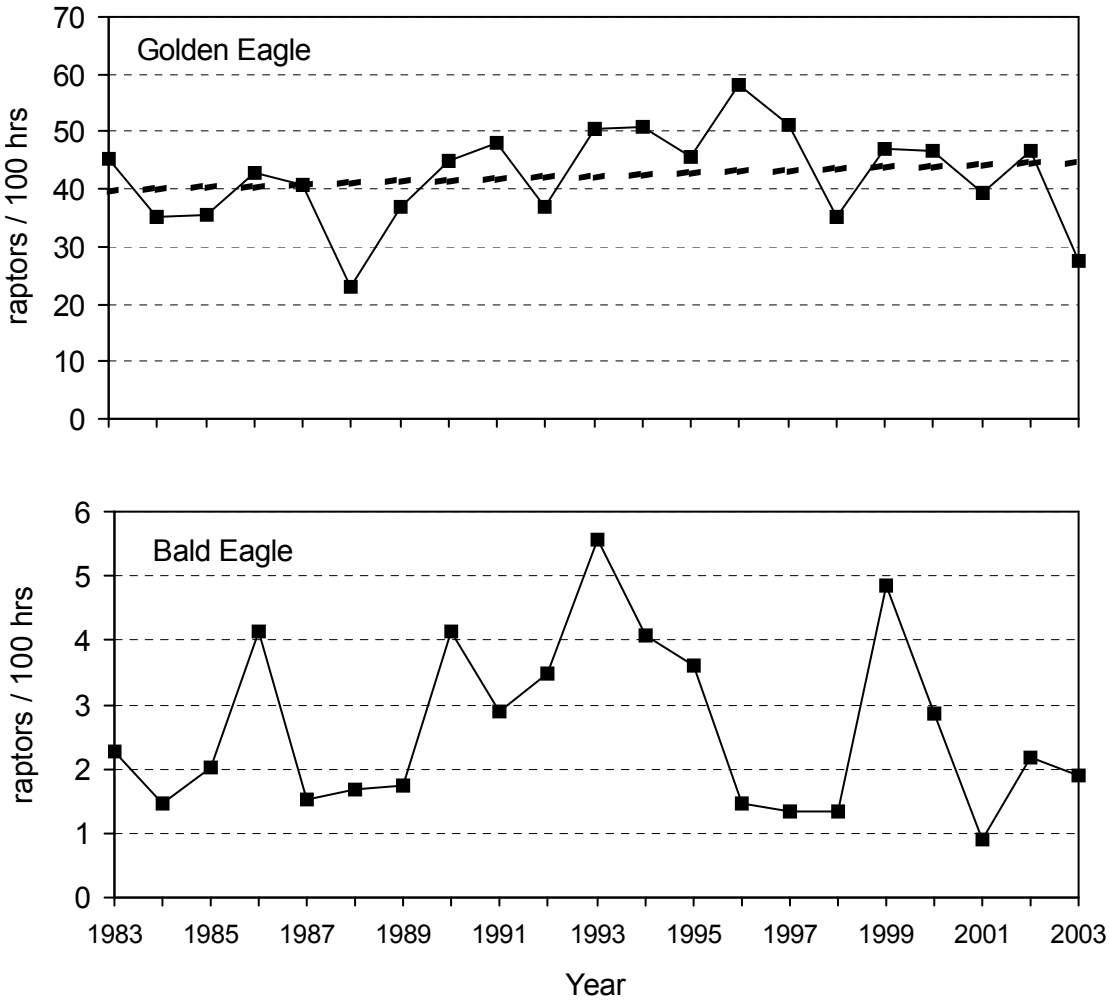

Figure 7. Adjusted fall-migration passage rates in the Goshute Mountains, Nevada for Golden and Bald Eagles: 1983–2003. Dashed lines indicate significant linear or quadratic regressions.

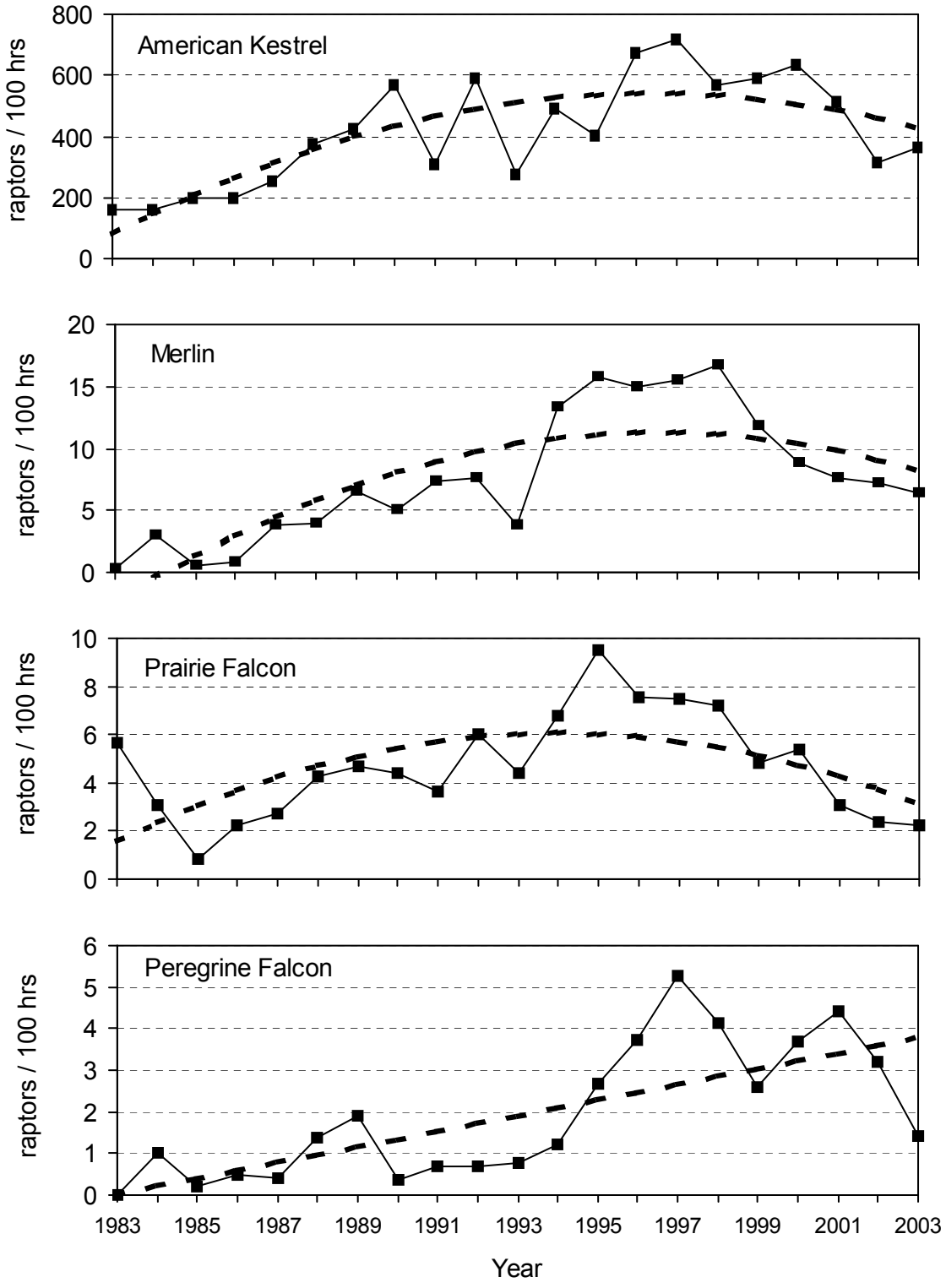

Figure 8. Adjusted fall-migration passage rates in the Goshute Mountains, Nevada for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons: 1983–2003. Dashed lines indicate significant linear or quadratic regressions.

