

**FALL 2006 RAPTOR MIGRATION STUDIES AT
BONNEY BUTTE, OREGON**



*Hawk*WATCH
INTERNATIONAL

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

January 2007

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BONNEY BUTTE, OREGON**

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January 2007

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INTRODUCTION

The Bonney Butte Raptor Migration Project in the northern Cascade Mountains of Oregon is an ongoing effort to monitor long-term trends in populations of raptors using the Cascade Mountains portion of the Pacific Coast Flyway (Smith and Hoffman 2000, Hoffman et al. 2002). HawkWatch International (HWI) initiated standardized counts of the autumn raptor migration at Bonney Butte 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 2,000 and 4,000 migrants per season. The 2006 season marked the 13th consecutive count and the 12th consecutive season of trapping and banding conducted at the site by HWI. This report summarizes the 2006 count and banding results.

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; elevation 1,754 m; 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. 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.

METHODS

COUNT

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). This was the first season of migration counting experience for the three individuals that served as official counters in 2006 (see Appendix A for a complete observer history). Justin Feld attended preseason protocol and field training. On-site education specialist Jakob Roy, who also served as an official counter at the beginning of the season and continued assisting the other counters throughout the season, received preseason training in both education and observation skills. All also benefited from visits by former site observers and volunteers. Other visitors periodically assisted with the count as well.

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

1. Species, age, sex, and color morph of each migrant raptor, whenever possible and applicable (Appendix B lists common and scientific names for all species, information about the applicability of age, sex, and color morph distinctions, and two-letter codes used to identify species in some tables and figures).
2. Hour of passage for each migrant; e.g., the 1000–1059 hrs 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.

Calculation of “adjusted” (to standardize sampling periods and adjust for incompletely identified birds) passage rates (migrants counted per 100 hours of observation) and analysis of trends follows Hoffman and Smith (2003). In comparing 2006 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2006 value falling outside the bounds of the confidence interval for the associated mean.

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. 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.

RESULTS AND DISCUSSION

WEATHER SUMMARY

Inclement weather entirely precluded observations on 8 days and substantially reduced observation time to <4 hrs on 4 other days between the targeted operation dates of 27 August and 31 October (see Appendix C for daily weather records). Both values were noticeably lower than the 1997–2005 (the period for which detailed summary data have been compiled) averages of 13.4 days entirely precluded and 5.6 days severely reduced.

Fog and low clouds that hovered on the ridge and severely obscured visibility were prevalent in 2006, but several heavy rain and snow events also hampered operations. The first spate of difficult weather occurred during the first week of operations, with heavy fog and rain precluding observations on 30 August. A second spate of heavy fog and rain reduced observations to less than 8 hours from 14–16 September. Between 22 September and 02 October during the primary peak activity period for most species, the weather improved markedly and allowed for full-time observing. Difficult weather then returned, bringing the first snow of the season from 03–04 October and significantly reducing observation time to only ~10 hours between 15–20 October. The snow came and went for the remainder of the season, but unlike many years did not shut down operations entirely before the projected end date of 31 October.

Weather data collected on site during active observation periods reflected a high prevalence of fair weather, with 62% of the active days featuring predominantly fair skies (second highest level since 1997), 18% transitional skies (i.e., changed from fair or partly cloudy to mostly cloudy or overcast during the day, or vice versa), and 21% mostly cloudy to overcast skies. The comparable 1997–2005 averages

are 49% fair, 24% transitional, and 27% mostly cloudy to overcast. The proportion of active days that featured noteworthy levels of visibility reducing fog and/or haze (46%) also was substantially below average (64%). In contrast, however, the proportion of active observation days that featured some rain or snow (18%) was markedly above average (10%). These statistics suggest that when stormy or reduced-visibility conditions occurred in 2006, the observers were more apt or able than usual to persevere and continue observing, and that haze and lingering pockets of fog were less prevalent than usual between bouts of inclement weather.

The daily-average temperature (average of hourly values for each day) during active observation periods averaged of 13.9°C, ranging from -3.8–30.4°C. The annual average was slightly above the 1997–2005 grand average of 13.4°C and the maximum daily value tied the previous high set in 2003; however, the minimum was moderately cool compared to the long-term average.

Wind speed conditions were similar to 2005; light winds (<12 kph) prevailed on a moderately high proportion of days (91% vs. average of 85% of days, but lower than the past three years), moderate winds (12–29 kph) prevailed on a moderately low proportion of days (9% vs. average 14% of days, but higher than the past three years), and no days featured predominantly stronger winds (average 1%). In terms of wind directions, however, 2006 was atypical. As usual, SW-W winds were the most common, prevailing on 33% of the active days (average 30%), and N-E winds ranked among the top three (21% vs. average of 16% of days); however, averaging second most common overall, variable SW-NW winds prevailed on only 5% of the days in 2006 (average 20%). Instead, a record-high 23% of the active observation days featured winds that shifted markedly during the day from predominantly SW-NW to predominantly N-NE winds, or vice versa (average of 3.2%). Note also that N-E and NE-SE (9% vs. average of 5%) winds were both at least slightly more common than usual. Thermal lift was rated good to excellent on a slightly below average proportion of the active observations days (37% vs. average of 44%), revealing a pattern opposite that observed in 2005.

In summary, compared to averages for the past 9 years, inclement weather severely restricted observations noticeably less often than usual in 2006, fair skies prevailed substantially more often during active observation periods (especially compared to the past the years), visibility reducing fog and haze were less prevalent during active periods, and temperatures averaged warmer than usual, but scattered rain and snow showers also were more common than usual during active observation periods. Wind-speed conditions were similar to the past three years, involving primarily light winds, but reflected a slight shift to more moderate winds. In contrast, the prevailing wind directions were atypical, reflecting a substantial shift toward more easterly and northeasterly as opposed to westerly winds.

COUNT SUMMARY

The observers worked on 57 of 66 possible days between 27 August and 31 October 2006, with the season ending 3 days later than the 1994–2005 average. The number of observation days was a significant 15% above the 1994–2005 average of $50 \pm 95\%$ CI of 3.5 days; and the number of observation hours (459.92) was a significant 30% above the long-term average of $354.64 \pm 95\%$ CI of 33.45 hours. The 2006 average of 2.7 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was also a significant 15% above the long-term average of $2.3 \pm 95\%$ CI of 0.28 observers per hour.

The observers counted 2,656 migrant raptors of 15 species, with the count a non-significant 9% below the 1994–2005 average (Table 1, and see Appendix D for daily count records). Counts dropped to record lows for Ospreys, Red-shouldered Hawks, Ferruginous Hawks, Golden Eagles, and American Kestrels, whereas the counts of Cooper's Hawks, Northern Goshawks, Rough-legged Hawks, Prairie Falcons, and Peregrine Falcons rose to a record highs (see Appendix E for annual count summaries).

The 2006 flight was composed of 58% accipiters, 22% buteos, 9% vultures, 4% eagles, 4% falcons, 2% Ospreys, 1% harriers and <1% unidentified raptors. The season featured significantly higher than average proportions of accipiters, but significantly lower than average proportions of eagles and Ospreys (Figure 2). As usual, Sharp-shinned and Red-tailed Hawks were the two most abundant species, followed by Cooper's Hawks, Turkey Vultures, Merlins, Golden Eagles, Bald Eagles, and Northern Goshawks (Table 1, Appendix E). The only difference was that Cooper's Hawks and Northern Goshawks moved up the proportional ladder compared to the long-term averages.

Adjusted passage rates were not significantly above average in 2006 for any species, whereas eight commonly encountered species showed significantly below average passage rates (Turkey Vultures, Ospreys, Sharp-shinned Hawks, Swainson's Hawks, Red-tailed Hawks, Golden Eagles, Bald Eagles, and American Kestrels; Table 1; Figures 3–8). Regression analyses of adjusted passage rates through 2006 revealed a highly significant ($P \leq 0.01$) quadratic trend (accelerating increase) for Peregrine Falcons (Figure 8); highly significant linear decreasing trends for adult Golden Eagles and American Kestrels (Figures 7 and 8); a significant ($P \leq 0.05$) linear decreasing trend for non-adult Golden Eagles (Figure 7); and no significant trends for other species (Figures 3–8). For several species, high passage rates in both 2003 and 2004 sharply reversed patterns of decline that had set in between 1998 and 2001/2002 coincident with the onset of widespread drought throughout much of the interior West (Hoffman and Smith 2003). For most such species, and others, passage rates dropped back down again in 2006, often to below average levels. Northern Harriers, Northern Goshawks, and Peregrine Falcons are notable exceptions in this regard, with each showing increases each year since 2001.

In last year's report, we speculated that the high counts of many species at Bonney Butte in 2003 and 2004 might have been indicative of a route shift among migrants that typically travel along the Intermountain Flyway (*sensu* Hoffman and Smith 2003). After three years of severe drought, counts in the Goshute Mountains of Nevada in the heart of the Great Basin plummeted in 2002 from ~20,000 to ~12,000 migrants per season (Smith and Neal 2007a), coincident with near-record high counts commencing at Bonney Butte in 2003 and 2004, at the same time that counts in the northern Cascades of Washington remained low (Smith and Neal 2007b). We suspected that a logical diversion path for migrants moving south through eastern Washington and northern Idaho to avoid the parched Great Basin would be to veer west through the Blue and Wallowa Mountains and over to the Cascades with Mt. Hood as a navigation target. This would result in those migrants intersecting the Cascades just north of Bonney Butte, and might explain the high counts at Bonney Butte despite low counts farther north in the Washington Cascades. Until 2006, counts at Idaho Bird Observatory's site near Boise had remained high (G. Kaltenecker personal communication) while the counts dropped in the Goshutes several hundred kilometers farther south, again suggesting the possibility that some migrants had begun to divert west out of Idaho before passing down through the heart of the Great Basin. Winter/spring moisture levels began to recover in the northern Great Basin in 2004, whereas drought conditions intensified in 2005 in the northern Cascades. It is therefore possible that the 2005 and 2006 drop in the Bonney Butte count signaled a shift in activity back towards the Great Basin. However, the counts at Boise Ridge and the Goshutes were well below average in 2006, while the count at Chelan Ridge in the northern Cascades recovered substantially compared to the past several years, so it appears that we will need to await additional years of data to clarify our understanding of these complex regional dynamics.

The marked and continuing long-term decline of American Kestrel passage rates at Bonney Butte is particularly conspicuous. Hoffman and Smith (2003) reported mixed trends for this species through 2001 across seven long-term HWI monitoring sites in the West. Across HWI's western network, kestrels have shown declining patterns at Bonney Butte since 1994, at Chelan Ridge in north-central Washington since 1998, in the Bridger Mountains of southwest Montana since 1998, in the Wellsville Mountains of northern Utah since 1994, in the Goshute Mountains of northeastern Nevada since 1997, and in the Grand Canyon of northern Arizona since 1991 (see www.hawkwatch.org for relevant technical reports).

In contrast, kestrel passage rates have remained relatively stable in the southern Rocky Mountains of northern and central New Mexico since 1985, and counts at HWT's newest migration site in southwest Wyoming increased steadily from 2002–2004 then dropped back to a moderate levels in 2005 and 2006. These data suggest that, outside of the central and southern Rocky Mountains, many western kestrel populations may be in decline, especially since widespread drought began plaguing much of the interior West in the late 1990s.

Among eight species for which reasonable age-specific comparisons were possible, Sharp-shinned Hawks and Golden Eagles showed significantly above-average immature: adult ratios in 2006, whereas four other species showed at least slightly below-average age ratios (Table 2). Sharp-shinned Hawks showed slightly above average counts of identified immature birds and slightly below average counts of adults, whereas Golden Eagles showed a drastically reduced adult count. In both cases, the high 2006 age ratios appear to reflect primarily low counts of identified adults. Nevertheless, given the below-average overall count for Sharp-shinned Hawks, the slightly above average count of immature birds suggests that productivity among northwestern source populations was probably at least average in 2006, while a low count of adult birds suggests that either adult mortality was high during 2006 for some unknown reason or many adults substantially altered their migration behavior in 2006 such that they did not pass by Bonney Butte in typical numbers. In contrast, age ratios were significantly below average for Northern Harriers and Northern Goshawks. In both cases, this was due to both absolute and relative (to numbers of immatures) increases in the numbers of identified adult birds (Table 2), which may reflect increased adult survivorship for these species.

