

**FALL 2006 RAPTOR MIGRATION STUDIES
AT CHELAN RIDGE, WASHINGTON**



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Salt Lake City, Utah**



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Winthrop, Washington**

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INTRODUCTION

The Chelan Ridge Raptor Migration Project in north-central Washington is an ongoing effort to monitor long-term trends in populations of raptors using this north Cascades migratory flyway. HawkWatch International (HWI), in partnership with the Okanogan and Wenatchee National Forests (OWNF), initiated standardized counts of the autumn raptor migration through this region in 1997, with full-season counts commencing in 1998. In cooperation with HWI and OWNF, the Falcon Research Group (FRG) initiated a trapping and banding program at the site in 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 2006 season marked the 9th consecutive, full-season count and the 8th consecutive season of banding at the site. This report summarizes the 2006 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 2006. The primary objective of these efforts is to track long-term population trends of diurnal raptors in western North America and around the Gulf Coast region (Ruelas I. et al. 2000, Smith and Hoffman 2000, Smith et al. 2001, Hoffman et al. 2002, Hoffman and Smith 2003, Lott 2006). 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 seasonal observers, banders, and on-site educator, play a critical role in coordinating educational opportunities at the site.

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 crew in 1999 and by HWI since 2001. 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 official, full-season observer Angela Sjollema’s second season of migration counting (see Appendix A for a complete history of observer participation). Past HWI observer Steve Siebel, with at least five partial or full seasons of prior migration counting experience, started as the second full-time observer on 15 September. Before Steve’s arrival, other former HWI observers and current crewmembers rotated duties as the second observer. Long-time project affiliate and former full-time Chelan observer Richard Hendrick, also ably assisted on a regular basis. Other USFS and HWI 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.

Calculation of “adjusted” (to standardize sampling periods and adjust for incompletely identified birds) passage rates (migrants counted per 100 hours of observation) and analysis of trends follows Hoffman and Smith (2003). In comparing 2006 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2006 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, dhogaza 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, usually much quicker.

RESULTS AND DISCUSSION

WEATHER

The project was shut down on 26 October, one day earlier than hoped for, due to expectations of heavy snowfall (see Appendix C for daily weather records). Inclement weather entirely precluded two other days of observation during the 2006 season, which is fewer than the 1998–2005 average of 3 days, and only one other was reduced to ≤ 4 hours of observation, which is also slightly lower than average (2 days). Weather data collected on site during active observation periods indicated that 50% of the active days featured predominantly fair skies, 36% transitional skies (i.e., changed from fair or partly cloudy to mostly cloudy or overcast during the day, or vice versa), and 14% mostly cloudy to overcast skies. The comparable 1997–2005 averages are 51% fair, 28% transitional and 21% mostly cloudy to overcast. The proportion of active fair and transitional weather days that featured noteworthy levels of visibility reducing fog and/or haze (42% and 18% respectively) was substantially above the long-term averages of 20% and 9%, respectively. In contrast, the proportion of active observation days that featured some rain or snow (12%) was about average (13%). These statistics suggest that reduced-visibility conditions were less associated with bouts of inclement weather in 2006 than usual and instead were due mostly to wildfire smoke and other haze-related factors.

Similar to 2002 and 2003, especially, when the prevalence of visibility reducing fog and particularly haze (mostly from wildfire smoke) was well above average, the proportion of such days in 2006 was a record high (68% vs. 37%). Interestingly, however, the average east and west visibility ratings remained relatively high (71 km E, 63 km W vs. 1998–2005 averages of 47 km).

In 2006, light winds (< 12 kph) prevailed on 74% of the active observation days, moderate winds on 26%, and strong winds (≥ 29 kph) on 0% of the active days (1998–2005 averages: 70%, 28%, and 2%). In terms of wind directions, 2006 was dissimilar to 2004 and 2005 in that some variant of S–W (steady S–

W, S–W calm/variable, and mixed S–W and N–E winds) winds prevailed significantly more often than usual (32% combined versus 18% of the active days). Steadier S–SW winds are usually the most common (42% in 2006), with the range of prevalence varying from 21–53% depending on the year. Patterns such as variable NW–NE, N–E, and SW–SE winds were correspondingly more common, especially from 1999–2003. Calm to variable winds predominated on a record high 16% of active observation days, compared to the 1998–2005 average of 6%.

The temperature during active observation periods averaged 13.3°C (the average of daily values, which in turn were averages of hourly readings), ranging from 4.3–27.4°C. The overall range was among the highest yet recorded, ranking second compared to 2005, and the average was one degree higher than the long-term grand average (12.3°C). In 2006, 48% of the active days were classified as featuring predominantly good-to-excellent thermal-lift ratings, which is slightly higher than the long-term average of 39%.

In summary, although inclement weather deterred our 2006 observers at a below average level, transitional weather was more prevalent than usual. The season featured much visibility reducing fog and haze, and temperature readings extended a steady warming trend since 1999. While smoke and haze were prevalent, similar to 2002 and 2003, visibility distances remained high. Wind speeds shifted back in favor of light winds, as opposed to moderate winds in 2005, while some type of variable S–W winds and overall calm/variable winds were more common than usual and the more typical steadier S–SW winds less common than usual. The combination of slightly warmer weather and lighter winds likely contributed to increased thermal lift ratings.

OBSERVATION EFFORT

Observations occurred on 64 of 66 possible days between the scheduled observation period of 24 August through 27 October. The number of observation days and hours (512.00) were both 7% above the 1998–2005 averages of $60 \pm 95\%$ CI of 3.0 days and 480.32 ± 31.65 hours, with the difference in days barely significant. The 2006 average of 2.0 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was a non-significant 1% higher than the 1998–2005 average of 1.9 ± 0.08 observers/hour.

FLIGHT SUMMARY AND TRENDS

The observers counted 2,349 migrating raptors of 16 species during the 2006 season (Table 1; see Appendix D for daily count records), which is a non-significant 10% higher than the 1998–2005 average (see Appendix E for annual count summaries). The flight consisted of 54% accipiters, 19% buteos, 7% eagles, 5% harriers, 4% falcons, 2% vultures, 2% Ospreys, and 2% unknown or other raptors (Figure 2). The proportions of falcons and unknown raptors were significantly below average, whereas the proportions of buteos and vultures were significantly above average. The most common species seen in 2006 were the Sharp-shinned Hawk (36% of the total count), Red-tailed Hawk (19%), Cooper’s Hawk (12%), Golden Eagle (7%), and Northern Harrier (5%). All other species each comprised less than 3% of the total count.

The count of Peregrine Falcons rose to a record high of 20 birds, whereas the American Kestrel count fell to a record low of 29 birds, accounting for the low proportion of falcons (Appendix E). Adjusted passage rates were significantly above average only for Peregrine Falcons in 2006, whereas passage rates were not significantly below average for any species (Table 1).

Population Trends.—Nine years of full-season data is still too short a duration to attach much significance to documented trends; nevertheless, comparisons across species and with data from other longer-term monitoring projects in the West are instructive. Regression analyses of trends in adjusted

passage rates between 1998 and 2006 indicated marginally ($P \leq 0.10$) to highly ($P \leq 0.01$) significant linear declining trends for Sharp-shinned Hawks (Figure 4), Broad-winged Hawks (Figure 5), and American Kestrels (Figure 7), whereas a significant linear increasing trend was indicated for Peregrine Falcons (Figure 7). A marginally significant, trough-shaped quadratic trend was shown for Northern Harriers, tracking a declining pattern between 1998 and 2003, but a recent upswing (Figure 3). Though not captured by statistically significant regressions, similar patterns were evident for Turkey Vultures, Sharp-shinned Hawks, and Cooper's Hawks (Figures 3 and 4). Both Ospreys and Red-tailed Hawks also showed distinct declining trends between 2000 and 2005, but the 2006 counts rose again to at least moderately high levels (Figure 3).

