

**FALL 2003 RAPTOR MIGRATION STUDIES
AT CHELAN RIDGE, WASHINGTON**



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



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

February 2004

**FALL 2003 RAPTOR MIGRATION STUDIES AT
CHELAN RIDGE, WASHINGTON**

Report prepared by:

Jeff P. Smith

Counts by:

Ben Kinkade and Blake Mathys

Assisted by Joshua Pitts, Dan Harrington, and Richard Hendricks

Banding by:

Steve Page and Luke Caldwell

**Assisted by Bob Davies, Joshua Pitts, Jim Watson, Dan Harrington, Loni Beyer
and other volunteers**

On-site Education by:

Joshua Pitts

Assisted by Dan Harrington, Tannis Thorlakson, and Megan Massone

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

February 2004

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
Migration Summary	4
Resident Raptors	5
Trapping Effort.....	5
Trapping and Banding Summary	6
Encounters with Previously Banded Birds.....	6
Satellite Telemetry	7
Identifying Migrant Origins through Stable Isotope Analyses	7
Visitor Participation and Public Outreach	7
Acknowledgements.....	8
Literature Cited.....	8
Tables.....	9
Figures	16
Appendix A. History of official observer participation in the Chelan Ridge Raptor Migration Project.....	25
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.....	26
Appendix C. Daily observation effort, visitor disturbance ratings, weather records, and flight summaries for the Chelan Ridge Raptor Migration Project: 2003.....	27
Appendix D. Daily observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 2003.....	29
Appendix E. Annual observation effort and fall raptor migration counts by species at Chelan Ridge, WA: 1997–2003.....	31
Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2003.	32
Appendix G. Annual trapping effort and capture totals by species for migrating raptors at Chelan Ridge, WA: 1999–2003.	34

LIST OF TABLES

Table 1.	Fall counts and passage rates by species for migrating raptors at Chelan Ridge, WA: 1998–2002 versus 2003.	10
Table 2.	Fall counts by age class and immature : adult ratios for selected species of migrating raptors at Chelan Ridge, WA: 1998–2002 versus 2003.	11
Table 3.	First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Chelan Ridge, WA in 2003, with a comparison of 2003 and 1998–2002 average median passage dates.	12
Table 4.	Median passage dates by age for selected species of migrating raptors at Chelan Ridge, WA: 1998–2002 versus 2003.	13
Table 5.	Fall capture totals, rates, and successes by species for migrating raptors at Chelan Ridge, WA: 1999–2002 versus 2003.	14
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: 2001–2002 versus 2003.	15
Table 7.	Foreign encounters of raptors banded at the Chelan Ridge Raptor Migration Project: 2000–2003.	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: 1998–2002 versus 2003.	18
Figure 3.	Fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Chelan Ridge, WA: 1998–2003.	19
Figure 4.	Fall-migration passage rates for Sharp-shinned Hawks, Cooper’s Hawks, and Northern Goshawks at Chelan Ridge, WA: 1998–2003.	20
Figure 5.	Fall-migration passage rates for Broad-winged, Swainson’s, Red-tailed, and Rough-legged Hawks at Chelan Ridge, WA: 1998–2003.	21
Figure 6.	Fall-migration passage rates for Golden and Bald Eagles at Chelan Ridge, WA: 1998–2003.	22
Figure 7.	Fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons at Chelan Ridge, WA: 1998–2003.	23
Figure 8.	Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998–2002 versus 2003.	24

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 2,400 and 2,900 migrants per season. The 2003 season marked the 6th consecutive full-season count at the site and the 5th consecutive season of banding. This report summarizes the 2003 count and banding results.

The Chelan project was 1 of 14 long-term, annual migration counts and 1 of 7 migration banding studies conducted or co-sponsored by HWI in North America during 2003. 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 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 staff and volunteers, conducted standardized daily counts of migrating raptors from a single traditional observation site. This was the first full season of migration counting for both primary observers, Ben Kinkade and Blake Mathys; however, Ben gained experience the previous year monitoring migration activity at a site in central California, and Blake received pre-season training (see Appendix A for a complete history of observer participation). They were also ably assisted by OWNF logistics coordinator and former Chelan observer Dan Harrington, former observer Rickard Hendrick, and on-site educator Joshua Pitts (no previous experience). Visitors also periodically 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).

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 2003 season to means for previous seasons and examine trends in annual passage rates. In comparing 2003 annual statistics against means and 95% confidence intervals for previous seasons, I equate significance with a 2003 value falling outside the bounds of the confidence interval for the associated mean.

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. 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 can take a bit longer.

RESULTS AND DISCUSSION

WEATHER

Observations proceeded full-time every day through the first week of October, but from 7–20 October, inclement weather (mostly rain, low clouds and fog) fully precluded six days of observation and reduced another two days of observation to ≤ 4 hours each. This is twice the 1998–2002 average number of days hampered by inclement weather (see Appendix C for daily weather records). Otherwise, however, generally fair skies predominated on a slightly above-average proportion of the active observation days (58%; average 53%), transitional weather (skies changed from fair to mostly cloudy/overcast, or vice versa, during the day) on 25% (average 29%), and mostly cloudy to overcast skies on 17% (average 19%). However, similar to 2002, what was unusual about the 2003 season was the high prevalence of visibility reducing fog and more importantly haze, the later resulting primarily from high incidence of wildfires in the region over the past two years.

Wind velocities averaged slightly higher than average in 2003, with light winds (<12 kph) prevailing on 63% of the active observation days (average 72%) and moderate winds (12–28 kph) prevailing on the remainder (average 25%, with 3% the long-term average for stronger winds). In terms of prevailing wind directions, 2003 was fairly typical, except that southeasterly winds and days where the winds shifted during the day from SE-SW to NW-NE, or vice versa, were a bit more common than usual. As is typical for the site, the most common wind pattern was south to southwest winds, which prevailed on 42% of the active observation days (average 40%).

The temperature during active observation periods averaged 14.8°C (the average of daily values, which in turn were averages of hourly readings), ranging from 4.4–24.7°C. The average and minimum temperatures are the warmest yet recorded at the site, with the maximum the second highest. The barometric pressure during active observation periods averaged 30.13 in Hg (the average of daily values, which in turn were averages of hourly readings), ranging from 29.67–30.60°C. These are the highest values recorded since we began keeping such records in 2001.

In 2003, only 34% of the active observation days received a median (of hourly ratings) thermal-lift rating of good to excellent, compared to the 1998–2002 average of 43% (range 16–69%).

In summary, the weather patterns at Chelan Ridge continue to vary from year to year. The 2003 season featured an above-average proportion of days severely hampered by inclement weather, especially in mid-October, and moderate winds prevailed slightly more often than usual, which probably contributed to lower than average thermal-lift ratings. Otherwise, however, the active observation periods featured warmer than average temperatures and higher than average barometric pressure, possibly related in part to a slightly higher prevalence of winds with a southerly component (88% versus and average of 83% of days). The most prominent difference between 2003 and previous years (except 2002) was the almost daily incidence of substantial haze due to wildfires in the region.

OBSERVATION EFFORT

Observations occurred on 59 of 65 possible observation days between 23 August and 26 October, with excessive snow also cutting the count one day short of the target end date of 27 October. The number of observation days was only 1% lower than the 1998–2002 average of $60 \pm 95\%$ CI of 4.9 days, whereas the number of observation hours in 2003 (509.24) was a non-significant 10% higher than the 1998–2002 average of $464.66 \pm 95\%$ CI of 46.61 hours. The 2002 average of 2.1 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 9% higher than the 1998–2002 average of $1.9 \pm 95\%$ CI of 0.12 observers/hour.

MIGRATION SUMMARY

The observers counted 1,513 raptors of 17 species during the 2003 season (Table 1, and see Appendix D for daily count records), which is the lowest total count since full-season counts began in 1998 (see Appendix E for annual count summaries). The flight consisted of 56% accipiters, 19% buteos, 6% falcons, 5% eagles, 5% harriers, 2% Ospreys, 1% vultures, and 6% unknown or other raptors (Figure 2). The proportions of accipiters and harriers were significantly below average, whereas the proportions of vultures and eagles were significantly above average. The most common species seen in 2003 were the Sharp-shinned Hawk (28% of the total count), Red-tailed Hawk (17%), Cooper's Hawk (9%), and Golden Eagle (9%). All other species each comprised less than 5% of the total count.

Counts fell to record lows (since full-season counts began in 1998) for seven species: Northern Harriers, Sharp-shinned and Cooper's Hawks, Broad-winged Hawks, American Kestrels, and Merlins (Appendix E). In contrast, counts rose to record highs for Prairie and Peregrine Falcons, and the highlight of the season was the first sighting of a White-tailed Kite. Passage rates were below average for 12 of the 18 species thus far recorded at the site, significantly so for 11 species (Table 1). Among commonly seen species, passage rates were significantly above average in 2003 only for Swainson's Hawks and Prairie and Peregrine Falcons.

Six years of full-season data is still too short a duration to attach much significance to documented trends. Nevertheless, especially with the addition of significantly below average passage rates in 2003, seven species appear to be showing downward trends at Chelan Ridge since 1998 (Northern Harrier, all three accipiters, Rough-legged Hawks, American Kestrels, and Merlins), whereas only Golden Eagles

and Peregrine Falcons appear to be showing distinct upward trends (Figures 3–7). 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 1998 (Hoffman and Smith 2003). In contrast, the increasing pattern shown for Peregrine Falcons at Chelan matches patterns seen throughout the West, as this species continues to show a strong recovery from the DDT era.

Seven of nine species for which comparisons of immature : adult ratios were possible showed lower than average ratios in 2003, with the difference significant for Broad-winged Hawks, Red-tailed Hawks, and Golden Eagles (Table 2). Low abundance of Broad-winged Hawks precludes attaching importance to the data for this species, and the low age ratio for Golden Eagles was due to high abundance of identified adults rather than low abundance of immature and subadult birds. However, for Northern Harriers and the three accipiters, both adults and immature birds were substantially less abundant than usual, as was the case for immature Red-tailed Hawks. This suggests that low nesting success and juvenile recruitment contributed to the low counts recorded for at least these species and probably others as well.

The combined-species median passage date of 22 September was an insignificant 1 day later than the 1998–2002 average (Table 3); however, the overall seasonal distribution was atypical in showing a bimodal pattern, with proportionately higher than usual activity in both late August/early September and late September/early October (Figure 3). At the species level, only four species showed median passage dates that differed significantly from the 1998–2002 averages, with Northern Goshawks, American Kestrels, and Peregrine Falcons earlier than average and Rough-legged Hawks later than average. All other species except Swainson's Hawks showed median passage dates that were within 2 days of average. For Swainson's Hawks, the 2003 median date of 20 September was similar to the 1999 value of 17 September and the 2002 value of 21 September, but was much later than the 1998 value of 7 September (too few birds were seen in 2000 and 2001 to render meaningful values). Age-specific data revealed two noteworthy clarifications, indicating that immature Cooper's Hawks were a significant 5 days later than average, while immature Red-tailed Hawks were a significant 8 days earlier than average (Table 4).

