

**FALL 2000 RAPTOR MIGRATION STUDIES AT
CHELAN RIDGE, WASHINGTON**

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INTRODUCTION

The Chelan Ridge Raptor Migration Project in north-central Washington is an ongoing effort to monitor long-term trends in populations of raptors using this north Cascades migratory flyway. HawkWatch International (HWI), in partnership with the Okanogan and Wenatchee National Forests (OWNF), initiated standardized counts of the autumn raptor migration through this region in 1997, with full-season counts commencing in 1998. The Falcon Research Group (FRG) also joined the partnership in 1998 to coordinate a trapping and banding program at the project site. To date, HWI observers have recorded 18 species of migratory diurnal raptors at the site, with counts ranging between 2,400 and 2,900 migrants per season. The 2000 season marked the third consecutive full-season count at the site and the second consecutive season of banding. This report summarizes the 2000 count and banding results.

The Chelan project was 1 of 15 long-term, annual migration counts (12 fall, 3 spring) and 1 of 7 migration banding studies (6 fall, 1 spring—including the FRG operation at Chelan) conducted or sponsored by HWI in North America during 2000. The primary objective of these efforts is to track long-term population trends of diurnal raptors throughout primarily western North America (see Smith and Hoffman 2000 for a comprehensive review of raptor migration monitoring in western North America). Raptors feed atop food pyramids, inhabit most ecosystems, occupy large home ranges, and are sensitive to environmental contamination and other human disturbances. Therefore, they serve as important biological indicators of ecosystem health (Cade et al. 1988; Bednarz et al. 1990a; Bildstein and Zalles 1995). Moreover, due to the remoteness and widespread distribution of most raptor populations, migration counts likely represent the most cost-effective and efficient method for monitoring the regional status and trends of multiple raptor species (Bednarz and Kerlinger 1989, Titus et al. 1989, Bildstein and Zalles 1995, Bildstein et al. 1995, Dunn and Hussell 1995, Dixon et al. 1998, Smith and Hoffman 2000).

The intensive counting and banding operations also provide valuable information about breeding and wintering distributions, migratory routes, migratory behavior, population demographics, mortality factors and longevity, morphometric variation, molt sequences and timing, and health assessments. This information enables us to better understand the life histories, ecology, status, and conservation needs of raptor populations in North America. In addition, these migration studies offer unique opportunities for the public to learn about raptors and the natural environment, and providing such opportunities is another important component of the missions of HWI, OWNF, and FRG. Accordingly, besides ensuring efficient local coordination of the overall project, OWNF personnel and volunteers, working in tandem with the HWI observers and FRG banders, have played a critical role in coordinating educational opportunities at the site each season.

STUDY SITE

Chelan Ridge is located approximately 21 km (13 mi) north–northwest of the village of Chelan on the Chelan County / Okanogan County and Okanogan National Forest / Wenatchee National Forest borders (48°01'12.8"N, 120°05'38.4"W; Figure 1). The study site is accessed by following Washington State Road 153 about 11 km northwest of Pateros, then Black Canyon Road (USFS Road 4010) west–southwest until it ends, then Cooper Mountain Road (USFS Road 8020) southeast for another 5.4 km.

The Chelan Ridge count site sits at an elevation of 1,729 m (5,675 ft) and provides a 360° view of the surrounding landscape. The view to the south extends across Lake Chelan and into the Wenatchee National Forest. The view to the west follows the ridgeline (known as Cooper Ridge) and extends into the Sawtooth Wilderness. The view to the north extends across the Methow Valley and into the Pasayten Wilderness. The view to the east extends across the Columbia River and the Waterville Plateau. The lookout's southwestern slope is a cliff face with a 70–80° slope that drops about 65 m (200 ft) into the

Mitchell Creek Basin. This cliff face creates excellent updrafts on days of moderate to strong south winds. On such days, migrants using the updrafts fly extremely close to the observation point. There are also unobstructed views of the regions to the south (the basin) and west where thermals frequently form. Mitchell Creek Basin fills the east–west view and is a common place to spot raptors. This basin is approximately 3.5 km wide, with Goff Peak the major landmark on the southern side of the basin. In 1970, a major forest fire cleared Mitchell Creek Basin and today it is filled with snags, lots of exposed rocks, and young, regenerating vegetation consisting mainly of Scouler willow (*Salix scouleri*), big basin sagebrush (*Artemisia tridentata*), and some lodgepole pine (*Pinus contorta*). Many migrants enter Mitchell Creek Basin through a gap in the ridge between the observation point and a similar high point further up the ridge. Looking north into Black Canyon it is difficult to spot migrants against the dark-green backdrop lodgepole and Ponderosa pine (*Pinus ponderosa*) forest. Although the view of the northern horizon is unobstructed, one can not see all of Black Canyon from the lookout. To the southeast, migrant raptors often fly through another gap between the lookout and Cooper Mountain. Some migrants pass the lookout undetected but later can be seen rising above the horizon on thermals near Cooper Mountain.

Two trapping and banding stations were located approximately 1.5 and 4 km southeast of the count site (Figure 1). Because the stations were located sufficiently “downstream” of the count site, the trapping operations did not affect the behavior of migrants in ways that might have produced a biased count.

METHODS

Two official or designated observers, relieved or supplemented by other trained volunteers, conducted standardized daily counts of migrating raptors from a single traditional observation site. Primary observers Dan Harrington and Richard Hendrick each had two previous seasons of experience counting migratory raptors (see Appendix A for a complete history of observer participation). Visitors also frequently assisted with spotting migrants. Weather permitting, observations usually began between 0700 and 0800 hrs and ended between 1500 and 1600 hrs Pacific Standard Time (PST).

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), 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 mean number of observers (official observers plus visitors who actively scanned for migrants for more than 10 minutes in a given hour) and visitors (all other guests) present during each hour.
6. Daily start and end times for each official observer.

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

published by the Hawk Migration Association of North America (HMANA). Assessments of thermal lift conditions as poor, fair, good, or excellent involved subjective evaluations of solar intensity, wind speed, and migrant behavior.

