

**FALL 2004 RAPTOR MIGRATION STUDIES
AT CHELAN RIDGE, WASHINGTON**



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Salt Lake City, Utah**



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

March 2005

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March 2005

TABLE OF CONTENTS

List of Tables	iii
List of Figures	iii
Introduction.....	1
Study Site.....	1
Methods	2
Standardized Counts.....	2
Trapping and Banding.....	3
Results and Discussion	3
Weather	3
Observation Effort.....	4
Flight Summary and Trends	4
Resident Raptors	6
Trapping Effort.....	6
Trapping and Banding Results	6
Encounters with Previously Banded Birds.....	7
Satellite Telemetry	7
Identifying Migrant Origins through Stable Isotope Analyses	8
Visitor Participation and Public Outreach	8
Acknowledgements.....	9
Literature Cited.....	9
Tables.....	11
Figures	18
Appendix A. History of official observer participation in the Chelan Ridge Raptor Migration Project.....	26
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.....	27
Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Chelan Ridge Raptor Migration Project: 2004.....	28
Appendix D. Daily observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 2004.....	30
Appendix E. Annual observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 1997–2004.....	32
Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2004.	33
Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Chelan Ridge, WA: 1999–2004.	35

LIST OF TABLES

Table 1.	Fall counts and passage rates by species for migrating raptors at Chelan Ridge, WA: 1998–2003 versus 2004.	11
Table 2.	Fall counts by age class and immature : adult ratios for selected species of migrating raptors at Chelan Ridge, WA: 1998–2002 versus 2004.	12
Table 3.	First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Chelan Ridge, WA in 2004, with a comparison of 2004 and 1998–2003 average median passage dates.	13
Table 4.	Median passage dates by age for selected species of migrating raptors at Chelan Ridge, WA: 1998–2003 versus 2004.	14
Table 5.	Fall capture totals, rates, and successes by species for migrating raptors at Chelan Ridge, WA: 1999–2003 versus 2004.	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: 2001–2003 versus 2004.	16
Table 7.	Foreign encounters of raptors banded at the Chelan Ridge Raptor Migration Project: 2000–2004.	17

LIST OF FIGURES

Figure 1.	Location of the Chelan Ridge Raptor Migration Project count and banding sites in north-central Washington.	18
Figure 2.	Fall raptor migration flight composition by major species groups at Chelan Ridge, WA: 1998–2003 versus 2004.	19
Figure 3.	Fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Chelan Ridge, WA: 1998–2004.	20
Figure 4.	Fall-migration passage rates for Sharp-shinned Hawks, Cooper’s Hawks, and Northern Goshawks at Chelan Ridge, WA: 1998–2004.	21
Figure 5.	Fall-migration passage rates for Broad-winged, Swainson’s, Red-tailed, and Rough-legged Hawks at Chelan Ridge, WA: 1998–2004.	22
Figure 6.	Fall-migration passage rates for Golden and Bald Eagles at Chelan Ridge, WA: 1998–2004.	23
Figure 7.	Fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons at Chelan Ridge, WA: 1998–2004.	24
Figure 8.	Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998–2003 versus 2004.	25

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. In cooperation with HWI and OWNF, the Falcon Research Group (FRG) initiated a trapping and banding program at the site during 1999 and 2000. 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 ~1,500–2,900 migrants per season. The 2004 season marked the 7th consecutive, full-season count and the 6th consecutive season of banding at the site. This report summarizes the 2004 count and banding results.

The Chelan project was 1 of 14 long-term, annual migration counts and 1 of 6 migration-banding studies conducted or co-sponsored by HWI in North America during 2004. 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, Hoffman et al. 2002, Hoffman and Smith 2003). Raptors serve as important biological indicators of ecosystem health (Bildstein 2001) and long-term migration counts are one of the most cost effective and efficient methods for monitoring the regional status and trends of multiple raptor species (Zalles and Bildstein 2000).

The intensive counting and banding operations, along with related research activities such as satellite tracking of migrants, 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 (Hoffman et al. 2002). This information helps us understand the life histories, ecology, status, and conservation needs of raptor populations in North America. In addition, these migration studies offer unique opportunities for the public to learn about raptors and the natural environment, and providing such opportunities is another important component of 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 are later 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 used regularly since 2001.

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 staff and volunteers, conducted standardized daily counts of migrating raptors from a single traditional observation site. This was the second full season of migration counting for primary observer Dan Russell and first full season of counting for primary observer Aran Meyer, who attended preseason training (see Appendix A for a complete history of observer participation). Long-time project affiliate and former full-time Chelan observer Richard Hendrick ably assisted them on a regular basis. Other USFS and HWI staff and crewmembers, as well as visitors, also periodically assisted with the counts. Weather permitting, observations usually began between 0700 and 0800 hrs and ended between 1500 and 1600 hrs Pacific Standard Time (PST).

Data gathering and recording followed standardized protocols used at all HWI migration sites (Hoffman and Smith 2003). The observers routinely recorded the following data:

1. Species, age, sex, and color morph of each migrant raptor, whenever possible and applicable (Appendix B lists common and scientific names for all species, information about the applicability of age, sex, and color morph distinctions, and two-letter codes used to identify species in some tables and figures).
2. Hour of passage for each migrant; e.g., the 1000–1059 hrs PST.
3. Wind speed and direction, air temperature, percent cloud cover, predominant cloud type(s), presence or of precipitation, visibility, and an assessment of thermal-lift conditions, recorded for each hour of observation on the half hour.
4. Predominant direction, altitude, and distance from the lookout of the flight during each hour.
5. Total minutes observed and the mean number of observers present during each hour (included designated observers plus volunteers/visitors who actively contributed to the count [active scanning,

pointing out birds, recording data, etc.] for more than 10 minutes in a given hour), recorded on the hour.

6. A subjective visitor-disturbance rating for each hour, recorded on the hour.
7. Daily start and end times for each official observer.

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. 1990). 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 2004 season to means for previous seasons and examine trends in annual passage rates. In comparing 2004 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2004 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

Weather permitting the trappers operated the two traditional 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. Trappers lured migrating raptors into the capture stations from camouflaged blinds using live, non-native avian lures attached to lines manipulated from the blinds. Unless already banded, all captured birds were fitted with a uniquely numbered USGS Biological Resources Division aluminum leg band. Data gathering and recording followed standardized protocols used at all HWI migration-banding sites (Hoffman et al. 2002). All birds were released within 45 minutes of capture unless outfitted with a satellite transmitter, which takes longer.

RESULTS AND DISCUSSION

WEATHER

Until heavy snowfall shut down the project entirely on 24 October, four days earlier than hoped for, inclement weather severely hampered relatively few days of potential observations, with only two days entirely precluded and no other days reduced to ≤ 4 hours of observation. The 1998–2003 averages for the site are 3 days entirely precluded and 2 days reduced to ≤ 4 hours (see Appendix C for daily weather records). Otherwise, however, the proportion of active observation days where generally fair skies predominated (37%) was the lowest on record (1998–2003 average of 53%, range 42–61%) and the proportion of days where mostly cloudy to overcast skies predominated (37%) was the highest on record (1998–2003 average of 18%, range 13–30%). The proportion of active observation days during which some rain or snow was recorded also was substantially above average (25% vs. 11%). Unlike in 2002 and 2003 when the prevalence of visibility reducing fog and especially haze (mostly from wildfire smoke) was well above average, the proportion of such days in 2004 was still higher than pre-2002 but overall was below average (33 vs. 39%). Moreover, the average east and west visibility ratings were among the highest yet recorded (73 km E, 66 km W vs. 1998–2003 averages of 43 and 44 km)

In 2004, light winds (< 12 kph) prevailed on 66% of the active observation days, moderate winds on 32%, and strong winds (≥ 29 kph) on 2% of the days (1998–2003 averages: 71%, 27%, and 2%). In terms of wind directions, 2004 was highly atypical in that steady S-SW winds prevailed on 75% of the active observation days. Such winds are usually the most common, but on average prevail on only 41% of the active observation days. Southeasterly and northerly winds were under-represented in 2004.

The temperature during active observation periods averaged 15.3°C (the average of daily values, which in turn were averages of hourly readings), ranging from 3.1–26.0°C. The average is the highest yet recorded (1998–2003 average of 11.8°C) with the minimum and maximum also high. In 2004, only 25% of the active observation days received a median (of hourly ratings) thermal-lift rating of good to excellent, compared to the 1998–2003 average of 41% (range 16–69%).

In summary, although inclement weather deterred our 2004 observers less than average, the season featured much unsettled weather and heavy snow shut the operation down earlier than hoped for. Temperature readings extended a steady warming trend since 1999, but mostly cloudy to overcast skies and rainy/snowy weather were also more prevalent than usual. Smoke and haze were less of a problem than in 2002 and 2003, but were still more prevalent than pre-2002. Wind speeds followed a pattern that was similar to four of the previous six seasons; however, steady S-SW winds prevailed much more frequently than usual, whereas southeasterly and northerly winds were less common than usual. The observers rated thermal lift conditions poor to fair 75% of the time, which is high but similar to several previous years.

OBSERVATION EFFORT

Observations occurred on 59 of 65 possible days between 24 August and 27 October. The number of observation days was only 1% lower than the 1998–2003 average of $60 \pm 95\%$ CI of 4.0 days, whereas the number of observation hours (507.50) was a non-significant 18% higher than the 1998–2003 average of $472.09 \pm 95\%$ CI of 40.75 hours. The 2004 average of 1.8 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was a significant 10% lower than the 1998–2003 average of $2.0 \pm 95\%$ CI of 0.10 observers/hour.

FLIGHT SUMMARY AND TRENDS

The observers counted 1,452 raptors of 16 species during the 2004 season (Table 1, and see Appendix D for daily count records), which for the second year in a row is the lowest total count since full-season counts began in 1998 (see Appendix E for annual count summaries). The flight consisted of 51% accipiters, 22% buteos, 9% eagles, 8% falcons, 4% harriers, 2% Ospreys, 2% vultures, and 2% unknown or other raptors (Figure 2). The proportions of harriers and unknown/other were significantly below average, whereas the proportions of falcons, vultures, and eagles were significantly above average. The most common species seen in 2004 were the Sharp-shinned Hawk (32% of the total count), Red-tailed Hawk (19%), Cooper's Hawk (15%), and Golden Eagle (9%). All other species each comprised less than 5% of the total count.

For the second year in a row, the count of Northern Harriers fell to a new low (Appendix E). The count of two Broad-winged Hawks matched the previous low, which occurred during the limited 1997 season. No record high counts occurred in 2004. Passage rates (birds counted per 100 hours of observation) were above average in 2004 only for Northern Goshawks and Peregrine Falcons, whereas passage rates were significantly below average for four species: Osprey, Northern Harrier, Sharp-shinned Hawk, and Broad-winged Hawk (Table 1).

