

**FALL 2007 RAPTOR MIGRATION STUDIES AT
BONNEY BUTTE, OREGON**



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



February 2008

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Report prepared by:

Jeff P. Smith and Mike C. Neal

Counts conducted by:

Sue Bruner, Mary Coolidge, and Justin Roberge

Banding conducted by:

Dan Sherman, James Cederstrom, and Rick Gerhardt

On-site education by:

Justin Roberge

Project Coordinated by:

HawkWatch International

Principal Investigator: Dr. Jeff P. Smith

2240 South 900 East, Salt Lake City, UT 84106

(801) 484-6808

February 2008

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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, Smith et al. in press). 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 2007 season marked the 14th consecutive count and the 13th consecutive season of trapping and banding conducted at the site by HWI. This report summarizes the 2007 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). Official observer Sue Brunner had two full seasons of prior raptor migration counting experience with HWI, including one previous season at Bonney Butte. Official observer Mary Coolidge had one season of prior raptor migration counting experience (see Appendix A for a complete observer history). As is typical for the site, on-site educator Justin Roberge frequently assisted with the count; this was his first season of exposure to raptor migration counting. All three crew members attended preseason protocol and field training. Other visitors also periodically assisted with the count.

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 including 2007 data follows Hoffman and Smith (2003). In comparing 2007 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2007 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 15 full days of potential observations in 2007, and substantially reduced observation time to ≤ 4 hrs on five other days between the targeted operation dates of 27 August and 31 October (see Appendix C for daily weather records). The number of fully precluded days was slightly above the 1997–2006 (the period for which detailed summary data have been compiled) average of 13.4 days, whereas the number of otherwise severely hampered days was slightly below the long-term average of 5.6 days.

Fog and low clouds that hovered on the ridge and obscured visibility were prevalent in 2007, but most of the lost observations days occurred during two protracted rain/snow events, one in late September / early October, and the other around the third week of October. The late-September event kept the crew away for a full week and the late October event for five days, in both cases due to combinations of low hanging clouds, rain, snow, and difficult access conditions. Similar to last year, though, the weather did allow for the season to continue through the projected end date of 31 October.

Weather data collected on site during active observation periods reflected above average prevalence of days featuring predominantly fair skies (57% vs. 1997–2006 average of 48%), below average prevalence of days featuring predominantly transitional skies (14% vs. average of 22%; defined as days that changed from fair or partly cloudy to mostly cloudy or overcast skies during the day, or vice versa), and average prevalence of days where mostly cloudy to overcast skies prevailed (29%). The proportion of active days that featured noteworthy levels of visibility reducing fog and/or haze (67%) was slightly above average (64%), whereas the proportion of active observation days that featured some rain or snow (10%) was slightly below average (13%). The daily-average temperature (average of hourly values for each day) during active observation periods averaged of 13.8°C, ranging from 1.3–26.6°C. The annual average was slightly above the 1997–2006 grand average of 13.4°C, and the minimum and maximum daily values fell well within the normal ranges of variation. 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.

Days where moderate winds (12–29 kph) prevailed were more prevalent than usual in 2007 (20% of active days vs. 1997–2006 average 13%), whereas days featuring predominantly light (<12 kph) or strong winds (>29 kph) were both at least slightly less prevalent than average (80% and 0% vs. averages of 86% and 1%). In terms of wind directions, 2007 was similar to the average pattern in that SW-W winds were most common (prevailing on 41% of the active observation days) and N-E (10%) and calm/variable (14%) winds were among the top four patterns in prevalence. The season differed from the average pattern in that SW-W and calm/variable winds were even more prevalent than usual (averages of 30% and 6% of days, respectively), whereas N-E winds were less common than usual (average 17% of days) and days classified as featuring variable SW-NW winds, which average second-highest in prevalence, were nearly absent (2% vs. 1997–2006 average of 19% of the active days).

In summary, compared to averages for the past 10 years, inclement weather severely restricted observations to a slightly above-average degree in 2007, but otherwise predominantly fair skies prevailed on a slightly above-average proportion of the active observation days, visibility reducing fog and haze were only slightly more prevalent than usual, and the temperature regime was typical for the site. A slight shift in favor of moderate as opposed to light winds occurred, and relatively steady SW-W winds prevailed more often than usual, while more variable SW-NW and N-E wind patterns were less common than usual.

COUNT SUMMARY

The observers worked on 51 of 66 possible days between 27 August and 31 October 2007. The number of observation days was a non-significant 1% above the 1994–2006 average of $50 \pm 95\%$ CI of 3.4 days; and the number of observation hours (397.00) was a non-significant 9% above the long-term average of $362.74 \pm 95\%$ CI of 34.62 hours. The 2007 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) was a marginally significant 10% above the long-term average of $2.3 \pm 95\%$ CI of 0.27 observers per hour.

The observers counted 2,269 migrant raptors of 16 species, with the count a significant 21% below the 1994–2006 average (Table 1, and see Appendix D for daily count records). Counts dropped to record lows for Red-tailed Hawks, Golden Eagles, and American Kestrels (see Appendix E for annual count summaries). The four lowest kestrel counts for the project have all occurred in the last four years. No record-high species-specific counts occurred in 2007.

The 2007 flight was composed of 56% accipiters, 19% buteos, 12% vultures, 4% eagles, 4% falcons, 2% Ospreys, 1% harriers and 1% unidentified raptors. The season featured significantly higher than average proportions of vultures and falcons, and significantly below average proportions of buteos, eagles, and harriers (Figure 2). As usual, the Sharp-shinned Hawk was by far the most abundant species, followed by Red-tailed Hawks, Turkey Vultures, Cooper's Hawks, Golden Eagles, Merlins, Ospreys, and Bald Eagles (Table 1, Appendix E).

Passage Rates and Long-term Trends

Adjusted passage rates were significantly above average in 2007 for only Red-shouldered Hawks and Prairie Falcons, whereas passage rates were significantly below average for nine commonly encountered species (Osprey, Northern Harrier, all three accipiters, Red-tailed and Rough-legged Hawks, Golden Eagle, and American Kestrel) plus uncommon Swainson's and Ferruginous Hawks (Table 1; Figures 3–8). Updated regression analyses (after Hoffman and Smith 2003) of adjusted passage rates through 2007 revealed a marginally significant ($0.05 < P \leq 0.10$) quadratic trend for Ospreys, tracking an increasing trend through 2000 and a declining pattern thereafter (Figure 3). Note, however, that the low passage rates recorded in 2006 and 2007 are at about the same level as was recorded in 1994. In contrast, at least marginally significant overall declines were indicated for Ferruginous Hawks, Golden Eagles (Figure 7),

and American Kestrels (Figures 8). Ferruginous Hawks are too uncommon at this site to place much faith in statistical trend analyses; nevertheless, the species was recorded only once in the past seven years, but five times during the previous seven years (Appendix E). The decline in Golden Eagle numbers is most pronounced among adult birds, for which the two lowest passage rates yet recorded occurred in 2006 and 2007, and passage rates recorded since 2000 have mostly been below those recorded before that (Figure 7). The Peregrine Falcon was the only other species for which a significant trend was indicated; overall this species is showing a strong long-term increase, but counts have dropped markedly in the last two years (Figure 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. A mixed bag occurred in 2007, with some passage rates dropping again and others rising slightly; however, no markedly higher than average species-specific passage rates occurred in 2007.

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 et al. 2002). 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 2008a), 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 2008b). 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. The counts at Boise Ridge and the Goshutes were well below average in 2006, however, while the count at Chelan Ridge in the northern Cascades recovered substantially compared to the past several years. In contrast, the 2007 Goshute count was the highest since 2001, ranked 3% above average, and finally appeared to signal a degree of recovery from the drought (Smith and Neal 2008a). Similarly, the 2007 count at Chelan Ridge in the Washington Cascades nearly matched the long-term average for that site (Smith and Neal 2008b), whereas both the 2006 and 2007 counts at Boise Ridge in Idaho ranked as the lowest since 1994/1995 (season summary available at <http://idahobirdobservatory.blogspot.com/2007/11/final-raptor-numbers-at-lucky-peak.html>). Accordingly, it appears that we may need a few more years of comparative data to clarify our understanding of these complex regional dynamics.

Smith et al. (in press) present trend analyses of data collected through 2005 for most of the long-term, on-going, autumn migration studies in western North America, including Bonney Butte for the first time. These analyses (hereafter called the Raptor Population Index or "RPI" analyses; see <http://www.rpi-project.org>) are based on a more sophisticated analytical approach (also see Farmer et al. 2007) than that represented in Hoffman and Smith (2003) and used herein to present analyses updated through 2007. Among other refinements, this new approach both fits polynomial trajectories to the complete series of annual count indices and allows for estimating rates of change between various periods, while also allowing for assessments of trend significance and precision. Note, however, that restrictions related to

the mathematical assumptions behind the new approach precluded analyzing data for rare species, which in this case included all buteos except Red-tailed Hawk, and Prairie and Peregrine Falcons. Otherwise, with a few notable exceptions, the overall patterns of change and derived trend estimates suggested by the new modeling technique generally yielded similar inferences as those derived using the simpler methodology of Hoffman and Smith (2003) and presented herein to provide trend assessments updated through 2007.

Differences between the RPI results and those presented herein that clearly relate to addition of two more years of data include: a) addition of two low counts in 2006 and 2007 eliminated a marginally significant increasing trend for Turkey Vultures shown in the RPI analyses; b) addition of two low counts in 2006 and 2007, which dropped abundance back down to levels not seen since 1994/1995, produced a significant quadratic regression for Ospreys in the 2007 analyses; and c) addition of two low counts in 2006 and 2007 resulted in a marginally significant decreasing trend for Golden Eagles in the 2007 analyses. Otherwise, for all remaining species analyzed in common, the RPI analyses of data through 2005 and the updated analyses of data through 2007 presented herein indicate the same conclusions; i.e., a highly significant ($P < 0.01$) decline for American Kestrels (averaging $7.9 \pm 95\%$ CI of 3.7% per year; Smith et al. in press) and no statistically significant trends ($P > 0.10$) for all other species.

At the 2007 joint meeting of the Raptor Research Foundation and Hawk Migration Association of North America in Allentown, Pennsylvania, a special symposium on American Kestrels was convened to draw attention to evidence of widespread declines of this otherwise common and ubiquitous species. The proceedings of this symposium is expected to be published in the Journal of Raptor Research later this year, and will include another manuscript that specifically summarizes migration trend data for the species from across the continent, including Bonney Butte (Farmer and Smith in review).

Age Ratios

Among eight species for which reasonable age-specific comparisons were possible, Golden Eagles showed a significantly above-average immature : adult ratio in 2007, and Northern Harriers and Sharp-shinned Hawks showed significantly below-average age ratios (Table 2). For Northern Harriers, the low age ratio was clearly due to a substantial reduction in the number of identified juveniles (Table 2), suggesting that low productivity may have been the cause. The low ratio for Sharp-shinned Hawks, however, was due to a combination of a reduced count of immature birds and a substantially elevated count of adults (Table 2). This suggests that productivity may have been slightly down for Pacific Northwest Sharp-shinned Hawks in 2007, but the counts also appear to reflect either high recruitment of new adults into the population in 2007 or high overwinter survival for adults the previous winter. For Golden Eagles, counts of both young and adult birds were well below average, but proportionately much more so for adults, which yielded the high age ratio.

