FALL 2011 RAPTOR MIGRATION STUDIES AT BONNEY BUTTE, OREGON



HawkWatch International, Inc. Salt Lake City, Utah



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Report prepared by:

Shawn E. Hawks and Markus Mika

Counts conducted by: Robert Baez, Jade Ajani, and Adam Baz

Banding conducted by:

Dan Sherman, Rick Gerhardt, Jade Ajani, and Adam Baz

On-site education by:

Jade Ajani, Adam Baz, and Robert Baez

Project Coordinated by:

HawkWatch International Principal Investigator: Dr. Markus Mika 2240 South 900 East, Salt Lake City, UT 84106 (801) 484-6808

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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 population trends of raptors that migrate through the Cascade Mountain 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 2011 season marked the 18th consecutive year of counting, but due to budgetary constraints this past season's trapping and banding efforts were done on an entirely volunteer basis and those efforts were coordinated under local collaborative efforts from Rick Gerhardt (under his federal and state banding permit authorizations) and Dan Sherman. This report summarizes the 2011 results of those activities.

The Bonney Butte project was 1 of 8 long-term, annual migration counts and 1 of 4 migration banding studies conducted or co-sponsored by HWI in North America during 2011. 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 can 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).

In coordination with the long-term counting and banding efforts, HWI has and will continue to explore related research activities to further help provide valuable information about migratory behavior of raptors, as well as identify species' ranges, migratory routes and connectivity, and track changes in raptor health and populations (e.g., Hoffman et al. 2002, Lott and Smith 2006, Goodrich and Smith 2008, McBride et al. 2004). 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 the raptor migration projects that HWI manages and co-sponsors.

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 shrub steppe 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

Three official observers were hired as per diem volunteers to conduct daily counts, interact with the public for on-site outreach, as well as assist with the banding efforts when available and the opportunities arose (see Appendix A for a complete observer history). Weather permitting, two official or designated observers conducted standardized daily counts of migrating raptors from late August through late October. Observations typically began between 0800–0900 hrs and ended near 1700 hrs Pacific Standard Time (PST). Occasionally, visitors also assist 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 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 of precipitation, visibility, and an assessment of thermal-lift conditions were 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 2011 data follows Farmer et al. (2007). In comparing 2011 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2011 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

As already mentioned in the Introduction, due to budgetary issues, this year's trapping efforts were again scaled down and relied upon from local collaborative and volunteer efforts. Those efforts occurred on 30 days from late August through late October at a single traditional banding station, generally between 0900–1700 hrs PST (see Appendix F for daily trapping records). 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 then released within 45 minutes of capture.

RESULTS AND DISCUSSION

WEATHER SUMMARY

For the 2011 season, inclement weather forced operations to end two days early (see Appendix C for daily weather records, as well as Appendix E for comparisons of annual start and end dates). Thirteen additional days were also precluded, and three days were shortened (reduced observation time to \leq 4 hours) due to weather (Appendix C). For comparison, weather, on an average seasonal basis (i.e., from 1997-2010) has demonstrated to preclude 12.9, and severely hamper 5.1 days of observation in a given season.

During active observation periods, sky conditions were recorded predominantly clear to partly cloudy, or fair 45% of the time, 18% as transitional (i.e., cloud cover changed from clear or partly cloudy to mostly cloudy or overcast during the day, or vice versa), and 33% as mostly cloudy or overcast. In comparison, the averages for the site are 50% fair, 24% transitional and 27% mostly cloudy to overcast, suggesting that the skies during the 2011 season were predominantly mostly cloudy to overcast. Similarly, the season's visibility was highly affected by fog and/or haze on 76% of the active observational days (vs. an

average 57% from previous years). Thus, visibility towards both the east and west were also rated low (58 km in 2011 vs. 68.3 km for the average, and 53 km vs. 64.1 km for the mean, respectively). Temperatures, however, were above average $(17.4^{\circ} \text{ C in 2011 vs. } 13.5^{\circ} \text{ C from the long-term mean})$, which also assisted in a higher than average percentage of days where the thermal lift was ranked good to excellent (45% of active days in 2011 vs. 39.1% on average). Thermal lift is often favorable for raptors to gain altitude and conserve energy during migration. Thus, with less than ideal visibility this past season, favorable conditions were present to lend the possibility for raptors to migrate above cloud, haze and/or fog cover and not be detected and counted. Lastly, observers also keep track of the proportion of days when the season's visibility may be affected by rain and/or snow. This past season, rain and/or snow had a relatively negligible affect (2%), compared to the long-term average (12%)

The 2011 wind conditions were again primarily light (<12 kph), but those conditions occurred on significantly fewer days when compared to the long-term mean (occurring on 67% of active observation days vs. 88% on average). In contrast, the number of days with moderate winds (12-29 kph) was significantly higher (33% vs. 12% on average). Strong winds (>29 kph) at this site are typically absent, occurring on average of 0.8 or less than one day, and this past season was no exception, as no strong winds were recorded. Wind directions, on average, often blow from the SW-W (29%), SW-NW (13%), and NE-E (12%). During this past season, winds seemed to gyrate more frequently, from the west: SW-NW (25%), SW-W (22%), W-NW (13% vs. 4% on average); but also easterly and back and forth; NE-E (7%), SW-NW part of the day then switching to NE-SE for another significant portion of the day (7% vs. 6% on average), N-E (7% vs. 2% on average), and SE-SW (7% vs. 1.2%). Thus, still comparable with previous wind speed and directional trends, winds recorded during this past season were less light, more moderate, and the directions quite variable.

In summary, inclement weather, more frequent gyrating winds, and good to excellent thermal lift rankings could have caused migrating raptors to behave differently, such as wait out storms, use different flight patterns, and migrate at higher altitudes beyond detectability. With crewmembers inexperienced with this site, coupled with rather poor visibility caused by haze, raptors using favorable winds with good to excellent thermal lift on a given day could have escaped detection and the number of raptors observed would have underestimated the true number of raptors passing by Bonney Butte.

COUNT SUMMARY

Observers during the 2011 season were able to work 55 of 63 possible days between 27 August and 31 October, which was above the long term average ($51 \pm 95\%$ CI of 2.8 days, Appendix E). In addition, the number of observation hours (414.33) was also well above the average (378.92 ± 30.758 hours, Appendix E). The 2011 average of 2.3 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) is a slight decrease from the long-term average of 2.4 \pm 0.22 observers.

Observers counted 3,701 migrant raptors of 16 species, resulting with a significant 30% above average count (Table 1, and see Appendix D for daily count records). Three species set record highs (i.e., the Bald Eagle (93 birds), Merlin (114), and Peregrine Falcon (21). Although an uncommon species at the site in general, observers counted a record low of only two Rough-legged Hawks (Appendix E). A very low count of only eight American Kestrels was observed throughout the season, which is also near a record low (Appendix E) and consistent with the ongoing trend of decline (see discussion below). Northern Goshawk counts were also slightly below average (Appendix E). On a more positive note, however, this year's counts for Turkey Vultures, Osprey, Northern Harriers, Sharp-shinned, Cooper's, and Red-tailed Hawks, as well as Golden Eagles were all above average (Appendix E). Lastly, two Swainson's Hawks and four Prairie Falcons were also counted (Appendix E) to represent two additional uncommon species observed at the site during the 2011 season.

The overall flight consisted of 52% accipiters, 21% buteos, 14% vultures, 6% eagles, 4% falcons, 2% Ospreys, 1% harriers, and <1% unidentified raptors. The season featured significantly higher than

average proportions of vultures and eagles, above average falcons, but below average accipiters, buteos, and ospreys (Figure 2). Sharp-shinned Hawks are typically the most common species observed, which held true again in 2011 with 39% of the total, followed by the Red-tailed Hawk (21%), Turkey Vulture (14%), Cooper's Hawk (10%), Golden Eagle (3%), Bald Eagle (3%), Merlin (3%), Osprey (2%), Northern Harrier (1%), and Northern Goshawk (1%). The remainder of the species observed only comprised of <1% (Appendix E).