Seven years of full-season data is still too short a duration to attach much significance to documented trends; however, comparisons across species and with data from other longer-term monitoring projects in the West are nevertheless instructive. Northern Harriers (Figure 3), Sharp-shinned Hawks (Figure 4), and American Kestrels (Figure 7) have shown distinct downward trends since 1998 at Chelan Ridge. The same was true through 2003 for Cooper's Hawks, Northern Goshawks, Rough-legged Hawks, and Merlins; however, higher counts in 2004 moderated the indications of declining trends for these species (Figures 4, 5, and 7). Passage rates of Ospreys (Figure 3) and Red-tailed Hawks (Figure 5) also have generally declined since 1999, but with current counts similar to those recorded in 1998. Distinctly

lower counts for Broad-winged Hawks in 2003 and 2004 also suggest an overall declining pattern; however, the low 2003/2004 counts preceded the highest count yet recorded for this species in 2002 and the small total counts for this species make even small differences appear relatively large (Figure 5). The only species that have shown any indication of increasing trends since 1998 are the Golden Eagle and Peregrine Falcon; however, for the former the 1998 passage rate was low, but otherwise rates have stayed relatively stable since 1999 (Figure 6).

Across HWI's network of western migration-monitoring sites, declining patterns have been common since widespread and prolonged drought began plaguing much of the interior West in 1999 (Hoffman and Smith 2003). In particular, overall counts have been very low for the past three years in the heart of the drought-stricken Great Basin at HWI's monitoring site in the Goshute Mountains of northeastern Nevada (Smith 2005a), and the count in the Grand Canyon of Arizona farther south along the same flyway dropped to a new low in 2004 (Smith 2005b). Several species have shown declining trends since 1999 at Chelan Ridge as well, but substantially lower overall counts kicked in a year later compared to the Goshute Mountains. Whether or not these are related patterns is unclear at present. Like the central Great Basin, the eastern Cascades region where Chelan Ridge lies has been hit hard by regional drought. A relatively high proportion of the migrants that pass through Chelan Ridge probably originate in areas that lie northwest of the primary drought region, however, whereas the Goshute Mountains normally draw from a much greater expanse of naturally xeric Great Basin habitat. The direct impact of the drought may have hit most quickly populations in the already xeric northern Great Basin and therefore affected the Goshute counts sooner.

It is also possible that declining counts at Chelan Ridge and the Goshute Mountains reflect, at least in part, migration routes shifting in response to the drought. In this regard, it may be noteworthy that while counts have fallen to new lows at Chelan Ridge in the past two years, counts have risen to new highs during the same period in the northern Cascades of Oregon at HWI's Bonney Butte monitoring site (Smith 2005c). Two of the highest counts yet recorded at Golden Gate Raptor Observatory's site in the Marin Headlands of California also occurred in the past three years (ref?). As discussed more below, we have now recorded three instances of migrants being caught at both Chelan Ridge and Bonney Butte in the same season. Moreover, several of HWI's satellite tracked raptors have passed near both sites, so we know that the two sites are connected for many migrants that move within the Pacific Coast Flyway and generally winter in California. In this light, it seems incongruous that counts at the two sites should have followed such divergent patterns in the past three years.

One possible explanation is that many migrants originating in the northern Intermountain region and farther north that previously traveled through the Great Basin on their way south may have begun to avoid that route after several years of severe drought and shift their passage west down the Sierra-Cascade ranges. A logical diversion route for such migrants would be to use as navigation aids the Snake and then Columbia River corridors leading out of northern Idaho and northeastern Washington, eventually using Mt. Hood as a target point for accessing the Cascade-Sierra Nevada leading line, which coincidentally places the birds on a line that leads directly over Bonney Butte. This mechanism would divert Intermountain birds towards Bonney Butte before they reached Nevada but well south of Chelan Ridge, with possible spillover effects down into central California. Counts have also remained relatively strong during the past few years at Idaho Bird Observatory's site on Boise Ridge in west-central Idaho (G. Kaltenecker personal communication). Again, we know from several exchanges of banded birds and satellite tracking that the Boise Ridge and Goshute Mountains sites are normally a connected route for many migrants (Hoffman et al. 2002). Perhaps, however, the strong recent counts at Boise Ridge but weak counts at the Goshutes are another indication that birds are diverting west before crossing into the heart of the drought-stricken Great Basin.

Five of six species for which reasonable comparisons of immature : adult ratios were possible showed lower than average ratios in 2004, but the difference was significant only for Golden Eagles (Table 2).

The age ratio for Peregrine Falcons was significantly above average, but low overall counts preclude attaching much significance to this comparison. Though not a significant difference, the Northern Goshawk was the only other species for which an above average age ratio was indicated in 2004. For both goshawks and peregrines, counts of immature birds were above average, suggesting that high productivity in 2004 may have contributed to the high age ratios. Conversely, for all species that showed below average age ratios in 2004, lower than average counts of young birds contributed.

The combined-species median passage date of 24 September was a marginally significant two days later than the 1998–2003 average (Table 3). Similar to 2003, the seasonal distribution of activity in 2004 was atypical in showing a bimodal pattern, with proportionately higher than usual activity during 6–10 September and during the last 10 days of the month, but significantly below-average activity levels in between (Figure 8). The low mid-September activity levels corresponded to the first substantial multi-day rain and snow event from 16–19 September.

At the species level, American Kestrels and Merlins showed significantly later than average median passage dates, whereas all three buteos for which a comparison was possible (Swainson's, Red-tailed and Rough-legged Hawks) and Golden Eagles showed significantly earlier than average timing in 2004. Most other species showed median passage dates that were within two days of average. Age-specific data revealed two noteworthy clarifications, indicating significantly earlier than average median passage dates for immature Cooper's Hawks and both age classes of Sharp-shinned Hawks (Table 4).

RESIDENT RAPTORS

During the first few weeks of the season, up to three resident immature Sharp-shinned Hawks and at least one immature Cooper's Hawk were regularly seen around the project site. Sightings of apparently local immature Northern Goshawks increased through the season, suggesting that some birds may have moved into the local area from other locales. A family of light-morph Red-tailed Hawks, including two immature birds and a pair of adults, also were resident in the area, with the young birds gone by early October but at least one adult still present when the project shut down in late October. A territorial pair of Golden Eagles was seen regularly, with their activity concentrated several drainages to the SW of the observation point. Two family groups of American Kestrels frequented the area through mid-September, with the focus of activity for one family near the south trapping blind and the other near the count site. It also appeared that several Merlins hung out and hunted the area for several days at a time before moving on.

This is a fairly typical resident assemblage for the site, except that local Turkey Vultures, Northern Harriers, Prairie Falcons, and immature Peregrine Falcons have frequented the area in past years. A couple of early-season attacks on the banding stations by an immature Peregrine Falcon may have reflected the presence of a local bird in 2004, but the bird was not seen regularly thereafter, so its status remained uncertain.

TRAPPING EFFORT

Trapping occurred on 53 of 55 days between 25 August and 18 October, with effort totaling 699.56 station hours (see Appendix F for daily trapping records). The number of trapping days was comparable to the past two years, whereas the number of station hours was roughly 15% less than in 2002 and 2003, but higher than in 2001 (see Appendix G for annual trapping summaries).

TRAPPING AND BANDING RESULTS

The 2004 capture total of 352 newly banded birds of 11 species was the lowest total since HWI took over the banding program in 2001, 40% lower than the 2001–2003 average, but only 20% below the overall 1999–2003 average for the site (Table 5, Appendix G). Based on 1999–2003 averages, capture totals

were below average for all species except Northern Goshawks and Golden Eagles, but were significantly below average only for Prairie Falcons and Rough-legged Hawks. The capture total for Northern Goshawks reached a new record high of 16 birds. The 2004 effort raised the total number of diurnal raptors captured at the site to 2,563 (Appendix G). The species captured most frequently in 2004 were the Sharp-shinned Hawk (67% of captures), Cooper's Hawk (17%), Northern Goshawk (5%), Red-tailed Hawk (5%), and Merlin (3%). All other species each comprised <2% of the total (Table 5).

Capture rates (birds captured per 100 station hours) were significantly below average for all but three species (Northern Goshawk, Golden Eagles, and Peregrine Falcons); however, capture success—a better measure of the efficiency of our trappers—was significantly below average only for Rough-legged Hawks (typically we catch at least one each season) and at least slightly above average for four species (Table 5). Overall capture success also was slightly above average (Table 5). These statistics clearly indicate that the low overall capture totals and rates were due to a combination of low flight volume and a reduced crew, rather than poor trapping efficiency.

Compared to the counts, banding at this site yields unique and substantial sex–age specific data only for the three accipiters and American Kestrels (Table 2). For Sharp-shinned and Cooper's Hawks, both the count and banding data indicated significantly below average immature : adult ratios (33 and 46% below average for sharp-shins and 49 and 51% below average for Cooper's Hawks). In contrast, for Northern Goshawks the count indicated a 27% above average age ratio, whereas the banding data indicated a 38% below average ratio; however, capture totals were above average for both immature and adult goshawks in 2004 and the difference in capture age ratios reflected addition of a single additional adult in 2004. The banding data also indicated a 49% below average age ratio for American Kestrels. For all four species, the banding data indicated above average female : male ratios (26–47%; Table 2). In contrast, the count data indicated a 5% below average sex ratio for kestrels, suggesting that female kestrels may have been more susceptible than usual to capture in 2004; however, the capture total for kestrels was too low in 2004 to attach much significance to these statistics.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Since banding began at Chelan Ridge in 1999, 10 foreign encounters with Chelan-banded birds have been recorded (Table 7). One new encounter occurred in 2004, involving a bird banded at Chelan and recaptured exactly one month later at HWI's migration study at Bonney Butte in the north Cascades of Oregon near Mt. Hood. This is the third exchange of banded birds between the two sites. Two involved immature Sharp-shinned Hawks, with both recaptures occurring during the initial banding season. The first bird took only 8 days to travel between the two sites, however, whereas the new bird took a month. The third exchange involved an immature Red-tailed Hawk. This bird also was caught at both sites during the same season, but was banded at Bonney Butte and recaptured 13 days later at Chelan Ridge.

SATELLITE TELEMETRY

For the fourth consecutive season, the Chelan Ridge crew outfitted at least one raptor with a satellite transmitter, which enables tracking of bird movements over large distances and long periods. During 2004, the crew outfitted a hatch-year male Golden Eagle. After being outfitted, this eagle took three days to travel to south-central Washington, then veered southwest and took two more days to reach Mt. Hood in the Cascade Mountains of northern Oregon. It then continued south, passing very near HWI's Bonney Butte migration project site, and took another four days to reach northeastern California, where it settled not far from the Mt. Shasta area. By late November, however, sensor data indicated that the transmitter was no longer on a live bird. Unfortunately, the signals ceased all together shortly thereafter, so we will not be able to go after the unit to confirm the bird's fate. The abrupt cessation of the signals after sensor data indicated the unit was down suggests that the transmitter may have been damaged or removed to a non-transmitting location by a scavenger.

