

**FALL 2001 RAPTOR MIGRATION STUDIES AT
BONNEY BUTTE, OREGON**



**HawkWatch International, Inc.
Salt Lake City, Utah**

April 2002

**FALL 2001 RAPTOR MIGRATION STUDIES AT
BONNEY BUTTE, OREGON**

Report prepared by:

Jeff P. Smith

Counts conducted by:

Alison Cebula Benedict and Eric Hallingstad

Banding conducted by:

Richard Gerhardt, Dan Sherman, and Geoff Fitzgerald

On-site education by:

Angel Hart

Project Coordinated by:

HawkWatch International

Principal Investigator: Dr. Jeff P. Smith

1800 South West Temple, Suite 226, Salt Lake City, UT 84115

(801) 484-6808

April 2002

TABLE OF CONTENTS

List of Tables	iii
List of Figures	iii
Introduction.....	1
Study Site.....	1
Methods	2
Counts	2
Trapping and Banding.....	3
Results.....	4
Weather Summary.....	4
Observation Effort.....	4
Flight Summary.....	4
Resident Raptors	5
Trapping Effort.....	6
Trapping and Banding Summary	6
Encounters with Previously Banded Birds.....	6
Visitation.....	7
Acknowledgments.....	7
Literature Cited.....	7
Tables.....	9
Figures	15
Appendix A. A history of observer participation in the Bonney Butte Raptor Migration Project: 1994–2001.....	20
Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications for all diurnal raptor species observed during fall migration at Bonney Butte, OR.....	21
Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Bonney Butte Raptor Migration Project: 2001.	22
Appendix D. Daily observation effort and fall raptor migration counts by species at Bonney Butte, OR: 2001.....	24
Appendix E. Annual observation effort and fall raptor migration counts by species at Bonney Butte, OR: 1994–2001.....	26
Appendix F. Daily capture totals of migrating raptors at Bonney Butte, OR: 2001.	27
Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Bonney Butte, OR: 1995–2001.	29

LIST OF TABLES

Table 1.	Fall raptor migration counts and passage rates by species at Bonney Butte, OR: 1994–2000 versus 2001.....	9
Table 2.	Fall raptor migration counts by age class and immature : adult ratios for selected species at Bonney Butte, OR: 1994–2000 versus 2001.....	10
Table 3.	First and last observation, bulk passage, and median passage dates by species for migrating raptors at Bonney Butte, OR in 2001, with comparisons of 2001 and 1994–2000 average median passage dates.	11
Table 4.	Median passage dates by age for selected species of migrating raptors at Bonney Butte, OR: 1994–2000 versus 2001.....	12
Table 5.	Fall capture totals, rates, and successes by species for migrating raptors at Bonney Butte, OR: 1995–2001.....	13
Table 6.	Fall 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 at Bonney Butte, OR: 1995–2000 versus 2001.....	13
Table 7.	Foreign recaptures and foreign encounters associated with the Bonney Butte Raptor Migration Project: 1995–2001.....	14

LIST OF FIGURES

Figure 1.	Location of the Bonney Butte Raptor Migration Project study site near Mt. Hood, Oregon.....	15
Figure 2.	Fall raptor migration flight composition by major species groups at Bonney Butte, OR: 1994–2000 versus 2001.	16
Figure 3.	Fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Bonney Butte, OR: 1994–2001.....	17
Figure 4.	Fall-migration passage rates for Sharp-shinned Hawks, Cooper’s Hawks, and Northern Goshawks at Bonney Butte, OR: 1994–2001.	17
Figure 5.	Fall-migration passage rates for Broad-winged, Red-tailed and Rough-legged Hawks at Bonney Butte, OR: 1994–2001.	18
Figure 6.	Fall-migration passage rates for Golden and Bald Eagles at Bonney Butte, OR: 1994–2001.	18
Figure 7.	Fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons at Bonney Butte, OR: 1994–2001.....	19
Figure 8.	Combined-species passage volume by five-day periods for migrating raptors at Bonney Butte, OR: 1994–2000 versus 2001.	19

INTRODUCTION

The Bonney Butte Raptor Migration Project in north-central Oregon is an ongoing effort to monitor long-term trends in populations of raptors using the northern portion of the Pacific Coast Flyway (*sensu* Hoffman et al. in press). HawkWatch International (HWI) initiated standardized counts of the autumn raptor migration through this region in 1994, and began a trapping and banding program at the project site in 1995. To date, HWI observers have recorded 18 species of migratory raptors at the site, with counts typically ranging between 2,500 and 4,000 migrants per season. The 2001 season marked the 8th consecutive count and the 7th consecutive season of trapping and banding conducted at the site by HWI. This report summarizes the 2001 count and banding results.

The Bonney Butte project was 1 of 15 long-term, annual migration counts (12 fall, 3 spring) and 1 of 8 migration banding studies (6 fall, 2 spring) conducted or co-sponsored by HWI in North America during 2001. 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). 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 (Cade et al. 1988, Bednarz et al. 1990a, 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).

The intensive counting and banding operations also provide valuable information about breeding and wintering distributions, migratory routes and timing, migratory behavior, population demographics, mortality factors and longevity, morphometric variation, molt timing and sequences, and health assessments (e.g., Hoffman et al. in press). 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 1996 the Bonney Butte 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

Bonney Butte is located approximately 9.5 km ESE of Government Camp, on the east side of the White River drainage within the Mt. Hood National Forest, Hood River County, Oregon (45°15'46.8" N, 121°35'31.2" W; Figure 1). The butte is the southern terminus of Surveyor's Ridge, which originates near Hood River, Oregon south of the Columbia River Gorge. The ridge extends southward for approximately 50 km and ends southeast of Mt. Hood. The central Oregon shrubsteppe region lies immediately to the east.

Bonney Butte is a mostly bald knoll with a summit elevation of 1,754 m. The south and west slopes are steep, dropping approximately 725 m to the White River, whereas the east slope drops only 65 m to Bonney Meadows. The area within a 5-km radius of Bonney Butte is forested, except for Bonney Meadows and several clearcut tracts. Mountain Hemlock (*Tsuga spp.*), true firs (*Abies spp.*), and pines (*Pinus spp.*) are common in the surrounding forests. Several huckleberry species (*Vaccinium spp.*) also commonly occur in the area. The observation site is located on the highest point of the butte. The

trapping station is located approximately 500 m north on a separate knoll and slightly lower in elevation. The intervening space is largely forested.

Several other ridges to the north funnel migrants past the Bonney Butte lookout. Bennett Ridge and Surveyor's Ridge form a "Y" junction 2 km north of Bonney Butte. Bluegrass Ridge parallels Surveyor's Ridge to the west and terminates pointing into the Y. Barlow Ridge lies 2 km west of Bonney Butte, and Frog Lake Butte is immediately south of Barlow. Two long north-south ridges lie to the east of Bonney Butte. Boulder Ridge is 4 km due east, and the lower, closer "Meadow" ridge is 1.5 km due east. Migrants have been seen using all of these ridges, depending on weather conditions.

METHODS

COUNTS

Weather permitting, two official or designated observers conducted standardized daily counts of migrating raptors from a single, traditional observation site from late August through late October. Observations typically began between 0800–0900 hrs and ended near 1700 hrs Pacific Standard Time (PST). Official observer Alison Cebula Benedict had one full season of previous experience counting migratory raptors, whereas this was Eric Hallingstad's first season of counting migratory raptors (see Appendix A for a complete history of observer participation). Visitors also occasionally assisted with spotting migrants.

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 PST.
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.

The observers used high quality 7–10x binoculars to assist in spotting and identifying birds. Clark and Wheeler (1987), Dunne et al. (1988), and Wheeler and Clark (1995) served as primary identification references. Assessments of wind speed, cloud type, cloud cover, and flight altitude followed guidelines published 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. All weather variables were recorded on-site.

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 nesting territories to favored wintering grounds in the same general region. However, we also know from recent satellite telemetry work 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, personal communication; Watson and Pierce 2000; HWI unpublished data).

For purposes of examining long-term variation in annual counts, it is often recommended that count data be standardized for sampling period and adjusted for daily variation in observation effort because seasonal and daily duration of observation effort can greatly affect count statistics (Hussell 1985, Kerlinger 1989, Bednarz et al. 1990b). For purposes of this report, I converted counts to passage rates (typically raptors/100 hours of observation) to adjust for daily variation in sampling effort, and present both raw counts and passage rates for comparison. I compare results from the 2001 season to means for previous seasons and examine trends in annual passage rates. In comparing 2001 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2001 value falling outside the bounds of the confidence interval for the associated mean.

The 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, in preparation for examining trends in annual passage rates, I 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. Beginning in 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 (rarely gyrfalcons), 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 that this debate applied. 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 prior to trend analyses.

TRAPPING AND BANDING

Weather permitting, the trappers operated a single traditional banding station daily from late August through late October, generally between 0900–1700 hrs PST. Capture devices included mist nets and remotely triggered bow nets (see Bloom 1987). Trappers lured migrating raptors into the capture stations from camouflaged blinds using live, non-native Rock Doves (*Columba livia*; hereafter called pigeons), Ringed Turtle-doves (*Streptopelia risoria*), European Starlings (*Sturnus vulgaris*), and House Sparrows (*Passer domesticus*) attached to lure lines manipulated from the blinds. 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 within 45 minutes from the time of capture.

RESULTS AND DISCUSSION

WEATHER SUMMARY

In 2001, inclement weather entirely precluded observations on 8 of 66 potential observation days between 27 August and 31 October, and severely restricted observations (≤ 4 hours) on 9 other days (see Appendix C for daily weather records). Compared to the last four seasons, this is a moderate amount of inclement weather interference. Otherwise, 50% of the active observation days in 2001 featured predominantly fair skies, 22% transitional weather (changed from fair skies to mostly cloudy or overcast during the day), and 28% mostly cloudy to overcast skies, which is a typical array for the site. The 2001 observers indicated that fog and especially haze occurred on 83% of the active days, which is much higher than the 1997–2000 average of 33%; however, the haze did not significantly reduce the estimated average visibility (68 km versus 1997–2000 average of 69 km). In terms of wind conditions, 60% of days featured primarily light winds (< 12 kph), 36% moderate winds, and 3% strong winds (> 28 kph), which compares to averages of 89%, 9%, and 2% for 1997–2000. The 2001 season also featured an unusual array of wind directions. As usual, westerly winds predominated, prevailing throughout or during much of 78% of the active observation days; however, steady winds from the southwest to west were more prevalent than usual (predominant on 57% of days versus an average of 13% for 1997–2000) while more variable westerly winds including some northwesterly component were less prevalent than usual (10% versus 1997–2000 average of 34%). North to northeasterly winds also were less prevalent than usual (14% of days versus 1997–2000 average of 29%). The temperature during active observation periods averaged 14.4°C (the average of daily values, which in turn were averages of hourly readings), ranging from 3–23.4°C, which is the warmest average recorded during the last five seasons. Forty-one percent of active observation days received a median (of hourly ratings) thermal-lift rating of fair to poor and 59% good to excellent, compared to averages of 58% poor/fair and 42% good/excellent from 1997–2000.

In summary, compared to the last four seasons, 2001 featured a moderate amount of inclement weather, a much higher than usual prevalence of light haze, slightly stronger winds, more steady southwest to west winds and less northwesterly and northeasterly winds, somewhat warmer temperatures, and a high proportion of days with good thermal lift.

OBSERVATION EFFORT

The observers worked on 58 of 66 possible days between 27 August and 31 October (Table 1). The number of days and hours (415.75) of observation were 20% and 28% higher than average, respectively. The 2001 average of 2.6 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) is 7% higher than average.