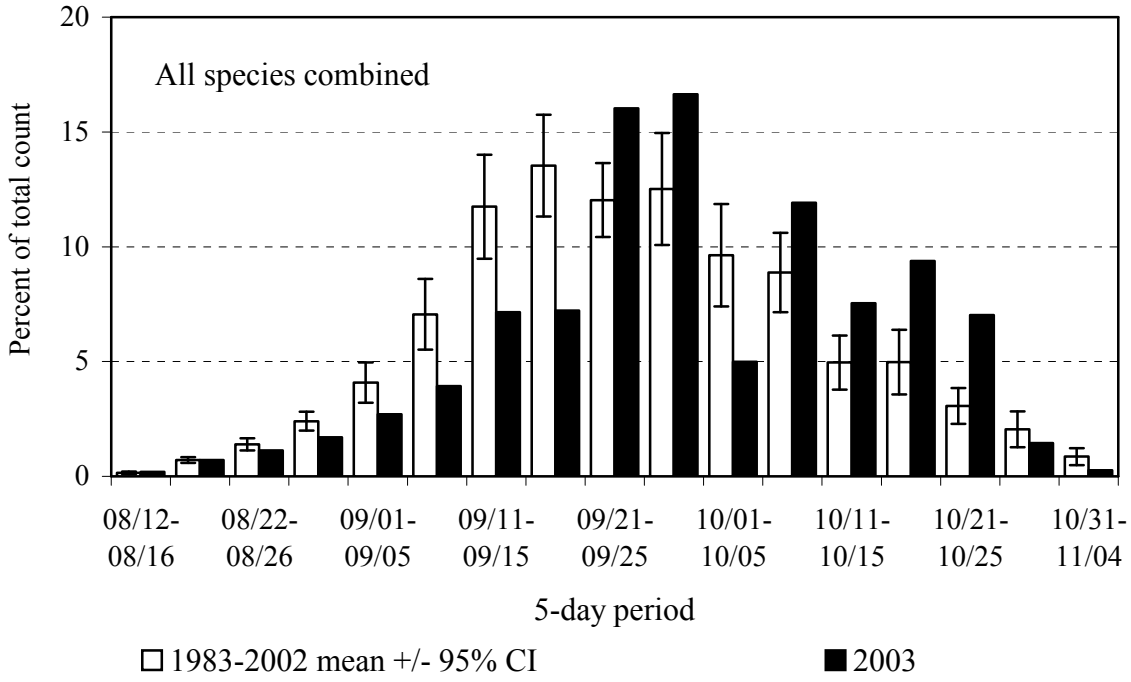

Figure 9. Combined-species passage volume by five-day periods: 1983–2002 versus 2003.

Appendix A. History of official observer participation on the Goshute Mountains Raptor Migration Project.

1983-1986: Single observer throughout with occasional scribe. 1983, David Sherman (0)[1]; 1984, three principal observers: Jim Daly (0), Jeff Smith (0), and Fred Tilly (14); 1985, two principal observers: Jim Daly (1) and Fred Tilly (15); 1986, principal observer: John Lower (0).

1987-1989: Single observer throughout, two observers during the peak month. 1987, two principal observers: Victor Fazio (2) and Fred Tilly (16); 1988, two principal observers: Brian Mongi (2) and Fred Tilly (17); 1989, two principal observers: Brian Mongi (3) and Fred Tilly (19).

1990: Two observers throughout with two teams of two for a comparison count during the peak month. Four principal observers: John Martin (1), LisaBeth Daly (2), Fred Tilly (21), and Cathy Tilly (1).

1991: Two observers throughout except 30 October - 5 November, with a scribe throughout. Principal observers: Steve Engel (1) and Dale Payne (0).

1992: Two observers throughout, three observers during the peak month, with a scribe throughout. Three principal observers: Steve Engel (2), Maureen O'Mara (0), and Fred Tilly (24).

1993: Two observers throughout with a scribe throughout. Principal observers: Emily Teachout (1) and Jeff Maurer (0).

1994: Two observers throughout, three observers during the peak month, with a scribe throughout. Principal observers: Steve Engel (3), Jeff Maurer (1), and Fred Tilly (27).

1995: Two observers throughout with a scribe through 17 October. Principal observers: Robert Clemens (3) and Susan Salafsky (2).

1996: Two observer throughout except 27 October- 4 November, three observers for the peak month with a scribe until 27 October. Principal observers: Fred Tilly (29), Cathy Tilly (4), Robert Clemens (4), and Aaron Barna (1).

1997: Two observers throughout with a scribe from 10 September - 15 October. Principal observers: Jessie Jewell (9) and Neils Maumenee (2).

1998: Two observers throughout. Principal observers: Jerry Liguori (14) and Mike Lanzone (0).

1999: Two observers throughout. Principal observers: Jerry Liguori (15) and Aaron Barna (4).

2000: Two observers throughout. Principle observers: Jerry Liguori (16), Jeff Maurer (3), Nathan McNett (4), and Aaron Barna (5).

2001: Two observers throughout. Principle observers: Jerry Liguori (17) and Nathan McNett (5).

2002: Two observers throughout. Principle observers: Nathan McNett (6) and Greg Levandoski (2).

2003: Two observers throughout (rotating assignments). Principle observers: Nathan McNett (7), Adam Hutchins (4), Allison Cebula (3), Eric Hallingstad (2).

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[1] Numbers in parentheses indicate the number of years of previous experience conducting season-long migratory raptor counts.

Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications for all migrant raptors seen in the Goshute Mountains, Nevada.

