FALL 2009 RAPTOR MIGRATION STUDIES AT BONNEY BUTTE, OREGON

HawkWatch International, Inc.
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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 (Hoffman et al. 2002, Smith et al. 2008a). 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 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 2009 season marked the 16th consecutive count and the 15th consecutive season of trapping and banding conducted at the site by HWI. This report summarizes the 2009 count and banding results.

The Bonney Butte project was 1 of 10 long-term, annual migration counts and 1 of 5 migration-banding studies conducted or co-sponsored by HWI in North America during 2009. The primary objective of these efforts is to track long-term population trends of diurnal raptors in western North America and around the Gulf Coast region (Hoffman and Smith 2003; Smith et al. 2001, 2008a, b). Raptors serve as important biological indicators of ecosystem health (Bildstein 2001) and long-term migration counts are one of the most cost effective and efficient methods for monitoring the regional status and trends of multiple raptor species (Zalles and Bildstein 2000, Bildstein et al. 2008).

The intensive counting and banding operations, along with related research activities such as satellite tracking of migrants, also provide valuable information about species' ranges, migratory routes and behaviors, and population demographics (e.g., Hoffman et al. 2002, Lott and Smith 2006, Goodrich and Smith 2008), as well as affording rich opportunities for a variety of other biological assessments and studies (e.g., DeLong and Hoffman 2004, McBride et al. 2004). This information helps us understand the life histories, ecology, status, and conservation needs of raptor populations in North America. In addition, these migration studies offer unique opportunities for the public to learn about raptors and the natural environment, and providing such opportunities is another important component of all HWI migration projects.

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). Lead Observer James Butch had two seasons of prior raptor migration counting experience with HWI, including counting at Bonney Butte in 2008, whereas this was official observer Glen McHargue's first season of raptor migration counting (see Appendix A for a complete observer history). As is typical for the site, on-site educator Nicholle Stephens frequently assisted with the count; this was her second

season of exposure to raptor migration counting at Bonney Butte. 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 2009 data follows Hoffman and Smith (2003). In comparing 2009 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2009 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 2009, including forcing the operation to be shut down six days early, and reduced observation time to ≤4 hrs on 3 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 higher than the 1997–2008 (the period for which detailed summary data have been compiled) average of 12.5 days, whereas the number of otherwise severely hampered days was slightly below the long-term average of 5.5 days.

Weather data collected on site during active observation periods reflected an above-average prevalence of days featuring mostly cloudy to overcast skies (35% vs. 1997–2008 average of 26%), a below-average

prevalence of days featuring predominantly clear to partly cloudy skies (41% vs. average of 51%), and a near-average prevalence (24% vs. average of 23%) of days with transitional weather (defined as days that changed from fair or partly cloudy to mostly cloudy or overcast skies during the day, or vice versa). The proportion of active days that featured noteworthy levels of visibility reducing fog and/or haze (41%) was well below average (59%), however, whereas the proportion of active observation days that featured some rain or snow (16%) was slightly above average (12%). The daily-average temperature (average of hourly values for each day) during active observation periods averaged 15.9°C, ranging from 2.2–27.8°C. The annual average was 2.5°C higher than the 1997–2008 grand average of 13.4°C and the second highest recorded since 1997; however, the minimum and maximum daily values fell well within the normal ranges of variation. Thermal lift was rated good to excellent on only 18% of the active days, which is the third lowest value yet recorded (lowest in 2008) and substantially below the 1997–2008 average of 39%.

Similar to five of the past six years, days where light winds (<12 kph) prevailed were particularly prevalent in 2009 (98% of the active days vs. 1997–2008 average of 86%), whereas the proportions of active observation days that featured predominantly moderate (12–29 kph) or strong (>29 kph) winds were below average (2% and 0% vs. averages of 13% and 1%, respectively). In terms of wind directions, 2009 was similar to the average pattern in that westerly winds were most common. Relatively consistent SW-W winds typically are the most common pattern at this site, with an average prevalence of 30% of the active days plus another 3% where other wind patterns intervened for a noteworthy portion of the day. Similar to 2008, however, in 2009 steadier SW-W winds were much less common than usual (20%), whereas the SW-W/variable pattern was much more common than usual (18%). More variable SW-NW winds prevailed throughout the day on an average 12% of the active days. Days featuring those winds but also significant periods of easterly winds also occurred on a near-average proportion of days (12% vs. average of 11%); however, days featuring primarily SW-NW winds but also noteworthy periods of highly variable wind directions occurred on an above-average 9% of the active days (average 1%). As usual, storm-bringing NE-E and NE-E/variable winds also were among the most prevalent patterns, with each prevailing on 6% of the active days, but the total of the two patterns was slightly below average (15%). In contrast, more variable NE-SE winds and NE-SE/variable winds were much more prevalent than usual, prevailing on a combined total 16% of the active days versus an average of only 3%. Other patterns that were noticeably less prevalent than usual included W-NW and VARIABLE (both 0% in 2009 vs. averages of 5%)

In summary, compared to averages for the past 12 years, inclement weather shut down the project six days earlier than hoped for and contributed to a higher-than-average prevalence of active days with overcast skies and scattered rain and snow showers. That said, visibility reducing fog and haze were less common than usual in 2009 and the observer's visibility ratings averaged among the highest to date. Wind speeds averaged lighter than usual and, although westerly winds still averaged most prevalent overall, easterly winds were more common than usual and many west wind days featured spates of variable winds more often than usual. The temperature regime also was warmer than average.

COUNT SUMMARY

The observers worked on only 51 of 66 possible days between 27 August and 31 October 2009, which stands in start contrast to last year's record high of 60 days but exactly matches the long-term average for the site (51 ± 95% CI of 3.2 days). Moreover, the number of observation hours (425.75) was well above the 1994–2008 average of 372.96 ± 33.801 hours. The 2009 average of 2.9 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was a significant 20% above the long-term average of 2.4 ± 0.24 observers per hour.

The observers counted 2,817 migrant raptors of 16 species, with the count a non-significant 2% below the 1994–2008 average (Table 1, and see Appendix D for daily count records). No record low or high species-specific counts occurred in 2009; however, the count of Red-tailed Hawks dropped to the second lowest yet—only two birds more than last year's record low (see Appendix E for annual count

summaries). In contrast, after five years of low counts, the count of American Kestrels bounced back to the third highest to date.

The 2009 flight was composed of 56% accipiters, 22% buteos, 11% vultures, 4% eagles, 4% falcons, 4% Ospreys, 1% harriers, and <1% unidentified raptors. The season featured significantly higher than average proportions of vultures and Ospreys, and significantly below average proportions of buteos, eagles, and unidentified raptors (Figure 2). As usual, the Sharp-shinned Hawk was by far the most abundant species (40% of total count), followed by the Turkey Vulture (17%), Red-tailed Hawk (13%), Cooper's Hawk (12%), Osprey (4%), Merlin (3%), Golden Eagle (2%), and Bald Eagle (2%; Table 1, Appendix E).

Passage Rates and Long-term Trends

Adjusted passage rates were significantly above average in 2009 for 3 species (Turkey Vulture, Osprey, and Peregrine Falcon), but were significantly below average for 7 species (Northern Goshawk, Swainson's Hawk, Red-tailed Hawk, Ferruginous Hawk, Rough-legged Hawk, Golden Eagle, and Prairie Falcon; Table 1; Figures 3–8). Updated regression analyses (after Hoffman and Smith 2003) of adjusted passage rates through 2009 revealed a significant ($P \leq 0.05$) overall decline for Red-tailed Hawks and a marginally significant ($P \leq 0.10$) decline for Ferruginous Hawks (Figure 6), a significant species-level decline for Golden Eagles, and a highly significant ($P \leq 0.01$) overall decline for 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 nine years, but five times during the previous seven years (Appendix E). The decline in Golden Eagle numbers is most pronounced among adult birds (highly significant linear decline), but passage rates of both adult and non-adult birds have dropped to record lows in the past few years (Figure 7). Except for an unusual high peak in 1997, passage rates of American Kestrels declined gradually most years from the beginning of the project through 2005, but since then have increased again at least slightly in most years and finally returned to a modest level in 2009 (Figure 8). At the species level, no significant trend currently is indicated for the Northern Goshawk (Figure 4); however, marginally significant declines are indicated for immature birds alone ($P = 0.075$) and for the ratio of immature to adult birds ($P = 0.069$). The Peregrine Falcon was the only other species for which a significant trend was indicated (Figure 8). Overall, this species is showing a strong, long-term increase; however, the count dropped markedly in 2006 and again slightly in 2007, but then increased again the past two years.

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, however, passage rates dropped again through 2007 but then, in many cases, appeared to start rebounding again in 2008 and 2009. These fluctuations likely reflect a complex mix of factors relating to climatic trends and effects on both population viability and migration geography (e.g., see Goodrich and Smith 2008 and Smith et al. 2008a).

Smith et al. (2008a) 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 complex analytical approach (also see Farmer et al. 2007) than that represented in Hoffman and Smith (2003) and used herein to present analyses updated through 2009. 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).

Differences between the RPI results and those presented herein that clearly relate to addition of four more years of data include: a) addition of three low to moderate counts from 2006–2008 eliminated a marginally significant increasing trend for Turkey Vultures shown in the RPI analyses; b) addition of four years of low counts, including a new record low in 2008, resulted in a significant long-term decline for Red-tailed Hawks beginning in 2008; and c) addition of four years of low counts resulted in a significant long-term decline for Golden Eagles in the 2008 analyses. Otherwise, for all remaining species analyzed in common, the RPI analyses of data through 2005 and the updated analyses of data through 2009 presented herein indicate the same conclusions; i.e., a highly significant ($P < 0.01$) decline for American Kestrels (averaging 7.9 ± 95% CI of 3.7% per year; Smith et al. 2008a) and no statistically significant trends ($P > 0.10$) for all other commonly analyzed 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 will be published in the fourth 2009 issue of the Journal of Raptor Research, 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 press).

Age Ratios

Among nine species for which reasonable age-specific comparisons were possible, Sharp-shinned Hawks, Cooper's Hawks, Red-tailed Hawks, and Bald Eagles showed significantly above-average immature : adult ratios in 2009, whereas Northern Harriers and Northern Goshawks showed significantly below average immature : adult ratios (Table 2). Note, however, that substantial variation in proportions of aged birds likely confound these comparisons for all but Red-tailed Hawks and Golden Eagles (Table 2). For the latter two species, counts of both age groups were well below average, suggesting that low adult survivorship (or perhaps simply low representation due to late passage or short-stopping to the north) was the primary cause of the high age ratios rather than high productivity and juvenile recruitment.

Seasonal Timing

The 2009 combined-species median passage date of 24 September was a significant six days earlier than the long-term average for the site (Table 3). The seasonal distribution of activity also was unusual in showing significantly above-average proportional activity from 11–25 September, a substantial reduction in proportional activity compared to the usual pattern in late September/early October, and then a complete absence of activity after 25 October due to the early weather-related closure (Figure 9). From 29 September through 4 October, observations occurred on only two days for a total of only 10 hours due to the first major snow storm of the season (Appendix C). Species-level median passage dates reflected a mixed pattern, however, with only 8 of 14 species for which a comparison was possible showing significantly earlier than average median passage dates in 2009 and three species (Northern Harrier, Northern Goshawk, and Peregrine Falcon) showing significantly late timing (Table 3). The only consistency within species groups was that all four buteos for which a comparison was possible were significantly earlier than average. Age-specific median dates generally followed the same patterns as the species-level data, except for clarifying significantly late timing for immature Northern Goshawks but significantly early timing for adults (Table 4).