The observers classified as residents and excluded from daily counts any raptor that exhibited hunting, territorial display, or perching behaviors for extended periods. The observers occasionally recorded as migrants birds that were not moving in a southerly direction, if such birds otherwise displayed migrant characteristics; i.e., continuous flight without stopping or substantially changing directions for several kilometers. Such birds may be dispersing juveniles or adults dispersing relatively short-distances from their nesting territories to favored wintering grounds in the same general region. However, we also know from recent satellite telemetry work that species such as Prairie Falcons and Ferruginous Hawks frequently “migrate” in non-standard directions to take advantage of favored post-breeding and wintering grounds (Watson and Pierce 2000, K. Steenhof personal communication).

For purposes of examining long-term variation in annual counts, it is often recommended that count data be standardized for sampling period and adjusted for daily variation in observation effort because seasonal and daily duration of observation effort can greatly affect count statistics (Hussell 1985, Kerlinger 1989, Bednarz et al. 1990b). For purposes of this report, I converted annual counts to passage rates (raptors/100 hours of observation) to adjust for variation in daily sampling effort, and present both raw counts and passage rates for comparison.

RESULTS

WEATHER

Inclement weather precluded observations on four days during the 2000 season, all of which occurred after 19 October (see Appendix C for daily weather records). This was similar to the past two seasons, but 2000 featured a substantially higher proportion of active observation days with mostly cloudy to overcast skies and fog/haze or rain/snow (22% vs. 4–7% for 1998–1999). Daily-average temperatures ranged from 2.3 to 19.4 °C, with a season average of 9.6 °C. The average falls between the averages for the past two years; however, the minimum is slightly warmer than for the past two years, while the maximum is about 5° colder. Average wind velocities were similar to 1999, with light winds (<12 kph) slightly more common (55% of days) than moderate (12–28 kph) winds (42%), and strong winds occurring on only 3% of the days. This contrasts markedly with 1998, however, which featured almost entirely light winds (91% of days) and no strong-wind days.

The combination of more overcast/stormy days and a high proportion of moderate to strong winds resulted in a relatively high proportion of days with thermal conditions rated fair to poor (91% vs. 47% and 77% in 1998 and 1999, respectively). At many ridgeline migration monitoring sites, poor thermal conditions and stronger winds frequently translate to more migrants hugging the ridgeline to take advantage of wind-driven updrafts as opposed to dispersed thermal lift. However, this did not appear to apply this season at Chelan Ridge, as a relatively high proportion of migrants were recorded as passing by at distances from the ridge requiring binoculars for identification. This may reflect the fact that when thermal and wind conditions are such that migrants tend to hug ridgelines, those using this flyway have several alternatives from which to choose.

Southwesterly winds are most common at this site. Such winds predominated on 40% of the active observation days in 2000 and occurred during portions of another 40% of the days. The only appreciable difference in wind directions between 2000 and the previous two years was that 2000 featured more days with some southeasterly winds (27% vs. 11–12%) and fewer days with some northeasterly winds (22% vs. 23–46%). How this difference might have affected the 2000 count is unknown at this time.

OBSERVATION EFFORT

The observers worked on 67 of 71 possible observation days between 27 August and 5 November. The numbers of observation days and hours (505.75) were 18% and 14% higher than average, respectively, primarily because we extended the season nine days later than during any previous season (Table 1). The 2000 average of 1.6 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was a statistically insignificantly 12% lower than the 1998–1999 average of $1.9 \pm 95\%$ CI of 0.44 observers/hr.

MIGRATION SUMMARY

The observers counted 2,434 raptors of 17 species during the 2000 season (Table 1, and see Appendix D for daily count records). The flight consisted of 57% accipiters, 21% buteos, 8% eagles, 4% harriers, 3% falcons, 3% Ospreys, 1% vultures, and 3% unknown raptors (Figure 2). Compared to the previous two seasons, these values reflect significantly higher than average proportions of eagles and Ospreys, and significantly lower than average proportions of falcons, harriers, and unknown raptors. The most common species seen in 2000 were the Sharp-shinned Hawk (43% of the total count), Red-tailed Hawk (15%), Cooper's Hawk (8%), and Golden Eagle (7%). All other species each comprised less than 5% of the total count.

A single adult Ferruginous Hawk seen on 6 October was the first individual of this species recorded by the project. Counts also reached record highs for Ospreys, Sharp-shinned Hawks, Rough-legged Hawks, and Golden and Bald Eagles (see Appendix E for annual summaries); however, passage rates increased significantly only for Ospreys and Golden and Bald Eagles (Table 1). Counts dropped to record lows for Northern Harriers and Peregrine Falcons, but passage rates were significantly lower than average for Northern Harriers, Northern Goshawks, Swainson's Hawks, and American Kestrels.

Six of eight species for which reasonable comparisons of immature : adult ratios are possible showed lower than average ratios in 2000 (significant difference for Northern Harriers; Table 2). Moreover, in all cases the lower age ratios were caused by significant reductions in the number of immature birds, while the numbers of adults were about average or well above average. This suggests that low nesting success and juvenile recruitment in the Pacific Northwest may have contributed to the low counts recorded for several of these species this season.

Comparing median passage dates suggests that most species were at least slightly later than average in 2000, with the differences significant for seven species (Table 3). This is probably at least somewhat misleading, because for most species the recorded median passage dates have been later each year, consistent with extending the season by six days in 1999 and nine days in 2000. However, most species' activity levels drop to minimal by the third week of October (see bulk passage dates in Table 3; primary exceptions include Northern Goshawks, Red-tailed and Rough-legged Hawks, and Golden and Bald Eagles), so extending the season should not have had a dramatic effect on the timing indicators. Moreover, for many species examination of the seasonal distribution patterns clearly indicated below average activity during the first half of September in 2000, as is illustrated by the combined-species pattern (Figure 3). Four moderate to weak storm systems that pushed through the area during the first three weeks of September, bringing rain and snow, undoubtedly contributed to this reduction in September activity.