Passage Rates and Long-term Trends

Regression analyses of the adjusted passage rates through 2011 reveal significant ($P \le 0.10$) declines for Red-tailed, Ferruginous, and Rough-legged Hawks (Fig. 6), adult Golden Eagles (Fig. 7), and American Kestrels (Fig. 8). The statistical decline for Ferruginous Hawks, however, is suspect because this species is not commonly seen at this site (see Table 1 and Appendix E). For Rough-legged Hawks, another relatively uncommon species, a marginal decline has also emerged (p = 0.085, Fig. 6), but given these estimates, inferring significance should be done with caution due to the likelihood of a Type I error. Of more importance. Bonney Butte numbers of Red-tailed Hawks have shown a steady significant decline since 2008 (Fig. 6). Thus, we will be comparing to see if other western sites in the North America are experiencing similar trends. Golden Eagles have (Farmer et al. 2008) and continue to demonstrate decline but data from Bonney Butte (Fig. 7) demonstrate the potential importance to be able to contrast whether adults, non-adults, or both age groups are declining to understand what age-specific group may be most affected. Evidence of widespread American Kestrel population decline has also been demonstrated (Farmer et al. 2008, Farmer and Smith 2009) and it appears to continue through 2011(Fig. 8). Much discussion has ensued on potential reasons for the decline (see Journal of Raptor Research 2009, Vol. 43, No. 4). In contrast, Bald Eagles and Peregrine Falcons continue to significantly increase (Figs. 7 & 8, respectively).

Age Ratios

Using observational data, it can be difficult to correctly identify immature vs. the adults in raptor species (see Table 2, % of unknown age column). Nevertheless, it is important to identify age (and gender) differences as best as possible so age structure comparisons (immatures vs. adults) can also be assessed in declining species to better understand if reproductive effort or juvenile survivorship prior to migration, adult survivorship, changes in behavior (e.g., age-specific short stopping), or something else may cause the trend. One likely assessment based on observed age classes is to compare the ratio from the most recent seasonal counts in relation to the average ratio over all the years observed (Table 2). During the 2011 season, immature : adult age ratios were below average for most species where ages could be separated; Northern Harriers, Cooper's Hawks, Northern Goshawks, Golden Eagles, Bald Eagles, and Peregrine Falcons (Table 2). For Northern Goshawks, the observers counted more adults than immature birds, which is atypical but there was also an above average percentage of Northern Goshawks that were not aged (Table 2). Thus, with a potential error of not being able to classify a species age, there are limitations pertaining to year-to-year productivity, for example. Likewise, there was a large percentage of unknown classified ages (>50%) associated with Sharp-shinned and Cooper's Hawks. Interestingly with Sharp-shins, on average immatures are seen in greater numbers, but this past season's counts resulted in nearly a 1 to 1 equal ratio (Table 2). With Red-tails, even though more birds were counted, adults still outnumbered immatures and the ratio was no different compared to the average from past counts (Table 2), suggesting that the overall increase in numbers wasn't caused by an increase in reproductive output. Again, assessing age ratios can be insightful, but to use these data to assess year-to-year reproductive output can be problematic, as addressed above.

Seasonal Timing

The combined-species median passage date of 03 October matched last year and was again three days later compared to the long-term average (Table 3). The volume of migration usually peaks around the last ten days of September, then declines steadily through mid-October when migration remains relatively consistent for ten days, then begins to again drop off steadily after 15 October, ending out the season (Fig.

9). This past season, however, illustrated an almost bi-modal distribution, separating out a peak in migration at the end of September (with a slight break around mid-September), then dramatically dropping in early October only to witness a steep rise with a peak at even higher numbers during the fiveday period of 16th through 20th October. This was followed by a dramatic decline to end out the season (Fig. 9). How different weather variables influence raptor migration at this site is unknown, but the very low numbers observed at the beginning of October corresponds well with weather days due to precipitation (Appendix C). There were also other weather days during the beginning of October, which could have caused birds to wait out the rain only to resume migration after the weather cleared. Most species-level median passage dates this past season were also 3 to 19 days later than usual, except for Ospreys and American Kestrels, which happened to pass one and five days earlier, respectively (Table 3). Northern Harriers demonstrated consistency, reflecting a median passage date of no change (Table 3). The age-specific median dates generally followed a usual pattern except that both age specific classes of Northern Goshawks were slightly early this past season (Table 4). It stands in contrast to the overall timing for Northern Goshawks arriving seven days later than in the past (Table 3). Including also the number of Northern Goshawks of unknown age, which passed through the site considerably later (Table 2), explain this discrepancy and results indicate that the 2011 median date for that species was 10 October (vs. 3 October for the long-term mean date). Immature Northern Harriers and Red-tailed Hawks arrived seven and one day early this year, respectively (Table 4).

Resident Raptors

From 27 August through 29 October, one adult and one immature light Red-tailed Hawks were seen on most days throughout the season. Similarly, observers also documented an immature Sharp-shinned Hawk for eleven days between 29 August and 24 September. An unknown aged Sharp-shinned Hawk was observed on 01 September as well, along with the immature. On the first day of the count, 27 August, observers documented three local Sharp-shins but unfortunately the ages couldn't be determined. After 24 September, an unknown aged female and an adult male Sharp-shinned Hawk were observed on 27 and 29 October, respectively. Local Cooper's Hawks were also present, primarily an immature seen on four days between 28 August and 16 September. On 01 September, the observers suspected an immature Cooper's Hawk to be a female. Otherwise, no gender was assigned to any of the other resident Cooper's Hawks that were observed. Along with the immature seen on 28 August, a local adult Cooper's Hawk was observed. the only adult documented among residents of this species. Two local Osprevs were recorded on 27 August, the first day of operation at the site. Thereafter, only one Osprey was seen for another seven days up to 13 September. Although rather infrequent, a local adult Bald Eagle was frequented the site on 28 and 29 August, as well as on 16 September. Likewise, one immature Golden Eagle was observed on 27 and 29 August, 12 September, and 18 October, for a total of four days; a Peregrine Falcon was seen on 28 August, 23 September, and 24 October, for a total of three days; an unknown aged Northern Goshawk was observed on 28 August and an adult on 29 October, for a total of two days; and an immature and unknown aged Northern Harrier was observed on 11 and 23 September, respectively, for also a total of two days. An adult Peregrine Falcon was observed on 28 August defending the local area, but the age was not confirmed on two subsequent dates.

TRAPPING AND BANDING SUMMARY

Trapping occurred on 30 days between 27August and 31 October, and totaled 139.52 hours (see Appendix G for comparing annual efforts against the overall mean, as well as Appendix F for daily trapping records). Because of the major reduction in effort, a total of only 148 raptors were captured representing six different species (Appendix G). As usual, the three most frequently captured species were Sharp-shinned Hawks (63% of captures), Cooper's Hawks (20%), and Red-tailed Hawks (13%). In addition, two Northern Goshawks, American Kestrels, and Merlins were also trapped during the season (Appendix G). The season's lower numbers (Appendix G) also precluded comparisons of age and gender ratios, as well as measures of morpho/physiological indices (i.e., crop fullness, keel muscle, and wing-pit fat ratings, weight, and other wing loading indices), even though those data continued to be collected. The

budget still remains uncertain for 2012, but our collaboration with Rick Gerhardt and Dan Sherman is ongoing and a limited effort of banding will most likely be maintained. In the future however, we hope to get our efforts back to a level where procedures are more standardized and maintained throughout the entire fall season.