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 after 1998 (Hoffman and Smith 2003). In particular, overall counts have been very low for the past four years in the heart of the drought-stricken Great Basin at HWI's monitoring site in the Goshute Mountains of northeastern Nevada (Smith and Neal 2007a), and the count in the Grand Canyon of Arizona farther south along the same flyway plummeted to record lows in 2005 and again in 2006 (Smith and Neal 2007b). 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, and more evidence of "recovery" was shown in the 2006 counts at Chelan than in 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. The drought has also become more severe in the northeastern Cascades in the last two years, whereas moisture levels finally began rebounding in the northern Great Basin in 2004 and especially 2005.

We have now recorded three instances of migrants being caught at both Chelan Ridge and at HWI's Bonney Butte migration site farther south in the Cascades of northern Oregon, and several of HWI's satellite-tracked raptors have passed near both sites. Thus, 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 is particularly noteworthy that counts and passage rates at the two sites over the past several years have followed highly divergent patterns. Counts were high at Chelan but low at Bonney Butte in 2002 (see Smith and Neal 2006c), then counts jumped to record highs at Bonney Butte in 2003 and 2005 while counts dropped to record lows at Chelan, and finally the overall count rose again by 10% at Chelan in 2006 but dropped by 9% at Bonney Butte in 2006.

One possible explanation for these divergent patterns concerns regional flight-line shifts. After three years of severe drought, counts in the Goshute Mountains in the heart of the Great Basin plummeted in 2002 from ~20,000 to ~11,000 migrants per season (Smith and Neal 2007a), coincident with near-record high counts commencing at Bonney Butte in 2003 and 2004 at the same time that counts at Chelan Ridge remained at low levels. We suspected that a logical diversion path for migrants moving south through eastern Washington and northern Idaho to use to avoid the parched Great Basin would be to veer west through the Blue and Wallowa Mountains and over to the Cascades, with Mt. Hood as a navigation target. This would result in those migrants intersecting the Cascades just north of Bonney Butte, and might explain the high counts at Bonney Butte despite low counts farther north in the Washington Cascades. Counts at Idaho Bird Observatory's site near Boise have also remained high in the last few years (G. Kaltenecker personal communication) while the counts dropped in the Goshutes several hundred kilometers farther south, again suggesting the possibility that some migrants have been diverting west out of Idaho before passing down through the heart of the Great Basin. Winter/spring moisture

levels finally began to rebound in the northern Great Basin in 2004 and especially 2005, whereas drought conditions intensified during 2004 and remained fairly severe through early winter 2005 in the northern Cascades before conditions rebounded to above-average snowpack by spring 2006. It is therefore possible that the 2006 drop in the Bonney Butte count indicates that raptors either remained further north or shifted migration activity along the eastern Cascades before heading west along the coast, particularly accipiters. Near record low counts at Boise Ridge, the Goshutes, and Grand Canyon in 2006 would seem to confirm this. Nonetheless, it appears we will need to await additional years of data to clarify our understanding of regional dynamics.

Age Ratios as Indicators of Regional Productivity.—Five of nine species for which comparisons of immature : adult ratios were possible showed higher than average ratios in 2006, with the differences significant for Sharp-shinned Hawks, Cooper’s Hawks, Northern Goshawks, Golden Eagles, and Bald Eagles (Table 2). Age ratios for Broad-winged Hawks were slightly below average, but low overall counts preclude attaching much significance to these comparisons. The Northern Goshawk experienced the most significant increase in age ratio in 2006, with the count of immature birds 372% above average. This suggests that, although the overall count and passage rate for this species were only slightly above average, it was probably a very productive year for goshawks in the northern Pacific Northwest in 2006.

Seasonal Timing.—The combined-species median passage date of 23 September was a non-significant 1 day later than the 1998–2005 average (Table 3). Similar to 2003–2005, the seasonal distribution of activity in 2006 was atypical compared to previous years in showing a bimodal pattern, with proportionately higher than usual activity during the 6–10 September and 21–25 September five-day periods, but significantly below-average activity in between (Figure 8). The low mid-September activity corresponded to one of only two rain and snow events of the season, which occurred on 14 September.

At the species level, Ospreys, Northern Harriers, Northern Goshawks, Red-tailed Hawks, Golden Eagles, and Merlins showed significantly later than average median passage dates in 2006, whereas only Prairie Falcons showed significantly earlier than average timing in 2006. Most other species showed median passage dates that were within five days of average. Age-specific data revealed two noteworthy clarifications: 1) the indicator of late species-level passage for Northern Goshawks primarily reflected late passage of immature birds; and 2) the indicator of late species-level passage for Red-tailed Hawks also primarily reflected late passage of immature birds (Table 4).

RESIDENT RAPTORS

A few adult accipiters were seen hunting around observation at the beginning of the season and were recorded as residents, but their presence was too intermittent to provide a precise estimate of when they departed.

One male American Kestrel made quite a few appearances hovering over the trail to observation through mid-September. It was seen hunting quite a bit, especially in late morning. A female was never seen with him. He was inconsistent, not seen every day, so sometimes it was difficult to determine whether it was the same bird.

A family of light-morph Red-tailed Hawks, including one immature bird and a pair of adults, also were resident in the Mitchell Creek drainage, with the young bird gone by early October but at least one adult still present when the project shut down in late October. These birds spent a lot of time perched on some of the snags along the trail and at the bottom of the drainage. They were also incredibly vigilant about escorting other birds, especially other buteos, out of the drainage. Other resident Red-tailed Hawks were noted to the south over Washington Butte. They spent a lot of time kiting near South Blind and over the butte. Observers were never able to determine whether they had young because they were too far away to determine their ages and color morphs.

On 20 October, observers sighted an unknown-age Golden Eagle acting like a local south of the observation point. It would come from the west and perch on a snag on the right side of the hill.

This is a fairly typical resident assemblage for the site, except that local Turkey Vultures, Northern Harriers, and Prairie Falcons have frequented the area in past years

TRAPPING EFFORT

Trapping occurred on 56 of 59 days between 25 August and 22 October, with effort totaling 797.33 station hours (see Appendix F for daily trapping records). The number of trapping days and station hours was comparable to 2002, 2003, and 2005, but significantly higher than for other years (see Appendix G for annual trapping summaries).

TRAPPING AND BANDING RESULTS

The 2006 capture total of 814 newly banded birds of 11 species was the highest total since HWI took over the banding program in 2001, 32% higher than the 2001–2005 average and 79% higher than the overall 1999–2005 average for the site (Table 5, Appendix G). Based on 1999–2005 averages, capture totals were above average for all species, significantly so for Northern Harriers, Sharp-shinned Hawks, Northern Goshawks, Red-tailed Hawks, Rough-legged Hawks, Golden Eagles, and Merlins, with totals reaching new record highs for each of these species except Merlins. The 2006 effort raised the total number of diurnal raptors captured at the site to 4,000 (Appendix G). The species captured most frequently in 2006 were the Sharp-shinned Hawk (66% of captures), Cooper's Hawk (18%), Merlin (4%), Red-tailed Hawk (4%), and Northern Goshawk (3%); all other species each comprised <2% of the total (Table 5).

Similar patterns applied to estimates of capture rate (birds captured per 100 station hours) and capture success (capture proportions of observed, trappable species), with a few notable exceptions (Table 5). No significant variation in capture statistics was evident for Cooper's Hawks, but the capture total was slightly above average while the capture rate and success were slightly below average. Similarly, no significant variation in capture statistics was evident for Peregrine Falcons, but the capture total and rate were slightly above average while capture success was slightly below average. For American Kestrels, the capture total was non-significantly above average and the capture rate was non-significantly below average, but capture success was significantly above average. For Merlins, all measures were above average, but the difference in capture rates was not significant.

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 5). For Sharp-shinned Hawks and Northern Goshawks, both the count and banding data indicated significantly above average immature : adult ratios (97 and 44% above average for sharp-shins and 372 and 208% above average for goshawks). Further, the two times greater proportional increase in the count age ratio for sharp-shins and goshawks compared to the capture-based age ratio suggests that immature birds of both species were much more common and less susceptible to capture than usual (i.e., better fitness than usual). For Cooper's Hawks, the count indicated a 69% above average age ratio (Table 2), whereas the banding data indicated a 14% below average ratio (Table 5). This suggests that immature Cooper's Hawks also were relatively more abundant than usual and were much less susceptible to capture than usual compared to adults. The capture data also uniquely indicated marginally significant 40% and 6% below-average female : male ratios for Northern Goshawks and Cooper's Hawks, whereas the capture-based sex ratio for Sharp-shinned Hawks was a marginally significant 8% above average.