RESIDENT RAPTORS

At least two light-morph Red-tailed Hawks resided in the area this season, an adult seen first on 28 August and last on 19 October, and a juvenile first positively identified on 31 August and last seen on 22 October.

A Sharp-shinned Hawk demonstrating resident behavior around the butte was first seen on 27 August and was identified as an immature bird a few days later. It remained in the area through 24 September, often seen swooping on the north owl or rising off the south side of the butte and heading towards the banding station. An immature Cooper's Hawk also was first seen on 27 August and remained in the area through 6 October. At one point, the crew also spotted an adult Cooper's Hawk in the east valley headed north and did not count this bird as a migrant, but then never witnessed another apparent resident adult.

The observers recorded multiple sightings of Golden and Bald Eagles during the season that they did not record as migrants due to atypical flight paths or behaviors. On 1 September, a Golden Eagle rose up out of the White River Valley to the west and headed north over banding. On 30 October, two Bald Eagles were seen together above Mt. Adams before separating, one heading north and the other east. Other sightings of apparently resident Bald Eagles occurred on 1, 3, 8, and 9 September.

These data suggest a limited resident assemblage compared to the usual scene. Northern Goshawks and American Kestrels typically are included; adult Sharp-shinned and Cooper's Hawks often are more apparent; Red-tailed Hawks usually are more apparent; and sightings of local Golden Eagles have diminished markedly since 2001.

TRAPPING AND BANDING SUMMARY

Trapping occurred on only 49 of 66 possible days between 27 August and 31 October, with effort totaling 359.5 hours (see Appendix F for daily trapping records and Appendix G for annual trapping summaries). Nevertheless, the number of trapping days was 9% above the 1997–2008 (period of comparable seasonal effort) average of 44.9 ± 95% CI of 5.9 days, and the hours of effort was a significant 24% above the 1997–2008 average of 291.0 ± 45.23 hours.

The 2009 capture total of 498 birds of 10 species was a highly significant 59% above average (Table 5). The captures included two recaptures of birds previously banded elsewhere, a new record-high capture total for Sharp-shinned Hawks, an amazing two Bald Eagles (bringing the project total to 3!), only the seventh American Kestrel ever caught at the site, and a tie for the second highest tally of Merlins (Appendix G). The 2009 effort raises the total number of birds captured since project inception to 4,878. As usual, the three most frequently captured species were the Sharp-shinned Hawk (68% of captures), Cooper's Hawk (20%), and Red-tailed Hawk (8%).

The capture totals, rates, and successes were all above average in 2009 for six species, with all significantly so for Sharp-shinned and Cooper's Hawks, Bald Eagles, and Merlins (Table 5). No other species showed any significantly above average values in 2009. In contrast, all three metrics were significantly below average for Northern Goshawks and Peregrine Falcons.

At this site, compared to the counts, banding data yield unique and useful sex–age specific data only for the three accipiters. In 2009, the immature : adult ratio for Sharp-shinned Hawks derived from the banding data was 9% below average (Table 6), whereas the count age ratio was 73% above average (Table 2); nevertheless, as is typical for the site, the banding age ratio (1.6) remained higher than the count age ratio (1.3). In combination, these data suggest that immature birds were more susceptible to capture than adults, which is typical, but to a much lesser degree than usual. This suggests that, similar to last year, immature birds were both more abundant and healthier than average in 2009. Again similar to last year, the capture data also indicated an average female : male ratio (Table 6).

For Cooper's Hawks, the 2009 capture age ratio was a significant 25% above average (Table 6), whereas the count age ratio was a highly significant 156% above average (Table 2). Atypically, this resulted in the count age ratio of 4.2 being much higher than the capture age ratio of 2.9. In combination, these data suggest that immature Cooper's Hawks were proportionately more abundant and less susceptible to capture (less hungry) than usual in 2009. Similar to Sharp shinned Hawks, the capture data indicated an average female : male ratio for Cooper's Hawks in 2009 (Table 6).

For Northern Goshawks, the 2009 count age ratio (0.6) was a significant 73% below average (Table 2) and the capture age ratio (2.0) was a non-significant 27% below average (Table 6). In combination, the available data suggest that immature northern goshawks were relatively scarce and more susceptible to capture (hungrier) than usual in 2009.

Another way to assess the relative condition of the three accipiter 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, these proportional measures indicated slightly more birds with empty crops, but more birds with healthy keels and good fat stores. For Northern Goshawks, all three captured birds had empty crops, normal keels, and at least some wing-pit fat, suggesting an overall similar pattern as for the two smaller accipiters. Thus, the body condition data appear to support the age ratio inferences in suggesting that the relatively high abundance of young Sharp-shinned and Cooper's Hawks was correlated with good overall body condition and proportionately lower susceptibility to capture of young birds compared to adults. Conversely, the messages were a bit mixed for goshawks, but this may be due to the influence of low overall sample sizes on which to base meaningful comparisons.

ENCOUNTERS WITH BANDED BIRDS

To date, 67 birds banded at Bonney Butte have subsequently been encountered elsewhere, with eight new "foreign encounters" recorded in 2009 involving 3 Sharp-shinned Hawks, 2 Cooper's Hawks, and 3 Red-tailed Hawks (Table 8). All of the new encounter locations fell within the expected confines of the Pacific Coast Flyway; i.e., along the Cascade-Sierra Nevada ranges and westward from southern British Columbia to Baja California (Hoffman et al. 2002). One hatch-year Sharp-shinned Hawk was banded on 13 September at Bonney Butte and was recaptured and released 10 days later at Golden Gate Raptor Observatory's (GGRO) site in the Marin Headlands of California, which translates to an average pace of 68 km/day. One of the Red-tailed Hawks, banded at Bonney Butte as an after-hatch-year adult in 2006, was taken to a rehabilitation center in June 2009 after it collided with a vehicle near Lacey, Washington ~211 km north-northwest of Bonney Butte. All the other birds were reported as simply found dead of unknown causes in locations ranging from the Tacoma area of Washington, to various areas of Oregon from Mt. Hood to the Klamath Basin, and south into northern California.

Fifteen birds banded elsewhere have been recaptured at Bonney Butte, with two new "foreign recaptures" in 2009. The new foreign recaptures both involved female Cooper's Hawks originally banded as hatch-birds by GGRO ~682 km to the south on the central coast of California in 2005 and 2008.

VISITATION

Visitation to the site occurred from 30 August through 24 October on 31 of 50 potential visitor days. A total of 220 individuals visited during the season, with ~35% of those having been to the site in previous years. The average length of stay for visitors was about two hours, but was highly variable from 20 minutes to seven hours. The largest visitation day (36 individuals) was 26 September when Portland Audubon brought a group to the site. The ages of visitors ranged from roughly 1–80 years old. Most visitors originated in Oregon; others came from nearby Vancouver, Washington, Vermont, and Michigan. A second Portland Audubon group had planned to visit but was thwarted by inclement weather.

In 2009, 431 hourly assessments of visitor disturbance by the primary observers resulted in the following ratings: 75% none, 19% low, 5% moderate, and 1% high. These ratings reflect a typical level of disturbance for the site during the past few years, but a higher level than was typical prior to 2006 when we implemented stricter regulations governing public visitation to the trapping blind.

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Table 1. Fall raptor migration unadjusted counts and adjusted passage rates by species at Bonney Butte, OR: 1994–2008 versus 2009.

	COUNT			RAPTORS / 100 HOURS		
SPECIES	1994–2008[1]	2009	% CHANGE	1994–2008[1]	2009	% CHANGE
Turkey Vulture	294 ± 60.0	469	+60	97.3 ± 20.27	127.3	-24
Osprey	64 ± 10.3	101	+59	23.1 ± 4.22	29.5	-9
Northern Harrier	29 ± 6.7	33	+16	8.6 ± 2.04	8.6	-52
Sharp-shinned Hawk	1092 ± 165.4	1110	+2	383.4 ± 60.17	327.0	-25
Cooper's Hawk	339 ± 44.3	339	0	119.5 ± 19.32	102.4	-18
Northern Goshawk	27 ± 5.4	18	-33	8.1 ± 1.76	5.1	-5
Unknown small accipiter[2]	32 ± 25.0	71	+123	–	–	–
Unknown large accipiter[2]	5 ± 3.8	6	+17	–	–	–
Unknown accipiter	63 ± 25.3	0	-100	–	–	–
TOTAL ACCIPITERS	1541 ± 201.5	1544	0	–	–	–
Red-shouldered Hawk	1 ± 1.0	1	-29	0.5 ± 0.35	0.3	+25
Broad-winged Hawk	7 ± 9.6	10	+40	4.0 ± 5.03	6.1	-32
Swainson's Hawk	1 ± 0.4	0	-100	0.2 ± 0.15	0.0	-100
Red-tailed Hawk	573 ± 78.9	361	-37	180.4 ± 30.17	95.8	-55
Ferruginous Hawk	0 ± 0.3	0	-100	0.1 ± 0.08	0.0	-100
Rough-legged Hawk	14 ± 4.2	8	-41	9.3 ± 2.89	5.4	-15
Unidentified buteo	30 ± 7.8	3	-90	–	–	–
TOTAL BUTEOS	626 ± 89.4	383	-39	–	–	–
Golden Eagle	87 ± 17.2	63	-27	28.9 ± 6.11	17.7	-57
Bald Eagle	47 ± 5.2	55	+17	14.1 ± 1.64	15.5	-12
Unidentified eagle	3 ± 1.5	5	+56	–	–	–
TOTAL EAGLES	137 ± 17.8	123	-10	–	–	–
American Kestrel	20 ± 3.8	27	+35	6.4 ± 1.45	6.8	-28
Merlin	67 ± 11.7	71	+6	25.5 ± 5.10	23.6	-36
Prairie Falcon	5 ± 1.4	2	-58	1.7 ± 0.48	0.6	-55
Peregrine Falcon	7 ± 2.4	11	57	2.4 ± 0.94	3.8	+19
Unknown small falcon[2]	1 ± 1.2	0	-100	–	–	–
Unknown large falcon[2]	2 ± 2.4	2	+14	–	–	–
Unknown falcon	3 ± 1.3	0	-100	–	–	–
TOTAL FALCONS	103 ± 13.5	113	+10	–	–	–
Unidentified Raptor	24 ± 11.4	1	-96	–	–	–
ALL SPECIES	2817 ± 333.7	2767	-2	–	–	–

[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: 1994–2008 versus 2009.

	Total and Age-classified Counts								Immature : Adult Ratio	
	1994–2008 Average			2009			% Unknown Age			
	Total	Imm.	Adult	Total	Imm.	Adult	1994–2008[1]	2009	1994–2008[1]	2009
Northern Harrier	29	14	5	33	2	1	33 ± 5.9	91	4.1 ± 1.97	2.0
Sharp-shinned Hawk	1092	233	341	1110	435	336	47 ± 6.1	31	0.7 ± 0.17	1.3
Cooper's Hawk	339	101	75	339	192	46	48 ± 6.6	30	1.6 ± 0.62	4.2
Northern Goshawk	27	12	7	18	6	10	32 ± 7.9	11	2.2 ± 0.70	0.6
Broad-winged Hawk	7	1	1	10	1	8	38 ± 27.2	10	0.4 ± 0.35	0.1
Red-tailed Hawk	573	163	281	361	125	151	23 ± 4.1	24	0.6 ± 0.10	0.8
Golden Eagle	87	48	20	63	38	10	20 ± 3.4	24	3.3 ± 1.12	3.8
Bald Eagle	47	10	34	55	14	33	7 ± 3.4	15	0.3 ± 0.07	0.4
Peregrine Falcon	7	1	2	11	3	4	52 ± 4.4	36	0.8 ± 0.72	0.8

[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 2009, with a comparison of 2009 and 1994–2008 average median passage dates.