The 2006 combined-species median passage date of 1 October was slightly later than the long-term average for the site of 30 September (Table 3). The seasonal distribution of activity was somewhat unusual (Figure 9). Relative flight volume was significantly below average in early September, corresponding to the brief spate of inclement weather that allowed for only 8 hours of observation from 14–16 September, and in mid October, corresponding to the first prolonged rain/snow event that shut down observations for nearly 4 days (Appendix C). In contrast, relative flight volume was significantly above average during late September and the second week of October when the weather was generally more cooperative. At the species level, Ospreys, Cooper's Hawks, Northern Goshawks, Rough-legged Hawks, American Kestrels, and Prairie Falcons showed significantly later than average median passage dates in 2006, whereas Sharp-shinned Hawks and Golden Eagles showed significantly early timing (Table 3). There were, however, no distinct multi-species patterns of variation in seasonal timing. Age-specific median dates added complexity to the picture, but again revealed no distinct multi-species patterns (Table 4).

RESIDENT RAPTORS

A pair of light-morph adult Red-tailed Hawks and at least one immature light-morph bird were resident in the White River Valley. Another light-morph pair with one juvenile seemed to dominate the eastern valley. An immature Northern Goshawk also was frequently seen hunting in the White River drainage to the west, but inclement weather seemed to push this bird from the area late in the season. An apparently local, early season adult Bald Eagle was frequently seen patrolling the White River drainage.

This is a typical local assemblage except that sightings of local Golden Eagles have diminished markedly since 2001, and local American Kestrels were not observed early in the season.

TRAPPING AND BANDING SUMMARY

Trapping occurred on 49 of 66 possible trapping days between 27 August and 31 October, with effort totaling 354 hours (see Appendix F for daily trapping records and Appendix G for annual trapping summaries). The number of trapping days was a non-significant 13% above the 1997–2005 (period of

comparable seasonal effort) average of $43 \pm 95\%$ CI of 7.5 days, whereas the hours of effort was a significant 32% above the 1997–2005 average of 268 ± 50.5 hours.

The 2006 capture total of 491 birds of 11 species was the second largest total recorded for the project (Table 2, Appendix G). The captures included one recapture of a bird previously banded at Bonney Butte; one recapture of a bird originally banded elsewhere; new record-high capture totals for American Kestrels and Prairie Falcons; the fifth Rough-legged Hawk ever captured at the site; and six Golden Eagles, which shatters the previous record high for that species (Appendix G). The 2006 effort raises the total number of birds captured since project inception to 3,618. As usual, the three most frequently captured species were the Sharp-shinned Hawk (53% of captures), Red-tailed Hawk (22%), and Cooper's Hawk (18%).

Capture totals, rates, and successes were all above average for all commonly captured species except Northern Harriers, with all values significantly above average for Red-tailed Hawks, Golden Eagles, American Kestrels, Merlins, and Prairie Falcons, and with both the capture totals and capture successes for Sharp-shinned and Cooper's Hawks significantly above average.

At this site, compared to the counts, banding data yield unique and useful sex–age specific data only for the three accipiters. In 2006, the immature : adult ratios for Sharp-shinned Hawks derived from the count and banding data were both above average; however, the two estimated ratios were themselves noticeably different (1.2 based on counts, 2.2 based on captures) and the count ratio was 66% above average while the capture ratio was only 22% above the 1995–2005 average of $1.8 \pm 95\%$ CI of 0.55 captures (Table 6). As usual, the fact that the capture age ratio was substantially higher than the count age ratio suggests that immature birds were more susceptible to capture than adults; however, in this case a slightly above average 2006 capture age ratio but a much higher than usual 2006 count age ratio suggests that this was less true than usual in 2006. The capture data further indicated a slightly below-average female : male ratio, suggesting that females were either proportionately less abundant than usual or were slightly less susceptible to capture than usual (Table 6).

For Cooper's Hawks, again both the count and capture age ratios showed a similar pattern compared to long-term averages, but in this case both fell below average (19% and 31% below average, respectively; Tables 2 and 6). The absolute values of the two estimated age ratios were more similar than for Sharp-shinned Hawks, but indicated the same relationship (i.e., a lower count [1.3] than capture [1.7] ratio), again suggesting that immature Cooper's Hawks were more susceptible to capture than adults were in 2006. The Coopers' Hawks count was above average in 2006, but passage rates of both small accipiter species were below average, significantly so for Sharp-shinned Hawks. Therefore, the proportionately greater reduction in Sharp-shinned Hawk adult count abundance, at least slightly above average capture age ratio, and indication of lower than usual susceptibility of young birds to capture may all be indicators of greater productivity in 2006 for northwestern populations of this species compared to Cooper's Hawks. Furthermore, like for Sharp-shinned Hawks, a reduced female : male capture ratio in 2006 for Cooper's Hawks suggests that either females were proportionately less abundant than usual or were less susceptible to capture than usual (Table 6).

For Northern Goshawks in 2006, the count age ratio (0.8) was a significant 64% below average (Table 2) and the capture age ratio of 1.2 was 62% below the 1995–2005 average of 3.2 ± 1.40 (Table 6). Thus, like for both smaller accipiters, these data indicate the usual inflated capture age ratio due to immature birds being more susceptible to capture than adults, but otherwise suggest that immature birds were at least relatively less abundant than usual in 2006 and showed a usual level of higher susceptibility to capture than adults. Thus, similar to Coopers Hawks, the data suggest that the a 15–20% reduction in the abundance of immature goshawks in 2006 correlated with indicators of reduced regional productivity (low immature : adult ratio), while high adult numbers suggest greater adult survival in recent years.

Another way to assess the relative condition of the three species is examining measures of body condition collected during banding; i.e., crop fullness, keel muscle, and wing-pit fat ratings (Table 7). For Sharp-shinned and Cooper's Hawks, all three measures indicated at least a slight shift toward poorer than usual condition, most notably for keel muscle and wing-pit fat indices. For keel muscle mass, both species showed noticeably higher than average proportions of birds with moderate keel muscles and lower proportions of birds with robust keels. Similar, both species showed noticeably higher than average proportions of birds with no or limited wing-pit fat and lower proportions of birds with moderate to heavy wing-pit fat. The crop fullness and keel muscle data for goshawks showed a pronounced shift toward birds of healthier condition, whereas wing-pit fat data showed no specific trend. Thus, it appears that the goshawks captured in 2006 were generally healthy, whereas both of the two smaller accipiters averaged poorer than usual body condition.

ENCOUNTERS WITH BANDED BIRDS

To date, 48 birds banded at Bonney Butte have subsequently been encountered elsewhere, with six new "foreign encounters" involving 3 Sharp-shinned Hawks and 3 Red-tailed Hawks having occurred in 2006 (Table 8). In addition, 12 birds banded elsewhere have been recaptured at Bonney Butte. One new "foreign recapture" occurred during the 2006 season, involving a hatch-year Red-tailed Hawk recently banded by former Bonney Butte trapper Carole Hallett with a colored leg band and breast marking at the Portland Airport as part of a study designed to evaluate collision threats. Curiously, Carole also recently recaptured another Red-tailed Hawk near the airport that was banded at Bonney Butte. All of the foreign encounter locations and known original banding locations of the foreign recaptures recorded to date have been located within the expected confines of the Pacific Coast Flyway between southern British Columbia and southern California (Hoffman et al. 2002). Of particular interest are six exchanges between different migration research projects: 1 Sharp-shinned Hawk and 1 Cooper's Hawk encountered at both Bonney Butte and Golden Gate Raptor Observatory's (GGRO) project in the Marin Headlands of California; 2 Sharp-shinned Hawks and 1 Red-tailed Hawk encountered at both Bonney Butte and HWI's Chelan Ridge project in north-central Washington; and 1 Sharp-shinned Hawk originally banded by the Falcon Research Group at Diamond Head in central Washington and later recaptured at Bonney Butte.

Among the six new foreign encounters recorded in 2006, 1 Red-tailed Hawk and 1 Sharp-shinned Hawk were reported simply as "found dead" with no specific cause of mortality known (Table 8). As alluded to above, one hatch-year Red-tailed Hawk was recaptured and released at the Portland Airport by Carole Hallett 4 weeks after its initial capture at Bonney Butte. A seven year old Red-tailed Hawk was found injured and later died. The two remaining Sharp-shinned hawks have been reported as encountered, but we have yet to receive Banding Lab reports containing specific details.

This year marked the third season in a row that recaptures of birds originally banded at Bonney Butte occurred, in this case involving a Northern Goshawk originally banded as a hatch-year bird in September 2003. This brings the recapture total for the site to four birds, involving 2 Sharp-shinned Hawks and 2 Northern Goshawks.

SATELLITE TRACKING

We did not outfit any new birds with satellite transmitters at this site in 2006.

The Golden Eagle outfitted at the site during fall 2005 is still alive and well and continues to transmit effectively. This young male, now almost two years old, has shown himself to be a long-distance migrant from the far north. After capture, he traveled southeast across the Great Basin and eventually wintered in southwestern New Mexico. He then set off north again in late April 2006, retraced his fall path back up through Oregon, and then continued north up into western Canada. By early June, he reached the Inuvik

region in the northwest corner of the Yukon Territory. He then diverted northeast for about 10 days along the northern coast of Canada, but then turned back to the west and proceeded into Alaska. About 10 days later he reached the Arctic National Wildlife Refuge, where he spent a combined total of almost three weeks, with an intervening jaunt of another ~400 km west along the coast in the vicinity of Prudhoe Bay. Then from mid-July to late August, he wandered slowly eastward again, stopping off at a few different locales for a few days each, before heading south again around 25 August. He reached Whitehorse in the Yukon Territory by 9 September and then spent about a month in this area before setting out in earnest to the southeast, traveling down through northern BC to the Prince George area and then continuing along the western flanks of the Rocky Mountains down through western Montana. Upon reaching the southwest corner of Montana, he then veered southwest into Idaho and since mid-December 2006 has resided near Grindstone Butte ~80 km w of Jerome, ID.

One of the two Northern Goshawks outfitted at the site in 2005, as a hatch-year female, ended up residing throughout the tracking period ~6 km southeast of the project site near Grasshopper Point. This bird's transmitter battery eventually failed in early July 2006, about as expected. Sensor data indicated that the bird was alive and well at that time. This is only the fourth goshawk among more than 30 that we have tracked successfully for more than six months without evidence of mortality. All four have occurred in the last two years, with the other three Wyoming birds. We are of the mind that the severe drought that has plagued much of the interior West since we began our satellite tracking studies in 1999 has been a major contributor to the high mortality rates we have documented among especially the young goshawks we have tracked. Nevertheless, among the three species we have been tracking, the goshawk mortality rate has been much higher, suggesting that the extra burden of carrying a transmitter may simply be too much for this species to handle when population stress is already high due to other factors such as drought.

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

STABLE ISOTOPE RESEARCH

In 2006, we continued to collect feather samples from a variety of species to support our on-going stable-isotope research, which seeks to use analyses of hydrogen stable-isotope ratios in feathers of juvenile birds to identify the approximate natal origins of migrants monitored at migration sites in North America (e.g., Meehan et al. 2001, Lott et al. 2003, Lott and Smith 2006).

VISITATION

In 2006, the HWI visitor logs documented 419 visits to Bonney Butte, including some repeat visitors, which represents a significant decline compared to the last three years (over 600). The lower visitation was probably due to a couple of factors. Two years ago, the Oregonian (Portland newspaper) ran an article that produced more than 200 visitors in just one weekend. Most visitors derived from the nearby Portland metropolitan area or other areas of Oregon. Organized groups that visited the site in 2006 included folks from the Cascade Raptor Center, Central Oregon Audubon Society, Friends of Doug, and students from Welches Middle School. In addition to on-site programs, educator Jakob Roy reached an additional 100 people through four off-site programs in local communities.

In 2006, 462 hourly assessments of visitor disturbance by the primary observers resulted in the following ratings: 73% none, 20% low, 5% moderate, and 2% high. These ratings reflect a considerably higher level of disturbance than in previous years. Reasons for this are uncertain, but may reflect greater sensitivity to disturbance by this year's observers, more emphasis on having the field educator dedicated to on-site as well as limited off-site education programs, and/or adoption during the season of stricter regulations governing public visitation to the trapping blind.