FLIGHT SUMMARY

The observers counted 2,499 migrant raptors of 14 species during the 2001 season (Table 1, and see Appendix D for daily count records). Counts fell to record lows for Northern Harrier, Cooper's Hawk, Northern Goshawk and Merlin, and to the second lowest ever for Rough-legged Hawk, Golden Eagle, and Prairie Falcon (see Appendix E for annual summaries).

The 2001 flight was composed of 52% accipiters, 22% buteos, 14% vultures, 5% eagles, 3% falcons, 3% Ospreys, and <1% harriers and unidentified raptors. The 2001 season featured a significantly higher than average proportion of vultures and Ospreys, and significantly lower than average proportions of falcons and harriers (Figure 2). As usual, Sharp-shinned and Red-tailed Hawks were the two most abundant species, followed by Turkey Vultures, Cooper's Hawks, Ospreys, and Golden Eagles (Table 1, Appendix E).

No species showed a significantly higher than average passage rate in 2001, whereas 10 commonly seen species (Northern Harrier, Sharp-shinned Hawk, Cooper's Hawk, Northern Goshawk, Red-tailed Hawk, Rough-legged Hawk, Golden Eagle, and American Kestrel, Merlin, and Prairie Falcon) showed significantly below average passage rates (Table 1, Figures 3–7). It is important to note that the 28% higher than average number of observation hours likely contributed to reduced passage rate estimates; however, only three species (Turkey Vulture, Osprey, and Bald Eagle) showed higher than average counts, so the general impression of reduced activity is accurate. The generally low counts and passage rates at Bonney Butte match the pattern shown at most HWI western sites in 2001, and probably reflect the cumulative effects of the widespread drought and wildfires that have plagued much of the interior West for the past 2–3 years.

At this time, simple linear regression analyses of annual passage rates indicate no significant ($P < 0.05$) long-term trends, with the low 2001 passage rates putting a damper on any increasing patterns that may have been evident previously (Figures 3–7). It is not surprising that few significant trends are evident at this stage, because the datasets are still relatively short term.

Sharp-shinned Hawks, Red-tailed Hawks, and Golden Eagles all showed significantly higher than average immature : adult ratios in 2001, whereas only Bald Eagles showed a significantly below average age ratio (Table 2). With regard to reflecting productivity trends, however, these age-ratio statistics are misleading, because the abundance of immature birds was well below average for all common species except Golden Eagles. Even for Golden Eagles, the much higher than average age ratio resulted primarily from a very low abundance of adults rather than a high abundance of young birds. Low productivity and juvenile recruitment was expected for 2001 due to the effects of prolonged drought and the widespread habitat alteration caused by wildfires, and it may be that adult survival also was low.

The combined-species median passage date of 29 September matched the long-term average (Table 3); however, the seasonal distribution showed some significant variation from the norm in October due to the effects of rain and snow events (Figure 8). At the species level, Turkey Vultures, American Kestrels, and Merlins showed significantly later than average median passage dates, Rough-legged Hawks showed significantly early timing, and the remaining eight species showed average timing (Table 3). Age-specific median dates showed a bit more variation, suggesting that adult Sharp-shinned Hawks and Golden Eagles were significantly later than average, whereas immature Cooper's Hawks and Northern Goshawks and immature/subadult Bald Eagles were significantly early. Thus, there did not appear to be any consistent pattern of variation in timing across species.

RESIDENT RAPTORS

This season, local birds included a probable family group of light-morph Red-tailed Hawks (two adults and at least one immature) seen regularly through out the season; at least one adult and one immature Sharp-shinned Hawk present through late September; an immature Cooper's Hawk seen regularly through September; at least one immature Northern Goshawk that raided the lure bird cages; a pair of American Kestrels observed regularly through mid-September; at least one and possibly several adult Bald Eagles seen regularly through September traveling along the White River Valley to the west; and at least one immature Golden Eagle seen several times early in the season primarily east of the observation

site. This is a typical assemblage of locals for the site except that territorial adult Golden Eagles are usually more evident.

TRAPPING EFFORT

Trapping occurred on 59 of 64 days between 25 August and 28 October, with effort totaling 320.50 hours (see Appendix F for daily trapping records). The number of trapping days and hours were 49% and 63% higher than the 1997–2000 averages (the period of comparable full-season effort) (see Appendix G for annual trapping summaries), by far the highest effort since the project began and largely reflecting the advantages of fair weather.

TRAPPING AND BANDING SUMMARY

The 2001 capture total of 330 newly banded birds of 8 species and 1 Sharp-shinned Hawk foreign-recapture (i.e., birds originally banded elsewhere and subsequently recaptured at Bonney Butte) was the largest total yet recorded for the project (Table 5, Appendix G). The captures included only the second American Kestrel and third Rough-legged Hawk ever captured at the site. The 2001 effort raises the total number of birds captured since project inception to 1,412, including three foreign recaptures (Appendix G). As usual, the three most frequently captured species were Sharp-shinned Hawk (52% of captures), Cooper's Hawk (23%), and Red-tailed Hawk (20%), all caught in record-high numbers this season, as was also the case for Northern Goshawk (Appendix G).

The 2001 capture totals and successes were above average for 8 of 12 species captured sometime during the history of the project, significantly so in most cases (Table 5). However, the 2001 capture rates were above average for only five species and significantly so only for Cooper's Hawk (Table 5). This discrepancy reflects the influence of greater effort on capture-rate estimates, because the expanded effort increased coverage of marginally productive periods. Otherwise, however, generally high capture success indicated that trapping efficiency improved for most of the common species.

Compared to the counts, banding yields unique and substantial sex–age specific data only for Sharp-shinned and Cooper's Hawks. Compared to age ratios derived from the count data, the 2001 and long-term average immature : adult capture ratios (Table 6) indicate a similar result for Sharp-shinned Hawk (above average) but the opposite result for Cooper's Hawk (slightly below average count ratio; significantly above average capture ratio). This suggests that immature Cooper's Hawks were proportionately more susceptible to capture than usual in 2001. The capture data uniquely suggest that female : male ratios were just barely significantly below average for Sharp-shinned Hawk and average for Cooper's Hawks in 2001 (Table 6).

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Since banding began in 1995, 15 raptors banded at Bonney Butte have subsequently been encountered elsewhere ("foreign encounters") and three raptors banded elsewhere have been recaptured at Bonney Butte ("foreign recaptures"; Table 7). Two new foreign encounters occurred in 2001. The first was an adult Sharp-shinned Hawk found near Port Coquitlam, British Columbia (just east of Vancouver; 391 km north of Bonney Butte) dead of unknown causes 7 months after being banded at Bonney Butte. The second was an immature Cooper's Hawk recaptured by the Golden Gate Raptor Observatory at their migration research site in the Marin Headlands (CA) 17 days after being banded at Bonney Butte. This bird covered the 682 km distance between the two research sites at an average rate of 40 km/day, and constitutes the second exchange of banded birds between the two projects (Table 7). One new foreign recapture also occurred during the 2001 season, involving an immature Sharp-shinned Hawk banded at HWI's migration research site at Chelan Ridge (WA) 8 days earlier. This bird covered the 288 km distance between north-central Washington and Bonney Butte at about the same rate of 36 km/day. Each

of these new encounters continues to indicate that Bonney Butte lies within the Pacific Coast Flyway as described by Hoffman et al. (in press).

VISITATION

In 2001, the HWI visitor logs documented 327 visits to Bonney Butte, including 38 repeat visits, which is about 14% higher than in 2000. The visitors included a variety of organized groups including two student groups from Madison High School in Portland (OR); five Audubon groups from Portland, Vancouver (WA), and central Oregon; a local women's club group; representatives from Mt. Hood National Forest; and Department of Fish and Wildlife students from Oregon State University.

ACKNOWLEDGMENTS

Funding for this project was provided by the USDA Forest Service, Mt. Hood National Forest, Hood River Ranger District; Oregon Department of Fish and Wildlife (ODFW), High Desert Regional Office; Oregon Parks Foundation; PacifiCorp Foundation; Central Oregon Audubon Society; and HWI members. We also gratefully acknowledge Mt. Hood National Forest for providing emergency radios and other logistical support, and ODFW for providing a canvas tent and stove that helped keep the crew warm and dry. In particular, we extend our deepest thanks to Rich Thurman of the Forest Service and Chris Carey of ODFW for their personal efforts to support our work. Lastly, thanks to Gordy Lind for his editorial assistance.

LITERATURE CITED

- Bednarz, J. C., T. J. Hayden, and T. Fischer. 1990a. The raptor and raven community of the Los Medanos area in southeastern New Mexico: a unique and significant resource. Pages 92–101 *in* R. S. Mitchell, C. J. Sheviak, and D. J. Leopold, editors. *Ecosystem management: rare species and significant habitats*. Bulletin No. 471. New York State Museum, Albany, New York, USA.
- Bednarz, J. C., and P. Kerlinger. 1989. Monitoring hawk populations by counting migrants. Pages 328–342 *in* B. Pendleton, editor. *Proceedings of the Northeast Raptor Management Symposium and Workshop*. National Wildlife Federation, Washington, D.C., USA.
- Bednarz, J. C., D. Klem Jr., L. J. Goodrich, and S. E. Senner. 1990b. Migration counts of raptors at Hawk Mountain, PA, as indicators of population trends, 1934–1986. *Auk* 107:96–109.
- Bildstein, K. L. 2001. Why migratory birds of prey make great biological indicators. Pages 169–179 *in* K. L. Bildstein and D. Klem (Editors). *Hawkwatching in the Americas*. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.
- Bildstein, K. L., J. J. Brett, L. J. Goodrich, and C. Viverette. 1995. Hawks Aloft Worldwide: a network to protect the world's migrating birds of prey and the habitats essential to their migrations. Pages 504–516 *in* D. A. Saunders, J. L. Craig, and E. M. Mattiske, editors. *Nature conservation 4: the role of networks*. Surrey Beatty & Sons, Chipping Norton, New South Wales, Australia.
- Bloom, P.H. 1987. Capturing and handling raptors. Pages 99–123 *in* B. G. Pendleton, B. A. Millsap, K. W. Cline, and D. M. Bird (Editors). *Raptor management techniques manual*. National Wildlife Federation, Washington, D.C., USA.
- Cade, T. J., J. E. Enderson, C. G. Thelander, and C. M. White. 1988. Peregrine falcon populations, their management and recovery. The Peregrine Fund, Inc., Boise, Idaho, USA.
- Clark, W. S. and B. K. Wheeler. 1987. *A field guide to hawks*. Houghton Mifflin Co., Boston, Massachusetts, USA. 198 pp.