ENCOUNTERS WITH BANDED BIRDS

In 2011, four recoveries were reported to the Patuxent Bird Banding Lab from individuals encountering alive or dead raptors banded by HWI personnel at Bonney Butte over the years: 1 Red-tailed Hawk, 1 Sharp-shinned Hawk, and 2 Cooper's Hawks (Table 5). Raptors that fly over Bonney Butte occupy the confines of the Pacific Coast Flyway on their migratory route (along the Cascade-Sierra Nevada ranges and westward from southern British Columbia to Baja California; Hoffman et al. 2002), and all these birds were recovered within this flyway boundary. All, except for the Red-tailed Hawk, were found to have died of unknown causes, a typical occurrence. The Red-tailed Hawk was reportedly being hand captured by a government official in Washington after it was found suffering from an injury. A phone call was made subsequently and we learned that the bird arrived at a rehab location emaciated with a severe case of bumble foot (i.e., an inflammation in the feet of birds, which can be detrimental since birds use their feet to perch and eat). Adding these four recoveries, thus far a total of 79 raptors banded at Bonney Butte have subsequently been encountered elsewhere.

Often banders at raptor migration trapping stations encounter previously banded birds that have been trapped at the same station in years past or previously banded elsewhere on a different project. Unfortunately, however, no previously banded birds were encountered during trapping efforts the past season. These recaptures are important because they provide information on the birds' survivorship and longevity, as well as information on migratory connectivity.

VISITATION

Including an Audubon group of 24 individuals that visited Bonney Butte on 24 September, a total of 206 individuals were recorded to have visited the hawk watch site during the 2011 season. Most of the visitors, however, appeared alone or in smaller groups of two to four. Also, most visitors were from Oregon, but visitors also traveled from Washington, Texas, and Ohio.

Every hour, observers assess the disturbance level of visitors to quantify how visitation may affect raptor detectability. During the 2011 season after 428 hours of observations visitor disturbance resulted in the following disturbance ratings: 83% of the time the crews indicated no disturbance, while 10% of the time disturbance documentation was low, 6% moderate, and 2% as high.

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LITERATURE CITED

Bildstein, K. L. 2001. Why migratory birds of prey make great biological indicators. Pages 169–179 *in*K. L. Bildstein and D. Klem (Editors). Hawkwatching in the Americas. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.

- Bildstein, K. L., J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors). 2008. State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC U.S.A.
- Farmer, C. J., and J. P. Smith. 2009. Migration counts indicate widespread declines of American Kestrels (*Falco sparverius*) in North America. Journal of Raptor Research 43:263-273.
- Farmer, C.J., L.J. Goodrich, E.R. Inzunza, and J.P.Smith. 2008. Raptor migration in North America. Pages 330–419 in K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Farmer, C. J., D. J. T. Hussell, and D. Mizrahi. 2007. Detecting population trends in migratory birds of prey. Auk 124:1047–1062.
- Goodrich, L. J., and J. P. Smith. 2008. Raptor migration in North America. Pages 37–150 in K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Hoffman, S. W., and J. P. Smith. 2003. Population trends of migratory raptors in western North America, 1977–2001. Condor 105:397-419.
- Hoffman, S. W., J. P. Smith, and T. D. Meehan. 2002. Breeding grounds, winter ranges, and migratory routes of raptors in the Mountain West. Journal of Raptor Research 36:97–110.
- Lott, C. A., and J. P. Smith. 2006. A geographic-information-system approach to estimating the origin of migratory raptors in North America using hydrogen stable isotope ratios in feathers. The Auk 123:822–835.
- McBride, T. J., J. P. Smith, H. P. Gross, and M. Hooper. 2004. Blood-lead and ALAD activity levels of Cooper's Hawks (*Accipiter cooperii*) migrating through the southern Rocky Mountains. Journal of Raptor Research 38:118–124.
- Smith, J. P., C. J. Farmer, S. W. Hoffman, G. S. Kaltenecker, K. Z. Woodruff, and P. Sherrington. 2008a. Trends in autumn counts of migratory raptors in western North America. Pages 217–252 in K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Smith, J. P., C. J. Farmer, S. W. Hoffman, C. A. Lott, L. J. Goodrich, J. Simon, C. Riley, and E. Ruelas Inzunza. 2008b. Trends in autumn counts of migratory raptors around the Gulf of Mexico, 1995– 2005. Pages 253–278 *in* K. L. Bildstein, J. P. Smith, E. Ruelas Inzunza, and R. R. Veit (Editors), State of North America's birds of prey. Series in Ornithology No. 3. Nuttall Ornithological Club, Cambridge, Massachusetts, and American Ornithologists' Union, Washington, DC.
- Smith, J. P., P. Grindrod, and S. W. Hoffman. 2001. Migration counts indicate Broad-winged Hawks are increasing in the West: evidence of breeding range expansion? Pages 93–106 in K. L. Bildstein and D. Klem (Editors), Hawkwatching in the Americas. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.
- Zalles, J. I., and K. L. Bildstein (Editors). 2000. Raptor watch: a global directory of raptor migration sites. BirdLife Conservation Series No. 9. BirdLife International, Cambridge, United Kingdom, and Hawk Mountain Sanctuary Association, Kempton, Pennsylvania, USA.

	Co	DUNT		RAPTORS / 100 HOURS							
SPECIES	1994–2010 ¹	2011	% CHANGE	1994–2010 ¹	2011	% CHANGE					
Turkey Vulture	313 ± 58.7	510	+63	83.0 ± 15.42	123.1	+48					
Osprey	67 ± 10.2	72	+8	18.0 ± 2.82	17.4	-3					
Northern Harrier	28 ± 6.1	39	+38	7.7 ± 1.73	9.4	+23					
Sharp-shinned Hawk	1114 ± 150.7	1448	+30	300.6 ± 43.23	349.5	+16					
Cooper's Hawk	344 ± 40.1	380	+11	94.0 ± 14.53	91.7	-2					
Northern Goshawk	28 ± 5.4	26	-6	7.5 ± 1.58	6.3	-16					
Unknown small accipiter ²	34 ± 21.7	81	+141	_	_	_					
Unknown large accipiter ²	6 ± 3.2	1	-82	_	_	_					
Unknown accipiter	57 ± 23.7	0	-100	_	_	_					
TOTAL ACCIPITERS	1565 ± 183.3	1936	24	_	_	_					
Red-shouldered Hawk	1 ± 0.9	0	-100	0.3 ± 0.25	0.0	-100					
Broad-winged Hawk	7 ± 8.5	0	-100	1.8 ± 2.04	0.0	-100					
Swainson's Hawk	1 ± 0.5	2	+183	0.2 ± 0.14	0.5	+148					
Red-tailed Hawk	561 ± 73.5	775	+38	154.6 ± 25.76	187.0	+21					
Ferruginous Hawk	0 ± 0.2	0	-100	0.1 ± 0.07	0.0	-100					
Rough-legged Hawk	13 ± 3.8	2	-84	3.5 ± 1.11	0.5	-86					
Unidentified buteo	$27~\pm~7.9$	5	-82	_	_	_					
TOTAL BUTEOS	610 ± 83.4	784	+28	_	_	_					
Golden Eagle	85 ± 15.4	110	+30	23.4 ± 4.78	26.5	+13					
Bald Eagle	49 ± 5.2	93	+91	13.0 ± 1.24	22.4	+73					
Unidentified eagle	3 ± 1.3	3	-6	_	_	_					
TOTAL EAGLES	137 ± 15.8	206	+51	_	_	_					
American Kestrel	20 ± 3.7	8	-59	5.5 ± 1.25	1.9	-65					
Merlin	70 ± 11.3	114	+64	18.8 ± 3.46	27.5	+46					
Prairie Falcon	5 ± 1.4	4	-17	1.3 ± 0.36	1.0	-25					
Peregrine Falcon	7 ± 2.2	21	+183	1.9 ± 0.55	5.1	+168					
Unknown small falcon ²	1 ± 1.0	0	-100	_	_	_					
Unknown large falcon ²	2 ± 1.9	1	-38	_	_	_					
Unknown falcon	2 ± 1.2	0	-100		_	_					
TOTAL FALCONS	105 ± 12.5	148	+40		_	_					
Unidentified Raptor	22 ± 10.6	6	-73	_	_	_					
ALL SPECIES	2848 ± 300.7	3701	+30	_	_	_					

 Table 1. Fall raptor migration unadjusted counts and adjusted passage rates by species at Bonney Butte, OR: 1994–2010 versus 2011.