Common Name	Scientific Name	Species Code	Age[1]	Sex[2]	Color Morph[3]
Turkey Vulture	*Cathartes aura*	TV	U	U	NA
Osprey	*Pandion haliaetus*	OS	U	U	NA
Northern Harrier	*Circus cyaneus*	NH	A I Br U	M F U	NA
Sharp-shinned Hawk	*Accipiter striatus*	SS	A I U	U	NA
Cooper's Hawk	*Accipiter cooperii*	CH	A I U	U	NA
Northern Goshawk	*Accipiter gentilis*	NG	A I U	U	NA
Unknown small accipiter	*A. striatus* or *cooperii*	SA	U	U	NA
Unknown large accipiter	*A. cooperii* or *gentilis*	LA	U	U	NA
Unknown accipiter	*Accipiter* spp.	UA	U	U	NA
Red-shouldered Hawk	*Buteo lineatus*	RS	A I 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
Unknown buteo	*Buteo* spp.	UB	U	U	D L U
Golden Eagle	*Aquila chrysaetos*	GE	I, S, NA, A, U[4]	U	NA
Bald Eagle	*Haliaeetus leucocephalus*	BE	I, S1, S2, NA, A, U[5]	U	NA
Unknown eagle	*Aquila* or *Haliaeetus spp.*	UE	U	U	NA
American Kestrel	*Falco sparverius*	AK	U	M F U	NA
Merlin	*Falco columbarius*	ML	AM Br	AM U	NA
Prairie Falcon	*Falco mexicanus*	PR	U	U	NA
Peregrine Falcon	*Falco peregrinus*	PG	A I U	U	NA
Unknown small falcon	*F. sparverius* or *columbarius*	SF	U	U	NA
Unknown large falcon	*F. mexicanus* or *peregrinus*	LF	U	U	NA
Unknown falcon	*Falco* spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

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

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

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

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

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

Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries: 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
15-Aug	8.00	1.8	0	pc, AM haze, PM ts	7.0	sw-w/var, ne	28.0	30.55	1	97	90	2	2.0
16-Aug	7.00	1.9	0	pc-ovc, AM haze, PM ts	5.0	wsw-w	20.6	30.49	2	92	83	2	1.6
17-Aug	8.50	1.9	0	clr	14.4	sw-w	21.0	30.49	2	100	94	2	2.1
18-Aug	8.42	1.7	0	clr, haze	4.8	sw-wsw/var, ene	21.2	30.48	2	65	83	1	2.4
19-Aug	8.00	2.0	0	clr, haze	4.7	w/var, ene	24.4	30.48	2	47	58	1	1.5
20-Aug	7.84	2.9	0	mc-ovc, AM rain	7.9	sw-w	23.8	30.51	3	99	94	2	4.1
21-Aug	6.42	4.0	0	pc-ovc, PM ts	10.0	sw-w	20.7	30.46	3	87	98	1	2.3
22-Aug	6.25	3.3	0	pc-ovc, scat ts/rain	11.3	sw-w, ne-ene	19.3	30.39	3	81	89	1	0.5
23-Aug	8.00	3.6	0	clr-pc, AM haze	7.9	wsw-wnw, PM ene	19.8	30.47	2	86	94	1	1.6
24-Aug	8.00	3.8	0	clr-ovc, PM ts/rain	11.4	e-ese	22.5	30.56	2	99	100	2	3.8
25-Aug	8.00	2.0	0	clr-pc	5.1	ne-ene, w-wnw	22.2	30.57	1	100	100	2	6.3
26-Aug	9.25	2.0	0	mc-ovc, scat rain	12.3	sw-wnw	23.7	30.43	3	100	85	1	6.4
27-Aug	9.00	2.0	0	clr-pc, AM/PM haze	8.3	w, ne-e	20.4	30.38	2	98	97	2	4.2
28-Aug	9.00	2.0	0	clr-ovc, AM haze	5.9	ne-ene, PM wsw	20.9	30.37	2	100	96	2	7.4
29-Aug	7.84	2.0	0	mc-ovc, ts, rain	13.1	wsw-wnw/var, ene-e	15.2	30.37	4	57	59	1	0.8
30-Aug	9.00	2.0	0	clr, haze	4.7	ne-e	16.6	30.42	2	90	90	2	5.0
31-Aug	9.00	2.0	0	clr, haze	8.1	wsw-w/var	17.5	30.40	2	63	83	1	8.7
1-Sep	9.00	2.0	0	pc-ovc	12.1	wsw-w	19.5	30.41	3	98	96	2	10.3
2-Sep	9.00	2.0	0	clr-pc, haze/dust	10.4	ene-e	21.4	30.45	1	94	91	2	7.8
3-Sep	9.25	2.0	0	clr-mc, haze	9.2	wsw-nw	19.5	30.47	2	97	94	1	11.9
4-Sep	8.59	2.0	0	mc-ovc, AM haze, scat rain	13.1	w-nw/var	17.7	30.44	4	81	76	1	3.5
5-Sep	8.00	2.0	0	pc-ovc, ts, rain	3.2	w, e-se, wnw	21.3	30.43	2	84	84	2	8.8
6-Sep	8.25	2.0	0	clr-ovc, ts/rain	4.6	w-wnw/var	17.8	30.34	3	96	93	2	14.8
7-Sep	9.00	2.0	0	clr-ovc	5.8	wsw-w	20.7	30.25	2	100	97	3	16.6
8-Sep	9.00	2.0	0	pc-ovc, PM haze	18.9	wsw-wnw	15.3	30.04	3	79	85	3	23.7
9-Sep	8.00	2.0	0	ovc, scat fog/rain	16.3	w-wnw	9.8	29.92	4	60	52	2	3.5
10-Sep	9.00	1.9	0	pc-mc, AM fog	10.6	wsw-w/var	10.7	30.21	3	85	79	3	3.2
11-Sep	9.75	2.0	0	clr, AM/PM haze	7.5	w-wnw	14.3	30.42	2	97	89	2	19.0
12-Sep	9.50	2.0	0	clr	15.8	ene-e	16.5	30.25	3	95	95	3	11.9
13-Sep	9.25	2.0	0	clr, AM haze	11.2	w-wnw	9.2	30.38	2	89	85	3	9.2
14-Sep	9.42	2.0	0	clr, PM haze	4.8	w	12.8	30.35	1	96	86	2	29.4
15-Sep	10.00	1.9	0	clr-mc, haze	15.6	wsw-wnw	18.0	30.22	3	72	67	2	32.5
16-Sep	8.50	2.0	0	ovc, dust	29.8	wsw-w	16.6	29.96	4	73	65	3	30.9
17-Sep	9.00	2.0	0	pc	15.9	ne-ene/var	5.1	30.12	4	92	81	3	2.9
18-Sep	9.00	2.0	0	clr, PM haze	5.3	wsw-wnw	7.7	30.30	1	95	88	2	16.8
19-Sep	9.75	2.0	0	clr-mc, PM haze	9.9	wsw-wnw	13.3	30.25	3	90	84	3	42.1
20-Sep	9.75	1.9	0	clr	6.9	var	14.6	30.31	1	98	93	2	14.9
21-Sep	10.00	2.0	0	clr	4.6	wsw-wnw/var	14.5	30.36	1	98	97	3	40.5
22-Sep	10.00	2.0	0	clr	2.5	w-wnw	16.2	30.36	1	100	100	3	67.6
23-Sep	9.50	2.0	0	clr	8.0	e/var	19.2	30.32	1	93	93	3	38.9
24-Sep	10.00	2.0	0	clr	1.5	ne-e, w/var	17.5	30.40	1	97	97	3	53.1
25-Sep	9.75	2.0	0	clr, PM haze	5.6	ne/calm, wnw	18.5	30.46	2	100	91	2	23.1
26-Sep	9.50	2.0	0	clr	3.3	ne, wnw/calm	18.5	30.43	1	92	94	2	34.9
27-Sep	10.00	2.0	0	clr	2.3	sw-wnw/var	18.0	30.41	1	100	100	3	109.0
28-Sep	10.00	2.0	0	clr, haze	5.4	wsw-w/var	18.0	30.34	1	94	94	3	30.1
29-Sep	9.75	1.9	0	clr, PM haze	7.8	wsw-w, ene-e/var	18.8	30.27	1	96	93	2	34.2
30-Sep	9.00	2.0	0	clr/haze-mc	5.1	w/var	19.1	30.41	1	72	76	2	26.1
1-Oct	7.75	1.8	0	ovc, rain, scat ts	9.3	ene-ese/var	14.7	30.35	4	93	92	1	7.9
2-Oct	9.00	2.0	0	ovc-pc, AM rain, scat ts	5.5	ne-ene	14.6	30.12	3	93	70	3	18.1
3-Oct	9.00	2.0	0	pc-mc	9.7	w/var, ene-e	12.1	30.14	4	82	87	2	10.3
4-Oct	9.00	2.0	0	clr-ovc	5.5	var, ene-ese	12.8	30.22	3	93	87	2	13.7
5-Oct	9.00	2.0	0	pc-ovc	5.5	ne-e	13.5	30.29	3	97	84	3	27.6
6-Oct	9.00	2.0	0	pc-mc	5.0	wsw-wnw	14.4	30.26	2	87	84	3	53.7