RESIDENT RAPTORS

The observers recorded 8 species of raptors as non-migrant, local birds during the 2003 migration season. These included at least two immature Sharp-shinned Hawks seen regularly through 22 September, one immature Cooper's Hawk seen frequently through 13 October, and at least one immature Northern Goshawk seen in the area on 12 September and 23 October. A family group of light-morph Red-tailed Hawks, including two adults and two immature birds, was seen throughout the season. At least one family of Golden Eagles, most likely including two adults and two immature birds, also was present in the area, with the immature birds seen regularly through mid-season. At least one pair of local American Kestrels was active in the area through 13 September. A possible local Merlin was seen in the area between 12 and 13 September. An immature Peregrine Falcon was seen occasionally until 15 September.

This is a fairly typical assemblage for the site, except that local Turkey Vultures, Northern Harriers, and Prairie Falcons also have been recorded in the area previously.

TRAPPING EFFORT

Trapping occurred on 56 of 64 days between 23 August and 25 October, with effort totaling 803.3 station hours (see Appendix F for daily trapping records). The number of trapping days was the highest recorded to date; however, the number of station hours was 4% less than in 2002 (see Appendix G for annual trapping summaries).

TRAPPING AND BANDING SUMMARY

The 2003 capture total of 589 newly banded birds of 11 species was the second highest total recorded for the site, 24% above the 1999–2002 average (Table 5, Appendix G). Highlights included record high totals for Golden Eagles (4; one outfitted with a satellite transmitter), Peregrine Falcons (4), American Kestrels (17), and Merlins (21), as well as only the fifth Rough-legged Hawk ever captured the site. The 2003 effort raised the total number of diurnal raptors captured at the site to 2,211 (Appendix G). The most frequently captured species were the Sharp-shinned Hawk (67% of captures), Cooper's Hawk (17%), Merlin (4%), and Red-tailed Hawk (3%). All other species each comprised <2% of the total (Table 5).

The Northern Goshawk is only species for which the crew recorded a below average capture total and rate in 2003; however, capture success for this species was average (Table 5), confirming that low abundance (45% below average) was the reason for the low capture total and rate. The Red-tailed Hawk was the only other species for which the crew recorded a significantly below average capture rate, but again capture success was significantly above average. Capture rates were significantly above average for four species (Golden Eagle, American Kestrel, Merlin, and Peregrine Falcon), and capture success was significantly above average for nine species.

Compared to the counts, banding at this site yields unique and substantial sex–age specific data only for the three accipiters and American Kestrels. For the three accipiters, immature : adult ratios derived from the count data were 32–37% below average in 2003 (Table 2), whereas age ratios derived from the capture data were 4–12% above average (Table 6). In an absolute sense, capture age ratios for Sharp-shinned Hawks and Northern Goshawks were higher than the count age ratios in both 2002 and 2003, but the opposite was true in 2001. Higher capture age ratios is a common pattern believed to reflect the fact that adults are generally more wary of unusual situations than inexperienced young birds, and therefore are generally more susceptible to capture. Reasons why this common pattern did not apply to sharpshins and goshawks in 2001 and thus far has not seemed to apply to Cooper's Hawks at Chelan Ridge are uncertain. Regardless, the stark contrast between consistently below average count ratios and above average capture ratios suggests that young birds were both less abundant and more susceptible to capture than usual in 2003.

With regard to American Kestrels, age-specific information derives only from capture data. The 2003 data indicated that immature birds were captured almost twice as often as adults; however, the immature : adult capture ratio was 69% below the 2001–2002 average due to a high number of adult captures (Table 6). Both the count and capture data yield sex ratios for kestrels. In 2003, the count data indicated a female : male ratio of 1, which was 32% above average due to a proportional scarcity of males. In contrast, the 2003 capture data indicated a sex ratio of 0.30, which was also 33% above average but due to a relative increase in the abundance of captured females rather than a decrease in the abundance of captured males. These data suggest that both sexes, especially males, were less common than usual, and that especially adults of both sexes were more susceptible to capture than usual.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Since banding began at Chelan Ridge in 1999, nine foreign encounters with Chelan-banded birds have been reported through the U.S. Bird Banding Lab (Table 7). All but two have involved hatch-year birds recovered or recaptured within two months of their original banding date in Oregon, California, or west-central Nevada. The exceptions include a Red-tailed Hawk banded as a full adult and found dead one year later during fall in British Columbia, and a Sharp-shinned Hawk banded as a hatch-year bird in 2001 and later found dead two years later during winter in western Idaho.

SATELLITE TELEMETRY

For the third consecutive season, the Chelan Ridge crew outfitted several raptors with satellite transmitters that enable tracking the birds' movements over large distances and long periods. Birds outfitted included one adult Northern Goshawk, one adult Red-tailed Hawk, and one second-year Golden Eagle. The three adult goshawks we outfitted at Bonney Butte (OR) and at Chelan Ridge during fall 2003 thus far have remained within 35 km of their respective project sites. These are the first adult goshawks that HWI has tracked and, like most of the immature birds tracked to date, limited movements indicate primarily regional residency. All three goshawks were still alive and transmitting as of late January 2004.

In contrast to the goshawks, two new Red-tailed Hawks outfitted in 2003 and tracked from Bonney Butte and Chelan Ridge are currently wintering in northern California, one in the Trinity Mountains near Redding (OR bird) and the other in the Coast Range near Healdsburg (WA bird). Curiously, the new Chelan Ridge bird is now wintering within about 15 miles of another red-tail that HWI outfitted in Oregon during fall 2002.

We were very pleased to outfit a new Golden Eagle at Chelan Ridge in 2003. This is only the second eagle HWI has outfitted at Chelan Ridge, and unfortunately the first deployment failed to yield any useful information. However, the new bird has already yielded valuable new insight, having traveled several thousand kilometers to wintering grounds in southern New Mexico!

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

During the 2003 season, HWI continued to collect feather samples to contribute to two Boise State University graduate student studies designed to use analyses of stable-isotope ratios to identify the origins of migrant Red-tailed Hawks and Northern Goshawks in western North America. This technique has already yielded valuable insight concerning the origins and migration ecology (relative passage timing of different subpopulations) of migrants sampled at HWI migration project sites in Florida (Meehan et al. 2001, Lott et al. 2003) and New Mexico (Smith et al. 2003, DeLong 2003). Compared to complimentary satellite-tracking studies, the stable-isotope technique can be applied to any size bird.

In 2003, HWI received a new grant from the National Fish and Wildlife Foundation that is enabling us to greatly expand our involvement in application of this technique to western migratory raptors. This grant supported sampling in 2003 and analysis of feathers from migrant Sharp-shinned Hawks, Cooper's Hawks, and American Kestrels captured at nine migration-trapping sites in western North America from Alaska to Mexico, including Chelan Ridge. The results of this investigation will be known by late summer 2004.

VISITOR PARTICIPATION AND PUBLIC OUTREACH

The 2003 visitor logs recorded 187 individuals from Washington, Oregon, California, Arizona, and the United Kingdom. Organized groups included the Chelan Independent School, Okanogan Homeschoolers, and Methow Homeschoolers. In 2003, 550 hourly assessments by the observers of visitor disturbance resulted in the following ratings: 92% none, 7% 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 2003 was provided by Okanogan and Wenatchee National Forests, the National Fish and Wildlife Foundation, the M. J. Murdock Charitable Trust, George Perkins, Jr., Jennifer and Randy Speers, 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 site director for OWNF this season, did a great job helping to coordinate all aspects of the project. Tannis Thorlakson and Megan Massone, who served as project interns, also were a welcome addition to the crew. We are also particularly grateful for the assistance of former Chelan project coordinator Bob Davies in getting the banding program set up; the considerable volunteer assistance of former full-time Chelan observer Richard Hendrick; the continued, substantial assistance as banders of Washington Department of Fish and Wildlife biologist Jim Watson and son Jesse; the continued service of Brad Martin who has generously nurtured and maintained our lure pigeons for the past several years; and the generous volunteer assistance of Loni Beyer who dedicated her weekends to helping with the trapping operation. Lastly, a sincere thanks to the OWNF Chelan Ranger District, Winthrop Visitor Center, and Twisp Office for their logistical and public outreach support.

LITERATURE CITED

- Bednarz, J. C., D. Klem Jr., L. J. Goodrich, and S. E. Senner. 1990. 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.
- DeLong, J. P. 2003. Flammulated Owl migration project: Manzano Mountains, New Mexico--2002 report. HawkWatch International, Inc., Salt Lake City, Utah, USA. 20 pp.
- Hoffman, S. W., and J. P. Smith. 2003. Population trends of migratory raptors in western North America, 1977–2001. *Condor* 105:397–419.
- Hoffman, S. W., J. P. Smith, and T. D. Meehan. 2002. Breeding grounds, winter ranges, and migratory routes of raptors in the Mountain West. *Journal of Raptor Research* 36:97–110.
- 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.
- Lott, C. A., T. D. Meehan, and J. A. Heath. 2003. Estimating the latitudinal origins of migratory raptors using hydrogen and sulfur stable isotopes in feathers: influence of marine prey base. *Oecologia* 134: 505–510.
- Meehan, T. D., C. A. Lott, Z. D. Sharp, R. B. Smith, R. N. Rosenfield, A. C. Stewart, and R. K. Murphy. 2001. Using hydrogen isotope geochemistry to estimate the natal latitudes of immature Cooper's Hawks migrating through the Florida Keys. *Condor* 103:11–20.
- 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, Canada, and Washington, USA.

- Smith, R. B., T. D. Meehan, and B. O. Wolf. 2003. Assessing migration patterns of Sharp-shinned Hawks *Accipiter striatus* using stable-isotope and band encounter analysis. *Journal of Avian Biology* 34:387–392.
- 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: 1998–2002 versus 2003.