The banding data indicated a 67% above-average sex ratio for American Kestrels (Table 5), whereas the count-based sex ratio was 96% below average (Table 2). The banding data also uniquely indicated an age-ratio that was roughly 90% above average (actually no adults captured so the age ratio is only a

rough approximation). Given that no adults of either sex were captured in 2006, these statistics suggest that female kestrels were particularly uncommon in 2006 and may have been more susceptible to capture than usual; however, the low overall capture total for this species warrants against placing much confidence in the capture-based comparisons.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Since banding began at Chelan Ridge in 1999, 25 foreign encounters with Chelan-banded birds have been recorded. Eleven new encounters occurred in 2006 (Table 7), one involving a bird that was captured at another research site. The first bird encountered in 2006 was a female Merlin banded as an unknown-age bird in 2001 and found dead of unknown causes 184 km south-southeast of Chelan Ridge near Pasco, WA in January 2006. The next bird was a male Sharp-shinned Hawk banded as a hatch-year (HY) bird in 2004 and found dead of unknown causes 275 km west-southwest of Chelan Ridge near Lake Symington, WA in February 2006. The next three birds encountered were female Sharp-shinned Hawks banded as a HY birds in 2005 and found dead of unknown causes near Newport Beach, CA in March 2006 (1,331 km SSW), near Manson, WA in April 2006 (20 km W), and near Tracy, CA in April 2006 (942 km S). The next bird encountered was a female Cooper's Hawk banded as a HY bird in 2005 and found dead of unknown causes 350 km southwest of Chelan Ridge near Rochester, WA. The next bird was a male Cooper's Hawk banded as a HY bird on 3 September 2001 and recaptured and released by the Falcon Research Group at their migration-banding station on Entiat Ridge 54 km south of Chelan Ridge during 10 September 2006. The next bird was a Red-tailed Hawk banded as a HY bird in 2003 and found dead of unknown causes 922 km south near Sonoma, CA. The next bird encountered was a female Cooper's Hawk banded as a HY bird in 2006 and found dead of unknown causes 45 days later and 1,734 km south-southeast near Scottsdale, AZ. Assuming constant diurnal travel, this bird averaged 39 km per day in traveling to Arizona, and is the first example of a Cooper's Hawk associated with the Chelan Ridge project that has been recovered east of the Sierra-Cascade Range. Other birds that have traveled east of the Sierra-Cascades after banding at Chelan Ridge include 2 Sharp-shinned Hawks encountered in western Nevada and western Idaho, 2 Merlins encountered in west-central Oregon and southeastern Washington, and 1 Golden Eagle tracked by satellite to a winter range in southern New Mexico. All other Chelan Ridge migrants tracked via band returns or satellite tracking have shown affinity to the Pacific Coast Flyway (*sensu* Hoffman et al. 2002), with winter ranges extending from western Washington to southern California. One other male Sharp-shinned Hawk banded as a hatch-year bird during fall 2006 was encountered sometime shortly thereafter, but we have yet to receive a formal report concerning the location of the encounter.

SAMPLING NORTHERN MIGRANTS FOR AVIAN INFLUENZA

In 2006, HWI began pilot efforts to sample 50 raptors, via cloacal swabbing, for avian influenza. In the end, 47 samples were extracted from eight different species of various age classes. Totals by species included: Cooper's Hawk (10), Golden Eagle (4), Merlin (7), Northern Harrier (6), Peregrine Falcon (1), Rough-legged Hawk (4), Red-tailed Hawk (7), and Sharp-shinned Hawk (8). Following the field season, HWI sent the samples for processing to a virology lab at the University of California Los Angeles; we expect to receive the results some time in 2007. This sampling effort was conducted in conjunction with a much larger, multifaceted avian sampling effort being coordinated by personnel and other colleagues of the U.S. Forest Service Redwood Sciences Laboratory in northern California, and the Landbird Migration Monitoring Network of the Americas (LaMMNA) program.

VISITOR PARTICIPATION AND PUBLIC OUTREACH

The 2006 visitor logs recorded 193 individuals, mostly from surrounding Washington communities. Five other states (Oregon, Minnesota, California, New York, and Colorado) also were represented. Most

visitors came between 12 September and 10 October, with 30 September being the day of highest individual visitor volume. Organized group visitation included students from Twisp Community School and Twisp Home School groups. In addition to on-site education programs and outreach, following the 2006 season, our education team also conducted off-site programs in high schools in Winthrop, Omak, Brewster, and Okanogan, WA.

In 2006, 515 hourly assessments by the observers of visitor disturbance resulted in the following ratings: 92% none, 7% low, 2% 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 2006 was provided by Okanogan and Wenatchee National Forests, Washington Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service - Neotropical Migratory Bird Conservation Act grant program, Community Foundation of North Central Washington, Fledgling Fund, Blue Mountain Audubon Society, and HWI private donors and members. Numerous individuals were essential in helping us achieve successful promotion and implementation of this season's effort. Richard Hendrick once again provided invaluable support with project set-up, lure birds, firewood, food, and supplementing the observation crew. His eyes are important to this project. Brad Martin gets the prize for longevity and consistency of his support in providing pigeons that allow the trapping aspect to proceed. The Methow Conservancy was a partner in recruiting volunteers. Tannis Thorlakson continued in her dedication to the project and nearly completed her internship requirements. Gretchen Albrecht volunteered for another term this season; her skill and enthusiasm were much appreciated. Bob and Dotti Wilson contributed this year for the first time, and Juliet Rhodes returned for the second year. Forest Service Visitor Services staff, including Tommy Days, Pat Tourangeau, Kathy Corrigan, and Sharon Cathcart, covered many bases, especially answering radio calls from the ridge each day, maintaining the tally board, interacting with visitors anxious to see the site, and especially presenting an interesting and informative visitor center display. As usual, WDFW biologist Jim Watson and his son Jesse ably assisted with the trapping operations. We greatly appreciate the connection to the WDFW that Jim and Area Wildlife Biologist Scott Fitkin provide. Rena Rex again kept the Chelan District involved with our efforts. The USFS staff and line support from District Biologist John Rohrer, District Ranger John Newcom, Forest Biologists Bob Naney and Bill Gaines, and Sarah Madsen, Elaine Rybak, and Robert Alvarado from the Regional Office was especially appreciated. It was also a pleasure to have a visit from USFS Regional Avian Program Coordinator Barb Bresson, who released the first-ever Northern Pygmy Owl captured at the project site. Lastly, we were pleased to have personnel from the WDFW's ALEA Volunteer Cooperative Program visit to interview and film the crew for a promotional piece they were compiling.

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Table 1. Fall counts and adjusted passage rates (truncated to standardized annual sampling periods and adjusted for incompletely identified birds) by species for migrating raptors at Chelan Ridge, WA: 1998–2005 versus 2006.