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
7-Oct	9.00	2.0	1	pc-ovc, PM rain	7.5	sw-wnw	16.1	30.11	4	92	91	2	43.0
8-Oct	9.50	2.0	0	clr	13.8	sw-wnw	15.4	30.19	3	88	96	3	30.7
9-Oct	9.84	2.0	0	clr, PM dust	29.6	wsw-wnw	16.9	30.03	4	87	80	2	43.7
10-Oct	9.00	2.0	0	clr	11.6	wnw	4.6	30.06	3	100	100	2	5.4
11-Oct	9.25	2.6	0	clr	8.5	w-wnw	7.7	30.23	3	100	95	1	18.6
12-Oct	9.50	2.0	0	clr-mc	17.8	var	12.2	30.23	4	100	92	2	15.1
13-Oct	8.00	1.9	0	clr	3.2	sw-wnw	5.1	30.38	2	98	97	3	10.4
14-Oct	9.00	1.9	0	clr	32.7	w-wnw	11.1	30.14	4	96	93	2	21.7
15-Oct	9.50	1.9	0	clr-ovc	14.3	wsw-wnw/var	12.1	30.15	3	100	100	1	46.9
16-Oct	9.50	2.0	0	clr-pc	10.2	sw-w, nw/var	10.8	30.41	3	100	100	1	13.7
17-Oct	9.16	1.9	0	clr	7.0	wsw-wnw	15.2	30.50	2	86	86	2	15.4
18-Oct	9.00	1.8	0	clr-mc	14.5	wsw-wnw	16.3	30.45	4	95	87	2	20.2
19-Oct	9.00	2.0	0	pc-ovc	15.6	wsw-wnw, PM var	14.5	30.44	4	85	84	2	18.8
20-Oct	9.00	2.0	0	clr, late mc	4.5	ne	15.4	30.58	2	100	100	3	74.4
21-Oct	8.75	2.0	0	clr	9.3	wsw-wnw, PM ese	13.0	30.61	3	100	100	3	31.0
22-Oct	8.84	2.0	0	clr	9.1	wsw-wnw, ne, wsw	17.2	30.45	3	95	87	2	23.1
23-Oct	8.75	2.0	0	ovc-clr/haze	8.4	wsw-wnw	12.7	30.36	2	90	94	2	9.0
24-Oct	8.84	2.0	0	mc-ovc	9.6	ne-ene, wsw	9.0	30.38	4	93	93	3	24.1
25-Oct	8.75	2.0	0	clr-pc	5.8	e-ese, wsw-w	4.6	30.55	4	100	100	2	23.0
26-Oct	8.50	2.0	0	clr-pc	6.6	wsw-nw	9.7	30.63	3	100	97	1	14.4
27-Oct	8.50	1.9	0	ovc	19.2	wsw-wnw	12.3	30.45	4	98	97	3	4.4
28-Oct	8.00	2.0	0	clr-pc	21.7	w	10.8	30.19	4	95	93	3	2.6
29-Oct	8.50	2.0	0	clr-mc, haze/dust	32.2	w	10.3	29.60	4	57	59	2	2.4
30-Oct	0.00			fog/snow									
31-Oct	0.00			fog/snow									
1-Nov	0.00			fog/snow									
2-Nov	3.25	2.5	0	pc-mc	13.6	w-wnw	-1.8	29.72	4	70	79	1	7.7
3-Nov	2.50	2.1	0	ovc, fog, PM snow	14.8	wsw-wnw	-1.3	29.55	4	10	5	1	1.2
4-Nov	8.00	2.2	0	mc-ovc, PM snow	10.4		-2.2	29.86	4	93	87	2	1.1
5-Nov	0.00			snow									

[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 = thunder storms.

[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 unadjusted raptor counts by species: 2003.