¹ Mean of annual values \pm 95% confidence interval.

² Designations used for the first time in 2001.

	To	OTAL AI	ND AGE-C	LASSIFIEI	OCOUN	TS			IMMATURE : ADULT			
	1994–2	2010 Av	VERAGE		2011		% Unknow	N AGE	RATIO			
	TOTAL	IMM.	ADULT	TOTAL	Імм.	ADULT	1994–2010 ¹	2011	1994–2010 ¹	2011		
Northern Harrier	28	13	4	39	11	5	37 ± 8.5	46	$3.9~\pm~1.77$	2.1		
Sharp-shinned Hawk	1114	259	345	1448	311	319	$46~\pm~5.8$	56	0.8 ± 0.16	1.0		
Cooper's Hawk	344	110	75	380	99	72	46 ± 6.3	55	1.8 ± 0.62	1.4		
Northern Goshawk	28	12	8	26	7	9	$29~\pm~7.8$	38	2.1 ± 0.64	0.8		
Broad-winged Hawk	7	1	2	0	0	0	36 ± 23.3	-	$0.4~\pm~0.33$	-		
Red-tailed Hawk	561	164	271	775	232	327	23 ± 3.6	28	$0.7~\pm~0.10$	0.7		
Golden Eagle	85	48	19	110	75	24	$20~\pm~3.0$	10	$3.4~\pm~0.99$	3.1		
Bald Eagle	49	10	35	93	16	72	7 ± 3.0	5	$0.3~\pm~0.06$	0.2		
Peregrine Falcon	7	1	2	21	4	9	52 ± 4.2	38	0.8 ± 0.63	0.4		

 Table 2. Fall counts by age class and immature : adult ratios for selected species of migrating raptors at Bonney Butte, OR: 1994–2010 versus 2011.

¹ Mean \pm 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.

	1994–2010				
	First	LAST	BULK	MEDIAN	MEDIAN
SPECIES	OBSERVED	OBSERVED	PASSAGE DATES ¹	PASSAGE DATE ²	PASSAGE DATE ^{2, 3}
Turkey Vulture	28-Aug	18-Oct	08-Sep – 29-Oct	29-Sep	23-Sep ± 1.2
Osprey	27-Aug	25-Oct	05-Sep - 16-Oct	18-Sep	19-Sep ± 1.6
Northern Harrier	01-Sep	28-Oct	02-Sep - 20-Oct	29-Sep	29-Sep ± 2.7
Sharp-shinned Hawk	01-Sep	29-Oct	16-Sep – 19-Oct	13-Oct	$05-Oct \pm 1.7$
Cooper's Hawk	28-Aug	29-Oct	13-Sep – 17-Oct	13-Oct	26-Sep ± 1.7
Northern Goshawk	12-Sep	29-Oct	14-Sep - 17-Oct	10-Oct	$3-Oct \pm 3.1$
Red-shouldered Hawk	_	_	-	-	26-Sep ⁴ 0.0
Broad-winged Hawk	_	-	_	-	24-Sep ± 5.1
Swainson's Hawk	02-Sep	06-Sep	_	_	
Red-tailed Hawk	27-Aug	29-Oct	08-Sep – 20-Oct	13-Oct	28-Sep ± 1.7
Rough-legged Hawk	26-Oct	29-Oct	_	_	20-Oct ± 2.4
Golden Eagle	28-Aug	29-Oct	24-Sep – 28-Oct	19-Oct	$12-Oct \pm 1.7$
Bald Eagle	04-Sep	29-Oct	26-Sep – 27-Oct	17-Oct	08-Oct ± 2.5
American Kestrel	28-Aug	16-Oct	06-Sep – 16-Oct	14-Oct	19-Sep ± 2.8
Merlin	28-Aug	29-Oct	28-Sep – 24-Oct	17-Oct	$10-Oct \pm 2.1$
Prairie Falcon	03-Sep	19-Oct	_		21-Sep ± 6.0
Peregrine Falcon	28-Aug	27-Oct	02-Sep – 17-Oct	17-Oct	28-Sep ± 4.8
Total	27-Aug	29-Oct	10-Sep – 19-Oct	03-Oct	30-Sep ± 1.7

Table 3. First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Bonney Butte, OR in 2011, with a comparison between 2011 and the 1994–2010 average median passage dates.

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 \pm 95% confidence interval in days; unless otherwise indicated, values are given only for species with annual counts \geq 5 birds for \geq 3 years.

⁴ Data for 2004 only. (See, again, superscript 3 above for criteria explanation, as well as Appendix E for a confirmation of annual counts.)

	ADUL	Г	IMMAT	URE
SPECIES	1994–2010 ¹	2011	1994–2010 ¹	2011
Sharp-shinned Hawk	$11-Oct \pm 1.7$	17-Oct	$24\text{-}\text{Sep} \pm 1.6$	25-Sep
Cooper's Hawk	$03-Oct \pm 2.3$	14-Oct	$21\text{-}\text{Sep} \pm 2.3$	25-Sep
Northern Goshawk	$12-Oct \pm 5.3$	10-Oct	$30\text{-}\text{Sep} \pm 4.8$	29-Sep
Red-tailed Hawk	$02-Oct \pm 2.5$	17-Oct	$22-Sep \pm 2.1$	21-Sep
Golden Eagle	$12-Oct \pm 2.7$	26-Oct	$10-Oct \pm 2.1$	18-Oct
Bald Eagle	$08-Oct \pm 2.9$	17-Oct	$11-Oct \pm 3.1$	-

Table 4. Median passage dates by age for selected species of migrating raptors at Bonney Butte,OR: 1994–2010 versus 2011.

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

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

BAND #	$\frac{\text{SPECIES-}}{\text{SEX}^1}$	Banding Date	BANDING AGE ²	Encounter Date	Encounter Age ²	Encounter Location	DISTANCE (km)	STATUS
1177-30965	RT-U	14-Oct-04	AHY	27-Jan-11	ATY	Yakima, WA	150	found injured – died next day in rehab
1623-24246	SS-F	27-Sep-10	НҮ	18-Mar-11	АНҮ	Napa, CA	631	found dead – cause unknown
1005-23067	CH-F	29-Sep-06	ASY	05-May-11	ATY	Lummi Island, WA	336	found dead – cause unknown
1075-01931	CH-F	30-Sep-10	AHY	30-Jun-11	АНҮ	Trout Lake, WA	65	found dead – cause unknown

Table 5. Foreign encounters in 2011 of raptors banded during autumn migration at Bonney Butte, Oregon.

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: 1994–2010 versus 2011.



Figure 3. Adjusted, fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Bonney Butte, Oregon: 1994–2011. 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: 1994–2011. 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: 1994–2011. 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: 1994–2011. Dashed lines indicate significant (P < 0.10) regressions.