	2009				1994–2008
Species	First Observed	Last Observed	Bulk Passage Dates[1]	Median Passage Date[2]	Median Passage Date[2, 3]
Turkey Vulture	27-Aug	6-Oct	8-Sep – 26-Sep	22-Sep	22-Sep ± 1.2
Osprey	27-Aug	22-Oct	1-Sep – 27-Sep	16-Sep	19-Sep ± 1.7
Northern Harrier	1-Sep	24-Oct	12-Sep – 18-Oct	6-Oct	27-Sep ± 2.8
Sharp-shinned Hawk	27-Aug	25-Oct	15-Sep – 17-Oct	6-Oct	05-Oct ± 1.9
Cooper's Hawk	27-Aug	22-Oct	10-Sep – 7-Oct	22-Sep	26-Sep ± 1.7
Northern Goshawk	9-Sep	22-Oct	20-Sep – 19-Oct	7-Oct	02-Oct ± 3.4
Red-shouldered Hawk	9-Oct	9-Oct	–	–	26-Sep [4]
Broad-winged Hawk	13-Sep	28-Sep	13-Sep – 24-Sep	18-Sep	25-Sep ± 5.5
Red-tailed Hawk	27-Aug	24-Oct	9-Sep – 17-Oct	22-Sep	28-Sep ± 1.7
Rough-legged Hawk	6-Oct	24-Oct	6-Oct – 24-Oct	9-Oct	21-Oct ± 2.1
Golden Eagle	28-Aug	25-Oct	10-Sep – 22-Oct	9-Oct	12-Oct ± 1.8
Bald Eagle	30-Aug	25-Oct	23-Sep – 24-Oct	9-Oct	07-Oct ± 2.7
American Kestrel	27-Aug	8-Oct	31-Aug – 27-Sep	9-Sep	19-Sep ± 2.8
Merlin	12-Sep	22-Oct	16-Sep – 19-Oct	5-Oct	10-Oct ± 2.1
Prairie Falcon	10-Sep	25-Sep	–	–	19-Sep ± 6.1
Peregrine Falcon	20-Sep	24-Oct	25-Sep – 22-Oct	16-Oct	25-Sep ± 3.4
Total	2-Sep	25-Oct	11-Sep – 17-Oct	24-Sep	30-Sep ± 1.7

[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] Data for 2004 only.

Table 4. Median passage dates by age for selected species of migrating raptors at Bonney Butte, OR: 1994–2008 versus 2009.

	ADULT		IMMATURE	
SPECIES	1994–2008[1]	2009	1994–2008[1]	2009
Sharp-shinned Hawk	10-Oct ± 1.9	12-Oct	23-Sep ± 1.5	21-Sep
Cooper's Hawk	03-Oct ± 2.2	23-Sep	20-Sep ± 2.3	18-Sep
Northern Goshawk	13-Oct ± 5.3	27-Sep	29-Sep ± 5.5	7-Oct
Broad-winged Hawk	28-Sep [3]	18-Sep	–	–
Red-tailed Hawk	01-Oct ± 2.3	25-Sep	21-Sep ± 2.2	18-Sep
Golden Eagle	12-Oct ± 2.1	26-Sep	10-Oct ± 2.3	8-Oct
Bald Eagle	07-Oct ± 3.2	8-Oct	11-Oct ± 3.3	12-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.

[2] Data for 1999 only.

Table 5. Fall capture totals, rates, and successes by species for migrating raptors at Bonney Butte, OR: 1995–2008 versus 2009.

	CAPTURE TOTALS		CAPTURE RATES[1]		CAPTURE SUCCESS[2]	
	1995–2008[3]	2009	1995–2008[3]	2009	1995–2008[3]	2009
Northern Harrier	2 ± 1.1	3	0.7 ± 0.32	0.8	7.7 ± 3.82	9.1
Sharp-shinned Hawk	178 ± 42.5	337	66.3 ± 7.39	93.7	16.0 ± 4.20	29.0
Cooper's Hawk	60 ± 17.3	98	20.5 ± 4.54	27.3	17.3 ± 5.63	27.1
Northern Goshawk	8 ± 2.4	3	3.1 ± 0.68	0.8	35.5 ± 15.89	16.7
Red-shouldered Hawk	0 ± 0.2	0	0.0 ± 0.05	0.0	8.3 ± 10.69	0.0
Broad-winged Hawk	0 ± 0.2	0	0.0 ± 0.07	0.0	3.0 ± 4.18	0.0
Red-tailed Hawk	54 ± 16.0	39	19.4 ± 4.03	10.8	9.5 ± 3.20	10.7
Rough-legged Hawk	0 ± 0.3	0	0.2 ± 0.12	0.0	4.7 ± 4.80	0.0
Golden Eagle	2 ± 0.8	2	0.8 ± 0.37	0.6	2.3 ± 1.43	3.0
Bald Eagle	0 ± 0.1	2	0.0 ± 0.04	0.6	0.1 ± 0.25	3.5
American Kestrel	0 ± 0.3	1	0.2 ± 0.12	0.3	2.8 ± 2.50	3.7
Merlin	6 ± 2.1	12	2.3 ± 0.68	3.3	8.4 ± 2.81	16.9
Prairie Falcon	2 ± 0.8	1	0.6 ± 0.32	0.3	36.1 ± 16.99	50.0
Peregrine Falcon	1 ± 0.6	0	0.2 ± 0.19	0.0	5.5 ± 4.50	0.0
All species	313 ± 75.8	498	114.3 ± 13.74	138.5	13.4 ± 3.71	22.7

[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: 1995–2008 versus 2009.

		Female		Male		Female : Male	Immature : Adult
Species	Years	HY	AHY	HY	AHY	Ratio[1]	Ratio[1]
Sharp-shinned Hawk	1995–2008	55	41	56	26	1.2 ± 0.16	1.8 ± 0.45
	2009	114	70	93	60	1.2	1.6
Cooper's Hawk	1995–2008	25	14	16	4	2.0 ± 0.28	2.3 ± 0.46
	2009	49	16	24	9	2.0	2.9
Northern Goshawk	1995–2008	3	1	3	1	1.3 ± 0.82	2.7 ± 1.20
	2009	1	1	1	0	2.0	2.0

[1] Long-term values: mean ± 95% Confidence Interval (CI).

Table 7. Fall body condition indices for migrant accipiters captured at Bonney Butte, OR: 1995–2008 versus 2009.

		Crop Fullness					Keel Muscle[1]			Wing-pit Fat[2]			
Species	Years	E	1/4	1/2	3/4	F	0	1	2	0	1	2	3
Sharp-shinned	1995-2008 mean	53	23	12	5	7	1	71	28	10	59	23	8
Hawk	2009	68	13	10	3	7	0	67	33	9	38	41	12
Cooper's	1995-2008 mean	55	17	14	6	8	8	78	14	16	62	17	6
Hawk	2009	69	5	11	9	5	2	82	16	3	55	31	11
Northern	1995-2008 mean	61	17	5	5	12	12	83	4	13	72	14	0
Goshawk	2009	100	0	0	0	0	0	100	0	0	33	67	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 2009 of raptors banded during autumn migration at Bonney Butte, Oregon.

BAND #	SPECIES-SEX[1]	BANDING DATE	BANDING AGE[2]	ENCOUNTER DATE	ENCOUNTER AGE[2]	ENCOUNTER LOCATION	DISTANCE (km)	STATUS
1177-25220	RT-U	21-Oct-06	AHY	5-Jan-09	4th yr	Chiloquin, OR	255	found dead – cause unknown
1177-25197	RT-U	13-Oct-08	AHY	26-Jan-09	ASY	Philo, CA	606	found dead – cause unknown
1623-21384	SS-F	14-Oct-07	AHY	4-Feb-09	ATY	Yreka, CA	348	found dead – cause unknown
0804-22113	CH-M	27-Sep-07	HY	6-Apr-09	TY	Enumclaw, WA	177	found dead – cause unknown
1177-25217	RT-U	05-Oct-06	AHY	29-Jun-09	≥5th yr	Lacey, WA	211	car collision - rehab
0804-15487	CH-M	08-Sep-07	HY	29-Aug-09	TY	Wamic, OR	13	found dead – cause unknown
1483-55917	SS-F	13-Sep-09	HY	23-Sep-09	HY	Marin Headlands, CA	682	research recapture
1623-25643	SS-F	28-Sep-05	HY	6-Oct-09	HY	Sisters, OR	86	found dead – cause unknown

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

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

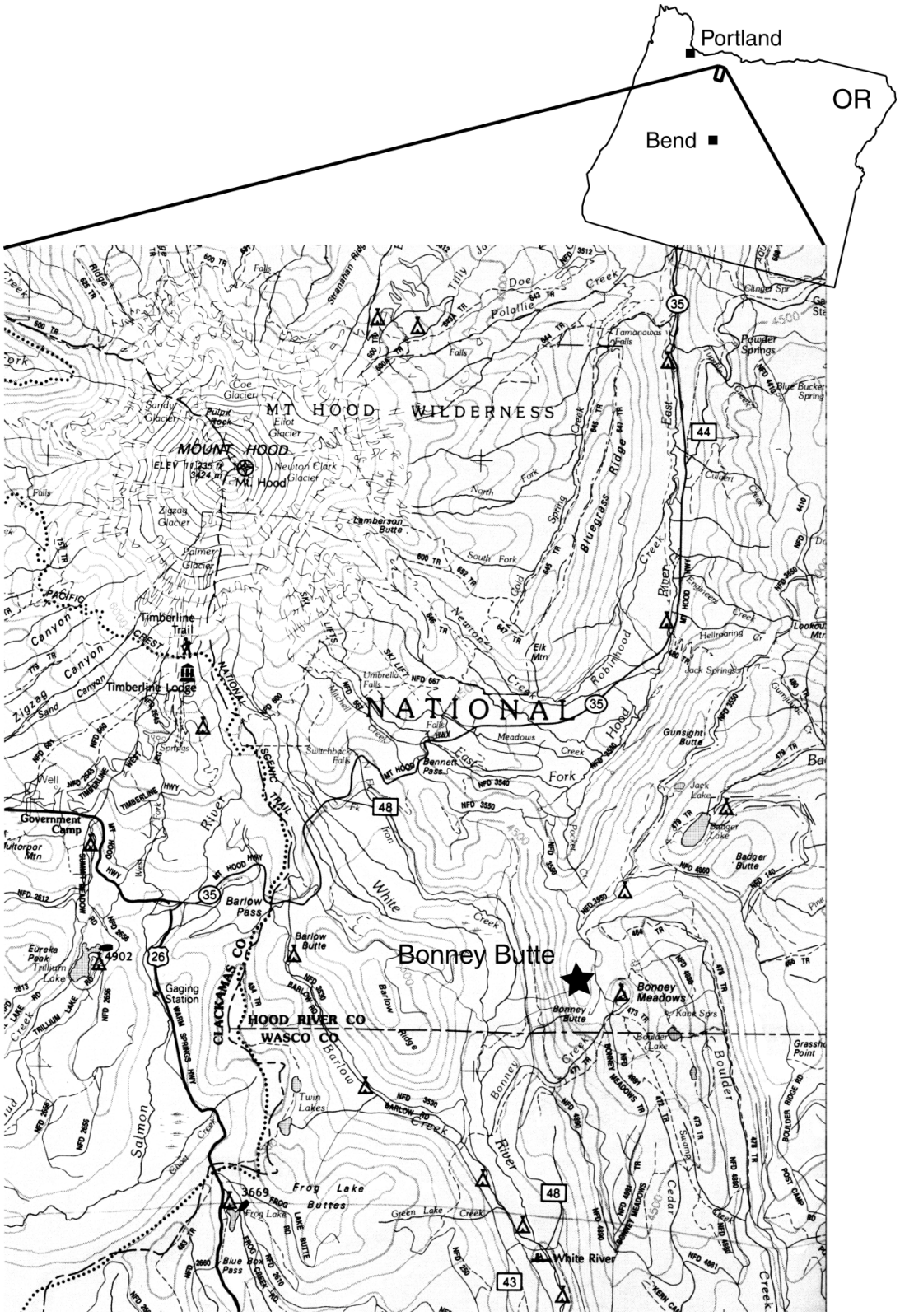

Figure 1. Location of the Bonney Butte Raptor Migration Project study site near Mt. Hood, Oregon.

