

**FALL 2001 RAPTOR MIGRATION STUDIES
AT CHELAN RIDGE, WASHINGTON**



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



**Okanogan and Wenatchee National Forests
Winthrop, Washington**

April 2002

**FALL 2001 RAPTOR MIGRATION STUDIES AT
CHELAN RIDGE, WASHINGTON**

Report prepared by:

Jeff P. Smith

Counts by:

Wendy King, Richard Hendrick, Don Loock, and Dan Harrington

Banding by:

Bob Davies and Eric Jepsen

With Significant Volunteer Assistance

On-site Education by:

Don Loock and Kent Woodruff

Project Cooperators:

HawkWatch International, Inc.

Principal Investigator: Dr. Jeff P. Smith

1800 South West Temple, Suite 226, Salt Lake City, UT 84115

(801) 484-6808

Okanogan and Wenatchee National Forests, Methow Valley Ranger District

Principal Investigator: Kent Woodruff

24 Chewuch Road, Winthrop, WA 98862

(509) 996-4002

April 2002

TABLE OF CONTENTS

List of Tables	iii
List of Figures	iii
Introduction.....	1
Study Site.....	1
Methods	2
Standardized Counts.....	2
Trapping and Banding.....	4
Results and Discussion	4
Weather	4
Observation Effort.....	5
Migration Summary	5
Resident Raptors	6
Trapping Effort.....	6
Trapping and Banding Summary	6
Encounters with Previously Banded Birds.....	7
Satellite Telemetry	7
Visitor Participation and Public Outreach	8
Acknowledgements.....	8
Literature Cited.....	9
Tables.....	11
Figures	17
Appendix A. History of official observer participation in the Chelan Ridge Raptor Migration Project.....	19
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 Chelan Ridge, WA.	20
Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Chelan Ridge Raptor Migration Project: 2001.....	21
Appendix D. Daily observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 2001.....	23
Appendix E. Annual observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 1997–2001.....	25
Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2001.	26
Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Chelan Ridge, WA: 1999–2001.	28

LIST OF TABLES

Table 1.	Fall counts and passage rates by species for migrating raptors at Chelan Ridge, WA: 1998–2000 versus 2001.....	11
Table 2.	Fall counts by age class and immature : adult ratios for selected species of migrating raptors at Chelan Ridge, WA: 1998–2000 versus 2001.....	12
Table 3.	First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Chelan Ridge, WA in 2001, with a comparison of 2001 and 1998–2000 average median passage dates.	13
Table 4.	Median passage dates by age for selected species of migrating raptors at Chelan Ridge, WA: 1998–2000 versus 2001.....	14
Table 5.	Fall capture totals, rates, and successes by species for migrating raptors at Chelan Ridge, WA: 1999–2000 versus 2001.....	15
Table 6.	Fall capture totals by sex and age (HY = hatching year; AHY = after hatching year), female : male capture ratios, and immature : adult capture ratios for selected species of migrating raptors at Chelan Ridge, WA: 2001.....	15
Table 7.	Foreign encounters associated with the Chelan Ridge Raptor Migration Project: 2000–2001.	16

LIST OF FIGURES

Figure 1.	Location of the Chelan Ridge raptor migration count and banding sites in north-central Washington.....	17
Figure 2.	Fall raptor migration flight composition by major species groups at Chelan Ridge, WA: 1998–2000 versus 2001.....	18
Figure 3.	Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998–2000 versus 2001.....	18

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) initiated a trapping banding program at the site in 1999 and coordinated banding in 2000, but HWI took over coordinating the banding program in 2001. 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 2001 season marked the 4th consecutive full-season count at the site and the 3rd consecutive season of banding. This report summarizes the 2001 count and banding results.

The Chelan project was 1 of 15 long-term, annual migration counts (12 fall, 3 spring) and 1 of 8 migration banding studies (6 fall, 2 spring) conducted or co-sponsored by HWI in North America during 2001. The primary objective of these efforts is to track long-term population trends of diurnal raptors throughout primarily western North America (Smith and Hoffman 2000). 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 2001). 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 et al. 1995, Dunn and Hussell 1995, Dixon et al. 1998, Smith and Hoffman 2000, Zalles and Bildstein 2000).

The intensive counting and banding operations also provide valuable information about breeding and wintering distributions, migratory routes and timing, migratory behavior, population demographics, mortality factors and longevity, morphometric variation, molt timing and sequences, and health assessments (e.g., Hoffman et al. in press). 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 and OWNF. Accordingly, besides ensuring efficient local coordination of the overall project, OWNF personnel and volunteers, working in tandem with the observers and banders, have played a critical role in coordinating educational opportunities at the site. To further enhance the educational aspects of the project, HWI added a full-time, on-site educator to the field crew in 2001.

STUDY SITE

Chelan Ridge is located approximately 21 km 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 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 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 cannot 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 and 2.25 km southeast of the count site (Figure 1). The North station was located on the northwest flank of Cooper Mountain in the same area used by the FRG in 1999. The South station was located in a saddle on the southwest flanks of Cooper Mountain in an area that had not been used previously.

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

STANDARDIZED COUNTS

Two official or designated observers, relieved or supplemented by the on-site educator and other trained volunteers, conducted standardized daily counts of migrating raptors from a single traditional observation site. Primary observer Richard Hendrick worked during the first half of the season and had three previous seasons of experience counting migratory raptors (see Appendix A for a complete history of observer participation). Primary observer Wendy King worked the whole season and had no previous full seasons of experience. On-site educator Don Loock (no previous experience) played a critical roll serving as second observer during much of the second half of the season. Past Chelan observer Dan Harrington also provided valuable assistance training the new observers and serving as a substitute observer throughout the season. Other visitors also 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), presence or of precipitation, visibility, and an assessment of thermal-lift conditions, recorded for each hour of observation on the half hour.
4. Predominant direction, altitude, and distance from the lookout of the flight during each hour.
5. Total minutes observed and the mean number of observers present during each hour (included designated observers plus volunteers/visitors who actively contributed to the count [active scanning, pointing out birds, recording data, etc.] for more than 10 minutes in a given hour), recorded on the hour.
6. A subjective visitor-disturbance rating for each hour, recorded on the hour.
7. Daily start and end times for each official observer.

The observers used high quality 7–10x binoculars to assist in 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. All weather variables were recorded on-site.

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 nesting territories to favored wintering grounds in the same general region. However, we also know from recent satellite telemetry work that species such as Golden Eagles, Prairie Falcons and Ferruginous Hawks frequently “migrate” in non-standard directions to take advantage of favored post-breeding and wintering grounds (Steenhof et al. 1984, personal communication; Watson and Pierce 2000; HWI unpublished data).

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 counts to passage rates (typically raptors/100 hours of observation) to adjust for daily variation in sampling effort, and present both raw counts and passage rates for comparison. I compare results from the 2001 season to means for previous seasons and examine trends in annual passage rates. In comparing 2001 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2001 value falling outside the bounds of the confidence interval for the associated mean.

The observers commonly identified distant or otherwise poorly observed migrants only to genus or other common non-specific groupings (e.g., unidentified eagle or buteo, which each can include multiple genera). Such identifications sometimes constitute a sizeable proportion of the birds seen, especially for accipiters, varying with observer experience and weather conditions. Excluding these birds from population trend analyses may render inaccurate assessments of true flight volume. Although it is not yet appropriate to analyze trends at Chelan Ridge because of the short duration of the counts, beginning in 2001, HWI adopted a new standard for recording information about incompletely identified accipiters and falcons that should improve the accuracy of classifying incompletely identified birds for trend analysis (see Appendix B). Whenever possible, all HWI observers now seek to classify any accipiters or falcons for which a species identification is not certain as small or large, using the simpler classifications of “unknown accipiter” or “unknown falcon” only as a last resort. For falcons, identification debates

usually center on distinguishing kestrels and Merlins or prairie falcons and peregrines (rarely Gyrfalcons), and the small and large size classes distinguish which debate applied. For the accipiters, most debates concern distinguishing Sharp-shinned Hawks and Cooper's Hawks, and designation of the small size class confirms that this debate applied. Occasionally, however, an observer struggles with distinguishing a large female Cooper's Hawk from a goshawk, and designation of the large size class confirms this and enables a more informed adjustment of the data prior to trend analyses.

TRAPPING AND BANDING

Weather permitting, the trappers operated the two banding stations daily from late August through mid-October, generally between 0900–1700 hrs PST. Capture devices included mist nets, dho-gaza nets, and remotely triggered bow nets (see Bloom 1987). Trappers lured migrating raptors into the capture stations from camouflaged blinds using live, non-native Rock Doves (*Columba livia*; hereafter called pigeons), Ringed Turtle-doves (*Streptopelia risoria*), European Starlings (*Sturnus vulgaris*), and House Sparrows (*Passer domesticus*) attached to lure lines manipulated from the blinds. Unless already banded, all captured birds were fitted with a uniquely numbered USGS Biological Resources Division aluminum leg band. Processors identified species, subspecies, sexes, and ages using morphological characteristics described in the U.S. Bird Banding Laboratory (BBL) Manual, Clark and Wheeler (1985), Wheeler and Clark (1995), and Hoffman et al. (1990). Processors also recorded a series of standard morphometric, health, and molt data for each bird. Unless outfitted for satellite telemetry, all birds were released within 45 minutes from the time of capture.