BANDING RESULTS

The FRG crew operated two trapping blinds this season, including a newly located and upgraded north blind (Figure 1). The trapping season encompassed 42 days between 2 September and 24 October. The capture total included 200 raptors of 10 species (Table 5). Sharp-shinned Hawks comprised 63% of the total captures, Cooper's Hawks 23%, Northern Goshawks 5%, Red-tailed Hawks 4%, Merlins 3%,

Northern Harriers 2%, and other species less than 1% each. The capture total was 20 less than last year, but included the first Rough-legged Hawk and Golden Eagle captured at the site, as well as a Northern Hawk-owl, which is a very rare bird in Washington! Moreover, both the overall combined-species capture rate of 4.8 captures / day and the overall combined-species capture success of 8.8% of birds counted were higher than last year, indicating greater trapping efficiency (Table 5). The project also recorded its first foreign encounter during 2000. An immature Cooper's Hawk banded on 16 September 2000 was recovered at Edwards Air Force Base in southern California on 4 October 2000. The bird had traveled about 1491 km in 19 days, which is an average of 78 km (49 mi) per day. This first return also is noteworthy because it indicates a connection to the Pacific Coast as opposed to Intermountain regional flyway (Hoffman et al. in review).

RESIDENT RAPTORS

The observers recorded 10 species of raptors as residents this season. One immature and one adult female Northern Harriers were seen once each in September. At least two immature (one female, one male) and one adult Sharp-shinned Hawks were seen regularly through mid-October. At least one first-year, one second-year, and one adult Cooper's Hawks were seen intermittently through September. At least two immature and one adult Northern Goshawks were seen intermittently throughout the season. At least three adult light-morph, one adult dark-morph, and two immature light-morph Red-tailed Hawks were seen regularly until late October. Two adult, one subadult, and one first-year Golden Eagles were seen intermittently throughout the season. Two adult Bald Eagles were seen once in mid-October. At least two female American Kestrels were seen intermittently until mid-September. Single Prairie Falcons were seen on four occasions through early October. Single immature Peregrine Falcons were seen on 9 and 22 September. This assemblage of resident birds is remarkably similar to last season.

VISITOR PARTICIPATION AND PUBLIC OUTREACH

The project continued to thrill visitors with the sight of raptors in migration and the occasional chance to see birds up close after they had been caught, measured, and banded. Interpreters greeted groups and individuals to talk about raptor ecology, the features of the Chelan Ridge site, and the science of counting and catching hawks, falcons, and eagles. The official observers were especially helpful sharing identification tips for all the birds observed.

Visitation to the observation site, as recorded by the observers, averaged 0.9 visitors/hour or a total of 518 visitor person-hours. These values are 31% and 27% higher than the 1998–1999 average. The visitor logs recorded 128 individuals from 11 states and Mexico, and many more visitors that neglected to sign in. Organized groups from Spokane, Moses Lake, Wenatchee, Twisp, Okanogan, Tonasket, Brewster, Ellensburg, and Winthrop made scheduled trips to the site, and three other groups attended unannounced.

The project received newspaper coverage in the Tacoma News Tribune, The Seattle Times, The Wenatchee World, and the Methow Valley News, and radio coverage in Spokane, Chelan, and Twisp. Several groups also included information about the project in their newsletters.

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Numerous individuals were essential in helping us achieve successful promotion and implementation of this season's effort. Dan Harrington again did a great job as lead observer, and we are all again indebted to Richard Hendrick for volunteering his time as the second lead observer. We are especially thankful for the OWNF staff at the Winthrop Visitor Center and Twisp Office, in particular Tommy Days, Pat Tourangeau, and Karen Dahl who prepared informative public displays about the project and communicated daily with observers on the ridge. Tommy, Pat, and Karen compiled daily reports of count and banding results, and provided strong PR support to the public. Rebecca Tanguay coordinated the interpretation effort for visitors and developed informative brochures to be distributed to anyone interested in the project.

We are also very grateful for the solid group of about 75 volunteers that Bud Anderson of FRG recruited to assist with the banding operations and provide educational opportunities for visitors to see birds in the hand.

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Table 1. Annual counts and passage rates by species: 1998–1999 versus 2000.

	1998–1999 ¹	2000	% Change	1998–1999 ¹	2000	% Change
Start Date	27-Aug ± 0.0	27-Aug				
End Date	24-Oct ± 5.9	5-Nov				
Observation Days	57 ± 7.8	67	+18			
Observations Hours	443.63 ± 118.985	505.75	+14			
SPECIES	COUNTS			RAPTORS/100 HOURS		
Turkey Vulture	25 ± 7.8	26	+4	5.9 ± 3.34	5.1	-12
Osprey	36 ± 22.5	71	+100	7.8 ± 2.99	14.0	+80
Northern Harrier	160 ± 14.7	104	-35	36.4 ± 6.45	20.6	-44
Sharp-shinned Hawk	941 ± 16.7	1050	+12	216.3 ± 61.77	207.6	-4
Cooper's Hawk	240 ± 14.7	198	-17	55.3 ± 18.13	39.1	-29
Northern Goshawk	41 ± 17.6	35	-15	9.1 ± 1.53	6.9	-24
Unidentified accipiter	235 ± 26.5	98	-58	53.4 ± 8.37	19.4	-64
TOTAL ACCIPITERS	1456 ± 12.7	1381	-5	334.1 ± 86.75	273.1	-18
Broad-winged Hawk	6 ± 2.0	5	-17	1.4 ± 0.82	1.0	-30
Swainson's Hawk	13 ± 8.8	2	-84	2.7 ± 1.26	0.4	-86
Red-tailed Hawk	316 ± 262.6	364	+15	68.4 ± 40.86	72.0	+5
Ferruginous Hawk	0 ± 0.0	1	–	0.0 ± 0.00	0.2	–
Rough-legged Hawk	29 ± 30.4	53	+86	6.1 ± 5.22	10.5	+73
Unidentified buteo	103 ± 88.2	97	-6	22.2 ± 13.91	19.2	-14
TOTAL BUTEOS	466 ± 388.1	522	+12	100.8 ± 60.44	103.2	+2
Golden Eagle	98 ± 84.3	174	+78	21.2 ± 13.32	34.4	+63
Bald Eagle	5 ± 4.9	15	+233	1.0 ± 0.85	3.0	+211
Unidentified eagle	4 ± 6.9	5	+43	0.7 ± 1.36	1.0	+42
TOTAL EAGLES	106 ± 96.0	194	+83	22.8 ± 15.53	38.4	+68
American Kestrel	98 ± 17.6	40	-59	22.8 ± 10.09	7.9	-65
Merlin	46 ± 18.6	26	-43	10.8 ± 7.08	5.1	-52
Prairie Falcon	9 ± 2.9	5	-41	2.0 ± 1.20	1.0	-51
Peregrine Falcon	6 ± 6.9	1	-82	1.2 ± 1.24	0.2	-83
Unidentified falcon	6 ± 0.0	2	-67	1.4 ± 0.37	0.4	-71
TOTAL FALCONS	164 ± 32.3	74	-55	38.1 ± 17.50	14.6	-62
Unidentified raptor	217 ± 2.0	62	-71	49.8 ± 12.92	12.3	-75
GRAND TOTAL	2628 ± 495.9	2434	-7	595.7 ± 48.00	481.3	-19