Seasonal Timing

The 2007 combined-species median passage date of 8 October was a significant 8 days later than the long-term average for the site (Table 3). The seasonal distribution of activity also was unusual, primarily reflecting the influence of inclement weather that kept the crew from counting for several days at a time (Appendix C) and resulted in proportionately much higher than average activity during active observation periods from mid-to-late October (Figure 9). At the species level, however, only four species showed significantly later than average median passage dates (Sharp-shinned Hawk, Rough-legged Hawk, Bald Eagle, and Merlin), whereas five species showed significantly earlier than average timing (Turkey Vulture, Osprey, Northern Harrier, Northern Goshawk, and Prairie Falcon; Table 3). Age-specific median dates added complexity to the picture; however, the only clear commonality across species groups was indication of early timing for immature accipiters, but late timing for adults (Table 4).

RESIDENT RAPTORS

At least one resident pair of light morph Red-tailed Hawks was present predominantly in the White River Valley throughout the 2007 season. These birds were observed hunting low on the valley floor as well as higher in the valley between Mt. Hood and the banding hill. One or more adult Bald Eagles were seen northbound in the White River Valley repeatedly throughout the season. Late in August and early in September, observers documented frequent sightings of presumed local American Kestrels and Merlins in the area, northbound or buzzing the decoy owl, and then out of sight. Early in the season, local Sharp-shinned and Cooper's Hawks were present almost daily, dog-fighting and moving off in a variety of directions around the Bonney Butte ridge.

This is a typical local assemblage except that sightings of local Golden Eagles have diminished markedly since 2001.

TRAPPING AND BANDING SUMMARY

Trapping occurred on 45 of 66 possible trapping days between 27 August and 31 October, with effort totaling 317.25 hours (see Appendix F for daily trapping records and Appendix G for annual trapping summaries). The number of trapping days was a non-significant 3% above the 1997–2006 (period of comparable seasonal effort) average of $44 \pm 95\%$ CI of 6.8 days, and the hours of effort was a non-significant 15% above the 1997–2006 average of 276.8 ± 48.2 hours.

The 2007 capture total of 333 birds of 9 species was a non-significant 10% above average (Table 5). The captures included one recapture of a bird previously banded elsewhere, and no new record-high capture totals (Appendix G). The 2007 effort raises the total number of birds captured since project inception to 3,951. As usual, the three most frequently captured species were the Sharp-shinned Hawk (60% of captures), Cooper's Hawk (22%), and Red-tailed Hawk (13%). Highlights of the season included the first Red-shouldered Hawk (an immature bird) ever captured at the site, and only the fifth American Kestrel ever captured at the site.

The only commonly captured species for which the capture totals, rates, and successes were all above average were the Cooper's Hawk and Merlin (Table 5). No other commonly captured species showed a significantly above average capture total or rate; however, capture success was significantly above average for Sharp-shinned Hawks.

At this site, compared to the counts, banding data yield unique and useful sex–age specific data only for the three accipiters. In 2007, the immature : adult ratios for Sharp-shinned Hawks derived from the count and banding data were both roughly 50% below average; however, as is fairly typical, the two estimated ratios were themselves noticeably different (0.4 based on counts [Table 2] vs. 0.9 based on captures [Table 6]). 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, which is typical, and the fact that both the capture and count age ratios were similarly below average (51% and 46%, respectively) suggests that there was no atypical variation in the relative levels of susceptibility for immatures and adults in 2007. 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, neither age-ratio estimate differed significantly from their respective averages; however, the count age ratio was 4% above average (Table 2), whereas the capture age ratio was 17% below average (Table 6). As is typical for this species, 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 [1.7] than capture [2.0] ratio), again suggesting that immature Cooper's Hawks were more susceptible to capture than adults were in 2007. In combination, these data suggest that, immature Cooper's Hawks were more susceptible to capture than adults in 2007, but less so than usual. In turn, this suggests that although the overall abundance of Cooper's Hawks was below average in 2007, the immature birds may

have been healthier than average. Like for Sharp-shinned Hawks, a reduced female : male capture ratio for Cooper's Hawks further suggests that either females were proportionately less abundant than usual or were less susceptible to capture than usual in 2007 (Table 6).

For Northern Goshawks in 2007, the count age ratio (2.3) was a non-significant 6% above average (Table 2), whereas the capture age ratio of 0.0 (no immature birds captured) was considerably below the long-term average of 3.0 ± 1.32 (Table 6). Thus, unlike for both smaller accipiters, these data suggest an atypical situation where adult goshawks appeared to be more susceptible to capture than immature birds in 2007. This suggests the possibility that, although overall abundance was low, immature birds were proportionately slightly more abundant than usual compared to adults and may have averaged healthier (less hungry) than usual.

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 all three species, these measures indicated proportionately fewer birds with significant food in their crops, but proportionately more birds with at least moderately healthy keels and some wing-pit fat. Thus, the body condition data seem to support the age ratio inferences in suggesting that, although overall abundance may have been low for all three species, most of the captured birds appeared reasonably healthy.

ENCOUNTERS WITH BANDED BIRDS

To date, 54 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 2007 (Table 8). In addition, 13 birds banded elsewhere have been recaptured at Bonney Butte, with one new “foreign recapture” having occurred in 2007. The new foreign recapture was a hatch-year, female Cooper’s Hawk banded four days earlier at HWI’s Chelan Ridge site in the northern Cascades of Washington. This is the third exchange of banded birds between these two sites, with this Cooper’s Hawk and a Sharp-shinned Hawk having been recaptured downstream after banding at Chelan Ridge, and a Red-tailed Hawk having done the opposite (i.e., documented moving north rather than south in the fall). This year’s Cooper’s Hawk averaged 72 km per day in making the 287 km trip between the two sites. In Washington, it weighed in at 440 g with an empty crop; in Oregon it weighed in 26 g heavier but with a full crop!

This was the second year in a row that exchanges of banded Red-tailed Hawks occurred between the Bonney Butte project and a project coordinated by former Bonney Butte trapper Carole Hallett at the Portland Airport. Last year, our crew recaptured one of Carole’s birds and she recaptured a Bonney Butte bird 28 days after it was banded; both were hatch-year birds. This year Carole recaptured another hatch-year Bonney Butte bird 22 days after it was banded. Thus, the evidence is growing that east-west movement along the Columbia River may be commonplace for some young red-tails moving through or within Oregon. Otherwise, the 2007 foreign encounter locations of the remaining five Sharp-shinned and Red-tailed Hawks all fell within the expected confines of the Pacific Coast Flyway (Table 8); i.e., west of the Cascade-Sierra ranges from southern British Columbia to Baja California (Hoffman et al. 2002). Thankfully, two of the five birds were rescued from difficult situations and then released apparently unharmed, including one six-year-old Red-tailed Hawk, whereas the other three were simply found dead of unknown causes (Table 8).

SATELLITE TRACKING

We did not outfit any new birds with satellite transmitters at this site in 2007.

The Golden Eagle outfitted at the site during fall 2005 is still alive and well, and continues to provide fascinating new information. Since capture, this bird spent the winters of 2005 and 2006 mostly in New Mexico, but with another significant late fall and early spring activity center in southwestern Utah. He

spent the two subsequent summers above the Arctic Circle ranging from Prudhoe Bay on the north-central coast of Alaska to Franklin Bay on the northwestern coast of the Northwest Territories in Canada. To this point, although the general winter and summer ranges he has occupied have been fairly consistent, the migratory pathways he has followed to reach these locations have varied considerably. Moreover, with the addition of the 2007 fall migration and winter season, his overall range expanded even farther. Although his fall 2005 and fall 2006 routes ultimately converged on the same location in southwest Utah and then continued along the same basic route across to New Mexico, the 2005 route took it through Oregon, whereas the 2006 route followed the Rocky Mountains through western Montana, then dropped down through Idaho to Utah. His fall 2007 route also initially tracked down along the Rockies into Alberta, but this time along the eastern flank of the range (to this point largely retracing its previous spring pathway) and after reaching northwestern Alberta veered away from the Rockies out onto the northern plains of central Saskatchewan, where he is currently wintering. Although we have tracked other young eagles that have shown a similar range of variation in their summer and winter ranges, thus far this bird has shown the greatest variation in use of different migration routes.

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

VISITATION

In 2007, the HWI visitor logs documented 311 individual visitors to Bonney Butte, with several people visiting multiple times. This level visitation represents a decline from last year and a significant decline compared to the three years prior to that. Inclement weather during peak flight periods was a major factor in the reduced numbers this year. Several organized groups, including three school groups, a birding club, and an outdoor enthusiasts group, were scheduled to visit during this time but were unable to do so because of the weather and could not reschedule. Two other school groups from Madison and Reynolds high schools, with a combined total of 25 students and teachers, did visit, however, despite the poor weather. Although the count and banding operations were not up and running at the time due to the poor weather, educator Justin Roberge was able to teach them about the history of the site, aspects of general raptor biology and conservation, and the research being conducted at the site. In addition, a troop of 40 boy scouts visited during a horseback riding trip on the first day of the season, and in mid-September long-time affiliate Steve Engel from Portland Audubon Society brought a group of 35 people to the site. Bird watchers and families comprised most of the other visitors, with most originating in Oregon or neighboring areas of Washington.

In 2007, 401 hourly assessments of visitor disturbance by the primary observers resulted in the following ratings: 76% none, 15% low, 5% moderate, and 4% high. These ratings reflect a similar level of disturbance as last year, but higher levels than in most previous years, likely related to a policy change affecting 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; USDI Fish and Wildlife Service, Neotropical Migratory Bird Conservation Act grant program; Oregon Parks Foundation; Fledgling Fund; Charlotte Martin Foundation; 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: 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: 1994–2006 versus 2007.