RESULTS AND DISCUSSION

WEATHER

Excessive snow precluded access to the site after 22 October in 2001. This was similar to 1998 but was 5 and 14 days sooner than in 1999 and 2000, respectively. Otherwise, in 2001 the number of days of observation entirely or severely (<4 hours observation) precluded by inclement weather before the third week of October (3; see Appendix C for daily weather records) was similar to 1999 and 2000 (2 each) but half as many as in 1998. Otherwise, fair skies predominated on 44% of the active observation days, transitional weather (skies changed from fair to mostly cloudy/overcast, or vice versa, during the day) on 40%, and mostly cloudy to overcast skies on 16%. Compared to 1998 and 1999, 2001 featured proportionately less fair weather (57–58% of days in 1998 and 1999) and more transitional weather (25–26% in 1998 and 1999), whereas compared to 2000, 2001 featured more transitional weather (28% in 2000) and less overcast weather (30% in 2001).

In terms of wind velocities, 2001 featured lighter winds (67% of days with predominantly light winds [<12 kph], 33% moderate, 0% strong [>28kph]) than in 1999 and 2000 (52–55% light, 36–42% moderate, 3–11% strong) but stronger winds than in 1998 (91% light, 9% moderate, 0% strong). In terms of prevailing wind directions, south to southwesterly winds predominated on 55% of the active days, 16% of days featured southwesterly winds for part of the day and northwesterly winds for the remainder, 11% variable southeasterly to southwesterly winds, 11% variable northwesterly to northeasterly winds, 4% variable southerly to westerly winds, and 4% highly variable winds. This overall distribution of wind directions is similar to 1998 but, compared to 1999 and 2000, reflects a proportionately greater prevalence of southwesterly winds (43–44% in 1999 and 2000) and a lesser prevalence of southeasterly and northeasterly winds.

The temperature during active observation periods averaged 12.3°C (the average of daily values, which in turn were averages of hourly readings), ranging from 2.5–20.0°C. This is similar to the 1998 profile

but slightly warmer than in 1999 and 2000. Visibility averaged an estimated 58 km to the west and 53 km to the east, which is high compared to 1999 and 2000 (about 40 km both ways). In 2001, 39% of the active observation days received a median (of hourly ratings) thermal-lift rating of good to excellent, compared to 62%, 28%, and 16% from 1998 to 2000, respectively.

In summary, each of the past four seasons at Chelan has featured somewhat different weather conditions. The 2001 season was most similar to 1998 except for showing more transitional as opposed to fair weather, stronger winds, and poorer thermal conditions. Compared to 1999, 2001 again showed somewhat more transitional as opposed to fair weather, but was slightly warmer with better thermal conditions, showed better visibility, and showed lighter winds and a greater prevalence of south to southwesterly as opposed to southeasterly and northeasterly winds. Compared to 2000, 2001 showed less overcast weather and similar differences in temperature, visibility, thermal, and wind conditions as compared to 1999.

OBSERVATION EFFORT

The observers worked on 55 of 57 possible observation days between 27 August and 22 October, with the season cut short by excessive snow that precluded access to the site after 22 October. The number of observation days and hours (439.00) were 9% and 5% below average, respectively (Table 1). The 2001 average of 1.9 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was 3% above the 1998–2000 average of $1.8 \pm 95\%$ CI of 0.25 observers/hr.

MIGRATION SUMMARY

The observers counted 2,065 raptors of 15 species during the 2001 season (Table 1, and see Appendix D for daily count records). The flight consisted of 58% accipiters, 18% buteos, 5% eagles, 4% harriers, 7% falcons, 2% Ospreys, 1% vultures, and 5% unknown raptors, which is an average distribution for the site (Figure 2). The most common species seen in 2001 were the Sharp-shinned Hawk (43% of the total count), Red-tailed Hawk (13%), Cooper's Hawk (10%), and Golden Eagle (5%). All other species each comprised less than 5% of the total count.

Counts fell to record lows for Northern Harriers and Northern Goshawks, and tied the lowest count for Bald Eagles (see Appendix E for annual count summaries). Passage rates were below average for 14 of 17 species thus far recorded at the site, significantly so for Northern Harriers, Northern Goshawks, Swainson's Hawks, and Rough-legged Hawks, and no species showed a significantly above average passage rate in 2001 (Table 1). The generally low flight volume at Chelan Ridge in 2001 matches the pattern shown at most HWI western sites in 2001, and likely reflects the cumulative effects of the prolonged drought and extensive wildfires that have plagued much of the interior West over the past 3–4 years.

Six of eight species for which comparisons of immature : adult ratios were possible showed lower than average ratios in 2001, with the difference significant for Golden Eagles, and only Broad-winged Hawks showed an above average ratio (not a significant difference; Table 2). Moreover, for all species except Broad-winged Hawks, the abundance of immature birds was well below average. This suggests that low nesting success and juvenile recruitment contributed to the low counts recorded for most species; however, generally low adult abundance suggests that adult survival also was below average.

The combined-species median passage date of 22 September matched the 1998–2000 average (Table 3) and the seasonal distribution was roughly similar to the average pattern (Figure 3). Similarly, only five of 15 species showed median passage dates that differed significantly from the relevant averages (Broad-winged Hawks, Rough-legged Hawks and American Kestrels early, and Red-tailed Hawks late) and there was little consistency in pattern across species (Table 3). Age-specific data clarified some patterns,

suggesting that adult harriers were significantly later than average (sex-specific data further indicated that only adult females were significantly late) while immatures were slightly early, both age classes of Sharp-shinned Hawks and immature goshawks were significantly early, and only adult Red-tailed Hawks were significantly late (Table 4). The age-specific data also highlighted a common pattern among the accipiters of immature birds being at least slightly earlier than average.

RESIDENT RAPTORS

The observers recorded 10 species of raptors as non-migrant, local birds this season. Two Turkey Vultures were seen occasionally in September. At least one immature Northern Harrier was seen occasionally through mid-September. At least two immature Sharp-shinned Hawks were seen regularly through September. At least one immature Cooper's Hawk was seen several times in early September. At least one Northern Goshawk was seen occasionally from late September through mid-October. At least one adult and one immature light-morph Red-tailed Hawks were seen regularly throughout the season, and one immature dark-morph bird was seen in early September. At least one immature, one subadult, and one adult Golden Eagles were seen fairly regularly throughout the season. A pair of American Kestrels was seen regularly through the third week of September. A Prairie Falcon was seen once in early September and possibly again in late October. One immature Peregrine Falcon was seen occasionally through mid-September. This is a typical assemblage for the site.

TRAPPING EFFORT

Trapping occurred on 47 of 50 days between 30 August and 18 October, with effort totaling 645.50 station hours (see Appendix F for daily trapping records). The number of trapping days was the same as in 1999 and five more than in 2000; however, the number of station hours was 66% higher in 2001 than in 1999 (see Appendix G for annual trapping summaries).

TRAPPING AND BANDING SUMMARY

The first season of HWI-coordinated trapping and banding yielded about 20% more captures than during the previous two seasons combined (Table 5). Increased effort and improved blind placement and station design contributed to the difference, but staffing two full-time, highly trained banders as opposed to relying on a large, highly variable team of volunteers probably was the most important contributing factor.

The 2001 capture total of 525 newly banded birds of 11 species included the first two Peregrine Falcons captured at the site (Table 5, Appendix G). Other highlights included the second Rough-legged Hawk and two Golden Eagles. The 2001 effort raised the total number of diurnal raptors captured at the site to 944 (Appendix G). The most frequently captured species were the Sharp-shinned Hawk (65% of captures) and Cooper's Hawk (20%); all other species each comprised <1% of the total (Table 5). All measures of capture efficiency and success were above average in 2001 (Table 5).

Compared to the counts, banding at this site yields unique and substantial sex-age specific data only for the three accipiters and American Kestrels. Compared to age ratios derived from the count data, the 2001 immature : adult capture ratios for the three accipiters were 13–44% lower (Table 6). In part, this discrepancy reflects the fact that 8–20% (depending on species) of the immature accipiters were counted before intensive trapping began on 2 September. However, at three other long-term HWI fall banding operations in the West, age ratios derived from trapping consistently equal or exceed ratios derived from counts despite similar later starting dates for trapping (Smith 2002 a, b; Vekasy and Smith 2002). This is a common result believed to reflect the fact that adults are generally more wary of unusual situations than inexperienced young birds. Thus, either typical age-related differences in susceptibility to capture did not apply at Chelan Ridge in 2001 (perhaps generally poor foraging conditions meant that the adults

dominated available opportunities more than usual) or the flight dynamics at Chelan exposed adults to the trapping operations more frequently than immature birds (perhaps adults tended to hug Cooper Ridge more than immature birds, thereby increasing the relative probability of their being exposed to the trapping operations). Future comparisons will be needed to clarify the situation.

With regard to American Kestrels, age-specific information derives only from capture data and the 2001 data indicated that immature birds were captured almost twice as often as adults (Table 6). In contrast, both the count and capture data yield sex ratios, and in 2001 the count data suggested that males and females were equally abundant (female: ratio = 0.97) whereas the capture data indicated a sex ratio of 0.14. This suggests that males were much more likely to be captured than females. Note, however, that the capture total for kestrels was very low, so this comparison must be considered with caution.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Since banding began at Chelan Ridge in 1999, six foreign encounters with birds banded at Chelan have occurred (Table 7). The first involved an immature Cooper's Hawk, banded by the FRG in 2000, which was recovered dead 18 days later at Edwards Air Force Base on the coast of southern California. The other five involved birds banded and encountered again during the 2001 migration season. One hatch-year Merlin was found near Bend, Oregon about 12 days after banding, apparently having been hit by car. It was later euthanized at a rehabilitation facility due to a compound fracture of the wing. Four hatch-year Sharp-shinned Hawks were re-encountered 8–42 days after banding in north-central Oregon, central California, and west-central Nevada. Two were killed after colliding with a car and some other stationary human structure. The other two encounters involved recaptures at other migration research stations: HWI's Bonney Butte site near Mt. Hood, Oregon, and Golden Raptor Observatory's (GGRO) site in the Marin Headlands, California. The Nevada encounter indicates movement along the transition zone between the Pacific Coast and Intermountain flyways; otherwise, each of these recoveries suggests that the Chelan Ridge flight is most closely aligned with the Pacific Coast Flyway (*sensu* Hoffman et al. in press).