SPECIES	1998–2002 ¹	2003	% Change	1998–2002 ¹	2003	% Change
	COUNTS			RAPTORS/100 HOURS		
Turkey Vulture	27 ± 10.5	30	+10	5.9 ± 2.22	5.9	0
Osprey	49 ± 15.0	31	-37	10.4 ± 2.53	6.1	-42
Northern Harrier	133 ± 28.6	66	-50	28.9 ± 7.18	13.0	-55
White-tailed Kite	0 ± 0.0	1	–	0.0 ± 0.00	0.2	–
Sharp-shinned Hawk	949 ± 54.9	421	-56	206.2 ± 21.79	82.7	-60
Cooper's Hawk	222 ± 19.7	136	-39	48.5 ± 8.34	26.7	-45
Northern Goshawk	31 ± 11.5	17	-45	6.7 ± 2.29	3.3	-50
Unknown small accipiter ²	92 ± 12.7	40	-56	19.8 ± 4.92	7.9	-60
Unknown large accipiter ²	5 ± 9.8	17	+240	1.0 ± 1.99	3.3	+228
Unknown accipiter	123 ± 94.5	36	-71	27.2 ± 21.96	7.1	-74
TOTAL ACCIPITERS	1364 ± 96.1	667	-51	296.9 ± 40.50	131.0	-56
Broad-winged Hawk	6 ± 1.5	3	-53	1.4 ± 0.37	0.6	-58
Swainson's Hawk	7 ± 5.8	15	+121	1.5 ± 1.19	2.9	+102
Red-tailed Hawk	329 ± 93.1	263	-20	69.4 ± 14.22	51.6	-26
Ferruginous Hawk	0 ± 0.4	0	-100	0.0 ± 0.08	0.0	-100
Rough-legged Hawk	34 ± 16.8	14	-58	6.9 ± 3.07	2.7	-60
Unidentified buteo	94 ± 29.4	39	-58	19.9 ± 4.87	7.7	-61
TOTAL BUTEOS	470 ± 135.5	334	-29	99.1 ± 20.80	65.6	-34
Golden Eagle	122 ± 39.2	142	+16	25.6 ± 6.44	27.9	+9
Bald Eagle	7 ± 4.7	1	-85	1.4 ± 0.89	0.2	-86
Unidentified eagle	3 ± 2.8	12	+362	0.5 ± 0.55	2.4	+352
TOTAL EAGLES	131 ± 45.3	155	+18	27.5 ± 7.57	30.4	+11
American Kestrel	78 ± 22.1	33	-57	17.3 ± 6.45	6.5	-63
Merlin	38 ± 9.2	21	-45	8.5 ± 3.04	4.1	-52
Prairie Falcon	7 ± 1.8	19	+188	1.5 ± 0.57	3.7	+154
Peregrine Falcon	5 ± 3.4	14	+192	1.0 ± 0.66	2.7	+174
Unknown small falcon ²	5 ± 2.0	6	+20	1.1 ± 0.54	1.2	+8
Unknown large falcon ²	2 ± 1.0	2	+33	0.3 ± 0.18	0.4	+24
Unknown falcon	3 ± 2.4	0	-100	0.7 ± 0.56	0.0	-100
TOTAL FALCONS	133 ± 33.8	95	-29	29.6 ± 10.22	18.7	-37
Unidentified raptor	157 ± 59.9	134	-15	34.7 ± 14.76	26.3	-24
GRAND TOTAL	2464 ± 259.8	1513	-39	533.1 ± 55.02	297.1	-44

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 2003.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1998–2002 AVERAGE			2003			% UNKNOWN AGE		RATIO	
	TOTAL	IMM	ADULT	TOTAL	IMM	ADULT	1998–2002 ¹	2003	1998–2002 ¹	2003
Northern Harrier	133	46	34	66	30	18	40 ± 6.7	26	1.4 ± 0.58	1.7
Sharp-shinned Hawk	949	479	145	421	192	69	34 ± 12.4	38	4.1 ± 2.65	2.8
Cooper's Hawk	222	103	27	136	49	17	42 ± 13.8	51	4.3 ± 2.64	2.9
Northern Goshawk	31	14	5	17	7	2	39 ± 14.9	47	5.5 ± 4.77	3.5
Broad-winged Hawk	6	2	1	3	0	1	40 ± 23.4	67	1.8 ± 1.00	0.0
Red-tailed Hawk	329	83	146	263	51	137	29 ± 7.2	29	0.6 ± 0.19	0.4
Golden Eagle	122	63	26	142	64	33	26 ± 6.4	32	2.5 ± 0.45	1.9
Bald Eagle	7	1	5	1	1	0	3 ± 4.9	0	0.1 ± 0.19	1.0
Peregrine Falcon	5	1	1	14	2	4	56 ± 31.6	57	0.8 ± 0.49	0.5

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 2003, with a comparison of 2003 and 1998–2002 average median passage dates.

SPECIES	2003				1998–2002
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	24-Aug	1-Oct	25-Aug – 28-Sep	16-Sep	15-Sep ± 6.2
Osprey	24-Aug	26-Oct	2-Sep – 30-Sep	18-Sep	19-Sep ± 1.5
Northern Harrier	24-Aug	25-Oct	2-Sep – 6-Oct	22-Sep	22-Sep ± 2.8
White-tailed Kite	4-Oct	4-Oct	–	–	–
Sharp-shinned Hawk	24-Aug	26-Oct	3-Sep – 13-Oct	21-Sep	20-Sep ± 3.6
Cooper's Hawk	24-Aug	24-Oct	30-Aug – 2-Oct	18-Sep	16-Sep ± 3.5
Northern Goshawk	6-Sep	3-Oct	7-Sep – 3-Oct	16-Sep	23-Sep ± 7.4
Broad-winged Hawk	13-Sep	26-Sep	–	–	13-Sep ± 1.8
Swainson's Hawk	10-Sep	21-Sep	13-Sep – 21-Sep	20-Sep	14-Sep ± 8.6
Red-tailed Hawk	23-Aug	25-Oct	30-Aug – 13-Oct	23-Sep	24-Sep ± 3.1
Rough-legged Hawk	9-Sep	26-Oct	6-Oct – 26-Oct	23-Oct	13-Oct ± 4.2
Golden Eagle	23-Aug	25-Oct	11-Sep – 21-Oct	2-Oct	3-Oct ± 3.1
Bald Eagle	24-Oct	24-Oct	–	–	14-Oct ± 7.4
American Kestrel	25-Aug	30-Sep	30-Aug – 29-Sep	2-Sep	13-Sep ± 4.2
Merlin	29-Aug	26-Oct	2-Sep – 6-Oct	20-Sep	19-Sep ± 3.6
Prairie Falcon	24-Aug	23-Oct	27-Aug – 7-Oct	17-Sep	19-Sep ± 12.0
Peregrine Falcon	25-Aug	4-Oct	25-Aug – 29-Sep	3-Sep	26-Sep ± 3.9
Total	23-Aug	26-Oct	31-Aug – 13-Oct	22-Sep	21-Sep ± 2.0

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: 1998–2002 versus 2003.

SPECIES	ADULT		IMMATURE	
	1998–2002 ¹	2003	1998–2002 ¹	2003
Northern Harrier	21-Sep ± 5.3	22-Sep	21-Sep ± 3.8	25-Sep
Sharp-shinned Hawk	2-Oct ± 2.0	4-Oct	14-Sep ± 2.7	16-Sep
Cooper’s Hawk	24-Sep ± 3.3	22-Sep	11-Sep ± 1.7	16-Sep
Northern Goshawk	8-Oct ± 10.8	–	20-Sep ± 6.2	26-Sep
Red-tailed Hawk	27-Sep ± 2.6	25-Sep	18-Sep ± 3.9	10-Sep
Golden Eagle	5-Oct ± 4.9	5-Oct	1-Oct ± 2.4	3-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: 1999–2002 versus 2003.

	CAPTURE TOTALS		CAPTURE RATE ¹		CAPTURE SUCCESS ²	
	1999–2002 ³	2003	1999–2002 ³	2003	1999–2002 ³	2003
Northern Harrier	8 ± 4.7	11	1.4 ± 0.37	1.4	6.2 ± 4.2	16.7
Sharp-shinned Hawk	266 ± 158.9	394	48.8 ± 12.69	49.0	25.8 ± 16.2	82.6
Cooper's Hawk	81 ± 42.1	100	14.5 ± 3.81	12.4	33.3 ± 17.2	58.8
Northern Goshawk	12 ± 1.7	9	2.4 ± 1.23	1.1	44.7 ± 24.0	45.0
Red-tailed Hawk	18 ± 9.6	20	3.3 ± 0.46	2.5	4.1 ± 2.6	6.7
Rough-legged Hawk	1.0 ± 0.80	1	0.1 ± 0.14	0.1	2.8 ± 2.5	6.3
Golden Eagle	1 ± 0.9	4	0.1 ± 0.21	0.5	0.6 ± 0.9	2.6
American Kestrel	5.3 ± 4.48	17	1.1 ± 0.32	2.1	6.6 ± 6.1	45.9
Merlin	12 ± 8.1	25	2.3 ± 0.73	3.1	32.0 ± 19.4	108.7
Prairie Falcon	2 ± 1.5	4	0.4 ± 0.15	0.5	35.4 ± 20.9	20.0
Peregrine Falcon	0.5 ± 1.0	4	0.1 ± 0.21	0.5	16.7 ± 32.7	26.7
All species	406 ± 230.2	589	74.5 ± 17.60	73.3	18.7 ± 11.4	44.7

¹ Captures / 100 station hours.

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

³ Mean of annual values ± 95% confidence interval; 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: 2001–2002 versus 2003.

SPECIES	YEARS	FEMALE		MALE		FEMALE :	IMMATURE :
		HY	AHY	HY	AHY	MALE	ADULT
						RATIO	RATIO
Sharp-shinned Hawk	Avg. 2001–2002	156	50	164	31	1.1 ± 0.00 ¹	3.9 ± 0.95
	2003	172	46	149	27	1.2	4.4
Cooper's Hawk	Avg. 2001–2002	40	24	43	11	1.2 ± 0.33	2.5 ± 0.98
	2003	42	22	30	6	1.8	2.6
Northern Goshawk	Avg. 2001–2002	3	1	8	2	0.4 ± 0.52	7.2 ± 11.37
	2003	2	1	6	0	0.5	8.0
American Kestrel	Avg. 2001–2002	1	1	7	1	0.2 ± 0.11	5.8 ± 8.17
	2003	0	3	9	2	0.3	1.8

¹ Mean ± 95% CI.

Table 7. Foreign encounters of raptors banded at the Chelan Ridge Raptor Migration Project: 2000–2003.

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

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.