¹ Mean ± 95% confidence interval.

Table 2. Adjusted counts by age class and immature : adult ratios for selected species: 1998–1999 versus 2000.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1998–1999 AVERAGE			2000			% UNKNOWN AGE		RATIO	
	TOTAL	IMM	ADULT	TOTAL	IMM	ADULT	1998–1999 ¹	2000	1998–1999 ¹	2000
Northern Harrier	160	55	43	104	31	37	39 ± 8.5	35	1.3 ± 0.38	0.8
Sharp-shinned Hawk	941	561	140	1050	362	209	26 ± 30.8	46	5.5 ± 7.22	1.7
Cooper's Hawk	240	119	32	198	62	31	38 ± 36.7	53	7.5 ± 12.74	2.0
Northern Goshawk	41	19	5	35	12	13	45 ± 21.8	29	8.2 ± 11.47	0.9
Broad-winged Hawk	6	2	0	5	2	2	63 ± 44.8	20	2.0 ± 1.96	1.0
Red-tailed Hawk	316	94	142	364	79	172	23 ± 12.9	31	0.8 ± 0.44	0.5
Ferruginous Hawk	0	0	0	1	0	1	–	0	–	0.0
Golden Eagle	98	59	22	174	89	31	19 ± 4.7	31	2.7 ± 0.19	2.9
Bald Eagle	5	0	5	15	3	10	0 ± 0.0	13	0.0 ± 0.00	0.3
Peregrine Falcon	6	0	2	1	1	0	78 ± 43.6	0	0.0 ± 0.0	≥1

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 2000, with a comparison of 2000 and 1998–1999 average median passage dates.

SPECIES	2000				1998–1999
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	1-Sep	4-Oct	7-Sep – 2-Oct	22-Sep	8-Sep ± 4.9
Osprey	2-Sep	11-Oct	5-Sep – 30-Sep	19-Sep	19-Sep ± 3.9
Northern Harrier	27-Aug	5-Nov	4-Sep – 11-Oct	25-Sep	19-Sep ± 3.9
Sharp-shinned Hawk	27-Aug	31-Oct	11-Sep – 7-Oct	23-Sep	21-Sep ± 7.8
Cooper's Hawk	27-Aug	5-Nov	11-Sep – 8-Oct	21-Sep	14-Sep ± 2.9
Northern Goshawk	9-Sep	5-Nov	11-Sep – 24-Oct	5-Oct	22-Sep ± 13.7
Broad-winged Hawk	11-Sep	17-Sep	11-Sep – 17-Sep	14-Sep	14-Sep ± 1.0
Swainson's Hawk	14-Sep	18-Sep	14-Sep – 18-Sep	–	11-Sep ± 9.8
Red-tailed Hawk	27-Aug	5-Nov	10-Sep – 21-Oct	27-Sep	20-Sep ± 1.0
Ferruginous Hawk	6-Oct	6-Oct	6-Oct – 6-Oct	–	–
Rough-legged Hawk	24-Sep	5-Nov	11-Oct – 1-Nov	18-Oct	13-Oct ± 8.8
Golden Eagle	4-Sep	5-Nov	18-Sep – 17-Oct	7-Oct	1-Oct ± 3.9
Bald Eagle	11-Sep	2-Nov	19-Sep – 30-Oct	21-Oct	14-Oct ⁴
American Kestrel	30-Aug	13-Oct	7-Sep – 27-Sep	19-Sep	15-Sep ± 4.9
Merlin	30-Aug	21-Oct	5-Sep – 12-Oct	17-Sep	23-Sep ± 5.9
Prairie Falcon	17-Sep	15-Oct	17-Sep – 15-Oct	4-Oct	9-Sep ± 9.8
Peregrine Falcon	24-Sep	24-Sep	24-Sep – 24-Sep	–	28-Sep ⁴
Total	27-Aug	5-Nov	11-Sep – 14-Oct	25-Sep	20-Sep ± 2.9

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 ± 95% confidence interval in days; calculated using only data for years when counts ≥5 birds.

⁴ Value for 1999 only.

Table 4. Falcon Research Group trapping effort and capture statistics: 1999–2000.

SPECIES	1999			2000		
	CAPTURES	CAPTURES / DAY	% CAPTURE SUCCESS ¹	CAPTURES	CAPTURES / DAY	% CAPTURE SUCCESS ¹
Start date	28 Aug			2-Sep		
End date	16 Oct			14-Oct		
Trapping days	47			42		
Northern Harrier	4	0.1	2.4	3	0.1	2.9
Sharp-shinned Hawk	139	3.0	12.4	125	3.0	11.1
Cooper’s Hawk	42	0.9	15.0	46	1.1	21.6
Northern Goshawk	14	0.3	23.3	10	0.2	26.5
Red-tailed Hawk	11	0.2	1.9	8	0.2	1.8
Rough-legged Hawk	0	0.0	0.0	1	<0.1	1.5
Golden Eagle	0	0.0	0.0	1	<0.1	0.6
American Kestrel	3	0.1	3.2	0	0.0	0.0
Merlin	6	0.1	16.0	4	0.1	15.0
Prairie Falcon	1	<0.1	13.7	1	<0.1	19.5
Northern Hawk-owl	0	0.0	0.0	1	<0.1	100.0
All species	220	4.7	8.5	200	4.8	8.8

¹ Number of birds captured / number of birds observed * 100, with birds identified only to the generic group level (i.e., unknown accipiter, buteo, falcon, or eagle) allocated to relevant species in proportion to their occurrence. For calculating the “all species” values, non-trappable species and distant birds not identified at least to the generic group level were excluded.