SATELLITE TELEMETRY

For the first time in 2001, several migrants captured at Chelan Ridge were fitted with satellite transmitters that enable tracking the birds' movements over large distances and long periods. Birds outfitted included one immature Northern Goshawk, one adult Northern Harrier, one adult Golden Eagle, and three adult Red-tailed Hawks. Jim Watson of the Washington Department of Fish and Wildlife outfitted the goshawk and harrier, HWI banded the remainder. Unfortunately, both the goshawk and eagle units failed to transmit after only a few days and a about month, respectively. During the time when signals were received, both birds remained in the local area. The cause of the transmission failures is unknown, potentially involving technological failure, a bird removing the transmitter antenna, or a bird dying in a place that precluded additional transmissions (e.g., a deep, narrow canyon). Otherwise, the harrier initially traveled to southern California and then veered east, one Red-tailed Hawk initially traveled almost to Mt. Hood (OR) but then backtracked and settled for the winter near Ellensburg (WA), and the other two red-tails ended up in central California for the winter. Thus, like the majority of the band-recovery data, thus far the telemetry results show primarily a connection to the Pacific Coast Flyway.

Unfortunately, one of the California red-tails did not make it through the winter. It appeared to settle near San Lorenzo in complex area of heavy development mixed with significant open space. We received a mortality signal by late February but have not been able to recover the bird because of poor transmission quality. The most interesting aspect of this bird's migration was that it traveled directly over GGRO's site in the Marin Headlands before crossing over the bay to San Lorenzo. The Ellensburg red-tail began its spring 2002 migration between 22 and 24 March, and as of 2 April appeared to have

settled in northwestern British Columbia about 200 km east of Prince Rupert. In contrast, as of 7 April the remaining California red-tail, which wintered near Lockeford in the Central Valley, had not yet begun its spring migration. Complete tracking summaries and maps for the Red-tailed Hawks can be viewed at www.hawkwatch.org.

VISITOR PARTICIPATION AND PUBLIC OUTREACH

The 2001 visitor logs recorded 95 individuals from Washington, Montana, and England. Educator Don Look also conducted a week of school programs in the Wenatchee area that were attended by 576 elementary school children. Thus, thanks to the positive outreach efforts of Forest Service coordinator Kent Woodruff and addition of a full-time educator to the field crew, our Chelan Ridge education efforts successfully expanded to an even broader audience in 2001.

Beginning with the fall 2001 season, HWI adopted a new approach to quantifying the influence of visitors on counts at all of its project sites. Encouraging visitation and achieving positive public education and outreach are important goals for all HWI projects; however, during migration counts, visitors can represent a distraction for the official observers that may compromise the integrity of the count. Tolerating a certain level of distraction in the interest of positive outreach is a tradeoff that we gladly accept as part of our operations; however, because the distraction potential fluctuates considerably through time, it is important that the data we record include a means of quantifying the distraction potential through statistical modeling. Previously, at each site we had the observers estimate the number of visitors present during each hour of active counts. Two primary problems confounded use of this system for quantifying the visitor-distraction factor.

First, during busy periods (in terms of birds to count or visitors present) tracking visitors often became a difficult task for the observers. This difficulty led to both inconsistent estimation and, in some cases, in and of itself represented an unnecessary distraction. Second, careful reflection over the years suggested that simply recording the number of visitors often failed to capture the true effect of specific situations. For example, a single, highly curious, and talkative individual often represents more of a distraction for the observers than a large group of relatively quiet visitors.

In an effort to overcome these limitations, we have adopted a new system for recording visitor effects, whereby the observers record a subjective, visitor-distraction rating for each hour (none, low, moderate, or high). The new system still requires that the observers keep track of the effects of visitors through the hour, but the task is much easier without having to specify numbers. Furthermore, the new rating system allows the observers to incorporate a broader range of input to generate a more representative index of true visitor effects on their performance. Thus, although data-recording protocol changes such as this can be troublesome with regard to analysis of long-term trends, we believe that in the end this new approach to estimating visitor-distraction effects will significantly improve the integrity of our count systems.

In 2001 at Chelan Ridge, 466 hourly assessments of visitor disturbance resulted in the following ratings: 90% none, 9% low, 1% moderate, and <1% high. This low level of disturbance testifies to the advantages of having a full-time educator and other dedicated volunteers available to ensure enjoyable and informative visits for all guests without unnecessarily distracting the observers from their primary task.

ACKNOWLEDGEMENTS

Financial and logistical support for this project in 2001 was provided by Okanogan and Wenatchee National Forests; M.J. Murdock Charitable Trust; National Fish and Wildlife Foundation; State of Washington Department of Fish and Wildlife, Volunteer Cooperative Fish and Wildlife Program;

Mountaineers Foundation; North Central Washington Community Foundation; PacifiCorp Foundation, Kittitas Audubon Society; North Central Washington Audubon Society; and HWI members.

Numerous individuals were essential in helping us achieve successful promotion and implementation of this season's effort. Dan Harrington, past observer serving as a seasonal technician for OWNF during the season, assisted with most aspects of the project. Although he was unable to finish the season, we were again grateful to have Richard Hendrick volunteer considerable time as an observer, and thank educator Don Loock for pulling double duty to fill in after Richard finished. Eric Jepsen, Kent Woodruff, and Meredith Spencer served as substitute observers. We are extremely grateful for the dedicated efforts of full-time banders Bob Davies and Eric Jepsen, who succeeded beyond our wildest dreams in achieving a productive trapping season. Thanks also to those individuals that dedicated time to assisting Bob and Eric, especially Jim Watson, Betty Davies, Dennis Ryan, Cindy Willis, Julia Bent, Dan Harrington, Don Loock, and Kent Woodruff, and to Brad Martin for providing the lure pigeons. Anaka Mines provided valuable service as an assistant educator. Thanks to Mallory Lenz and Bob Sheehan of the OWNF Chelan Ranger District for providing a port-a-pot and hosting a District Field Day at the project site. The North Central Audubon Society also provided valuable logistical assistance, as well as hosting HWI's Executive Director for an evening program. Lastly, we are especially thankful for the OWNF staff at the Winthrop Visitor Center and Twisp Office who prepared informative public displays about the project and communicated daily with observers on the ridge.

LITERATURE CITED

- Bednarz, J. C., T. J. Hayden, and T. Fischer. 1990a. The raptor and raven community of the Los Medanos area in southeastern New Mexico: a unique and significant resource. Pages 92–101 *in* R. S. Mitchell, C. J. Sheviak, and D. J. Leopold, editors. *Ecosystem management: rare species and significant habitats*. Bulletin No. 471. New York State Museum, Albany, New York, USA.
- Bednarz, J. C., and P. Kerlinger. 1989. Monitoring hawk populations by counting migrants. Pages 328–342 *in* B. Pendleton, editor. *Proceedings of the Northeast Raptor Management Symposium and Workshop*. National Wildlife Federation, Washington, D.C., USA.
- Bednarz, J. C., D. Klem Jr., L. J. Goodrich, and S. E. Senner. 1990b. Migration counts of raptors at Hawk Mountain, PA, as indicators of population trends, 1934–1986. *Auk* 107:96–109.
- 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. J. Brett, L. J. Goodrich, and C. Viverette. 1995. Hawks Aloft Worldwide: a network to protect the world's migrating birds of prey and the habitats essential to their migrations. Pages 504–516 *in* D. A. Saunders, J. L. Craig, and E. M. Mattiske, editors. *Nature conservation 4: the role of networks*. Surrey Beatty & Sons, Chipping Norton, New South Wales, Australia.
- Bloom, P.H. 1987. Capturing and handling raptors. Pages 99–123 *in* B. G. Pendleton, B. A. Millsap, K. W. Cline, and D. M. Bird (Editors). *Raptor management techniques manual*. National Wildlife Federation, Washington, D.C., USA.
- Cade, T. J., J. E. Enderson, C. G. Thelander, and C. M. White. 1988. Peregrine falcon populations, their management and recovery. The Peregrine Fund, Inc., Boise, Idaho, USA.
- Clark, W. S. and B. K. Wheeler. 1987. *A field guide to hawks*. Houghton Mifflin Co., Boston, Massachusetts, USA. 198 pp.
- Dixon, P. M., A. R. Olsen, and B. M. Kahn. 1998. Measuring trends in ecological resources. *Ecological Applications* 8:225–227