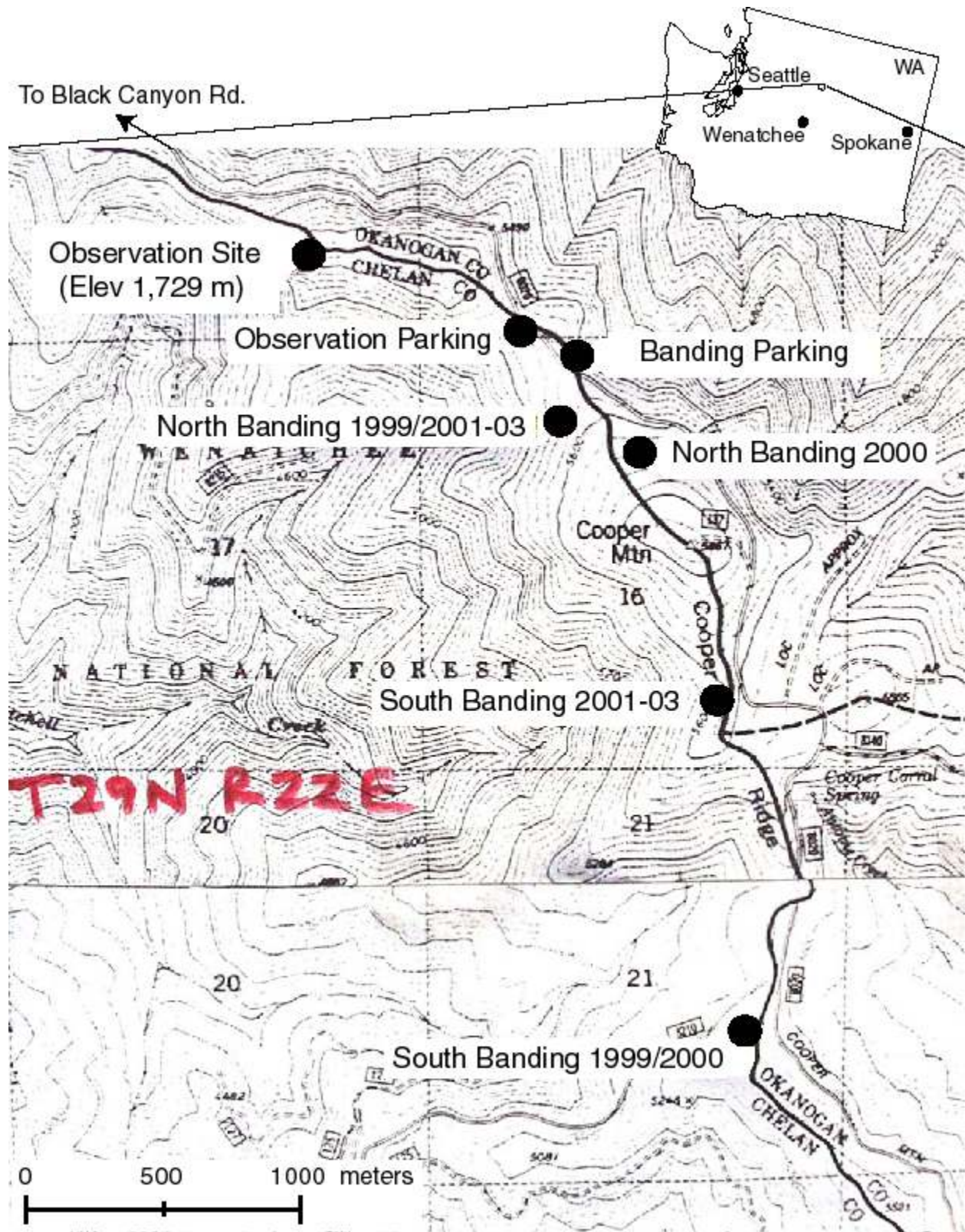


Figure 1. Location of the Chelan Ridge raptor migration count and banding sites in north-central Washington.

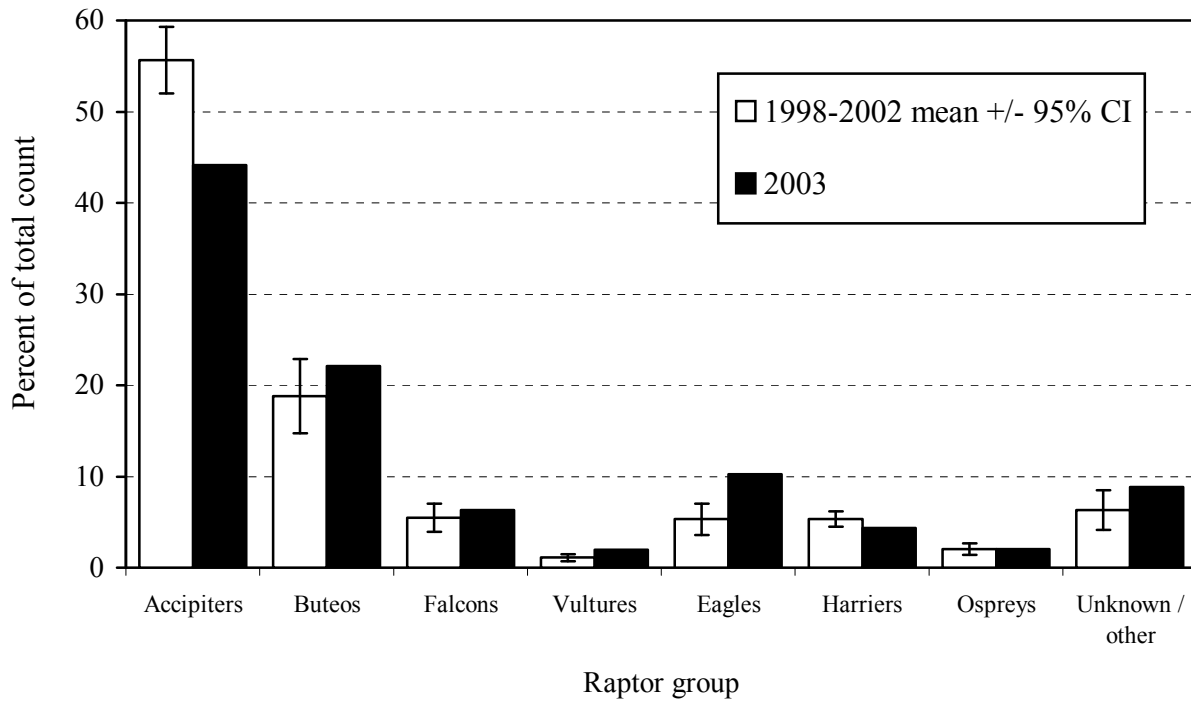


Figure 2. Fall raptor migration flight composition by major species groups at Chelan Ridge, WA: 1998–2002 versus 2003.

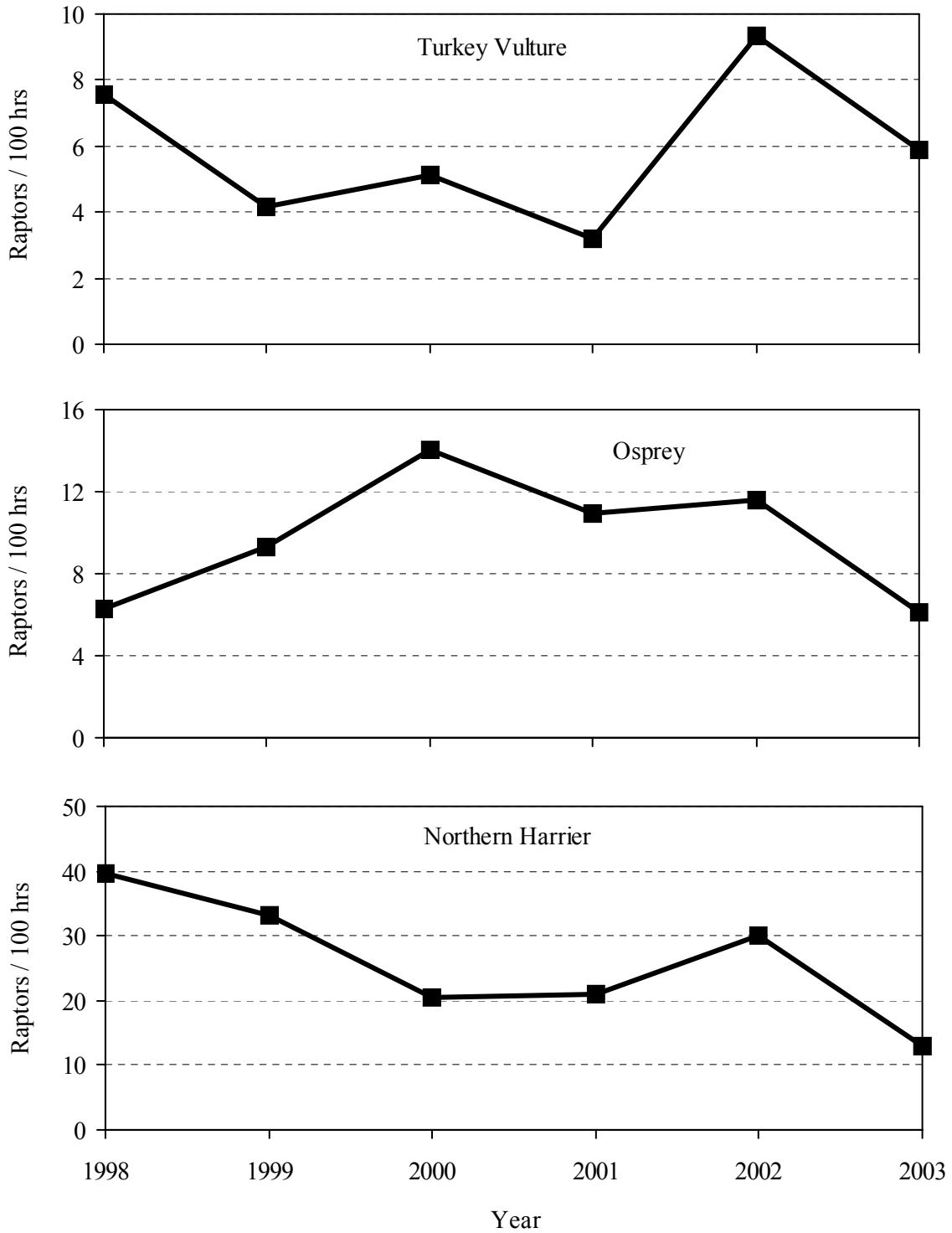


Figure 3. Fall-migration passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Chelan Ridge, WA: 1998–2003.