- Dixon, P. M., A. R. Olsen, and B. M. Kahn. 1998. Measuring trends in ecological resources. *Ecological Applications* 8:225–227
- Dunn, E. H., and D. J. T. Hussell. 1995. Using migration counts to monitor landbird populations: review and evaluation of status. Pages 43–88 *in* D. M. Power, editor. *Current Ornithology*, Vol. 12. Plenum Press, New York, New York, USA.
- Dunne, P., D. Sibley, and C. Sutton. 1988. *Hawks in flight*. Houghton Mifflin Co., Boston, Massachusetts. 254 pp.
- Hoffman, S. W., J. P. Smith, and J. A. Gessaman. 1990. Size of fall-migrant accipiters from the Goshute Mountains of Nevada. *Journal of Field Ornithology* 61:201–211.
- Hoffman, S. W., J. P. Smith, and T. D. Meehan. In press. Breeding grounds, winter ranges, and migratory routes of raptors in the Mountain West. *Journal of Raptor Research*.
- Hussell, D. J. T. 1985. Analysis of hawk migration counts for monitoring population levels. Pages 243–254 *in* M. Harwood, editor. *Proceedings of Hawk Migration Conference IV*. Hawk Migration Association of North America.
- Kerlinger, P. 1989. *Flight strategies of migrating hawks*. University of Chicago Press, Chicago, Illinois. 375 pp.
- Smith, J. P., and S. W. Hoffman. 2000. The value of extensive raptor migration monitoring in western North America. Pages 597–615 *in* R. D. Chancellor and B.-U. Meyburg, editors. *Raptors at risk*. World Working Group on Birds of Prey and Owls, Berlin, Germany, and Hancock House Publishers, British Columbia and Washington.
- Steenhof, K., M. N. Kochert, and M. Q. Moritsch. 1984. Dispersal and migration of southwestern Idaho raptors. *Journal of Field Ornithology* 55:357–368.
- Titus, K., M. R. Fuller, and J. L. Ruos. 1989. Considerations for monitoring raptor population trends based on counts of migrants. Pages 19–32 *in* B. U. Meyburg and R. D. Chancellor, editors. *Raptors in the modern world*. Proceedings of the III World Conference on Birds of Prey and Owls, Eilat, Israel, 1987. World Working Group on Birds of Prey and Owls, Berlin, Germany.
- Watson, J. W., and D. J. Pierce. 2000. Migration and winter ranges of ferruginous hawks from Washington. Annual Report. Washington Department of Fish and Wildlife, Olympia, Washington, USA.
- Wheeler, B. K., and W. S. Clark. 1995. *A photographic guide to North American raptors*. Academic Press, London, England. 198 pp.
- Zalles, J. I., and K. L. Bildstein (Editors). 2000. *Raptor watch: a global directory of raptor migration sites*. BirdLife Conservation Series No. 9. BirdLife International, Cambridge, United Kingdom, and Hawk Mountain Sanctuary Association, Kempton, Pennsylvania, USA.

Table 1. Fall raptor migration counts and passage rates by species at Bonney Butte, OR: 1994–2000 versus 2001.

	1994–2000 ¹	2001	% CHANGE	1994–2000 ¹	2001	% CHANGE
Start date	30-Aug ± 2.1	27-Aug				
End date	29-Oct ± 2.4	28-Oct				
Observation days	48 ± 5.7	58	+20			
Observation hours	325.82 ± 43.114	415.75	+28			
SPECIES	COUNT			RAPTORS / 100 HOURS		
Turkey Vulture	257 ± 110.1	338	+32	79.1 ± 32.30	81.3	+3
Osprey	63 ± 17.4	78	+23	19.6 ± 5.02	18.8	-4
Northern Harrier	33 ± 11.4	7	-79	10.1 ± 2.72	1.7	-83
Sharp-shinned Hawk	1064 ± 205.9	957	-10	326.5 ± 37.00	230.2	-30
Cooper's Hawk	340 ± 52.6	256	-25	107.8 ± 22.45	61.6	-43
Northern Goshawk	30 ± 6.8	10	-67	9.3 ± 2.20	2.4	-74
Unknown small accipiter ²	–	84	–	–	20.2	–
Unknown large accipiter ²	–	0	–	–	0.0	–
Unknown accipiter	98 ± 34.2	0	–	30.3 ± 10.28	0.0	–
TOTAL ACCIPITERS	1533 ± 246.7	1307	-15	473.8 ± 56.30	314.4	-34
Red-shouldered Hawk	1 ± 0.9	0	-100	0.3 ± 0.25	0.0	-100
Broad-winged Hawk	13 ± 20.5	0	-100	3.3 ± 4.88	0.0	-100
Swainson's Hawk	1 ± 0.7	0	-100	0.3 ± 0.21	0.0	-100
Red-tailed Hawk	620 ± 122.8	513	-17	193.0 ± 33.08	123.4	-36
Ferruginous Hawk	1 ± 0.4	0	-100	0.2 ± 0.11	0.0	-100
Rough-legged Hawk	16 ± 6.2	7	-57	4.9 ± 1.85	1.7	-66
Unidentified buteo	37 ± 10.0	29	-22	11.5 ± 3.08	7.0	-40
TOTAL BUTEOS	689 ± 151.0	549	-20	213.5 ± 37.64	132.1	-38
Golden Eagle	105 ± 28.1	75	-29	32.1 ± 6.14	18.0	-44
Bald Eagle	40 ± 5.1	52	+31	12.4 ± 1.63	12.5	+1
Unidentified eagle	3 ± 2.2	6	+100	1.0 ± 0.76	1.4	+50
TOTAL EAGLES	148 ± 30.8	133	-10	45.4 ± 6.36	32.0	-30
American Kestrel	25 ± 4.9	23	-7	7.7 ± 1.66	5.5	-28
Merlin	66 ± 17.8	33	-50	20.4 ± 5.76	7.9	-61
Prairie Falcon	5 ± 2.3	1	-82	1.6 ± 0.58	0.2	-85
Peregrine Falcon	4 ± 2.0	3	-16	1.1 ± 0.59	0.7	-33
Unknown small falcon ²	–	0	–	–	0.0	–
Unknown large falcon ²	–	0	–	–	0.0	–
Unknown falcon	3 ± 2.0	7	+145	0.9 ± 0.62	1.7	+84
TOTAL FALCONS	102 ± 21.9	67	-35	31.7 ± 6.95	16.1	-49
Unidentified Raptor	37 ± 20.1	20	-46	11.9 ± 7.23	4.8	-60
ALL SPECIES	2863 ± 498.6	2499	-13	885.2 ± 116.64	601.1	-32

¹ Mean of annual values ± 95% confidence interval.

² Designations used for the first time in 2001.

Table 2. Fall raptor migration counts by age class and immature : adult ratios for selected species at Bonney Butte, OR: 1994–2000 versus 2001.

	TOTAL AND AGE-CLASSIFIED COUNTS							IMMATURE : ADULT			
	1994–2000 AVERAGE			2001			% UNKNOWN AGE		RATIO		
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1994–2000 ¹	2001	1994–2000 ¹	2001	
Northern Harrier	33	17	5	7	4	1	35 ± 8.6	29	5.0 ± 3.87	4.0	
Sharp-shinned Hawk	1064	216	356	957	133	152	45 ± 7.7	70	0.6 ± 0.25	0.9	
Cooper's Hawk	340	97	69	256	52	31	50 ± 8.6	68	1.9 ± 1.32	1.7	
Northern Goshawk	30	12	7	10	5	2	37 ± 13.9	30	2.3 ± 1.11	2.5	
Broad-winged Hawk	13	1	2	0	0	0	26 ± 35.1	–	0.5 ± 0.55	–	
Red-tailed Hawk	620	171	331	513	140	157	20 ± 3.7	42	0.6 ± 0.19	0.9	
Golden Eagle	105	54	28	75	50	9	21 ± 4.7	21	2.1 ± 0.94	5.6	
Bald Eagle	40	7	29	52	6	43	9 ± 4.7	6	0.3 ± 0.12	0.1	
Peregrine Falcon	4	1	1	3	0	0	32 ± 6.9	100	0.6 ± 0.48	–	

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 average numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in the observed age ratio.

Table 3. First and last observation, bulk passage, and median passage dates by species for migrating raptors at Bonney Butte, OR in 2001, with comparisons of 2001 and 1994–2000 average median passage dates.

SPECIES	2001				1994–2000
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ³
Turkey Vulture	29-Aug	17-Oct	13-Sep – 2-Oct	26-Sep	21-Sep ± 1.6
Osprey	27-Aug	13-Oct	3-Sep – 1-Oct	17-Sep	17-Sep ± 2.3
Northern Harrier	1-Sep	15-Oct	1-Sep – 15-Oct	26-Sep	28-Sep ± 5.7
Sharp-shinned Hawk	1-Sep	28-Oct	11-Sep – 18-Oct	2-Oct	4-Oct ± 2.5
Cooper’s Hawk	28-Aug	26-Oct	8-Sep – 14-Oct	23-Sep	24-Sep ± 3.0
Northern Goshawk	30-Aug	27-Oct	18-Sep – 27-Oct	30-Sep	2-Oct ± 4.7
Red-tailed Hawk	27-Aug	26-Oct	8-Sep – 17-Oct	30-Sep	27-Sep ± 3.0
Rough-legged Hawk	9-Sep	20-Oct	9-Sep – 20-Oct	14-Oct	21-Oct ± 2.2
Golden Eagle	7-Sep	26-Oct	17-Sep – 20-Oct	13-Oct	11-Oct ± 2.6
Bald Eagle	2-Sep	26-Oct	19-Sep – 24-Oct	5-Oct	5-Oct ± 3.9
American Kestrel	27-Aug	13-Oct	28-Aug – 4-Oct	23-Sep	18-Sep ± 4.1
Merlin	12-Sep	26-Oct	23-Sep – 25-Oct	16-Oct	9-Oct ± 2.9
Prairie Falcon	13-Oct	13-Oct	–	–	21-Sep ± 6.0
Peregrine Falcon	27-Aug	1-Oct	–	–	20-Sep ± 15.7 ⁴
All species	27-Aug	28-Oct	9-Sep – 17-Oct	29-Sep	29-Sep ± 2.4

¹ Dates between which the central 80% of the flight passed; values are given only for species with annual counts ≥5 birds.

² Date by which 50% of the flight had passed; values are given only for species with annual counts ≥5 birds.

³ Mean of annual values ± 95% confidence interval in days; unless otherwise indicated, values are given only for species with annual counts ≥5 birds for ≥ 3 years.

⁴ Based on data for 1999 and 2000 only.

Table 4. Median passage dates by age for selected species of migrating raptors at Bonney Butte, OR: 1994–2000 versus 2001.

SPECIES	ADULT		IMMATURE	
	1994–2000 ¹	2001	1994–2000 ¹	2001
Sharp-shinned Hawk	9-Oct ± 3.3	14-Oct	22-Sep ± 2.3	23-Sep
Cooper’s Hawk	30-Sep ± 2.8	29-Sep	18-Sep ± 3.3	14-Sep
Northern Goshawk	17-Oct ± 6.1	–	27-Sep ± 6.9	18-Sep
Red-tailed Hawk	1-Oct ± 4.3	2-Oct	20-Sep ± 3.0	17-Sep
Golden Eagle	12-Oct ± 1.7	16-Oct	8-Oct ± 3.8	8-Oct
Bald Eagle	6-Oct ± 5.1	2-Oct	11-Oct ± 5.1	5-Oct

Note: Median passage dates are dates by which 50% of species/age-specific flights had passed; values are based only on annual counts ≥5 birds.

¹ Mean ± 95% confidence interval in days; values are given only for species with annual counts ≥5 birds for ≥ 3 years.

Table 5. Fall capture totals, rates, and successes by species for migrating raptors at Bonney Butte, OR: 1995–2001.

	CAPTURE TOTALS		CAPTURE RATES ¹		CAPTURE SUCCESSES ²	
	1995–2000 ³	2001	1995–2000 ³	2001	1995–2000 ³	2001
Northern Harrier	1 ± 0.6	0	0.5 ± 0.34	0.0	2.6 ± 2.28	0.0
Sharp-shinned Hawk	107 ± 45.8	171	63.0 ± 10.91	53.4	9.3 ± 4.36	16.7
Cooper's Hawk	29 ± 18.9	74	14.9 ± 7.70	23.1	7.6 ± 4.74	27.0
Northern Goshawk	5 ± 2.3	11	3.0 ± 1.14	3.4	13.9 ± 5.55	110.0
Broad-winged Hawk	0.2 ± 0.3	0	0.1 ± 0.14	0.0	2.5 ± 4.90	0.0
Red-tailed Hawk	31 ± 17.7	66	17.0 ± 6.99	20.6	4.6 ± 2.62	12.2
Rough-legged Hawk	0.3 ± 0.4	1	0.2 ± 0.25	0.3	1.5 ± 1.88	14.3
Golden Eagle	2 ± 0.9	2	1.1 ± 0.65	0.6	1.8 ± 1.23	2.5
American Kestrel	0.2 ± 0.3	1	0.1 ± 0.23	0.3	0.6 ± 1.09	3.8
Merlin	4 ± 3.1	4	2.4 ± 1.36	1.2	4.9 ± 3.53	10.8
Prairie Falcon	1 ± 1.2	0	0.5 ± 0.62	0.0	15.3 ± 14.55	0.0
Peregrine Falcon	0.3 ± 0.7	0	0.1 ± 0.27	0.0	5.0 ± 9.80	0.0
All species	180 ± 83.1	330	102.9 ± 23.40	103.0	7.1 ± 3.49	16.0

¹ Captures / 100 station hours.