- Dunn, E. H., and D. J. T. Hussell. 1995. Using migration counts to monitor landbird populations: review and evaluation of status. Pages 43–88 *in* D. M. Power, editor. *Current Ornithology*, Vol. 12. Plenum Press, New York, New York, USA.
- Dunne, P., D. Sibley, and C. Sutton. 1988. *Hawks in flight*. Houghton Mifflin Co., Boston, Massachusetts. 254 pp.
- Hoffman, S. W., J. P. Smith, and J. A. Gessaman. 1990. Size of fall-migrant accipiters from the Goshute Mountains of Nevada. *Journal of Field Ornithology* 61:201–211.
- Hoffman, S. W., J. P. Smith, and T. D. Meehan. In press. Breeding grounds, winter ranges, and migratory routes of raptors in the Mountain West. *Journal of Raptor Research*.
- Hussell, D. J. T. 1985. Analysis of hawk migration counts for monitoring population levels. Pages 243–254 *in* M. Harwood, editor. *Proceedings of Hawk Migration Conference IV*. Hawk Migration Association of North America.
- Kerlinger, P. 1989. *Flight strategies of migrating hawks*. University of Chicago Press, Chicago, Illinois. 375 pp.
- Smith, J. P. 2002a. Fall 2001 raptor migration studies in the Wellsville Mountains of northern Utah. HawkWatch International, Inc., Salt Lake City, Utah. 27 pp.
- Smith, J. P. 2002b. Fall 2001 raptor migration studies in the Manzano Mountains of central New Mexico. HawkWatch International, Inc., Salt Lake City, Utah. 33 pp.
- Smith, J. P., and S. W. Hoffman. 2000. The value of extensive raptor migration monitoring in western North America. Pages 597–615 *in* R. D. Chancellor and B.-U. Meyburg, editors. *Raptors at risk*. World Working Group on Birds of Prey and Owls, Berlin, Germany, and Hancock House Publishers, British Columbia and Washington.
- Steenhof, K., M. N. Kochert, and M. Q. Moritsch. 1984. Dispersal and migration of southwestern Idaho raptors. *Journal of Field Ornithology* 55:357–368.
- Titus, K., M. R. Fuller, and J. L. Ruos. 1989. Considerations for monitoring raptor population trends based on counts of migrants. Pages 19–32 *in* B. U. Meyburg and R. D. Chancellor, editors. *Raptors in the modern world*. Proceedings of the III World Conference on Birds of Prey and Owls, Eilat, Israel, 1987. World Working Group on Birds of Prey and Owls, Berlin, Germany.
- Vekasy, M.S., and J. P. Smith. 2002. Fall 2001 raptor migration studies in the Goshute Mountains of northeastern Nevada. HawkWatch International, Inc., Salt Lake City, Utah. 41 pp.
- Watson, J. W., and D. J. Pierce. 2000. Migration and winter ranges of ferruginous hawks from Washington. Annual Report. Washington Department of Fish and Wildlife, Olympia, Washington, USA.
- Wheeler, B. K., and W. S. Clark. 1995. *A photographic guide to North American raptors*. Academic Press, London, England. 198 pp.
- 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.

Table 1. Fall counts and passage rates by species for migrating raptors at Chelan Ridge, WA: 1998–2000 versus 2001.

	1998–2000 ¹	2001	% Change	1998–2000 ¹	2001	% Change
Start Date	26-Aug ± 0.7	27-Aug				
End Date	27-Oct ± 9.1	22-Oct				
Observation Days	60 ± 7.9	55	-9			
Observations Hours	464.33 ± 79.790	439.00	-5			
SPECIES	COUNTS			RAPTORS/100 HOURS		
Turkey Vulture	25 ± 4.6	14	-45	5.6 ± 1.99	3.2	-43
Osprey	47 ± 26.6	48	+1	9.9 ± 4.43	10.9	+11
Northern Harrier	141 ± 37.2	91	-35	31.1 ± 11.00	20.7	-33
Sharp-shinned Hawk	977 ± 72.2	878	-10	213.4 ± 36.12	200.0	-6
Cooper's Hawk	226 ± 28.4	198	-12	49.9 ± 14.84	45.1	-10
Northern Goshawk	39 ± 10.9	16	-59	8.4 ± 1.69	3.6	-57
Unknown small accipiter ²		98	–		22.3	–
Unknown large accipiter ²		0	–		0.0	–
Unknown accipiter	189 ± 90.5	0	–	42.1 ± 22.78	0.0	–
TOTAL ACCIPITERS	1431 ± 49.2	1190	-17	313.8 ± 64.04	271.1	-14
Broad-winged Hawk	6 ± 1.3	6	+6	1.3 ± 0.55	1.4	+8
Swainson's Hawk	9 ± 8.5	0	-100	2.0 ± 1.69	0.0	-100
Red-tailed Hawk	332 ± 154.8	263	-21	69.6 ± 23.71	59.9	-14
Ferruginous Hawk	0 ± 0.7	0	-100	0.1 ± 0.13	0.0	-100
Rough-legged Hawk	37 ± 23.7	13	-65	7.5 ± 4.18	3.0	-61
Unidentified buteo	101 ± 51.1	83	-18	21.2 ± 8.28	18.9	-11
TOTAL BUTEOS	485 ± 227.0	365	-25	101.6 ± 34.93	83.1	-18
Golden Eagle	123 ± 69.5	105	-15	25.6 ± 11.58	23.9	-6
Bald Eagle	8 ± 7.4	2	-75	1.6 ± 1.40	0.5	-72
Unidentified eagle	4 ± 4.1	1	-75	0.8 ± 0.81	0.2	-71
TOTAL EAGLES	135 ± 79.9	108	-20	28.0 ± 13.55	24.6	-12
American Kestrel	79 ± 39.2	84	+7	17.8 ± 11.34	19.1	+7
Merlin	39 ± 16.7	36	-8	8.9 ± 5.49	8.2	-8
Prairie Falcon	7 ± 2.8	5	-32	1.7 ± 0.96	1.1	-32
Peregrine Falcon	4 ± 4.9	3	-25	0.8 ± 0.95	0.7	-18
Unknown small falcon ²	–	6	–	–	1.4	–
Unknown large falcon ²	–	1	–	–	0.2	–
Unknown falcon	5 ± 2.6	2	–	1.1 ± 0.68	0.5	–
TOTAL FALCONS	134 ± 61.4	137	+2	30.3 ± 18.35	31.2	+3
Unidentified raptor	165 ± 101.3	112	-32	37.3 ± 25.65	25.5	-32
GRAND TOTAL	2563 ± 313.1	2065	-19	557.6 ± 79.76	470.4	-16

¹ Mean ± 95% confidence interval.

² Designations used for the first time in 2001.

Table 2. Fall counts by age class and immature : adult ratios for selected species of migrating raptors at Chelan Ridge, WA: 1998–2000 versus 2001.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1998–2000 AVERAGE			2001			% UNKNOWN AGE		RATIO	
	TOTAL	IMM	ADULT	TOTAL	IMM	ADULT	1998–2000 ¹	2001	1998–2000 ¹	2001
Northern Harrier	135	47	41	91	23	20	38 ± 5.7	53	1.2 ± 0.39	1.2
Sharp-shinned Hawk	811	494	163	878	422	108	32 ± 22.0	40	4.2 ± 4.84	3.9
Cooper's Hawk	207	100	32	198	75	25	43 ± 23.4	49	3.3 ± 2.77	3.0
Northern Goshawk	39	16	8	16	5	2	40 ± 16.6	56	5.7 ± 8.13	2.5
Broad-winged Hawk	5	2	1	6	3	1	49 ± 38.1	33	1.7 ± 1.31	3.0
Red-tailed Hawk	285	89	152	263	63	123	25 ± 9.3	29	0.7 ± 0.32	0.5
Golden Eagle	119	69	25	105	48	30	23 ± 8.1	26	2.7 ± 0.17	1.6
Bald Eagle	7	2	6	2	0	2	0 ± 0.0	0	0.2 ± 0.33	0.0
Peregrine Falcon	4	0	1	3	1	0	52 ± 56.7	67	–	–

¹ Mean ± 95% confidence interval. For age ratios, note that long-term mean immature : adult ratios are averages of annual ratios and may differ from values obtained by dividing average numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in the observed age ratio.

Table 3. First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Chelan Ridge, WA in 2001, with a comparison of 2001 and 1998–2000 average median passage dates.

SPECIES	2001				1998–2000
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	7-Sep	6-Oct	9-Sep – 28-Sep	22-Sep	13-Sep ± 9.3
Osprey	30-Aug	20-Oct	4-Sep – 3-Oct	21-Sep	19-Sep ± 2.3
Northern Harrier	29-Aug	17-Oct	4-Sep – 6-Oct	23-Sep	21-Sep ± 4.5
Sharp-shinned Hawk	27-Aug	19-Oct	5-Sep – 8-Oct	21-Sep	21-Sep ± 4.7
Cooper's Hawk	27-Aug	20-Oct	5-Sep – 4-Oct	21-Sep	16-Sep ± 4.6
Northern Goshawk	29-Aug	16-Oct	9-Sep – 14-Oct	17-Sep	26-Sep ± 11.6
Broad-winged Hawk	9-Sep	18-Sep	9-Sep – 18-Sep	10-Sep	14-Sep ± 0.7
Red-tailed Hawk	27-Aug	20-Oct	5-Sep – 9-Oct	28-Sep	22-Sep ± 4.3
Rough-legged Hawk	27-Sep	16-Oct	3-Oct – 16-Oct	8-Oct	15-Oct ± 5.9
Golden Eagle	28-Aug	20-Oct	9-Sep – 13-Oct	1-Oct	3-Oct ± 4.5
Bald Eagle	18-Sep	3-Oct	–	–	17-Oct ± 6.9 ⁴
American Kestrel	27-Aug	6-Oct	27-Aug – 29-Sep	9-Sep	16-Sep ± 3.6
Merlin	27-Aug	17-Oct	5-Sep – 4-Oct	17-Sep	21-Sep ± 5.2
Prairie Falcon	9-Sep	6-Oct	9-Sep – 6-Oct	4-Oct	17-Sep ± 17.3
Peregrine Falcon	28-Sep	5-Oct	–	–	28-Sep ⁵
Total	27-Aug	20-Oct	5-Sep – 8-Oct	22-Sep	22-Sep ± 3.4

¹ Dates between which the central 80% of the flight passed the lookout.