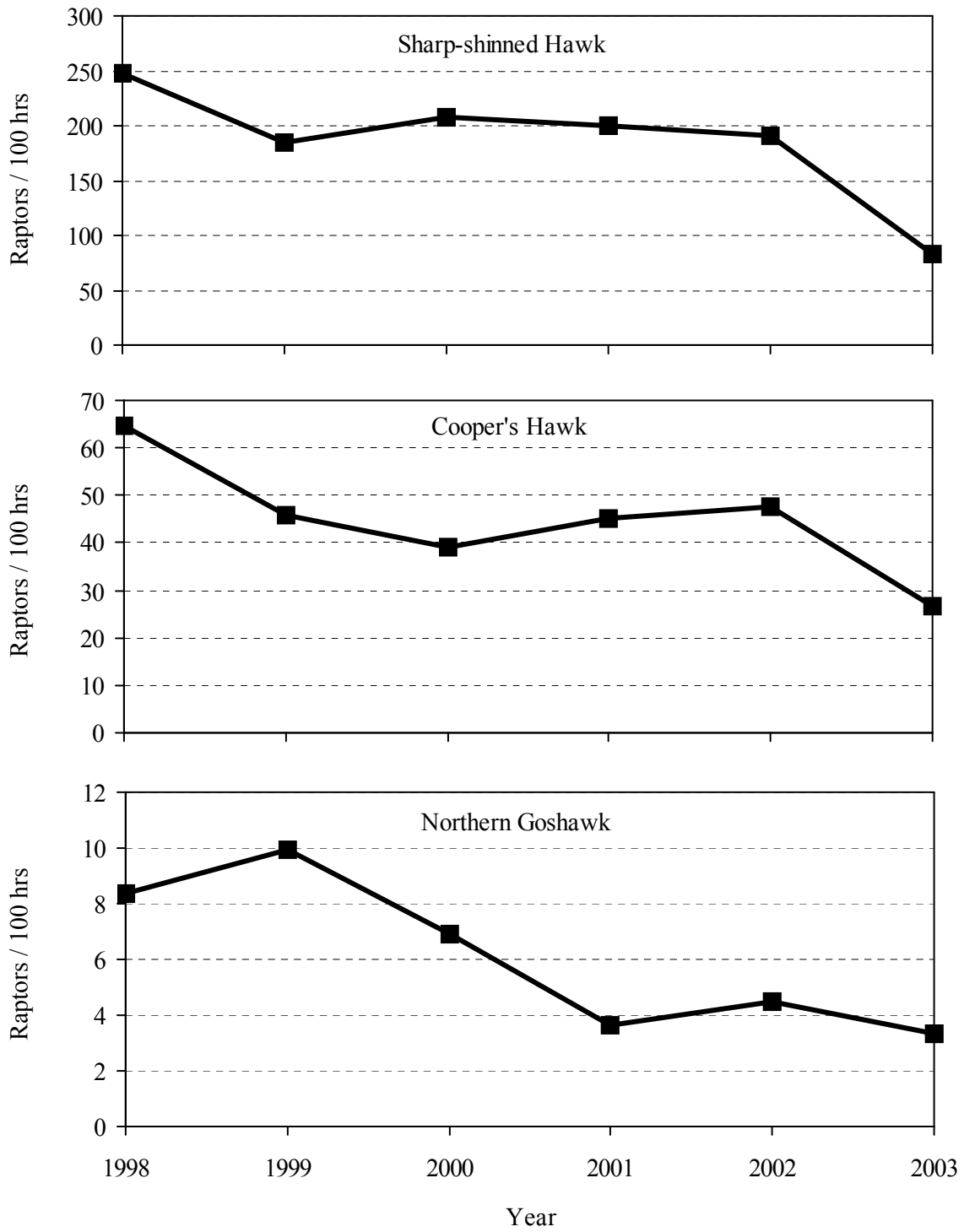


Figure 4. Fall-migration passage rates for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks at Chelan Ridge, WA: 1998–2003.

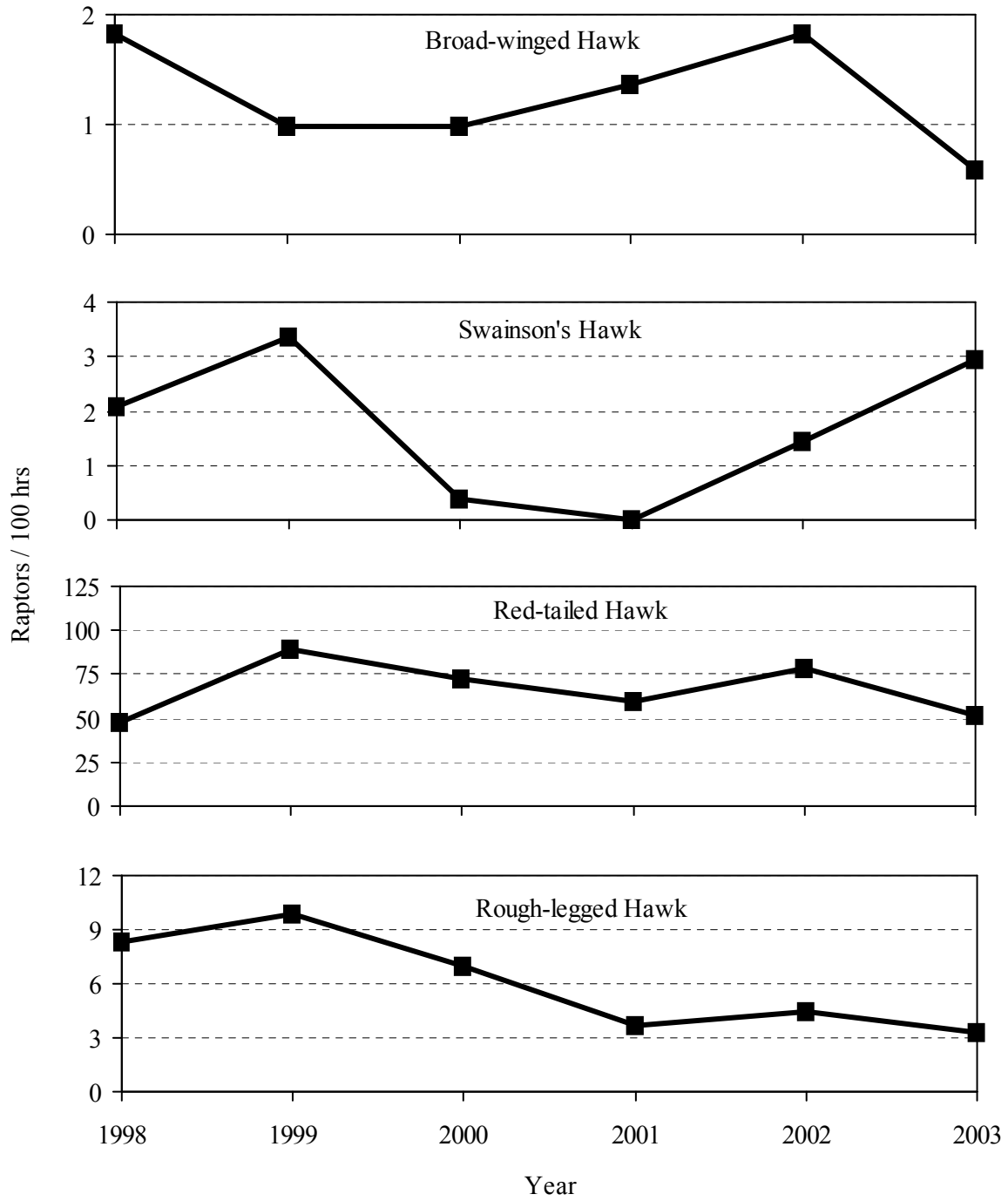


Figure 5. Fall-migration passage rates for Broad-winged, Swainson's, Red-tailed, and Rough-legged Hawks at Chelan Ridge, WA: 1998–2003.

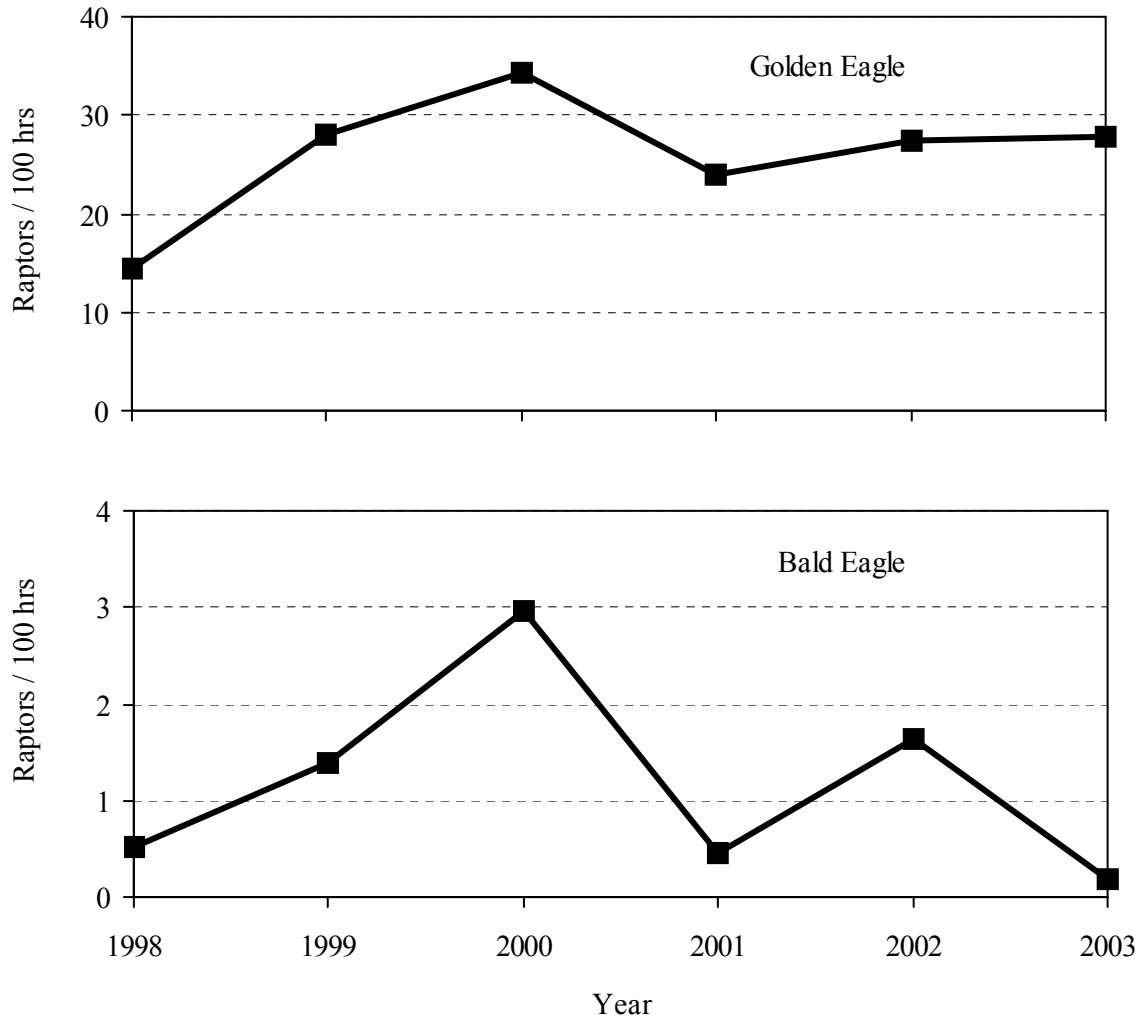


Figure 6. Fall-migration passage rates for Golden and Bald Eagles at Chelan Ridge, WA: 1998–2003.