Figure 1. Location of Chelan Ridge count and banding sites in north-central Washington.

Figure 2. Composition of raptor flights by major species groups: 1998–1999 versus 2000.

Figure 3. Combined-species passage volume by five-day periods: 1998–1999 versus 2000.

Appendix A. History of official observer participation.

1997: Single observer throughout: Dan Rossman (0)

1998: Two observers throughout: Steve Seibel (partial), Susan Crampton (0), Richard Hendrick (0).

1999: Two observers throughout: Dan Harrington (1), Richard Hendrick (1).

2000: Two observers throughout: Dan Harrington (2), Richard Hendrick (2).

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

Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications.

Common Name	Scientific Name	Species			Color
		Code	Age ¹	Sex ²	Morph ³
Turkey Vulture	<i>Cathartes aura</i>	TV	U	U	NA
Osprey	<i>Pandion haliaetus</i>	OS	U	U	NA
Northern Harrier	<i>Circus cyaneus</i>	NH	A I Br U	M F U	NA
Sharp-shinned Hawk	<i>Accipiter striatus</i>	SS	A I U	U	NA
Cooper's Hawk	<i>Accipiter cooperii</i>	CH	A I U	U	NA
Northern Goshawk	<i>Accipiter gentilis</i>	NG	A I U	U	NA
Unknown accipiter	<i>Accipiter</i> spp.	UA	U	U	NA
Red-shouldered Hawk	<i>Buteo lineatus</i>	RS	A I U	U	NA
Broad-winged Hawk	<i>Buteo platypterus</i>	BW	A I U	U	D L U
Swanson's Hawk	<i>Buteo swainsoni</i>	SW	U	U	D L U
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RT	A I U	U	D L U
Ferruginous Hawk	<i>Buteo regalis</i>	FH	A I U	U	D L U
Rough-legged Hawk	<i>Buteo lagopus</i>	RL	U	U	D L U
Unknown buteo	<i>Buteo</i> spp.	UB	U	U	D L U
Golden Eagle	<i>Aquila chrysaetos</i>	GE	A 2 1 I/S U ⁴	U	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BE	A 3 2 1 I/S U ⁵	U	NA
Unknown eagle	<i>Aquila</i> or <i>Haliaeetus</i> spp.	UE	U	U	NA
American Kestrel	<i>Falco sparverius</i>	AK	U	M F U	NA
Merlin	<i>Falco columbarius</i>	ML	AM Br	M U	NA
Prairie Falcon	<i>Falco mexicanus</i>	PR	U	U	NA
Peregrine Falcon	<i>Falco peregrinus</i>	PG	U	U	NA
Unknown falcon	<i>Falco</i> spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

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

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

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

⁴ Golden Eagle age codes: A = adult - no white in wings or tail; 2 = plumage class 2 - no white patch in wings, obvious white in tail; 1 = plumage class 1- white wing patch visible below, small wing patch may be visible above, bold white in tail; I/S = unknown age immature or subadult - obvious white in tail, wings not adequately observed

⁵ Bald Eagle age codes: A = adult - completely white head and tail; 3 = plumage class 3 -head mostly white, with osprey-like dark eyeline; 2 = plumage class 2 - dark head, light belly, and/or upside-down white triangle on back; 1 = plumage class 1 - dark head, breast, and belly; I/S = unknown age immature or subadult - dark or mottled head, other plumage features not adequately observed.

Appendix C. Daily observation effort, weather, and flight summaries: 2000.