SPECIES	COUNTS			RAPTORS/100 HOURS		
	1998–2005 ¹	2006	% Change	1998–2005 ¹	2006	% Change
Turkey Vulture	31 ± 9.8	50	61	10.8 ± 5.53	14.8	38
Osprey	42 ± 11.5	50	19	15.1 ± 4.86	18.3	21
Northern Harrier	113 ± 27.9	127	13	33.4 ± 9.63	39.3	18
White-tailed Kite	0.1 ± 0.2	0	-100	–	–	
Sharp-shinned Hawk	796 ± 162.6	854	7	257.1 ± 63.16	282.1	10
Cooper's Hawk	212 ± 24.3	270	28	73.1 ± 10.93	95.1	30
Northern Goshawk	28 ± 9.2	31	10	7.3 ± 2.38	6.3	-14
Unknown small accipiter ²	35 ± 31.2	97	179	–	–	
Unknown large accipiter ²	8 ± 5.5	11	41	–	–	
Unknown accipiter	96 ± 63.9	12	-88	–	–	
TOTAL ACCIPITERS	1158 ± 216.9	1275	10	–	–	
Broad-winged Hawk	5 ± 1.5	4	-26	4.7 ± 1.87	2.7	-43
Swainson's Hawk	7 ± 4.3	2	-71	5.3 ± 3.51	1.6	-70
Red-tailed Hawk	302 ± 61.8	441	46	88.9 ± 19.73	131.4	48
Ferruginous Hawk	0.1 ± 0.2	0	-100	0.2 ± 0.27	0.0	-100
Rough-legged Hawk	28 ± 11.5	28	0	19.7 ± 6.68	17.9	-9
Unidentified buteo	69 ± 29.8	57	-17	–	–	
TOTAL BUTEOS	412 ± 98.5	532	29	–	–	
Golden Eagle	127 ± 24.0	157	24	36.1 ± 6.99	44.1	22
Bald Eagle	5 ± 3.3	8	56	1.6 ± 0.88	2.6	62
Unidentified eagle	3 ± 3.0	0	-100	–	–	
TOTAL EAGLES	135 ± 27.7	165	22	–	–	
American Kestrel	66 ± 18.0	29	-56	20.4 ± 6.65	9.6	-53
Merlin	38 ± 8.1	34	-11	11.4 ± 3.20	11.1	-3
Prairie Falcon	8 ± 3.4	9	18	2.1 ± 0.76	3.1	49
Peregrine Falcon	6 ± 3.1	20	227	1.8 ± 0.71	5.6	216
Unknown small falcon ²	4 ± 1.7	3	-29	–	–	
Unknown large falcon ²	2 ± 0.6	3	50	–	–	
Unknown falcon	3 ± 1.8	0	-100	–	–	
TOTAL FALCONS	124 ± 22.5	98	-21	–	–	
Unidentified raptor	124 ± 52.0	52	-58	–	–	
GRAND TOTAL	2139 ± 355.5	2349	10	–	–	

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: 1998–2005 versus 2006.

	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1998–2005 AVERAGE			2006			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1998–2005 ¹	2006	1998–2005 ¹	2006
Northern Harrier	113	38	27	127	41	23	43 ± 8.7	50	1.4 ± 0.36	1.8
Sharp-shinned Hawk	796	405	127	854	430	63	33 ± 7.8	42	3.6 ± 1.65	6.8
Cooper's Hawk	212	99	27	270	134	19	42 ± 8.9	43	4.3 ± 1.96	7.1
Northern Goshawk	28	13	5	31	21	1	38 ± 9.7	29	4.8 ± 3.14	21.0
Broad-winged Hawk	5	2	1	4	1	1	40 ± 19.0	50	1.3 ± 0.89	1.0
Red-tailed Hawk	302	68	138	441	94	142	31 ± 5.1	46	0.5 ± 0.16	0.7
Golden Eagle	127	60	28	157	80	24	29 ± 6.0	34	2.2 ± 0.39	3.3
Bald Eagle	5	1	4	8	2	5	8 ± 12.2	13	0.3 ± 0.25	1.0
Peregrine Falcon	6	2	2	20	10	4	47 ± 23.2	30	1.5 ± 1.24	2.5

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 2006, with a comparison of 2006 and 1998–2005 average median passage dates.

SPECIES	2006				1998–2005
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}
Turkey Vulture	26-Aug	6-Oct	27-Aug – 28-Sep	16-Sep	16-Sep ± 4.5
Osprey	27-Aug	7-Oct	6-Sep – 1-Oct	22-Sep	18-Sep ± 3.6
Northern Harrier	25-Aug	22-Oct	6-Sep – 11-Oct	25-Sep	22-Sep ± 2.2
Sharp-shinned Hawk	24-Aug	25-Oct	4-Sep – 6-Oct	22-Sep	21-Sep ± 2.3
Cooper's Hawk	24-Aug	26-Oct	30-Aug – 30-Sep	16-Sep	18-Sep ± 2.3
Northern Goshawk	2-Sep	25-Oct	6-Sep – 22-Oct	1-Oct	25-Sep ± 5.7
Broad-winged Hawk	8-Sep	22-Sep	–	–	12-Sep ± 2.7
Swainson's Hawk	16-Sep	23-Sep	–	–	14-Sep ± 6.5
Red-tailed Hawk	26-Aug	26-Oct	10-Sep – 11-Oct	28-Sep	24-Sep ± 2.1
Rough-legged Hawk	5-Oct	26-Oct	5-Oct – 25-Oct	12-Oct	15-Oct ± 3.8
Golden Eagle	26-Aug	26-Oct	21-Sep – 21-Oct	8-Oct	04-Oct ± 2.0
Bald Eagle	23-Sep	26-Oct	23-Sep – 26-Oct	21-Oct	15-Oct ± 7.4
American Kestrel	25-Aug	18-Oct	28-Aug – 27-Sep	8-Sep	12-Sep ± 5.4
Merlin	6-Sep	26-Oct	11-Sep – 20-Oct	27-Sep	21-Sep ± 3.2
Prairie Falcon	1-Sep	1-Oct	1-Sep – 1-Oct	6-Sep	19-Sep ± 8.6
Peregrine Falcon	26-Aug	23-Oct	28-Aug – 1-Oct	15-Sep	19-Sep ± 10.8
Total	27-Aug	26-Oct	5-Sep – 10-Oct	23-Sep	22-Sep ± 1.8

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: 1998–2005 versus 2006.

SPECIES	ADULT		IMMATURE	
	1998–2005 ¹	2006	1998–2005 ¹	2006
Northern Harrier	22-Sep ± 3.2	25-Sep	22-Sep ± 2.8	25-Sep
Sharp-shinned Hawk	02-Oct ± 1.6	28-Sep	14-Sep ± 1.8	9-Sep
Cooper’s Hawk	26-Sep ± 3.0	25-Sep	13-Sep ± 1.6	7-Sep
Northern Goshawk	08-Oct ± 6.6	–	23-Sep ± 4.6	7-Oct
Red-tailed Hawk	28-Sep ± 2.4	30-Sep	16-Sep ± 4.1	25-Sep
Golden Eagle	06-Oct ± 3.0	7-Oct	03-Oct ± 2.5	6-Oct
Bald Eagle	14-Oct ± 9.7	21-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: 1999–2005 versus 2006.

	CAPTURE TOTALS		CAPTURE RATE ¹		CAPTURE SUCCESS ²	
	1999–2005 ³	2006	1999–2005 ³	2006	1999–2005 ³	2006
Northern Harrier	8 ± 3.0	28	1.3 ± 0.24	3.5	8.9 ± 3.7	22.0
Sharp-shinned Hawk	298 ± 97.6	556	46.0 ± 7.43	69.7	40.8 ± 18.3	59.3
Cooper's Hawk	88 ± 29.0	100	13.5 ± 2.84	12.5	39.0 ± 13.2	32.7
Northern Goshawk	12 ± 1.8	24	2.0 ± 0.72	3.0	49.4 ± 17.4	75.0
Red-tailed Hawk	17 ± 5.5	50	2.7 ± 0.67	6.3	4.7 ± 1.6	10.1
Rough-legged Hawk	1.4 ± 1.27	6	0.2 ± 0.18	0.8	5.5 ± 5.4	19.4
Golden Eagle	2 ± 1.0	6	0.2 ± 0.16	0.8	1.2 ± 0.7	3.8
American Kestrel	7.0 ± 4.06	8	1.1 ± 0.43	1.0	13.2 ± 11.3	26.7
Merlin	19 ± 11.4	31	2.9 ± 1.31	3.9	50.3 ± 27.8	86.1
Prairie Falcon	2 ± 1.2	3	0.3 ± 0.17	0.4	25.4 ± 15.2	30.0
Peregrine Falcon	1.1 ± 1.1	2	0.2 ± 0.16	0.3	17.5 ± 17.8	9.1
All species	455 ± 145.7	814	70.4 ± 11.13	102.1	26.0 ± 10.0	37.1

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: 2001–2005 versus 2006.