SPECIES	COUNT			RAPTORS / 100 HOURS		
	1994–2006 ¹	2007	% CHANGE	1994–2006 ¹	2007	% CHANGE
Turkey Vulture	297 ± 69.4	281	-5	129.4 ± 30.08	121.4	-6
Osprey	64 ± 11.6	47	-27	24.1 ± 4.78	15.9	-34
Northern Harrier	30 ± 7.2	13	-57	9.4 ± 2.14	3.7	-60
Sharp-shinned Hawk	1112 ± 189.2	921	-17	395.9 ± 67.04	310.6	-22
Cooper's Hawk	347 ± 49.1	249	-28	122.9 ± 21.79	96.1	-22
Northern Goshawk	27 ± 6.0	16	-41	8.4 ± 1.90	4.1	-51
Unknown small accipiter ²	15 ± 10.0	52	239	–	–	–
Unknown large accipiter ²	3 ± 3.9	10	216	–	–	–
Unknown accipiter	69 ± 27.7	12	-83	–	–	–
TOTAL ACCIPITERS	1565 ± 229.2	1260	-19	–	–	–
Red-shouldered Hawk	1 ± 1.1	3	160	0.5 ± 0.42	1.2	160
Broad-winged Hawk	8 ± 11.1	0	-100	4.8 ± 6.39	0.0	-100
Swainson's Hawk	1 ± 0.4	1	86	0.2 ± 0.18	0.0	-100
Red-tailed Hawk	603 ± 78.2	388	-36	192.3 ± 29.51	121.4	-37
Ferruginous Hawk	0 ± 0.3	0	-100	0.1 ± 0.09	0.0	-100
Rough-legged Hawk	14 ± 4.7	6	-57	9.8 ± 3.27	5.0	-49
Unidentified buteo	31 ± 8.6	40	31	–	–	–
TOTAL BUTEOS	658 ± 91.1	438	-33	–	–	–
Golden Eagle	92 ± 18.1	52	-44	31.7 ± 6.30	16.2	-49
Bald Eagle	47 ± 6.0	45	-5	14.3 ± 1.87	12.8	-10
Unidentified eagle	3 ± 1.5	2	-32	–	–	–
TOTAL EAGLES	142 ± 18.9	99	-30	–	–	–
American Kestrel	21 ± 3.8	7	-67	6.8 ± 1.66	3.0	-56
Merlin	67 ± 13.5	71	6	26.0 ± 5.74	28.2	8
Prairie Falcon	5 ± 1.6	6	24	1.6 ± 0.48	2.4	50
Peregrine Falcon	7 ± 2.7	5	-27	2.3 ± 1.08	2.3	1
Unknown small falcon ²	1 ± 0.7	5	650	–	–	–
Unknown large falcon ²	2 ± 3.2	3	64	–	–	–
Unknown falcon	3 ± 1.4	1	-66	–	–	–
TOTAL FALCONS	104 ± 15.6	98	-6	–	–	–
Unidentified Raptor	25 ± 13.0	33	32	–	–	–
ALL SPECIES	2885 ± 371.8	2269	-21	–	–	–

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: 1994–2006 versus 2007.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1994–2006 AVERAGE			2007			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1994–2006 ¹	2007	1994–2006 ¹	2007
Northern Harrier	30	16	5	13	6	4	32 ± 5.9	23	4.6 ± 2.19	1.5
Sharp-shinned Hawk	1112	234	339	921	179	444	49 ± 6.7	32	0.8 ± 0.18	0.4
Cooper's Hawk	347	97	76	249	127	76	51 ± 5.7	18	1.6 ± 0.72	1.7
Northern Goshawk	27	11	7	16	7	3	33 ± 8.5	38	2.2 ± 0.81	2.3
Broad-winged Hawk	8	1	1	0	0	0	41 ± 28.9	–	0.4 ± 0.39	–
Red-tailed Hawk	603	171	298	388	116	205	23 ± 4.4	17	0.6 ± 0.12	0.6
Golden Eagle	92	51	22	52	34	6	19 ± 3.3	23	3.2 ± 1.24	5.7
Bald Eagle	47	10	34	45	11	34	7 ± 3.3	0	0.3 ± 0.08	0.3
Peregrine Falcon	7	1	2	5	0	1	50 ± 4.5	80	1.0 ± 0.83	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 2007, with a comparison of 2007 and 1994–2006 average median passage dates.

SPECIES	2007				1994–2006
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	27-Aug	23-Oct	30-Aug – 26-Sep	21-Sep	23-Sep ± 1.2
Osprey	31-Aug	25-Oct	1-Sep – 13-Oct	13-Sep	19-Sep ± 1.7
Northern Harrier	8-Sep	31-Oct	9-Sep – 28-Oct	21-Sep	28-Sep ± 3.1
Sharp-shinned Hawk	28-Aug	31-Oct	14-Sep – 28-Oct	13-Oct	04-Oct ± 1.5
Cooper's Hawk	27-Aug	30-Oct	7-Sep – 14-Oct	24-Sep	26-Sep ± 1.9
Northern Goshawk	28-Aug	29-Oct	28-Aug – 28-Oct	22-Sep	03-Oct ± 3.6
Broad-winged Hawk	30-Aug	13-Oct	–	–	26-Sep ± 0.0
Red-tailed Hawk	–	–	–	–	27-Sep ± 2.6
Rough-legged Hawk	28-Aug	28-Aug	–	–	–
Golden Eagle	27-Aug	31-Oct	3-Sep – 24-Oct	–	28-Sep ± 1.8
Bald Eagle	–	–	–	–	20-Oct ± 0.0
American Kestrel	12-Oct	30-Oct	12-Oct – 30-Oct	22-Oct	12-Oct ± 2.9
Merlin	28-Aug	31-Oct	11-Sep – 29-Oct	14-Oct	12-Oct ± 2.1
Prairie Falcon	2-Sep	31-Oct	3-Sep – 28-Oct	12-Oct	06-Oct ± 2.9
Peregrine Falcon	30-Aug	13-Oct	30-Aug – 13-Oct	19-Sep	19-Sep ± 3.1
Total	11-Sep	31-Oct	27-Sep – 28-Oct	14-Oct	10-Oct ± 2.3

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: 1994–2006 versus 2007.

SPECIES	ADULT		IMMATURE	
	1994–2006 ¹	2007	1994–2006 ¹	2007
Northern Harrier	04-Oct ± 6.7	04-Oct	26-Sep ± 2.2	21-Sep
Sharp-shinned Hawk	10-Oct ± 2.1	10-Oct	23-Sep ± 1.5	22-Sep
Cooper's Hawk	02-Oct ± 2.0	02-Oct	21-Sep ± 2.4	14-Sep
Northern Goshawk	14-Oct ± 5.7	14-Oct	30-Sep ± 6.2	27-Sep
Red-tailed Hawk	02-Oct ± 2.5	27-Sep	22-Sep ± 2.1	14-Sep
Golden Eagle	13-Oct ± 1.5	14-Oct	09-Oct ± 2.6	13-Oct
Bald Eagle	06-Oct ± 3.5	12-Oct	10-Oct ± 3.8	15-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: 1995–2006 versus 2007.

	CAPTURE TOTALS		CAPTURE RATES ¹		CAPTURE SUCCESSES ²	
	1995–2006 ³	2007	1995–2006 ³	2007	1995–2006 ³	2007
Northern Harrier	2 ± 1.3	1	0.8 ± 0.4	0.3	7.0 ± 4.3	7.7
Sharp-shinned Hawk	170 ± 48.0	200	66.9 ± 8.6	63.0	15.1 ± 4.7	20.6
Cooper's Hawk	55 ± 18.7	74	19.9 ± 5.3	23.3	15.6 ± 6.1	27.2
Northern Goshawk	8 ± 2.2	3	3.2 ± 0.7	0.9	36.0 ± 18.4	17.6
Red-shouldered Hawk	0.0 ± 0.0	1	0.0 ± 0.0	0.3	0.0 ± 0.0	33.3
Broad-winged Hawk	0.1 ± 0.2	0	0.03 ± 0.07	0.0	1.1 ± 2.2	–
Red-tailed Hawk	56 ± 18.6	42	20.5 ± 4.3	13.2	9.3 ± 3.7	9.8
Rough-legged Hawk	0.4 ± 0.3	0	0.2 ± 0.1	0.0	5.0 ± 5.6	0.0
Golden Eagle	2 ± 0.9	0	0.9 ± 0.4	0.0	2.6 ± 1.6	0.0
Bald Eagle	0.1 ± 0.2	0	0.02 ± 0.05	0.0	0.2 ± 0.3	0.0
American Kestrel	0.3 ± 0.4	1	0.1 ± 0.1	0.3	1.6 ± 2.0	14.3
Merlin	5 ± 2.4	9	2.2 ± 0.8	2.8	7.8 ± 3.2	11.7
Prairie Falcon	2 ± 1.0	2	0.6 ± 0.4	0.6	37.4 ± 20.1	25.0
Peregrine Falcon	1 ± 0.7	0	0.2 ± 0.2	0.0	5.7 ± 5.2	0.0
All species	302 ± 86.4	333	115.7 ± 15.86	105.0	12.5 ± 4.1	17.5

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: 1995–20076 versus 2007.

SPECIES	FEMALE		MALE		FEMALE : MALE	IMMATURE : ADULT
	HY	AHY	HY	AHY	RATIO	RATIO
Sharp-shinned Hawk						
1995–2006	54	38	55	24	1.2 ± 0.18	1.8 ± 0.50
2007	38	60	56	46	1.0	0.9
Cooper's Hawk						
1995–2006	23	13	15	4	2.1 ± 0.32	2.3 ± 0.55
2007	30	17	19	8	1.7	2.0
Northern Goshawk						
1995–2006	3	1	3	1	1.4 ± 0.93	3.0 ± 1.32
2007	0	2	0	1	2.0	0.0

¹ Mean ± 95% Confidence Interval (CI).

Table 7. Fall body condition indices for migrant accipiters captured at Bonney Butte, OR: 1995–2006 versus 2007.

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	1995-2006 mean	51	24	12	5	8	1	69	29	10	58	23	9
	2007	61	23	12	0	5	0	83	18	7	71	18	5
Cooper's Hawk	1995-2006 mean	54	17	14	6	9	9	76	15	17	62	16	6
	2007	57	19	16	0	8	1	88	11	9	74	16	0
Northern Goshawk	1995-2006 mean	57	20	4	5	14	14	81	5	16	69	15	0
	2007	100	0	0	0	0	0	100	0	0	100	0	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 2007 of raptors banded during migration at Bonney Butte, Oregon.

BAND #	SPECIES-SEX ¹	BANDING DATE	BANDING AGE ²	ENCOUNTER DATE	ENCOUNTER AGE ²	ENCOUNTER LOCATION	DISTANCE (KM)	STATUS
1593-53955	SS-F	08-Oct-05	SY	3-Jan-07	4th yr	Gold Hill, OR	311	trapped in building / released
1807-81745	RT-U	26-Sep-05	HY	16-Feb-07	TY	Anacortes, WA	315	found dead – cause unknown
1593-54251	SS-F	06-Sep-05	HY	1-Apr-07	TY	Paso Robles, CA	869	found dead – cause unknown
1212-71048	SS-M	22-Sep-03	AHY	4-May-07	6 th yr	White Salmon, WA	36	found dead – cause unknown
1177-06372	RT-U	28-Aug-07	HY	19-Sep-07	HY	Portland Airport, OR	144	control operation capture/injured
1177-06107	RT-U	21-Sep-01	HY	19-Oct-07	7 th yr	McMinnville, OR	220	collision on farm - captured/released

¹ SS = Sharp-shinned Hawk, 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.