We obtained quite a bit more data from the Golden Eagle we outfitted at the site in 2003; however, this bird also has since perished or perhaps shed its transmitter. This eagle initially traveled several thousand kilometers to the southwest to winter in southeastern New Mexico. It then returned to the northwest in the spring, following a roughly similar path back but one that took it farther west than in the fall into central Oregon and then up through western Washington. The bird appeared to settle by late June just east of Prince Rupert, British Columbia, but by late July sensor data indicated the transmitter was no longer on a live bird. After that, signal quality declined rapidly, precluding an efficient recovery attempt before winter, but the unit now seems to be transmitting effectively again, so we may be able to finally go after this unit sometime this spring or summer in hopes of confirming the bird's fate.

The only other bird outfitted at Chelan Ridge that was still transmitting at the time of our last annual report was an adult female Red-tailed Hawk outfitted during fall 2003. This bird ended up wintering two years in a row near Healdsburg just inland from the coast of northern California. It summered during 2004 in north-central Washington just north of the Chelan Ridge project site, and followed very similar pathways to and from these two locations during the three migration seasons across which we tracked it. Sensor data indicated the bird was alive and well on its California winter range when the transmitter battery failed, a little earlier than hoped for but within the expected range of variation in battery life.

Complete tracking summaries and maps for all of HWI's satellite-tracked raptors can be viewed at www.hawkwatch.org.

IDENTIFYING MIGRANT ORIGINS THROUGH STABLE ISOTOPE ANALYSES

In 2004, HWI continued to collect feather samples from a variety of species to support our on-going stable-isotope research, which seeks to use analyses of hydrogen stable-isotope ratios to identify the approximate natal origins of migrants monitored at migration sites across the West (e.g., Meehan et al. 2001). HWI scientists currently have in a review at a respected ornithological journal a manuscript detailing a new GIS-based approach for mapping the origins of raptors based on this technique, and we hope to begin producing several other relevant publications in the next several months.

VISITOR PARTICIPATION AND PUBLIC OUTREACH

The 2004 visitor logs recorded 180 individuals, mostly from surrounding Washington communities as far away as Seattle. The tally included 33 students representing three local-area school groups; unfortunately, inclement weather caused two other school groups to cancel their planned visits. Roughly 75% of the visitors had visited the site in previous years, and roughly 10% returned for more than one visit in 2004. The total visitation rate was similar to 2003.

The project was featured in news articles in the local Audubon Society Newsletter, a Methow Valley newsletter called *The Naturalist*, and in the Wenatchee World newspaper from Wenatchee, Washington. As always, information about the project was also prominently displayed in the nearby U.S. Forest Service Visitor Center in Winthrop.

In 2004, 513 hourly assessments by the observers of visitor disturbance resulted in the following ratings: 97% none, 3% low, 1% moderate, and 0% 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 of documenting the migration.

ACKNOWLEDGEMENTS

Financial and logistical support for this project in 2004 was provided by Okanogan and Wenatchee National Forests, the National Fish and Wildlife Foundation, the M. J. Murdock Charitable Trust, the Mountaineers Foundation, the Walbridge Fund, and HWI private donors and members.

Numerous individuals were essential in helping us achieve successful promotion and implementation of this season's effort. We thank Bob Davies for assistance setting up the banding operation. Local intern Tannis Thorlakson continued to provide significant assistance with on-site education. Long-time local project affiliate and former full-time observer Richard Hendrick continued to provide invaluable assistance with the count and with general site management. USFS employees Pat Tourangeau, Tia Buzzard, and Tommy Days provided helpful assistance handling daily radio reports, answering visitor questions, and managing the tally board at the Winthrop Visitor Center. Rena Rex from the USFS Chelan District provided valuable assistance in connecting the project to that District and helping Chelan District seasonal employees learn about and participate in the science of migrating raptors. We are also very grateful for the continued support of Methow Valley District Ranger John Newcom, Supervisory Wildlife Biologist John Rohrer, and Forest Wildlife Biologists Bill Gaines and Bob Naney for their continued interest in and strong support of the project. Lastly, special thanks to Brad Martin for once again ensuring our supply of lure pigeons.

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Table 1. Fall counts and passage rates by species for migrating raptors at Chelan Ridge, WA: 1998–2003 versus 2004.

SPECIES	COUNTS			RAPTORS/100 HOURS		
	1998–2003 ¹	2004	% Change	1998–2003 ¹	2004	% Change
Turkey Vulture	28 ± 8.6	25	-10	5.9 ± 1.82	4.9	-16
Osprey	46 ± 13.7	34	-27	9.7 ± 2.50	6.7	-31
Northern Harrier	122 ± 31.9	59	-51	26.2 ± 7.84	11.6	-56
White-tailed Kite	0 ± 0.3	0	-100	0.0 ± 0.06	0.0	-100
Sharp-shinned Hawk	861 ± 178.3	468	-46	185.6 ± 44.10	92.2	-50
Cooper's Hawk	208 ± 32.3	220	+6	44.8 ± 9.85	43.3	-3
Northern Goshawk	29 ± 10.4	41	+43	6.1 ± 2.16	8.1	+32
Unknown small accipiter ²	74 ± 34.4	1	-99	15.8 ± 8.31	0.2	-99
Unknown large accipiter ²	9 ± 9.7	6	-33	1.8 ± 1.90	1.2	-34
Unknown accipiter	109 ± 82.2	10	-91	23.9 ± 19.11	2.0	-92
Broad-winged Hawk	6 ± 1.6	2	-66	1.3 ± 0.40	0.4	-69
Swainson's Hawk	8 ± 5.4	5	-39	1.7 ± 1.08	1.0	-42
Red-tailed Hawk	318 ± 79.0	277	-13	66.5 ± 12.98	54.6	-18
Ferruginous Hawk	0 ± 0.3	0	-100	0.0 ± 0.06	0.0	-100
Rough-legged Hawk	30 ± 15.1	20	-34	6.2 ± 2.86	3.9	-37
Unidentified buteo	85 ± 29.9	15	-82	17.8 ± 5.63	3.0	-83
Golden Eagle	125 ± 32.7	130	+4	26.0 ± 5.31	25.6	-1
Bald Eagle	6 ± 4.3	2	-66	1.2 ± 0.83	0.4	-67
Unidentified eagle	4 ± 3.8	0	-100	0.8 ± 0.75	0.0	-100
American Kestrel	70 ± 23.2	48	-32	15.5 ± 6.34	9.5	-39
Merlin	35 ± 9.4	39	+10	7.8 ± 2.87	7.7	-1
Prairie Falcon	9 ± 4.3	5	-42	1.8 ± 0.87	1.0	-47
Peregrine Falcon	6 ± 4.1	7	+11	1.3 ± 0.79	1.4	+7
Unknown small falcon ²	5 ± 1.3	5	-6	1.1 ± 0.32	1.0	-12
Unknown large falcon ²	1.7 ± 0.7	2	+20	0.3 ± 0.11	0.4	+15
Unknown falcon	2.7 ± 2.2	4	+50	0.6 ± 0.51	0.8	+31
Unidentified raptor	153 ± 49.5	27	-82	33.3 ± 12.36	5.3	-84
GRAND TOTAL	2306 ± 376.2	1452	-37	493.8 ± 89.22	286.1	-42

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: 1998–2002 versus 2004.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1998–2003 AVERAGE			2004			% UNKNOWN AGE		RATIO	
	TOTAL	IMM	ADULT	TOTAL	IMM	ADULT	1998–2003 ¹	2004	1998–2003 ¹	2004
Northern Harrier	122	44	31	59	15	12	38 ± 7.2	54	1.5 ± 0.48	1.3
Sharp-shinned Hawk	861	431	132	468	251	92	35 ± 10.2	27	3.9 ± 2.21	2.7
Cooper's Hawk	208	94	26	220	92	42	44 ± 11.7	39	4.1 ± 2.21	2.2
Northern Goshawk	29	13	5	41	26	4	40 ± 12.5	27	5.2 ± 3.96	6.5
Broad-winged Hawk	6	2	1	2	2	0	45 ± 21.0	0	1.5 ± 1.00	(2)
Red-tailed Hawk	318	78	145	277	59	112	29 ± 5.8	38	0.6 ± 0.17	0.5
Golden Eagle	125	64	27	130	59	37	27 ± 5.5	26	2.4 ± 0.41	1.6
Bald Eagle	6	1	5	2	0	1	2 ± 4.1	50	0.3 ± 0.32	1.0
Peregrine Falcon	6	1	2	7	3	1	56 ± 25.8	43	0.5 ± 0.57	3.0

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

Table 3. First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Chelan Ridge, WA in 2004, with a comparison of 2004 and 1998–2003 average median passage dates.

SPECIES	2004				1998–2003
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	5-Sep	3-Oct	6-Sep – 27-Sep	21-Sep	16-Sep ± 5.0
Osprey	23-Aug	7-Oct	4-Sep – 29-Sep	20-Sep	20-Sep ± 1.3
Northern Harrier	30-Aug	20-Oct	5-Sep – 3-Oct	24-Sep	23-Sep ± 2.3
Sharp-shinned Hawk	23-Aug	23-Oct	6-Sep – 7-Oct	21-Sep	21-Sep ± 3.0
Cooper's Hawk	27-Aug	14-Oct	4-Sep – 30-Sep	20-Sep	18-Sep ± 2.9
Northern Goshawk	28-Aug	23-Oct	7-Sep – 16-Oct	27-Sep	23-Sep ± 6.5
Broad-winged Hawk	20-Sep	20-Sep	–	–	14-Sep ± 1.8
Swainson's Hawk	31-Aug	20-Sep	31-Aug – 20-Sep	6-Sep	16-Sep ± 6.7
Red-tailed Hawk	27-Aug	23-Oct	6-Sep – 12-Oct	21-Sep	24-Sep ± 2.6
Rough-legged Hawk	26-Sep	23-Oct	30-Sep – 23-Oct	8-Oct	16-Oct ± 4.6
Golden Eagle	27-Aug	23-Oct	19-Sep – 12-Oct	1-Oct	04-Oct ± 2.6
Bald Eagle	7-Oct	23-Oct	–	–	15-Oct ± 7.4
American Kestrel	28-Aug	12-Oct	30-Aug – 2-Oct	23-Sep	12-Sep ± 5.1
Merlin	31-Aug	23-Oct	7-Sep – 16-Oct	29-Sep	20-Sep ± 2.9
Prairie Falcon	30-Aug	8-Oct	30-Aug – 8-Oct	11-Sep	20-Sep ± 9.8
Peregrine Falcon	27-Aug	7-Oct	27-Aug – 7-Oct	20-Sep	19-Sep ± 15.2
Total	27-Aug	23-Oct	6-Sep – 7-Oct	24-Sep	22-Sep ± 1.7

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

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

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

Table 4. Median passage dates by age for selected species of migrating raptors at Chelan Ridge, WA: 1998–2003 versus 2004.