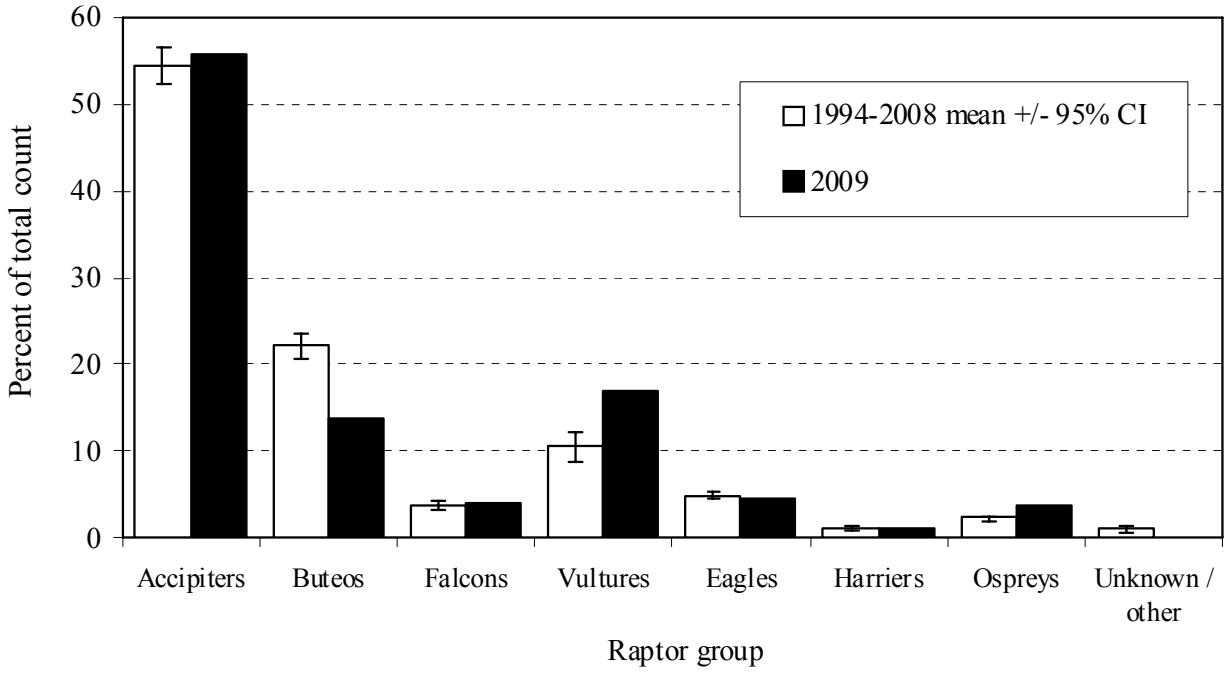

Figure 2. Fall raptor migration flight composition by major species groups at Bonney Butte, Oregon: 1994–2008 versus 2009.

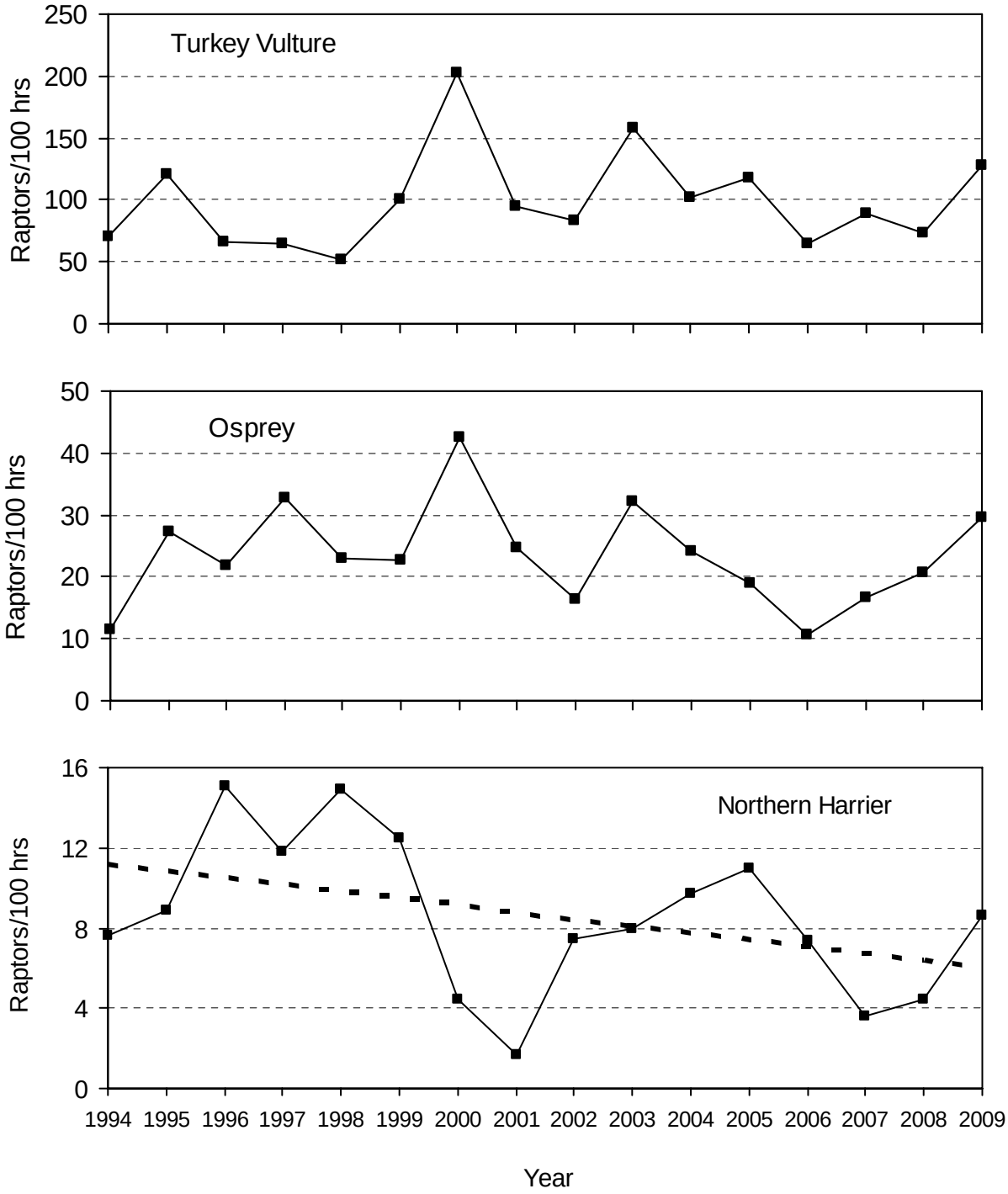

Figure 3. Adjusted, fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Bonney Butte, Oregon: 1994–2009. Dashed lines indicate significant ($P < 0.10$) regressions.

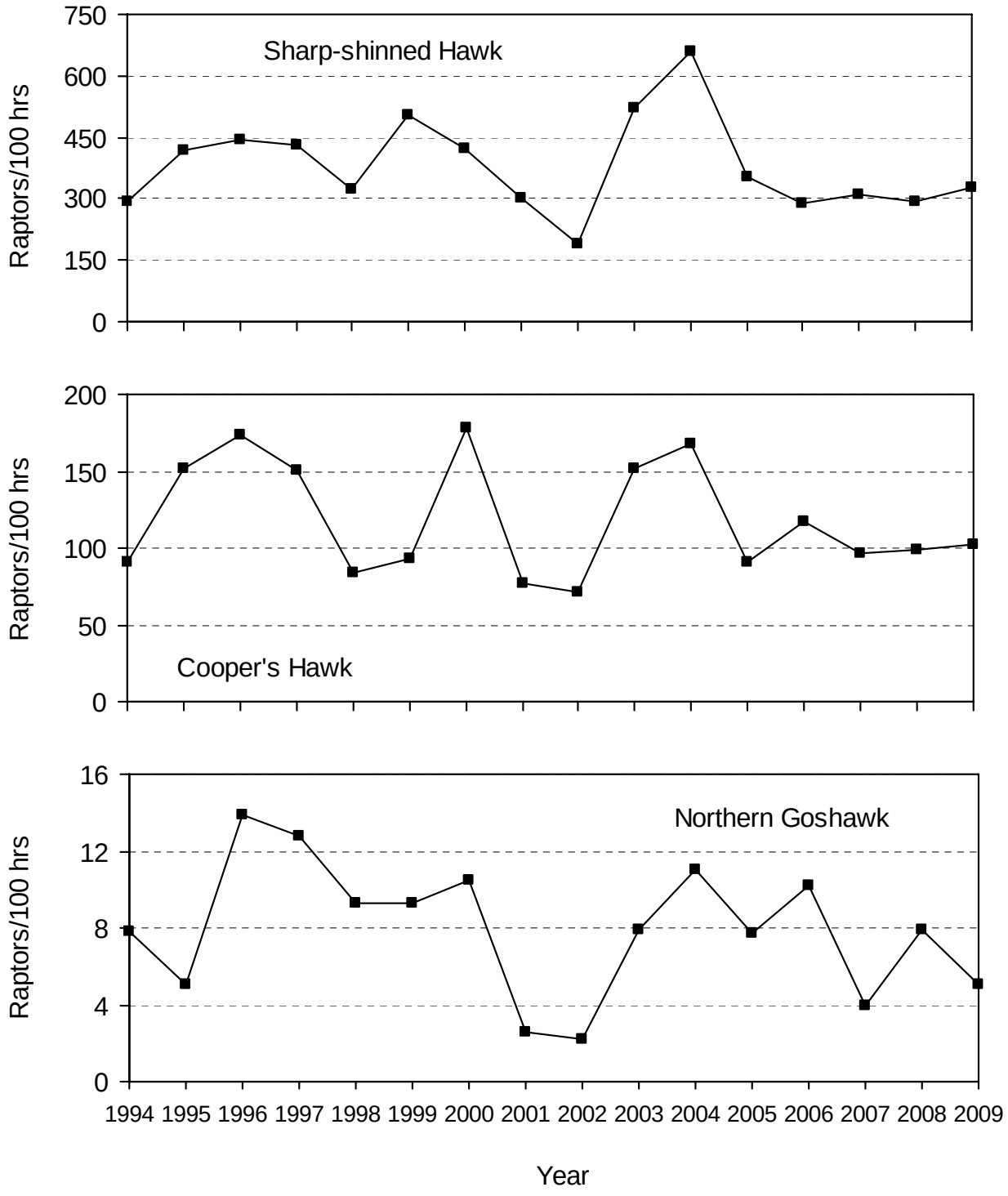

Figure 4. Adjusted, fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks at Bonney Butte, Oregon: 1994–2009. Dashed lines indicate significant (P < 0.10) regressions.