ACKNOWLEDGMENTS

Funding and logistical support for this project were provided by the USDA Forest Service, Mt. Hood National Forest; U.S. Fish and Wildlife Service, Neotropical Migratory Bird Conservation Act Grant Program; Oregon Parks Foundation; Fledgling Fund; Portland and Central Oregon Audubon Societies; and HWI private donors and members. Special thanks to Maggie Gould of Mt. Hood National Forest and Chris Carey of the Oregon Department of Fish and Wildlife and Central Oregon Audubon Society for their logistical assistance. We also extend special thanks to the following individuals who assisted the crew in various ways during the season: Amanda Gladics, Don Baccus, Craig Plumber, Carole Hallett, Steve Engel, and Tom Jordan.

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Table 1. Fall raptor migration unadjusted counts and adjusted passage rates by species at Bonney Butte, OR: 1994–2005 versus 2006.

SPECIES	COUNT				RAPTORS / 100 HOURS			
	1994–2005 ¹		2006	% CHANGE	1994–2005 ¹		2006	% CHANGE
Turkey Vulture	302	± 74.6	232	-23	132.8	± 31.85	87.8	-34
Osprey	67	± 11.8	38	-43	25.1	± 4.67	11.3	-55
Northern Harrier	30	± 7.8	33	9	9.6	± 2.28	7.5	-22
Sharp-shinned Hawk	1120	± 205.0	1015	-9	409.2	± 72.02	296.0	-28
Cooper's Hawk	342	± 51.9	418	22	123.3	± 23.67	117.2	-5
Northern Goshawk	26	± 6.1	40	52	8.7	± 2.18	10.4	20
Unknown small accipiter ²	17	± 11.5	7	-59	–	–	–	–
Unknown large accipiter ²	3	± 4.7	2	-41	–	–	–	–
Unknown accipiter	70	± 30.1	60	-14	–	–	–	–
TOTAL ACCIPITERS	1566	± 249.1	1542	-2	–	–	–	–
Red-shouldered Hawk	1	± 1.2	0	-100	0.5	± 0.47	0.0	-100
Broad-winged Hawk	8	± 12.0	1	-88	5.2	± 6.90	0.7	-87
Swainson's Hawk	1	± 0.4	0	-100	0.3	± 0.25	0.0	-100
Red-tailed Hawk	609	± 84.0	531	-13	197.6	± 30.07	129.4	-35
Ferruginous Hawk	1	± 0.3	0	-100	0.1	± 0.09	0.0	-100
Rough-legged Hawk	13	± 4.5	27	108	9.7	± 3.55	11.0	14
Unidentified buteo	31	± 9.4	30	-2	–	–	–	–
TOTAL BUTEOS	664	± 98.3	589	-11	–	–	–	–
Golden Eagle	95	± 18.7	56	-41	33.1	± 6.15	14.8	-55
Bald Eagle	47	± 6.5	44	-7	14.9	± 1.93	9.9	-33
Unidentified eagle	3	± 1.6	1	-68	–	–	–	–
TOTAL EAGLES	146	± 19.2	101	-31	–	–	–	–
American Kestrel	22	± 4.0	17	-21	7.0	± 1.75	4.4	-37
Merlin	67	± 14.6	69	3	26.6	± 6.22	20.7	-22
Prairie Falcon	5	± 1.7	7	50	1.8	± 0.57	2.2	26
Peregrine Falcon	7	± 2.9	10	52	2.2	± 1.17	2.8	25
Unknown small falcon ²	1	± 0.7	0	-100	–	–	–	–
Unknown large falcon ²	2	± 3.9	1	-50	–	–	–	–
Unknown falcon	3	± 1.5	1	-68	–	–	–	–
TOTAL FALCONS	104	± 16.9	105	1	–	–	–	–
Unidentified Raptor	26	± 14.0	16	-38	–	–	–	–
ALL SPECIES	2904	± 402.1	2656	-9	–	–	–	–

¹ Mean of annual values ± 95% confidence interval.

² Designations used for the first time in 2001.

Table 2. Fall counts by age class and immature : adult ratios for selected species of migrating raptors at Bonney Butte, OR: 1994–2005 versus 2006.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1994–2005 AVERAGE			2006			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1994–2005 ¹	2006	1994–2005 ¹	2006
Northern Harrier	30	16	5	33	18	8	33 ± 6.1	21	4.8 ± 2.35	2.3
Sharp-shinned Hawk	1120	226	344	1015	338	284	50 ± 7.0	39	0.7 ± 0.18	1.2
Cooper's Hawk	342	94	73	418	136	105	51 ± 6.1	42	1.6 ± 0.78	1.3
Northern Goshawk	26	11	7	40	14	17	34 ± 9.1	23	2.3 ± 0.85	0.8
Broad-winged Hawk	8	1	1	1	0	0	35 ± 29.0	100	0.4 ± 0.39	–
Red-tailed Hawk	609	172	302	531	167	251	23 ± 4.7	21	0.6 ± 0.13	0.7
Golden Eagle	95	52	23	56	46	5	20 ± 3.1	9	2.7 ± 0.82	9.2
Bald Eagle	47	10	34	44	9	33	8 ± 3.1	5	0.3 ± 0.08	0.3
Peregrine Falcon	7	1	2	10	1	0	47 ± 4.8	90	1.0 ± 0.92	1.0

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.

Table 3. First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Bonney Butte, OR in 2006, with a comparison of 2006 and 1994–2005 average median passage dates.

SPECIES	2006				1994–2005
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	31-Aug	30-Oct	7-Sep – 5-Oct	24-Sep	23-Sep ± 1.4
Osprey	2-Sep	30-Oct	10-Sep – 5-Oct	24-Sep	19-Sep ± 1.6
Northern Harrier	28-Aug	30-Oct	10-Sep – 20-Oct	29-Sep	28-Sep ± 3.3
Sharp-shinned Hawk	28-Aug	31-Oct	13-Sep – 22-Oct	2-Oct	05-Oct ± 1.5
Cooper's Hawk	31-Aug	30-Oct	22-Sep – 11-Oct	1-Oct	26-Sep ± 1.9
Northern Goshawk	4-Sep	28-Oct	23-Sep – 23-Oct	10-Oct	02-Oct ± 3.7
Broad-winged Hawk	2-Oct	2-Oct	–	–	27-Sep ± 2.6
Red-tailed Hawk	28-Aug	31-Oct	11-Sep – 23-Oct	–	28-Sep ± 1.9
Rough-legged Hawk	22-Sep	31-Oct	11-Oct – 31-Oct	22-Oct	12-Oct ± 3.2
Golden Eagle	31-Aug	31-Oct	2-Oct – 27-Oct	9-Oct	12-Oct ± 2.2
Bald Eagle	23-Sep	31-Oct	24-Sep – 31-Oct	6-Oct	06-Oct ± 3.2
American Kestrel	3-Sep	22-Oct	11-Sep – 10-Oct	24-Sep	19-Sep ± 3.3
Merlin	13-Sep	31-Oct	24-Sep – 23-Oct	10-Oct	10-Oct ± 2.5
Prairie Falcon	11-Sep	13-Oct	11-Sep – 13-Oct	29-Sep	20-Sep ± 5.2
Peregrine Falcon	7-Sep	14-Oct	7-Sep – 10-Oct	24-Sep	24-Sep ± 4.7
Total	2-Sep	31-Oct	11-Sep – 22-Oct	1-Oct	30-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 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: 1994–2005 versus 2006.

SPECIES	ADULT		IMMATURE	
	1994–2005 ¹	2006	1994–2005 ¹	2006
Northern Harrier	05-Oct ± 7.8	29-Sep	26-Sep ± 2.4	28-Sep
Sharp-shinned Hawk	10-Oct ± 2.3	10-Oct	23-Sep ± 1.6	25-Sep
Cooper's Hawk	02-Oct ± 2.1	5-Oct	20-Sep ± 2.4	27-Sep
Northern Goshawk	15-Oct ± 6.6	11-Oct	30-Sep ± 6.7	6-Oct
Red-tailed Hawk	02-Oct ± 2.7	1-Oct	22-Sep ± 1.9	29-Sep
Golden Eagle	13-Oct ± 1.6	13-Oct	09-Oct ± 2.8	9-Oct
Bald Eagle	06-Oct ± 3.8	6-Oct	11-Oct ± 4.1	6-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: 1995–2005 versus 2006.

	CAPTURE TOTALS		CAPTURE RATES ¹		CAPTURE SUCCESSES ²	
	1995–2005 ³	2006	1995–2005 ³	2006	1995–2005 ³	2006
Northern Harrier	2 ± 1.4	2	0.8 ± 0.40	0.6	5.9 ± 4.51	6.1
Sharp-shinned Hawk	162 ± 49.6	259	66.4 ± 9.29	73.1	12.9 ± 4.48	24.4
Cooper's Hawk	52 ± 19.5	88	19.5 ± 5.67	24.8	13.3 ± 5.98	20.0
Northern Goshawk	8 ± 2.4	10	3.2 ± 0.73	2.8	36.2 ± 22.01	23.8
Broad-winged Hawk	0.1 ± 0.2	0	0.04 ± 0.07	0.0	1.4 ± 2.80	0.0
Red-tailed Hawk	51 ± 17.9	106	19.7 ± 4.39	29.9	8.1 ± 3.94	19.0
Rough-legged Hawk	0.4 ± 0.30	1	0.2 ± 0.15	0.3	2.3 ± 2.85	3.6
Golden Eagle	2 ± 0.7	6	0.8 ± 0.40	1.7	1.6 ± 0.82	10.5
Bald Eagle	0 ± 0.2	0	0.0 ± 0.05	0.0	0.0 ± 0.00	0.0
American Kestrel	0.2 ± 0.2	2	0.1 ± 0.13	0.6	0.7 ± 0.94	11.8
Merlin	5 ± 2.3	12	2.1 ± 0.84	3.4	6.1 ± 2.74	17.1
Prairie Falcon	2 ± 1.0	4	0.6 ± 0.40	1.1	32.7 ± 23.63	57.1
Peregrine Falcon	0.6 ± 0.8	1	0.2 ± 0.24	0.3	4.0 ± 5.67	9.1
All species	284 ± 87.1	491	113.6 ± 16.79	138.6	10.7 ± 4.01	20.7

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: 1995–2005 versus 2006.

SPECIES	FEMALE		MALE		FEMALE : MALE	IMMATURE : ADULT
	HY	AHY	HY	AHY	RATIO	RATIO
Sharp-shinned Hawk	51	37	51	23	1.3 ± 0.20	1.8 ± 0.55
1995–2005	85	51	93	30	1.1	2.2
2006	23	12	15	3	2.1 ± 0.35	2.4 ± 0.59
Cooper's Hawk	32	23	23	10	1.7	1.7
1995–2005	3	1	3	1	1.4 ± 1.01	3.2 ± 1.40
2006	1	3	5	2	0.6	1.2
Northern Goshawk	51	37	51	23	1.3 ± 0.20	1.8 ± 0.55
1995–2005	85	51	93	30	1.1	2.2
2006	23	12	15	3	2.1 ± 0.35	2.4 ± 0.59

¹ Mean ± 95% Confidence Interval (CI).

Table 7. Fall body condition indices for migrant accipiters captured at Bonney Butte, OR: 1995–2005 versus 2006.

Species	Years	Crop Fullness					Keel Muscle ¹			Wing-pit Fat			
		E	1/4	1/2	3/4	F	0	1	2	0	1	2	3
Sharp-shinned Hawk	1995-2005 mean	50	24	12	6	8	1	68	30	10	57	23	9
Hawk	2006	60	15	12	0	13	1	80	19	12	67	19	2
Cooper's Hawk	1995-2005 mean	54	18	13	7	8	9	74	16	18	60	16	6
Hawk	2006	53	11	19	0	16	6	90	5	7	80	11	2
Northern Goshawk	1995-2005 mean	59	20	4	5	12	15	80	6	15	69	16	0
Hawk	2006	36	27	9	0	27	9	91	0	18	73	9	0

¹ Subjective rating based on visual and tactile assessment of keel muscle mass, with 0 indicating a skinny bird, 1 indicating a moderately healthy bird, and 2 indicating a bird with a robust keel muscle.

² Subjective rating based on visual assessment of fat deposit in the "wing-pit" hollow directly under the wing, with 0 indicating no fat, 1 indicating a modest fat deposit, 2 indicating a deposit that mostly fills the wing-pit, and 3 indicating a bulging deposit.

Table 8. Foreign encounters in 2006 of raptors banded during migration at Bonney Butte, Oregon.