DATE	OBS. HOURS	AVERAGE	AVERAGE	SKY CONDITION ¹	THERMAL LIFT ²	WIND SPEED ³	WIND DIRECT.	AVG.	BARO.	AVG.	AVG.	FLIGHT DIST. ⁴	RAPTORS / HOUR
		NUMBER OBSERVERS	NUMBER VISITORS					TEMP. (°C)	PRESS. (IN HG)	VISIB. E (KM)	VISIB. W (KM)		
27-Aug	8.00	1.0	0.0	clr-mc	3	2	s, nw late	10.9		40	40	var	1.4
28-Aug	8.00	1.0	0.0	pc	2	2	s-ssw	9.6		40	40	1	0.1
29-Aug	7.00	1.0	0.0	ovc	4	1	w AM, s-ssw	11.8		37	23	-	0.0
30-Aug	8.00	1.0	0.0	clr-pc	2	1	nw-n, s-sw	12.2		40	40	var	2.3
31-Aug	8.00	1.9	0.1	clr-ovc	4	3	s-sw	11.4		40	40	2	1.8
01-Sep	8.50	1.8	0.2	pc-ovc	3	1	var	8.2		40	40	2	1.5
02-Sep	8.25	1.8	0.9	ovc	4	1	var, s-sw	9.8		35	36	2	1.7
03-Sep	7.50	2.0	0.3	ovc/fog-mc	3	0	var	7.4	24.36	15	19	2	0.3
04-Sep	7.50	2.0	0.3	pc-mc	4	1	ssw-sw	8.8	24.42	47	38	2	3.2
05-Sep	7.00	2.0	0.0	clr-ovc/rain	3	1	ssw-sw	10.0	24.42	58	37	2	8.1
06-Sep	8.00	1.7	0.2	clr	3	2	var, sw	11.2	24.52	59	40	2	2.6
07-Sep	8.00	1.0	0.6	pc-ovc	3	3	s-sw	10.9		32	40	2	3.1
08-Sep	6.50	1.6	0.1	mc-ovc, scat snow	3	4	s-sw	8.3	23.92	32	25	2	0.9
09-Sep	8.25	1.9	0.2	ovc, scat rain	4	5	s-ssw	7.3	24.19	53	28	3	1.8
10-Sep	6.50	1.6	0.8	ovc/fog/rain	4	1	ssw-sw	8.8	24.23	18	17	2	0.9
11-Sep	8.75	1.9	0.3	clr	3	3	s-sw	9.9	24.41	41	40	2	9.5
12-Sep	9.00	2.2	0.7	clr	3	2	s-sw	15.4	24.38	55	40	3	14.1
13-Sep	8.25	1.8	0.0	clr	2	1	s-ssw	15.7	24.52	59	41	3	8.2
14-Sep	8.50	1.0	0.6	mc-clr, haze	3	1	var, s-ssw	17.5		29	44	3	7.3
15-Sep	8.25	1.9	1.1	ovc-clr	2	2	n-nne, ssw-sw	19.4	24.41	43	41	3	6.7
16-Sep	9.00	1.8	0.8	clr	2	2	s-sw	16.2	24.48	37	41	2	10.0
17-Sep	9.00	1.8	3.2	clr	3	3	s-sw	18.2	24.52	57	42	2	12.8
18-Sep	8.75	1.8	1.7	ovc, scat rain	3	3	sw-nw	15.5	24.45	51	30	3	4.3
19-Sep	8.00	1.2	2.0	clr	3	2	nnw-nne	12.3	24.54	60	40	3	8.6
20-Sep	5.25	1.0	0.0	ovc, rain PM	4	2	nw-nne	10.1	24.28	52	34	4	0.4
21-Sep	6.50	1.0	0.0	mc-ovc/rain/snow	4	3	n-nne	2.7	24.11	22	24	3	2.8
22-Sep	9.00	1.8	0.4	clr-pc	3	3	nw-ne	2.9	24.32	56	41	3	8.0
23-Sep	8.50	1.8	2.9	clr	3	2	sse-ssw	7.6	24.45	58	42	3	7.6
24-Sep	8.50	1.8	3.0	clr	3	1	se-ssw	11.1	24.54	56	41	3	10.6
25-Sep	9.00	1.8	3.6	clr	3	1	s-sw	12.5	24.51	58	42	3	11.9
26-Sep	8.00	1.4	1.9	clr	4	3	se-ssw	14.4	24.48	55	40	2	10.1
27-Sep	8.50	1.8	0.3	clr	3	2	sse-ssw	16.7	24.49	50	41	3	6.5
28-Sep	8.50	1.0	0.1	mc-ovc, haze	4	3	sse-ssw	15.8	24.34	46	50	var	5.5
29-Sep	8.50	1.8	0.2	mc	4	4	sse-ssw	14.1	24.31	47	30	var	4.2
30-Sep	9.00	1.8	1.2	mc-ovc	4	4	sw	14.2	24.14	52	25	2	5.8
01-Oct	8.50	1.8	3.9	clr	4	4	s-wsw	10.6	24.18	59	41	2	14.4
02-Oct	8.00	1.8	0.6	clr-pc	3	3	s-sw	8.7	24.36	58	33	3	8.3
03-Oct	8.00	1.0	1.5	clr-pc	3	3	nne, ssw	6.8	24.43	54	40	3	1.9
04-Oct	8.50	2.2	0.6	clr-pc	2	2	ne, sse-ssw	7.7	24.46	58	43	3	10.9
05-Oct	8.00	1.0	0.4	clr/haze	3	3	n-e/var	5.7	24.51	50	50	3	3.8
06-Oct	8.50	1.2	2.8	clr/haze	3	1	se-ssw	7.7	24.48	50	50	var	5.2
07-Oct	8.50	1.9	3.0	clr/haze	3	2	s-ssw	10.0	24.46	32	41	2	3.5
08-Oct	8.50	1.8	1.6	clr-mc	3	2	ssw-sw	13.5	24.39	39	41	3	2.5
09-Oct	8.00	1.6	0.9	ovc, rain AM	4	1	ne-se, s-sw	13.1	24.11	15	32	3	1.3
10-Oct	3.50	1.0	1.0	ovc, rain AM	4	4	nw-nnw	10.4	24.05	25	33	4	4.3
11-Oct	8.50	2.0	0.1	clr-pc	3	2	n-ne, var	10.6	24.26	43	39	3	5.4
12-Oct	8.00	1.0	0.2	clr	3	2	n-e, sw	11.1	24.27	35	50	3	9.3
13-Oct	8.50	2.3	0.2	clr	3	2	se-ssw	11.1	24.37	30	38	3	7.4
14-Oct	8.50	1.8	3.6	ovc-clr	3	2	sse-ssw	8.8	24.39	59	41	3	5.5

Appendix C. continued

DATE	OBS. HOURS	AVERAGE NUMBER OBSERVERS	AVERAGE NUMBER VISITORS	SKY CONDITION ¹	THERMAL LIFT ²	WIND SPEED ³	WIND DIRECTION	AVG. TEMP. (°C)	BARO. PRESS. (IN HG)	AVG. VISIB. E (KM)	AVG. VISIB. W (KM)	FLIGHT DIST. ⁴	RAPTORS / HOUR
15-Oct	7.50	1.8	0.5	pc-ovc	4	3	sse-ssw	7.4	24.31	48	41	2	1.5
16-Oct	5.00	2.0	0.0	ovc, rain	4	4	se-s	6.6	24.31	31	26	3	0.2
17-Oct	7.50	1.0	7.5	mc-ovc, haze PM	4	4	sse-ssw	10.0	24.31	48	40	2	2.8
18-Oct	7.25	1.8	0.0	pc-mc	4	5	ssw-sw	7.7	24.29	56	27	var	1.8
19-Oct	7.00	1.0	0.6	ovc	4	3	sw	6.3	24.34	50	50	3	0.6
20-Oct	0.00												
21-Oct	7.50	3.2	1.5	clr-pc	3	2	nw-n, sw	4.1	24.32	59	37	3	6.3
22-Oct	7.50	2.6	1.0	clr-pc, ovc PM	4	3	s-sw	4.0	24.59	59	41	2	2.0
23-Oct	8.00	1.3	0.6	clr	4	3	s-ssw	5.7	24.46	50	46	2	0.5
24-Oct	7.00	1.6	1.0	clr-ovc/haze	4	3	sse-ssw	7.7	24.35	50	40	3	2.3
25-Oct	7.00	2.0	0.4	pc-mc, haze	3	1	var	7.9	24.32	30	38	3	0.6
26-Oct	6.50	1.0	0.0	ovc/haze, rain PM	4	2	n-nne	7.9	24.12	15	35	3	0.6
27-Oct	4.50	2.0	0.0	ovc, fog/haze	4	3	sse-s	5.5	24.07	7	10	3	0.2
28-Oct	0.00												
29-Oct	0.00												
30-Oct	4.00	2.0	0.0	clr-mc/fog	4	2	sse-ssw	3.5	24.38	35	23	var	6.5
31-Oct	5.00	1.7	0.0	clr-mc, scat snow	3	4	sse-sw	3.9	24.36	46	26	2	1.0
01-Nov	5.25	1.0	0.0	clr-pc	4	4	s-sw	2.3	24.41	54	40	var	2.5
02-Nov	6.00	1.9	0.0	pc-mc, scat fog	3	2	s-sw	2.6	24.42	41	37	2	0.3
03-Nov	5.00	1.8	0.0	pc-ovc, haze PM	4	3	sse-sw	5.1	24.46	45	39	2	0.4
04-Nov	0.00												
05-Nov	5.00	2.0	0.0	ovc, haze AM	4	3	s-sw	2.6	24.20	60	34	var	2.0