² Date by which 50% of the flight had passed the lookout.

³ Mean of annual values ± 95% confidence interval in days; unless otherwise indicated, values are given only for species with annual counts ≥5 birds for ≥3 years.

⁴ Value for 1999 and 200 only.

⁵ Value is for 2000 only.

Table 4. Median passage dates by age for selected species of migrating raptors at Chelan Ridge, WA: 1998–2000 versus 2001.

SPECIES	ADULT		IMMATURE	
	1998–2000 ¹	2001	1998–2000 ¹	2001
Northern Harrier	20-Sep ± 6.0	29-Sep	21-Sep ± 4.6	18-Sep
Sharp-shinned Hawk	2-Oct ± 1.1	29-Sep	16-Sep ± 2.3	11-Sep
Cooper’s Hawk	24-Sep ± 5.6	27-Sep	12-Sep ± 3.0	11-Sep
Northern Goshawk	8-Oct ± 10.8	#VALUE!	24-Sep ± 5.6	10-Sep
Red-tailed Hawk	25-Sep ± 2.4	30-Sep	18-Sep ± 6.2	22-Sep
Golden Eagle	5-Oct ± 6.8	30-Sep	30-Sep ± 1.1	1-Oct

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

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

Table 5. Fall capture totals, rates, and successes by species for migrating raptors at Chelan Ridge, WA: 1999–2000 versus 2001.

	CAPTURE TOTALS		CAPTURE RATES ¹		CAPTURE SUCCESSES ²	
	1999–2000 ³	2001	1999 ONLY ³	2001	1999–2000 ³	2001
Northern Harrier	4 ± 1.0	10	1.0	1.5	2.6 ± 0.48	11.0
Sharp-shinned Hawk	132 ± 13.7	341	35.8	52.8	11.7 ± 1.30	35.6
Cooper's Hawk	44 ± 3.9	107	10.8	16.6	18.3 ± 6.41	49.5
Northern Goshawk	12 ± 3.9	12	3.6	1.9	24.8 ± 2.92	75.0
Red-tailed Hawk	10 ± 2.9	22	2.8	3.4	1.8 ± 0.11	6.5
Rough-legged Hawk	0.5 ± 0.98	1	0.0	0.2	0.8 ± 1.51	5.9
Golden Eagle	1 ± 1.0	2	0.0	0.3	0.3 ± 0.55	1.9
American Kestrel	1.5 ± 2.94	8	0.8	1.2	1.6 ± 3.16	9.0
Merlin	5 ± 2.0	17	1.5	2.6	15.3 ± 0.96	43.6
Prairie Falcon	1 ± 0.0	3	0.3	0.5	17.1 ± 5.60	50.0
Peregrine Falcon	0.0 ± 0.0	2	0.0	0.3	0.0 ± 0.00	66.7
All species	210 ± 20.6	525	56.7	81.3	8.6 ± 0.26	27.8

¹ Captures / 100 station hours.

² Number of birds captured / number of birds observed. The combined-species value was calculated excluding Ospreys, Turkey Vultures, and unknown raptors from the count totals. Species-specific values were calculated after birds identified only to genus were allocated across possible species in proportion to the relative abundance of birds identified to those species.

³ Mean of annual values ± 95% confidence interval; data collected by the Falcon Research Group.

Table 6. Fall capture totals by sex and age (HY = hatching year; AHY = after hatching year), female : male capture ratios, and immature : adult capture ratios for selected species of migrating raptors at Chelan Ridge, WA: 2001.

SPECIES	FEMALE		MALE		FEMALE : MALE	IMMATURE : ADULT
	HY	AHY	HY	AHY	RATIO	RATIO
Sharp-shinned Hawk	123	52	141	25	1.05	3.43
Cooper's Hawk	27	27	44	9	1.02	1.97
Northern Goshawk	3	2	4	3	0.71	1.40
American Kestrel	0	1	5	2	0.14	1.67

Table 7. Foreign encounters associated with the Chelan Ridge Raptor Migration Project: 2000–2001.

BAND #	SPECIES ¹	SEX	BANDING DATE	BANDING AGE ²	ENCOUNTER LOCATION	ENCOUNTER DATE	ENCOUNTER AGE ²	DISTANCE (KM)	STATUS
? – ?	CH	?	16-Sep-00	HY	Edwards AFB, CA	4-Oct-00	HY	583	found dead
1593 – 02001	SS	F	30-Aug-01	HY	Fallon, NV	16-Sep-01	HY	798	hit by car / captive
1293 – 25056	ML	F	13-Sep-01	HY	Bend, OR	25-Sep-01	HY	376	hit by car / euthanized
1593 – 02076	SS	F	02-Oct-01	HY	Bonney Butte, OR	10-Oct-01	HY	288	research recapture
1593 – 02002	SS	F	02-Sep-01	HY	Georgetown, CA	14-Oct-01	HY	831	collision kill
1202 – 22157	SS	M	24-Sep-01	HY	Marin Headlands, CA	26-Oct-01	HY	957	research recapture

¹ SS = Sharp-shinned Hawk; CH = Cooper's Hawk; ML = Merlin.

² HY = hatch year.



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

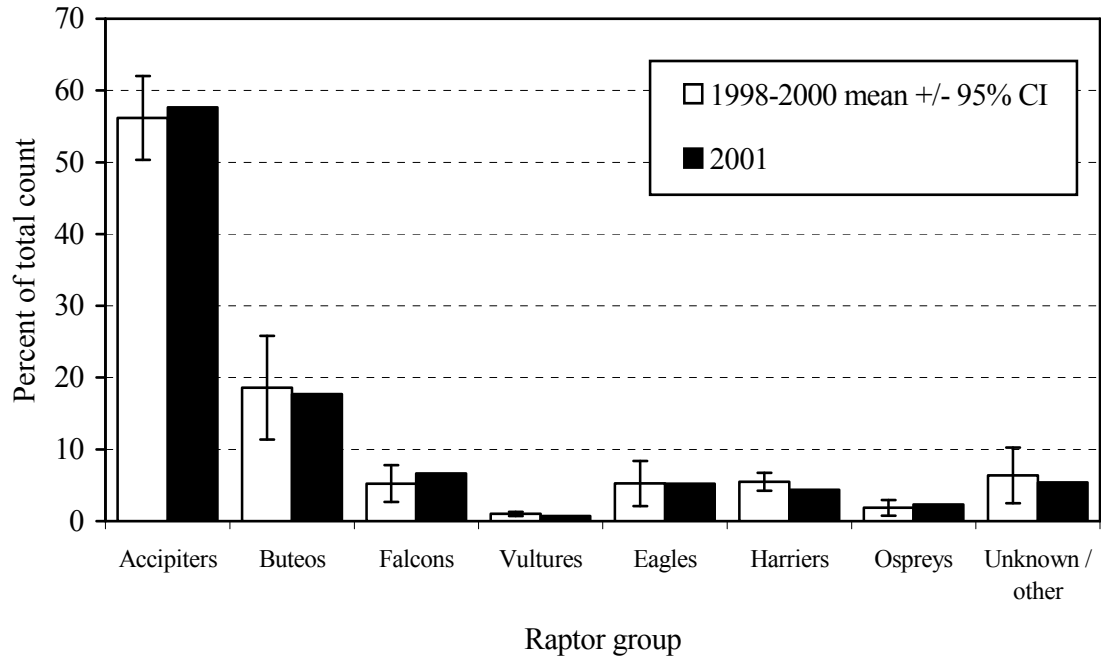


Figure 2. Fall raptor migration flight composition by major species groups at Chelan Ridge, WA: 1998-2000 versus 2001.

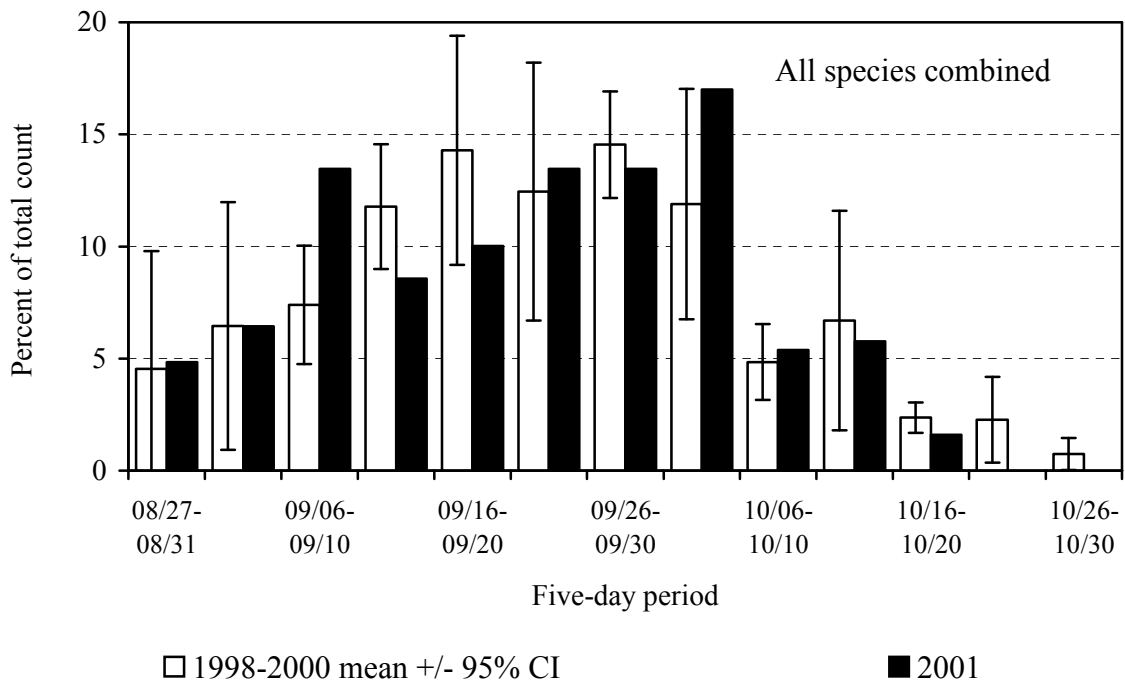


Figure 3. Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998-2000 versus 2001.