² Number of birds captured / number of birds observed. The combined-species value was calculated excluding Ospreys, Turkey Vultures, and unknown raptors from the count totals. Species-specific values were calculated after birds identified only to genus were allocated across possible species in proportion to the relative abundance of birds identified to those species.

³ Mean of annual values ± 95% confidence interval.

Table 6. Fall 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 at Bonney Butte, OR: 1995–2000 versus 2001.

SPECIES	YEAR	FEMALE		MALE		FEMALE : MALE	IMMATURE : ADULT
		HY	AHY	HY	AHY	RATIO	RATIO
Sharp-shinned Hawk	1995–2000	36	24	30	18	1.3 ± 0.28	1.7 ± 0.99
	2001	48	37	67	19	1.0	2.1
Cooper's Hawk	1995–2000	12	8	8	1	2.1 ± 0.30	2.1 ± 0.84
	2001	38	12	20	4	2.1	3.6

Table 7. Foreign recaptures and foreign encounters associated with the Bonney Butte Raptor Migration Project: 1995–2001.

BAND #	SPECIES ¹	SEX	BANDING SITE	BANDING AGE ²	BANDING DATE	ENCOUNTER DATE	ENCOUNTER AGE ²	ENCOUNTER LOCATION	DISTANCE (KM)	STATUS
1443 – 86178	SS	F	Bonney Butte, OR	HY	28-Oct-95	15-Dec-95	HY	Drew, OR	273	found dead
2003 – 29497	SS	F	Diamond Head, WA	HY	02-Sep-97	06-Sep-97	HY	Bonney Butte, OR	189	research recapture
2003 – 76971	SS	F	Bonney Butte, OR	HY	29-Sep-97	19-Oct-97	HY	Madras, OR	66	window kill
1387 – 80939	RT	U	Bonney Butte, OR	HY	19-Sep-97	26-Jan-98	SY	Walnut Creek, CA	690	injured/died
2003 – 76986	SS	F	Bonney Butte, OR	HY	16-Oct-97	14-Feb-98	SY	Central Point, OR	310	found dead
1433 – 89898	SS	F	Marin Headlands, CA	HY	24-Sep-93	13-Sep-98	5th yr	Bonney Butte, OR	681	research recapture
1142 – 77189	SS	M	Bonney Butte, OR	AHY	24-Oct-97	13-Mar-99	ATY	San Francisco, CA	737	car kill?
1705 – 35433	CH	F	Bonney Butte, OR	HY	20-Sep-98	24-Sep-99	SY	San Simeon area, CA	872	research recapture
1387 – 93602	RT	U	Bonney Butte, OR	HY	28-Sep-98	04-Oct-99	SY	Abbotsford, BC	354	injured/died
1177 – 02043	RT	U	Bonney Butte, OR	HY	24-Sep-99	27-Nov-99	HY	Marin Co., CA	660	research recapture
1177 – 02045	RT	U	Bonney Butte, OR	HY	29-Sep-99	03-Dec-99	HY	Ft Bragg, CA	592	injured/captive
1177 – 02043	RT	U	Bonney Butte, OR	HY	24-Sep-99	16-Dec-99	HY	Tomales, CA	660	found dead
1162 – 34006	SS	M	Bonney Butte, OR	HY	17-Sep-99	12-Mar-00	SY	Columbia, CA	662	found dead
1523 – 73278	SS	F	Bonney Butte, OR	AHY	24-Oct-99	20-Nov-00	ASY	Lodi, CA	645	research recapture
1705 – 35425	CH	M	Bonney Butte, OR	ASY	21-Oct-97	03-Dec-00	≥5th yr	Madera, CA	765	found dead
1523 – 71438	SS	F	Bonney Butte, OR	ASY	24-Sep-00	19-Apr-01	ATY	Port Coquitlam, BC	391	found dead
1705 – 16953	CH	F	Bonney Butte, OR	HY	02-Sep-01	19-Sep-01	HY	Marin Headlands, CA	682	research recapture
1593 – 02076	SS	F	Chelan Ridge, WA	HY	02-Oct-01	10-Oct-01	HY	Bonney Butte, OR	288	research recapture

¹ SS = Sharp-shinned Hawk; CH = Cooper's Hawk; RT = Red-tailed Hawk.

² HY = hatch year; SY = second year; AHY = after hatch year; ASY = after second year; ATY = after third year.

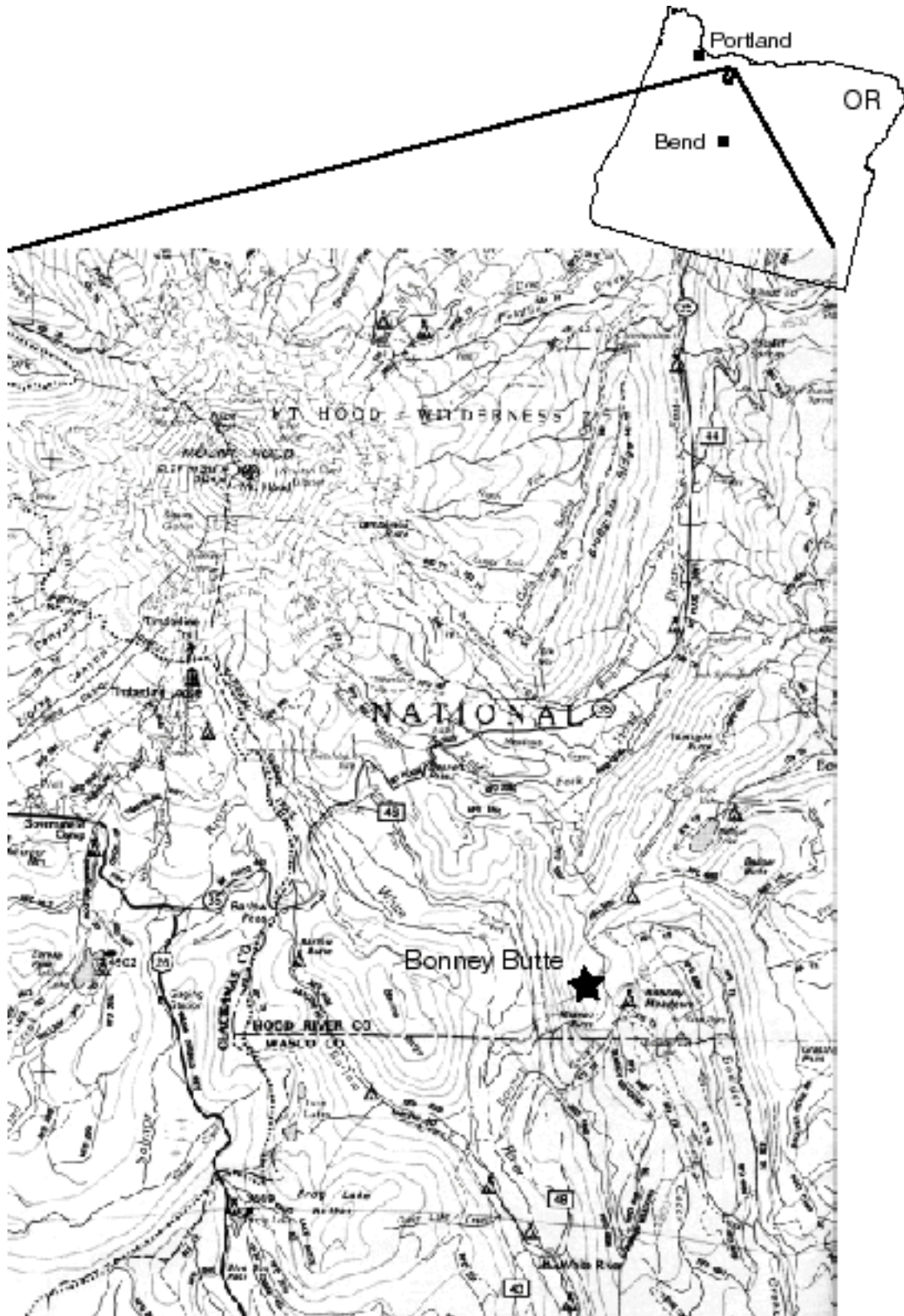


Figure 1. Location of the Bonney Butte Raptor Migration Project study site near Mt. Hood, Oregon.

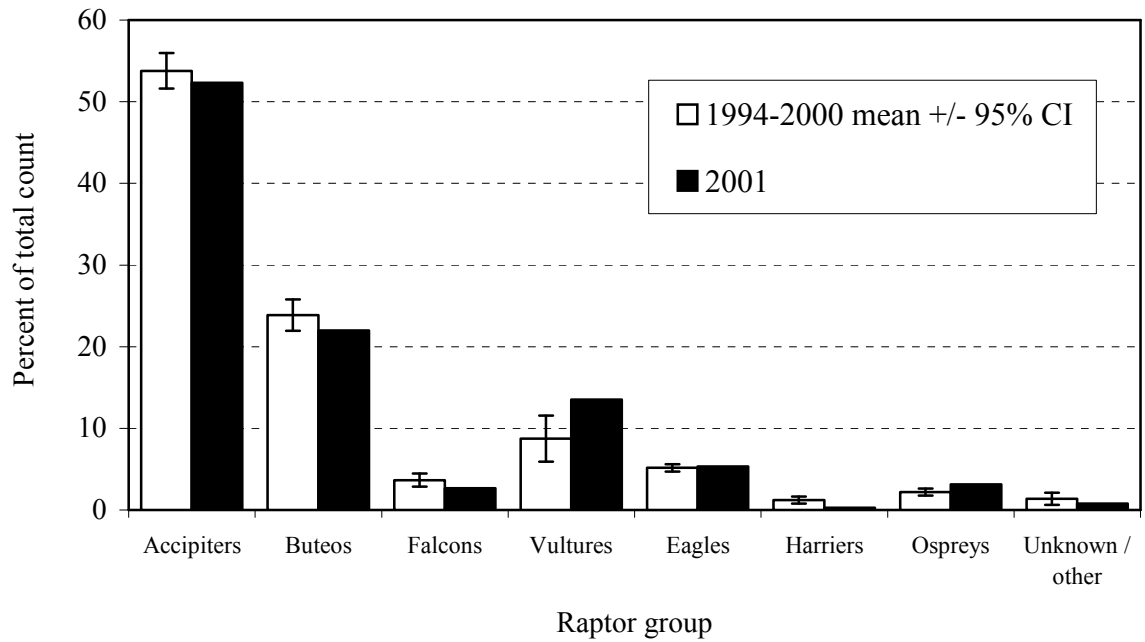


Figure 2. Fall raptor migration flight composition by major species groups at Bonney Butte, OR: 1994–2000 versus 2001.