		Species[1]																											Birds
Date	Hours	TV	OS	NH	SS	CH	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	Total	/ Hour
15-Aug	8.00	0	0	0	1	2	0	0	0	0	0	0	1	7	0	0	0	0	0	0	5	0	0	0	0	0	0	0	16	2.0
16-Aug	7.00	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	3	0	0	3	0	1	0	0	0	0	0	11	1.6
17-Aug	8.50	0	0	0	0	1	0	0	0	0	0	0	0	14	0	0	0	1	0	0	2	0	0	0	0	0	0	0	18	2.1
18-Aug	8.42	0	0	1	1	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	7	0	1	1	0	0	0	1	20	2.4
19-Aug	8.00	1	0	3	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	6	0	0	0	0	0	0	0	12	1.5
20-Aug	7.84	0	0	2	2	1	0	0	0	0	0	0	0	11	1	0	0	2	0	0	13	0	0	0	0	0	0	0	32	4.1
21-Aug	6.42	0	0	0	0	1	0	0	0	0	0	0	0	9	0	0	0	0	0	0	5	0	0	0	0	0	0	0	15	2.3
22-Aug	6.25	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.5
23-Aug	8.00	0	0	1	2	1	0	0	0	0	0	0	0	6	1	0	0	0	0	0	2	0	0	0	0	0	0	0	13	1.6
24-Aug	8.00	0	0	3	2	1	0	0	0	0	0	0	1	15	0	0	1	0	0	0	7	0	0	0	0	0	0	0	30	3.8
25-Aug	8.00	0	0	0	0	1	0	0	0	0	0	0	0	18	0	0	1	0	0	0	29	0	1	0	0	0	0	0	50	6.3
26-Aug	9.25	0	2	3	2	1	0	0	0	0	0	0	11	15	1	0	0	2	0	0	21	0	1	0	0	0	0	0	59	6.4
27-Aug	9.00	0	0	2	3	0	0	0	0	0	0	0	2	17	0	0	1	2	0	0	10	0	0	0	0	0	0	1	38	4.2
28-Aug	9.00	0	3	2	3	2	0	0	0	0	0	0	6	34	0	0	0	1	0	0	16	0	0	0	0	0	0	0	67	7.4
29-Aug	7.84	0	0	0	2	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	6	0.8
30-Aug	9.00	0	3	1	5	4	1	0	0	0	0	0	4	17	1	0	0	1	0	0	8	0	0	0	0	0	0	0	45	5.0
31-Aug	9.00	0	4	4	4	5	0	1	0	0	0	0	0	36	0	0	1	2	0	0	20	0	0	0	0	0	0	1	78	8.7
01-Sep	9.00	0	1	2	11	7	1	1	0	0	0	0	0	28	0	0	1	1	0	0	38	0	0	2	0	0	0	0	93	10.3
02-Sep	9.00	0	2	3	6	11	0	3	0	0	0	0	3	8	0	0	0	3	0	0	29	0	0	0	0	0	0	2	70	7.8
03-Sep	9.25	0	2	3	25	10	1	2	0	0	0	0	4	30	0	0	0	0	0	0	33	0	0	0	0	0	0	0	110	11.9
04-Sep	8.59	0	2	0	8	6	0	0	0	0	0	0	1	6	1	0	0	1	0	0	4	0	0	0	0	0	0	1	30	3.5
05-Sep	8.00	1	1	0	6	7	0	2	0	0	0	0	1	22	0	0	1	1	0	0	28	0	0	0	0	0	0	0	70	8.8
06-Sep	8.25	0	1	2	25	15	0	3	0	0	0	0	3	34	0	0	1	1	0	0	36	0	0	0	0	0	0	1	122	14.8
07-Sep	9.00	0	2	1	23	19	0	0	0	0	0	0	2	15	0	0	1	1	0	0	85	0	0	0	0	0	0	0	149	16.6
08-Sep	9.00	5	6	0	45	23	0	3	0	0	0	0	3	21	0	0	2	4	0	0	98	0	0	0	0	0	1	2	213	23.7
09-Sep	8.00	2	1	0	6	2	0	0	0	0	0	0	2	12	0	0	1	0	0	0	2	0	0	0	0	0	0	0	28	3.5
10-Sep	9.00	0	0	0	11	5	0	2	0	0	0	0	0	5	0	0	1	0	0	0	5	0	0	0	0	0	0	0	29	3.2
11-Sep	9.75	12	2	0	48	40	0	3	0	0	0	0	4	38	0	0	0	0	0	0	35	0	0	0	0	0	0	3	185	19.0
12-Sep	9.50	3	2	0	34	12	0	9	0	0	0	0	1	18	0	0	3	1	0	0	28	1	0	0	0	0	0	1	113	11.9
13-Sep	9.25	13	4	1	5	22	0	0	0	0	0	0	3	20	1	0	4	2	0	0	9	0	0	0	0	0	0	1	85	9.2
14-Sep	9.42	17	7	0	107	77	0	5	0	0	0	1	3	22	1	0	1	1	0	0	32	0	1	0	0	0	0	2	277	29.4
15-Sep	10.00	5	0	1	94	78	0	3	0	0	0	0	4	47	0	0	1	4	0	0	87	0	0	0	1	0	0	0	325	32.5

Appendix D. continued

		Species[1]																											Birds
Date	Hours	TV	OS	NH	SS	CH	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	Total	/ Hour
16-Sep	8.50	2	5	0	72	71	0	11	0	0	0	0	11	37	0	0	4	3	0	0	41	1	0	0	0	1	0	4	263	30.9
17-Sep	9.00	5	0	0	2	13	0	0	0	0	0	0	0	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	26	2.9
18-Sep	9.00	15	2	2	25	49	0	6	0	0	0	0	14	30	1	0	1	0	0	0	5	1	0	0	0	0	0	0	151	16.8
19-Sep	9.75	7	5	4	153	114	0	8	0	0	0	0	7	32	1	0	1	0	0	0	69	2	0	0	2	0	0	5	410	42.1
20-Sep	9.75	44	0	2	15	25	0	2	0	0	0	0	1	19	1	0	3	1	0	0	29	0	1	1	0	0	0	1	145	14.9
21-Sep	10.00	17	1	0	55	53	0	11	0	0	0	5	55	50	0	0	1	2	0	0	153	0	0	0	0	0	0	2	405	40.5
22-Sep	10.00	41	5	4	135	225	0	24	0	0	0	5	24	77	0	0	2	0	0	0	126	1	0	0	0	0	0	7	676	67.6
23-Sep	9.50	13	3	2	65	130	2	20	0	0	0	3	7	37	0	0	1	0	0	0	79	0	0	0	0	0	0	8	370	38.9
24-Sep	10.00	32	3	3	46	101	0	19	0	0	0	2	168	45	0	0	1	2	0	0	103	0	1	0	0	0	0	5	531	53.1
25-Sep	9.75	40	1	2	21	48	0	3	0	0	0	1	43	23	1	0	3	1	0	0	35	2	0	0	0	0	0	1	225	23.1
26-Sep	9.50	38	1	2	56	62	0	8	0	0	0	8	49	47	1	0	1	0	0	0	48	1	0	0	0	0	0	10	332	34.9
27-Sep	10.00	27	1	6	137	320	0	19	0	0	0	22	353	155	1	0	1	2	0	0	45	1	0	0	0	0	0	0	1090	109.0
28-Sep	10.00	9	4	1	74	67	1	15	0	0	0	2	64	28	0	0	2	2	0	0	24	5	0	0	0	0	0	3	301	30.1
29-Sep	9.75	19	2	5	123	71	0	3	0	0	0	1	13	21	0	0	0	5	0	0	65	2	0	0	3	0	0	0	333	34.2
30-Sep	9.00	21	2	3	66	57	0	10	0	0	0	3	17	42	0	0	0	4	0	0	7	0	0	0	1	0	0	2	235	26.1
01-Oct	7.75	0	0	0	36	11	0	4	0	0	0	1	0	7	0	0	1	0	0	0	1	0	0	0	0	0	0	0	61	7.9
02-Oct	9.00	33	2	0	31	31	0	5	0	0	0	0	2	43	0	0	1	2	0	0	12	0	0	0	0	0	0	1	163	18.1
03-Oct	9.00	7	0	1	30	23	0	1	0	0	0	1	0	24	0	0	0	2	0	0	3	1	0	0	0	0	0	0	93	10.3
04-Oct	9.00	10	3	0	35	37	0	1	0	0	0	0	1	23	0	0	0	4	0	0	8	1	0	0	0	0	0	0	123	13.7
05-Oct	9.00	0	1	1	105	32	0	2	0	0	0	1	3	77	0	0	0	5	0	0	19	1	0	0	0	0	0	1	248	27.6
06-Oct	9.00	6	3	4	194	68	2	11	0	0	0	1	8	146	0	0	1	11	0	0	28	0	0	0	0	0	0	0	483	53.7
07-Oct	9.00	0	0	1	171	56	1	3	0	0	0	0	3	57	0	0	2	5	0	0	83	0	2	0	0	0	0	3	387	43.0
08-Oct	9.50	15	1	3	170	31	1	4	1	0	0	0	2	42	0	0	0	8	0	0	12	1	0	0	0	0	0	1	292	30.7
09-Oct	9.84	2	1	2	218	71	0	15	0	0	0	1	2	84	0	0	3	2	0	0	23	2	0	0	1	0	0	3	430	43.7
10-Oct	9.00	2	0	0	13	7	0	0	0	0	0	0	0	24	0	0	0	1	0	0	1	0	1	0	0	0	0	0	49	5.4
11-Oct	9.25	1	0	0	24	10	0	2	0	0	0	0	0	126	0	0	0	3	0	0	5	0	0	1	0	0	0	0	172	18.6
12-Oct	9.50	0	0	0	59	25	0	6	1	0	0	0	1	32	0	0	3	4	0	0	6	1	2	0	1	0	0	2	143	15.1
13-Oct	8.00	0	0	0	18	3	0	0	0	0	0	0	0	58	1	0	0	1	0	0	1	1	0	0	0	0	0	0	83	10.4
14-Oct	9.00	0	0	0	40	14	1	6	0	0	0	0	0	117	1	0	1	7	0	0	5	0	0	2	0	0	1	0	195	21.7
15-Oct	9.50	0	1	6	95	47	0	1	0	0	0	0	1	278	0	0	0	4	1	0	11	0	1	0	0	0	0	0	446	46.9
16-Oct	9.50	0	0	3	52	6	0	0	0	0	0	0	0	65	0	0	0	3	0	0	1	0	0	0	0	0	0	0	130	13.7
17-Oct	9.16	0	1	3	80	5	0	0	0	0	0	0	0	45	0	0	0	3	0	0	3	1	0	0	0	0	0	0	141	15.4