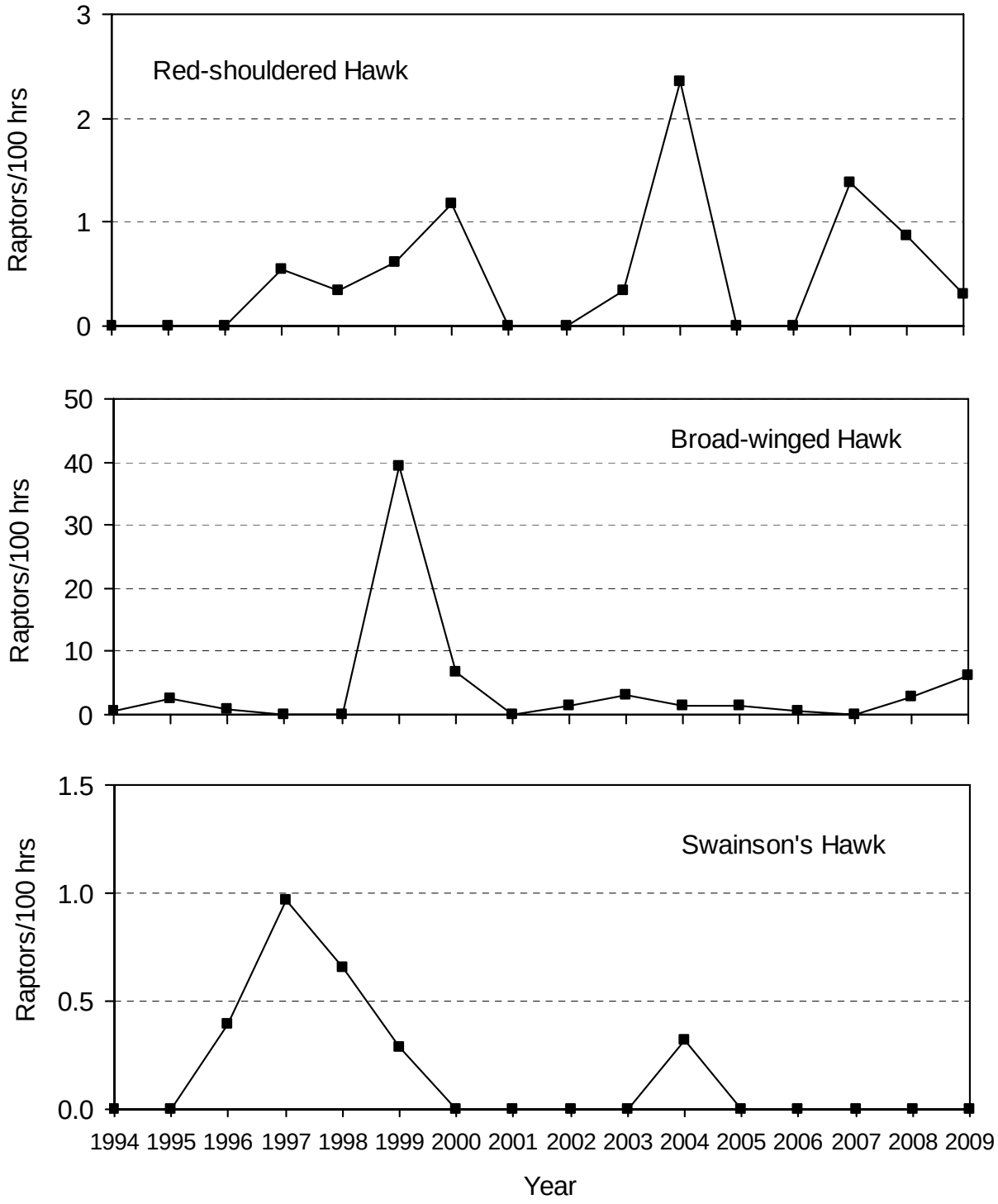

Figure 5. Adjusted, fall-migration passage rates for Red-shouldered, Broad-winged, and Swainson's Hawks at Bonney Butte, Oregon: 1994–2009. Dashed lines indicate significant ($P < 0.10$) regressions.

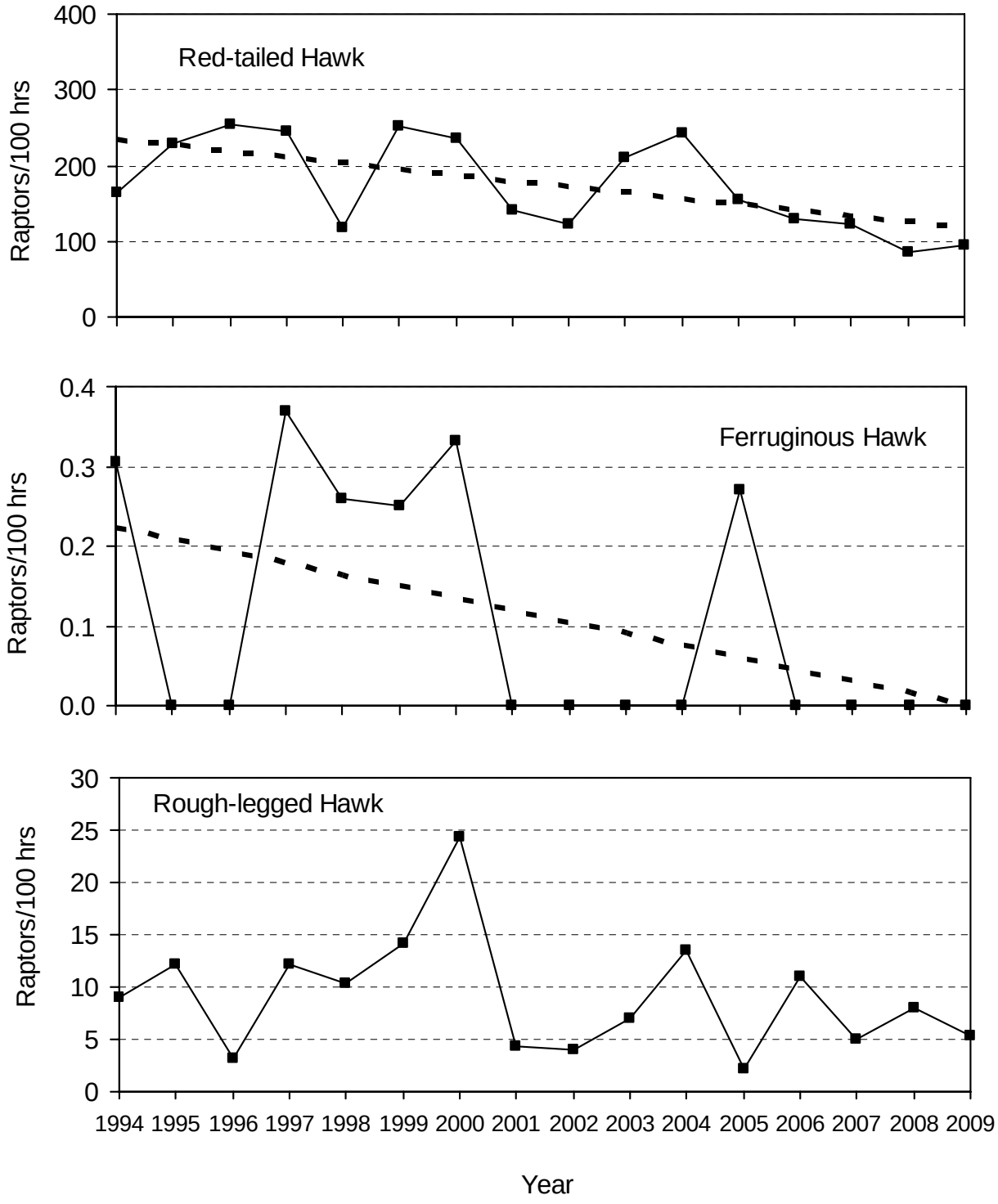

Figure 6. Adjusted, fall-migration passage rates for Red-tailed, Ferruginous, and Rough-legged Hawks at Bonney Butte, Oregon: 1994–2009. Dashed lines indicate significant ($P < 0.10$) regressions.

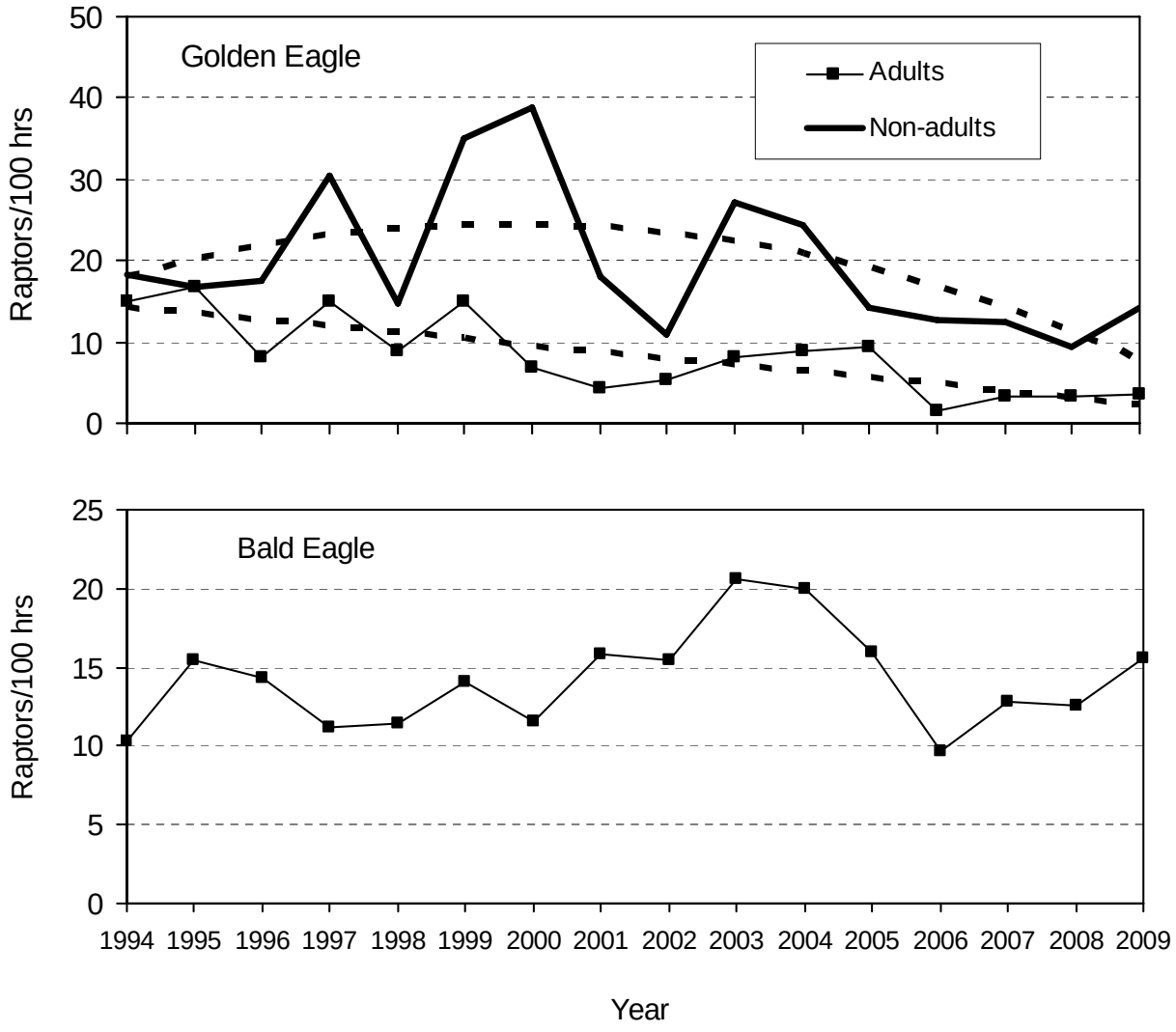

Figure 7. Adjusted, fall-migration passage rates for Golden and Bald Eagles at Bonney Butte, Oregon: 1994–2009. Dashed lines indicate significant ($P < 0.10$) regressions.