¹ 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 = thunder storms.

² Average of hourly ratings 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.

³ Average of hourly categorical ratings: 0 = less than 1 km/h; 1 = 1–5 km/h; 2 = 6–11 km/h; 3 = 12–19 km/h; 4 = 20–28 km/h; 5 = 29–38 km/h, etc.

⁴ Average of hourly line-of-sight ratings concerning 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 count records by species: 2000.

DATE	HOURS	SPECIES CODES ¹																				BIRDS /			
		TV	OS	NH	SS	CH	NG	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	UF	UU	TOTAL	HOURL
27-Aug	8.00	0	0	1	6	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	11	1.4
28-Aug	8.00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
29-Aug	7.00	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
30-Aug	8.00	0	0	0	7	2	0	0	0	0	5	0	0	2	0	0	0	1	1	0	0	0	0	18	2.3
31-Aug	8.00	0	0	0	5	2	0	0	0	0	5	0	0	0	0	0	0	1	1	0	0	0	0	14	1.8
01-Sep	8.50	1	0	2	4	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	13	1.5
02-Sep	8.25	0	2	6	4	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	14	1.7
03-Sep	7.50	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0.3
04-Sep	7.50	1	5	3	9	1	0	1	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	24	3.2
05-Sep	7.00	0	3	1	36	4	0	2	0	0	8	0	0	0	1	0	0	1	1	0	0	0	0	57	8.1
06-Sep	8.00	0	1	1	13	2	0	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	0	21	2.6
07-Sep	8.00	2	2	3	10	2	0	0	0	0	1	0	0	2	0	0	0	2	1	0	0	0	0	25	3.1
08-Sep	6.50	0	0	0	2	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	6	0.9
09-Sep	8.25	2	2	1	2	0	2	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	2	15	1.8
10-Sep	6.50	0	0	0	2	1	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	6	0.9
11-Sep	8.75	1	3	6	40	7	2	3	1	0	9	0	0	4	0	1	1	1	1	0	0	0	3	83	9.5
12-Sep	9.00	1	3	5	81	14	2	3	0	0	11	0	0	1	1	0	0	3	0	0	0	0	2	127	14.1
13-Sep	8.25	0	2	3	40	8	0	1	0	0	8	0	0	0	0	0	0	1	2	0	0	0	3	68	8.2
14-Sep	8.50	0	4	2	26	8	0	5	2	1	9	0	0	3	0	0	0	1	1	0	0	0	0	62	7.3
15-Sep	8.25	0	1	0	26	4	0	2	0	0	10	0	0	1	6	0	0	0	1	0	0	1	3	55	6.7
16-Sep	9.00	0	3	1	45	10	1	4	1	0	10	0	0	4	4	0	0	5	0	0	0	0	2	90	10.0
17-Sep	9.00	1	4	4	58	19	0	6	1	0	8	0	0	4	3	0	1	1	2	1	0	0	2	115	12.8
18-Sep	8.75	0	0	0	23	4	0	2	0	1	5	0	0	1	1	0	0	1	0	0	0	0	0	38	4.3
19-Sep	8.00	1	3	3	31	3	0	4	0	0	13	0	0	1	4	1	0	3	2	0	0	0	0	69	8.6
20-Sep	5.25	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0.4
21-Sep	6.50	1	1	0	4	3	0	2	0	0	3	0	0	2	1	0	0	0	0	0	0	0	1	18	2.8
22-Sep	9.00	3	9	2	28	6	3	2	0	0	8	0	0	4	6	0	0	1	0	0	0	0	0	72	8.0
23-Sep	8.50	0	2	1	33	8	1	5	0	0	8	0	0	1	4	0	0	0	0	0	0	0	2	65	7.6
24-Sep	8.50	0	3	3	36	16	1	5	0	0	7	0	2	3	6	0	0	2	0	0	1	0	5	90	10.6
25-Sep	9.00	0	2	12	36	10	1	7	0	0	15	0	0	3	13	0	0	4	1	0	0	0	3	107	11.9
26-Sep	8.00	1	1	7	32	5	0	5	0	0	11	0	0	2	8	0	0	6	2	0	0	0	1	81	10.1
27-Sep	8.50	0	5	11	16	3	0	0	0	0	9	0	0	4	3	0	0	2	0	0	0	0	2	55	6.5
28-Sep	8.50	6	0	2	24	2	0	2	0	0	9	0	0	1	0	0	0	0	1	0	0	0	0	47	5.5
29-Sep	8.50	0	0	0	19	6	0	2	0	0	5	0	0	2	2	0	0	0	0	0	0	0	0	36	4.2
30-Sep	9.00	0	3	3	21	4	0	1	0	0	12	0	0	5	2	1	0	0	0	0	0	0	0	52	5.8