SPECIES	ADULT		IMMATURE	
	1998–2003 ¹	2004	1998–2003 ¹	2004
Northern Harrier	22-Sep ± 4.4	23-Sep	23-Sep ± 3.3	24-Sep
Sharp-shinned Hawk	03-Oct ± 1.7	29-Sep	15-Sep ± 2.3	12-Sep
Cooper’s Hawk	25-Sep ± 2.8	24-Sep	13-Sep ± 1.9	10-Sep
Northern Goshawk	09-Oct ± 10.8	0-Jan	22-Sep ± 5.4	25-Sep
Red-tailed Hawk	27-Sep ± 2.2	24-Sep	18-Sep ± 4.3	7-Sep
Golden Eagle	06-Oct ± 4.0	5-Oct	02-Oct ± 1.7	30-Sep

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: 1999–2003 versus 2004.

	CAPTURE TOTALS		CAPTURE RATE ¹		CAPTURE SUCCESS ²	
	1999–2003 ³	2004	1999–2003 ³	2004	1999–2003 ³	2004
Northern Harrier	8 ± 3.9	6	1.4 ± 0.26	0.9	8.3 ± 5.2	10.2
Sharp-shinned Hawk	292 ± 132.9	237	48.8 ± 8.97	33.9	37.1 ± 25.6	49.9
Cooper's Hawk	84 ± 33.5	58	14.0 ± 2.88	8.3	38.4 ± 16.6	25.4
Northern Goshawk	12 ± 1.8	16	2.1 ± 1.07	2.3	44.8 ± 18.6	37.2
Red-tailed Hawk	18 ± 7.5	16	3.1 ± 0.51	2.3	4.6 ± 2.2	5.5
Rough-legged Hawk	1.0 ± 0.62	0	0.1 ± 0.10	0.0	3.5 ± 2.4	0.0
Golden Eagle	1 ± 1.5	2	0.2 ± 0.24	0.3	1.0 ± 1.0	1.5
American Kestrel	7.6 ± 5.77	5	1.3 ± 0.55	0.7	14.4 ± 16.1	9.4
Merlin	15 ± 8.1	10	2.5 ± 0.66	1.4	47.3 ± 33.6	23.3
Prairie Falcon	3 ± 1.3	1	0.4 ± 0.11	0.1	32.3 ± 17.3	16.7
Peregrine Falcon	1.2 ± 1.6	1	0.2 ± 0.24	0.1	18.7 ± 25.6	12.5
All species	442 ± 192.3	352	74.2 ± 12.46	50.3	23.9 ± 13.5	25.8

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 in 1999 and 2000.

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: 2001–2003 versus 2004.

SPECIES	YEARS	FEMALE		MALE		FEMALE :	IMMATURE :
		HY	AHY	HY	AHY	MALE	ADULT
						RATIO	RATIO
Sharp-shinned Hawk	Avg. 2001–2003	180	47	168	32	1.1 ± 0.18	4.4 ± 0.00
	2004	93	47	74	23	1.4	2.4
Cooper's Hawk	Avg. 2001–2003	48	21	36	9	1.6 ± 0.42	2.8 ± 0.39
	2004	23	17	11	7	2.2	1.4
Northern Goshawk	Avg. 2001–2003	2	1	9	0	0.3 ± 0.31	10.5 ± 4.93
	2004	5	0	8	2	0.5	6.5
American Kestrel	Avg. 2001–2003	1	2	9	1	0.3 ± 0.02	5.9 ± 8.08
	2004	1	0	2	1	0.3	3.0

¹ Mean ± 95% CI.

Table 7. Foreign encounters of raptors banded at the Chelan Ridge Raptor Migration Project: 2000–2004.

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
1177 – 06406	RT	U	05-Oct-01	ASY	Clinton, BC	21-Oct-02	ATY	312	found dead
1573 – 60662	SS	F	21-Sep-02	HY	Stinson Beach, CA	24-Nov-02	HY	956	found dead
1593 – 02189	SS	F	26-Sep-01	HY	Nampa, ID	06-Dec-03	TY	574	found dead
1483 – 55870	SS	F	13-Sep-04	HY	Bonney Butte, OR	13-Oct-04	HY	288	research recapture

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

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



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

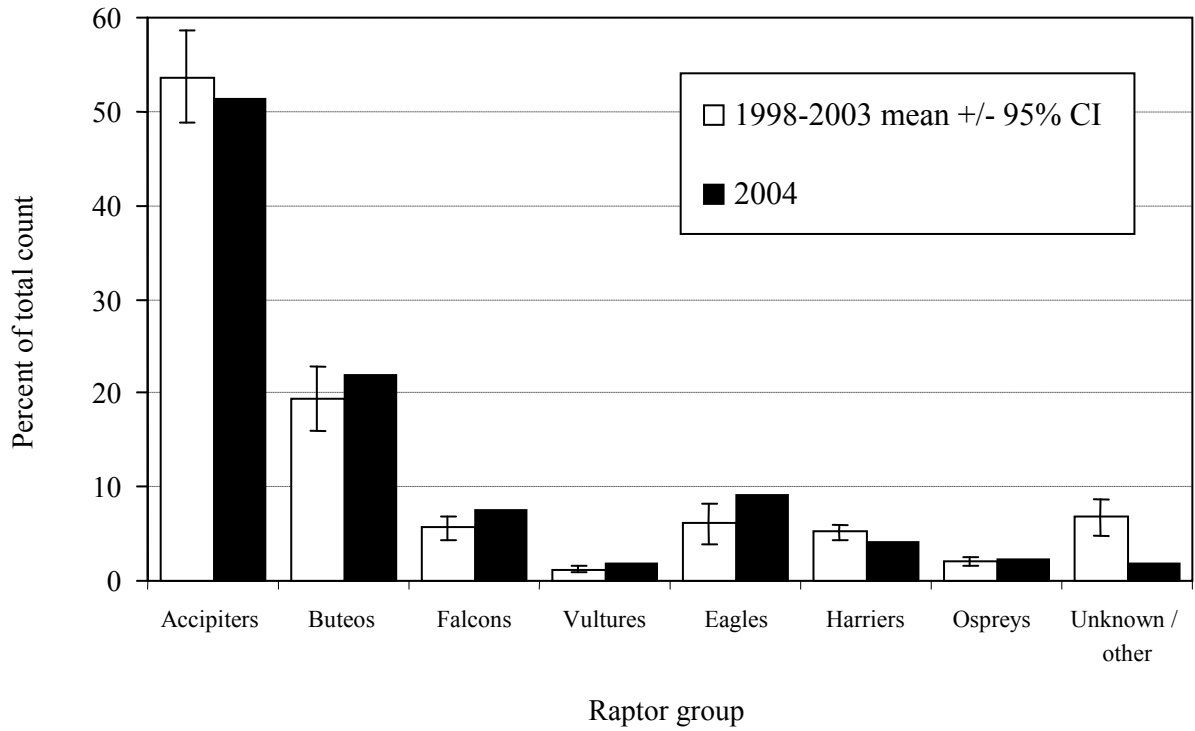


Figure 2. Fall raptor migration flight composition by major species groups at Chelan Ridge, WA: 1998-2003 versus 2004.

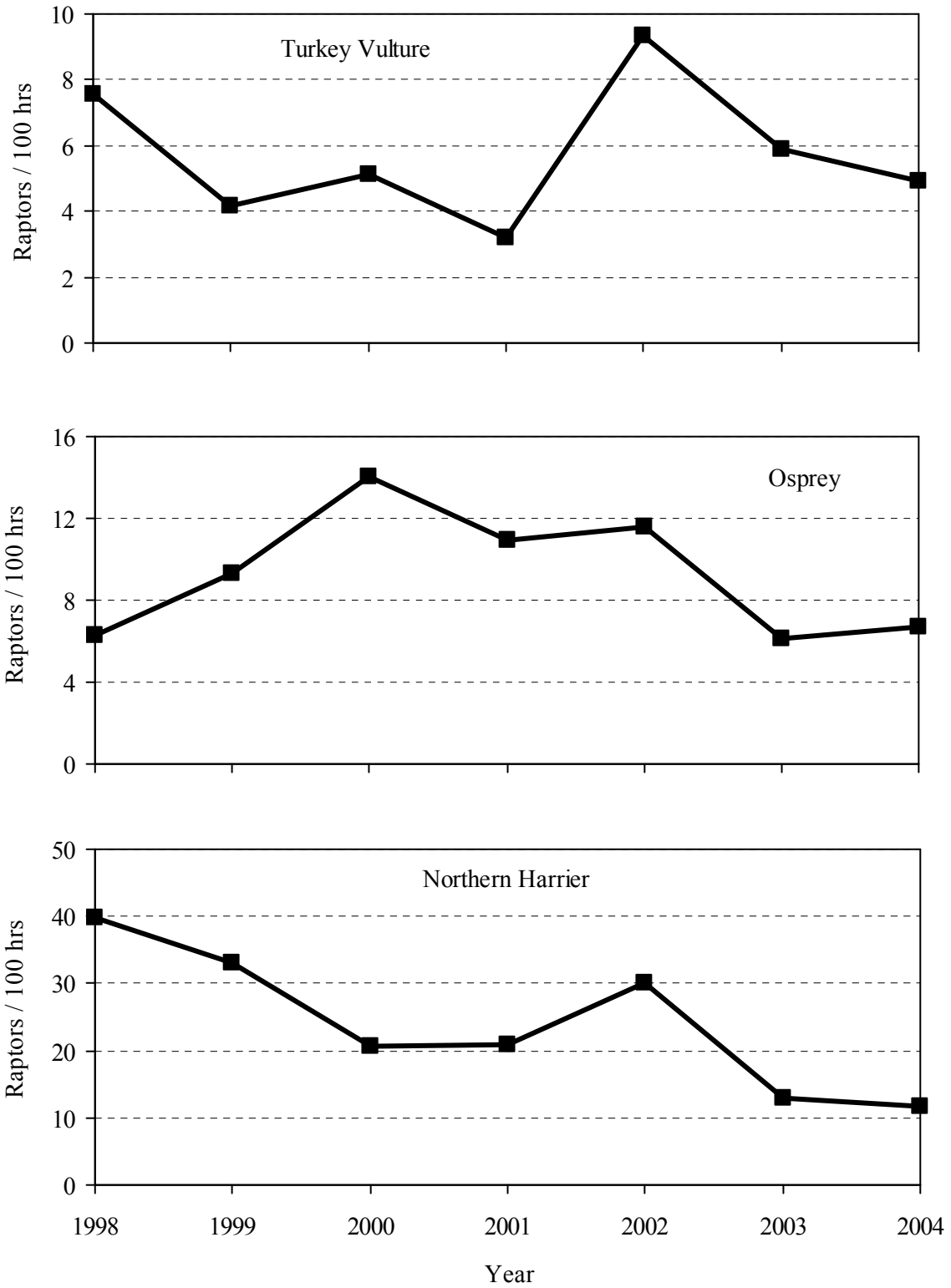


Figure 3. Fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Chelan Ridge, WA: 1998–2004.