BAND #	SPECIES-SEX ¹	BANDING DATE	BANDING AGE ²	ENCOUNTER DATE	ENCOUNTER LOCATION	DISTANCE (KM)	STATUS
1593-01374	SS-F	17-Oct-03	HY	19-Feb-06	Salinas, CA	775	found dead
1807-93962	RT-U	05-Sep-06	HY	03-Oct-06	Portland, OR	137	captured/released
1177-06182	RT-U	14-Sep-03	AHY	21-Oct-06	Salt Spring Island, BC	375	found dead
1177-02040	RT-U	18-Sep-99	HY	08-Nov-06	Grants Pass, OR	332	injured/died
1212-72902	SS-M	28-Aug-06	HY	unknown ³	unknown	unknown	unknown
1212-94956	SS-F	11-Sep-06	HY	unknown ³	unknown	unknown	unknown

¹ SS = Sharp-shinned Hawk, CH = Cooper's Hawk, NG = Northern Goshawk, RT = Red-tailed Hawk.

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

³ Awaiting full report from Bird Banding Lab.

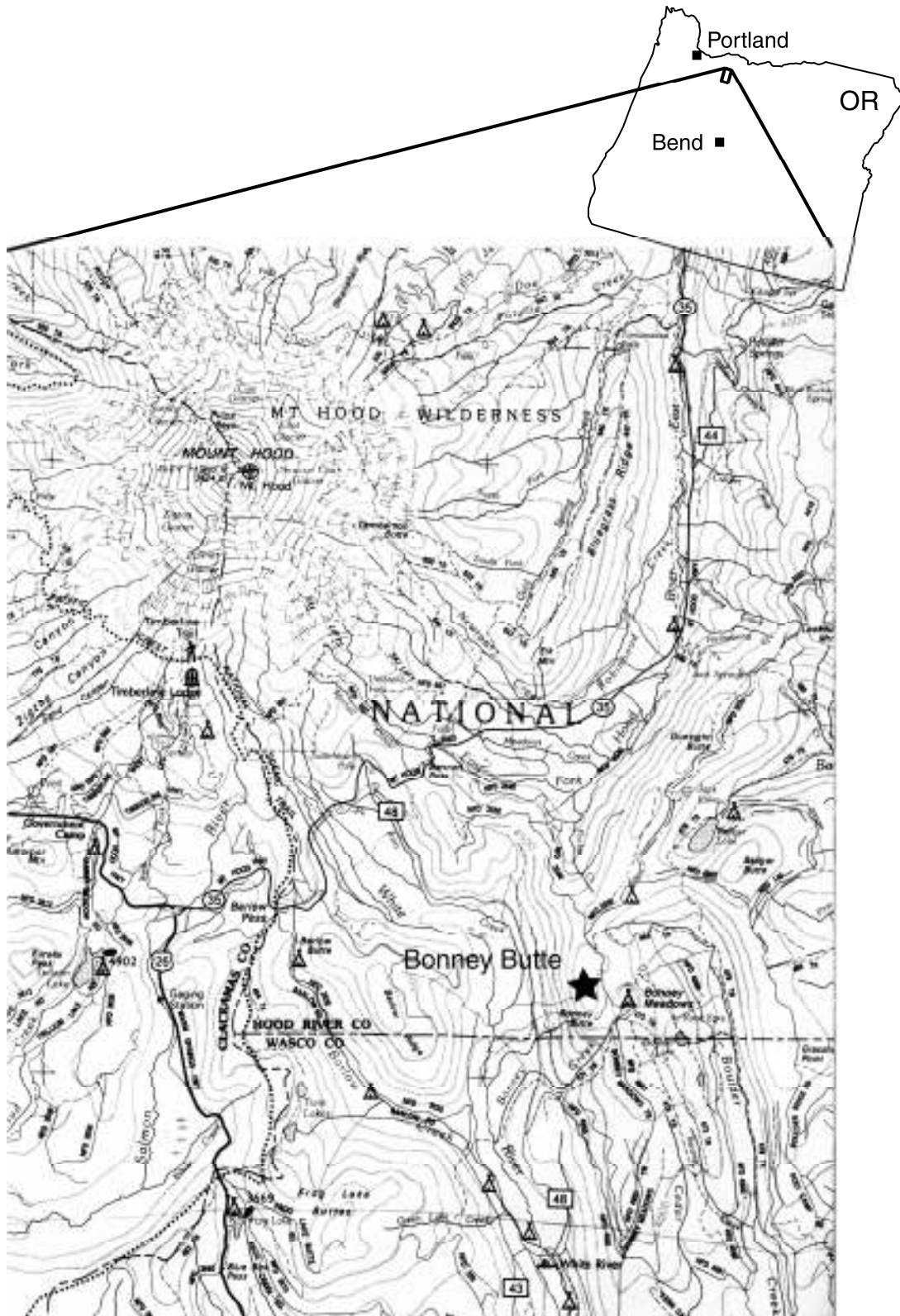


Figure 1. Location of the Bonney Butte Raptor Migration Project study site near Mt. Hood, Oregon.

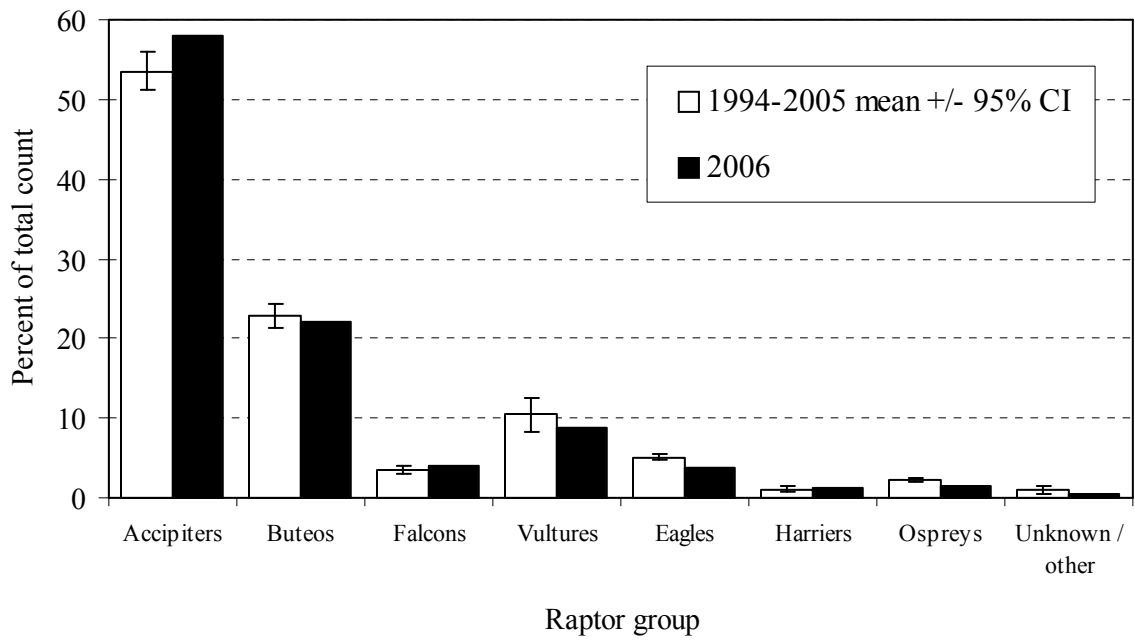


Figure 2. Fall raptor migration flight composition by major species groups at Bonney Butte, Oregon: 1994–2005 versus 2006.

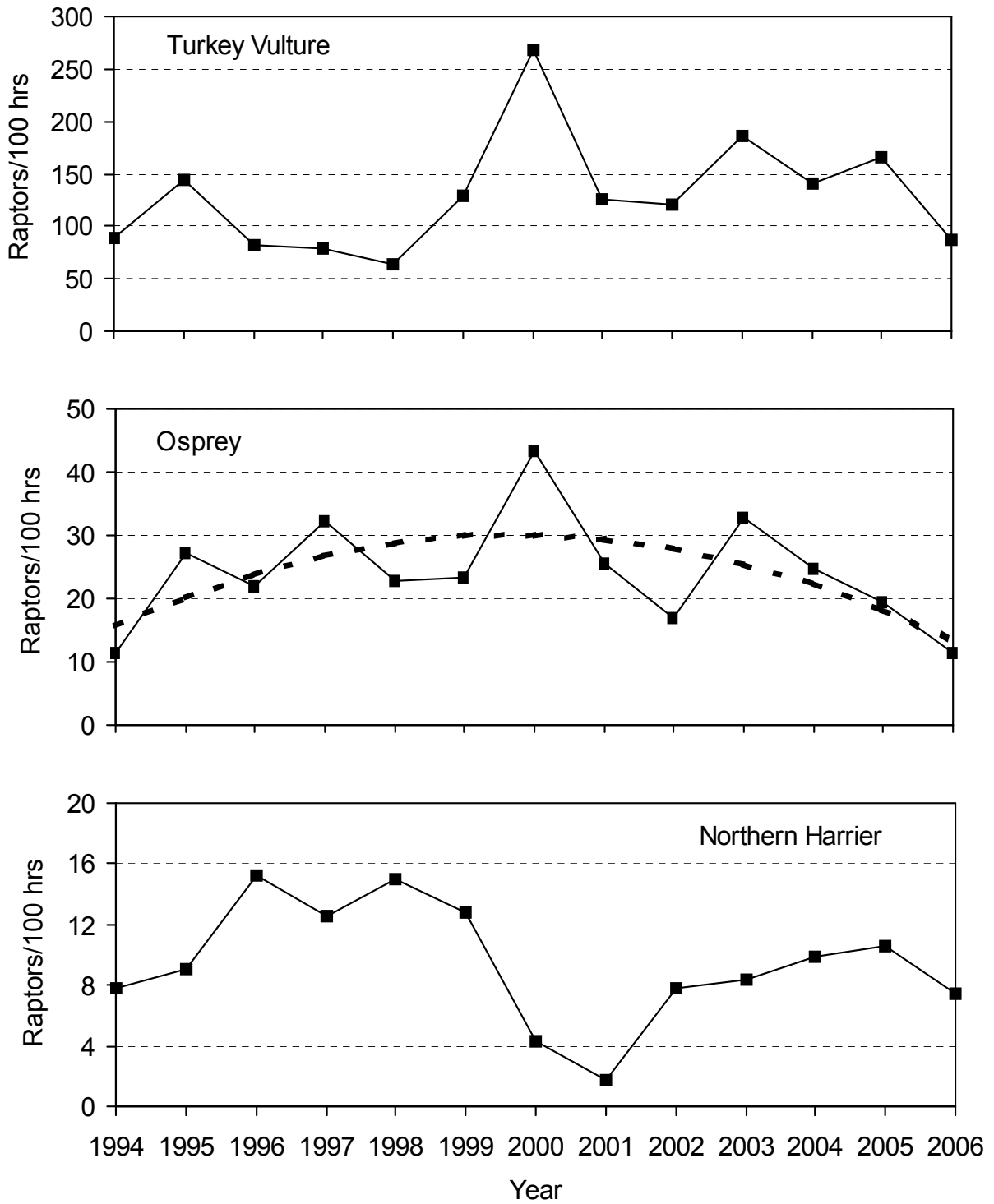


Figure 3. Adjusted, fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Bonney Butte, Oregon: 1994–2006. Dashed lines indicate significant ($P < 0.10$) regressions.