SPECIES	YEARS	FEMALE		MALE		FEMALE : MALE RATIO	IMM. : ADULT RATIO
		HY	AHY	HY	AHY		
Sharp-shinned Hawk	Avg. 2001–2005	146	51	137	32	1.2 ± 0.08 ¹	3.5 ± 0.46 ¹
	2006	253	60	210	33	1.3	5.0
Cooper's Hawk	Avg. 2001–2005	40	23	35	8	1.6 ± 0.22	2.4 ± 0.33
	2006	37	23	30	10	1.5	2.0
Northern Goshawk	Avg. 2001–2005	3	1	7	1	0.5 ± 0.12	7.8 ± 2.14
	2006	6	0	18	0	0.3	24.0
American Kestrel	Avg. 2001–2005	1	1	5	1	0.2 ± 0.04	3.7 ± 1.76
	2006	2	0	5	0	0.4	7.0

¹ Mean ± 95% CI.

Table 7. Foreign encounters of raptors banded at the Chelan Ridge Raptor Migration Project in 2006.

BAND #	SPECIES ¹	SEX	BANDING DATE	BANDING AGE ²	ENCOUNTER LOCATION	ENCOUNTER DATE	ENCOUNTER AGE ²	DISTANCE (KM)	STATUS
1593 – 02181	ML	F	24-Sep-01	U	Pasco, WA	15-Jan-06	ATY	184	found dead
0822 – 20615	SS	M	13-Sep-04	HY	Lake Symington, WA	17-Feb-06	TY	275	found dead
1593 – 53794	SS	F	08-Sep-05	HY	Newport Beach, CA	06-Mar-06	SY	1,331	found dead
1202 – 22384	SS	F	05-Sep-05	HY	Manson, WA	06-Apr-06	SY	20	found dead
1593 – 60924	SS	F	25-Aug-05	HY	Tracy, CA	11-Apr-06	SY	942	found dead
1005 – 21932	CH	F	03-Sep-05	HY	Rochester, WA	13-Apr-06	SY	350	found dead
0804 – 15652	CH	M	03-Sep-01	HY	Entiat Ridge, WA	10-Sep-06	ATY	54	research recapture
1177 – 06465	RT	U	19-Sep-03	HY	Sonoma, CA	01-Oct-06	ATY	922	found dead
1075 – 01001	CH	F	29-Aug-06	HY	Scottsdale, AZ	13-Oct-06	HY	1,734	found dead
1623 – 21182	SS	F	27-Sep-06	AHY	Kennewick, WA	13-Oct-06	AHY	210	found dead
1232 – 35131	SS	M	07-Sep-06	HY	Unknown ³	Unknown	HY	Unk	unknown

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.

³ Awaiting recovery report from National Bird Banding Lab.



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

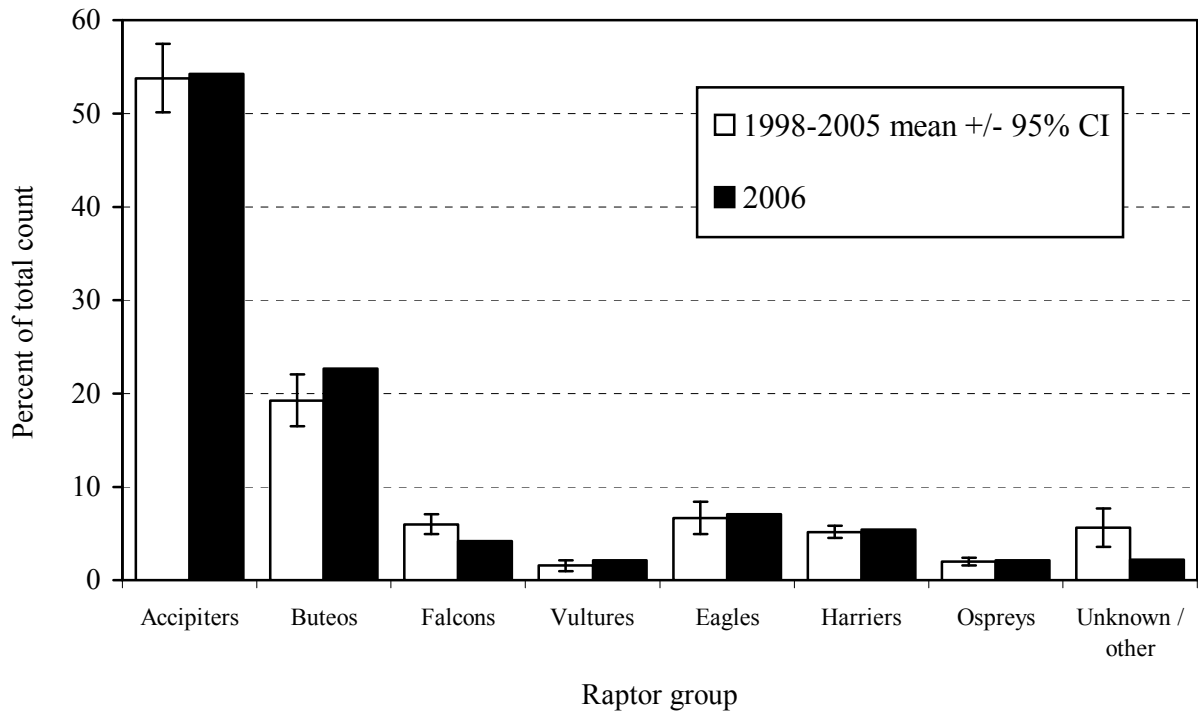


Figure 2. Fall raptor migration flight composition by major species groups at Chelan Ridge, WA: 1998–2005 versus 2006.