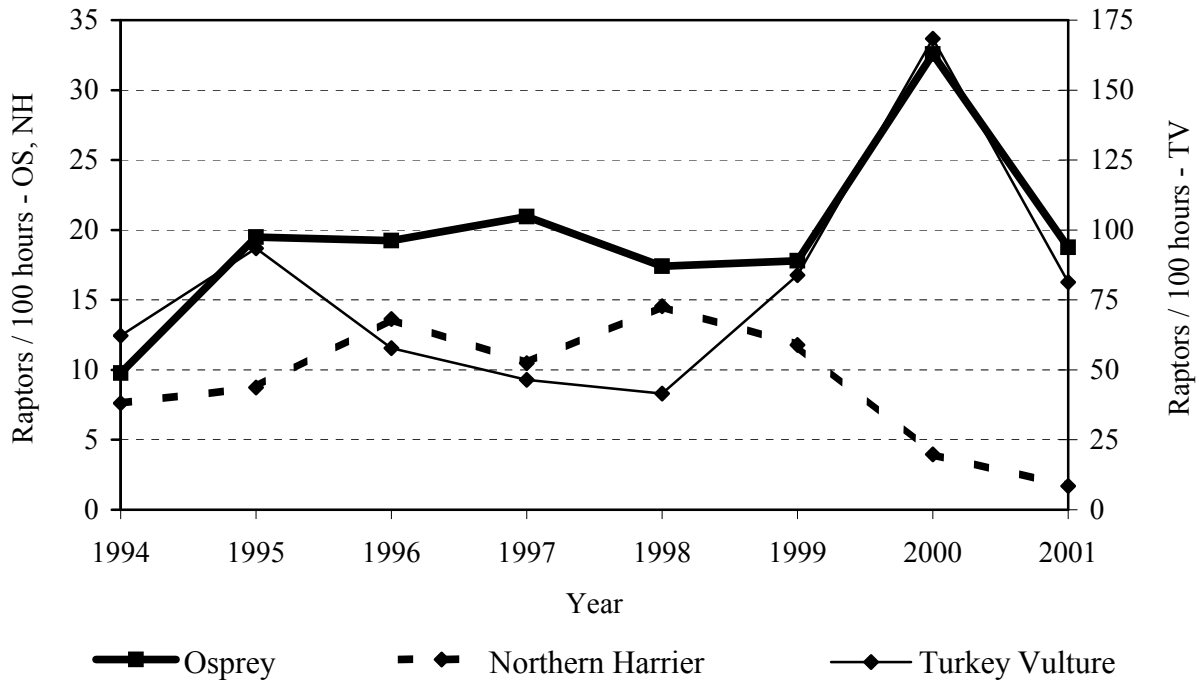


Figure 3. Fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Bonney Butte, OR: 1994–2001.

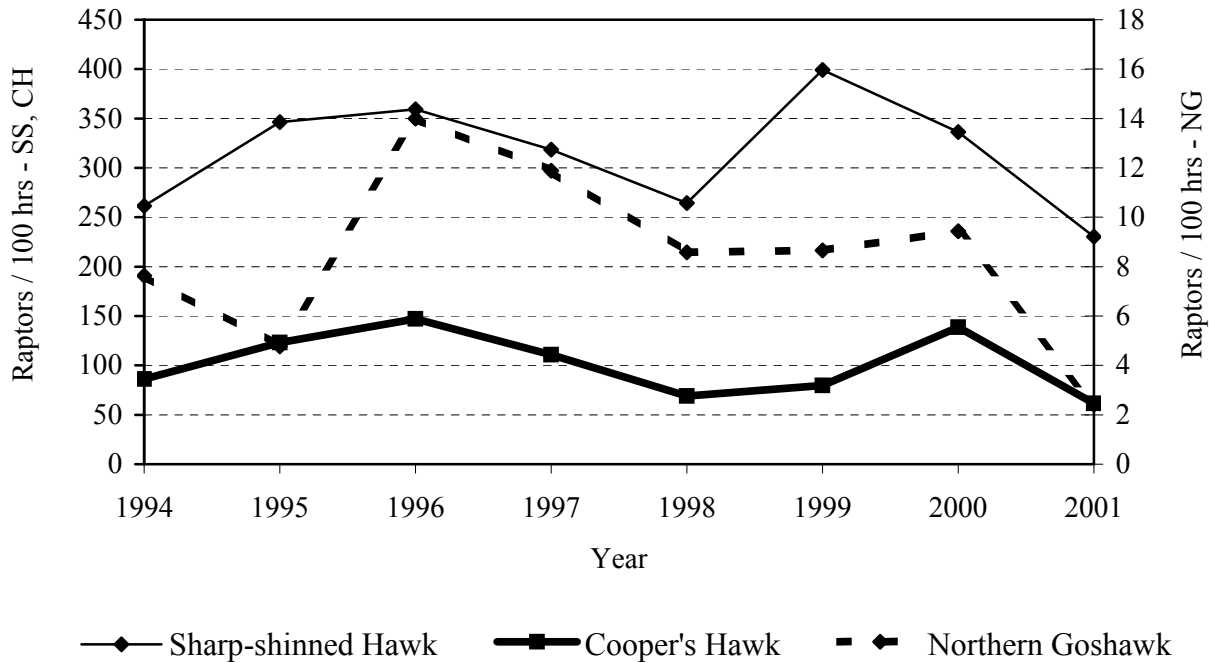


Figure 4. Fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks at Bonney Butte, OR: 1994–2001.

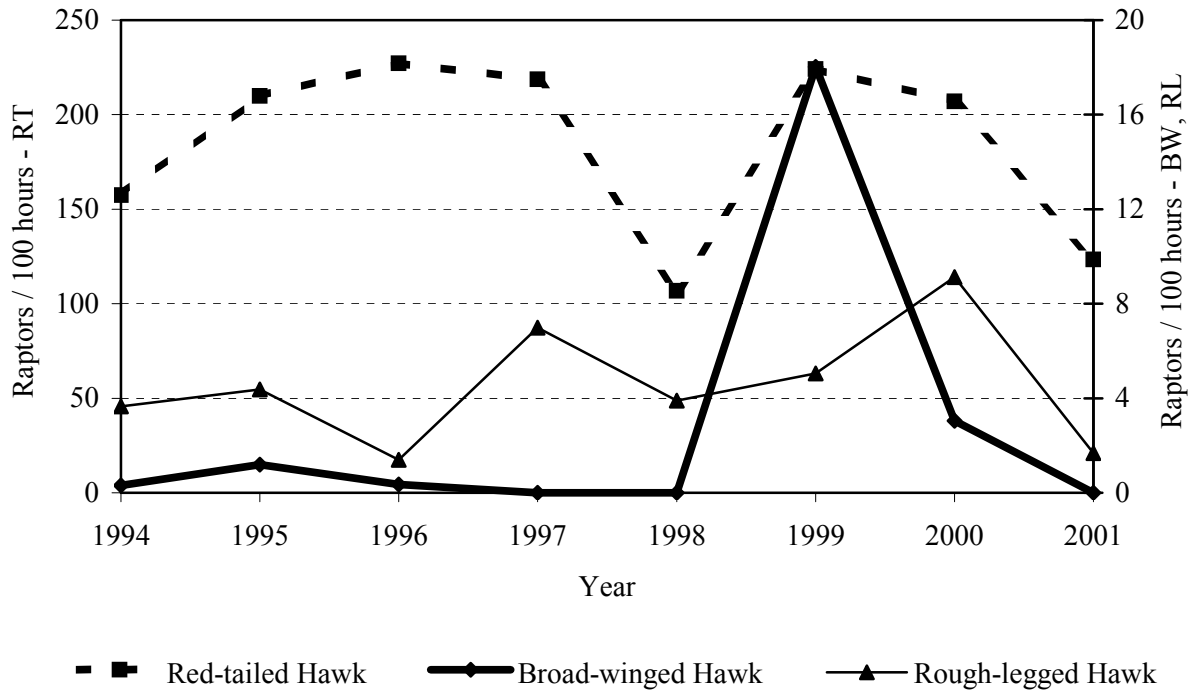


Figure 5. Fall-migration passage rates for Broad-winged, Red-tailed and Rough-legged Hawks at Bonney Butte, OR: 1994–2001.

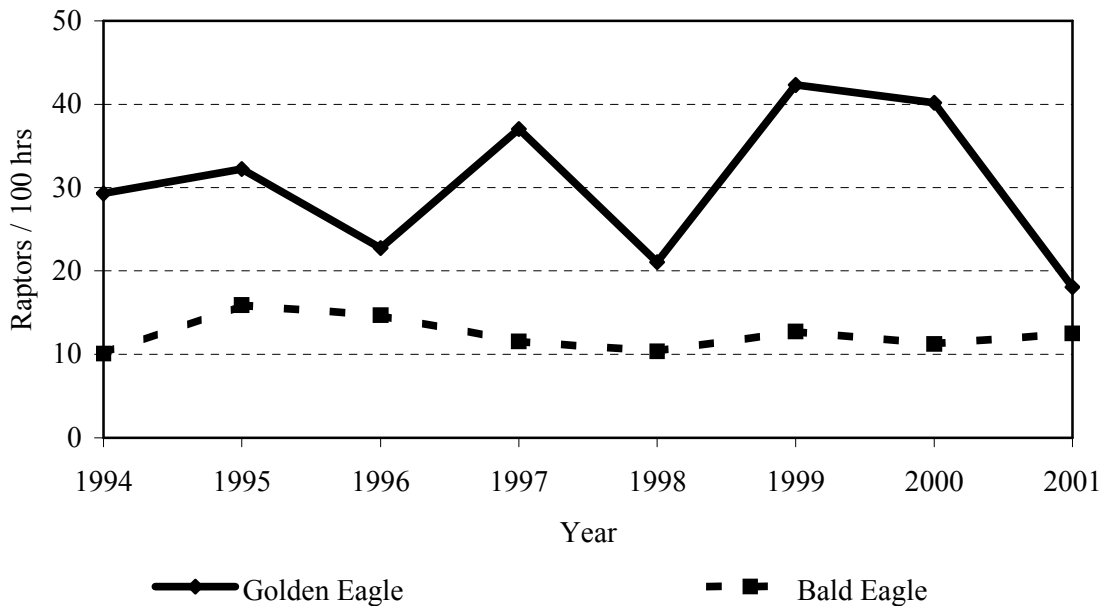


Figure 6. Fall-migration passage rates for Golden and Bald Eagles at Bonney Butte, OR: 1994–2001.

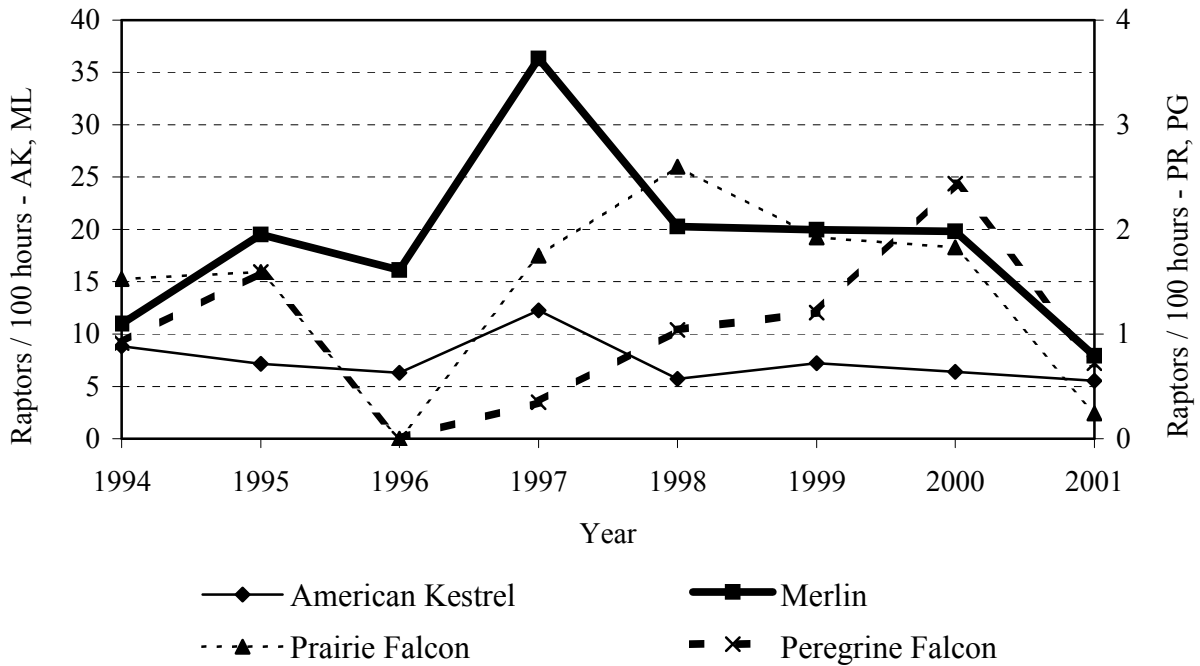


Figure 7. Fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons at Bonney Butte, OR: 1994–2001.