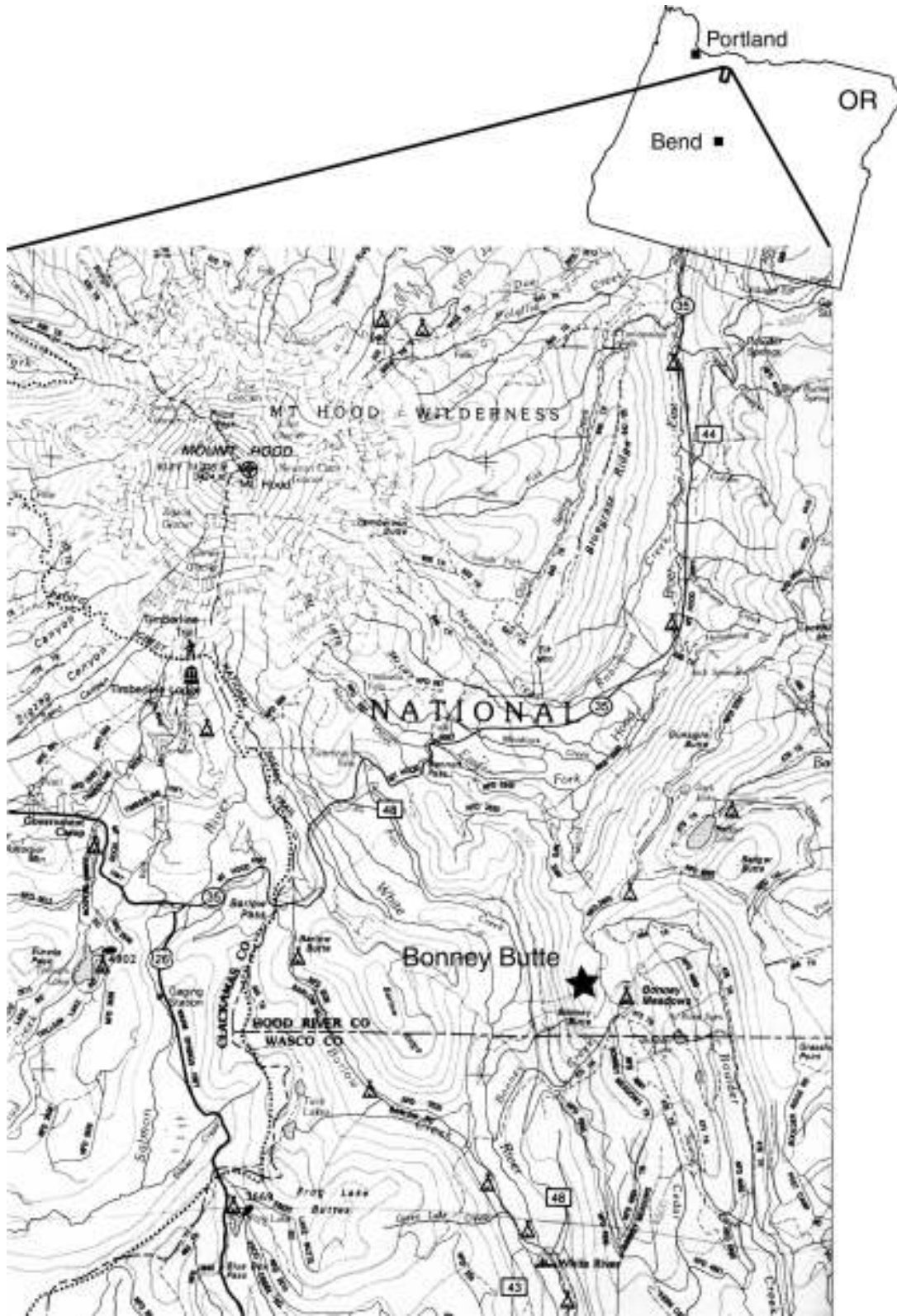


Figure 1. Location of the Bonney Butte Raptor Migration Project study site near Mt. Hood, Oregon.

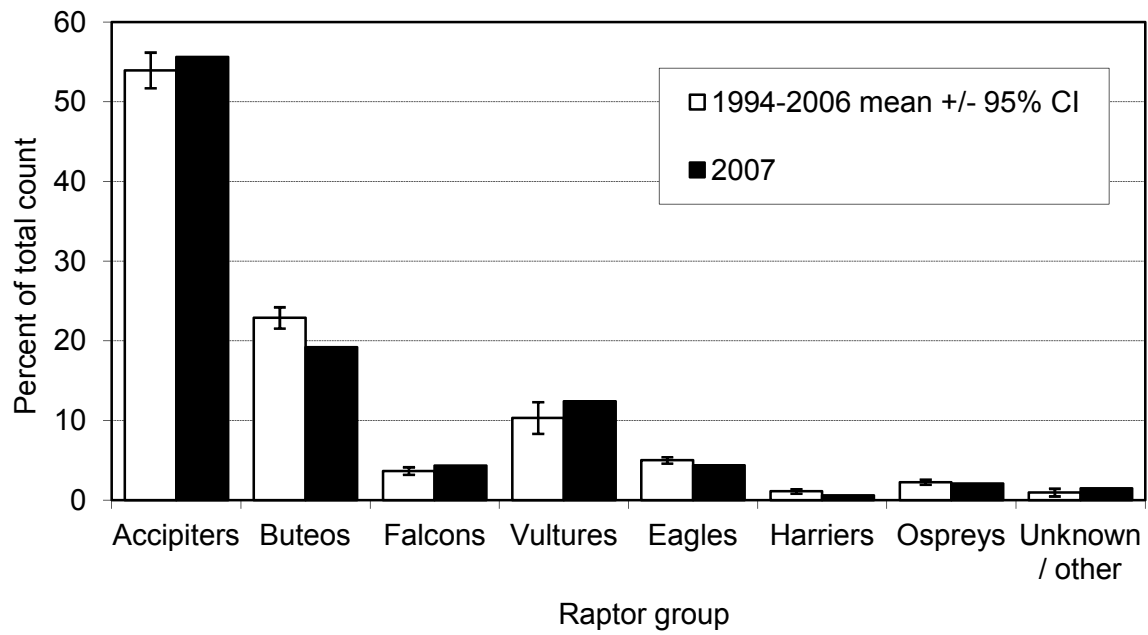


Figure 2. Fall raptor migration flight composition by major species groups at Bonney Butte, Oregon: 1994–2006 versus 2007.

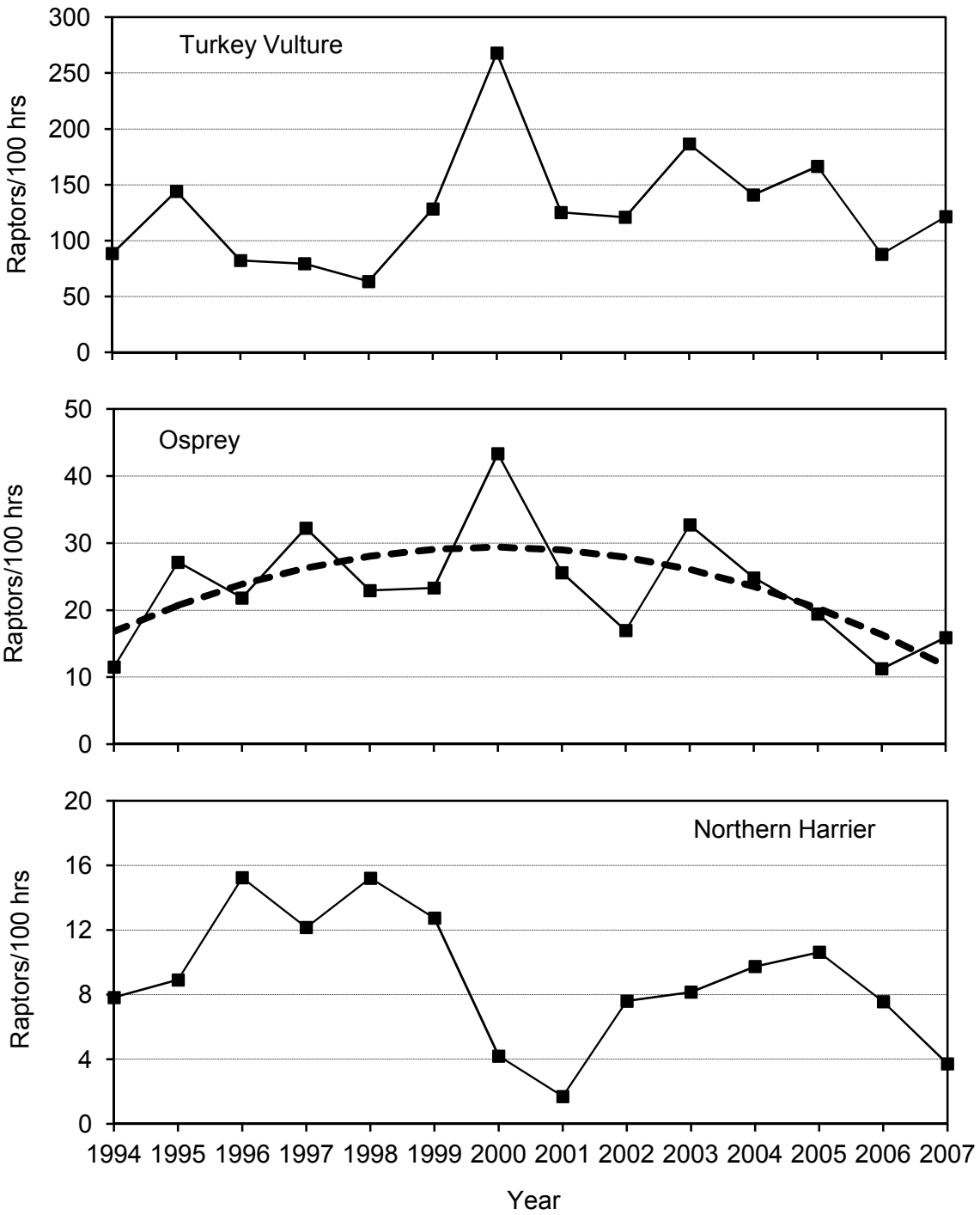


Figure 3. Adjusted, fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Bonney Butte, Oregon: 1994–2007. Dashed lines indicate significant ($P < 0.10$) regressions.