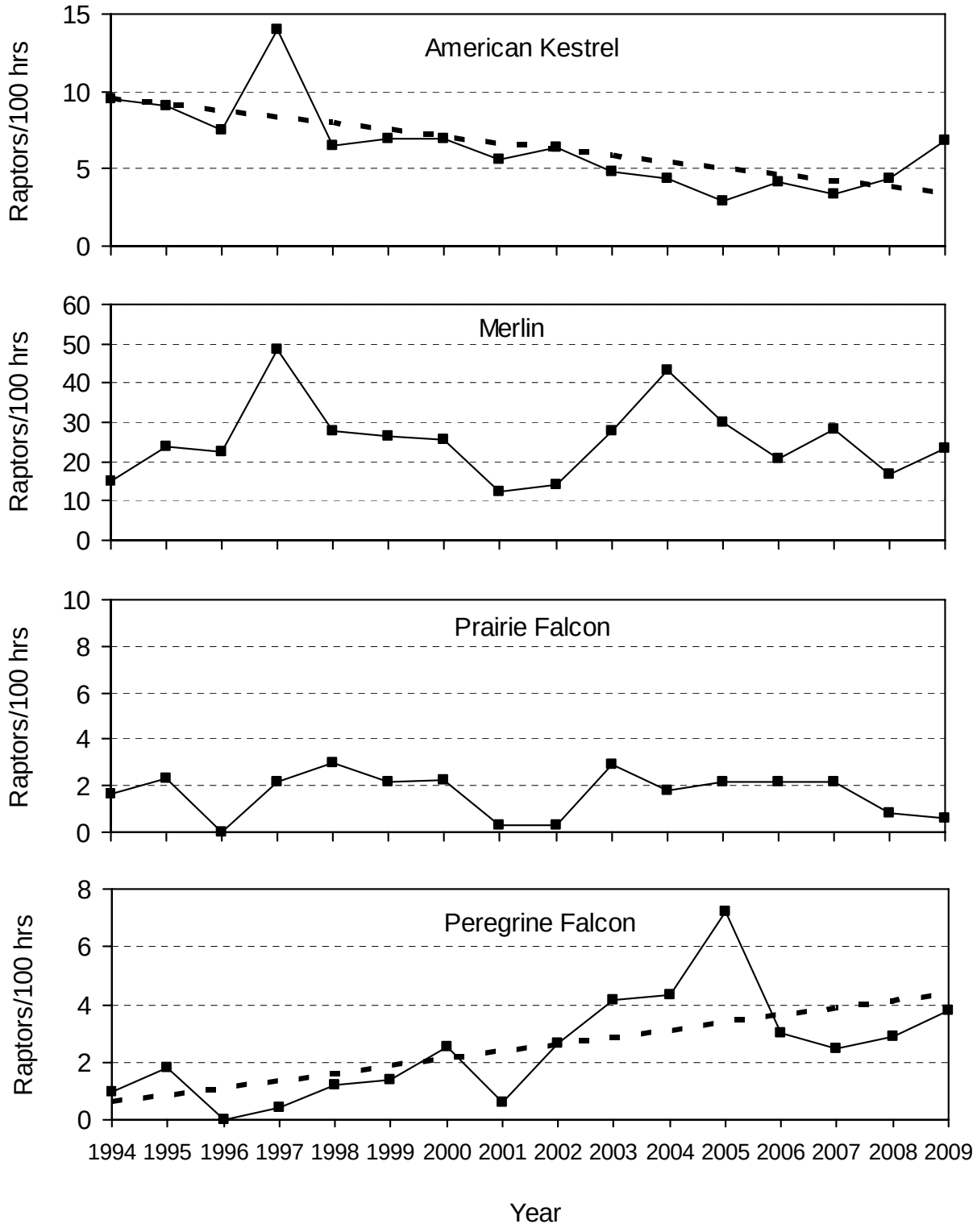

Figure 8. Adjusted, fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, Peregrine Falcons at Bonney Butte, Oregon: 1994–2009. Dashed lines indicate significant ($P < 0.10$) regressions.

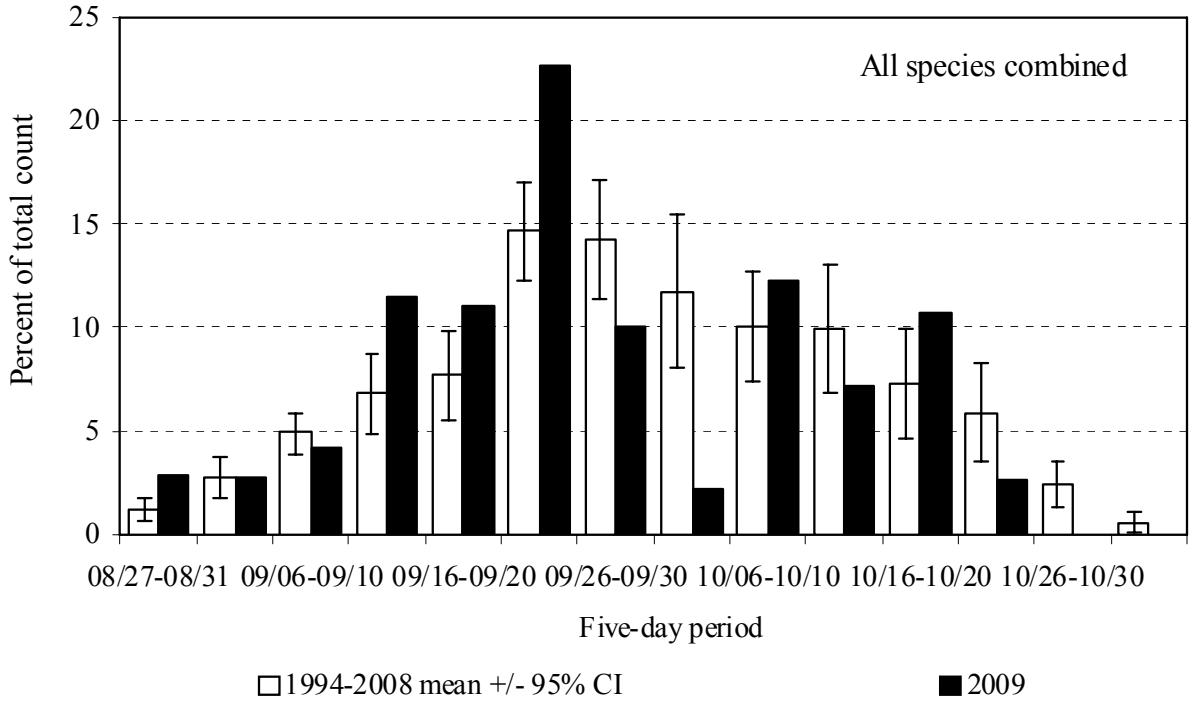

Figure 9. Combined-species passage volume by five-day periods for migrating raptors at Bonney Butte, Oregon: 1994–2008 versus 2009.

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 (+).

2005: Two observers throughout: Sean Wolfe (0) and Jim DeStaebler (0)

2006: Two observers throughout: Justin Feld (0) and Juliet Lamb (0).

2007: Two observers throughout: Mary Coolidge (1) and Sue Bruner (2)

2008: Two observers throughout: Aaron Viducich (1) and James Butch (0)

2009: Two observers throughout: James Butch (2) and Glen McHargue (0)

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

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

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

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

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

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

Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Bonney Butte Raptor Migration Project in northern Oregon: 2009.

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	2.8	0	clr, AM haze	2.2	ne-e, se/calm	26.8	30.27	2	96.7	98.9	2	3.1
28-Aug	9.00	2.9	0	pc-ovc, PM rain	9.2	sw-w	20.2	30.24	3	91.1	97.8	2	0.8
29-Aug	9.00	3.0	0	ovc, PM fog	7.6	sw-wnw	17.4	30.14	4	72.2	32.2	2	0.1
30-Aug	9.00	3.7	0	clr-ovc, AM haze	0.9	e/se, wsw/calm	21.8	30.02	3	97.2	98.9	2	3.2
31-Aug	9.00	2.6	0	clr-pc, AM/PM haze	4.3	sw-w	27.0	29.94	2	98.9	87.2	2	1.6
1-Sep	9.00	2.7	0	pc	8.3	wsw-wnw	24.3	30.04	3	98.9	89.4	2	2.2
2-Sep	9.00	2.1	0	pc	3.4	sw/calm, sw-wsw	25.4	30.09	2	92.8	97.2	1	2.4
3-Sep	9.00	2.7	0	ovc-pc	6.4	sw-w	18.6	30.13	3	91.1	78.3	2	1.2
4-Sep	9.00	2.9	0	ovc	0.9	ne-ese/calm	21.2	30.03	3	96.7	93.3	2	2.4
5-Sep	1.00	2.0	0	ovc, fog/rain	6.3	sw	11.3	29.86	4	4.3	0.0	-	1.0
6-Sep	0.00			weather day: fog/rain									
7-Sep	6.50	2.6	0	mc-ovc, fog, scat rain	3.5	sw-w	11.5	30.09	4	54.4	27.3	2	0.2
8-Sep	9.00	3.0	1	clr-mc	1.1	ne-ene, wnw/calm	16.8	30.04	2	100.0	97.2	2	3.8
9-Sep	9.00	4.7	0	pc-ovc	3.6	sw-wnw	18.6	30.12	3	96.7	96.7	2	5.2
10-Sep	9.00	2.2	0	clr-pc	3.8	se, ene-se	21.9	30.29	2	100.0	98.3	2	3.7
11-Sep	9.00	2.9	0	clr	7.1	ne-ene	22.1	30.22	3	100.0	100.0	2	5.6
12-Sep	9.00	3.6	0	clr/haze	6.2	ene, calm/var	25.4	29.97	3	90.6	93.9	2	8.6
13-Sep	9.00	2.2	1	mc-ovc, PM haze	3.3	calm, wsw-wnw	25.0	29.74	3	93.3	88.3	2	5.8
14-Sep	9.00	2.0	0	pc-mc	8.7	sw-wsw	17.8	29.99	4	90.0	47.2	2	3.9
15-Sep	9.00	3.2	1	mc-ovc, PM haze	3.8	ene-se, calm	19.7	30.20	2	100.0	97.2	2	11.3
16-Sep	9.00	3.7	1	clr-ovc	9.0	w-nw, sw	18.7	30.14	4	98.9	92.2	2	4.3
17-Sep	9.00	3.0	0	pc	2.6	sw/calm	18.7	30.21	3	100.0	94.4	2	5.2
18-Sep	9.00	3.0	1	clr	4.9	ene-e, calm	23.8	30.06	2	100.0	100.0	2	15.9
19-Sep	1.00	3.0	0	ovc, fog/rain	6.3	sw-wsw	12.0	29.98	4	3.3	1.7	-	0.0
20-Sep	9.00	3.6	2	clr	1.2	calm/var	14.3	30.32	3	100.0	95.0	2	8.7
21-Sep	9.00	2.6	0	clr, PM haze	9.3	ne-ene	18.1	30.37	4	97.8	96.7	2	13.9
22-Sep	9.00	3.6	0	clr	10.3	ne-se	23.9	30.32	3	96.7	96.7	2	20.8
23-Sep	9.00	3.9	0	clr-pc, PM haze	5.4	ese-sse, sw-wnw	27.8	30.24	2	82.2	68.9	2	13.1
24-Sep	9.00	3.6	1	clr, AM haze	5.0	sw-wnw, calm	22.7	30.17	3	98.3	97.8	2	10.1
25-Sep	9.00	3.6	1	clr	1.8	calm, sw-wsw	24.7	30.24	2	98.3	97.8	2	11.8
26-Sep	9.00	3.2	0	clr	7.9	wsw-wnw	18.8	30.27	3	100.0	98.3	2	16.2
27-Sep	9.00	3.0	0	clr, AM haze	8.4	ne-ene	16.0	30.11	4	90.0	100.0	2	6.9
28-Sep	9.00	2.8	0	clr-ovc, haze	9.7	wsw-wnw	12.8	29.68	4	85.0	59.4	2	7.8
29-Sep	0.00			weather day: fog/snow									
30-Sep	0.00			weather day: fog/snow									
1-Oct	7.50	1.8	0	mc-ovc, AM fog	2.4	wsw	8.4	30.22	4	66.3	39.4	1	2.5
2-Oct	2.75	1.9	0	ovc, fog/snow	5.3	sw-wsw	5.1	29.98	4	15.0	10.0	0	0.4
3-Oct	0.00			weather day: fog/snow									
4-Oct	0.00			weather day: fog/snow									
5-Oct	8.25	2.7	0	clr	1.1	w-nw/calm	8.3	30.08	4	100.0	96.3	1	4.8
6-Oct	9.00	4.0	0	clr	4.3	calm, sw-w	11.9	30.11	3	100.0	96.7	1	9.8
7-Oct	9.00	4.5	0	clr-pc	3.1	ne-ese/calm	12.9	30.02	3	100.0	98.9	2	8.9
8-Oct	9.50	2.7	0	clr-pc	5.1	ene/calm, sw-wsw	12.2	30.08	3	100.0	92.2	2	7.8
9-Oct	9.00	2.6	0	pc-mc	1.0	ne-ese, sw-wnw, calm	9.7	30.17	4	84.4	82.2	2	7.1
10-Oct	9.00	2.5	0	ovc-pc	8.3	ne-ese	3.9	29.97	4	87.8	91.1	1	3.8
11-Oct	9.00	3.0	0	mc-ovc	10.7	ne-ese	2.2	29.74	4	100.0	100.0	1	6.2
12-Oct	9.00	2.0	0	ovc	5.6	ne-ene/calm	3.2	29.54	4	92.8	94.4	2	10.1
13-Oct	0.00			weather day: fog/rain									
14-Oct	0.00			weather day: fog/rain									