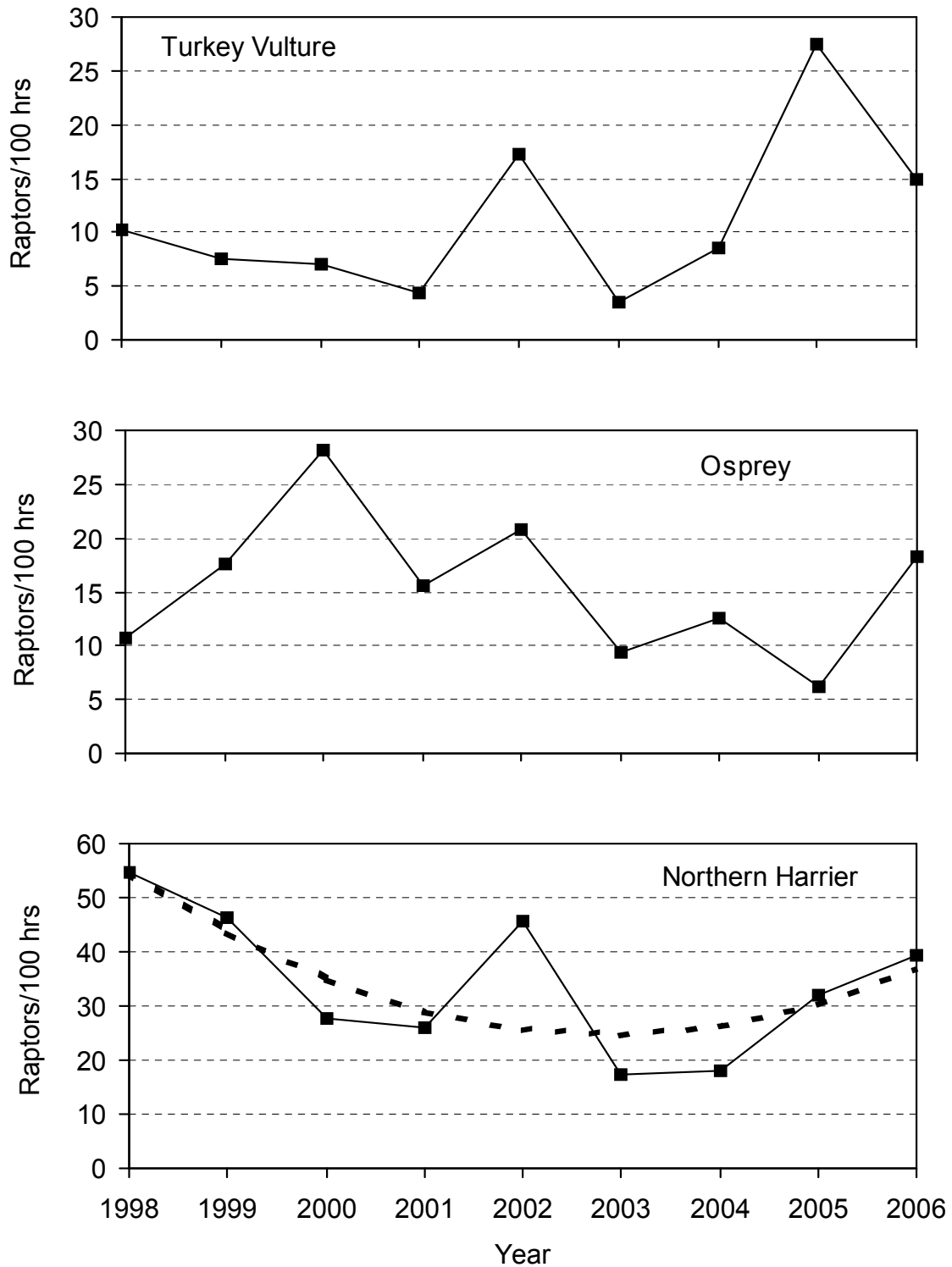


Figure 3. Adjusted fall-migration passage rates at Chelan Ridge, WA for Turkey Vultures, Ospreys, and Northern Harriers: 1998–2006. Dashed lines indicate significant linear or quadratic regressions.

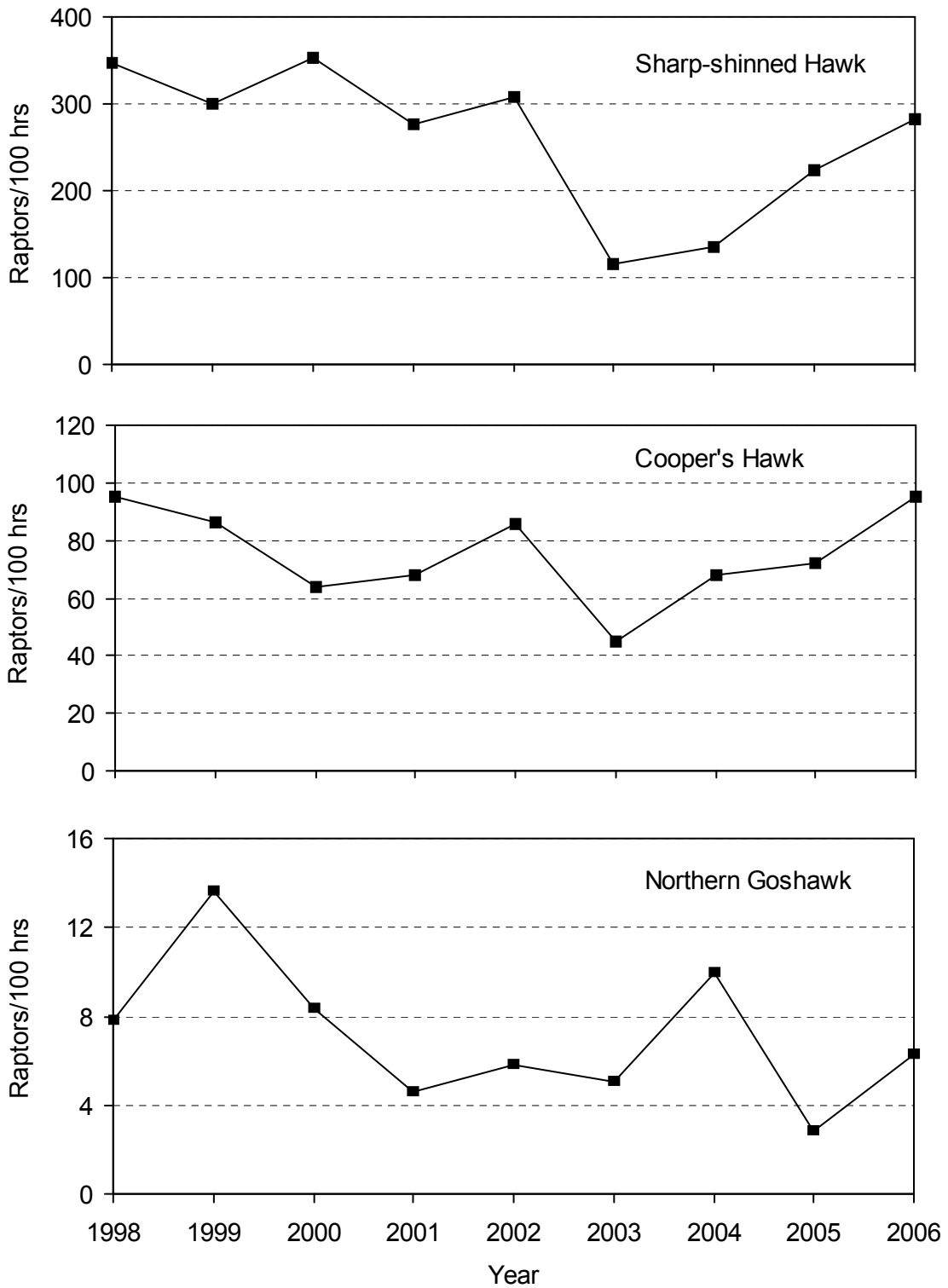


Figure 4. Adjusted fall-migration passage rates at Chelan Ridge, WA for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks: 1998–2006. Dashed lines indicate significant linear or quadratic regressions.