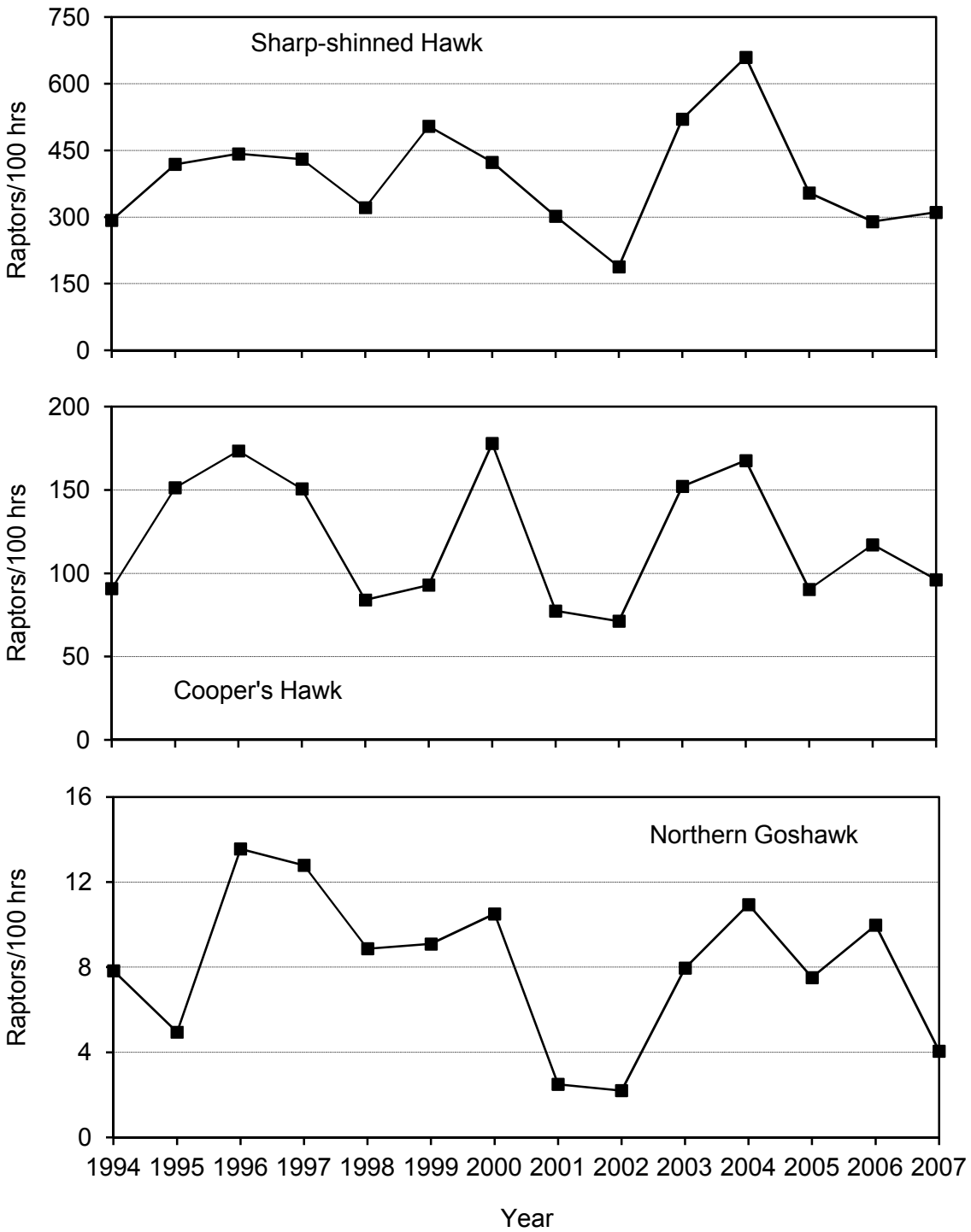


Figure 4. Adjusted, fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks at Bonney Butte, Oregon: 1994–2007. Dashed lines indicate significant ($P < 0.10$) regressions.

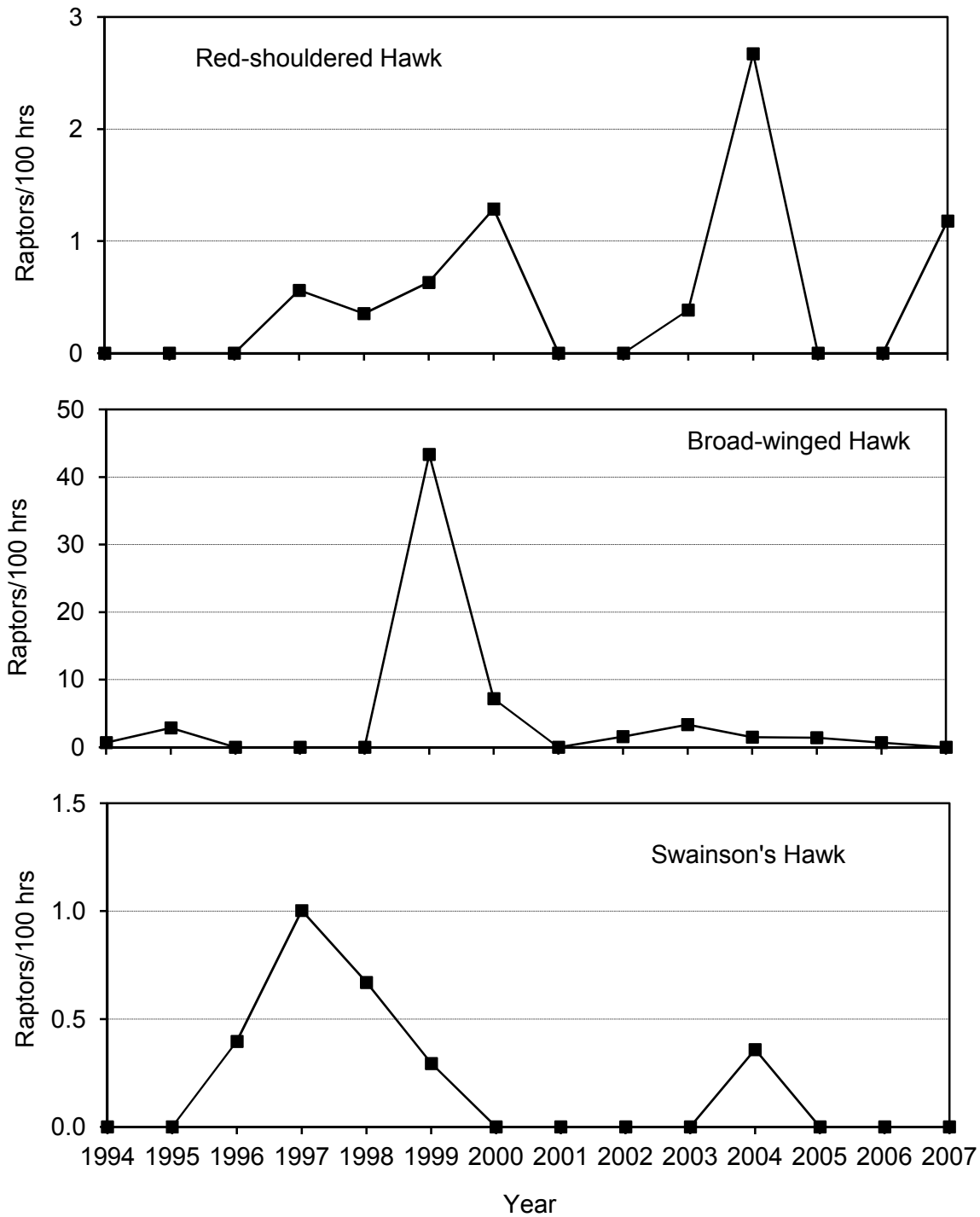


Figure 5. Adjusted, fall-migration passage rates for Red-shouldered, Broad-winged, and Swainson's Hawks at Bonney Butte, Oregon: 1994–2007. Dashed lines indicate significant ($P < 0.10$) regressions.

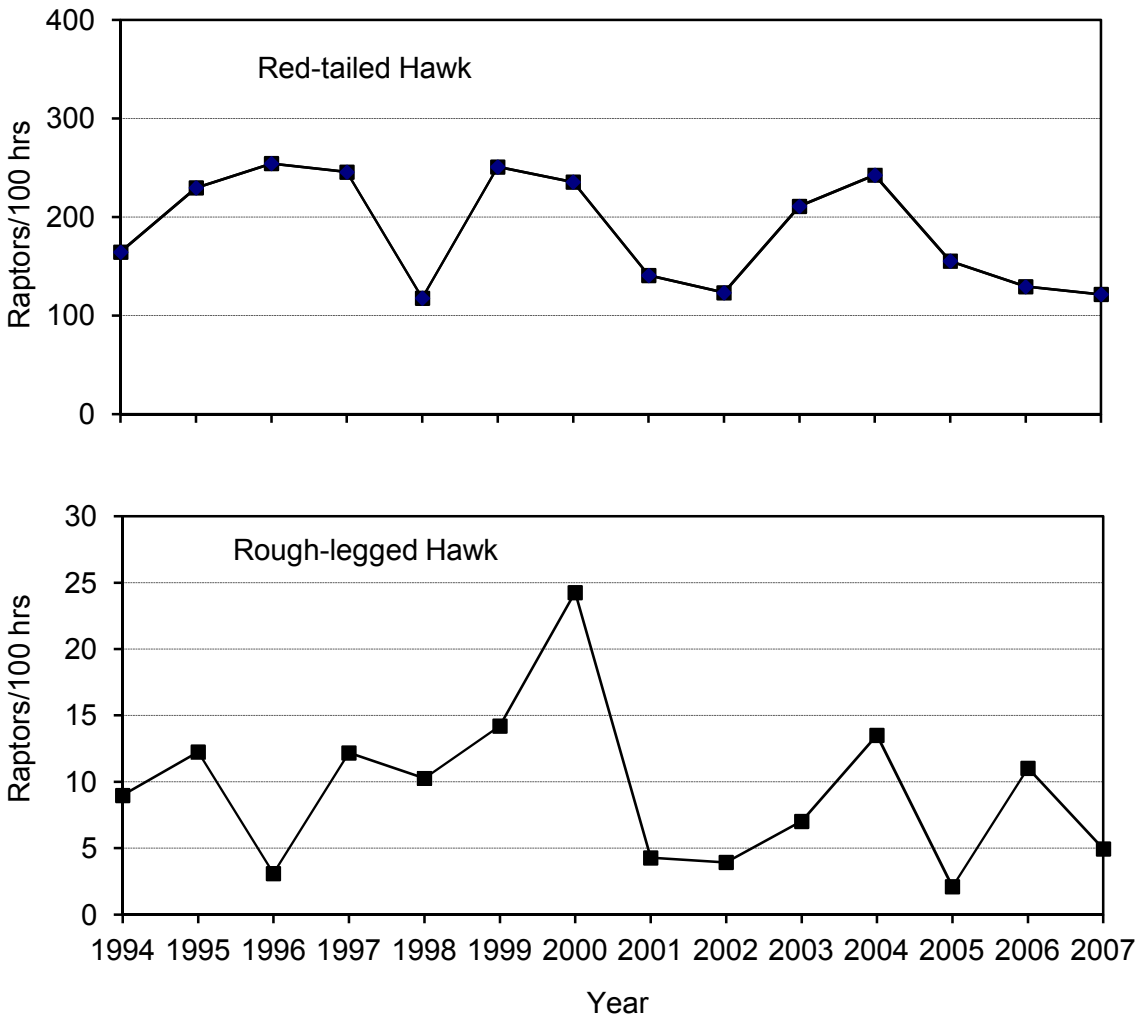


Figure 6. Adjusted, fall-migration passage rates for Red-tailed and Rough-legged Hawks at Bonney Butte, Oregon: 1994–2007. Dashed lines indicate significant ($P < 0.10$) regressions.