Figure 7. Adjusted, fall-migration passage rates for Golden and Bald Eagles at Bonney Butte, Oregon: 1994–2011. 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: 1994–2011. 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: 1994–2010 versus 2011.

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)
- 2010: Two observers throughout: Juliet Lamb (1), Yvan Satge (0), and Andrew Tillinghast (0)
- 2011: Two observers throughout: Robert Baez (2), Jade Ajani (0), and Adam Baz (0)

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

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	AIU	U	NA
Cooper's Hawk	Accipiter cooperii	СН	AIU	U	NA
Northern Goshawk	Accipiter gentilis	NG	AIU	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	AIU	U	DLU
Swanson's Hawk	Buteo swainsoni	SW	U	U	DLU
Red-tailed Hawk	Buteo jamaicensis	RT	AIU	U	DLU
Ferruginous Hawk	Buteo regalis	FH	AIU	U	DLU
Rough-legged Hawk	Buteo lagopus	RL	U	U	DLU
Unknown buteo	Buteo spp.	UB	U	U	DLU
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	AIU	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

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.

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: 2011.

			Median		WIND			BAROM.	Median	VISIB.	VISIB.	MEDIAN	
	OBS.	OBSRVR	VISITOR	PREDOMINANT	SPEED	WIND	TEMP	PRESS.	THERMAL	EAST	WEST	FLIGHT	BIRDS
DATE	HOURS	/ HOUR ¹	DISTURB ²	WEATHER ³	(KPH) ¹	DIRECTION	$(^{\circ}C)^{1}$	(IN HG) ¹	LIFT ⁴	$(KM)^1$	$(KM)^1$	DISTANCE ⁵	/ Hour
27-Aug	8.75	3.0	0	clr-mc-clr, haze	3.2	sw-w / variable	32.0	30.52	2	27.0	77.8	0	0.5
28-Aug	9.00	3.0	0	pc, haze	3.4	S-W	25.8	30.44	2	26.5	70.5	2	2.2
29-Aug	9.00	2.8	0	clr, haze	6.7	SW-W	22.2	30.38	3	33.2	76.8	0	0.8
30-Aug	2.67	3.7	0	ovc, fog	16.3	sw-nw	16.7	30.30	4	25.0	18.3	0	0.0
31-Aug	5.00	2.3	0	ovc	6.6	w-nw	10.0	30.35	4	20.0	4.8	0	0.0
1-Sep	8.83	2.6	0	clr, haze	7.9	sw-nw, ne-se	20.0	30.54	3	25.0	70.0	0	0.9
2-Sep	9.00	2.4	0	clr, haze	6.4	SW-W	22.0	30.56	3	37.0	57.0	2	2.4
3-Sep	8.92	3.3	0	clr, haze	9.6	ne-e	19.7	30.55	3	46.0	73.0	2	3.3
4-Sep	8.92	3.4	0	clr, haze	8.2	SW-W	26.3	30.44	1	37.5	59.0	2	3.6
5-Sep	9.00	2.9	0	clr, haze	8.2	SW-W	25.5	30.45	2	32.0	60.5	2	2.8
6-Sep	9.00	2.0	0	clr, haze	1.4	se-sw	26.0	30.63	2	24.0	22.0	2	2.9
7-Sep	9.00	2.4	0	clr-pc, haze	12.1	n-e	25.7	30.62	2	41.5	48.0	2	2.4
8-Sep	9.00	1.9	0	pc, haze	4.8	ne-e	29.1	30.67	2	32.5	40.0	2	5.3
9-Sep	9.00	2.0	0	clr, haze	4.7	n-e	27.5	30.70	2	22.0	35.5	1	4.8
10-Sep	8.83	2.9	0	clr, haze	4.2	n-e	27.2	30.53	2	16.5	50.0	2	4.9
11-Sep	8.25	3.3	0	clr, haze	3.9	sw-nw, ne-se	28.4	30.46	2	28.5	25.7	3	5.6
12-Sep	9.00	2.1	0	clr, haze	5.8	sw-nw, n-ne	27.9	30.55	2	8.0	5.7	2	3.4
13-Sep	9.00	2.4	0	clr, haze	9.8	w-nw	25.2	30.55	2	21.0	24.5	2	3.1
14-Sep	9.00	3.4	0	clr, haze	11.7	w-nw	20.0	30.41	2	41.0	67.0	2	4.1
15-Sep	1.75	2.0	0	ovc	19.0	SW-W	9.7	30.34	4	33.3	6.0	1	0.6
16-Sep	8.75	2.3	1	ovc-mc	14.3	sw-nw	13.1	30.31	3	57.0	14.8	2	4.5
17-Sep	7.75	2.6	2	ovc	13.2	sw-nw	13.1	30.43	4	52.8	33.1	2	2.6
18-Sep	0.00			weather day									
19-Sep	5.50	1.8	0	pc-clr	10.8	sw-nw	17.8	30.37	3	58.3	14.7	2	6.0
20-Sep	9.00	2.8	0	clr	8.8	sw-nw, ne-se	20.7	30.36	1	84.5	87.0	2	12.1
21-Sep	9.00	3.9	0	clr-pc, haze	8.2	se-sw	25.0	30.34	2	81.0	85.0	2	13.8
22-Sep	9.00	2.6	0	pc-mc, haze	16.3	sw-nw	22.9	30.33	2	84.5	74.0	2	6.3
23-Sep	9.25	2.7	0	clr, haze	16.7	sw-nw	25.6	30.35	4	72.5	75.5	2	13.9
24-Sep	9.00	3.8	2	clr-mc, haze	14.5	se-sw	25.9	30.11	2	34.5	58.5	2	16.3
25-Sep	1.75	2.8	0	mc, haze	23.3	sw-nw	11.3	30.03	4	75.0	43.7	2	3.4
26-Sep	5.00	2.0	0	ovc, rain	23.2	sw-nw	12.8	30.17	4	91.7	53.3	2	2.0
27-Sep	0.00	0.0		weather day									
28-Sep	9.00	3.8	0	clr, fog/haze	10.9	ne-e	12.9	30.42	3	77.5	90.5	1	31.2
29-Sep	8.75	2.9	0	clr, haze	8.3	sw-nw, ne-se	21.7	30.24	2	63.1	91.9	2	29.5
30-Sep	8.75	2.3	0	mc-ovc	11.6	sw-nw	23.3	30.12	2	78.9	77.8	2	8.8
1-Oct	5.50	3.2	0	ovc	17.0	sw-nw	14.3	30.09	4	53.3	17.8	1	3.8
2-Oct	4.25	2.8	1	ovc, fog	8.6	SW-W	13.1	30.11	4	43.6	6.0	2	3.1
3-Oct	0.00	0.0		weather day									
4-Oct	5.83	2.0	0	ovc, fog	11.4	sw-w / variable	9.7	29.74	4	62.1	49.3	1	7.7
5-Oct	0.00	0.0		weather day									
6-Oct	0.00	0.0		weather day									
7-Oct	0.00	0.0		weather day									
8-Oct	9.33	3.0	0	ovc-pc-clr, fog	6.9	se-sw	12.4	30.34	4	86.6	62.0	2	28.1
9-Oct	3.75	2.4	0	ovc, fog	11.0	SW-W	11.0	30.15	4	57.4	3.8	2	6.4
10-Oct	0.00	0.0		weather day									
11-Oct	0.00	0.0		weather day									
12-Oct	8.00	3.3	0	ovc-mc, fog	16.2	SW-W	10.4	30.33	3	51.1	17.7	2	29.6
13-Oct	7.00	3.4	0	ovc	5.4	ne-e	8.9	30.25	4	91.4	82.1	2	14.1
14-Oct	8.00	2.0	0	ovc	13.5	SW-W	12.3	30.13	4	53.1	44.3	2	11.1