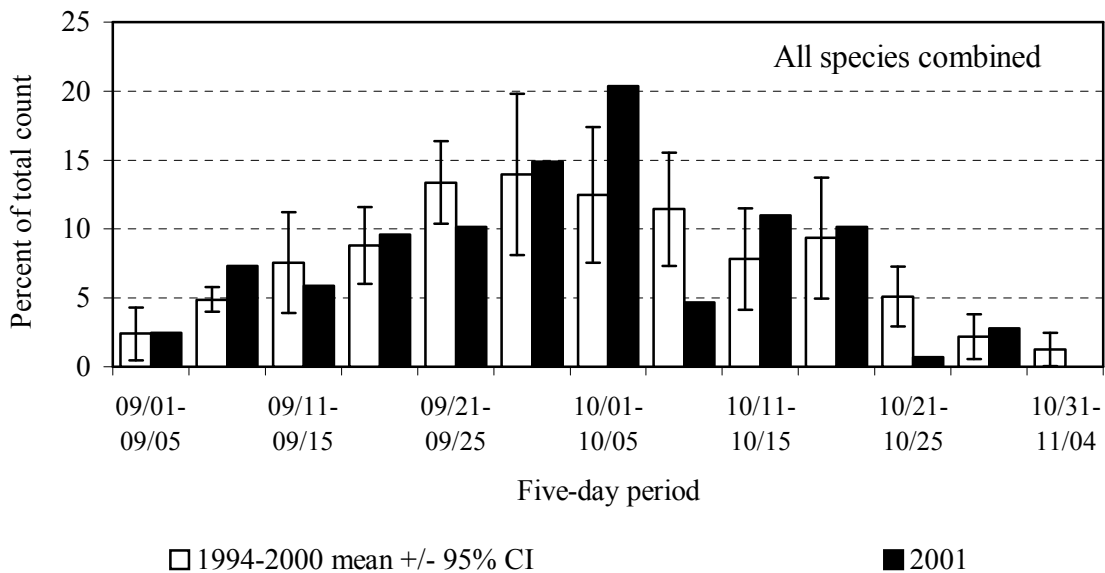


Figure 8. Combined-species passage volume by five-day periods for migrating raptors at Bonney Butte, OR: 1994–2000 versus 2001.

Appendix A. A history of observer participation in the Bonney Butte Raptor Migration Project: 1994–2001.

- 1994:** Single observer throughout: David Schuetze (0) and Sean O’Connor (0)¹.
1995: Two observers throughout: David Schuetze (1) and Alison Clark (0).
1996: Two observers throughout: David Schuetze (2) and Alison Clark (1).
1997: Two observers throughout: Rose Jaffe (0) and Sean Donaghy (0).
1998: Two observers throughout: Nick Vulgares (1) and Jeremy Davit (0).
1999: Two observers throughout: Nick Vulgares (3) and Sue Vulgares (0).
2000: Two observers throughout: Nick Vulgares (5) and Sue Vulgares (2).
2001: Two observers throughout: Alison Cebula Benedict (1) and Eric Hallingstad (0).

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 diurnal raptor species observed during fall migration at Bonney Butte, OR.

COMMON NAME	SCIENTIFIC NAME	SPECIES CODE	AGE ¹	SEX ²	COLOR MORPH ³
Turkey Vulture	<i>Cathartes aura</i>	TV	U	U	NA
Osprey	<i>Pandion haliaetus</i>	OS	U	U	NA
Northern Harrier	<i>Circus cyaneus</i>	NH	AM AF I Br U	AM AF U	NA
Sharp-shinned Hawk	<i>Accipiter striatus</i>	SS	A I U	U	NA
Cooper's Hawk	<i>Accipiter cooperii</i>	CH	A I U	U	NA
Northern Goshawk	<i>Accipiter gentilis</i>	NG	A I U	U	NA
Unknown small accipiter	<i>A. striatus</i> or <i>cooperii</i>	SA	U	U	NA
Unknown large accipiter	<i>A. cooperii</i> or <i>gentilis</i>	LA	U	U	NA
Unknown accipiter	<i>Accipiter</i> spp.	UA	U	U	NA
Red-shouldered Hawk	<i>Buteo lineatus</i>	RS	A, I, U	U	NA
Broad-winged Hawk	<i>Buteo platypterus</i>	BW	A I U	U	D L U
Swanson's Hawk	<i>Buteo swainsoni</i>	SW	U	U	D L U
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RT	A I U	U	D L U
Ferruginous Hawk	<i>Buteo regalis</i>	FH	A I U	U	D L U
Rough-legged Hawk	<i>Buteo lagopus</i>	RL	U	U	D L U
Unknown buteo	<i>Buteo</i> spp.	UB	U	U	D L U
Golden Eagle	<i>Aquila chrysaetos</i>	GE	I, S, NA, A, U ⁴	U	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BE	I, S1, S2, NA, A, U ⁵	U	NA
Unknown eagle	<i>Aquila</i> or <i>Haliaeetus</i> spp.	UE	U	U	NA
American Kestrel	<i>Falco sparverius</i>	AK	U	M F U	NA
Merlin	<i>Falco columbarius</i>	ML	AM Br U	AM Br U	NA
Prairie Falcon	<i>Falco mexicanus</i>	PR	U	U	NA
Peregrine Falcon	<i>Falco peregrinus</i>	PG	A I U	U	NA
Unknown small falcon	<i>F. sparverius</i> or <i>columbarius</i>	SF	U	U	NA
Unknown large falcon	<i>F. mexicanus</i> or <i>peregrinus</i>	LF	U	U	NA
Unknown falcon	<i>Falco</i> spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

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

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

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

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

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

Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Bonney Butte Raptor Migration Project: 2001.

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN VISITOR DISTURB ²	PREDOMINANT WEATHER ³	WIND SPEED (KPH) ¹	WIND DIRECTION	TEMP (°C) ¹	BAROM. PRESS. (IN HG) ¹	MEDIAN THERMAL LIFT ⁴	VISIB. WEST (KM) ¹	VISIB. EAST (KM) ¹	MEDIAN FLIGHT DISTANCE ⁵	BIRDS / HOUR
27-Aug	8.00	2.0	0	clr/haze	1.7	sw	19.9	30.25	2	84	82	2	2.1
28-Aug	8.00	2.6	0	clr, AM haze	1.4	sw-wnw	20.6	30.24	2	86	94	2	1.0
29-Aug	8.00	3.0	0	clr/haze	1.1	ne-e, sse/var	23.2	29.87	1	74	94	2	1.9
30-Aug	8.00	2.5	0	clr-pc, haze	1.9	sw-wnw	20.5	30.14	2	61	74	2	1.4
31-Aug	8.00	2.0	1.5	clr-ovc, haze	2.0	w/var	19.1	30.21	2	69	84	2	0.8
1-Sep	7.00	3.0	0	pc-ovc, fog/haze/rain	2.8	sw-w	15.9	30.16	3	79	59	2	1.0
2-Sep	8.00	3.6	0	clr/haze	2.7	sw-wsw	18.4	30.13	2	71	79	2	4.4
3-Sep	8.00	3.6	1	clr-pc, haze	2.6	sw-w	19.3	30.22	3	82	82	2	1.8
4-Sep	4.00	2.4	0	mc-ovc, fog/haze	2.4	wsw-w	17.2	30.15	4	71	36	2	0.8
5-Sep	2.50	2.5	0	ovc, fog/rain	3.8	sw-wnw	6.3	30.11	4	66	9	1	0.4
6-Sep	8.00	2.0	0	clr-pc, AM fog, haze	17.1	sw-w	11.8	30.36	2	80	70	2	0.8
7-Sep	8.00	2.4	1.5	clr/haze	4.1	var	15.6	30.38	1	66	78	3	4.3
8-Sep	8.50	4.1	1	clr/haze	7.8	ne, var	17.6	30.32	2	52	89	2	5.6
9-Sep	9.00	3.1	0	pc-mc, haze	6.7	sw-w	23.4	30.17	2	55	95	2	6.3
10-Sep	9.00	2.4	0	pc/haze	10.8	sw-w	21.4	30.20	2	81	98	2	3.8
11-Sep	8.50	2.0	0	clr/haze	4.2	var	23.3	30.26	1	67	89	2	6.7
12-Sep	9.00	2.8	1.5	clr-pc, haze	5.0	ne/var	22.8	30.13	1	55	85	2	3.9
13-Sep	8.50	1.8	0	pc/haze	4.9	ene-e/var	23.3	30.25	1	57	75	2	1.4
14-Sep	8.50	2.6	0	clr-mc, haze	5.8	ne-ene	22.8	30.29	2	48	73	2	2.0
15-Sep	4.75	3.1	2	mc-ovc, haze/rain	4.6	sw-wnw	19.1	30.22	3	50	66	2	4.8
16-Sep	9.50	3.8	0	clr-pc, fog/haze	16.8	sw-wnw	15.6	30.17	3	54	64	2	4.9
17-Sep	9.00	2.1	0	clr/haze	11.5	wsw-w	17.3	30.23	1	74	95	2	4.4
18-Sep	9.00	2.0	0	clr-pc, PM haze	12.3	wsw-w	14.9	30.19	2	86	86	2	5.0
19-Sep	8.50	1.9	0	clr-pc, AM fog, haze	7.1	sw-w	16.1	30.20	1	78	81	2	4.8
20-Sep	8.50	1.9	0	clr-pc, haze	12.0	sw-wsw	18.5	30.19	1	75	86	2	7.3
21-Sep	8.50	2.2	0	pc-mc, haze	10.6	sw-wsw	16.6	30.26	2	67	69	2	5.4
22-Sep	8.50	4.5	2	clr/haze	8.7	ne-e	19.8	30.24	1	70	86	2	9.2
23-Sep	8.50	3.9	1	clr-ovc, haze	10.5	ne-e, sw	21.6	30.13	2	54	80	2	6.6
24-Sep	8.50	2.4	0	clr-ovc, haze	9.1	sw	20.7	30.19	2	66	78	2	8.0
25-Sep	2.25	2.0	0	ovc, fog/rain	10.5	sw-w	11.5	29.96	4	15	10	-	0.0
26-Sep	0.00			rain									
27-Sep	7.50	2.3	0	ovc, fog	7.7	ne, var, sw-w	9.0	30.05	4	44	22	2	4.8
28-Sep	9.25	2.0	0	clr/haze	10.3	sw-w	11.0	30.15	2	94	91	2	17.1
29-Sep	8.75	3.6	1	clr/haze	6.0	var	16.1	30.32	1	86	94	2	11.7
30-Sep	8.75	3.4	1	clr/haze	21.8	ne	16.4	30.27	3	83	91	2	7.8
1-Oct	9.25	2.3	0	clr/haze	15.5	sw-w	20.5	30.26	2	79	90	2	12.0
2-Oct	8.75	2.3	1	clr-pc, haze	10.3	sw-w	16.5	30.30	1	85	96	2	14.2
3-Oct	9.00	2.0	0	clr/haze	5.0	se, sw-wsw	20.5	30.26	1	74	90	2	13.7
4-Oct	8.75	2.2	0	clr/haze	24.8	ne	11.5	30.21	3	58	84	1	1.7
5-Oct	8.50	3.2	1	clr-mc, haze	10.3	ne-e, calm/sw	13.7	30.11	2	54	69	2	14.6
6-Oct	6.50	3.0	0	pc-ovc, fog/haze	19.4	sw-wsw	9.7	30.13	3	49	31	2	6.3
7-Oct	5.00	3.6	0	ovc, rain/snow	17.8	sw-wsw	7.8	30.13	4	86	68	2	1.6
8-Oct	0.00			rain/snow									
9-Oct	6.25	2.0	0	ovc-clr, fog/haze	11.9	sw-wsw	5.8	30.28	2	79	33	2	9.8
10-Oct	1.75	2.7	0	ovc, rain	24.3	sw	6.3	30.08	4	95	58	2	2.3
11-Oct	0.00			rain/snow									
12-Oct	2.00	1.6	0	ovc, rain/snow	20.0	wsw-w	3.0	30.30	4	20	10	2	1.0
13-Oct	8.00	3.1	1.5	clr-pc, AM fog	17.0	sw-wsw	7.2	30.31	3	100	37	2	12.3
14-Oct	7.00	3.8	1	clr-mc, AM fog	12.4	sw-w	10.2	30.25	2	91	40	2	12.6