Appendix D. continued

		Species[1]																											Birds
Date	Hours	TV	OS	NH	SS	CH	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	Total	/ Hour
18-Oct	9.00	0	0	6	111	4	1	1	0	0	0	0	0	57	0	0	0	1	0	0	0	0	1	0	0	0	0	0	182	20.2
19-Oct	9.00	0	1	3	67	13	0	2	0	0	0	0	0	72	1	0	0	4	1	0	1	3	0	0	0	0	0	1	169	18.8
20-Oct	9.00	0	0	5	146	7	0	1	0	0	0	0	0	487	1	0	2	13	0	0	5	2	0	0	0	0	0	1	670	74.4
21-Oct	8.75	1	0	5	68	2	0	2	0	0	0	0	0	183	1	0	0	7	1	0	0	0	0	0	1	0	0	0	271	31.0
22-Oct	8.84	0	1	6	95	6	1	0	0	0	0	0	0	89	1	1	0	3	0	0	1	0	0	0	0	0	0	0	204	23.1
23-Oct	8.75	0	1	2	17	6	0	1	0	0	0	0	0	47	0	0	1	2	0	0	1	1	0	0	0	0	0	0	79	9.0
24-Oct	8.84	0	0	1	12	1	2	0	0	0	0	0	0	191	0	0	0	3	0	0	1	0	0	1	0	0	0	1	213	24.1
25-Oct	8.75	0	0	1	18	4	0	1	0	0	0	0	0	169	1	0	0	6	1	0	0	0	0	0	0	0	0	0	201	23.0
26-Oct	8.50	0	0	0	13	0	1	0	1	0	0	0	0	99	0	0	0	6	1	0	0	1	0	0	0	0	0	0	122	14.4
27-Oct	8.50	0	0	1	5	0	0	2	0	0	0	0	0	27	0	0	0	2	0	0	0	0	0	0	0	0	0	0	37	4.4
28-Oct	8.00	0	0	1	2	0	0	1	0	0	0	0	0	9	0	0	0	6	2	0	0	0	0	0	0	0	0	0	21	2.6
29-Oct	8.50	0	0	1	4	0	0	0	0	0	0	0	0	13	0	0	0	0	1	0	0	0	0	0	0	0	0	1	20	2.4
30-Oct	0.00																													
31-Oct	0.00																													
01-Nov	0.00																													
02-Nov	3.25	0	0	0	2	0	0	0	0	0	0	0	0	20	0	0	0	2	1	0	0	0	0	0	0	0	0	0	25	7.7
03-Nov	2.50	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	0	3	1.2
04-Nov	8.00	0	0	0	1	0	0	0	0	0	0	0	0	7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	9	1.1
05-Nov	0.00																													
Total	688.21	466	96	127	3460	2281	16	268	3	0	0	58	908	3903	20	1	57	181	9	0	1768	33	14	9	10	1	2	79	13770	20.0

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

Appendix E. Annual summaries of observation effort and unadjusted raptor counts by species: 1983–2003.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	MEAN
Start Date	15-Aug	16-Aug	20-Aug	16-Aug	17-Aug	17-Aug	18-Aug	15-Aug	16-Aug	16-Aug	16-Aug	16-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug
End Date	23-Oct	17-Nov	5-Nov	31-Oct	27-Oct	9-Nov	4-Nov	31-Oct	5-Nov	10-Nov	5-Nov	5-Nov	5-Nov	4-Nov	5-Nov	31-Oct	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	3-Nov
Observation days	68	83	76	67	66	85	76	78	79	85	80	78	83	74	79	71	82	78	83	81	79	78
Observation hours	561.08	638.66	654.50	485.00	564.25	734.66	567.50	667.00	707.67	743.42	659.50	709.58	694.92	620.17	673.58	719.50	748.08	681.50	787.30	725.67	688.21	668.18
Raptors / 100 hours	1517	1130	1427	1435	1921	1704	2397	2527	1879	2703	1510	3122	2276	3514	2541	3515	3003	2542	2662	1564	2001	2224
SPECIES	RAPTOR COUNTS																					
Turkey Vulture	92	141	211	131	165	198	200	285	327	473	270	418	289	486	482	732	349	297	441	243	466	319
Osprey	41	39	40	43	51	54	65	86	62	119	54	130	92	99	187	176	110	152	152	83	96	92
Northern Harrier	109	105	139	89	120	125	77	161	152	184	116	292	252	255	255	247	356	233	178	154	127	177
Sharp-shinned Hawk	2021	2067	3177	2233	3537	4405	5404	5275	3702	5931	2838	6835	4752	6773	4677	9598	8094	6071	7429	3009	3460	4782
Cooper's Hawk	1698	1378	1741	1149	2042	3012	3074	3647	2779	5071	2298	5576	3252	5075	3848	6736	4109	3022	5107	2369	2281	3278
Northern Goshawk	105	146	119	65	65	74	80	123	146	259	120	105	150	241	97	99	103	123	80	11	16	110
Unknown small accipiter[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	55	246	268	257
Unknown large accipiter[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	4	3	4
Unknown accipiter	562	362	311	251	710	295	204	374	648	639	348	522	416	464	368	75	132	87	0	7	0	325
TOTAL ACCIPITERS	4386	3953	5348	3698	6354	7786	8762	9419	7275	11900	5604	13038	8570	12553	8990	16508	12438	9303	12671	5646	6028	8521
Red-shouldered Hawk	0	0	0	1	1	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0.3
Broad-winged Hawk	6	13	15	7	30	16	37	35	44	26	27	41	40	27	37	160	59	87	79	58	58	43
Swainson's Hawk	116	34	78	276	69	43	60	351	108	208	159	244	287	498	143	507	334	132	251	91	908	233
Red-tailed Hawk	2105	1765	2132	1663	2317	2048	2263	3336	2976	3489	1827	4663	3572	3990	2922	3329	5183	3446	3924	3008	3903	3039
Ferruginous Hawk	3	6	17	5	15	9	23	17	26	19	15	20	29	16	18	16	25	19	14	20	20	17
Rough-legged Hawk	0	17	17	10	9	23	21	14	3	13	7	17	11	17	10	6	50	24	23	6	1	14
Unidentified buteo	185	74	65	42	156	44	47	36	147	70	128	110	69	62	77	5	24	21	13	42	57	70
TOTAL BUTEOS	2415	1909	2324	2004	2597	2183	2451	3790	3304	3825	2163	5095	4008	4612	3207	4023	5675	3730	4340	3225	4947	3417
Golden Eagle	239	206	230	196	221	154	203	290	324	263	317	338	299	344	329	235	348	305	295	330	181	269
Bald Eagle	8	10	9	13	7	8	9	19	16	21	26	19	17	6	6	6	31	14	8	12	9	13
Unidentified eagle	2	0	0	1	0	0	0	2	6	1	1	1	1	1	0	0	0	0	0	0	0	1
TOTAL EAGLES	249	216	239	210	228	162	212	311	346	285	344	358	317	351	335	241	379	319	303	342	190	282
American Kestrel	731	697	934	708	1099	1844	1669	2634	1564	2982	1234	2461	1964	3199	3394	3169	2974	3149	2774	1503	1768	2017
Merlin	4	14	3	3	17	20	33	25	37	43	19	72	86	71	78	91	74	49	51	39	33	40
Prairie Falcon	31	16	5	11	15	27	24	26	23	40	26	45	58	44	48	50	33	37	23	12	14	29
Peregrine Falcon	0	5	1	3	2	8	9	3	5	4	4	7	15	21	29	26	15	21	59	15	9	11
Unknown small falcon[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	0	10	5
Unknown large falcon[1]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0	4	1	3
Unidentified falcon	6	7	2	8	6	7	5	10	11	4	6	9	18	21	7	2	7	3	2	2	2	7
TOTAL FALCONS	772	739	945	733	1139	1906	1740	2698	1640	3073	1289	2594	2141	3356	3556	3338	3103	3259	2879	1575	1837	2105
Unidentified raptor	446	113	94	53	186	107	96	106	193	234	117	229	149	83	102	25	57	34	26	81	79	124
GRAND TOTAL	8510	7215	9340	6961	10840	12521	13603	16856	13299	20093	9957	22154	15818	21795	17114	25290	22467	17327	20954	11349	13770	15037