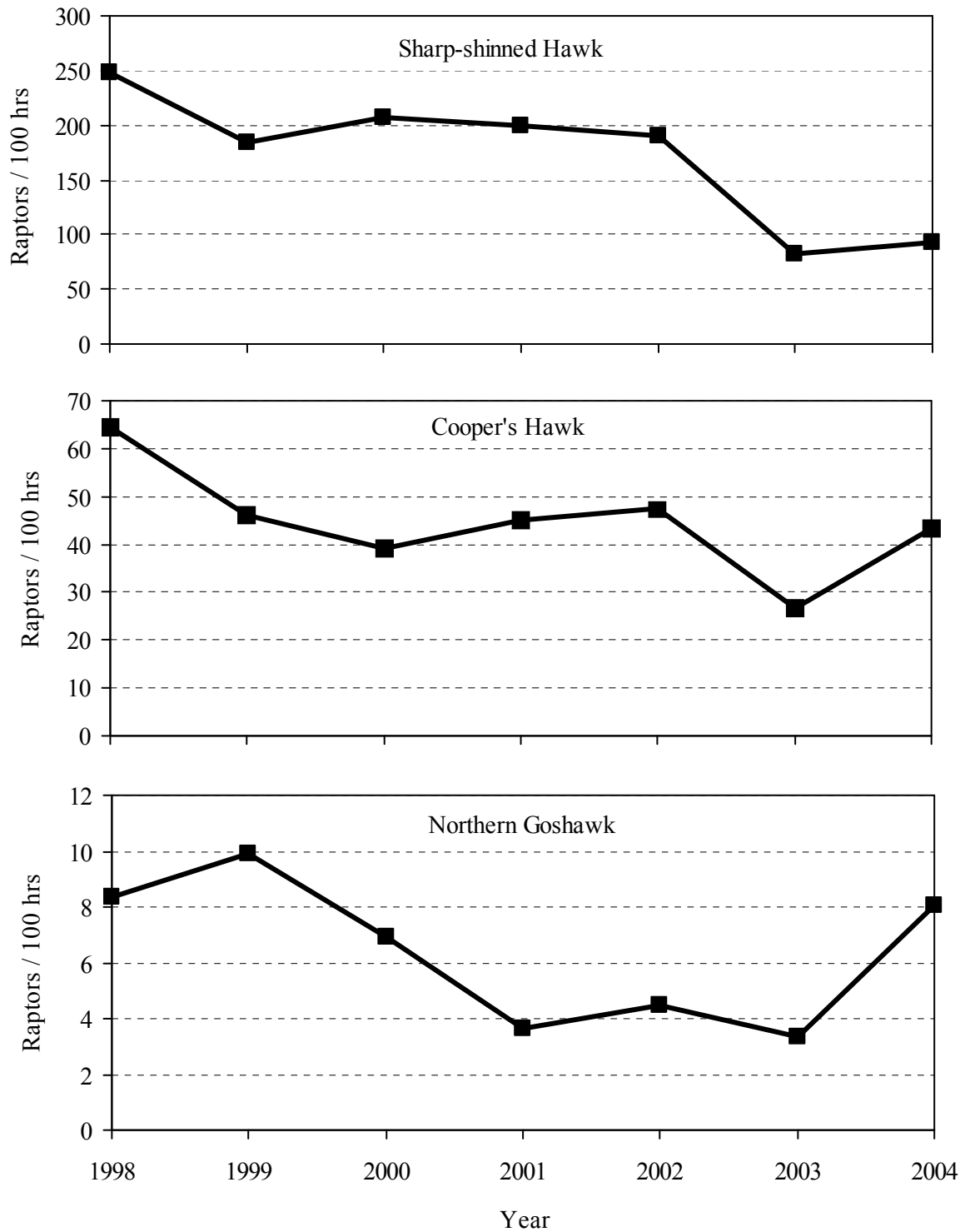


Figure 4. Fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks at Chelan Ridge, WA: 1998–2004.

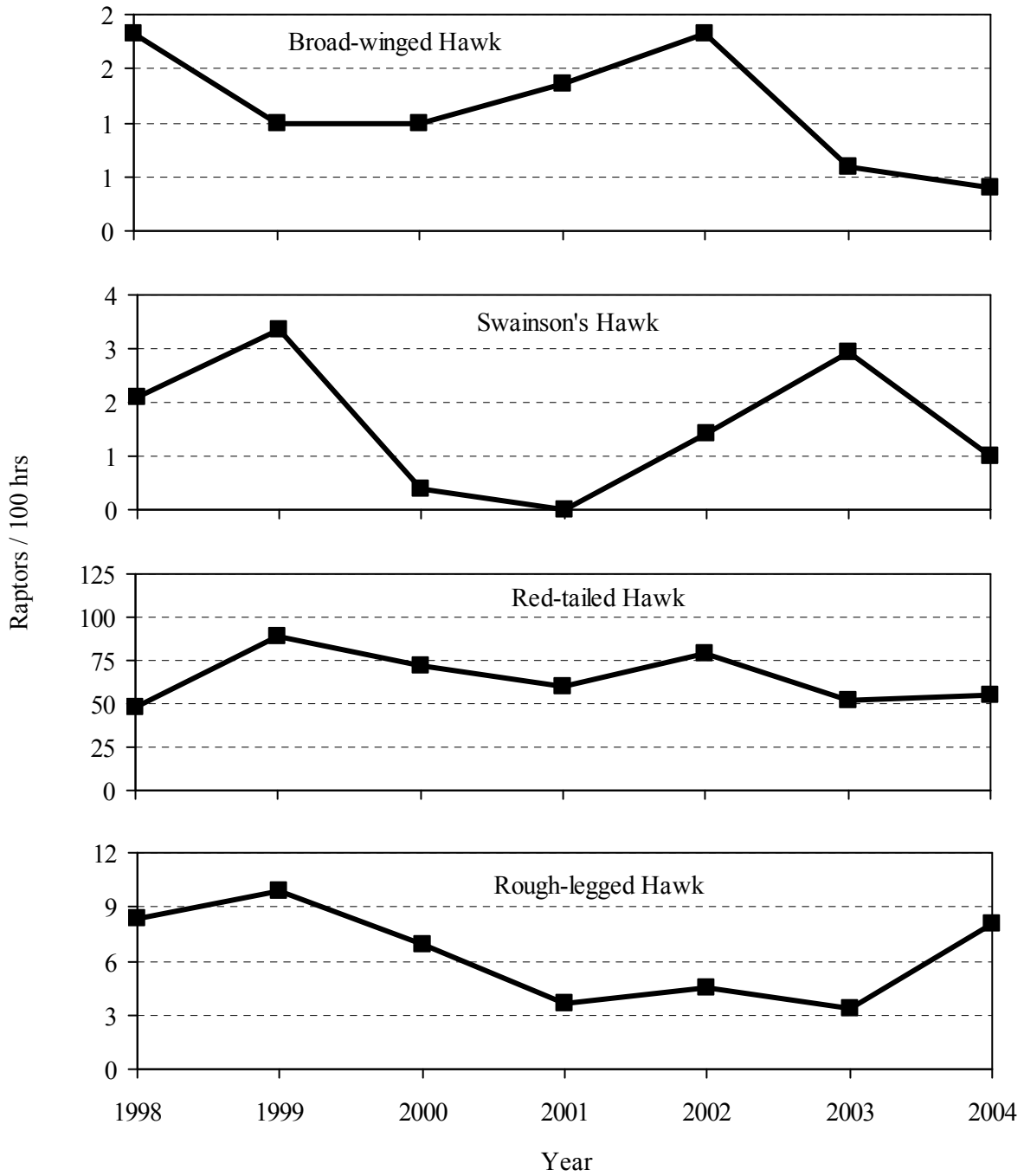


Figure 5. Fall-migration passage rates for Broad-winged, Swainson's, Red-tailed, and Rough-legged Hawks at Chelan Ridge, WA: 1998–2004.

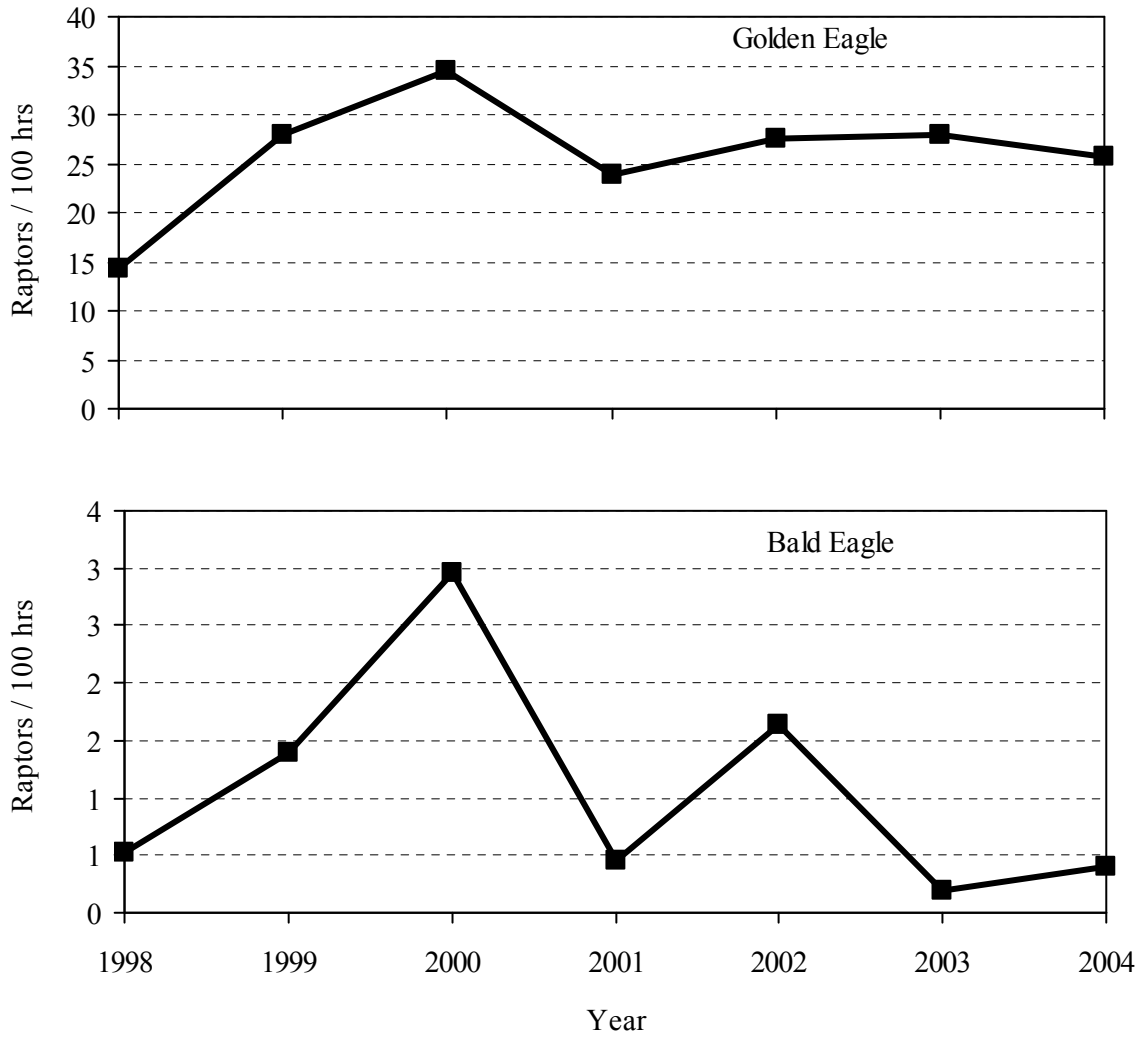


Figure 6. Fall-migration passage rates for Golden and Bald Eagles at Chelan Ridge, WA: 1998–2004.