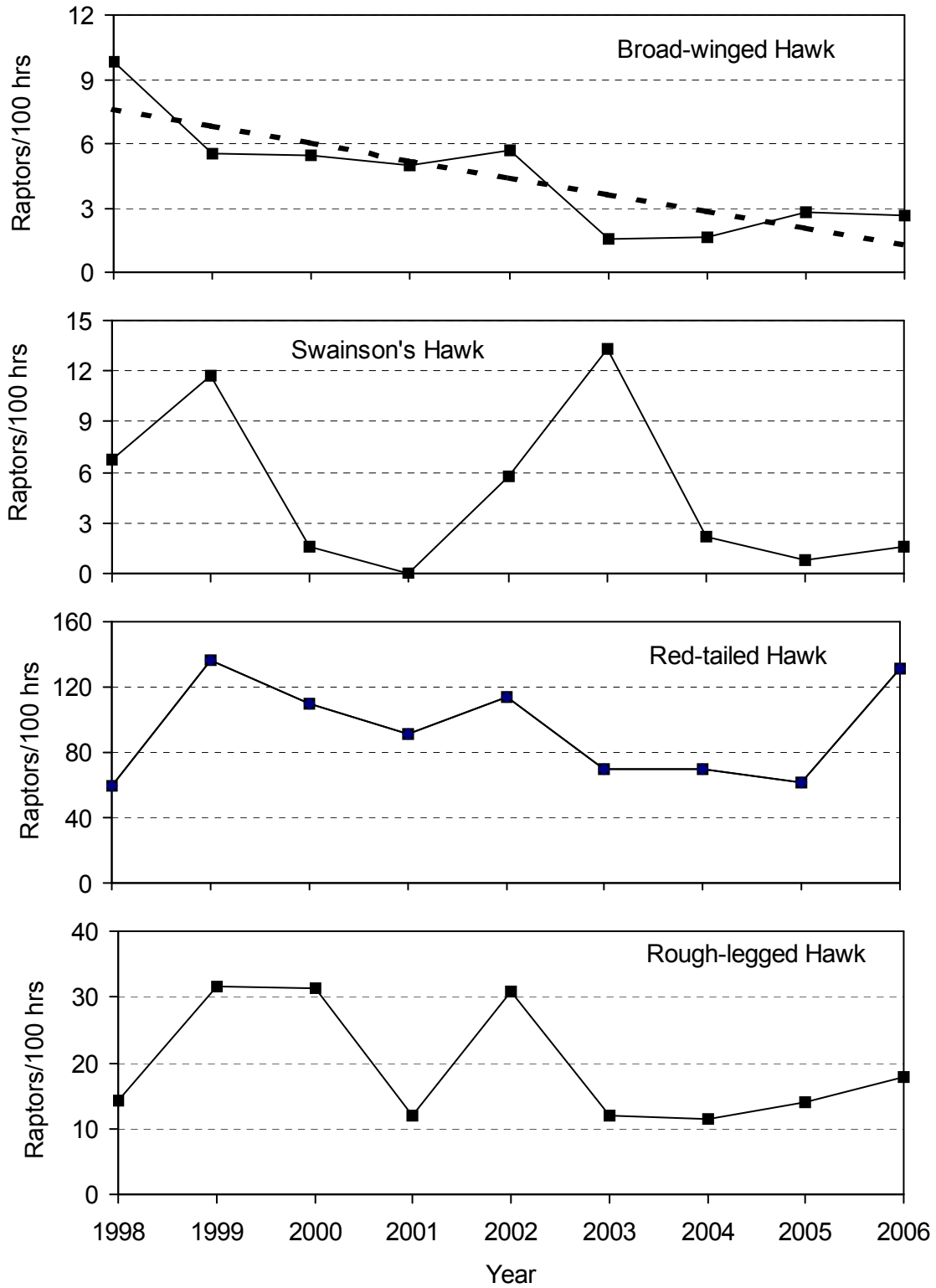


Figure 5. Adjusted fall-migration passage rates at Chelan Ridge, WA for Broad-winged, Swainson's, Red-tailed, and Rough-legged Hawks: 1998–2006. Dashed lines indicate significant linear or quadratic regressions.

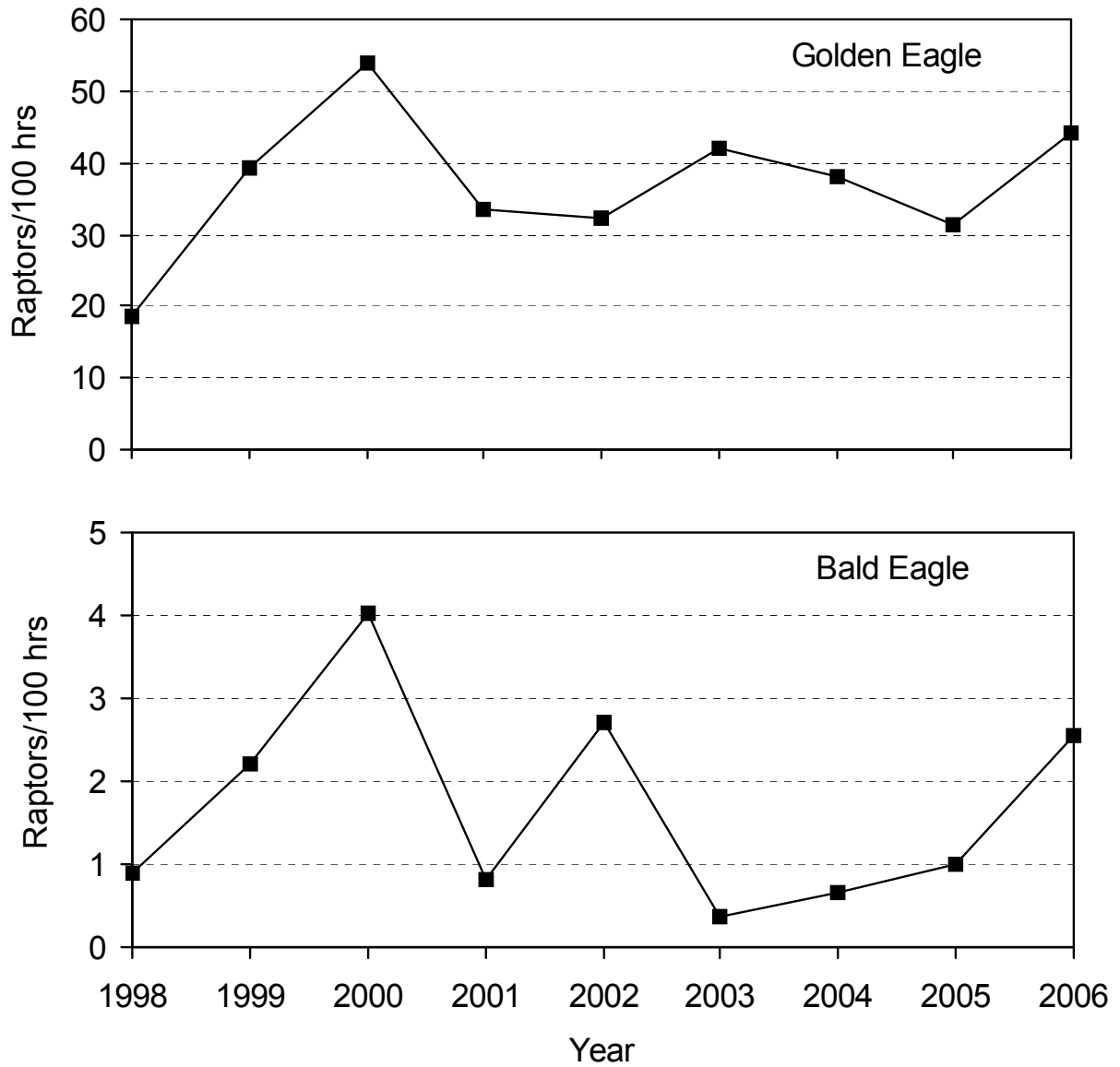


Figure 6. Adjusted fall-migration passage rates at Chelan Ridge, WA for Golden and Bald Eagles: 1998–2006. Dashed lines indicate significant linear or quadratic regressions.