			Median		Wind			BAROM.	MEDIAN	VISIB.	VISIB.	Median	
	OBS.	OBSRVR	VISITOR	PREDOMINANT	Speed	WIND	TEMP	PRESS.	THERMAL	EAST	WEST	FLIGHT	BIRDS
DATE	HOURS	$/ HOUR^1$	DISTURB ²	WEATHER ³	$(KPH)^1$	DIRECTION	$(^{\circ}C)^{1}$	(IN HG) ¹	$LIFT^4$	$(KM)^1$	$(KM)^1$	DISTANCE ⁵	/HOUR
15-Oct	6.00	3.0	2	ovc, fog	2.4	sw-nw	15.0	30.20	4	1.4	8.0	1	2.8
16-Oct	8.00	2.9	0	ovc-mc-pc, fog	11.4	sw-nw	13.7	30.28	3	50.9	35.0	2	53.1
17-Oct	9.00	3.3	0	clr, fog	3.4	variable	14.9	30.52	1	103.5	115.5	2	18.0
18-Oct	9.00	3.6	0	clr, haze	15.8	ne-se	11.6	30.36	3	63.3	98.3	2	13.4
19-Oct	4.50	2.0	0	clr-ovc, haze	15.3	SW-W	11.7	30.18	3	72.5	37.5	1	2.9
20-Oct	9.00	1.7	0	clr-pc-ovc, haze	9.4	sw-nw	12.3	30.25	4	112.0	85.0	2	12.1
21-Oct	1.75	2.0	0	pc-ovc, fog	12.5	w-nw	13.0	30.39	3	70.0	30.0	2	14.3
22-Oct	0.00	0.0		weather day									
23-Oct	6.00	3.0	1	pc-ovc	10.7	sw-nw	13.1	30.28	2	88.6	13.6	2	10.8
24-Oct	7.75	2.2	0	ovc-pc, fog	14.6	w-nw	4.7	30.32	3	84.3	40.0	2	5.8
25-Oct	8.50	3.8	0	clr, fog	5.0	n-e	5.8	30.45	2	120.1	117.7	2	4.9
26-Oct	9.00	2.3	0	ovc, fog	10.9	w-nw	7.1	30.37	4	111.0	102.0	2	1.7
27-Oct	8.75	3.2	0	clr, haze	2.8	variable	9.8	30.33	4	115.0	103.0	2	4.1
28-Oct	7.00	3.0	0	ovc, haze-fog	26.0	SW-W	9.8	30.18	3	72.8	66.7	2	5.7
29-Oct	7.00	1.9	2.5	pc-clr	16.5	w-nw	9.6	30.39	3	117.5	81.9	2	4.9
30-Oct	0.00			weather day									
31-Oct	0.00			weather day									

Appendix C. continued

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.

	OBS	SPEC	TES ¹																											BIRDS
DATE	HOURS	TV	OS	NH	SS	СН	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-11	8.75	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.5
28-Aug-11	9.00	1	0	0	0	1	0	0	0	0	0	0	0	12	0	0	0	3	0	0	1	1	0	1	0	0	0	0	20	2.2
29-Aug-11	9.00	0	0	0	0	1	0	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0.8
30-Aug-11	2.67	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
31-Aug-11	5.00	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
01-Sep-11	8.83	1	1	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0.9
02-Sep-11	9.00	0	0	1	1	1	0	0	0	0	0	0	1	17	0	0	0	0	0	0	0	0	0	1	0	0	0	0	22	2.4
03-Sep-11	8.92	6	1	1	9	4	0	0	0	0	0	0	0	6	0	0	0	1	0	0	0	0	1	0	0	0	0	0	29	3.3
04-Sep-11	8.92	5	2	1	8	3	0	0	0	0	0	0	0	12	0	0	0	0	1	0	0	0	0	0	0	0	0	0	32	3.6
05-Sep-11	9.00	3	2	0	6	3	0	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	2.8
06-Sep-11	9.00	7	1	1	4	3	0	0	0	0	0	0	1	3	0	0	0	0	3	0	1	1	0	0	0	1	0	0	26	2.9
07-Sep-11	9.00	4	0	2	5	4	0	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	2.4
08-Sep-11	9.00	15	0	0	17	6	0	3	0	0	0	0	0	5	0	0	0	1	0	0	0	1	0	0	0	0	0	0	48	5.3
09-Sep-11	9.00	24	0	0	10	2	0	1	0	0	0	0	0	4	0	0	0	1	0	0	0	0	0	1	0	0	0	0	43	4.8
10-Sep-11	8.83	12	0	1	15	2	0	1	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	4.9
11-Sep-11	8.25	9	2	0	16	1	0	1	0	0	0	0	0	14	0	0	1	0	1	0	0	0	0	0	0	0	0	1	46	5.6
12-Sep-11	9.00	15	4	0	4	0	2	1	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	3.4
13-Sep-11	9.00	2	5	0	5	4	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	3.1
14-Sep-11	9.00	11	3	1	5	1	1	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	4.1
15-Sep-11	1.75	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.6
16-Sep-11	8.75	3	6	0	9	1	0	1	0	0	0	0	0	15	0	0	0	2	1	0	0	0	1	0	0	0	0	0	39	4.5
17-Sep-11	7.75	5	2	0	7	2	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	20	2.6
18-Sep-11	0.00	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
19-Sep-11	5.50	0	6	0	5	3	0	1	0	0	0	0	0	17	0	0	0	1	0	0	0	0	0	0	0	0	0	0	33	6.0
20-Sep-11	9.00	32	2	2	38	7	1	3	0	0	0	0	0	18	0	0	0	2	1	1	0	2	0	0	0	0	0	0	109	12.1
21-Sep-11	9.00	36	3	1	38	12	0	6	0	0	0	0	0	25	0	0	1	0	0	0	1	0	0	1	0	0	0	0	124	13.8
22-Sep-11	9.00	12	1	2	17	7	0	0	0	0	0	0	0	14	0	0	0	0	1	0	0	2	0	1	0	0	0	0	57	6.3
23-Sep-11	9.25	27	6	1	46	14	0	9	0	0	0	0	0	21	0	0	0	1	1	0	0	2	0	1	0	0	0	0	129	13.9

Appendix D. Daily observation effort and fall raptor migration counts by species at Bonney Butte, Oregon: 2011.