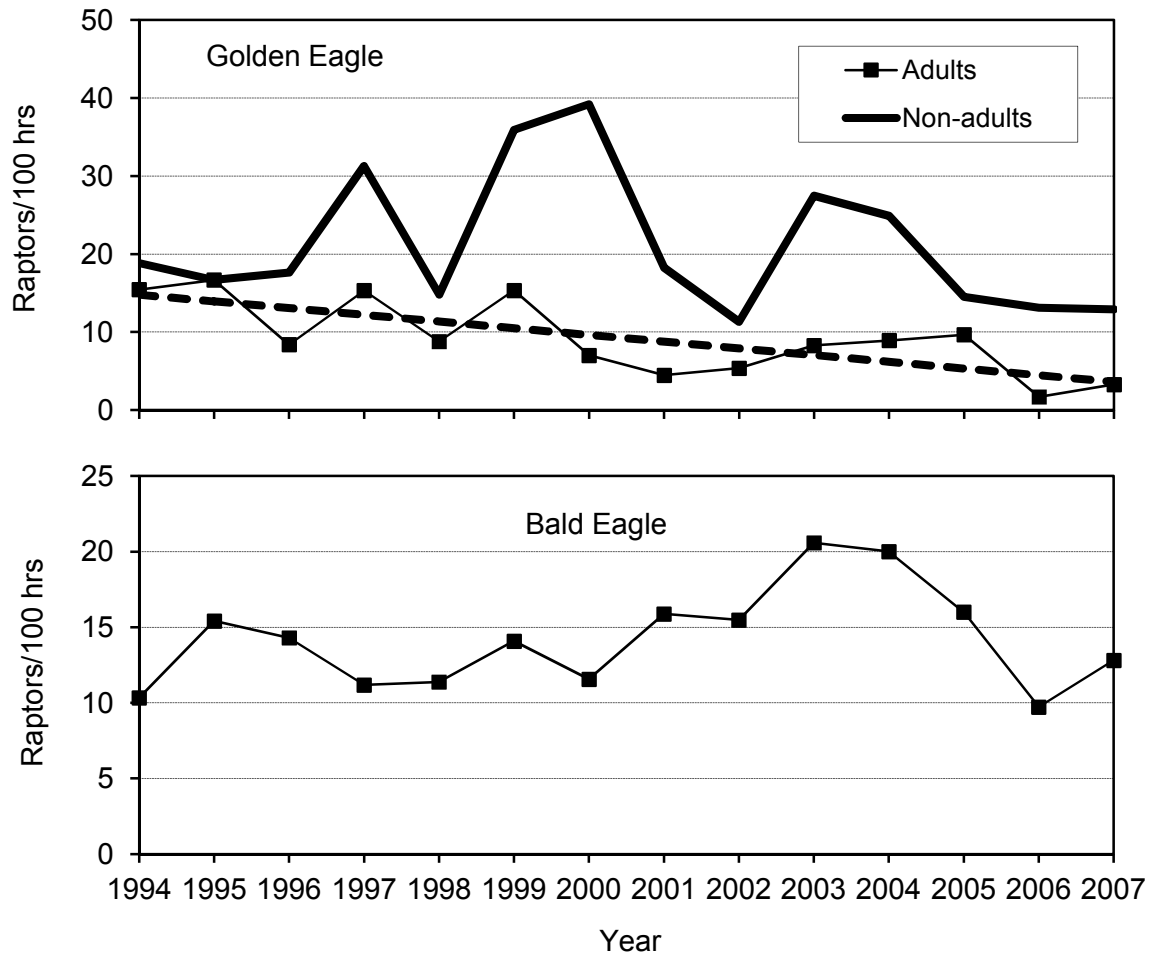


Figure 7. Adjusted, fall-migration passage rates for Golden and Bald Eagles at Bonney Butte, Oregon: 1994–2007. Dashed lines indicate significant ($P < 0.10$) regressions.

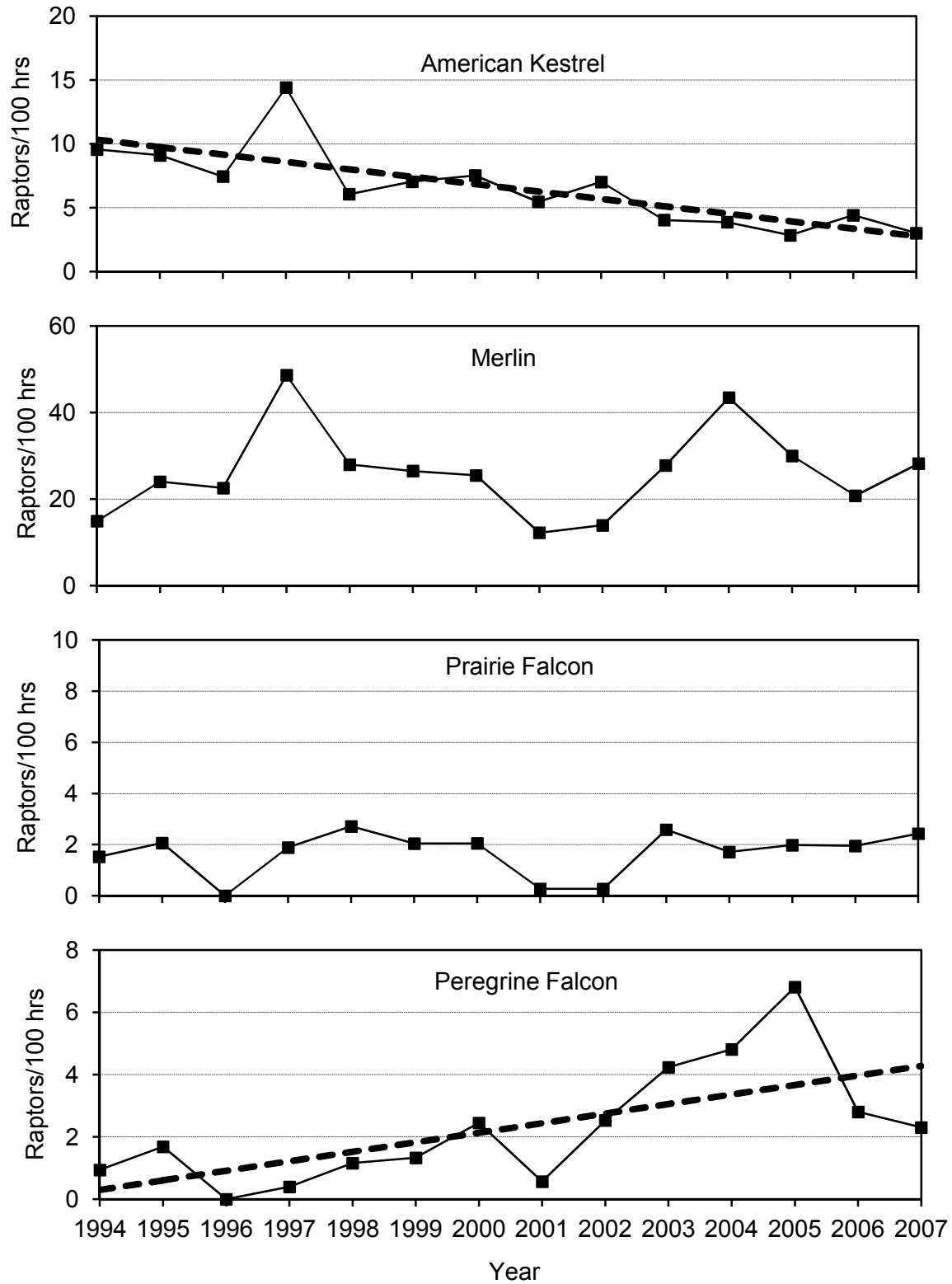


Figure 8. Adjusted, fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, Peregrine Falcons at Bonney Butte, Oregon: 1994–2007. Dashed lines indicate significant ($P < 0.10$) regressions.

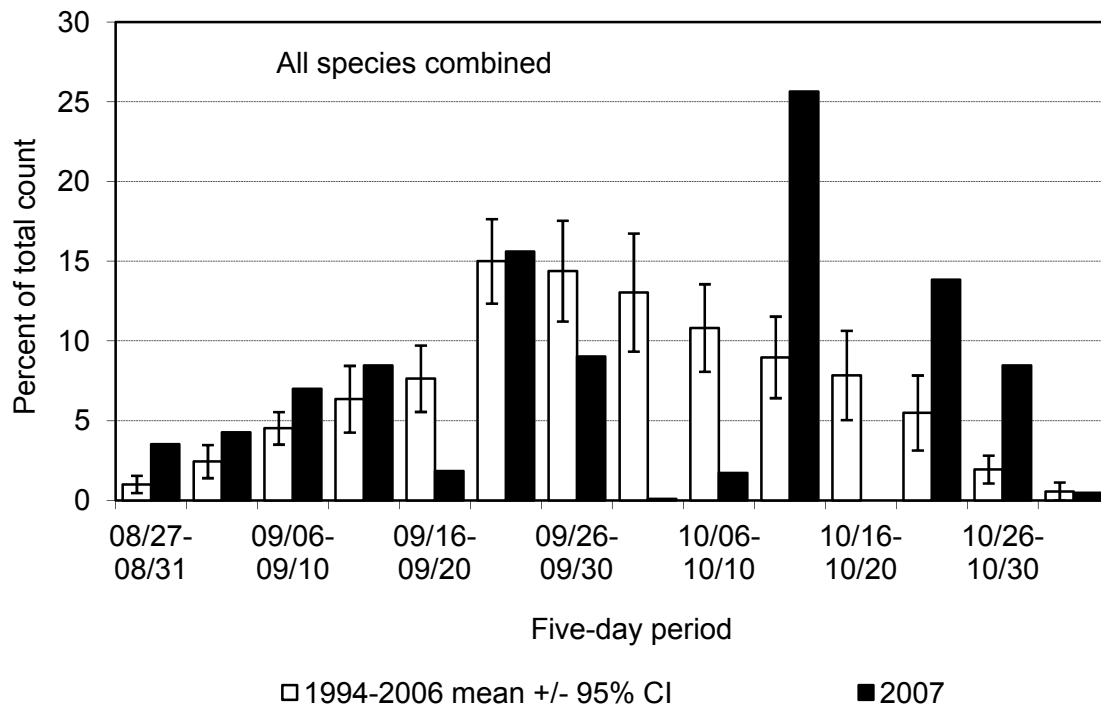


Figure 9. Combined-species passage volume by five-day periods for migrating raptors at Bonney Butte, Oregon: 1994–2006 versus 2007.

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 (+).
- 2007:** Two observers throughout: Mary Coolidge (1), Sue Bruner (2)

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: 2007.