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
15-Oct	9.00	4.0	0	mc/haze	19.1	ne, se	11.2	30.21	3	86	90	2	8.9
16-Oct	6.00	1.7	0	pc-ovc, haze	33.4	sw-wsw	11.3	30.05	4	54	55	2	5.7
17-Oct	8.75	1.9	0	clr-pc, fog/haze	9.5	sw-w	3.7	30.32	1	84	38	2	9.5
18-Oct	9.00	2.0	0	clr-mc, haze	17.5	sw-w	8.3	30.33	3	89	93	2	7.6
19-Oct	3.75	1.7	0	mc-ovc, fog	14.7	wsw	11.2	30.16	3	63	6	2	1.3
20-Oct	9.00	3.0	1	clr/haze	7.7	ne, sw	12.4	30.11	1	80	93	2	6.4
21-Oct	2.25	2.7	0	ovc/rain	21.0	w	3.0	29.98	4	46	20	-	0.0
22-Oct	0.00			fog/rain									
23-Oct	0.00			snow									
24-Oct	1.00	2.0	0	ovc, fog/haze	15.3	wsw	6.0	30.24	3	80	53	2	4.0
25-Oct	5.25	1.9	0	mc, scat fog/haze	14.4	sw-wsw	7.0	30.27	2	85	58	2	2.5
26-Oct	7.25	1.0	0	mc-ovc, haze	23.7	sw	9.8	30.15	3	67	87	2	8.3
27-Oct	1.00	4.0	0	ovc, fog/rain	36.0	sw-wsw	6.7	29.88	4	20	8	2	2.0
28-Oct	6.50	2.0	0	ovc, fog/scat snow	6.4	ne-e	4.3	30.11	4	53	52	1	0.9
29-Oct	0.00			ovc, fog/rain									
30-Oct	0.00			ovc, fog/rain									
31-Oct	0.00			ovc, fog/rain									

¹ Average of hourly records.

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

³ Predominant sky condition during day: clr = clear (0-15% cloud cover); pc = partly cloudy (16-50% cover); mc = mostly cloudy (51-75% cover); ovc = overcast (76-100% cover); ts = thunderstorms.

⁴ Median hourly rating concerning prevalence of lift-generating thermals, based on subjective assessments of solar intensity, wind speeds, and migrant behavior: 1 = excellent, 2 = good, 3 = fair, 4 = poor.

⁵ Median hourly rating concerning line-of-sight distance of flight from observation site: 1 = close, detection and identification possible with naked eye; 2 = moderate, detection possible with naked eye, but binoculars needed for identification; 3 = far, binoculars needed for both detection and identification; 4 = distant, birds detected and identified only with excellent binoculars or spotting scope and by experienced observers.

Appendix D. Daily observation effort and fall raptor migration counts by species at Bonney Butte, OR: 2001.

DATE	OBS		SPECIES ¹																								BIRDS			
	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
27-Aug	8.00	0	1	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	2	0	0	1	0	0	1	0	17	2.1
28-Aug	8.00	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	1	0	0	0	1	0	0	0	0	0	0	1	8	1.0
29-Aug	8.00	1	0	0	0	5	0	2	0	0	0	0	0	4	0	0	1	0	0	0	1	0	0	0	0	0	0	1	15	1.9
30-Aug	8.00	0	1	0	0	0	1	0	0	0	0	0	0	8	0	0	0	0	0	0	1	0	0	0	0	0	0	0	11	1.4
31-Aug	8.00	2	1	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.8
1-Sep	7.00	2	0	1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1.0
2-Sep	8.00	12	4	0	8	2	0	2	0	0	0	0	0	5	0	0	0	0	1	0	0	0	0	0	0	0	0	1	35	4.4
3-Sep	8.00	1	1	0	6	2	0	1	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	14	1.8
4-Sep	4.00	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.8
5-Sep	2.50	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.4
6-Sep	8.00	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	6	0.8
7-Sep	8.00	4	1	0	11	4	0	8	0	0	0	0	0	2	0	0	1	1	0	0	1	0	0	0	0	0	0	1	34	4.3
8-Sep	8.50	2	1	0	12	11	0	5	0	0	0	0	0	14	0	0	0	1	0	0	2	0	0	0	0	0	0	0	48	5.6
9-Sep	9.00	0	2	0	19	13	0	5	0	0	0	0	0	14	0	1	1	1	0	0	0	0	0	0	0	0	1	0	57	6.3
10-Sep	9.00	3	4	0	9	2	0	3	0	0	0	0	0	10	0	0	0	1	1	0	0	0	0	0	0	0	1	0	34	3.8
11-Sep	8.50	2	2	0	30	10	0	1	0	0	0	0	0	9	0	0	2	1	0	0	0	0	0	0	0	0	0	0	57	6.7
12-Sep	9.00	0	3	0	17	9	0	0	0	0	0	0	0	4	0	0	1	0	0	0	0	1	0	0	0	0	0	0	35	3.9
13-Sep	8.50	5	0	0	3	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	1.4
14-Sep	8.50	1	2	0	4	4	0	3	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	17	2.0
15-Sep	4.75	11	2	0	1	3	0	2	0	0	0	0	0	2	0	0	0	1	0	0	1	0	0	0	0	0	0	0	23	4.8
16-Sep	9.50	6	8	0	5	9	0	0	0	0	0	0	0	15	0	0	0	1	2	0	0	0	0	0	0	0	0	1	47	4.9
17-Sep	9.00	4	1	0	8	3	0	3	0	0	0	0	0	18	0	0	0	2	0	1	0	0	0	0	0	0	0	0	40	4.4
18-Sep	9.00	8	7	0	7	4	1	1	0	0	0	0	0	13	0	0	1	2	1	0	0	0	0	0	0	0	0	0	45	5.0
19-Sep	8.50	4	3	1	17	7	1	1	0	0	0	0	0	3	0	0	1	0	1	0	0	1	0	0	0	0	1	0	41	4.8
20-Sep	8.50	37	4	0	11	4	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	62	7.3
21-Sep	8.50	16	2	0	14	2	0	1	0	0	0	0	0	8	0	0	0	0	1	0	1	1	0	0	0	0	0	0	46	5.4
22-Sep	8.50	22	3	0	27	10	0	5	0	0	0	0	0	8	0	0	0	0	0	0	1	0	0	0	0	0	0	2	78	9.2
23-Sep	8.50	11	2	1	18	8	1	1	0	0	0	0	0	10	0	0	0	3	0	0	0	1	0	0	0	0	0	0	56	6.6
24-Sep	8.50	11	4	0	23	13	0	3	0	0	0	0	0	11	0	0	0	1	0	0	1	0	0	0	0	0	1	0	68	8.0
25-Sep	2.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26-Sep	0.00																													
27-Sep	7.50	21	0	1	9	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	4.8
28-Sep	9.25	55	4	0	44	11	0	4	0	0	0	0	0	27	0	0	3	4	3	0	0	3	0	0	0	0	0	0	158	17.1
29-Sep	8.75	12	0	0	55	8	0	3	0	0	0	0	0	19	0	0	1	0	0	1	1	0	0	0	0	0	0	2	102	11.7
30-Sep	8.75	19	3	0	24	5	0	2	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	7.8
1-Oct	9.25	22	2	0	41	10	1	0	0	0	0	0	0	21	0	0	4	2	2	0	3	0	0	1	0	0	0	2	111	12.0

Appendix D. continued

DATE	OBS			SPECIES ¹																								BIRDS		
	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
2-Oct	8.75	27	1	0	35	18	0	4	0	0	0	0	0	29	0	0	0	2	3	0	3	2	0	0	0	0	0	0	124	14.2
3-Oct	9.00	11	3	0	59	4	1	2	0	0	0	0	0	29	0	0	0	1	8	0	1	2	0	0	0	0	1	1	123	13.7
4-Oct	8.75	1	0	0	7	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	1	0	0	0	0	0	0	15	1.7	
5-Oct	8.50	2	0	2	79	17	0	1	0	0	0	0	0	21	0	0	0	0	0	0	1	1	0	0	0	0	0	124	14.6	
6-Oct	6.50	1	1	0	13	3	0	2	0	0	0	0	0	4	0	0	3	1	12	1	0	0	0	0	0	0	0	41	6.3	
7-Oct	5.00	0	0	0	7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.6	
8-Oct	0.00																													
9-Oct	6.25	0	0	0	21	7	0	2	0	0	0	0	0	22	0	0	0	2	3	1	0	0	0	0	0	0	3	61	9.8	
10-Oct	1.75	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	4	2.3	
11-Oct	0.00																													
12-Oct	2.00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2	1.0	
13-Oct	8.00	0	2	0	47	8	0	1	0	0	0	0	0	29	0	1	0	7	0	0	1	0	1	0	0	0	1	98	12.3	
14-Oct	7.00	0	0	0	52	6	1	2	0	0	0	0	0	16	0	1	1	7	2	0	0	0	0	0	0	0	0	88	12.6	
15-Oct	9.00	0	0	1	52	5	0	1	0	0	0	0	0	13	0	2	3	2	0	0	0	0	0	0	0	0	1	80	8.9	
16-Oct	6.00	1	0	0	15	4	0	0	0	0	0	0	0	7	0	0	0	4	1	0	0	2	0	0	0	0	0	34	5.7	
17-Oct	8.75	1	0	0	37	8	1	2	0	0	0	0	0	22	0	0	0	5	2	0	0	3	0	0	0	0	1	83	9.5	
18-Oct	9.00	0	0	0	30	3	0	1	0	0	0	0	0	22	0	0	0	7	0	0	0	4	0	0	0	0	1	68	7.6	
19-Oct	3.75	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	5	1.3	
20-Oct	9.00	0	0	0	31	4	0	3	0	0	0	0	0	1	0	2	0	7	3	0	0	7	0	0	0	0	0	58	6.4	
21-Oct	2.25	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	
22-Oct	0.00																													
23-Oct	0.00																													
24-Oct	1.00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	4	4.0	
25-Oct	5.25	0	0	0	5	0	1	0	0	0	0	0	0	4	0	0	1	0	1	0	0	1	0	0	0	0	0	13	2.5	
26-Oct	7.25	0	0	0	34	1	0	0	0	0	0	0	0	12	0	0	0	6	4	0	0	3	0	0	0	0	0	60	8.3	
27-Oct	1.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	2.0	
28-Oct	6.50	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0.9	
29-Oct	0.00																													
30-Oct	0.00																													
31-Oct	0.00																													
Total	415.75	338	78	7	957	256	10	84	0	0	0	0	0	513	0	7	29	75	52	6	23	33	1	3	0	0	7	20	2499	6.0

¹ See Appendix B for full names associated with species codes.