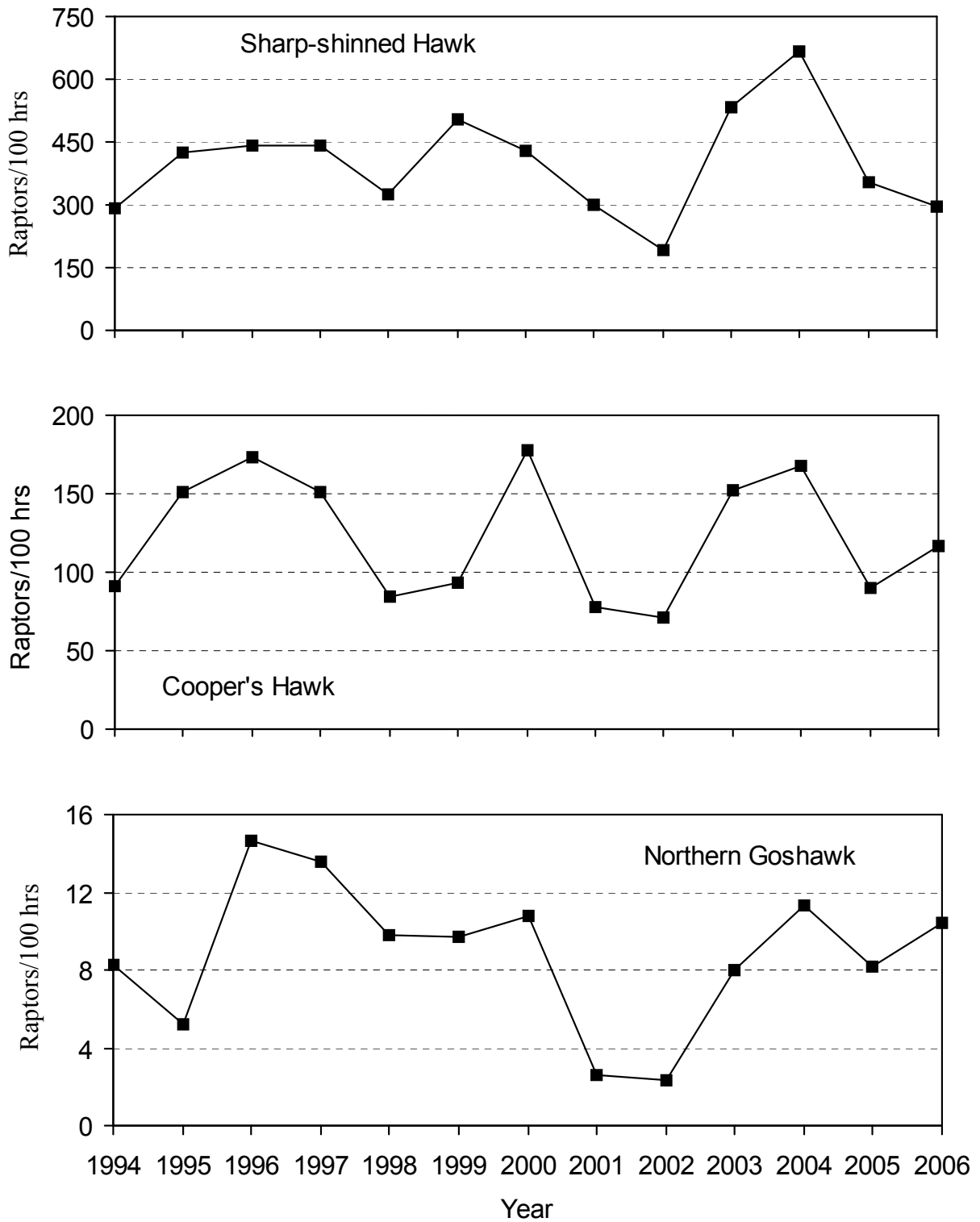


Figure 4. Adjusted, fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks at Bonney Butte, Oregon: 1994–2006. Dashed lines indicate significant ($P < 0.10$) regressions.

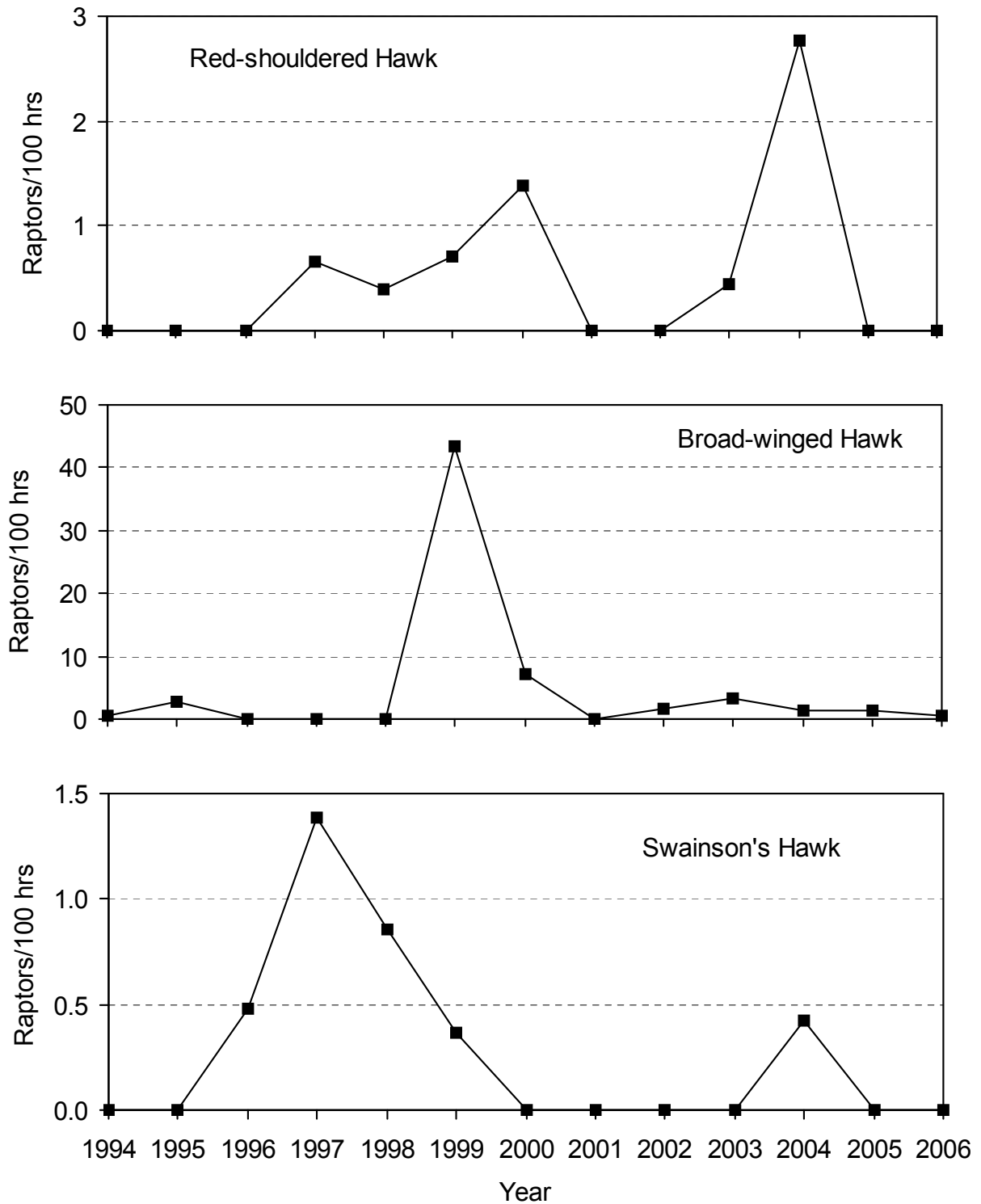


Figure 5. Adjusted, fall-migration passage rates for Red-shouldered, Broad-winged, and Swainson's Hawks at Bonney Butte, Oregon: 1994–2006. Dashed lines indicate significant ($P < 0.10$) regressions.

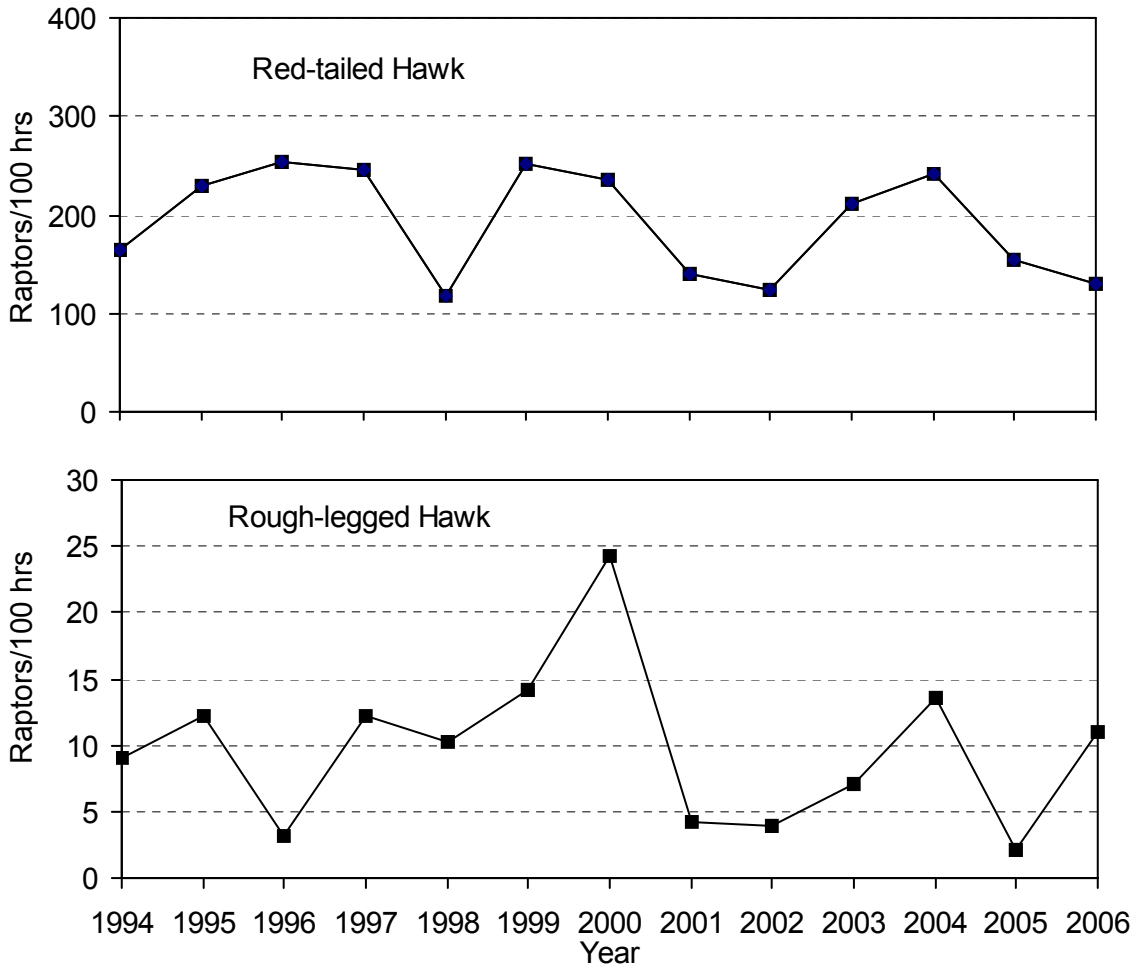


Figure 6. Adjusted, fall-migration passage rates for Red-tailed and Rough-legged Hawks at Bonney Butte, Oregon: 1994–2006. Dashed lines indicate significant ($P < 0.10$) regressions.