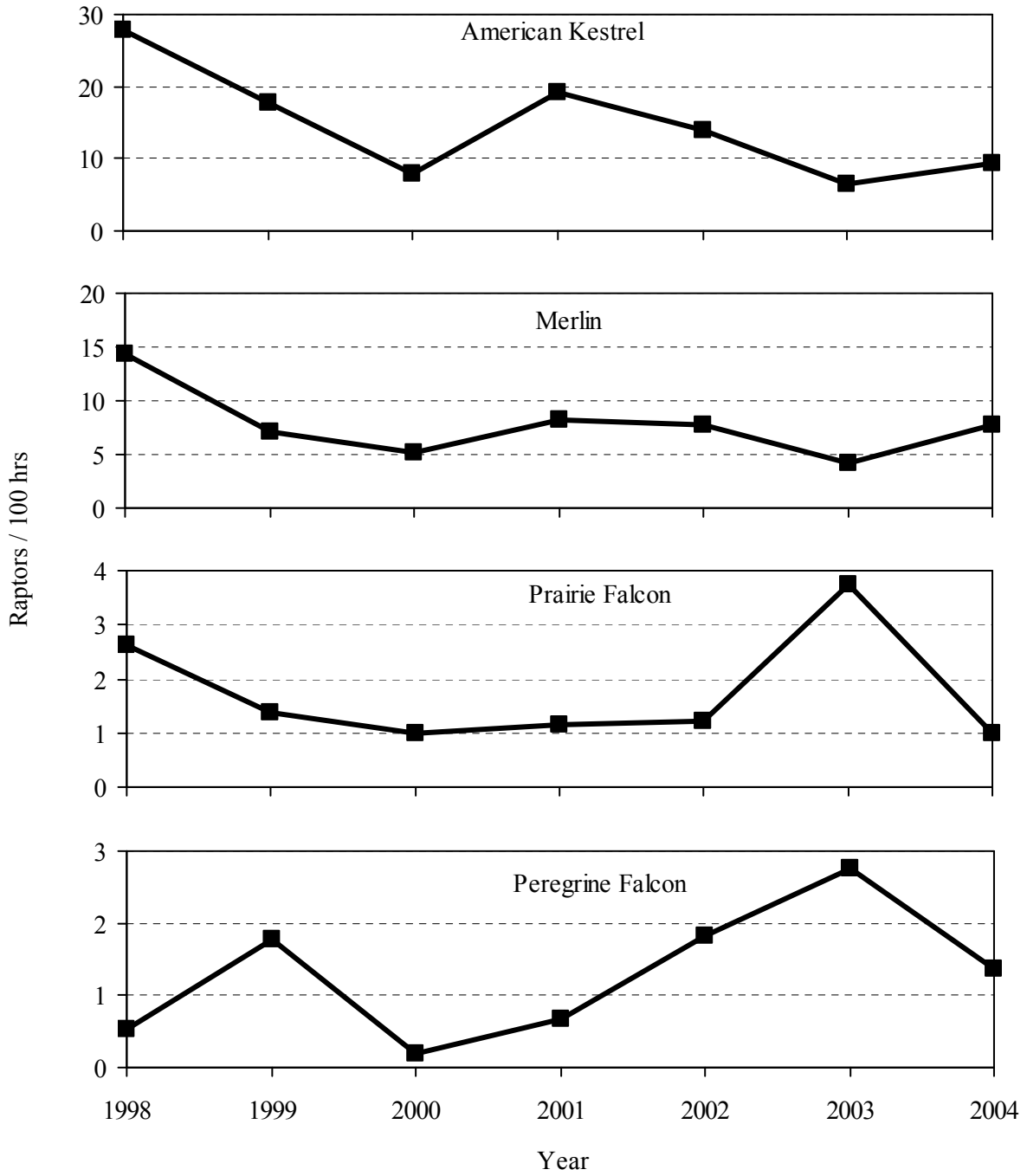


Figure 7. Fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons at Chelan Ridge, WA: 1998–2004.

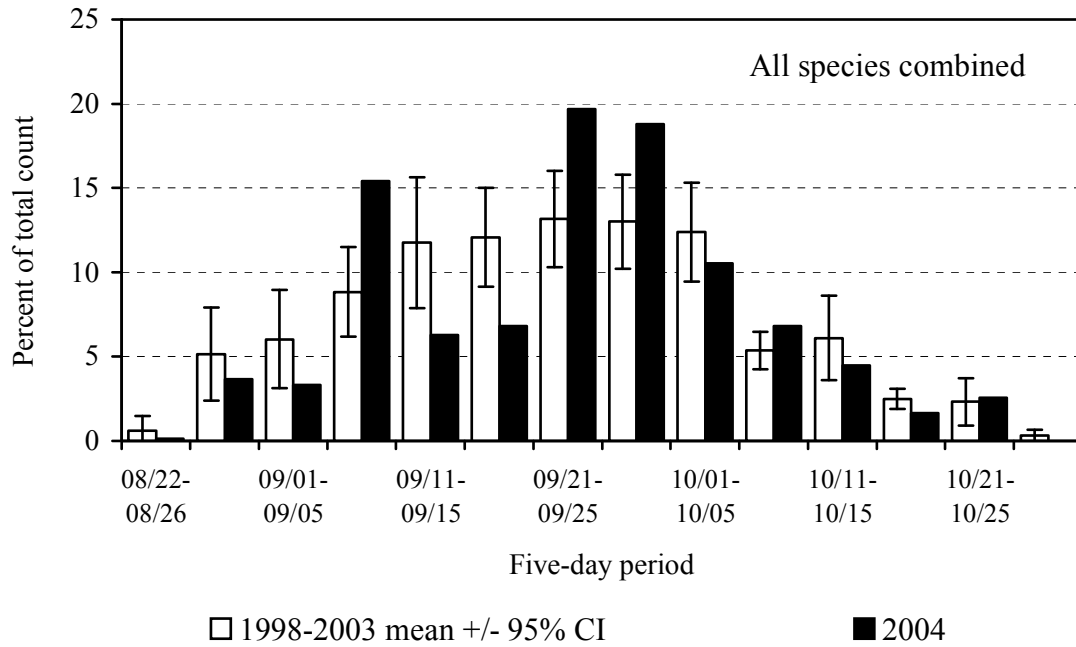


Figure 8. Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998–2003 versus 2004.

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).

2002: Two observers throughout: Mark Leavens (0), Teresa Lorenz (0), Dan Harrington (3+; training and substitute observer), Richard Hendrick (4+; regular substitute).

2003: Two observers throughout: Ben Kinkade (~1/2), Blake Mathys (0), Dan Harrington (3+; training and substitute observer), Richard Hendrick (4+; regular substitute).

2004: Two observers throughout: Dan Russell (1), Aran Meyer (0), Richard Hendrick (4+; regular substitute).

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
White-tailed Kite	<i>Elanus leucurus</i>	WK	A, I, U	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: 2004.

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
24-Aug	4.50	2.0	0	ovc, fog/rain	15.3	ssw	12.2	29.69	4	10	11	-	0.0
25-Aug	9.00	2.0	0	mc-ovc, AM fog, scat rain	12.7	ssw	15.3	29.66	4	51	27	-	0.0
26-Aug	9.00	2.0	0	pc-mc, PM rain	9.4	ssw	16.3	30.04	3	57	47	1	0.1
27-Aug	9.00	2.0	0	pc-ovc	8.7	ssw	18.9	30.21	3	62	48	3	1.3
28-Aug	8.50	2.8	0	pc-mc	13.0	ssw	19.1	30.14	3	71	57	2	1.8
29-Aug	9.00	2.2	0	clr	13.0	ssw	19.6	30.09	2	93	80	2	1.0
30-Aug	9.00	2.0	0	pc	14.7	ssw-sw	20.7	30.10	2	90	81	2	1.8
31-Aug	9.00	2.3	0	pc-mc	9.3	ssw	26.0	30.10	2	81	67	2	3.0
1-Sep	9.00	2.0	0	pc-mc, scat rain, PM dust	30.7	s-ssw	14.5	29.86	4	61	48	1	0.1
2-Sep	9.00	1.8	0	ovc	9.0	ssw	13.3	29.96	4	60	55	1	0.3
3-Sep	9.00	2.0	0	ovc	6.1	var	15.5	30.03	4	70	64	1	0.3
4-Sep	9.00	2.0	0	clr-pc	14.5	var	16.7	29.97	3	66	61	2	1.6
5-Sep	9.00	2.0	0	pc	10.0	s	19.5	30.15	3	74	67	1	2.9
6-Sep	9.00	2.0	0	clr-ovc	8.0	ssw	17.8	30.14	3	70	66	2	5.0
7-Sep	9.00	1.8	0	clr	8.1	ssw	18.3	30.07	2	89	83	2	9.0
8-Sep	9.00	2.0	0	pc-mc	16.0	s-ssw	18.6	29.93	3	79	74	1	5.6
9-Sep	9.00	1.7	0	pc-mc	13.5	ssw	17.0	29.95	4	78	67	2	2.4
10-Sep	9.00	2.4	0	clr-ovc	15.8	s-ssw	15.9	29.97	3	81	75	2	3.9
11-Sep	9.00	2.0	0	pc-mc	26.3	s	12.0	29.86	4	76	77	1	0.7
12-Sep	9.00	2.0	0	pc-ovc	10.5	s-ssw	15.5	29.82	3	87	80	1	2.0
13-Sep	9.00	1.6	0	ovc, fog AM rain	9.9	s-ssw	10.5	29.72	4	58	33	2	0.9
14-Sep	9.00	1.6	0	clr-ovc	11.5	ssw	15.6	29.88	3	85	70	2	2.7
15-Sep	5.00	1.9	0	ovc	7.3	s-ssw	9.5	29.79	4	39	29	-	0.0
16-Sep	9.00	1.6	0	ovc, fog, rain/snow	10.8	s-ssw	9.8	29.76	4	74	65	2	1.6
17-Sep	9.00	1.0	0	mc-ovc, PM rain	9.4	ssw	13.4	29.60	3	70	53	1	2.4
18-Sep	9.00	2.0	0	mc-ovc, scat snow	15.9	calm/ssw	9.9	29.55	4	55	33	2	3.3
19-Sep	9.00	2.0	0	ovc, scat fog/snow	6.8	nw	7.6	29.68	4	42	18	1	3.7
20-Sep	9.00	2.0	0	pc	8.5	s, var	10.8	30.05	2	93	74	2	12.8
21-Sep	9.00	2.0	0	clr	8.7	s-ssw	17.2	30.24	3	89	88	2	3.0
22-Sep	7.50	2.0	0	ovc, PM rain	8.2	ssw	15.9	30.10	4	59	51	2	1.7
23-Sep	8.00	1.7	0	mc-ovc	6.6	ssw	22.0	30.12	2	74	77	3	5.0
24-Sep	9.00	2.0	0	clr, PM haze	11.2	s-ssw	20.4	30.19	2	88	87	1	10.1
25-Sep	9.50	1.0	1	clr, PM haze	7.9	s-ssw	23.5	30.10	3	80	79	2	8.0
26-Sep	9.50	1.0	1	clr, haze	9.5	calm/var	24.2	30.16	2	76	80	3	4.3
27-Sep	9.00	2.0	0	clr, haze	6.5	calm/var	25.4	30.22	1	85	81	3	5.2
28-Sep	9.00	2.0	0	clr, haze	9.3	s-ssw	22.0	29.26	2	77	80	2	3.3
29-Sep	9.00	1.8	0	clr	10.5	n, calm	18.3	27.78	2	80	87	3	8.8
30-Sep	9.00	1.7	0	clr-pc	21.1	nne-ne	17.4	27.84	3	88	93	3	6.2