Appendix C. continued

Date	Obs. Hours	Obsrvr / Hour[1]	Median Visitor Disturb[2]	Predominant Weather[3]	Wind Speed (kph)[1]	Wind Direction	Temp (°C)[1]	Barom. Press. (in Hg)[1]	Median Thermal Lift[4]	Visib. West (km)[1]	Visib. East (km)[1]	Median Flight Distance[5]	Birds / Hour
15-Oct	7.00	1.8	0	ovc, fog, AM rain	3.6	ene-se/calm	11.6	30.17	4	24.4	33.8	2	7.4
16-Oct	9.00	2.9	0	mc-ovc	2.3	sw/calm	15.1	30.21	4	90.6	83.3	2	9.2
17-Oct	4.75	2.5	0	ovc, PM fog/rain	12.2	sw-wsw	13.3	29.89	4	65.8	57.5	1	13.7
18-Oct	8.50	2.8	0	ovc, fog	2.2	wsw/calm	9.6	29.92	4	60.5	47.0	2	7.5
19-Oct	9.00	2.0	0	mc-ovc	4.3	sw-wsw/calm	9.2	29.89	4	55.0	42.8	1	4.3
20-Oct	9.00	2.6	0	mc-ovc	1.8	calm, sw-w	10.0	30.03	4	93.3	90.6	2	5.0
21-Oct	0.00			weather day: fog/rain									
22-Oct	9.00	2.0	0	clr-ovc	0.9	calm, sw	8.1	30.15	4	96.7	95.6	2	4.2
23-Oct	0.00			weather day: fog									
24-Oct	9.00	2.6	1	clr-mc	1.6	wnw-nnw/calm	5.8	30.15	3	96.7	92.8	2	2.9
25-Oct	9.00	3.2	0	ovc, PM fog/rain	6.3	ese-se, sw-wsw	6.2	30.16	4	67.8	61.7	1	1.1
26-Oct	0.00			weather day: fog/snow									
27-Oct	0.00			weather day: fog/snow									
28-Oct	0.00			weather day: fog									
29-Oct	0.00			weather day: fog/rain									
30-Oct	0.00			weather day: fog/rain									
31-Oct	0.00			weather day: fog/rain									

[1] Average of hourly records.

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

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

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

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

Appendix D. Daily observation effort and fall raptor migration counts by species at Bonney Butte, Oregon: 2009.

	Obs	Species[1]																											Birds
Date	Hours	TV	OS	NH	SS	CH	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	Total	/ Hour
27-Aug	9.00	14	4	0	4	2	0	1	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	28	3.1
28-Aug	9.00	4	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7	0.8
29-Aug	9.00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
30-Aug	9.00	5	2	0	10	5	0	1	0	0	0	0	0	2	0	0	0	1	1	1	0	0	0	0	0	0	0	1	29	3.2
31-Aug	9.00	3	2	0	3	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	14	1.6
1-Sep	9.00	5	4	1	2	1	0	2	0	0	0	0	0	1	0	0	0	1	1	0	2	0	0	0	0	0	0	0	20	2.2
2-Sep	9.00	3	0	0	4	5	0	0	0	0	0	0	0	6	0	0	0	0	0	0	4	0	0	0	0	0	0	0	22	2.4
3-Sep	9.00	0	2	0	3	2	0	0	0	0	0	0	0	2	0	0	0	1	0	0	1	0	0	0	0	0	0	0	11	1.2
4-Sep	9.00	4	0	0	6	3	0	1	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	2.4
5-Sep	1.00	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	1.0
6-Sep	0.00																													
7-Sep	6.50	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	0	1	0.2
8-Sep	9.00	14	1	0	7	7	0	1	0	0	0	0	0	1	0	0	0	2	0	0	1	0	0	0	0	0	0	0	34	3.8
9-Sep	9.00	7	9	0	3	3	1	1	0	0	0	0	0	19	0	0	0	0	0	0	4	0	0	0	0	0	0	0	47	5.2
10-Sep	9.00	9	2	1	3	8	0	2	1	0	0	0	0	4	0	0	1	1	0	0	0	0	1	0	0	0	0	0	33	3.7
11-Sep	9.00	7	1	1	7	20	0	1	0	0	0	0	0	8	0	0	0	1	0	0	4	0	0	0	0	0	0	0	50	5.6
12-Sep	9.00	9	2	1	34	16	0	1	1	0	0	0	0	8	0	0	0	1	0	0	1	3	0	0	0	0	0	0	77	8.6
13-Sep	9.00	10	8	3	7	7	0	2	0	0	0	1	0	13	0	0	0	0	0	0	0	1	0	0	0	0	0	0	52	5.8
14-Sep	9.00	4	1	0	9	4	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	1	0	0	0	0	0	0	35	3.9
15-Sep	9.00	16	4	0	46	14	0	3	2	0	0	2	0	13	0	0	0	0	0	0	0	2	0	0	0	0	0	0	102	11.3
16-Sep	9.00	1	8	0	12	2	0	0	0	0	0	0	0	11	0	0	0	3	1	0	0	1	0	0	0	0	0	0	39	4.3
17-Sep	9.00	5	1	0	26	3	0	1	0	0	0	0	0	9	0	0	0	0	0	0	1	1	0	0	0	0	0	0	47	5.2
18-Sep	9.00	30	9	1	58	20	0	5	0	0	0	2	0	14	0	0	0	1	1	0	0	2	0	0	0	0	0	0	143	15.9
19-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	0.0
20-Sep	9.00	28	2	1	20	15	1	2	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	78	8.7
21-Sep	9.00	26	10	2	42	19	0	2	0	0	0	0	0	18	0	0	0	0	1	0	0	5	0	0	0	0	0	0	125	13.9
22-Sep	9.00	69	5	2	55	27	0	7	0	0	0	3	0	17	0	0	0	0	0	0	1	1	0	0	0	0	0	0	187	20.8
23-Sep	9.00	32	0	0	27	39	0	8	0	0	0	0	0	7	0	0	0	1	2	0	0	2	0	0	0	0	0	0	118	13.1
24-Sep	9.00	34	3	1	14	11	0	4	0	0	0	1	0	13	0	0	1	0	1	0	1	7	0	0	0	0	0	0	91	10.1
25-Sep	9.00	18	3	1	49	12	2	3	0	0	0	0	0	13	0	0	0	1	0	0	0	2	1	1	0	0	0	0	106	11.8
26-Sep	9.00	67	6	0	34	11	0	5	0	0	0	0	0	19	0	0	0	2	1	0	0	1	0	0	0	0	0	0	146	16.2
27-Sep	9.00	16	1	0	22	11	1	1	0	0	0	0	0	7	0	0	0	0	1	0	1	1	0	0	0	0	0	0	62	6.9
28-Sep	9.00	22	5	1	12	7	0	0	1	0	0	1	0	12	0	0	0	3	3	0	1	1	0	1	0	0	0	0	70	7.8
29-Sep	0.00																													
30-Sep	0.00																													
1-Oct	7.50	5	0	0	3	3	1	1	0	0	0	0	0	2	0	0	0	1	2	0	0	1	0	0	0	0	0	0	19	2.5
2-Oct	2.75	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	0.4