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	9.00	2.7	1	clr-pc	1.7	calm, sw, w	16.6	30.86	3	100	100	2	2.0
28-Aug	9.00	2.9	0	clr	5.5	ne, var	20.8	30.95	2	100	100	2	2.6
29-Aug	9.00	2.4	0	clr	6.1	ne, wsw	24.8	30.91	2	99	100	2	1.9
30-Aug	9.00	1.9	0	clr, haze	7.3	sw	26.6	30.89	2	97	93	2	1.4
31-Aug	9.00	2.0	0	clr-ovc, AM haze	8.9	sw	20.5	30.84	3	72	78	2	1.0
1-Sep	9.00	3.4	0	clr-pc, PM haze	5.4	se, wsw	21.4	30.84	3	33	35	2	3.1
2-Sep	9.00	3.5	1	clr	6.0	wsw	20.5	30.86	2	97	100	2	4.3
3-Sep	9.00	1.9	0	clr, AM haze	5.5	wsw	21.6	30.79	3	84	85	2	2.2
4-Sep	3.00	2.0	0	ovc, fog/rain					4	0	0		0.0
5-Sep	8.75	2.8	0	clr, PM fog	5.8	e, wnw	17.4	30.86	4	77	23	2	1.1
6-Sep	9.00	2.0	0	clr-ovc, AM fog	5.7	wsw	17.5	30.92	3	76	52	2	2.9
7-Sep	9.00	2.9	0	clr	5.3	wnw	15.8	30.95	3	89	79	2	3.4
8-Sep	9.00	3.8	0	clr-pc	4.4	ne	15.4	31.04	3	99	100	2	4.9
9-Sep	9.00	2.9	0	clr	10.7	ne	15.6	30.95	3	90	95	2	3.0
10-Sep	9.00	2.0	0	clr, PM haze	6.9	ne	19.8	31.06	2	95	90	1	3.4
11-Sep	9.00	2.2	0	clr, haze	2.7	calm, w	24.8	30.92	2	80	77	2	6.4
12-Sep	9.00	2.7	1	clr, haze	8.6	w	21.9	30.83	2	82	77	2	4.6
13-Sep	9.00	1.9	0	clr-pc	4.5	ne	20.6	30.81	3	65	62	2	3.2
14-Sep	9.00	2.8	0	clr, fog, haze	7.4	var	19.4	30.82	3	65	4	2	5.0
15-Sep	9.00	3.0	0	clr-ovc	7.2	calm, sw	17.5	30.84	3	60	39	2	2.1
16-Sep	1.00	2.0	0	ovc, fog/rain					4	0	0		0.0
17-Sep	0.00			ovc, fog/rain									
18-Sep	2.75	2.0	1	ovc, fog	14.3	w	5.8	30.74	4	98	58	-	0.0
19-Sep	7.50	1.0	0	clr-ovc	4.0	nne, var	11.0	30.76	3	75	88	2	1.9
20-Sep	9.00	2.8	0	ovc, blow snow	10.4	w	12.7	30.75	3	88	97	2	3.1
21-Sep	9.00	2.8	0	clr	5.0	ne, sw	17.8	30.78	2	96	93	2	7.8
22-Sep	9.00	2.8	2	mc-ovc	9.6	wsw	10.5	30.60	4	77	58	2	9.0
23-Sep	2.75	3.0	1	ovc, fog	8.3	wsw	6.5	30.77	4	10	10	2	2.2
24-Sep	9.00	1.9	0	clr, PM haze	2.4	var	13.3	30.97	2	90	92	2	9.9
25-Sep	9.00	2.6	0	clr-pc	8.8	wsw	13.7	30.99	2	95	76	2	12.0
26-Sep	9.00	2.8	0	clr	5.1	wsw	20.5	30.99	1	98	91	3	6.9
27-Sep	9.00	2.7	0	mc-ovc, PM blow snow	9.5	wsw	18.3	30.66	2	78	75	2	15.9
28-Sep	0.00			fog/snow									
29-Sep	0.00			fog/rain/snow									
30-Sep	0.00			snow									
1-Oct	0.00			fog/rain									
2-Oct	0.00			weather day									
3-Oct	0.00			weather day									
4-Oct	0.00			weather day									
5-Oct	5.00	2.2	0	ovc, fog	7.2	w	4.0	30.68	4	31	5	0	0.4
6-Oct	0.00			fog/rain									
7-Oct	2.50	1.5	0	ovc, fog	14.3	w	8.7	30.80	4	67	43	2	1.2
8-Oct	7.00	2.5	0	ovc, AM fog	6.0	e, se	9.2	30.67	4	59	56	1	1.9
9-Oct	9.00	1.8	0	ovc	19.4	ne, se	10.1	30.51	4	90	93	2	2.6
10-Oct	0.00			fog/rain									
11-Oct	7.25	1.4	0	ovc, AM fog,	12.6	ese	6.6	30.71	4	88	89	2	7.0
12-Oct	8.50	2.9	0	pc-ovc, fog	1.9	calm-var	8.5	30.57	4	56	65	2	15.2
13-Oct	9.25	2.9	1.5	pc-mc, fog	3.3	calm, ne, ese	10.0	30.78	3	82	83	2	17.6
14-Oct	9.00	2.6	2	pc	4.7	calm-var	13.4	30.72	2	90	82	2	20.9
15-Oct	5.00	2.5	0	ovc, scat rain	9.8	ne, sw	8.6	30.51	4	71	54	2	10.2
16-Oct	0.00			rain/snow									

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
17-Oct	0.00			snow									
18-Oct	0.00			snow									
19-Oct	0.00			snow									
20-Oct	0.00			snow									
21-Oct	6.00	2.8	0	ovc, PM fog	12.1	wsw	5.3	31.14	4	91	74	2	7.0
22-Oct	9.00	3.4	0	clr	11.2	wsw	10.4	31.29	2	95	85	2	14.7
23-Oct	9.00	4.0	0	clr, PM haze	7.6	calm-var	13.7	31.15	3	77	72	2	7.6
24-Oct	4.25	4.2	0	clr-ovc, haze, PM fog	20.3	w	10.3	30.93	4	64	50	2	12.2
25-Oct	9.00	2.8	0	clr-pc, fog	4.7	calm-var	2.5	31.02	4	91	85	2	2.2
26-Oct	8.50	2.9	0	clr, haze	11.9	nne	1.3	31.07	4	72	62	2	2.9
27-Oct	8.00	3.0	0	clr, haze	12.8	e, wsw	8.3	31.00	4	73	61	2	3.5
28-Oct	8.50	2.6	0	clr, haze	20.3	wsw	11.6	31.04	4	64	57	2	6.2
29-Oct	8.00	2.6	0	mc-ovc, haze, PM fog	9.4	w	10.3	30.89	3	64	58	3	7.0
30-Oct	8.50	2.0	0	clr, haze	5.8	calm, ne, w	5.7	31.02	3	73	58	2	3.5
31-Oct	5.00	1.9	0	clr, haze	3.9	calm, sw	8.3	31.03	3	80	90	2	2.2

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: 2007.

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	9.00	7	0	0	0	1	0	3	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	18	2.0
28-Aug	9.00	8	0	0	6	1	2	0	0	0	0	0	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	23	2.6	
29-Aug	9.00	9	0	0	0	3	1	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	17	1.9	
30-Aug	9.00	5	0	0	0	2	0	1	0	0	1	0	0	2	0	0	0	0	0	0	1	0	1	0	0	0	0	13	1.4		
31-Aug	9.00	2	1	0	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	9	1.0		
1-Sep	9.00	3	4	0	7	0	0	0	0	0	0	0	0	13	0	0	0	1	0	0	0	0	0	0	0	0	0	28	3.1		
2-Sep	9.00	8	4	0	9	3	0	0	0	0	0	0	0	7	0	0	0	1	4	0	0	0	2	0	0	0	1	39	4.3		
3-Sep	9.00	8	0	0	2	2	0	1	1	0	0	0	0	5	0	0	0	0	1	0	0	0	0	0	0	0	0	20	2.2		
4-Sep	3.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	
5-Sep	8.75	3	3	0	0	1	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1.1		
6-Sep	9.00	7	1	0	0	5	1	0	0	0	0	0	0	9	0	0	1	1	0	0	0	0	0	0	0	0	1	26	2.9		
7-Sep	9.00	2	1	0	2	8	0	1	0	0	0	0	0	15	0	0	2	0	0	0	0	0	0	0	0	0	0	31	3.4		
8-Sep	9.00	9	2	1	12	6	0	3	0	0	0	0	0	10	0	0	0	0	0	0	1	0	0	0	0	0	0	44	4.9		
9-Sep	9.00	9	0	1	4	7	0	1	0	1	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	27	3.0		
10-Sep	9.00	1	2	1	14	5	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	1	0	0	2	31	3.4		
11-Sep	9.00	10	1	0	12	15	0	2	1	0	0	0	0	12	0	0	1	1	0	0	1	1	0	0	0	0	1	58	6.4		
12-Sep	9.00	12	4	0	8	7	0	2	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	41	4.6		
13-Sep	9.00	7	1	0	10	9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	29	3.2			
14-Sep	9.00	7	1	0	12	10	1	0	0	1	0	0	0	11	0	0	0	0	0	0	0	0	1	0	1	0	45	5.0			
15-Sep	9.00	2	3	0	4	2	1	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	19	2.1		
16-Sep	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0		
17-Sep	0.00																														
18-Sep	2.75	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	
19-Sep	7.50	8	0	0	2	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	14	1.9		
20-Sep	9.00	8	2	2	3	1	1	3	0	0	0	0	0	6	0	0	0	1	1	0	0	0	0	0	0	0	0	28	3.1		
21-Sep	9.00	16	1	2	24	10	0	1	0	0	0	0	0	12	0	0	0	1	0	0	0	2	0	1	0	0	0	70	7.8		
22-Sep	9.00	20	1	0	9	14	1	2	0	1	0	0	0	23	0	0	2	2	2	1	0	0	0	1	0	0	2	81	9.0		
23-Sep	2.75	1	0	0	1	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2.2		
24-Sep	9.00	29	0	1	29	13	2	0	0	0	0	0	0	13	0	0	0	0	0	1	0	1	0	0	0	0	0	89	9.9		
25-Sep	9.00	31	0	0	17	18	0	6	0	0	0	0	0	28	0	0	1	1	2	0	0	3	0	0	1	0	0	108	12.0		
26-Sep	9.00	22	2	0	10	10	0	3	2	0	0	0	0	9	0	0	2	0	1	0	0	0	0	1	0	0	0	62	6.9		
27-Sep	9.00	25	2	0	68	15	2	2	0	1	0	0	0	18	0	0	0	2	5	0	0	2	0	0	0	1	0	143	15.9		
28-Sep	0.00																														
29-Sep	0.00																														
30-Sep	0.00																														
1-Oct	0.00																														
2-Oct	0.00																														
3-Oct	0.00																														