Appendix C. continued

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN	PREDOMINANT WEATHER ³	WIND		TEMP (°C) ¹	BAROM.	MEDIAN	VISIB.	VISIB.	MEDIAN	BIRDS / HOUR
			VISITOR DISTURB ²		SPEED (KPH) ¹	WIND DIRECTION		PRESS. (IN HG) ¹	THERMAL LIFT ⁴	WEST (KM) ¹	EAST (KM) ¹	FLIGHT DISTANCE ⁵	
1-Oct	9.00	2.1	0	clr, AM dust, PM haze	6.5	n-nne, ssw-sw	22.4	27.99	2	81	80	3	2.3
2-Oct	9.00	2.0	0	clr, haze	3.0	calm/var	15.1	28.06	2	72	65	2	3.2
3-Oct	9.00	2.0	0	clr, haze	8.4	s-ssw	19.4	28.11	3	84	87	3	2.7
4-Oct	9.00	1.0	0	clr, haze	13.2	s-ssw	17.2	28.01	3	70	83	1	2.6
5-Oct	9.00	1.7	0	clr-mc, haze	18.6	s-ssw	18.4	27.88	4	66	84	2	4.2
6-Oct	9.00	1.0	0	mc, scat rain	31.4	s-ssw	13.5	27.76	4	72	53	1	0.7
7-Oct	9.00	1.8	0	mc-ovc	9.2	ssw	13.4	27.93	3	80	70	3	4.4
8-Oct	7.00	2.0	0	ovc, scat rain	20.0	s-ssw	11.0	27.68	4	62	46	2	1.9
9-Oct	9.00	2.0	0	ovc	12.4	s-ssw	7.5	27.76	4	82	61	1	0.2
10-Oct	9.00	2.0	0	clr-pc	10.8	s-ssw	12.6	28.05	4	76	74	1	1.8
11-Oct	9.00	2.0	0	mc-ovc	7.7	ssw	12.6	28.07	4	83	89	2	1.3
12-Oct	9.00	1.0	0	clr-pc	7.7	n, s	16.1	28.22	3	88	94	3	2.1
13-Oct	9.00	2.0	0	clr	7.9	n, s	19.1	28.23	2	90	90	2	0.9
14-Oct	9.00	1.6	0	clr	10.7	calm/ssw	17.2	27.99	2	100	99	3	1.1
15-Oct	9.00	2.0	0	ovc	8.4	calm, sw-wsw	13.2	27.73	4	85	84	3	0.7
16-Oct	9.00	1.0	0	ovc, fog PM rain	4.0	s-ssw	11.6	27.42	4	66	46	1	1.2
17-Oct	0.00			rain									
18-Oct	9.00	1.7	0	ovc	17.4	sw	3.8	27.29	4	89	78	2	0.8
19-Oct	0.00			snow									
20-Oct	8.00	1.3	0	pc-ovc, PM rain	6.6	ssw	5.9	27.45	4	89	75	3	1.5
21-Oct	5.00	2.0	0	mc, fog	10.7	sw	9.0	27.52	4	87	28	3	0.4
22-Oct	5.00	1.0	0	ovc, fog, blowing snow	20.1	sw	3.1	27.47	4	0	0	-	0.0
23-Oct	7.00	2.0	0	clr-mc	7.1	s-ssw	6.3	27.52	4	90	84	3	3.3

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: 2004.

DATE	OBS.		SPECIES ¹																								BIRDS				
	HOURS	TV	OS	NH	WK	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	
24-Aug	4.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25-Aug	9.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26-Aug	9.00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
27-Aug	9.00	0	1	0	0	5	3	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	12	1.3
28-Aug	8.50	0	0	0	0	5	3	1	0	0	0	0	0	2	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	15	1.8
29-Aug	9.00	0	0	0	0	5	1	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	9	1.0	
30-Aug	9.00	0	0	1	0	4	3	0	0	0	0	0	0	4	0	0	0	0	0	0	3	0	1	0	0	0	0	0	16	1.8	
31-Aug	9.00	0	0	1	0	5	8	2	0	0	0	0	2	7	0	0	0	0	0	0	1	1	0	0	0	0	0	0	27	3.0	
1-Sep	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1	
2-Sep	9.00	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.3	
3-Sep	9.00	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0.3	
4-Sep	9.00	0	1	0	0	4	5	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	14	1.6	
5-Sep	9.00	2	0	4	0	10	4	0	0	0	0	0	0	4	0	0	0	0	0	0	1	1	0	0	0	0	0	0	26	2.9	
6-Sep	9.00	1	1	0	0	10	9	0	0	0	2	0	2	16	0	0	0	0	0	0	2	0	0	1	0	0	0	1	45	5.0	
7-Sep	9.00	1	2	1	0	38	12	3	0	1	0	0	0	12	0	0	0	1	0	0	8	2	0	0	0	0	0	0	81	9.0	
8-Sep	9.00	1	0	1	0	29	4	0	0	0	0	0	0	13	0	0	0	0	0	0	1	0	1	0	0	0	0	0	50	5.6	
9-Sep	9.00	1	0	0	0	11	4	0	0	3	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	22	2.4	
10-Sep	9.00	0	0	1	0	18	9	1	0	0	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	35	3.9	
11-Sep	9.00	0	1	0	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	6	0.7	
12-Sep	9.00	0	0	0	0	11	4	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	2.0	
13-Sep	9.00	0	2	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	8	0.9	
14-Sep	9.00	0	2	0	0	9	4	1	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	24	2.7	
15-Sep	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	
16-Sep	9.00	0	2	0	0	3	3	2	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	1.6	
17-Sep	9.00	0	2	1	0	5	6	0	0	0	0	0	0	3	0	0	0	3	0	0	1	1	0	0	0	0	0	0	22	2.4	
18-Sep	9.00	4	0	0	0	11	4	0	0	0	0	0	0	9	0	0	0	2	0	0	0	0	0	0	0	0	0	0	30	3.3	
19-Sep	9.00	1	1	0	0	8	13	0	0	0	0	0	0	4	0	0	0	5	0	0	1	0	0	0	0	0	0	0	33	3.7	
20-Sep	9.00	1	5	4	0	34	22	1	0	0	1	2	1	31	0	0	0	1	0	0	2	2	0	1	0	0	0	7	115	12.8	
21-Sep	9.00	2	1	0	0	10	2	0	0	0	0	0	0	8	0	0	1	3	0	0	0	0	0	0	0	0	0	0	27	3.0	
22-Sep	7.50	0	0	4	0	5	1	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	1.7	
23-Sep	8.00	0	0	6	0	11	9	3	0	0	0	0	0	2	0	0	2	4	0	0	1	0	1	0	0	0	1	0	40	5.0	
24-Sep	9.00	4	3	7	0	38	16	1	0	0	0	0	0	13	0	0	0	2	0	0	2	1	0	0	0	0	0	4	91	10.1	
25-Sep	9.50	3	2	11	0	25	11	3	0	0	0	0	0	7	0	0	0	6	0	0	5	2	0	1	0	0	0	0	76	8.0	
26-Sep	9.50	0	0	2	0	7	8	2	0	1	0	0	0	8	0	1	2	6	0	0	1	2	0	0	0	0	0	1	41	4.3	
27-Sep	9.00	2	0	3	0	16	7	1	0	1	0	0	0	9	0	0	0	2	0	0	1	0	0	0	0	0	2	3	47	5.2	
28-Sep	9.00	0	1	2	0	13	3	0	0	0	3	0	0	2	0	0	0	1	0	0	3	1	0	0	0	0	1	0	30	3.3	

Appendix D. continued

DATE	OBS.			SPECIES ¹																								BIRDS		
	HOURS	TV	OS	NH	WK	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
29-Sep	9.00	1	3	2	0	15	7	2	0	0	1	0	0	23	0	0	1	9	0	0	6	5	0	0	2	1	0	1	79	8.8
30-Sep	9.00	0	2	0	0	7	9	4	0	0	1	0	0	10	0	2	3	13	0	0	0	2	0	1	1	1	0	0	56	6.2
1-Oct	9.00	0	0	0	0	1	3	0	0	0	0	0	0	8	0	1	1	4	0	0	1	0	0	0	0	0	0	2	21	2.3
2-Oct	9.00	0	0	1	0	10	2	0	0	0	0	0	0	3	0	1	0	6	0	0	2	2	0	0	1	0	0	1	29	3.2
3-Oct	9.00	1	0	3	0	2	3	0	0	0	0	0	0	6	0	0	0	7	0	0	1	1	0	0	0	0	0	0	24	2.7
4-Oct	9.00	0	0	0	0	9	3	0	0	0	0	0	0	3	0	0	0	6	0	0	1	1	0	0	0	0	0	0	23	2.6
5-Oct	9.00	0	0	0	0	11	3	1	0	0	0	0	0	2	0	4	2	10	0	0	0	1	0	0	0	0	0	4	38	4.2
6-Oct	9.00	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	6	0.7
7-Oct	9.00	0	1	1	0	14	3	1	0	0	0	0	0	2	0	0	0	15	1	0	0	0	0	1	0	0	0	1	40	4.4
8-Oct	7.00	0	0	0	0	6	0	0	0	0	0	0	0	1	0	2	0	1	0	0	0	2	1	0	0	0	0	0	13	1.9
9-Oct	9.00	0	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	0	2	0.2
10-Oct	9.00	0	0	1	0	8	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	16	1.8
11-Oct	9.00	0	0	1	0	4	0	0	0	0	0	0	0	2	0	2	0	2	0	0	0	1	0	0	0	0	0	0	12	1.3
12-Oct	9.00	0	0	0	0	3	0	3	0	0	0	0	0	5	0	0	0	5	0	0	1	1	0	0	0	0	0	1	19	2.1
13-Oct	9.00	0	0	0	0	1	2	1	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0.9
14-Oct	9.00	0	0	0	0	4	1	1	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	10	1.1
15-Oct	9.00	0	0	0	0	1	0	1	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	6	0.7
16-Oct	9.00	0	0	0	0	1	0	2	0	0	0	0	0	2	0	1	1	1	0	0	0	2	0	0	1	0	0	0	11	1.2
17-Oct	0.00																													
18-Oct	9.00	0	0	0	0	3	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	7	0.8
19-Oct	0.00																													
20-Oct	8.00	0	0	1	0	3	0	0	0	0	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	12	1.5
21-Oct	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0.4
22-Oct	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
23-Oct	7.00	0	0	0	0	2	0	2	1	0	0	0	0	10	0	3	0	3	1	0	0	1	0	0	0	0	0	0	23	3.3
Total	507.50	25	34	59	0	468	220	41	1	6	10	2	5	277	0	20	15	130	2	0	48	39	5	7	5	2	4	27	1452	2.9

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: 1997–2004.