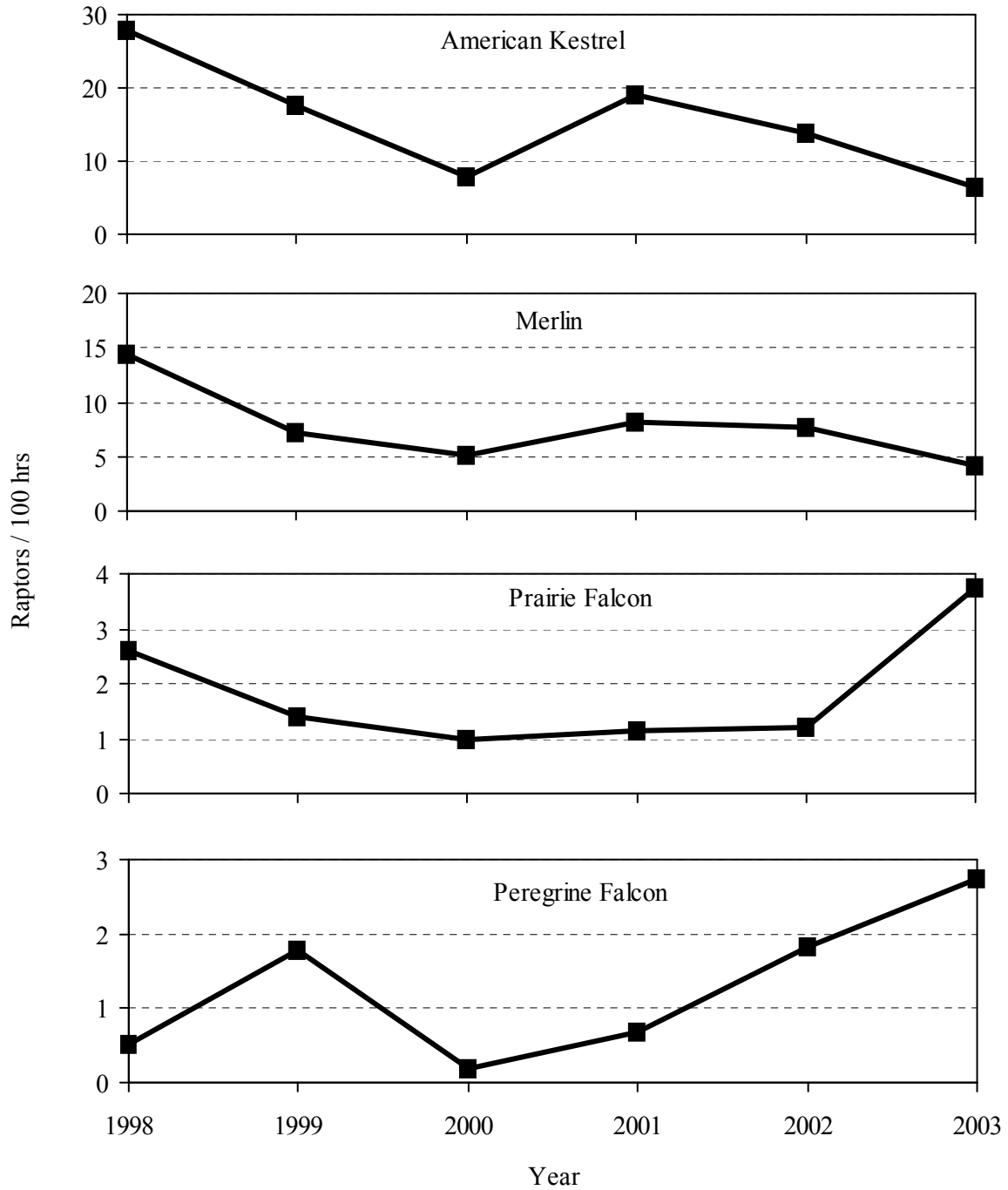


Figure 7. Fall-migration passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons at Chelan Ridge, WA: 1998–2003.

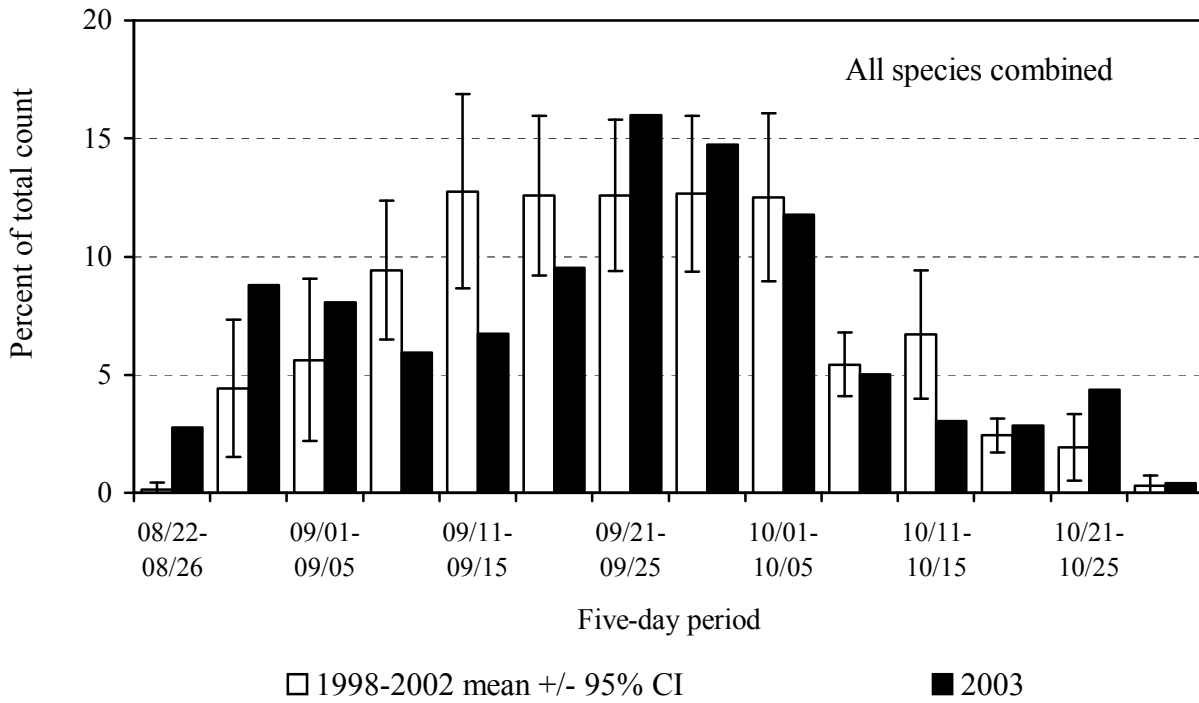


Figure 8. Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998–2002 versus 2003.

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 Look (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).

2003: Two observers throughout: Ben Kinkade (~1/2), Blake Mathys (0), 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
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: 2003.

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 / HOUR	BIRDS / HOUR
23-Aug	9.00	5.9	1.5	pc-mc, haze	12.9	se-sw	18.5	30.09	3	55	55	3	0.9
24-Aug	9.00	2.8	0	clr-pc, haze	11.5	sse-ssw	17.2	30.18	2	55	55	2	2.0
25-Aug	9.00	2.5	0	pc-clr, haze	8.7	sse-ssw	19.9	30.19	2	49	49	3	1.4
26-Aug	9.00	2.3	0	pc, haze	19.1	s-ssw	19.6	30.00	3	55	55	2	0.3
27-Aug	9.00	1.8	0	clr-mc, haze	4.4	wnw-nw/calm	16.3	30.07	3	55	41	3	1.2
28-Aug	8.50	2.0	0	clr-pc, haze	8.5	n, s	19.1	30.20	3	55	55	3	1.5
29-Aug	10.00	2.7	0	clr, haze	7.4	nw-n, calm, s-sw	20.6	30.33	2	44	44	2	3.1
30-Aug	9.50	2.6	0	clr-pc, haze	10.9	se-sw	21.0	30.28	2	41	40	2	5.4
31-Aug	9.50	2.3	1.5	clr, haze	9.6	calm-nw, s-sw	21.5	30.17	1	37	42	1	2.8
1-Sep	9.50	1.9	0	clr, haze	7.9	n-ne, ene-sse, n	20.5	30.22	3	42	49	2	1.4
2-Sep	9.00	2.0	0	clr, haze	7.0	nnw, ssw	22.3	30.28	2	45	36	2	3.2
3-Sep	9.00	1.9	0	clr, haze	12.9	se-ssw	24.2	30.22	3	37	33	2	2.9
4-Sep	9.00	1.9	0	ovc, haze	8.7	n-ne, se-ssw	24.7	30.15	4	33	34	2	2.0
5-Sep	9.00	1.9	0	clr, haze	11.4	sse-s	22.4	30.15	2	41	55	0	4.0
6-Sep	9.50	1.9	0	pc-mc, haze	12.9	ssw	24.4	30.04	2	50	55	0	1.3
7-Sep	9.50	1.8	0	ovc, haze	16.5	sw	16.8	29.89	3	43	37	2	1.6
8-Sep	5.00	2.0	0	ovc, haze, AM fog	13.3	sw	12.1	29.83	4	44	47	3	1.0
9-Sep	9.50	2.3	0	pc-mc, haze	5.5	calm, ssw-sw	12.6	29.79	3	48	55	3	4.0
10-Sep	9.50	2.6	0	mc-ovc, haze	16.1	sw	12.7	30.08	3	48	41	2	2.1
11-Sep	9.50	1.9	0	pc, haze	13.3	s-sw	13.5	30.06	3	48	50	3	1.3
12-Sep	8.50	2.0	0	pc, haze	1.6	var/calm	10.7	30.30	2	51	55	3	2.7
13-Sep	9.50	2.3	0	clr, haze	20.1	s-ssw	13.5	30.34	3	45	51	3	3.4
14-Sep	9.50	2.2	0	pc-ovc, haze	12.6	s-ssw	15.9	30.03	3	50	48	3	2.3
15-Sep	9.00	2.1	0	pc-ovc, haze	10.6	n, s-ssw	10.9	29.95	4	51	53	2	1.4
16-Sep	7.50	1.9	0	mc-ovc, AM haze, PM snow	6.8	ssw, nw, ssw	7.4	29.72	4	42	42	4	3.3
17-Sep	9.00	1.9	0	pc, haze	10.0	s-ssw	8.5	30.12	1	53	54	2	6.2
18-Sep	9.00	1.9	0	pc-ovc, haze, scat rain	19.9	s-ssw	10.2	30.07	3	50	33	2	0.9
19-Sep	9.50	1.9	0	pc-clr, haze/dust	9.0	s-ssw	12.9	29.97	3	53	51	1	3.2
20-Sep	9.50	1.9	0	clr, haze	12.7	se-ssw	12.1	30.16	3	49	54	2	2.6
21-Sep	10.00	1.8	0	clr-pc, haze	14.0	n, s-sw	12.3	30.26	2	50	53	2	6.1
22-Sep	9.00	2.0	0	clr, haze	8.2	s	16.4	30.10	3	55	55	1	3.9
23-Sep	9.50	3.4	0	pc, haze	2.1	calm, s-sw	16.2	30.08	2	44	54	3	5.8
24-Sep	9.00	2.7	0	clr-mc, haze	20.2	s	14.3	30.15	2	50	54	3	7.3
25-Sep	9.00	1.6	0	clr, haze	9.5	s-wsw	16.9	30.22	3	49	55	3	2.8
26-Sep	9.50	1.9	0	clr, haze	5.1	n, s/calm	18.5	30.34	2	41	52	2	2.7
27-Sep	9.50	2.1	0	clr, haze	6.1	nw-n, sw	17.7	30.31	2	49	48	3	6.0
28-Sep	9.50	2.2	0	clr, haze, AM fog	5.1	n, s, calm	18.0	30.19	1	42	52	2	4.4
29-Sep	9.25	1.9	0	clr, haze	4.8	n, s/calm, n	16.4	30.16	2	45	53	2	5.1
30-Sep	9.00	2.7	0	clr-pc, haze	7.8	nw-ne, sw	14.2	30.23	3	46	48	3	5.7
1-Oct	8.75	1.9	0	pc, haze	3.8	n, nw/calm	17.4	30.23	3	45	54	3	3.9
2-Oct	9.50	2.3	0	clr-pc, haze	11.1	nnw-nne	15.5	30.14	2	43	49	2	4.1
3-Oct	9.00	2.1	0	clr, haze	2.8	n/calm, s	17.0	30.11	2	42	50	2	3.7
4-Oct	9.00	2.5	0	clr, haze	2.6	sse/calm, sw	18.8	30.04	2	47	52	3	3.8