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	0.00																														
5-Oct	5.00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0.4
6-Oct	0.00																														
7-Oct	2.50	0	0	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	3	1.2	
8-Oct	7.00	0	0	0	10	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1.9	
9-Oct	9.00	0	1	0	14	3	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	23	2.6		
10-Oct	0.00																														
11-Oct	7.25	0	0	0	38	5	0	0	0	0	0	0	4	0	0	0	0	2	0	0	0	1	0	1	0	0	0	51	7.0		
12-Oct	8.50	0	2	2	70	10	1	1	0	6	1	0	6	0	1	6	2	6	0	1	2	0	0	0	0	0	12	129	15.2		
13-Oct	9.25	0	5	0	81	20	0	1	1	0	1	0	20	0	0	9	4	1	0	1	14	0	0	1	1	1	2	163	17.6		
14-Oct	9.00	0	0	1	108	15	0	13	2	1	0	0	19	0	0	3	8	4	0	0	14	0	0	0	0	0	0	188	20.9		
15-Oct	5.00	0	1	0	39	1	0	0	0	0	0	0	1	0	0	0	2	2	0	0	4	0	0	0	0	0	1	51	10.2		
16-Oct	0.00																														
17-Oct	0.00																														
18-Oct	0.00																														
19-Oct	0.00																														
20-Oct	0.00																														
21-Oct	6.00	0	0	0	27	5	0	0	0	0	0	0	6	0	1	0	0	1	1	0	1	0	0	0	0	0	0	42	7.0		
22-Oct	9.00	0	1	0	81	7	0	2	0	0	0	0	30	0	1	3	3	2	0	0	2	0	0	0	0	0	132	14.7			
23-Oct	9.00	2	0	0	43	2	0	0	0	0	0	0	16	0	0	0	2	1	0	0	2	0	0	0	0	0	68	7.6			
24-Oct	4.25	0	0	0	16	2	0	0	0	0	0	0	12	0	2	2	5	1	0	0	9	0	0	0	0	0	3	52	12.2		
25-Oct	9.00	0	1	0	5	0	1	0	0	0	0	0	4	0	0	0	2	1	0	0	3	0	0	0	0	0	3	20	2.2		
26-Oct	8.50	0	0	0	11	0	0	0	0	0	0	0	7	0	0	4	2	1	0	0	0	0	0	0	0	0	0	25	2.9		
27-Oct	8.00	0	0	0	17	0	0	0	0	0	0	0	7	0	0	0	1	2	0	0	1	0	0	0	0	0	0	28	3.5		
28-Oct	8.50	0	0	1	40	2	1	0	0	0	0	0	3	0	0	1	2	1	0	0	2	0	0	0	0	0	0	53	6.2		
29-Oct	8.00	0	0	0	36	2	1	0	0	0	0	0	6	0	0	0	4	0	0	0	5	1	0	0	1	0	0	56	7.0		
30-Oct	8.50	0	0	0	18	3	0	0	0	0	0	0	4	0	1	0	1	3	0	0	0	0	0	0	0	0	0	30	3.5		
31-Oct	5.00	0	0	1	1	0	0	0	0	0	0	0	4	0	0	1	1	1	0	0	2	0	0	0	0	0	0	11	2.2		
Total	397.00	281	47	13	921	249	16	52	10	12	3	0	1	388	0	6	40	52	45	2	7	71	6	5	5	3	1	33	2269	5.7	

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: 1994–2007.

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

Appendix E. continued

	2004	2005	2006	2007	MEAN
Start date	27-Aug	27-Aug	28-Aug	27-Aug	28-Aug
End date	29-Oct	27-Oct	31-Oct	31-Oct	28-Oct
Observation days	46	49	57	51	50
Observation hours	341.25	392.92	459.92	397.00	365.19
Raptors / 100 hours	1119.7	699.6	577.5	571.5	797.92
SPECIES	RAPTOR COUNTS				
Turkey Vulture	326	389	232	281	296
Osprey	70	60	38	47	63
Northern Harrier	29	38	33	13	29
Sharp-shinned Hawk	1790	1067	1015	921	1099
Cooper's Hawk	485	269	418	249	340
Northern Goshawk	33	24	40	16	27
Unknown small accipiter ¹	27	14	7	52	21
Unknown large accipiter ¹	2	13	2	10	4
Unknown accipiter	0	46	60	12	65
TOTAL ACCIPITERS	2337	1433	1542	1260	1543
Red-shouldered Hawk	7	0	0	3	1
Broad-winged Hawk	2	2	1	0	7
Swainson's Hawk	1	0	0	1	1
Red-tailed Hawk	725	562	531	388	588
Ferruginous Hawk	0	1	0	0	0
Rough-legged Hawk	17	3	27	6	14
Unidentified buteo	9	4	30	40	31
TOTAL BUTEOS	761	572	589	438	642
Golden Eagle	93	72	56	52	89
Bald Eagle	61	55	44	45	47
Unidentified eagle	2	1	1	2	3
TOTAL EAGLES	156	128	101	99	139
American Kestrel	14	9	17	7	20
Merlin	105	80	69	71	67
Prairie Falcon	5	3	7	6	5
Peregrine Falcon	14	14	10	5	7
Unknown small falcon ¹	1	2	0	5	1
Unknown large falcon ¹	0	10	1	3	2
Unknown falcon	0	6	1	1	3
TOTAL FALCONS	139	124	105	98	104
Unidentified raptor	3	5	16	33	26
GRAND TOTAL	3821	2749	2656	2269	2841

¹ Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Bonney Butte, Oregon: 2007.

DATE	STATION HOURS	SPECIES ¹														TOTAL CAPTURES/HR	
		NH	SS	CH	NG	RS	BW	RT	RL	GE	BE	AK	ML	PR	PG		
27-Aug	7.25	0	1	1	0	0	0	2	0	0	0	0	0	0	0	4	0.6
28-Aug	7.50	0	2	2	1	0	0	1	0	0	0	0	0	0	0	6	0.8
29-Aug	8.00	0	0	6	0	0	0	1	0	0	0	0	0	0	0	7	0.9
30-Aug	7.00	0	0	0	0	1	0	3	0	0	0	1	0	0	0	5	0.7
31-Aug	7.50	0	1	2	0	0	0	4	0	0	0	0	0	0	0	7	0.9
01-Sep	8.00	0	4	0	0	0	0	1	0	0	0	0	0	0	0	5	0.6
02-Sep	8.00	0	3	2	0	0	0	1	0	0	0	0	0	0	0	6	0.8
03-Sep	8.00	0	1	7	0	0	0	1	0	0	0	0	0	0	0	9	1.1
04-Sep	0.00																
05-Sep	7.00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0.3
06-Sep	8.00	0	1	1	0	0	0	1	0	0	0	0	0	0	0	3	0.4
07-Sep	8.00	0	0	1	0	0	0	2	0	0	0	0	0	0	0	3	0.4
08-Sep	7.75	0	3	2	1	0	0	1	0	0	0	0	0	0	0	7	0.9
09-Sep	7.50	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	0.3
10-Sep	8.00	0	5	1	0	0	0	4	0	0	0	0	0	0	0	10	1.3
11-Sep	7.75	0	10	5	0	0	0	3	0	0	0	0	1	0	0	19	2.5
12-Sep	8.00	0	7	3	0	0	0	2	0	0	0	0	0	0	0	12	1.5
13-Sep	8.00	0	2	0	0	0	0	1	0	0	0	0	0	0	0	3	0.4
14-Sep	7.50	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2	0.3
15-Sep	7.75	0	3	0	0	0	0	1	0	0	0	0	1	0	0	5	0.6
16-Sep	0.00																
17-Sep	0.00																
18-Sep	3.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
19-Sep	0.00																
20-Sep	7.50	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0.3
21-Sep	7.75	1	8	3	0	0	0	0	0	0	0	0	0	0	0	12	1.5
22-Sep	8.00	0	4	2	1	0	0	1	0	0	0	0	1	0	0	9	1.1
23-Sep	1.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24-Sep	8.00	0	7	3	0	0	0	2	0	0	0	0	0	0	0	12	1.5
25-Sep	8.00	0	3	3	0	0	0	0	0	0	0	0	0	0	0	6	0.8
26-Sep	8.00	0	6	3	0	0	0	3	0	0	0	0	1	0	0	13	1.6
27-Sep	8.00	0	16	7	0	0	0	1	0	0	0	0	1	0	0	25	3.1
28-Sep	0.00																
29-Sep	0.00																
30-Sep	0.00																
01-Oct	0.00																
02-Oct	0.00																
03-Oct	0.00																
04-Oct	0.00																
05-Oct	3.00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3
06-Oct	0.00																

Appendix F. continued

STATION		SPECIES ¹														TOTAL CAPTURES/HR	
DATE	HOURS	NH	SS	CH	NG	RS	BW	RT	RL	GE	BE	AK	ML	PR	PG		
07-Oct	0.00																
08-Oct	4.25	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
09-Oct	7.25	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0.4
10-Oct	0.00																
11-Oct	6.50	0	13	0	0	0	0	0	0	0	0	0	0	0	0	13	2.0
12-Oct	7.25	0	11	1	0	0	0	0	0	0	0	0	1	0	0	13	1.8
13-Oct	8.00	0	13	4	0	0	0	1	0	0	0	0	1	0	0	19	2.4
14-Oct	8.00	0	28	4	0	0	0	1	0	0	0	0	0	0	0	33	4.1
15-Oct	4.75	0	14	1	0	0	0	0	0	0	0	0	0	0	0	15	3.2
16-Oct	0.00																
17-Oct	0.00																
18-Oct	0.00																
19-Oct	0.00																
20-Oct	0.00																
21-Oct	0.00																
22-Oct	7.50	0	15	0	0	0	0	1	0	0	0	0	0	0	0	16	2.1
23-Oct	7.50	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3	0.4
24-Oct	3.25	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	0.6
25-Oct	6.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26-Oct	7.00	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.1
27-Oct	7.50	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2	0.3
28-Oct	7.50	0	4	1	0	0	0	0	0	0	0	0	0	0	0	5	0.7
29-Oct	7.50	0	3	0	0	0	0	0	0	0	0	0	1	1	0	5	0.7
30-Oct	7.50	0	4	1	0	0	0	0	0	0	0	0	0	0	0	5	0.7
Total	317.25	1	200	74	3	1	0	42	0	0	0	1	9	2	0	333	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, Oregon: 1995–2007.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	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	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	30-Oct		
Number of stations	1	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	45	39.5	
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	317.25	250.56	
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	10.5	11.5	
SPECIES	RAPTOR CAPTURES														
Northern Harrier	0	1	0	2	1	1	0	6	4	2	7	2	1	2	27
Sharp-shinned Hawk	18	80	139	163	82	161	171	172	268	218	309	259	200	172	2240
Cooper's Hawk	0	20	29	43	14	67	74	71	64	90	101	88	74	57	735
Northern Goshawk	1	7	7	3	3	8	11	7	12	13	12	10	3	7	97
Red-shouldered Hawk	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Broad-winged Hawk	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Red-tailed Hawk	2	14	39	29	36	66	66	108	73	61	67	106	42	55	709
Rough-legged Hawk	0	0	1	0	1	0	1	0	0	0	1	1	0	0	5
Golden Eagle	0	3	2	1	2	3	2	0	2	1	3	6	0	2	25
Bald Eagle	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
American Kestrel	0	0	0	0	1	0	1	0	0	0	0	2	1	0	5
Merlin	1	2	5	11	3	1	4	5	4	4	13	12	9	6	74
Prairie Falcon	0	0	1	4	0	1	0	1	3	4	3	4	2	2	23
Peregrine Falcon	0	0	0	0	0	2	0	1	0	0	4	1	0	1	8
All species	22	127	223	256	143	311	330	371	430	393	521	491	333	304	3951
Recaptures ¹	0	0	0	0	0	0	0	0	0	2	1	1	0	0.3	4
Foreign Recaptures ²	0	0	1	2	0	0	1	0	2	2	3	1	1	1.0	13
Foreign Encounters ³	1	0	1	2	6	3	2	5	8	2	9	6	6	4.2	54

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.