[1] Designations used consistently beginning in 2001.

Appendix F. Daily trapping effort and captures by species: 2003.

Date	Station Hours	Species[1]													Captures	
		NH	SS	CH	NG	BW	SW	RT	RL	GE	AK	ML	PR	PG	Total	/ stn hr
24-Aug	5.00	0	0	1	0	0	0	1	0	0	0	0	0	0	2	0.4
25-Aug	9.00	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0.2
26-Aug	9.50	0	0	1	0	0	0	1	0	0	0	0	0	0	2	0.2
27-Aug	9.50	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0.1
28-Aug	16.75	1	2	0	0	0	0	1	0	0	3	0	0	0	7	0.4
29-Aug	15.33	0	2	1	0	0	0	0	0	0	0	0	0	0	3	0.2
30-Aug	25.50	0	0	2	0	0	0	1	0	0	1	0	0	0	4	0.2
31-Aug	21.75	0	5	1	0	0	0	6	0	0	0	0	0	0	12	0.6
01-Sep	27.00	0	6	2	1	0	0	2	0	0	5	0	0	0	16	0.6
02-Sep	9.50	0	3	1	0	0	0	0	0	0	1	0	0	0	5	0.5
03-Sep	13.50	1	3	2	1	0	0	3	0	0	5	0	0	0	15	1.1
04-Sep	15.20	0	5	1	0	0	0	0	0	0	0	0	0	0	6	0.4
05-Sep	22.00	0	7	2	0	0	0	1	0	0	5	0	0	0	15	0.7
06-Sep	26.00	0	13	1	0	0	0	4	0	0	4	0	0	0	22	0.8
07-Sep	9.25	1	1	2	0	0	0	1	0	0	0	0	0	0	5	0.5
08-Sep	18.25	0	9	2	0	0	0	1	0	0	9	0	0	0	21	1.2
09-Sep	18.00	0	4	1	0	0	0	1	0	0	1	0	0	0	7	0.4
10-Sep	25.20	0	4	0	2	0	0	0	0	0	1	0	0	0	7	0.3
11-Sep	26.70	0	19	6	0	0	0	3	0	0	5	0	0	0	33	1.2
12-Sep	26.50	0	6	3	0	0	0	1	0	0	1	0	0	0	11	0.4
13-Sep	26.00	0	3	9	0	0	0	0	0	0	2	0	0	0	14	0.5
14-Sep	25.75	1	40	20	0	0	0	2	0	0	2	0	0	0	65	2.5
15-Sep	26.50	0	33	18	0	0	0	3	0	0	2	0	0	0	56	2.1
16-Sep	17.50	0	11	7	0	0	0	0	0	0	0	0	0	0	18	1.0
17-Sep	23.25	0	0	4	0	0	0	0	0	0	0	0	0	0	4	0.2
18-Sep	22.00	0	6	14	2	0	0	0	0	0	1	0	0	0	23	1.0
19-Sep	17.00	0	25	18	0	0	0	0	0	0	7	0	0	0	50	2.9
20-Sep	26.00	0	8	7	0	0	0	0	0	0	2	0	1	0	18	0.7
21-Sep	24.25	0	18	8	0	0	0	0	0	1	4	0	0	0	31	1.3
22-Sep	25.50	0	47	53	0	0	0	0	0	0	2	0	0	0	102	4.0
23-Sep	17.75	0	9	17	0	0	0	0	0	0	3	0	0	0	29	1.6
24-Sep	26.00	0	16	36	0	0	0	1	0	0	2	0	0	0	55	2.1
25-Sep	25.50	0	10	19	0	0	0	0	0	0	6	0	0	0	35	1.4
26-Sep	26.25	0	15	19	0	0	0	1	0	0	2	0	0	0	37	1.4
27-Sep	27.25	0	35	49	0	0	0	2	0	0	0	0	0	0	86	3.2
28-Sep	17.25	0	16	12	0	0	0	0	0	0	3	0	0	0	31	1.8
29-Sep	26.00	0	25	19	0	1	0	3	0	0	2	0	0	0	50	1.9