Appendix D. continued

DATE	HOURS	SPECIES CODES ¹																				BIRDS /			
		TV	OS	NH	SS	CH	NG	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	UF	UU	TOTAL	HOURL
01-Oct	8.50	0	2	0	84	6	0	6	0	0	15	0	0	1	6	0	0	0	0	1	0	0	1	122	14.4
02-Oct	8.00	4	1	1	42	3	1	1	0	0	4	0	0	2	3	0	0	1	2	0	0	0	1	66	8.3
03-Oct	8.00	0	0	0	8	0	0	0	0	0	6	0	0	0	1	0	0	0	0	0	0	0	0	15	1.9
04-Oct	8.50	1	1	2	44	3	2	7	0	0	18	0	0	2	8	0	0	0	1	1	0	0	3	93	10.9
05-Oct	8.00	0	1	1	14	2	2	2	0	0	5	0	0	2	0	0	0	0	0	0	0	0	1	30	3.8
06-Oct	8.50	0	1	1	23	4	1	2	0	0	6	1	1	1	1	0	1	0	0	0	0	0	1	44	5.2
07-Oct	8.50	0	0	0	13	1	2	1	0	0	1	0	2	0	9	0	0	0	1	0	0	0	0	30	3.5
08-Oct	8.50	0	0	0	10	2	0	0	0	0	2	0	0	0	7	0	0	0	0	0	0	0	0	21	2.5
09-Oct	8.00	0	0	2	3	1	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	10	1.3
10-Oct	3.50	0	0	1	6	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6	15	4.3
11-Oct	8.50	0	1	2	11	3	0	1	0	0	6	0	5	4	9	0	1	1	0	0	0	0	2	46	5.4
12-Oct	8.00	0	0	2	14	4	1	5	0	0	16	0	6	3	18	0	0	0	1	0	0	1	3	74	9.3
13-Oct	8.50	0	0	0	21	1	1	2	0	0	15	0	4	5	9	1	1	1	0	0	0	0	2	63	7.4
14-Oct	8.50	0	0	0	10	1	3	0	0	0	9	0	3	7	11	0	0	0	1	0	0	0	2	47	5.5
15-Oct	7.50	0	0	0	1	1	0	0	0	0	3	0	0	2	2	0	0	0	0	1	0	0	1	11	1.5
16-Oct	5.00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2
17-Oct	7.50	0	0	1	3	1	0	0	0	0	3	0	3	1	7	0	0	0	0	0	0	0	2	21	2.8
18-Oct	7.25	0	0	0	5	0	1	0	0	0	2	0	2	0	1	0	0	0	1	0	0	0	1	13	1.8
19-Oct	7.00	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	4	0.6
20-Oct	0.00																								
21-Oct	7.50	0	0	2	7	1	3	2	0	0	9	0	4	4	7	4	0	0	1	0	0	0	3	47	6.3
22-Oct	7.50	0	0	1	2	0	0	0	0	0	7	0	1	0	1	3	0	0	0	0	0	0	0	15	2.0
23-Oct	8.00	0	0	0	2	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	4	0.5
24-Oct	7.00	0	0	2	2	0	1	0	0	0	3	0	5	1	1	1	0	0	0	0	0	0	0	16	2.3
25-Oct	7.00	0	0	0	1	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	4	0.6
26-Oct	6.50	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	4	0.6
27-Oct	4.50	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0.2	
28-Oct	0.00																								
29-Oct	0.00																								
30-Oct	4.00	0	0	0	1	2	1	1	0	0	8	0	3	5	3	1	0	0	0	0	0	0	1	26	6.5
31-Oct	5.00	0	0	0	1	0	0	0	0	0	1	0	2	1	0	0	0	0	0	0	0	0	0	5	1.0
01-Nov	5.25	0	0	0	0	0	1	0	0	0	8	0	2	1	1	0	0	0	0	0	0	0	0	13	2.5
02-Nov	6.00	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2	0.3	
03-Nov	5.00	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0.4	
04-Nov	0.00																								
05-Nov	5.00	0	0	1	0	1	1	1	0	0	1	0	2	2	1	0	0	0	0	0	0	0	0	10	2.0
Total	505.75	26	71	104	1050	198	35	98	5	2	364	1	53	97	174	15	5	40	26	5	1	2	62	2434	4.8

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

Appendix E. Annual summaries of observation effort and raptor counts by species: 1997–2000.

	1997	1998	1999	2000	MEAN
Start Date	5-Sep	27-Aug	27-Aug	27-Aug	26-Aug
End Date	11-Oct	21-Oct	27-Oct	5-Nov	27-Oct
Observation days	29	53	61	67	60
Observation hours	204.60	382.92	504.33	505.75	464.33
Raptors / 100 hours	691.1	620.2	571.3	481.3	591.0
SPECIES	RAPTOR COUNTS				
Turkey Vulture	4	29	21	26	25
Osprey	41	24	47	71	47
Northern Harrier	115	152	167	104	141
Sharp-shinned Hawk	311	949	932	1,050	977
Cooper's Hawk	150	247	232	198	226
Northern Goshawk	38	32	50	35	39
Unidentified accipiter	182	221	248	98	189
TOTAL ACCIPITERS	681	1,449	1,462	1,381	1,431
Broad-winged Hawk	2	7	5	5	6
Swainson's Hawk	0	8	17	2	9
Red-tailed Hawk	145	182	450	364	332
Ferruginous Hawk	0	0	0	1	0.3
Rough-legged Hawk	1	13	44	53	37
Unidentified buteo	75	58	148	97	101
TOTAL BUTEOS	223	268	664	522	485
Golden Eagle	105	55	141	174	123
Bald Eagle	2	2	7	15	8
Unidentified eagle	7	0	7	5	4
TOTAL EAGLES	114	57	155	194	135
American Kestrel	24	107	89	40	79
Merlin	17	55	36	26	39
Prairie Falcon	2	10	7	5	7
Peregrine Falcon	5	2	9	1	4
Unidentified falcon	10	6	6	2	5
TOTAL FALCONS	58	180	147	74	134
Unidentified Raptor	178	216	218	62	165
GRAND TOTAL	1,414	2,375	2,881	2,434	2,563