Appendix C. continued

DATE	OBS. HOURS	OBSRVR / HOUR ¹	MEDIAN		PREDOMINANT WEATHER ³	WIND		TEMP (°C) ¹	BAROM.	MEDIAN	VISIB.		MEDIAN	BIRDS / HOUR
			VISITOR DISTURB ²	FLIGHT DISTANCE ⁵		WIND DIRECTION	PRESS. (IN HG) ¹		THERMAL LIFT ⁴	WEST (KM) ¹	EAST (KM) ¹	FLIGHT DISTANCE ⁵ / HOUR		
5-Oct	9.50	2.5	0		pc-mc, haze	10.5	s-sw	18.6	30.10	3	45	44	3	4.0
6-Oct	9.00	2.7	0		pc-ovc, haze	13.7	s	17.2	29.96	3	48	47	2	5.1
7-Oct	4.50	1.6	0		mc, haze	16.8	s-ssw	8.8	29.86	4	52	50	2	0.7
8-Oct	2.00	1.0	0		mc, haze, fog/rain	21.0	ssw	5.7	29.67	4	43	42	1	1.0
9-Oct	8.50	1.6	0		ovc, haze, rain	17.1	ssw	5.9	29.84	4	54	51	2	0.9
10-Oct	9.50	1.9	0		clr-mc, haze	7.9	sw	6.7	30.01	3	50	52	3	1.8
11-Oct	0.00				ovc, fog/rain									
12-Oct	0.00				ovc, fog/rain									
13-Oct	9.00	1.1	0		pc-mc, haze	6.3	se-ssw	6.4	30.26	3	54	54	2	4.6
14-Oct	4.00	2.1	0		pc-ovc, haze, snow	1.0	sw/calm	6.0	30.09	4	50	50	3	1.3
15-Oct	0.00				ovc, fog/rain									
16-Oct	0.00				ovc, fog/rain									
17-Oct	0.00				ovc, rain									
18-Oct	6.00	1.5	0		ovc-mc, haze	18.0	s	12.9	29.98	4	50	49	2	2.3
19-Oct	8.75	1.7	0		pc-mc, haze	27.4	s	9.6	30.00	4	52	33	2	3.3
20-Oct	0.00				ovc, fog/rain									
21-Oct	6.50	1.4	0		pc, PM haze	17.1	s	15.4	30.30	3	58	46	2	1.1
22-Oct	7.83	2.2	0		mc-ovc, haze	10.8	s-ssw	14.2	30.01	4	25	16	3	1.5
23-Oct	8.16	2.0	0		clr, PM haze	9.2	sse-sw	4.4	30.27	4	60	45	3	2.0
24-Oct	8.50	1.3	0		pc-mc, haze	9.8	n, s	4.8	30.45	4	56	52	3	2.5
25-Oct	8.50	1.3	0		clr-pc, haze	6.6	sse-sw	9.5	30.60	3	50	53	2	1.2
26-Oct	8.00	1.2	0		clr-pc, haze	16.3	sw	14.3	30.53	3	46	54	2	0.8

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: 2003.

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
23-Aug	9.00	0	0	0	0	0	0	8	1	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	2	0	0	0	8	0.9
24-Aug	9.00	3	2	1	0	2	1	18	0	0	0	0	6	0	0	0	1	0	0	0	0	1	0	0	0	0	0	18	2.0	
25-Aug	9.00	5	0	0	0	0	1	13	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	2	13	1.4	
26-Aug	9.00	0	0	0	0	0	1	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0.3	
27-Aug	9.00	1	0	0	0	0	0	11	0	0	0	0	3	0	1	0	2	0	0	0	0	1	0	1	0	0	0	11	1.2	
28-Aug	8.50	0	0	0	0	1	2	13	0	1	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	13	1.5	
29-Aug	10.00	0	0	2	0	7	8	31	1	0	0	0	4	0	0	0	1	2	0	0	2	0	1	0	0	0	31	3.1		
30-Aug	9.50	2	1	3	0	7	3	51	1	1	0	0	12	0	2	0	0	2	0	8	0	2	0	0	0	0	1	51	5.4	
31-Aug	9.50	1	0	0	0	9	5	27	1	0	0	0	4	0	2	0	1	1	0	1	0	0	0	0	0	0	1	27	2.8	
1-Sep	9.50	1	0	0	0	3	1	13	1	0	0	0	3	0	0	0	0	1	0	1	0	0	0	0	0	0	1	13	1.4	
2-Sep	9.00	1	1	2	0	10	5	29	0	0	0	0	2	0	0	0	1	0	0	4	2	0	0	0	0	0	1	29	3.2	
3-Sep	9.00	0	0	1	0	12	5	26	0	2	0	0	3	0	0	0	0	0	0	2	0	0	0	0	0	0	0	26	2.9	
4-Sep	9.00	0	0	0	0	14	2	18	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	18	2.0	
5-Sep	9.00	0	0	1	0	17	4	36	0	3	0	0	3	0	0	0	1	0	0	2	1	1	0	1	0	0	2	36	4.0	
6-Sep	9.50	0	0	0	0	7	2	12	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	1.3	
7-Sep	9.50	0	1	0	0	3	0	15	1	0	1	0	2	0	0	0	3	1	0	1	0	0	0	0	0	0	0	15	1.6	
8-Sep	5.00	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1.0	
9-Sep	9.50	0	2	0	0	5	2	38	0	0	1	0	15	0	2	1	1	2	0	1	1	0	0	0	0	0	0	38	4.0	
10-Sep	9.50	0	3	2	0	7	0	20	0	0	1	0	1	4	0	0	0	0	0	0	1	0	0	0	0	0	0	20	2.1	
11-Sep	9.50	0	0	1	0	2	1	12	0	1	0	0	1	0	2	0	3	0	0	0	0	0	0	0	0	0	0	12	1.3	
12-Sep	8.50	0	1	0	0	4	6	23	3	1	0	0	4	0	0	0	0	1	0	1	0	1	0	0	0	0	0	23	2.7	
13-Sep	9.50	0	0	3	0	9	2	32	0	1	3	1	2	0	0	0	8	0	0	0	0	0	0	0	0	0	0	32	3.4	
14-Sep	9.50	0	0	1	0	10	1	22	0	1	0	0	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	22	2.3	
15-Sep	9.00	0	0	4	0	5	1	13	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	13	1.4	
16-Sep	7.50	0	0	1	0	4	2	25	1	0	1	0	4	0	1	0	1	0	0	0	0	1	1	0	1	0	0	25	3.3	
17-Sep	9.00	1	1	0	0	25	8	56	1	0	1	0	8	0	1	0	2	1	0	0	1	2	1	0	0	0	1	56	6.2	
18-Sep	9.00	1	1	0	0	3	0	8	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	8	0.9	
19-Sep	9.50	0	1	1	0	15	6	30	0	0	0	0	2	0	0	0	0	0	0	0	1	2	0	0	0	0	1	30	3.2	
20-Sep	9.50	0	1	3	0	5	2	25	1	0	2	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	25	2.6	
21-Sep	10.00	0	1	2	0	11	8	61	0	2	0	0	13	9	0	1	0	6	0	4	2	0	0	0	0	0	0	61	6.1	
22-Sep	9.00	3	0	1	0	15	2	35	2	0	0	1	8	0	0	0	1	0	0	0	1	0	0	0	0	0	0	35	3.9	
23-Sep	9.50	0	1	4	0	16	6	55	3	1	2	0	8	0	5	0	3	1	0	0	0	0	0	0	0	0	0	55	5.8	
24-Sep	9.00	5	4	3	0	25	3	66	0	1	0	0	13	0	2	0	0	2	0	2	1	1	0	0	0	0	0	66	7.3	
25-Sep	9.00	0	0	0	0	3	2	25	0	1	0	0	8	0	4	0	1	0	0	0	0	1	1	0	0	0	0	25	2.8	
26-Sep	9.50	0	2	2	0	4	3	26	0	0	0	1	7	0	0	0	3	1	0	0	2	0	0	0	0	0	0	26	2.7	
27-Sep	9.50	1	1	3	0	5	6	57	3	0	1	0	16	0	4	0	2	2	0	0	0	0	0	0	0	0	0	57	6.0	

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
28-Sep	9.50	3	0	3	0	8	7	42	2	0	1	0	0	10	0	0	0	2	1	0	0	0	1	0	0	0	0	1	42	4.4
29-Sep	9.25	1	0	3	0	19	7	47	4	0	0	0	0	5	0	0	0	3	0	0	3	0	1	0	0	0	0	1	47	5.1
30-Sep	9.00	0	2	2	0	11	1	51	4	1	0	0	0	3	0	1	0	13	0	0	1	0	0	5	0	0	0	0	51	5.7
1-Oct	8.75	1	0	1	0	12	4	34	0	0	0	0	0	8	0	2	0	3	1	0	0	1	0	0	1	0	0	0	34	3.9
2-Oct	9.50	0	0	2	0	16	4	39	1	0	0	0	0	6	0	1	0	4	4	0	0	0	0	0	0	0	0	0	39	4.1
3-Oct	9.00	0	0	1	0	9	3	33	1	0	2	0	0	4	0	0	0	8	1	0	0	0	0	0	0	0	0	0	33	3.7
4-Oct	9.00	0	2	2	1	4	0	34	3	0	0	0	0	7	0	0	0	8	1	0	0	0	1	0	0	0	0	1	34	3.8
5-Oct	9.50	0	0	4	0	10	0	38	0	0	0	0	0	9	0	2	0	9	0	0	0	0	0	1	0	1	0	0	38	4.0
6-Oct	9.00	0	0	2	0	15	3	46	1	0	0	0	0	8	0	0	1	10	1	0	0	3	0	0	0	0	0	0	46	5.1
7-Oct	4.50	0	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0.7
8-Oct	2.00	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	1.0
9-Oct	8.50	0	0	0	0	3	0	8	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	8	0.9
10-Oct	9.50	0	0	0	0	2	1	17	0	0	0	0	0	4	0	0	2	6	0	0	0	1	0	0	0	0	0	0	17	1.8
11-Oct	0.00																													
12-Oct	0.00																													
13-Oct	9.00	0	0	1	0	14	1	41	0	0	0	0	9	0	0	0	8	2	0	0	0	0	0	0	0	0	0	0	41	4.6
14-Oct	4.00	0	0	0	0	2	1	5	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1.3
15-Oct	0.00																													
16-Oct	0.00																													
17-Oct	0.00																													
18-Oct	6.00	0	0	0	0	6	1	14	1	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	14	2.3
19-Oct	8.75	0	0	3	0	6	0	29	1	0	0	0	6	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	29	3.3
20-Oct	0.00																													
21-Oct	6.50	0	0	0	0	4	0	7	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	7	1.1
22-Oct	7.83	0	0	0	0	7	1	12	0	0	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	12	1.5
23-Oct	8.16	0	0	0	0	4	0	16	0	0	0	0	5	0	0	0	3	0	0	0	0	1	1	0	0	0	0	0	16	2.0
24-Oct	8.50	0	0	0	0	2	1	21	0	0	0	0	2	0	2	2	7	0	1	0	0	0	0	0	0	0	0	0	21	2.5
25-Oct	8.50	0	0	1	0	0	0	10	0	0	0	0	2	0	1	4	1	0	0	0	0	0	0	0	0	0	0	0	10	1.2
26-Oct	8.00	0	1	0	0	1	0	6	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	6	0.8
Total	483.24	27	28	65	1	418	135	1481	39	17	17	3	15	256	0	36	12	138	39	1	33	20	18	12	4	2	0	14	1481	3.1

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: 1997–2003.