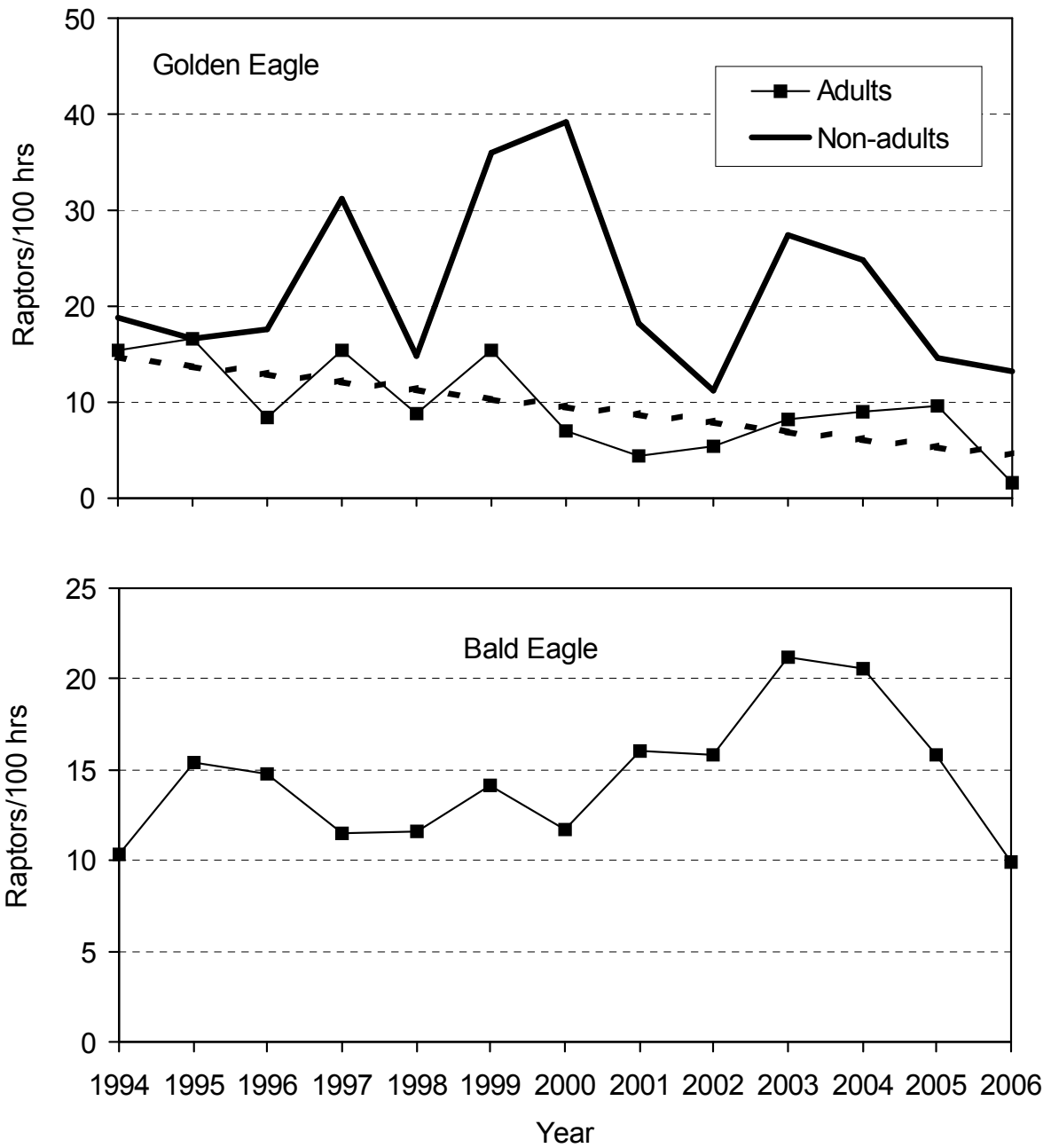


Figure 7. Adjusted, fall-migration passage rates for Golden and Bald Eagles at Bonney Butte, Oregon: 1994–2006. Dashed lines indicate significant ($P < 0.10$) regressions.

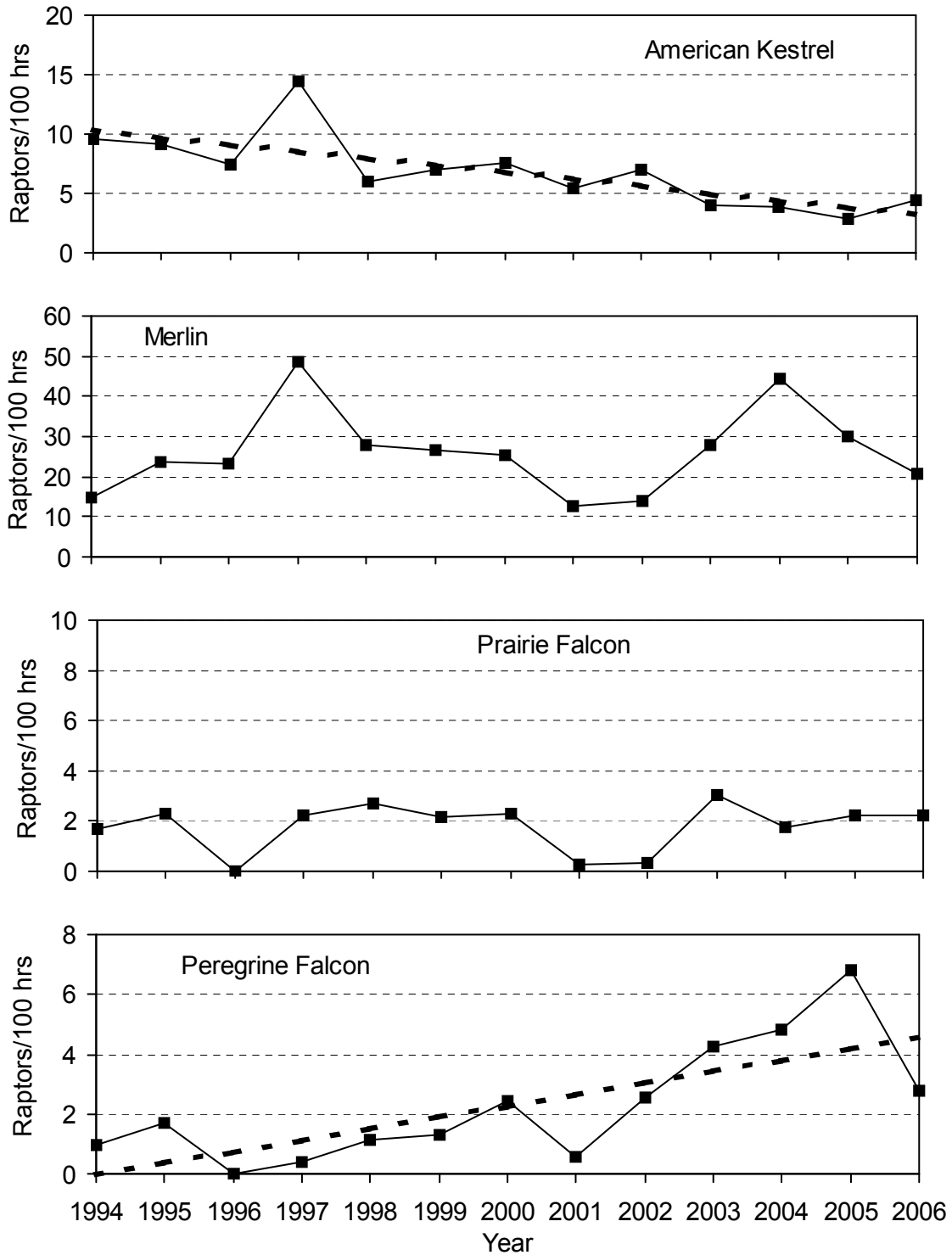


Figure 8. Adjusted, fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, Peregrine Falcons at Bonney Butte, Oregon: 1994–2006. Dashed lines indicate significant ($P < 0.10$) regressions.

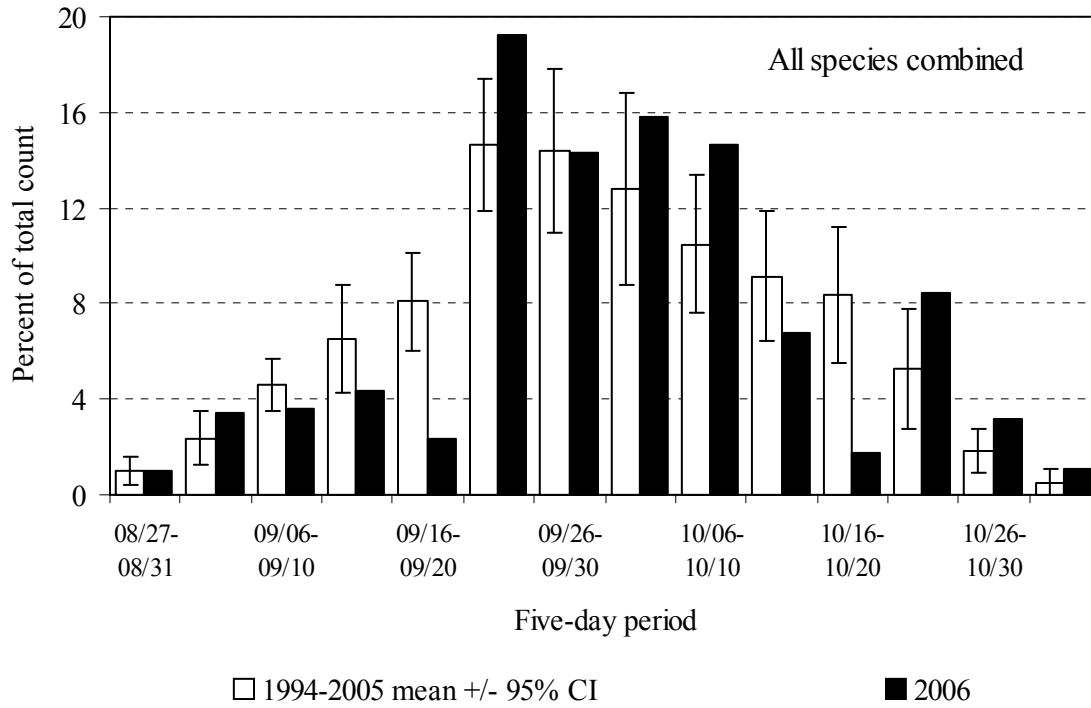


Figure 9. Combined-species passage volume by five-day periods for migrating raptors at Bonney Butte, Oregon: 1994–2005 versus 2006.

Appendix A. A history of observer participation in the Bonney Butte Raptor Migration Project in northern Oregon.

- 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).
- 2002:** Two observers throughout: Eric Hallingstad (1) and Sue Bruner (1).
- 2003:** Two observers throughout: David Haines (0) and Lindsay Reynolds (0).
- 2004:** Two observers throughout: David Haines (1) and Amy Scarpignato (1 partial).
- 2005:** Two observers throughout: Sean Wolfe (0), Jim DeStaebler (0), and James Cederstrom (0)
- 2006:** Two observers throughout: Justin Feld (0), Juliet Lamb (0), Jakob Roy (0), and assisted by Amanda Gladics (+).

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, Oregon.

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 in northern Oregon: 2006.

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN	PREDOMINANT WEATHER ³	WIND	WIND DIRECTION	TEMP (°C) ¹	BAROM.	MEDIAN	VISIB.	VISIB.	MEDIAN	BIRDS / HOUR
			VISITOR DISTURB ²		SPEED (KPH) ¹			PRESS. (IN HG) ¹	THERMAL LIFT ⁴	WEST (KM) ¹	EAST (KM) ¹	FLIGHT DISTANCE ⁵	
28-Aug	9.00	2.4	0	clr/haze	6.3	ws	30.4	31.00	2	70	88	3	9.00
29-Aug	4.75	2.0	0	ovc	11.8	wnw	12.2	31.15	4	44	6	1	4.75
30-Aug	0.00			weather day									0.00
31-Aug	9.00	2.0	0	clr	4.7	e	15.8	31.40	3	95	98	2	9.00
1-Sep	9.00	2.3	0	clr/haze	20.6	e	17.5	31.51	3	71	70	2	9.00
2-Sep	9.00	2.8	0	clr/haze	6.5	e	25.1	31.30	1	70	76	2	9.00
3-Sep	9.00	3.0	0	clr/haze	4.8	n, e	26.4	31.25	1	50	46	3	9.00
4-Sep	9.00	2.9	1	clr/haze	6.0	n, w	25.3	31.34	1	50	65	2	9.00
5-Sep	9.00	2.0	0	clr/haze	3.0	n, wsw	28.0	31.51	1	78	66	3	9.00
6-Sep	9.00	2.0	0	clr/haze	10.8	n, w	21.9	31.47	2	100	83	1	9.00
7-Sep	9.00	2.0	0	clr	4.8	n, wsw	22.6	31.28	1	100	100	1	9.00
8-Sep	9.00	1.9	0	clr-pc/haze	10.6	ws	18.9	30.97	2	100	90	2	9.00
9-Sep	6.50	2.1	0	pc-ovc	13.4	wnw	13.8	31.21	2	100	86	2	6.50
10-Sep	9.00	2.7	0	clr	2.9	var	20.9	31.37	1	100	100	2	9.00
11-Sep	9.00	1.9	0	pc	2.5	var	24.8	31.46	1	100	100	3	9.00
12-Sep	9.00	2.7	0	clr	7.4	w	22.0	30.40	3	100	100	2	9.00
13-Sep	9.00	2.0	0	clr-ovc, AM haze	7.4	ws	13.2	30.19	4	96	90	2	9.00
14-Sep	0.00			weather day									0.00
15-Sep	1.25	5.0	0	ovc, snow	3.3	ws	13.0	29.86	4	30	27	-	1.25
16-Sep	5.50	2.3	0	ovc, PM fog	6.3	w	8.3	30.31	4	92	42	2	5.50
17-Sep	9.00	3.0	0	clr-mc	1.0	n, w	14.7	30.35	2	100	100	2	9.00
18-Sep	2.00	2.5	0	ovc, rain	8.6	sw	12.0	30.16	4	60	40	1	2.00
19-Sep	0.67	1.0	0	pc-ovc	7.0	w	9.0	30.17	4	67	8	1	0.67
20-Sep	5.75	2.5	3.5	ovc/scat rain	8.3	w	7.3	30.22	4	21	8	1	5.75
21-Sep	0.00			weather day									0.00
22-Sep	9.00	2.3	1	clr	1.0	nne	9.9	30.38	1	100	100	2	9.00
23-Sep	9.00	3.8	1	clr	4.8	n-e	13.1	30.44	2	100	100	2	9.00
24-Sep	9.00	4.9	1	clr	6.5	n-e	14.8	30.42	2	100	100	3	9.00
25-Sep	9.00	3.7	1	clr	3.6	n, ese	20.9	30.41	1	100	100	3	9.00
26-Sep	9.00	2.0	0	clr-pc	2.7	n, w	20.7	30.42	2	100	100	1	9.00
27-Sep	9.00	2.5	0	clr, AM haze	3.2	ene, w	21.8	30.48	2	95	95	2	9.00
28-Sep	9.00	2.0	0	clr/haze	4.4	n, w	20.4	30.41	2	65	83	3	9.00
29-Sep	9.00	3.3	1	clr/haze	7.0	w	20.0	30.30	3	94	87	3	9.00
30-Sep	9.00	3.7	0	pc, AM haze	8.8	w	15.1	30.16	4	99	92	3	9.00
1-Oct	9.00	2.9	1	pc-mc	7.3	w	11.3	30.11	3	95	100	3	9.00
2-Oct	9.00	3.2	0	pc-mc	7.9	ws	11.5	30.17	3	100	92	3	9.00
3-Oct	9.00	2.1	0	ovc, rain/snow	1.0	e, n	10.4	30.22	4	96	85	1	9.00
4-Oct	7.25	3.6	1.5	ovc, scat snow	10.7	ene	7.7	30.16	4	16	49	2	7.25
5-Oct	9.00	2.2	0	clr-pc	2.8	n, sw	14.1	30.13	4	84	100	2	9.00