Appendix E. Annual observation effort and fall raptor migration counts by species at Bonney Butte, OR: 1994–2001.

	1994	1995	1996	1997	1998	1999	2000	2001	MEAN
Start date	2-Sep	4-Sep	1-Sep	1-Sep	1-Sep	27-Aug	27-Aug	27-Aug	29-Aug
End date	25-Oct	31-Oct	2-Nov	3-Nov	30-Oct	28-Oct	30-Oct	28-Oct	29-Oct
Observation days	47	38	46	45	52	63	48	58	50
Observation hours	327.74	251.51	285.82	286.25	384.91	416.00	328.50	415.75	337.06
Raptors / 100 hours	688.4	939.9	959.7	953.7	631.8	993.5	1029.5	601.1	849.70
SPECIES	RAPTOR COUNTS								
Turkey Vulture	204	235	165	133	160	349	553	338	267
Osprey	32	49	55	60	67	74	107	78	65
Northern Harrier	25	22	39	30	56	49	13	7	30
Sharp-shinned Hawk	857	871	1027	912	1018	1660	1105	957	1051
Cooper's Hawk	282	310	420	317	266	331	456	256	330
Northern Goshawk	25	12	40	34	33	36	31	10	28
Unknown small accipiter ¹	0	0	0	0	0	0	0	84	–
Unknown large accipiter ¹	0	0	0	0	0	0	0	0	–
Unknown accipiter	27	67	85	156	99	155	98	0	–
TOTAL ACCIPITERS	1191	1260	1572	1419	1416	2182	1690	1307	1505
Red-shouldered Hawk	0	0	0	1	1	2	3	0	1
Broad-winged Hawk	1	3	1	0	0	75	10	0	11
Swainson's Hawk	0	0	1	2	2	1	0	0	1
Red-tailed Hawk	516	528	649	626	411	932	680	513	607
Ferruginous Hawk	1	0	0	1	1	1	1	0	1
Rough-legged Hawk	12	11	4	20	15	21	30	7	15
Unidentified buteo	23	30	40	52	30	58	26	29	36
TOTAL BUTEOS	553	572	695	702	460	1090	750	549	671
Golden Eagle	96	81	65	106	81	176	132	75	102
Bald Eagle	33	40	42	33	40	53	37	52	41
Unidentified eagle	3	2	1	9	4	2	0	6	3
TOTAL EAGLES	132	123	108	148	125	231	169	133	146
American Kestrel	29	18	18	35	22	30	21	23	25
Merlin	36	49	46	104	78	83	65	33	62
Prairie Falcon	5	4	0	5	10	8	6	1	5
Peregrine Falcon	3	4	0	1	4	5	8	3	4
Unknown small falcon ¹	0	0	0	0	0	0	0	0	–
Unknown large falcon ¹	0	0	0	0	0	0	0	0	–
Unknown falcon	8	3	2	3	4	0	0	7	3
TOTAL FALCONS	81	78	66	148	118	126	100	67	98
Unidentified raptor	38	25	43	90	30	32	0	20	35
GRAND TOTAL	2256	2364	2743	2730	2432	4133	3382	2499	2817

¹ Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Bonney Butte, OR: 2001.

DATE	STATION	SPECIES ¹												TOTAL	CAPTURES / HOUR
	HOURS	NH	SS	CH	NG	BW	RT	RL	GE	AK	ML	PR	PG		
25-Aug	1.00	0	1	0	0	0	0	0	0	0	0	0	0	1	1.0
26-Aug	0.00														
27-Aug	5.75	0	0	0	0	0	5	0	0	0	0	0	0	5	0.9
28-Aug	6.50	0	0	1	0	0	0	0	1	0	0	0	0	2	0.3
29-Aug	8.00	0	0	2	0	0	0	0	0	0	0	0	0	2	0.3
30-Aug	6.25	0	1	0	1	0	0	0	0	0	0	0	0	2	0.3
31-Aug	8.00	0	0	1	0	0	4	0	0	0	0	0	0	5	0.6
01-Sep	6.00	0	1	1	0	0	0	0	0	0	0	0	0	2	0.3
02-Sep	7.50	0	4	4	0	0	0	0	0	0	0	0	0	8	1.1
03-Sep	7.00	0	1	2	1	0	0	0	0	0	0	0	0	4	0.6
04-Sep	1.00	0	0	1	1	0	1	0	0	0	0	0	0	3	3.0
05-Sep	0.00														
06-Sep	7.25	0	0	1	0	0	4	0	0	0	0	0	0	5	0.7
07-Sep	8.00	0	10	1	1	0	0	0	0	0	0	0	0	12	1.5
08-Sep	7.50	0	0	2	2	0	1	0	0	0	0	0	0	5	0.7
09-Sep	7.75	0	3	4	1	0	4	0	0	0	0	0	0	12	1.5
10-Sep	8.00	0	6	4	0	0	2	0	0	0	0	0	0	12	1.5
11-Sep	7.50	0	4	2	0	0	2	0	0	0	0	0	0	8	1.1
12-Sep	7.00	0	3	5	0	0	0	0	0	0	0	0	0	8	1.1
13-Sep	7.00	0	2	7	0	0	0	0	0	0	0	0	0	9	1.3
14-Sep	7.75	0	3	2	0	0	2	0	0	0	0	0	0	7	0.9
15-Sep	3.50	0	1	1	0	0	1	0	0	0	0	0	0	3	0.9
16-Sep	7.25	0	2	1	0	0	1	0	0	0	0	0	0	4	0.6
17-Sep	6.50	0	1	0	0	0	1	0	0	0	0	0	0	2	0.3
18-Sep	6.75	0	4	2	1	0	1	0	0	0	0	0	0	8	1.2
19-Sep	7.75	0	2	2	1	0	1	0	0	0	0	0	0	6	0.8
20-Sep	7.00	0	4	1	0	0	2	0	0	0	0	0	0	7	1.0
21-Sep	7.00	0	6	0	0	0	2	0	0	0	0	0	0	8	1.1
22-Sep	7.50	0	4	2	0	0	0	0	0	0	0	0	0	6	0.8
23-Sep	7.50	0	5	3	0	0	2	0	0	0	0	0	0	10	1.3
24-Sep	7.75	0	5	4	0	0	0	0	0	0	0	0	0	9	1.2
25-Sep	0.00														
26-Sep	0.00														
27-Sep	4.00	0	2	0	0	0	0	0	0	0	0	0	0	2	0.5
28-Sep	8.00	0	13	3	0	0	1	0	0	1	0	0	0	18	2.3
29-Sep	7.00	0	9	1	0	0	2	0	0	0	0	0	0	12	1.7
30-Sep	7.75	0	6	2	0	0	0	0	0	0	0	0	0	8	1.0
01-Oct	7.50	0	7	2	1	0	1	0	0	0	0	0	0	11	1.5
02-Oct	7.50	0	10	0	0	0	4	0	0	0	0	0	0	14	1.9
03-Oct	7.50	0	4	3	0	0	3	0	0	0	0	0	0	10	1.3
04-Oct	6.50	0	0	0	0	0	1	0	0	0	0	0	0	1	0.2
05-Oct	6.50	0	12	2	0	0	1	0	0	0	0	0	0	15	2.3

Appendix F. continued

DATE	STATION	SPECIES ¹												TOTAL	CAPTURES /HOUR	
	HOURS	NH	SS	CH	NG	BW	RT	RL	GE	AK	ML	PR	PG			
06-Oct	0.00															
07-Oct	0.00															
08-Oct	0.00															
09-Oct	5.50	0	0	1	0	0	2	0	0	0	1	0	0	4	0.7	
10-Oct	1.00	0	2	0	0	0	0	0	0	0	0	0	0	2	2.0	
11-Oct	0.00															
12-Oct	0.00															
13-Oct	7.50	0	3	1	0	0	3	0	0	0	0	0	0	7	0.9	
14-Oct	5.00	0	4	0	0	0	1	0	0	0	0	0	0	5	1.0	
15-Oct	7.50	0	9	0	0	0	0	0	0	0	0	0	0	9	1.2	
16-Oct	4.50	0	0	0	0	0	2	0	1	0	0	0	0	3	0.7	
17-Oct	6.00	0	4	1	0	0	1	0	0	0	0	0	0	6	1.0	
18-Oct	7.00	0	1	1	0	0	3	0	0	0	1	0	0	6	0.9	
19-Oct	0.00															
20-Oct	7.50	0	5	1	1	0	0	1	0	0	1	0	0	9	1.2	
21-Oct	0.00															
22-Oct	0.00															
23-Oct	0.00															
24-Oct	0.00															
25-Oct	3.50	0	1	0	0	0	2	0	0	0	1	0	0	4	1.1	
26-Oct	6.00	0	6	0	0	0	3	0	0	0	0	0	0	9	1.5	
27-Oct	0.00															
28-Oct	4.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	
Total	320.50	0	171	74	11	0	66	1	2	1	4	0	0	330	1.0	

¹ See Appendix B for full names associated with species codes.

Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Bonney Butte, OR: 1995–2001.

	1995	1996	1997	1998	1999	2000	2001	MEAN	TOTAL
First trapping day	7-Oct	18-Sep	31-Aug	6-Sep	5-Sep	28-Aug	25-Aug		
Last trapping day	28-Oct	10-Oct	1-Nov	30-Oct	24-Oct	24-Oct	28-Oct		
Number of stations	1	1	1	1	1	1	1	1	
Station days	10	21	39	34	22	39	50	31	
Station hours	44.50	127.20	202.80	199.95	142.75	239.75	320.50	182.49	
Captures / stn. hr.	4.9	10.0	11.0	12.8	10.0	13.0	10.3	10.3	
SPECIES	RAPTOR CAPTURES								
Northern Harrier	0	1	0	2	1	1	0	0.7	5
Sharp-shinned Hawk	18	80	139	163	82	161	171	116	814
Cooper's Hawk	0	20	29	43	14	67	74	35	247
Northern Goshawk	1	7	7	3	3	8	11	6	40
Broad-winged Hawk	0	0	0	0	0	1	0	0	1
Red-tailed Hawk	2	14	39	29	36	66	66	36	252
Rough-legged Hawk	0	0	1	0	1	0	1	0.4	3
Golden Eagle	0	3	2	1	2	3	2	2	13
American Kestrel	0	0	0	0	1	0	1	0	2
Merlin	1	2	5	11	3	1	4	4	27
Prairie Falcon	0	0	1	4	0	1	0	1	6
Peregrine Falcon	0	0	0	0	0	2	0	0	2
All species	22	127	223	256	143	311	330	202	1412
Recaptures ¹	0	0	0	0	0	0	0	0	0
Foreign Recaptures ²	0	0	1	1	0	0	1	0.4	3
Foreign Encounters ³	1	0	1	2	6	3	2	2	15

¹ Recaptures at Bonney Butte of birds originally banded at Bonney Butte.

² Recaptures at Bonney Butte of birds originally banded elsewhere.

³ Birds originally banded at Bonney Butte and subsequently encountered elsewhere.