Appendix A. History of official observer participation in the Chelan Ridge Raptor Migration Project.

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).

2001: Two observers throughout: Richard Hendrick (3; first half of season), Wendy King (0), Don Loock (0; primarily second half of season), Dan Harrington (3; training and substitute observer).

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

Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications for all diurnal raptor species observed during fall migration at Chelan Ridge, WA.

COMMON NAME	SCIENTIFIC NAME	SPECIES CODE	AGE ¹	SEX ²	COLOR MORPH ³
Turkey Vulture	<i>Cathartes aura</i>	TV	U	U	NA
Osprey	<i>Pandion haliaetus</i>	OS	U	U	NA
Northern Harrier	<i>Circus cyaneus</i>	NH	AM AF I Br U	AM AF U	NA
Sharp-shinned Hawk	<i>Accipiter striatus</i>	SS	A I U	U	NA
Cooper's Hawk	<i>Accipiter cooperii</i>	CH	A I U	U	NA
Northern Goshawk	<i>Accipiter gentilis</i>	NG	A I U	U	NA
Unknown small accipiter	<i>A. striatus</i> or <i>cooperii</i>	SA	U	U	NA
Unknown large accipiter	<i>A. cooperii</i> or <i>gentilis</i>	LA	U	U	NA
Unknown accipiter	<i>Accipiter</i> spp.	UA	U	U	NA
Broad-winged Hawk	<i>Buteo platypterus</i>	BW	A I U	U	D L U
Swanson's Hawk	<i>Buteo swainsoni</i>	SW	U	U	D L U
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RT	A I U	U	D L U
Ferruginous Hawk	<i>Buteo regalis</i>	FH	A I U	U	D L U
Rough-legged Hawk	<i>Buteo lagopus</i>	RL	U	U	D L U
Unknown buteo	<i>Buteo</i> spp.	UB	U	U	D L U
Golden Eagle	<i>Aquila chrysaetos</i>	GE	I, S, NA, A, U ⁴	U	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BE	I, S1, S2, NA, A, U ⁵	U	NA
Unknown eagle	<i>Aquila</i> or <i>Haliaeetus</i> spp.	UE	U	U	NA
American Kestrel	<i>Falco sparverius</i>	AK	U	M F U	NA
Merlin	<i>Falco columbarius</i>	ML	AM Br U	AM Br U	NA
Prairie Falcon	<i>Falco mexicanus</i>	PR	U	U	NA
Peregrine Falcon	<i>Falco peregrinus</i>	PG	A I U	U	NA
Unknown small falcon	<i>F. sparverius</i> or <i>columbarius</i>	SF	U	U	NA
Unknown large falcon	<i>F. mexicanus</i> or <i>peregrinus</i>	LF	U	U	NA
Unknown falcon	<i>Falco</i> spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

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

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

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

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

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

Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Chelan Ridge Raptor Migration Project: 2001.

DATE	OBS. HOURS	OBSVR / HOUR ¹	MEDIAN VISITOR DISTURB ²	PREDOMINANT WEATHER ³	WIND SPEED (KPH) ¹	WIND DIRECTION	TEMP (°C) ¹	BAROM. PRESS. (IN HG) ¹	MEDIAN THERMAL LIFT ⁴	VISIB. WEST (KM) ¹	VISIB. EAST (KM) ¹	MEDIAN FLIGHT DISTANCE ⁵	BIRDS / HOUR
27-Aug	8.00	1.0	0	clr-pc	7.4	ws, s-ssw	19.3	-	2	50	50	1	2.3
28-Aug	8.00	1.0	0	pc-mc	7.9	n-ne, s-ssw	15.4	-	3	50	50	3	2.4
29-Aug	8.00	1.0	0	clr	3.5	ne, s-sw	17.2	-	2	50	50	3	2.3
30-Aug	8.00	1.0	0	clr-mc	4.0	se-ssw	18.0	-	2	50	50	3	3.6
31-Aug	9.42	1.3	0	clr-ovc	7.5	s-sw	15.6	30.00	3	49	46	3	1.7
1-Sep	9.50	2.2	0	ovc, pc late	23.8	sw	11.5	30.00	4	36	11	1	0.3
2-Sep	8.58	2.4	0	mc-ovc	7.6	s-sw	11.9	30.00	3	50	50	2	1.6
3-Sep	9.25	1.7	0	pc-ovc	14.6	ssw-sw	12.5	30.00	3	50	47	1	3.8
4-Sep	9.00	2.0	0	pc-ovc	13.5	ssw-sw	14.5	29.99	4	50	50	3	3.8
5-Sep	9.50	2.5	0	clr-ovc	8.5	var	9.1	30.00	2	50	45	3	4.9
6-Sep	9.25	2.3	0	pc-ovc	7.7	s-sw	10.9	30.09	4	50	47	2	2.8
7-Sep	8.25	1.7	0	clr	12.1	nw-e	7.4	30.24	3	54	50	3	5.2
8-Sep	9.00	2.6	0	clr	14.5	ssw-sw	11.2	30.18	2	55	50	3	3.8
9-Sep	9.25	1.7	0	clr	9.0	ne-e, sw	12.0	30.02	2	55	50	3	8.5
10-Sep	8.75	1.8	0	clr-pc	10.8	ne, sw	14.3	29.99	2	50	41	2	11.0
11-Sep	9.25	1.7	0	clr	10.4	ne, sw	13.0	30.11	2	60	46	3	8.0
12-Sep	8.00	1.0	0	clr	7.9	se-sw	14.8	30.05	2	48	50	3	4.5
13-Sep	8.00	1.9	0	clr-mc	12.0	n-ne, var	16.1	30.11	3	52	16	3	3.0
14-Sep	8.25	3.1	1	clr	9.5	s-sw	16.9	30.19	2	49	50	2	0.0
15-Sep	10.00	6.4	2	clr/haze	3.0	sse-sw	17.8	30.07	3	25	23	3	4.3
16-Sep	9.00	1.9	0	pc	9.7	n-ne, sw	17.8	30.04	3	51	41	3	4.9
17-Sep	8.50	1.9	0	clr-ovc, PM haze	7.9	n/calm, ssw-sw	16.6	30.04	3	38	39	1	5.6
18-Sep	7.50	2.0	0	clr-mc, haze	5.4	calm, sw	19.0	29.97	2	38	43	1	9.2
19-Sep	8.00	2.0	0	clr-pc, PM haze	5.7	ne/calm, ssw-sw	12.8	30.05	2	44	34	2	2.6
20-Sep	9.00	2.6	0	clr-ovc	7.3	ssw/var	16.3	30.01	2	54	66	3	2.8
21-Sep	8.50	1.7	0	pc-ovc, scat haze	4.3	ssw-wnw	16.6	30.07	2	49	46	3	5.2
22-Sep	9.00	3.5	0	clr	11.6	sw	17.7	30.17	3	57	61	2	5.4
23-Sep	9.00	4.2	0	clr-pc	2.5	var	20.0	30.07	2	54	57	3	8.0
24-Sep	8.75	2.2	0	pc	10.6	sse-ssw	19.7	30.03	3	17	23	3	8.8
25-Sep	6.25	1.7	0	mc-ovc, PM rain	18.6	nnw, var	18.6	29.79	4	41	38	3	5.8
26-Sep	5.00	2.5	0	ovc, fog/rain	15.3	ssw	11.0	29.86	4	29	18	2	1.6
27-Sep	8.00	1.8	0	pc-ovc	12.8	ne, sw	7.3	29.95	3	57	53	3	4.5
28-Sep	9.00	1.8	0	clr-mc	12.0	sw	10.5	29.98	3	70	70	3	6.7
29-Sep	9.00	1.7	0	clr-pc, AM haze	14.3	s-sw	11.5	30.20	3	77	61	3	8.9
30-Sep	9.00	1.9	0	clr	7.8	s-sw	13.3	30.23	2	89	89	3	10.4
1-Oct	8.00	1.6	0	pc-ovc	12.7	s-sw	16.4	30.05	3	63	83	3	6.5
2-Oct	7.75	2.1	0	pc-ovc	9.1	s-sw	14.3	30.13	2	80	79	3	14.3
3-Oct	9.25	2.2	0	clr	9.5	nnw-ne, var	11.0	30.17	3	83	79	3	7.4
4-Oct	8.00	1.5	0	clr	11.5	nw-ne	8.6	30.22	2	84	63	2	7.4
5-Oct	7.75	1.8	0	clr	6.7	sse-ssw	11.0	30.04	2	96	86	2	7.9
6-Oct	8.25	1.9	0	clr-ovc, haze	11.1	ssw-sw	10.7	29.90	3	55	40	2	5.1
7-Oct	8.00	1.4	0	ovc/haze	12.1	sw	7.2	29.92	4	39	43	2	0.5
8-Oct	7.50	2.0	0	clr-pc, AM fog	16.1	sw	6.9	29.88	3	43	41	2	4.8
9-Oct	5.75	1.0	0	pc	17.9	s-sw	6.9	30.10	3	100	54	2	5.0
10-Oct	0.00			rain/snow									
11-Oct	7.75	1.4	0	pc-mc	10.2	s-sw	5.4	29.96	3	83	56	3	3.4
12-Oct	4.75	0.9	0	ovc, rain/snow	19.0	sw	7.2	29.81	4	57	28	3	1.1
13-Oct	7.75	1.7	0	clr-ovc	10.6	se, ssw-sw	7.8	30.03	4	79	78	3	5.0
14-Oct	6.75	1.4	0	mc-ovc	6.4	n-nne, var	6.6	30.07	3	85	60	3	4.7