Appendix C. continued

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN	PREDOMINANT WEATHER ³	WIND	TEMP (°C) ¹	BAROM. PRESS. (IN HG) ¹	MEDIAN	VISIB. WEST (KM) ¹	VISIB. EAST (KM) ¹	MEDIAN	BIRDS / HOUR	
			VISITOR DISTURB ²		SPEED (KPH) ¹			WIND DIRECTION			THERMAL LIFT ⁴		FLIGHT DISTANCE ⁵
6-Oct	7.50	3.0	0	mc-ovc	5.8	wnw	7.3	30.17	4	59	59	2	7.50
7-Oct	9.00	2.7	2	pc-ovc, AM rain	3.5	n, w	8.4	30.36	3	91	50	3	9.00
8-Oct	4.50	3.0	0	ovc, rain/snow	5.0	wsw	8.9	30.44	4	29	1	1	4.50
9-Oct	9.00	2.0	0	clr	8.6	ne	6.4	30.42	4	80	100	2	9.00
10-Oct	9.00	2.6	0	clr	4.8	ne, nnw	11.2	30.35	3	100	97	2	9.00
11-Oct	9.00	2.7	0	clr	3.7	nne	16.5	30.34	2	100	100	2	9.00
12-Oct	9.00	3.0	0	clr	2.9	n, e, sw	18.6	30.20	3	98	100	2	9.00
13-Oct	9.00	2.8	0	clr/haze	6.7	n, wsw	16.5	30.05	2	90	99	2	9.00
14-Oct	9.00	2.9	0	pc-ovc	3.8	n, wsw	14.3	30.03	4	86	98	2	9.00
15-Oct	0.00			weather day									0.00
16-Oct	0.00			weather day									0.00
17-Oct	8.00	2.5	0	ovc, rain	0.3	n, w	7.5	30.23	4	47	1	1	8.00
18-Oct	7.50	2.7	0	ovc, rain/snow	7.3	wsw	4.5	30.31	4	42	26	2	7.50
19-Oct	0.00			weather day									0.00
20-Oct	8.50	2.3	1	clr	5.5	n, ese	6.6	30.34	4	100	68	2	8.50
21-Oct	9.00	2.6	0	clr-pc	17.1	e	6.0	30.34	4	98	100	2	9.00
22-Oct	9.00	3.5	0	clr	8.0	ese, w	12.3	30.25	3	96	100	2	9.00
23-Oct	9.00	3.4	0	clr	2.0	n, w	10.5	30.27	3	63	95	3	9.00
24-Oct	0.00			fog/snow									0.00
25-Oct	3.25	2.4	0	pc-ovc, scat rain	15.7	w	1.3	30.41	4	65	28	-	3.25
26-Oct	9.00	2.0	0	mc-ovc	8.8	sw	6.2	30.48	4	100	100	2	9.00
27-Oct	9.00	2.7	0	clr/haze	8.0	w	10.5	30.55	4	85	100	2	9.00
28-Oct	9.00	3.5	0	clr	9.7	w	13.0	30.32	4	85	100	3	9.00
29-Oct	0.00			fog/snow									0.00
30-Oct	9.00	2.4	0	clr-ovc	6.7	ne	-3.8	30.15	4	91	75	2	9.00
31-Oct	9.00	2.4	0	clr	11.9	e	-2.5		4	97	100	2	9.00

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, Oregon: 2006.

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	0.00																														
28-Aug	9.00	0	0	2	2	0	0	0	0	2	0	0	0	3	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	13	1.4
29-Aug	4.75	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2	
30-Aug	0.00																														
31-Aug	9.00	1	0	1	4	2	0	0	0	1	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	13	1.4	
1-Sep	9.00	2	0	0	6	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1.4	
2-Sep	9.00	7	2	0	9	4	0	0	0	2	0	0	0	8	0	0	2	0	0	0	0	0	0	0	0	0	0	1	35	3.9	
3-Sep	9.00	1	0	0	5	4	0	1	0	0	0	0	0	1	0	0	3	0	0	0	1	0	0	0	0	0	0	16	1.8		
4-Sep	9.00	1	0	0	6	4	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	15	1.7		
5-Sep	9.00	7	0	0	1	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	12	1.3		
6-Sep	9.00	1	0	0	3	3	0	0	0	0	0	0	0	5	0	0	2	0	0	0	0	0	0	0	0	0	0	14	1.6		
7-Sep	9.00	4	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0	1	10	1.1		
8-Sep	9.00	0	0	0	2	0	0	0	0	1	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	8	0.9		
9-Sep	6.50	1	0	0	2	0	0	0	0	2	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1.5		
10-Sep	9.00	5	2	1	32	0	0	0	0	1	0	0	0	11	0	0	0	0	0	0	0	0	0	1	0	0	0	53	5.9		
11-Sep	9.00	7	1	1	21	9	0	2	1	5	0	0	0	15	0	0	0	0	0	0	2	0	1	0	0	0	0	65	7.2		
12-Sep	9.00	8	1	0	7	5	0	0	0	0	0	0	0	10	0	0	0	0	0	0	1	0	0	1	0	0	0	33	3.7		
13-Sep	9.00	1	2	0	5	0	1	0	0	0	0	0	0	7	0	0	0	0	0	0	0	1	0	0	0	0	1	18	2.0		
14-Sep	0.00																														
15-Sep	1.25	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	
16-Sep	5.50	2	1	0	4	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	11	2.0		
17-Sep	9.00	2	2	1	20	2	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	1	37	4.1		
18-Sep	2.00	0	0	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6	3.0		
19-Sep	0.67	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	1	1.5		
20-Sep	5.75	0	0	0	2	1	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.4		
21-Sep	0.00																														
22-Sep	9.00	31	1	1	10	10	1	0	0	1	0	0	0	9	0	1	1	0	0	0	2	0	0	1	0	0	0	69	7.7		
23-Sep	9.00	18	4	1	17	16	1	0	1	3	0	0	0	23	0	0	0	0	1	0	1	3	0	0	0	0	3	92	10.2		
24-Sep	9.00	20	3	3	48	38	0	0	0	9	0	0	0	38	0	0	5	1	5	0	3	3	0	2	0	0	1	180	20.0		
25-Sep	9.00	16	1	3	74	36	0	0	0	6	0	0	0	26	0	0	3	1	0	0	1	2	1	0	0	0	0	170	18.9		
26-Sep	9.00	1	0	1	22	1	1	1	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	30	3.3		
27-Sep	9.00	2	0	0	17	11	1	0	0	1	0	0	0	9	0	0	0	0	0	0	1	1	0	0	0	0	0	43	4.8		
28-Sep	9.00	8	0	1	11	16	1	0	0	1	0	0	0	10	0	0	0	0	0	0	2	0	0	0	0	0	0	50	5.6		
29-Sep	9.00	20	5	1	65	18	2	0	0	6	0	0	0	20	0	0	3	0	0	0	0	8	2	0	0	0	0	150	16.7		
30-Sep	9.00	10	2	0	45	23	0	0	0	2	0	0	0	21	0	0	0	0	2	0	1	0	0	0	1	0	1	108	12.0		
1-Oct	9.00	9	0	0	26	13	3	0	0	1	0	0	0	15	0	0	1	0	3	0	0	0	1	0	0	0	0	72	8.0		
2-Oct	9.00	13	7	1	64	35	3	0	0	5	0	1	0	36	0	0	0	7	6	0	0	7	0	1	0	0	2	188	20.9		
3-Oct	9.00	0	0	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.7		

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
4-Oct	7.25	0	0	0	6	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	10	1.4
5-Oct	9.00	28	1	0	56	32	1	0	0	0	0	0	0	17	0	0	0	5	2	0	0	3	0	0	0	0	0	145	16.1	
6-Oct	7.50	3	0	1	27	15	1	0	0	0	0	0	0	19	0	0	0	2	9	0	0	0	0	0	0	0	0	77	10.3	
7-Oct	9.00	1	1	3	64	37	2	0	0	5	0	0	0	24	0	0	2	7	2	1	0	2	0	0	0	0	0	151	16.8	
8-Oct	4.50	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.4	
9-Oct	9.00	0	0	3	46	9	0	3	0	0	0	0	0	7	0	0	1	4	0	0	0	0	0	1	0	0	1	75	8.3	
10-Oct	9.00	0	0	1	48	17	1	0	0	1	0	0	0	6	0	0	0	0	2	0	1	4	1	1	0	0	0	83	9.2	
11-Oct	9.00	0	0	0	24	11	4	0	0	0	0	0	0	4	0	2	0	1	1	0	0	1	0	0	0	0	0	48	5.3	
12-Oct	9.00	0	0	0	36	10	1	0	0	1	0	0	0	6	0	0	0	1	0	0	0	5	0	0	0	0	0	60	6.7	
13-Oct	9.00	0	0	1	11	10	2	0	0	0	0	0	0	8	0	0	0	1	0	0	0	5	1	0	0	0	0	39	4.3	
14-Oct	9.00	0	0	0	16	3	0	0	0	1	0	0	0	6	0	0	0	3	1	0	0	1	0	1	0	0	0	32	3.6	
15-Oct	0.00																													
16-Oct	0.00																													
17-Oct	8.00	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	6	0.8	
18-Oct	7.50	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1	
19-Oct	0.00																													
20-Oct	8.50	0	0	2	12	4	1	0	0	0	0	0	0	13	0	5	0	1	0	0	0	2	0	0	0	0	0	40	4.7	
21-Oct	9.00	0	0	0	11	2	1	0	0	0	0	0	0	11	0	3	1	5	1	0	0	4	0	0	0	0	0	39	4.3	
22-Oct	9.00	0	1	0	71	5	5	0	0	0	0	0	0	25	0	6	0	5	1	0	1	4	0	0	0	0	1	125	13.9	
23-Oct	9.00	0	0	1	20	5	2	0	0	0	0	0	0	22	0	2	0	3	1	0	0	3	0	0	0	0	1	60	6.7	
24-Oct	0.00																													
25-Oct	3.25	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	
26-Oct	9.00	0	0	1	5	0	1	0	0	0	0	0	0	11	0	0	0	1	1	0	0	1	0	0	0	0	1	22	2.4	
27-Oct	9.00	0	0	0	6	0	2	0	0	0	0	0	0	12	0	0	0	1	0	0	0	1	0	0	0	0	0	22	2.4	
28-Oct	9.00	0	0	0	6	1	1	0	0	0	0	0	0	10	0	3	0	3	1	0	0	2	0	0	0	0	1	28	3.1	
29-Oct	0.00																													
30-Oct	9.00	2	1	1	1	1	0	0	0	0	0	0	0	4	0	1	1	0	0	0	0	1	0	0	0	0	0	13	1.4	
31-Oct	9.00	0	0	0	4	0	0	0	0	0	0	0	0	12	0	4	0	2	5	0	0	1	0	0	0	0	0	28	3.1	
Total	459.92	232	38	33	1015	418	40	7	2	60	0	1	0	531	0	27	30	56	44	1	17	69	7	10	0	1	1	16	2656	5.8