Appendix D. continued

Date	Obs Hours	Species[1]																											Total	Birds / Hour
		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		
3-Oct	0.00																													
4-Oct	0.00																													
5-Oct	8.25	1	0	0	16	9	0	2	0	0	0	0	0	5	0	0	1	0	1	0	0	4	0	1	0	0	0	0	40	4.8
6-Oct	9.00	1	0	1	42	17	1	1	0	0	0	0	0	11	0	1	0	1	3	1	0	5	0	1	0	2	0	0	88	9.8
7-Oct	9.00	0	2	0	44	6	3	4	1	0	0	0	0	15	0	0	0	2	2	0	0	1	0	0	0	0	0	0	80	8.9
8-Oct	9.50	0	1	2	31	3	0	4	0	0	0	0	0	14	0	0	0	7	6	0	1	5	0	0	0	0	0	0	74	7.8
9-Oct	9.00	0	0	3	35	5	0	0	0	0	1	0	0	6	0	3	0	5	2	0	0	4	0	0	0	0	0	0	64	7.1
10-Oct	9.00	0	0	0	29	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	34	3.8
11-Oct	9.00	0	0	1	42	0	0	0	0	0	0	0	0	5	0	0	0	6	2	0	0	0	0	0	0	0	0	0	56	6.2
12-Oct	9.00	0	1	1	71	0	2	0	0	0	0	0	0	7	0	0	0	3	4	0	0	2	0	0	0	0	0	0	91	10.1
13-Oct	0.00																													
14-Oct	0.00																													
15-Oct	7.00	0	0	0	49	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	52	7.4
16-Oct	9.00	0	0	3	72	3	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	0	0	0	83	9.2
17-Oct	4.75	0	0	1	53	1	1	2	0	0	0	0	0	2	0	0	0	1	0	0	0	4	0	0	0	0	0	0	65	13.7
18-Oct	8.50	0	0	4	34	6	2	1	0	0	0	0	0	8	0	0	0	2	1	1	0	3	0	2	0	0	0	0	64	7.5
19-Oct	9.00	0	0	0	13	4	2	0	0	0	0	0	0	7	0	0	0	4	6	1	0	2	0	0	0	0	0	0	39	4.3
20-Oct	9.00	0	0	0	26	3	0	0	0	0	0	0	0	7	0	1	0	0	2	0	0	5	0	1	0	0	0	0	45	5.0
21-Oct	0.00																													
22-Oct	9.00	0	1	0	20	3	1	0	0	0	0	0	0	4	0	1	0	3	1	1	0	2	0	1	0	0	0	0	38	4.2
23-Oct	0.00																													
24-Oct	9.00	0	0	1	4	0	0	0	0	0	0	0	0	9	0	1	0	5	5	0	0	0	0	1	0	0	0	0	26	2.9
25-Oct	9.00	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	10	1.1
26-Oct	0.00																													
27-Oct	0.00																													
28-Oct	0.00																													
29-Oct	0.00																													
30-Oct	0.00																													
31-Oct	0.00																													
Total	425.75	469	101	33	1110	339	18	71	6	0	1	10	0	361	0	8	3	63	55	5	27	71	2	11	0	2	0	1	2767	6.5

[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: 1994–2009.

	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	2008	2009	MEAN
Start date	27-Aug	27-Aug	28-Aug	27-Aug	28-Aug	27-Aug	28-Aug
End date	29-Oct	27-Oct	31-Oct	31-Oct	31-Oct	25-Oct	29-Oct
Observation days	46	49	57	51	60	51	51
Observation hours	341.25	392.92	459.92	397.00	481.83	425.75	376.26
Raptors / 100 hours	1119.7	699.6	577.5	571.5	514.5	649.9	770.95
SPECIES	RAPTOR COUNTS						
Turkey Vulture	326	389	232	281	269	469	305
Osprey	70	60	38	47	70	101	66
Northern Harrier	29	38	33	13	19	33	29
Sharp-shinned Hawk	1790	1067	1015	921	1003	1110	1093
Cooper's Hawk	485	269	418	249	316	339	339
Northern Goshawk	33	24	40	16	33	18	26
Unknown small accipiter[1]	27	14	7	52	111	71	36
Unknown large accipiter[1]	2	13	2	10	12	6	5
Unknown accipiter	0	46	60	12	37	0	59
TOTAL ACCIPITERS	2337	1433	1542	1260	1512	1544	1541
Red-shouldered Hawk	7	0	0	3	3	1	1
Broad-winged Hawk	2	2	1	0	5	10	7
Swainson's Hawk	1	0	0	1	0	0	1
Red-tailed Hawk	725	562	531	388	359	361	559
Ferruginous Hawk	0	1	0	0	0	0	0
Rough-legged Hawk	17	3	27	6	16	8	13
Unidentified buteo	9	4	30	40	16	3	29
TOTAL BUTEOS	761	572	589	438	399	383	611
Golden Eagle	93	72	56	52	52	63	85
Bald Eagle	61	55	44	45	46	55	47
Unidentified eagle	2	1	1	2	8	5	3
TOTAL EAGLES	156	128	101	99	106	123	136
American Kestrel	14	9	17	7	16	27	20
Merlin	105	80	69	71	62	71	67
Prairie Falcon	5	3	7	6	3	2	5
Peregrine Falcon	14	14	10	5	11	11	7
Unknown small falcon[1]	1	2	0	5	0	0	1
Unknown large falcon[1]	0	10	1	3	0	2	2
Unknown falcon	0	6	1	1	2	0	3
TOTAL FALCONS	139	124	105	98	94	113	104
Unidentified raptor	3	5	16	33	10	1	23
GRAND TOTAL	3821	2749	2656	2269	2479	2767	2814

[1] Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Bonney Butte, Oregon: 2009.

	Station	Species[1]															
Date	Hours	NH	SS	CH	NG	RS	BW	RT	RL	GE	BE	AK	ML	PR	PG	Total	Captures/hr
27-Aug	7.00	0	2	1	0	0	0	1	0	0	0	0	0	0	0	4	0.6
28-Aug	7.50	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.1
29-Aug	8.00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.1
30-Aug	8.00	0	0	2	0	0	0	0	0	0	1	0	0	0	0	3	0.4
31-Aug	8.00	0	2	1	1	0	0	0	0	0	0	0	0	0	0	4	0.5
01-Sep	7.75	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
02-Sep	8.00	0	5	1	0	0	0	1	0	0	0	0	0	0	0	7	0.9
03-Sep	8.00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	0.3
04-Sep	8.25	0	4	0	0	0	0	1	0	0	0	0	0	0	0	5	0.6
05-Sep	0.00																
06-Sep	0.00																
07-Sep	5.75	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0.7
08-Sep	8.00	0	9	3	1	0	0	0	0	0	0	0	0	0	0	13	1.6
09-Sep	8.00	0	2	1	0	0	0	5	0	0	0	1	0	0	0	9	1.1
10-Sep	8.00	0	1	4	0	0	0	0	0	0	0	0	0	0	0	5	0.6
11-Sep	8.00	0	1	3	0	0	0	0	0	1	0	0	0	0	0	5	0.6
12-Sep	8.00	0	3	4	0	0	0	0	0	0	0	0	0	0	0	7	0.9
13-Sep	8.00	1	6	1	0	0	0	2	0	0	0	0	0	0	0	10	1.3
14-Sep	8.00	0	4	3	0	0	0	2	0	0	0	0	0	0	0	9	1.1
15-Sep	8.00	0	27	4	0	0	0	3	0	0	0	0	1	0	0	35	4.4
16-Sep	6.50	0	4	0	0	0	0	1	0	0	0	0	0	0	0	5	0.8
17-Sep	7.50	0	5	2	0	0	0	1	0	0	0	0	0	0	0	8	1.1
18-Sep	8.00	0	10	5	0	0	0	2	0	0	0	0	0	0	0	17	2.1
19-Sep	0.00																
20-Sep	8.00	0	8	5	1	0	0	0	0	0	0	0	0	0	0	14	1.8
21-Sep	8.00	0	6	5	0	0	0	1	0	0	0	0	0	0	0	12	1.5
22-Sep	8.00	0	10	11	0	0	0	0	0	0	0	0	0	0	0	21	2.6
23-Sep	8.00	0	12	7	0	0	0	1	0	0	0	0	0	0	0	20	2.5
24-Sep	8.25	0	9	4	0	0	0	3	0	0	0	0	0	0	0	16	1.9
25-Sep	8.00	0	25	4	0	0	0	2	0	0	0	0	0	1	0	32	4.0
26-Sep	8.00	0	13	0	0	0	0	2	0	0	0	0	0	0	0	15	1.9
27-Sep	8.00	0	3	1	0	0	0	0	0	0	0	0	1	0	0	5	0.6
28-Sep	8.00	1	6	3	0	0	0	2	0	1	0	0	0	0	0	13	1.6
29-Sep	0.00																
30-Sep	0.00																
01-Oct	6.00	0	3	2	0	0	0	2	0	0	0	0	1	0	0	8	1.3
02-Oct	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
03-Oct	0.00																
04-Oct	0.00																
05-Oct	7.75	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1

Appendix F. Daily capture totals of migrating raptors at Bonney Butte, Oregon: 2009.

	Station	Species[1]														
Date	Hours	NH	SS	CH	NG	RS	BW	RT	RL	GE	BE	AK	ML	PR	PG	Total	Captures/hr
06-Oct	7.75	0	7	3	0	0	0	2	0	0	0	0	0	0	0	12	1.5
07-Oct	8.00	0	6	1	0	0	0	0	0	0	0	0	0	0	0	7	0.9
08-Oct	7.75	0	9	4	0	0	0	2	0	0	0	0	0	0	0	15	1.9
09-Oct	7.25	0	10	0	0	0	0	1	0	0	1	0	1	0	0	13	1.8
10-Oct	7.50	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.3
11-Oct	7.75	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0.1
12-Oct	7.75	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
13-Oct	0.00																
14-Oct	0.00																
15-Oct	2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
16-Oct	7.50	0	35	3	0	0	0	0	0	0	0	0	4	0	0	42	5.6
17-Oct	3.75	0	19	1	0	0	0	0	0	0	0	0	1	0	0	21	5.6
18-Oct	7.50	1	26	2	0	0	0	0	0	0	0	0	1	0	0	30	4.0
19-Oct	7.50	0	9	0	0	0	0	0	0	0	0	0	0	0	0	9	1.2
20-Oct	7.50	0	16	2	0	0	0	1	0	0	0	0	1	0	0	20	2.7
21-Oct	0.00																
22-Oct	7.50	0	5	1	0	0	0	0	0	0	0	0	0	0	0	6	0.8
23-Oct	0.00																
24-Oct	6.50	0	0	1	0	0	0	0	0	0	0	0	1	0	0	2	0.3
25-Oct	5.25	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5	1.0
Total	359.50	3	337	98	3	0	0	39	0	2	2	1	12	1	0	498	1.4

[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: 1995–2009.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	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	28-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	30-Oct	25-Oct		
Number of stations	1	1	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	56	49	41	
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	406.00	359.50	268.19	
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	10.5	13.9	11.6	
SPECIES																	
Northern Harrier	0	1	0	2	1	1	0	6	4	2	7	2	1	3	3	2.2	33
Sharp-shinned Hawk	18	80	139	163	82	161	171	172	268	219	310	259	200	247	337	188.4	2826
Cooper's Hawk	0	20	29	43	14	67	74	71	64	90	101	88	74	100	98	62.2	933
Northern Goshawk	1	7	7	3	3	8	11	7	12	14	12	11	3	15	3	7.8	117
Red-shouldered Hawk	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0.1	2
Broad-winged Hawk	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0.1	2
Red-tailed Hawk	2	14	39	29	36	66	66	108	73	61	67	106	42	45	39	52.9	793
Rough-legged Hawk	0	0	1	0	1	0	1	0	0	0	1	1	0	1	0	0.4	6
Golden Eagle	0	3	2	1	2	3	2	0	2	1	3	6	0	1	2	1.9	28
Bald Eagle	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0.2	3
American Kestrel	0	0	0	0	1	0	1	0	0	0	0	2	1	1	1	0.5	7
Merlin	1	2	5	11	3	1	4	5	4	4	13	12	9	8	12	6.3	94
Prairie Falcon	0	0	1	4	0	1	0	1	3	4	3	4	2	1	1	1.7	25
Peregrine Falcon	0	0	0	0	0	2	0	1	0	0	4	1	0	1	0	0.6	9
All species	22	127	223	256	143	311	330	371	430	395	522	492	333	425	498	325.2	4878
Recaptures[1]	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0.3	4
Foreign Recaptures[2]	0	0	1	1	0	0	1	0	2	2	3	1	1	1	2	1.0	15
Foreign Encounters[3]	1	0	1	2	6	3	2	6	8	5	9	6	7	3	8	4.5	67

[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.