Appendix F. continued

Date	Station Hours	Species[1]													Captures
		NH	SS	CH	NG	BW	SW	RT	RL	GE	AK	ML	PR	PG	Total / stn hr
30-Sep	17.10	1	12	14	0	1	0	0	0	0	0	0	0	0	28 1.6
01-Oct	13.10	0	14	6	0	0	0	0	0	0	0	0	0	0	20 1.5
02-Oct	15.00	0	2	2	0	0	0	0	0	0	1	0	0	0	5 0.3
03-Oct	25.25	0	14	10	0	0	0	2	0	0	0	0	0	0	26 1.0
04-Oct	25.25	0	22	7	0	0	0	0	0	0	1	0	0	0	30 1.2
05-Oct	25.00	0	18	12	0	0	0	1	0	0	1	0	0	0	32 1.3
06-Oct	16.75	1	27	14	1	0	0	0	0	0	1	0	0	0	44 2.6
07-Oct	12.00	0	17	4	1	0	0	1	0	0	2	0	1	0	26 2.2
08-Oct	16.25	0	33	10	0	0	0	1	0	0	0	1	0	0	45 2.8
09-Oct	17.00	0	30	3	0	0	0	0	0	0	0	1	0	0	34 2.0
10-Oct	24.25	0	0	0	0	0	0	0	0	0	0	0	1	0	1 0.0
11-Oct	19.50	0	6	3	0	0	0	4	0	0	0	0	0	0	13 0.7
12-Oct	24.50	0	10	1	0	0	0	0	0	0	0	0	0	0	11 0.4
13-Oct	19.50	0	4	1	0	0	0	0	0	0	0	0	0	0	5 0.3
14-Oct	14.50	0	3	0	0	0	0	0	0	0	0	0	0	0	3 0.2
15-Oct	16.83	0	18	5	0	0	0	5	0	0	1	0	0	0	29 1.7
16-Oct	16.00	0	20	2	0	0	0	0	0	0	0	0	0	0	22 1.4
17-Oct	23.83	1	33	0	0	0	0	0	0	0	0	1	0	0	35 1.5
18-Oct	24.00	0	41	2	0	0	0	1	0	0	0	0	0	0	44 1.8
19-Oct	24.00	0	14	1	0	0	0	0	0	0	0	0	0	0	15 0.6
20-Oct	24.25	0	36	1	0	0	0	0	0	0	0	1	0	0	38 1.6
21-Oct	14.50	0	13	0	0	0	0	1	0	0	0	0	0	0	14 1.0
22-Oct	20.25	0	18	1	0	0	0	1	0	0	0	0	0	0	20 1.0
23-Oct	15.00	0	6	1	0	0	0	0	0	0	0	0	0	0	7 0.5
24-Oct	15.50	0	2	0	0	0	0	0	0	0	0	0	0	0	2 0.1
25-Oct	13.75	0	4	2	1	0	0	1	0	0	0	0	0	0	8 0.6
26-Oct	13.75	0	0	0	0	0	0	1	0	0	0	1	0	0	2 0.1
27-Oct	16.25	0	1	0	0	0	0	2	0	0	0	0	0	0	3 0.2
28-Oct	4.00	0	1	0	0	0	0	0	0	0	0	0	0	0	1 0.3
Total	5.00	0	0	1	0	0	0	1	0	0	0	0	0	0	2 0.4

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

Appendix G. Annual summaries of banding effort and capture totals by species: 1980–2003.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	MEAN
Start date	23 Sep	2 Sep	8 Sep	25 Aug	28 Aug	2 Sep	27 Aug	30 Aug	28 Aug	30 Aug	24 Aug	21 Aug	19 Aug	22 Aug	19 Aug	22 Aug	19 Aug	18 Aug	18 Aug	21 Aug	21 Aug	22-Aug	24-Aug	24-Aug	
End date	19 Oct	10 Oct	16 Oct	22 Oct	17 Nov	8 Nov	10 Oct	27 Oct	23 Oct	24 Oct	31 Oct	26 Oct	7 Nov	22 Oct	29 Oct	25 Oct	23 Oct	22 Oct	22 Oct	3 Nov	28 Oct	4-Nov	5-Nov	28-Oct	
Blinds in operation	1	1	2	2	2	3	3	3	4	4	4	4	5	5	5	6	5	5	5	3	4	4	4	4	3.7
Trapping days	21	37	27	55	69	?	?	?	?	?	66	64	74	59	65	63	61	62	63	72	62	72	68	66	59
Station days	21	37	?	66	104	?	?	?	?	159	205	240	296	254	278	312	270	264	236	131	174	210	188	163	191
Station hours	149	227	159	443	622	654	483.8	833	1085	1203	1454	1899	2316	1971	2290	2382	2061	2087	1690	939	1286	1666	1474	1276	1277.0
Capture/100 stn hrs	84.5	341.0	215.1	228.9	149.1	185.2	127.5	168.2	175.4	196.9	190.3	159.8	166.8	136.0	205.1	120.1	160.7	147.0	202.3	163.6	167.0	173.0	159.9	114.7	172.4
SPECIES	RAPTOR CAPTURES																								
Northern Harrier	0	2	0	8	3	6	2	4	10	9	4	9	10	4	7	2	1	18	4	0	17	11	8	7	6
Sharp-shinned Hawk	62	376	186	571	548	705	410	886	1177	1527	1583	1694	2036	1526	2686	1823	2091	1783	2131	897	1235	1608	1283	825	1237
Cooper's Hawk	36	300	129	306	261	366	164	395	553	652	821	909	1220	822	1473	695	737	767	1006	438	504	975	791	460	617
Northern Goshawk	6	11	3	32	40	42	5	27	22	29	44	33	104	27	35	27	68	20	20	20	24	23	7	9	28
Broad-winged Hawk	0	0	0	0	2	0	1	1	1	1	1	2	0	2	1	3	0	0	1	0	3	1	0	2	1
Swainson's Hawk	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0
Red-tailed Hawk	14	26	13	43	31	51	15	43	37	66	99	93	97	53	158	93	84	67	69	49	58	76	109	63	63
Rough-legged Hawk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Golden Eagle	1	1	1	1	5	6	2	4	7	6	10	3	3	2	11	4	7	5	4	8	2	1	9	1	4
Bald Eagle	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
American Kestrel	7	58	8	51	28	34	17	37	85	61	190	266	367	223	285	193	290	351	149	97	285	168	127	88	145
Merlin	0	1	1	0	2	0	0	1	5	8	2	9	10	8	21	13	18	26	13	16	11	12	15	5	8
Prairie Falcon	0	0	0	6	5	2	1	3	7	5	7	7	8	1	7	3	7	17	7	3	8	3	4	3	5
Peregrine Falcon	0	0	0	0	1	0	0	0	0	2	1	1	0	1	0	1	1	4	0	1	1	1	3	0	1
All Species	126	775	341	1019	926	1212	617	1401	1904	2366	2762	3026	3855	2671	4685	2857	3304	3058	3404	1529	2148	2882	2356	1463	2115
Recaptures[1]	0	0	0	0	0	0	0	0	0	0	4	4	7	9	10	3	3	7	9	4	6	9	7	2	4
Foreign Recaptures[2]	0	0	1	0	0	0	0	0	0	2	0	0	1	1	2	1	4	3	5	2	3	4	3	1	1
Foreign Encounters[3]	0	1	5	3	9	12	5	7	11	12	15	18	14	21	19	16	9	18	14	10	19	9	27	10	12

[1] Recaptures in the Goshutes of birds originally banded in the Goshutes.

[2] Recaptures in the Goshutes of birds originally banded elsewhere.

[3] Birds originally banded in the Goshutes and subsequently encountered elsewhere.