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, Oregon: 1994–2006.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	MEAN
Start date	2-Sep	4-Sep	1-Sep	1-Sep	1-Sep	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	28-Aug	28-Aug
End date	25-Oct	31-Oct	2-Nov	3-Nov	30-Oct	28-Oct	30-Oct	28-Oct	31-Oct	31-Oct	29-Oct	27-Oct	31-Oct	28-Oct
Observation days	47	38	46	45	52	63	48	58	59	51	46	49	57	50
Observation hours	327.74	251.51	285.82	286.25	384.91	416.00	328.50	415.75	423.67	402.65	341.25	392.92	459.92	362.74
Raptors / 100 hours	688.4	939.9	959.7	953.7	631.8	993.5	1029.5	601.1	453.7	948.0	1119.7	699.6	577.5	815.33
SPECIES	RAPTOR COUNT													
Turkey Vulture	204	235	165	133	160	349	553	338	286	488	326	389	232	297
Osprey	32	49	55	60	67	74	107	78	50	97	70	60	38	64
Northern Harrier	25	22	39	30	56	49	13	7	27	28	29	38	33	30
Sharp-shinned Hawk	857	871	1027	912	1018	1660	1105	957	600	1578	1790	1067	1015	1112
Cooper's Hawk	282	310	420	317	266	331	456	256	233	473	485	269	418	347
Northern Goshawk	25	12	40	34	33	36	31	10	8	29	33	24	40	27
Unknown small accipiter ¹	–	–	–	–	–	–	–	84	11	33	27	14	7	15
Unknown large accipiter ¹	–	–	–	–	–	–	–	0	1	1	2	13	2	3
Unknown accipiter	27	67	85	156	99	155	98	0	21	1	0	46	60	69
TOTAL ACCIPITERS	1191	1260	1572	1419	1416	2182	1690	1307	874	2115	2337	1433	1542	1565
Red-shouldered Hawk	0	0	0	1	1	2	3	0	0	1	7	0	0	1
Broad-winged Hawk	1	3	1	0	0	75	10	0	1	6	2	2	1	8
Swainson's Hawk	0	0	1	2	2	1	0	0	0	0	1	0	0	1
Red-tailed Hawk	516	528	649	626	411	932	680	513	425	744	725	562	531	603
Ferruginous Hawk	1	0	0	1	1	1	1	0	0	0	0	1	0	<1
Rough-legged Hawk	12	11	4	20	15	21	30	7	6	10	17	3	27	14
Unidentified buteo	23	30	40	52	30	58	26	29	48	18	9	4	30	31
TOTAL BUTEOS	553	572	695	702	460	1090	750	549	480	779	761	572	589	658
Golden Eagle	96	81	65	106	81	176	132	75	56	108	93	72	56	92
Bald Eagle	33	40	42	33	40	53	37	52	55	68	61	55	44	47
Unidentified eagle	3	2	1	9	4	2	0	6	7	0	2	1	1	3
TOTAL EAGLES	132	123	108	148	125	231	169	133	118	176	156	128	101	142
American Kestrel	29	18	18	35	22	30	21	23	21	19	14	9	17	21
Merlin	36	49	46	104	78	83	65	33	38	84	105	80	69	67
Prairie Falcon	5	4	0	5	10	8	6	1	1	8	5	3	7	5
Peregrine Falcon	3	4	0	1	4	5	8	3	9	14	14	14	10	7
Unknown small falcon ¹	–	–	–	–	–	–	–	0	1	0	1	2	0	1
Unknown large falcon ¹	–	–	–	–	–	–	–	0	0	0	0	10	1	2
Unknown falcon	8	3	2	3	4	0	0	7	2	2	0	6	1	3
TOTAL FALCONS	81	78	66	148	118	126	100	67	72	127	139	124	105	104
Unidentified raptor	38	25	43	90	30	32	0	20	15	7	3	5	16	25
GRAND TOTAL	2256	2364	2743	2730	2432	4133	3382	2499	1922	3817	3821	2749	2656	2885

¹ Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Bonney Butte, Oregon: 2006.

DATE	STATION		SPECIES ¹												TOTAL	CAPTURES/HR	
	HOURS		NH	SS	CH	NG	BW	RT	RL	GE	BE	AK	ML	PR			PG
27-Aug	7.75		0	2	1	0	0	2	0	0	0	0	0	0	0	5	0.6
28-Aug	8.00		0	2	1	0	0	4	0	0	0	0	0	0	0	7	0.9
29-Aug	4.50		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31-Aug	7.00		0	3	6	0	0	2	0	0	0	0	0	0	0	11	1.6
01-Sep	7.75		0	5	1	0	0	3	0	0	0	0	0	0	0	9	1.2
02-Sep	8.00		0	7	1	0	0	1	0	0	0	0	0	0	0	9	1.1
03-Sep	8.00		0	4	4	0	0	0	0	0	0	0	0	0	0	8	1.0
04-Sep	8.00		0	5	2	0	0	2	0	0	0	0	0	0	0	9	1.1
05-Sep	8.00		0	2	1	0	0	3	0	0	0	0	0	0	0	6	0.8
06-Sep	7.75		0	2	5	0	0	2	0	0	0	0	0	0	0	9	1.2
07-Sep	8.00		0	0	1	0	0	5	0	0	0	0	0	0	0	6	0.8
08-Sep	7.75		0	0	0	0	0	2	0	1	0	0	0	0	0	3	0.4
09-Sep	5.50		0	3	1	0	0	3	0	0	0	0	0	0	0	7	1.3
10-Sep	8.00		0	21	4	0	0	2	0	0	0	0	0	0	1	28	3.5
11-Sep	8.00		0	15	5	0	0	7	0	0	0	0	0	1	0	28	3.5
12-Sep	7.75		0	9	0	0	0	4	0	0	0	1	0	0	0	14	1.8
13-Sep	7.50		0	1	0	1	0	5	0	0	0	0	1	0	0	8	1.1
16-Sep	2.00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
17-Sep	7.50		0	11	2	0	0	1	0	0	0	0	0	0	0	14	1.9
22-Sep	8.00		0	1	3	0	0	7	0	0	0	0	0	0	0	11	1.4
23-Sep	8.25		0	2	4	1	0	3	0	0	0	0	1	0	0	11	1.3
24-Sep	8.00		1	2	7	0	0	3	0	0	0	0	1	0	0	14	1.8
25-Sep	8.00		0	17	6	0	0	0	0	0	0	0	0	1	0	24	3.0
26-Sep	8.00		0	4	3	0	0	0	0	0	0	0	0	0	0	7	0.9
27-Sep	8.00		0	5	4	1	0	5	0	0	0	0	1	0	0	16	2.0
28-Sep	8.00		0	8	2	0	0	2	0	0	0	0	1	0	0	13	1.6
29-Sep	8.00		0	20	3	0	0	4	0	0	0	0	0	1	0	28	3.5
30-Sep	8.00		0	9	1	1	0	3	0	0	0	0	0	0	0	14	1.8
01-Oct	7.75		0	8	4	0	0	1	0	1	0	0	0	0	0	14	1.8
02-Oct	8.00		0	7	3	0	0	3	0	1	0	0	0	0	0	14	1.8
03-Oct	5.00		0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.2
04-Oct	3.75		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
05-Oct	7.50		1	13	3	0	0	3	0	0	0	0	1	0	0	21	2.8

Appendix F. continued

DATE	STATION		SPECIES ¹												TOTAL	CAPTURES/HR
	HOURS	NH	SS	CH	NG	BW	RT	RL	GE	BE	AK	ML	PR	PG		
06-Oct	5.00	0	4	3	0	0	2	0	0	0	0	0	0	0	9	1.8
07-Oct	8.00	0	27	3	0	0	6	0	0	0	0	1	1	0	38	4.8
09-Oct	7.50	0	0	0	0	0	3	0	1	0	0	0	0	0	4	0.5
10-Oct	8.00	0	2	0	1	0	2	0	0	0	0	0	0	0	5	0.6
11-Oct	7.50	0	9	1	1	0	0	0	0	0	0	0	0	0	11	1.5
12-Oct	7.75	0	11	1	1	0	0	0	1	0	0	0	0	0	14	1.8
13-Oct	8.00	0	5	0	1	0	1	0	0	0	0	2	0	0	9	1.1
14-Oct	7.75	0	4	2	0	0	0	0	0	0	0	0	0	0	6	0.8
18-Oct	4.50	0	1	0	0	0	1	0	0	0	0	1	0	0	3	0.7
20-Oct	6.50	0	1	0	0	0	1	0	0	0	0	1	0	0	3	0.5
21-Oct	7.75	0	1	0	0	0	1	1	0	0	0	0	0	0	3	0.4
22-Oct	7.75	0	4	0	1	0	0	0	0	0	1	0	0	0	6	0.8
23-Oct	8.00	0	1	0	0	0	0	0	1	0	0	1	0	0	3	0.4
26-Oct	5.25	0	0	0	0	0	3	0	0	0	0	0	0	0	3	0.6
27-Oct	7.00	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0.1
28-Oct	7.00	0	0	0	2	0	3	0	0	0	0	0	0	0	5	0.7
Total	354.25	2	259	88	11	0	106	1	6	0	2	12	4	1	492	64.3

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, Oregon: 1995–2006.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	MEAN	TOTAL
First trapping day	7-Oct	18-Sep	31-Aug	6-Sep	5-Sep	28-Aug	25-Aug	27-Aug	26-Aug	27-Aug	27-Aug	27-Aug		
Last trapping day	28-Oct	10-Oct	1-Nov	30-Oct	24-Oct	24-Oct	28-Oct	27-Oct	27-Oct	15-Oct	27-Oct	28-Oct		
Number of stations	1	1	1	1	1	1	1	1	1	1	1	1	1	
Trapping days	10	21	39	34	22	58	50	55	47	36	48	49	39	
Trapping hours	44.50	127.20	202.80	199.95	142.75	239.75	320.50	357.75	345.35	263.00	342.25	354.25	245.00	
Captures / 10 hours	4.9	10.0	11.0	12.8	10.0	13.0	10.3	10.4	12.5	14.9	15.2	13.9	11.6	
SPECIES	NUMBER OF CAPTURES													
Northern Harrier	0	1	0	2	1	1	0	6	4	2	7	2	2.2	26
Sharp-shinned Hawk	18	80	139	163	82	161	171	172	268	218	309	259	170	2040
Cooper's Hawk	0	20	29	43	14	67	74	71	64	90	101	88	55	661
Northern Goshawk	1	7	7	3	3	8	11	7	12	13	12	10	8	94
Broad-winged Hawk	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Red-tailed Hawk	2	14	39	29	36	66	66	108	73	61	67	106	56	667
Rough-legged Hawk	0	0	1	0	1	0	1	0	0	0	1	1	0.4	5
Golden Eagle	0	3	2	1	2	3	2	0	2	1	3	6	2	25
Bald Eagle	0	0	0	0	0	0	0	0	0	0	1	0	0	1
American Kestrel	0	0	0	0	1	0	1	0	0	0	0	2	0	4
Merlin	1	2	5	11	3	1	4	5	4	4	13	12	5	65
Prairie Falcon	0	0	1	4	0	1	0	1	3	4	3	4	2	21
Peregrine Falcon	0	0	0	0	0	2	0	1	0	0	4	1	1	8
All species	22	127	223	256	143	311	330	371	430	393	521	491	302	3618
Recaptures ¹	0	0	0	0	0	0	0	0	0	2	1	1	0.3	4
Foreign Recaptures ²	0	0	1	2	0	0	1	0	2	2	3	1	1.0	12
Foreign Encounters ³	1	0	1	2	6	3	2	5	8	2	9	6	4.0	48

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.