	1997	1998	1999	2000	2001	2002	2003	2004	MEAN
Start Date	5-Sep	27-Aug	27-Aug	27-Aug	27-Aug	25-Aug	23-Aug	24-Aug	25-Aug
End Date	11-Oct	21-Oct	27-Oct	5-Nov	22-Oct	25-Oct	26-Oct	23-Oct	25-Oct
Observation days	29	53	61	67	55	62	59	59	59
Observation hours	204.60	382.92	504.33	505.75	439.00	491.28	509.24	507.50	477.15
Raptors / 100 hours	691.1	620.2	571.2	481.3	470.4	522.1	297.1	286.1	464.1
SPECIES	RAPTOR COUNTS								
Turkey Vulture	4	29	21	26	14	46	30	25	27
Osprey	41	24	47	71	48	57	31	34	45
Northern Harrier	115	152	167	104	91	148	66	59	113
White-tailed Kite						0	1	0	0
Sharp-shinned Hawk	311	949	932	1050	878	937	421	468	805
Cooper's Hawk	150	247	232	198	198	234	136	220	209
Northern Goshawk	38	32	50	35	16	22	17	41	30
Unknown small accipiter ¹					98	85	40	1	56
Unknown large accipiter ¹					0	10	17	6	8
Unknown accipiter	182	221	248	98	0	49	36	10	95
TOTAL ACCIPITERS	681	1449	1462	1381	1190	1337	667	746	1176
Broad-winged Hawk	2	7	5	5	6	9	3	2	5
Swainson's Hawk	0	8	17	2	0	7	15	5	8
Red-tailed Hawk	145	182	450	364	263	386	263	277	312
Ferruginous Hawk	0	0	0	1	0	0	0	0	0
Rough-legged Hawk	1	13	44	53	13	45	14	20	29
Unidentified buteo	75	58	148	97	83	82	39	15	75
TOTAL BUTEOS	223	268	664	522	365	529	334	319	429
Golden Eagle	105	55	141	174	105	135	142	130	126
Bald Eagle	2	2	7	15	2	8	1	2	5
Unidentified eagle	7	0	7	5	1	0	12	0	4
TOTAL EAGLES	114	57	155	194	108	143	155	132	135
American Kestrel	24	107	89	40	84	68	33	48	67
Merlin	17	55	36	26	36	38	21	39	36
Prairie Falcon	2	10	7	5	5	6	19	5	8
Peregrine Falcon	5	2	9	1	3	9	14	7	6
Unknown small falcon ¹					6	4	6	5	5
Unknown large falcon ¹					1	2	2	2	2
Unknown falcon	10	6	6	2	2	0	0	4	3
TOTAL FALCONS	58	180	147	74	137	127	95	110	124
Unidentified Raptor	178	216	218	62	112	178	134	27	135
GRAND TOTAL	1414	2375	2881	2434	2065	2565	1513	1452	2184

¹ Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2004.

DATE	STN.	SPECIES ¹											CAPTURES	
	HOURS	NH	SS	CH	NG	RT	RL	GE	AK	ML	PR	PG	TOTAL	/ STN HR
25-Aug	4.00	0	0	0	0	0	0	0	0	0	0	0	0	0.0
26-Aug	6.00	0	0	0	0	0	0	0	0	0	0	0	0	0.0
27-Aug	8.00	0	1	1	0	0	0	0	1	0	0	0	3	0.4
28-Aug	7.00	0	0	1	1	0	0	0	0	0	0	0	2	0.3
29-Aug	6.17	0	2	1	0	0	0	0	2	0	0	0	5	0.8
30-Aug	13.60	0	3	2	0	2	0	0	0	0	0	0	7	0.5
31-Aug	7.75	0	2	2	0	0	0	0	1	0	0	0	5	0.6
1-Sep	6.50	0	2	0	0	0	0	0	0	0	0	0	2	0.3
2-Sep	0.00													
3-Sep	12.05	0	1	3	0	0	0	0	0	0	0	0	4	0.3
4-Sep	16.35	0	1	2	0	0	0	0	0	0	0	0	3	0.2
5-Sep	15.50	1	0	2	0	0	0	0	0	0	0	0	3	0.2
6-Sep	17.40	0	13	2	0	0	0	0	0	0	0	0	15	0.9
7-Sep	17.25	0	20	1	0	1	0	0	0	1	0	0	23	1.3
8-Sep	16.07	0	11	2	0	2	0	0	1	0	0	0	16	1.0
9-Sep	16.45	0	4	1	0	0	0	0	0	0	0	0	5	0.3
10-Sep	15.00	0	12	5	0	2	0	0	0	0	0	0	19	1.3
11-Sep	10.50	0	2	0	0	0	0	0	0	0	0	0	2	0.2
12-Sep	7.16	0	0	1	0	0	0	0	0	0	0	0	1	0.1
13-Sep	10.75	0	3	0	0	0	0	0	0	1	0	0	4	0.4
14-Sep	16.00	0	3	1	0	0	0	0	0	0	0	0	4	0.3
15-Sep	5.00	0	1	0	0	1	0	0	0	0	0	0	2	0.4
16-Sep	16.25	0	3	1	0	0	0	0	0	0	0	0	4	0.2
17-Sep	15.50	0	2	1	0	0	0	0	0	0	0	0	3	0.2
18-Sep	16.25	0	5	3	0	1	0	0	0	0	0	0	9	0.6
19-Sep	9.50	0	2	1	0	0	0	0	0	0	0	0	3	0.3
20-Sep	17.50	0	10	7	0	1	0	0	0	1	0	0	19	1.1
21-Sep	14.65	0	5	4	0	0	0	1	0	0	0	0	10	0.7
22-Sep	13.75	0	5	1	0	0	0	0	0	0	0	0	6	0.4
23-Sep	17.25	1	8	4	0	1	0	0	0	1	1	0	16	0.9
24-Sep	16.50	1	9	5	1	0	0	0	0	1	0	0	17	1.0
25-Sep	8.50	0	9	0	2	0	0	0	0	0	0	0	11	1.3

Appendix F. continued

DATE	STN.	SPECIES ¹											TOTAL	CAPTURES / STN HR
	HOURS	NH	SS	CH	NG	RT	RL	GE	AK	ML	PR	PG		
26-Sep	9.00	0	2	0	0	0	0	0	0	0	0	0	2	0.2
27-Sep	8.50	0	6	0	0	0	0	0	0	1	0	0	7	0.8
28-Sep	16.50	1	17	0	0	0	0	0	0	0	0	0	18	1.1
29-Sep	17.00	0	6	1	3	0	0	0	0	0	0	0	10	0.6
30-Sep	16.00	0	3	1	0	1	0	0	0	0	0	1	6	0.4
1-Oct	17.75	0	8	0	1	1	0	1	0	0	0	0	11	0.6
2-Oct	17.00	0	8	0	0	0	0	0	0	0	0	0	8	0.5
3-Oct	16.75	0	8	1	0	0	0	0	0	0	0	0	9	0.5
4-Oct	10.00	0	9	0	0	0	0	0	0	1	0	0	10	1.0
5-Oct	15.25	1	2	0	0	1	0	0	0	0	0	0	4	0.3
6-Oct	15.16	0	3	1	0	0	0	0	0	0	0	0	4	0.3
7-Oct	16.25	0	6	0	2	0	0	0	0	1	0	0	9	0.6
8-Oct	13.25	0	3	0	0	0	0	0	0	0	0	0	3	0.2
9-Oct	16.00	0	3	0	0	0	0	0	0	0	0	0	3	0.2
10-Oct	15.75	0	4	0	2	0	0	0	0	0	0	0	6	0.4
11-Oct	16.00	1	4	0	0	0	0	0	0	1	0	0	6	0.4
12-Oct	8.00	0	0	0	1	0	0	0	0	0	0	0	1	0.1
13-Oct	16.00	0	2	0	1	0	0	0	0	0	0	0	3	0.2
14-Oct	16.00	0	0	0	0	1	0	0	0	0	0	0	1	0.1
15-Oct	15.25	0	0	0	1	0	0	0	0	0	0	0	1	0.1
16-Oct	16.00	0	2	0	0	0	0	0	0	1	0	0	3	0.2
17-Oct	0.00													
18-Oct	12.00	0	1	0	1	0	0	0	0	0	0	0	2	0.2
Total	689.56	6	236	58	16	15	0	2	5	10	1	1	350	0.5

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: 1999–2004.

	1999 ¹	2000 ¹	2001	2002	2003	2004	MEAN	TOTAL
First trapping day	28-Aug	2-Sep	30-Aug	27-Aug	23-Aug	25-Aug		
Last trapping day	16-Oct	14-Oct	17-Oct	19-Oct	25-Oct	18-Oct		
Number of stations	2	2	2	2	2	2	2	
Trapping days	47	42	44	54	56	53	49	
Station hours	388	?	612.75	837.25	803.31	699.56	668.17	
Captures / stn. hour	5.7	?	8.6	8.1	7.3	5.0	6.9	
SPECIES	RAPTOR CAPTURES							
Northern Harrier	4	3	10	13	11	6	7.8	47
Sharp-shinned Hawk	139	125	341	459	394	237	283	1695
Cooper's Hawk	42	46	107	127	100	58	80	480
Northern Goshawk	14	10	12	13	9	16	12	74
Red-tailed Hawk	11	8	22	29	20	16	18	106
Rough-legged Hawk	0	1	1	2	1	0	0.8	5
Golden Eagle	0	1	2	0	4	2	2	9
American Kestrel	3	0	8	10	17	5	7	43
Merlin	6	4	17	21	25	10	14	83
Prairie Falcon	1	1	3	4	4	1	2	14
Peregrine Falcon	0	0	2	0	4	1	1	7
All species	220	199	525	678	589	352	427	2563
Recaptures ²	0	0	0	0	0	0	0	0
Foreign Recaptures ³	0	0	0	1	0	0	0.2	1
Foreign Encounters ⁴	0	1	5	2	1	1	1.7	10

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.