	1997	1998	1999	2000	2001	2002	2003	1998-'02 MEAN
Start Date	5-Sep	27-Aug	27-Aug	27-Aug	27-Aug	25-Aug	23-Aug	25-Aug
End Date	11-Oct	21-Oct	27-Oct	5-Nov	22-Oct	25-Oct	26-Oct	25-Oct
Observation days	29	53	61	67	55	62	59	60
Observation hours	204.60	382.92	504.33	505.75	439.00	491.28	509.24	472.09
Raptors / 100 hours	691.1	620.2	571.2	481.3	470.4	522.1	297.1	493.8
SPECIES	RAPTOR COUNTS							
Turkey Vulture	4	29	21	26	14	46	30	28
Osprey	41	24	47	71	48	57	31	46
Northern Harrier	115	152	167	104	91	148	66	122
White-tailed Kite						0	1	0
Sharp-shinned Hawk	311	949	932	1050	878	937	421	861
Cooper's Hawk	150	247	232	198	198	234	136	208
Northern Goshawk	38	32	50	35	16	22	17	29
Unknown small accipiter ¹					98	85	40	74
Unknown large accipiter ¹					0	10	17	9
Unknown accipiter	182	221	248	98	0	49	36	109
TOTAL ACCIPITERS	681	1449	1462	1381	1190	1337	667	1248
Broad-winged Hawk	2	7	5	5	6	9	3	6
Swainson's Hawk	0	8	17	2	0	7	15	8
Red-tailed Hawk	145	182	450	364	263	386	263	318
Ferruginous Hawk	0	0	0	1	0	0	0	0
Rough-legged Hawk	1	13	44	53	13	45	14	30
Unidentified buteo	75	58	148	97	83	82	39	85
TOTAL BUTEOS	223	268	664	522	365	529	334	447
Golden Eagle	105	55	141	174	105	135	142	125
Bald Eagle	2	2	7	15	2	8	1	6
Unidentified eagle	7	0	7	5	1	0	12	4
TOTAL EAGLES	114	57	155	194	108	143	155	135
American Kestrel	24	107	89	40	84	68	33	70
Merlin	17	55	36	26	36	38	21	35
Prairie Falcon	2	10	7	5	5	6	19	9
Peregrine Falcon	5	2	9	1	3	9	14	6
Unknown small falcon ¹					6	4	6	5
Unknown large falcon ¹					1	2	2	2
Unknown falcon	10	6	6	2	2	0	0	3
TOTAL FALCONS	58	180	147	74	137	127	95	127
Unidentified Raptor	178	216	218	62	112	178	134	153
GRAND TOTAL	1414	2375	2881	2434	2065	2565	1513	2306

¹ Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2003.

DATE	STN.	SPECIES ¹											CAPTURES	
	HOURS	NH	SS	CH	NG	RT	RL	GE	AK	ML	PR	PG	TOTAL	/ STN HR
23-Aug	2.00	0	0	1	0	0	0	0	0	0	0	0	1	0.5
24-Aug	9.00	0	2	0	0	0	0	0	0	0	0	0	2	0.2
25-Aug	9.00	0	0	2	0	0	0	0	0	0	0	0	2	0.2
26-Aug	9.25	0	0	1	0	0	0	0	0	1	0	0	2	0.2
27-Aug	9.00	0	2	2	0	0	0	0	1	0	0	0	5	0.6
28-Aug	13.08	0	11	1	0	0	0	0	1	1	0	0	14	1.1
29-Aug	18.00	0	3	4	0	1	0	0	0	0	0	1	9	0.5
30-Aug	18.75	1	6	3	0	0	0	0	4	0	1	0	15	0.8
31-Aug	18.00	0	12	5	0	1	0	0	2	0	0	0	20	1.1
1-Sep	18.50	0	11	1	0	1	0	0	1	0	0	0	14	0.8
2-Sep	17.75	0	15	6	0	0	0	1	0	2	0	0	24	1.4
3-Sep	13.25	0	15	0	0	0	0	0	1	0	0	0	16	1.2
4-Sep	17.00	0	15	3	0	0	0	0	2	1	0	0	21	1.2
5-Sep	17.00	0	11	7	0	0	0	0	0	1	0	0	19	1.1
6-Sep	18.00	0	24	1	0	0	0	0	0	0	0	0	25	1.4
7-Sep	17.00	0	7	2	0	0	0	0	0	0	0	0	9	0.5
9-Sep	17.75	0	12	4	0	0	0	0	1	0	0	0	17	1.0
10-Sep	14.50	0	3	1	0	0	0	0	0	0	0	0	4	0.3
11-Sep	11.25	0	5	2	0	0	0	0	2	0	0	0	9	0.8
12-Sep	17.75	0	24	2	1	1	0	0	0	1	0	0	29	1.6
13-Sep	17.50	1	17	5	0	0	0	0	0	2	1	0	26	1.5
14-Sep	17.50	0	17	2	0	0	0	0	1	0	0	0	20	1.1
15-Sep	14.00	0	6	0	0	1	0	0	1	0	0	0	8	0.6
16-Sep	14.50	0	5	1	0	1	0	0	0	0	0	0	7	0.5
17-Sep	18.00	0	24	6	0	1	0	0	0	0	0	2	33	1.8
18-Sep	17.50	0	6	5	0	0	0	0	0	0	1	0	12	0.7
19-Sep	18.90	0	13	6	0	1	0	0	0	2	0	0	22	1.2
20-Sep	18.25	0	9	2	0	0	0	0	0	1	0	0	12	0.7
21-Sep	13.00	0	13	3	0	0	0	0	0	2	0	0	18	1.4
22-Sep	12.75	0	6	4	0	0	0	0	0	2	0	0	12	0.9
23-Sep	18.50	2	9	4	0	1	0	0	0	2	0	0	18	1.0
24-Sep	18.25	1	7	2	1	0	0	0	0	1	1	0	13	0.7
25-Sep	16.08	1	6	2	0	2	0	0	0	1	0	0	12	0.7
26-Sep	18.00	0	3	3	0	0	0	0	0	1	0	0	7	0.4
27-Sep	11.25	0	2	0	0	0	0	0	0	0	0	0	2	0.2
28-Sep	17.00	0	7	1	0	0	0	0	0	0	0	0	8	0.5
29-Sep	16.25	1	10	0	0	0	0	0	0	0	0	0	11	0.7
30-Sep	15.75	0	3	0	0	0	0	0	0	0	0	0	3	0.2

Appendix F. continued

DATE	STN.	SPECIES ¹											CAPTURES	
	HOURS	NH	SS	CH	NG	RT	RL	GE	AK	ML	PR	PG	TOTAL	/STN HR
1-Oct	17.00	0	8	3	1	0	0	0	0	0	0	0	12	0.7
2-Oct	16.75	0	2	0	0	0	0	0	0	0	0	0	2	0.1
3-Oct	16.25	1	7	0	0	0	1	0	0	0	0	0	9	0.6
4-Oct	16.75	0	3	0	0	2	0	0	0	0	0	1	6	0.4
5-Oct	15.00	1	3	1	1	1	0	1	0	0	0	0	8	0.5
6-Oct	16.75	0	10	2	0	1	0	0	0	1	0	0	14	0.8
7-Oct	4.25	0	0	0	0	0	0	0	0	0	0	0	0	0.0
8-Oct	0.00													
9-Oct	7.25	0	0	0	1	2	0	0	0	0	0	0	3	0.4
10-Oct	15.25	1	3	0	0	0	0	1	0	0	0	0	5	0.3
11-Oct	0.00													
12-Oct	0.00													
13-Oct	13.75	1	5	0	0	0	0	1	0	1	0	0	8	0.6
14-Oct	13.00	0	2	0	2	0	0	0	0	0	0	0	4	0.3
15-Oct	0.00													
16-Oct	0.00													
17-Oct	0.00													
18-Oct	12.25	0	2	0	1	0	0	0	0	0	0	0	3	0.2
19-Oct	15.50	0	5	0	0	2	0	0	0	0	0	0	7	0.5
20-Oct	0.00													
21-Oct	12.00	0	1	0	1	0	0	0	0	1	0	0	3	0.3
22-Oct	8.25	0	2	0	0	1	0	0	0	1	0	0	4	0.5
23-Oct	8.25	0	0	0	0	0	0	0	0	0	0	0	0	0.0
24-Oct	8.25	0	0	0	0	0	0	0	0	0	0	0	0	0.0
25-Oct	8.00	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Total	803.31	11	394	100	9	20	1	4	17	25	4	4	589	0.7

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: 1999–2003.

	1999 ¹	2000 ¹	2001	2002	2003	MEAN	TOTAL
First trapping day	28-Aug	2-Sep	30-Aug	27-Aug	23-Aug		
Last trapping day	16-Oct	14-Oct	17-Oct	19-Oct	25-Oct		
Number of stations	2	2	2	2	2	2	
Trapping days	47	42	44	54	56	49	
Station hours	388	?	612.75	837.25	803.31	660.33	
Captures / stn. hour	5.7	?	8.6	8.1	7.3	7.4	
SPECIES	RAPTOR CAPTURES						
Northern Harrier	4	3	10	13	11	8.2	41
Sharp-shinned Hawk	139	125	341	459	394	292	1458
Cooper's Hawk	42	46	107	127	100	84	422
Northern Goshawk	14	10	12	13	9	12	58
Red-tailed Hawk	11	8	22	29	20	18	90
Rough-legged Hawk	0	1	1	2	1	1.0	5
Golden Eagle	0	1	2	0	4	1	7
American Kestrel	3	0	8	10	17	8	38
Merlin	6	4	17	21	25	15	73
Prairie Falcon	1	1	3	4	4	3	13
Peregrine Falcon	0	0	2	0	4	1	6
All species	220	199	525	678	589	442	2211
Recaptures ²	0	0	0	0	0	0	0
Foreign Recaptures ³	0	0	0	1	0	<1	1
Foreign Encounters ⁴	0	1	5	2	1	2	9

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.