Appendix C. continued

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN VISITOR DISTURB ²	PREDOMINANT WEATHER ³	WIND SPEED (KPH) ¹	WIND DIRECTION	TEMP (°C) ¹	BAROM. PRESS. (IN HG) ¹	MEDIAN THERMAL LIFT ⁴	VISIB. WEST (KM) ¹	VISIB. EAST (KM) ¹	MEDIAN FLIGHT DISTANCE ⁵	BIRDS / HOUR
15-Oct	8.00	1.9	0	mc-ovc	14.9	ssw	7.2	30.13	4	64	77	2	2.1
16-Oct	7.50	1.5	0	pc-ovc	20.7	s-sw	9.2	29.83	4	59	70	3	1.7
17-Oct	8.00	1.0	0	clr-pc	11.5	ssw-sw	4.6	30.10	3	77	73	2	0.8
18-Oct	5.25	1.4	0	mc-ovc	13.7	s-ssw	6.6	30.07	3	56	69	1	0.2
19-Oct	6.00	1.4	0	pc	10.1	sw	9.6	29.92	3	83	70	2	0.5
20-Oct	7.00	1.9	0	clr-ovc	5.8	ssw-sw	7.9	29.96	3	83	84	3	1.4
21-Oct	0.00			rain/snow									
22-Oct	1.25	1.0	0	ovc	16.7	sw	2.5	29.66	4	70	60	-	0.0

¹ Average of hourly records.

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

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

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

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

Appendix D. Daily observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 2001.

DATE	OBS.		SPECIES ¹																								BIRDS			
	HOURS	TV	OS	NH	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/HOUR	
27-Aug	8.00	0	0	0	4	2	0	0	0	0	0	0	1	0	0	0	0	0	0	9	1	0	0	0	0	0	0	1	18	2.3
28-Aug	8.00	0	0	0	5	3	0	0	0	0	0	0	3	0	0	1	2	0	0	5	0	0	0	0	0	0	0	0	19	2.4
29-Aug	8.00	0	0	4	8	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2	18	2.3	
30-Aug	8.00	0	1	3	13	1	0	1	0	0	0	0	5	0	0	1	0	0	0	4	0	0	0	0	0	0	0	29	3.6	
31-Aug	9.42	0	0	0	4	0	0	1	0	0	0	0	4	0	0	4	2	0	0	0	0	0	0	0	0	0	1	16	1.7	
01-Sep	9.50	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0.3	
02-Sep	8.58	0	3	1	5	1	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	14	1.6	
03-Sep	9.25	0	0	0	18	1	0	0	0	0	0	0	5	0	0	2	3	0	0	3	0	0	0	0	0	0	3	35	3.8	
04-Sep	9.00	0	1	2	18	2	0	2	0	0	0	0	6	0	0	0	0	0	0	1	1	0	0	0	0	0	1	34	3.8	
05-Sep	9.50	0	0	3	18	9	0	2	0	0	0	0	4	0	0	3	0	0	0	5	1	0	0	0	0	0	2	47	4.9	
06-Sep	9.25	0	2	1	11	6	0	2	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	26	2.8	
07-Sep	8.25	1	1	4	23	3	0	0	0	0	0	0	5	0	0	0	0	0	0	4	0	0	0	0	0	0	2	43	5.2	
08-Sep	9.00	0	1	1	17	3	0	4	0	0	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	2	34	3.8	
09-Sep	9.25	1	2	4	42	12	1	3	0	0	2	0	6	0	0	0	2	0	0	1	2	1	0	0	0	0	0	79	8.5	
10-Sep	8.75	1	1	5	45	9	0	6	0	0	0	0	8	0	0	4	0	0	0	13	2	0	0	0	0	0	2	96	11.0	
11-Sep	9.25	2	1	2	42	6	1	2	0	0	2	0	8	0	0	2	0	0	0	1	2	0	0	0	0	0	3	74	8.0	
12-Sep	8.00	0	0	0	23	3	0	1	0	0	1	0	2	0	0	1	0	0	0	3	2	0	0	0	0	0	0	36	4.5	
13-Sep	8.00	0	0	0	15	0	0	3	0	0	0	0	2	0	0	0	0	0	0	2	1	0	0	0	0	0	1	24	3.0	
14-Sep	8.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	
15-Sep	10.00	0	0	2	21	2	2	5	0	0	0	0	1	0	0	1	1	0	0	2	1	0	0	0	0	1	4	43	4.3	
16-Sep	9.00	0	2	0	17	5	1	2	0	0	0	0	5	0	0	4	1	0	0	3	1	0	0	0	0	0	3	44	4.9	
17-Sep	8.50	0	3	3	22	4	0	4	0	0	0	0	4	0	0	1	1	0	1	2	1	0	0	0	0	0	2	48	5.6	
18-Sep	7.50	0	0	0	33	10	2	2	0	0	1	0	6	0	0	3	1	1	0	1	2	0	0	0	1	0	6	69	9.2	
19-Sep	8.00	0	1	1	8	3	0	3	0	0	0	0	2	0	0	1	2	0	0	0	0	0	0	0	0	0	0	21	2.6	
20-Sep	9.00	0	2	1	7	2	0	3	0	0	0	0	3	0	0	2	1	0	0	0	2	0	0	2	0	0	0	25	2.8	
21-Sep	8.50	1	2	2	15	7	0	2	0	0	0	0	6	0	0	7	0	0	0	0	0	0	0	0	0	0	2	44	5.2	
22-Sep	9.00	0	2	3	22	4	0	4	0	0	0	0	4	0	0	3	3	0	0	0	0	0	0	0	0	0	4	49	5.4	
23-Sep	9.00	1	1	2	40	11	0	1	0	0	0	0	6	0	0	1	2	0	0	5	2	0	0	0	0	0	0	72	8.0	
24-Sep	8.75	4	0	2	39	10	0	3	0	0	0	0	10	0	0	0	3	0	0	4	0	0	0	0	0	0	2	77	8.8	
25-Sep	6.25	0	1	0	19	10	0	1	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	2	36	5.8	
26-Sep	5.00	0	0	0	3	2	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.6	
27-Sep	8.00	0	0	1	12	7	0	4	0	0	0	0	5	0	1	2	2	0	0	0	0	0	0	0	0	0	2	36	4.5	
28-Sep	9.00	2	6	0	24	5	0	0	0	0	0	0	7	0	0	3	4	0	0	2	1	1	1	1	0	0	3	60	6.7	
29-Sep	9.00	0	3	0	32	14	1	4	0	0	0	0	10	0	0	2	1	0	0	4	4	0	0	0	0	0	5	80	8.9	
30-Sep	9.00	0	2	6	44	6	0	4	0	0	0	0	12	0	0	0	5	0	0	3	0	0	0	2	0	0	10	94	10.4	
01-Oct	8.00	0	2	13	9	1	0	2	0	0	0	0	14	0	0	2	5	0	0	1	3	0	0	0	0	0	0	52	6.5	
02-Oct	7.75	0	2	9	28	8	0	10	0	0	0	0	17	0	0	7	8	0	0	2	2	0	1	1	0	1	15	111	14.3	

Appendix D. continued

DATE	OBS.		SPECIES ¹																								BIRDS			
	HOURS	TV	OS	NH	SS	CH	NG	SA	LA	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/HOUR	
03-Oct	9.25	0	2	2	21	5	0	4	0	0	0	0	11	0	2	4	8	1	0	0	0	0	0	0	0	0	0	8	68	7.4
04-Oct	8.00	0	0	1	17	3	0	3	0	0	0	0	17	0	0	6	5	0	0	0	1	0	0	0	0	0	0	6	59	7.4
05-Oct	7.75	0	1	3	10	7	0	3	0	0	0	0	17	0	2	3	5	0	0	1	1	2	1	0	0	0	5	61	7.9	
06-Oct	8.25	1	0	3	19	4	3	0	0	0	0	0	4	0	0	1	5	0	0	1	0	1	0	0	0	0	0	42	5.1	
07-Oct	8.00	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0.5	
08-Oct	7.50	0	2	1	20	1	1	2	0	0	0	0	5	0	0	0	3	0	0	0	1	0	0	0	0	0	0	36	4.8	
09-Oct	5.75	0	0	1	13	0	0	1	0	0	0	0	7	0	2	0	5	0	0	0	0	0	0	0	0	0	0	29	5.0	
10-Oct	0.00																													
11-Oct	7.75	0	0	1	7	2	0	0	0	0	0	0	3	0	1	2	5	0	0	0	0	0	0	0	0	0	5	26	3.4	
12-Oct	4.75	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	5	1.1	
13-Oct	7.75	0	0	1	19	0	1	0	0	0	0	0	5	0	2	2	6	0	0	0	0	0	0	0	0	0	3	39	5.0	
14-Oct	6.75	0	0	0	21	1	1	0	0	0	0	0	6	0	0	0	2	0	0	0	0	0	0	0	0	0	1	32	4.7	
15-Oct	8.00	0	0	1	10	0	0	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	1	17	2.1	
16-Oct	7.50	0	0	1	4	0	1	0	0	0	0	0	2	0	2	1	1	0	0	0	0	0	0	0	0	0	1	13	1.7	
17-Oct	8.00	0	0	1	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	6	0.8	
18-Oct	5.25	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2	
19-Oct	6.00	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.5	
20-Oct	7.00	0	1	0	0	1	0	0	0	0	0	0	4	0	0	0	3	0	0	0	0	0	0	0	0	0	1	10	1.4	
21-Oct	0.00																													
22-Oct	1.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	
Total	439.00	14	48	91	878	198	16	98	0	0	6	0	263	0	13	83	105	2	1	84	36	5	3	6	1	2	112	2065	4.7	

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

Appendix E. Annual observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 1997–2001.