Appendix D. continued

	OBS	SPEC	CIES ¹																											BIRDS
DATE	Hours	TV	OS	NH	SS	СН	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/ Hour
24-Sep-11	9.00	23	1	0	61	24	1	8	0	0	0	0	0	23	0	0	0	3	0	0	0	1	0	1	0	0	0	1	147	16.3
25-Sep-11	1.75	0	0	0	2	2	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6	3.4
26-Sep-11	5.00	4	0	0	3	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	10	2.0
27-Sep-11	0.00	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
28-Sep-11	9.00	174	1	4	45	20	1	10	0	0	0	0	0	22	0	0	0	3	0	0	0	1	0	0	0	0	0	0	281	31.2
29-Sep-11	8.75	53	0	3	116	40	5	5	0	0	0	0	0	31	0	0	0	2	1	0	1	0	1	0	0	0	0	0	258	29.5
30-Sep-11	8.75	4	3	0	33	9	3	3	0	0	0	0	0	18	0	0	0	0	1	0	0	2	0	1	0	0	0	0	77	8.8
01-Oct-11	5.50	0	0	1	13	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	21	3.8
02-Oct-11	4.25	0	1	0	8	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	3.1
03-Oct-11	0.00	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
04-Oct-11	5.83	12	0	0	28	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	1	0	0	0	1	45	7.7
05-Oct-11	0.00	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
06-Oct-11	0.00	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
07-Oct-11	0.00	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
08-Oct-11	9.33	2	6	2	144	26	1	4	0	0	0	0	0	46	0	0	0	11	4	0	0	12	0	4	0	0	0	0	262	28.1
09-Oct-11	3.75	2	0	0	13	0	2	0	0	0	0	0	0	5	0	0	0	0	1	0	0	1	0	0	0	0	0	0	24	6.4
10-Oct-11	0.00	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
11-Oct-11	0.00	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
12-Oct-11	8.00	0	2	1	115	34	0	5	0	0	0	0	0	53	0	0	0	3	13	0	0	10	0	1	0	0	0	0	237	29.6
13-Oct-11	7.00	0	0	0	65	11	1	1	0	0	0	0	0	9	0	0	0	2	7	0	2	1	0	0	0	0	0	0	99	14.1
14-Oct-11	8.00	0	1	3	59	10	0	0	0	0	0	0	0	4	0	0	0	4	1	0	0	7	0	0	0	0	0	0	89	11.1
15-Oct-11	6.00	0	0	0	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	17	2.8
16-Oct-11	8.00	5	4	1	169	67	1	7	0	0	0	0	0	99	0	0	2	12	23	0	2	28	0	4	0	0	0	1	425	53.1
17-Oct-11	9.00	0	1	2	66	13	2	5	0	0	0	0	0	53	0	0	0	6	3	0	0	8	0	2	0	0	0	1	162	18.0
18-Oct-11	9.00	1	0	1	65	10	0	2	0	0	0	0	0	33	0	0	1	2	3	0	0	3	0	0	0	0	0	0	121	13.4
19-Oct-11	4.50	0	0	1	7	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	1	0	0	0	0	0	13	2.9
20-Oct-11	9.00	0	3	1	66	6	0	0	0	0	0	0	0	20	0	0	0	2	3	0	0	8	0	0	0	0	0	0	109	12.1
21-Oct-11	1.75	0	0	0	15	5	0	0	0	0	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	25	14.3

Appen	dix D.	continue	d
p		••••••••	-

	OBS	SPEC	IES ¹																											Birds
DATE	HOURS	TV	OS	NH	SS	СН	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/ Hour
22-Oct-11	0.00	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
23-Oct-11	6.00	0	0	0	33	5	1	0	0	0	0	0	0	17	0	0	0	6	1	0	0	2	0	0	0	0	0	0	65	10.8
24-Oct-11	7.75	0	0	0	9	4	0	0	0	0	0	0	0	15	0	0	0	11	3	1	0	2	0	0	0	0	0	0	45	5.8
25-Oct-11	8.50	0	1	1	10	2	1	0	0	0	0	0	0	17	0	0	0	4	5	0	0	1	0	0	0	0	0	0	42	4.9
26-Oct-11	9.00	0	0	0	5	1	0	0	0	0	0	0	0	4	0	1	0	3	1	0	0	0	0	0	0	0	0	0	15	1.7
27-Oct-11	8.75	0	0	1	12	2	0	0	0	0	0	0	0	7	0	0	0	5	4	0	0	4	0	1	0	0	0	0	36	4.1
28-Oct-11	7.00	0	0	1	8	2	0	0	0	0	0	0	0	15	0	0	0	12	1	1	0	0	0	0	0	0	0	0	40	5.7
29-Oct-11	7.00	0	0	0	4	1	2	0	0	0	0	0	0	12	0	1	0	6	5	0	0	3	0	0	0	0	0	0	34	4.9
30-Oct-11	0.00	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
31-Oct-11	0.00	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
Total	414.33	510	72	39	1448	380	26	81	1	0	0	0	2	775	0	2	5	110	93	3	8	114	4	21	0	1	0	6	3701	8.9

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

	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. Annual observation effort and fall raptor migration counts by species at Bonney Butte, Oregon: 1994–2011.

	2004	2005	2006	2007	2008	2009	2010	2011	Mean
Start date	27-Aug	27-Aug	28-Aug	27-Aug	28-Aug	27-Aug	27-Aug	27-Aug	28-Aug
End date	29-Oct	27-Oct	31-Oct	31-Oct	31-Oct	25-Oct	22-Oct	29-Oct	28-Oct
Observation days	46	49	57	51	60	51	52	55	51
Observation hours	341.25	392.92	459.92	397.00	481.83	425.75	421.42	414.33	378.92
Raptors / 100 hours	1119.7	699.6	577.5	571.5	514.5	649.9	804.4	893.2	772.92
SPECIES					RAPTOR	Counts			
Turkey Vulture	326	389	232	281	269	469	446	510	313
Osprey	70	60	38	47	70	101	81	72	67
Northern Harrier	29	38	33	13	19	33	18	39	28
Sharp-shinned Hawk	1790	1067	1015	921	1003	1110	1438	1448	1114
Cooper's Hawk	485	269	418	249	316	339	420	380	344
Northern Goshawk	33	24	40	16	33	18	47	26	28
Unknown small accipiter ¹	27	14	7	52	111	71	10	81	34
Unknown large accipiter ¹	2	13	2	10	12	6	10	1	6
Unknown accipiter	0	46	60	12	37	0	27	0	57
TOTAL ACCIPITERS	2337	1433	1542	1260	1512	1544	1952	1936	1565
Red-shouldered Hawk	7	0	0	3	3	1	0	0	1
Broad-winged Hawk	2	2	1	0	5	10	2	0	7
Swainson's Hawk	1	0	0	1	0	0	4	2	1
Red-tailed Hawk	725	562	531	388	359	361	588	775	561
Ferruginous Hawk	0	1	0	0	0	0	0	0	0
Rough-legged Hawk	17	3	27	6	16	8	5	2	13
Unidentified buteo	9	4	30	40	16	3	7	5	27
TOTAL BUTEOS	761	572	589	438	399	383	606	784	610
Golden Eagle	93	72	56	52	52	63	80	110	85
Bald Eagle	61	55	44	45	46	55	68	93	49
Unidentified eagle	2	1	1	2	8	5	1	3	3
TOTAL EAGLES	156	128	101	99	106	123	149	206	137
American Kestrel	14	9	17	7	16	27	9	8	20
Merlin	105	80	69	71	62	71	108	114	70
Prairie Falcon	5	3	7	6	3	2	8	4	5
Peregrine Falcon	14	14	10	5	11	11	10	21	7
Unknown small falcon ¹	1	2	0	5	0	0	0	0	1
Unknown large falcon ¹	0	10	1	3	0	2	0	1	2
Unknown falcon	0	6	1	1	2	0	0	0	2
TOTAL FALCONS	139	124	105	98	94	113	135	148	105
Unidentified raptor	3	5	16	33	10	1	3	6	22
GRAND TOTAL	3821	2749	2656	2269	2479	2767	3390	3701	2848

Appendix E. continued

¹ Designations used for the first time in 2001.