	1997	1998	1999	2000	2001	1998–01 MEAN
Start Date	5-Sep	27-Aug	27-Aug	27-Aug	27-Aug	26-Aug
End Date	11-Oct	21-Oct	27-Oct	5-Nov	22-Oct	25-Oct
Observation days	29	53	61	67	55	59
Observation hours	204.60	382.92	504.33	505.75	439.00	458.00
Raptors / 100 hours	691.1	620.2	571.2	481.3	470.4	535.8
SPECIES	RAPTOR COUNTS					
Turkey Vulture	4	29	21	26	14	23
Osprey	41	24	47	71	48	48
Northern Harrier	115	152	167	104	91	129
Sharp-shinned Hawk	311	949	932	1050	878	952
Cooper's Hawk	150	247	232	198	198	219
Northern Goshawk	38	32	50	35	16	33
Unknown small accipiter ¹	0	0	0	0	98	
Unknown large accipiter ¹	0	0	0	0	0	
Unknown accipiter	182	221	248	98	0	
TOTAL ACCIPITERS	681	1449	1462	1381	1190	1371
Broad-winged Hawk	2	7	5	5	6	6
Swainson's Hawk	0	8	17	2	0	7
Red-tailed Hawk	145	182	450	364	263	315
Ferruginous Hawk	0	0	0	1	0	0
Rough-legged Hawk	1	13	44	53	13	31
Unidentified buteo	75	58	148	97	83	97
TOTAL BUTEOS	223	268	664	522	365	455
Golden Eagle	105	55	141	174	105	119
Bald Eagle	2	2	7	15	2	7
Unidentified eagle	7	0	7	5	1	3
TOTAL EAGLES	114	57	155	194	108	129
American Kestrel	24	107	89	40	84	80
Merlin	17	55	36	26	36	38
Prairie Falcon	2	10	7	5	5	7
Peregrine Falcon	5	2	9	1	3	4
Unknown small falcon ¹	0	0	0	0	6	
Unknown large falcon ¹	0	0	0	0	1	
Unknown falcon	10	6	6	2	2	4
TOTAL FALCONS	58	180	147	74	137	135
Unidentified Raptor	178	216	218	62	112	152
GRAND TOTAL	1414	2375	2881	2434	2065	2439

¹ Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2001.

DATE	STN.	SPECIES ¹											TOTAL	CAPTURES / STN HR
	HOURS	NH	SS	CH	NG	RT	RL	GE	AK	ML	PR	PG		
30-Aug	2.00	0	1	1	0	0	0	0	0	0	0	0	2	1.0
31-Aug	0.00													
01-Sep	0.00													
02-Sep	12.60	0	11	2	0	0	0	0	1	0	0	0	14	1.1
03-Sep	15.50	0	5	4	0	1	0	0	0	0	0	0	10	0.6
04-Sep	16.50	0	7	4	0	0	0	0	1	0	1	0	13	0.8
05-Sep	19.00	0	10	8	0	0	0	0	0	1	0	1	20	1.1
06-Sep	15.50	0	9	2	0	0	0	0	1	0	1	0	13	0.8
07-Sep	9.75	0	7	3	0	0	0	0	0	0	0	0	10	1.0
08-Sep	16.50	0	7	4	0	1	0	0	0	0	0	0	12	0.7
09-Sep	16.50	1	18	5	1	2	0	1	2	0	0	0	30	1.8
10-Sep	7.50	0	3	5	0	0	0	0	0	0	0	0	8	1.1
11-Sep	13.75	0	18	5	0	3	0	0	0	0	0	0	26	1.9
12-Sep	17.50	0	15	9	1	0	0	0	0	1	0	0	26	1.5
13-Sep	16.75	0	3	2	1	1	0	0	0	2	0	0	9	0.5
14-Sep	16.50	0	12	5	1	1	0	0	0	1	0	0	20	1.2
15-Sep	16.75	0	15	3	0	1	0	0	0	0	0	0	19	1.1
16-Sep	14.00	1	4	2	1	1	0	0	0	0	0	0	9	0.6
17-Sep	14.00	0	22	5	0	1	0	0	0	1	0	0	29	2.1
18-Sep	6.50	0	7	5	1	0	0	0	0	0	0	0	13	2.0
19-Sep	7.00	0	0	2	0	1	0	0	0	0	0	0	3	0.4
20-Sep	16.35	0	12	3	0	1	0	0	0	0	0	0	16	1.0
21-Sep	15.75	0	11	1	0	1	0	0	1	0	0	0	14	0.9
22-Sep	14.75	0	8	1	0	1	0	0	0	0	0	0	10	0.7
23-Sep	15.75	0	12	5	0	1	0	0	0	1	0	0	19	1.2
24-Sep	16.50	0	16	3	0	1	0	0	0	1	0	0	21	1.3
25-Sep	13.75	0	9	1	0	0	0	0	0	0	0	0	10	0.7
26-Sep	4.25	0	3	2	0	0	0	0	0	0	0	0	5	1.2
27-Sep	16.00	0	5	0	0	0	0	0	0	1	0	0	6	0.4
28-Sep	17.00	0	9	1	0	0	0	0	0	2	0	0	12	0.7
29-Sep	16.50	0	12	4	0	0	0	1	1	3	0	0	21	1.3
30-Sep	15.00	1	4	5	0	0	0	0	0	0	0	0	10	0.7
01-Oct	17.75	0	3	0	0	1	0	0	0	0	0	0	4	0.2
02-Oct	15.50	2	17	1	0	0	0	0	0	1	0	0	21	1.4
03-Oct	17.75	1	3	1	0	0	0	0	0	0	0	1	6	0.3
04-Oct	14.50	0	2	1	0	0	0	0	0	0	0	0	3	0.2
05-Oct	13.75	0	4	1	0	2	0	0	0	0	1	0	8	0.6
06-Oct	16.50	0	3	1	1	0	0	0	0	0	0	0	5	0.3
07-Oct	9.00	0	0	0	1	0	0	0	0	0	0	0	1	0.1
08-Oct	15.00	0	0	0	0	0	0	0	0	0	0	0	0	0
09-Oct	13.25	0	6	0	0	0	0	0	0	0	0	0	6	0.5
10-Oct	0.00													

Appendix F. continued

DATE	STN.	SPECIES ¹											CAPTURES	
	HOURS	NH	SS	CH	NG	RT	RL	GE	AK	ML	PR	PG	TOTAL	/ STN HR
11-Oct	13.25	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Oct	8.75	0	2	0	0	0	0	0	0	0	0	0	2	0.2
13-Oct	14.80	0	1	0	1	0	0	0	0	0	0	0	2	0.1
14-Oct	15.00	0	1	0	0	0	1	0	1	1	0	0	4	0.3
15-Oct	15.50	3	15	0	1	0	0	0	0	1	0	0	20	1.3
16-Oct	14.75	1	8	0	0	0	0	0	0	0	0	0	9	0.6
17-Oct	11.25	0	1	0	2	1	0	0	0	0	0	0	4	0.4
18-Oct	3.50	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	645.5	10	341	107	12	22	1	2	8	17	3	2	525	0.8

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

Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Chelan Ridge, WA: 1999–2001.

	1999 ¹	2000 ¹	2001	MEAN	TOTAL
First trapping day	28-Aug	2-Sep	30-Aug		
Last trapping day	16-Oct	14-Oct	18-Oct		
Number of stations	2	2	2	2	
Trapping days	47	42	47	45	
Station days	?	?	87	–	
Station hours	388	?	645.50	516.75	
Captures / stn. hour	5.7	?	8.1	6.9	
Northern Harrier	4	3	10	6	17
Sharp-shinned Hawk	139	125	341	202	605
Cooper's Hawk	42	46	107	65	195
Northern Goshawk	14	10	12	12	36
Red-tailed Hawk	11	8	22	14	41
Rough-legged Hawk	0	1	1	1	2
Golden Eagle	0	1	2	1	3
American Kestrel	3	0	8	4	11
Merlin	6	4	17	9	27
Prairie Falcon	1	1	3	2	5
Peregrine Falcon	0	0	2	1	2
All species	220	199	525	315	944
Recaptures ²	0	0	0	0	0
Foreign Recaptures ³	0	0	0	0	0
Foreign Encounters ⁴	0	1	5	2	6

¹ Data collected by the Falcon Research Group.

² Recaptures at Chelan Ridge of birds originally banded at Chelan Ridge.

³ Recaptures at Chelan Ridge of birds originally banded elsewhere.

⁴ Birds originally banded at Chelan Ridge and subsequently encountered elsewhere.