	STATION							SPEC	CIES ¹								
DATE	HOURS	NH	SS	СН	NG	RS	BW	RT	RL	GE	BE	AK	ML	PR	PG	TOTAL	CAPTURES/HR
27-Aug-11	0.00																
28-Aug-11	0.00																
29-Aug-11	0.00																
30-Aug-11	0.00																
31-Aug-11	0.00																
01-Sep-11	4.00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.3
02-Sep-11	6.00	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2	0.3
03-Sep-11	5.10	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3	0.6
04-Sep-11	0.00																
05-Sep-11	0.00																
06-Sep-11	0.00																
07-Sep-11	0.00																
08-Sep-11	0.00																
09-Sep-11	3.25	0	1	2	0	0	0	2	0	0	0	0	0	0	0	5	1.5
10-Sep-11	4.75	0	0	1	0	0	0	2	0	0	0	0	0	0	0	3	0.6
11-Sep-11	0.00																
12-Sep-11	6.50	0	1	1	1	0	0	1	0	0	0	0	1	0	0	5	0.8
13-Sep-11	4.50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
14-Sep-11	0.50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2.0
15-Sep-11	0.00																
16-Sep-11	7.00	0	1	1	0	0	0	1	0	0	0	0	0	0	0	3	0.4
17-Sep-11	4.25	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
18-Sep-11	0.00																
19-Sep-11	3.75	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3	0.8
20-Sep-11	7.00	0	5	1	0	0	0	1	0	0	0	0	0	0	0	7	1.0
21-Sep-11	7.25	0	5	4	0	0	0	3	0	0	0	0	I	0	0	13	1.8
22-Sep-11	0.00																
23-Sep-11	0.00	0	17	4	0	0	0	1	0	0	0	0	0	0	0	21	2.5
24-Sep-11	0.00	0	16	4	0	0	0	1	0	0	0	0	0	0	0	21	3.5
25-Sep-11	0.00																
20-Sep-11	0.00																
27-Sep-11 28 Sep 11	0.00																
20-Sep-11	5.25	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0.8
30-Sep-11	7.00	0	4	5	1	0	0	2	0	0	0	0	0	0	0	4 17	0.8
01-Oct-11	2.00	0	9 1	0	0	0	0	0	0	0	0	0	0	0	0	1	2.4
02-Oct-11	1.50	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0.3
02-Oct-11	0.00	0	2	U	U	U	0	0	0	0	U	0	0	U	U	2	1.5
04-Oct-11	0.00																
05-Oct-11	0.00																
06-Oct-11	0.00																
07-Oct-11	0.00																
08-Oct-11	3.67	0	12	4	0	0	0	0	0	0	0	0	0	0	0	16	44
09-Oct-11	2.75	Ő	2	0	Õ	Ő	Ő	Ő	Õ	Õ	Õ	Ő	Ő	Ő	Õ	2	0.7
10-Oct-11	0.00	-	_	-	-	-	~	-	-	-	-	÷	-	-	-	-	
11-Oct-11	0.00																

Appendix F. Daily capture totals of migrating raptors at Bonney Butte, Oregon: 2011.

	STATION							SPE	CIES ¹								
DATE	HOURS	NH	SS	СН	NG	RS	BW	RT	RL	GE	BE	AK	ML	PR	PG	TOTAL	CAPTURES/HR
12-Oct-11	6.00	0	6	1	0	0	0	1	0	0	0	0	1	0	0	9	1.5
13-Oct-11	5.25	0	5	0	0	0	0	0	0	0	0	0	0	0	0	5	1.0
14-Oct-11	0.00																
15-Oct-11	0.00																
16-Oct-11	0.00																
17-Oct-11	5.50	0	3	0	0	0	0	2	0	0	0	0	0	0	0	5	0.9
18-Oct-11	5.00	0	4	2	0	0	0	1	0	0	0	0	0	0	0	7	1.4
19-Oct-11	2.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
20-Oct-11	2.00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	1.5
21-Oct-11	0.00																
22-Oct-11	0.00																
23-Oct-11	5.25	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4	0.8
24-Oct-11	5.00	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2	0.4
25-Oct-11	6.00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
26-Oct-11	5.00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2

Appendix F. Daily capture totals of migrating raptors at Bonney Butte, Oregon: 2011.

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

	1995	1996	1997	1998	1999	2000	2001	2002	2003
First trapping day	7-Oct	18-Sep	31-Aug	6-Sep	5-Sep	28-Aug	25-Aug	27-Aug	26-Aug
Last trapping day	28-Oct	10-Oct	1-Nov	30-Oct	24-Oct	24-Oct	28-Oct	27-Oct	27-Oct
Number of stations	1	1	1	1	1	1	1	1	1
Station days	10	21	39	34	22	58	50	55	47
Station hours	44.50	127.20	202.80	199.95	142.75	239.75	320.50	357.75	345.35
Captures / 10 stn hrs	4.9	10.0	11.0	12.8	10.0	13.0	10.3	10.4	12.5
Species	Number of	f captures							
Northern Harrier	0	1	0	2	1	1	0	6	4
Sharp-shinned Hawk	18	80	139	163	82	161	171	172	268
Cooper's Hawk	0	20	29	43	14	67	74	71	64
Northern Goshawk	1	7	7	3	3	8	11	7	12
Red-shouldered Hawk	0	0	0	0	0	0	0	0	0
Broad-winged Hawk	0	0	0	0	0	1	0	0	0
Red-tailed Hawk	2	14	39	29	36	66	66	108	73
Rough-legged Hawk	0	0	1	0	1	0	1	0	0
Golden Eagle	0	3	2	1	2	3	2	0	2
Bald Eagle	0	0	0	0	0	0	0	0	0
American Kestrel	0	0	0	0	1	0	1	0	0
Merlin	1	2	5	11	3	1	4	5	4
Prairie Falcon	0	0	1	4	0	1	0	1	3
Peregrine Falcon	0	0	0	0	0	2	0	1	0
All species	22	127	223	256	143	311	330	371	430
Recaptures	0	0	0	0	0	0	0	0	0
Foreign Recaptures	0	0	1	1	0	0	1	0	2
Foreign Encounters	1	0	1	2	6	3	2	6	8

Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Bonney Butte, Oregon: 1995–2011.

Appendix	G.	continu	led
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	2004	2005	2006	2007	2008	2009	2010	2011	Mean	Total
First trapping day	27-Aug	27-Aug	27-Aug	27-Aug	28-Aug	27-Aug	27-Aug	1-Sep	28-Aug	
Last trapping day	15-Oct	27-Oct	28-Oct	30-Oct	30-Oct	25-Oct	21-Oct	26-Oct	25-Oct	
Number of stations	1	1	1	1	1	1	1	1	1	
Station days	36	48	49	45	56	49	38	30	44	
Station hours	263.00	342.25	354.25	317.25	406.00	359.50	263.25	139.52	283.56	
Captures / 10 stn hrs	15.0	15.3	13.9	10.5	10.5	13.9	13.5	10.6	12.2	
Species										
Northern Harrier	2	7	2	1	3	3	0	0	2.1	33
Sharp-shinned Hawk	219	310	259	200	247	337	199	93	201.3	2826
Cooper's Hawk	90	101	88	74	100	98	68	30	67.4	933
Northern Goshawk	14	12	11	3	15	3	21	2	8.8	117
Red-shouldered Hawk	0	0	0	1	1	0	0	0	0.1	2
Broad-winged Hawk	0	0	0	0	1	0	0	0	0.1	2
Red-tailed Hawk	61	67	106	42	45	39	57	19	56.9	793
Rough-legged Hawk	0	1	1	0	1	0	0	0	0.4	6
Golden Eagle	1	3	6	0	1	2	1	0	1.7	28
Bald Eagle	0	1	0	0	0	2	0	0	0.2	3
American Kestrel	0	0	2	1	1	1	1	2	0.7	7
Merlin	4	13	12	9	8	12	8	2	6.7	94
Prairie Falcon	4	3	4	2	1	1	0	0	1.7	25
Peregrine Falcon	0	4	1	0	1	0	0	0	0.6	9
All species	395	522	492	333	425	498	355	148	348.8	4878
Recaptures	2	1	1	0	0	0	0	0	0.3	4
Foreign Recaptures	2	3	1	1	1	2	1	0	1.1	15
Foreign Encounters	5	9	6	7	3	8	0	0	4.4	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.