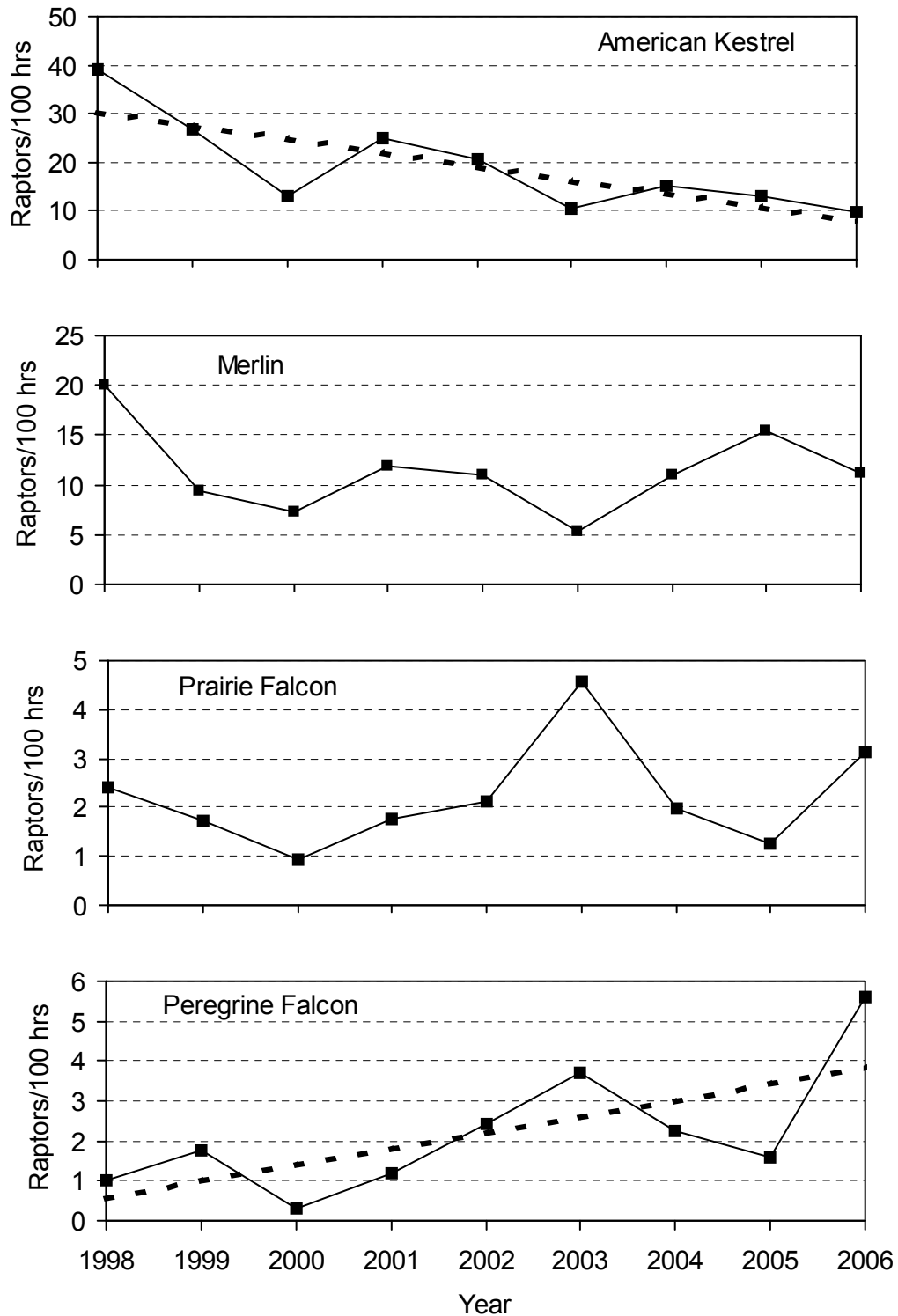


Figure 7. Adjusted fall-migration passage rates at Chelan Ridge, WA for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons: 1998–2005. Dashed lines indicate significant linear or quadratic regressions.

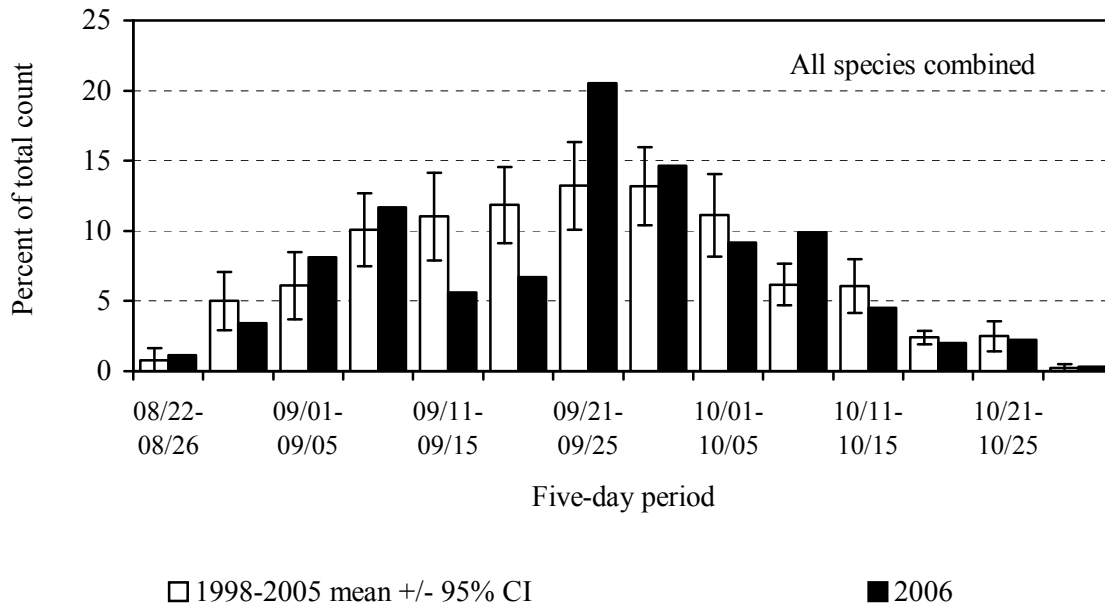


Figure 8. Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998–2005 versus 2006.

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), 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).

2005: Two observers throughout: Angela Sjollema (0), James Waddell (0; first half), Steve Seibel (3+; second half), and regular substitutes Richard Hendrick (4+) and Dan Russell (2).

2006: Two observers throughout: Angela Sjollema (1), Steve Seibel (4+), with assistance from Aran Meyer (1+), Rob Spaul (2), Devon Batley (1), and Richard Hendrick (4+).

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: 2006.

DATE	OBS. HOURS	OBSRVR / HOUR ¹	VISITOR DISTURB ²	PREDOMINANT WEATHER ³	SPEED (KPH) ¹	WIND DIRECTION	TEMP (°C) ¹	PRESS. (IN HG) ¹	THERMAL LIFT ⁴	WEST (KM) ¹	EAST (KM) ¹	FLIGHT DISTANCE ⁵ / HOUR	BIRDS
24-Aug	9.00	1.3	0	pc-ovc, haze	2.5	calm/var			2	57	95	2	0.2
25-Aug	9.00	2.0	0	clr-pc, haze	12.6	var			2	55	32	1	0.9
26-Aug	9.00	2.0	0	clr, haze	13.8	ssw			1	39	25	2	1.9
27-Aug	8.75	2.0	0	clr-pc, haze	10.2	ssw			1	44	49	1	3.7
28-Aug	9.00	2.0	0	clr-pc, haze	12.6	ssw			1	59	40	1	2.9
29-Aug	9.00	1.7	0	pc, haze	6.7	wsw			3	68	83	3	0.2
30-Aug	6.25	1.7	0	mc-ovc, haze/scat rain	16.1	sw			4	100	58	1	1.3
31-Aug	8.25	1.6	0	clr, haze	5.2	var			1	87	84	3	1.5
1-Sep	9.00	1.6	0	clr, haze	4.5	var			1	74	74	1	3.3
2-Sep	9.00	2.0	0	clr, haze	10.1	ssw			1	65	77	1	4.6
3-Sep	9.00	2.0	0	pc-mc, haze	5.3	var			1	49	67	1	3.1
4-Sep	9.00	1.9	0	pc-mc, haze	6.9	ssw			2	32	31	1	2.4
5-Sep	9.00	1.8	0	clr, haze	6.8	ne, sw			2	17	20	2	7.8
6-Sep	9.00	1.8	0	clr, haze	6.4	calm, s	27.4	30.53	1	23	18	-	6.3
7-Sep	8.50	1.9	0	clr, haze	7.9	n, s	27.3	30.38	2	10	9	2	7.5
8-Sep	9.00	2.0	0	clr, haze	7.6	ssw	24.4	30.17	1	31	25	-	9.1
9-Sep	9.00	1.9	0	pc, haze	9.5	ssw	18.5	30.20	2	45	30	1	3.7
10-Sep	9.00	2.6	0	clr, haze	8.6	ssw	18.1	30.45	2	50	69	1	4.2
11-Sep	9.00	2.5	0	pc, haze	6.6	ssw	20.8	30.54	2	41	51	1	7.3
12-Sep	9.00	1.3	0	pc, haze	9.1	wsw	22.1	30.54	1	41	71	3	5.0
13-Sep	9.00	2.1	1	ovc	8.3	calm, ssw	13.6	30.17	4	96	91	1	2.2
14-Sep	0.00			weather day - zero visibility									
15-Sep	4.00	2.0	0	ovc, fog/snow	4.8	nne, nnw	7.5	30.03	4	27	11	1	0.3
16-Sep	9.00	1.9	0	clr-mc	8.2	ssw	11.2	30.33	2	92	51	1	6.6
17-Sep	9.00	2.1	0	pc-ovc, haze	10.9	ssw	12.4	30.44	3	100	60	1	3.2
18-Sep	5.25	1.3	0	ovc, fog/rain	14.7	sse	7.8	30.25	4	23	12	-	0.0
19-Sep	9.00	2.7	0	pc-ovc	6.3	nne	13.0	30.25	3	59	45	3	6.7
20-Sep	9.00	1.9	0	ovc, AM fog/rain	16.3	ssw	7.5	30.08	4	86	14	1	1.0
21-Sep	8.75	1.8	0	pc-ovc	5.8	var	11.0	29.81	3	90	33	2	5.7
22-Sep	9.00	2.6	0	clr-pc	7.7	var	15.8	30.20	1	100	100	3	13.9
23-Sep	8.75	2.3	0	clr-ovc	4.6	n, ssw	17.5	30.31	3	100	95	3	16.6
24-Sep	9.00	2.1	0	clr	5.6	nne, s	16.5	30.30	2	100	100	2	4.1
25-Sep	9.00	2.2	0	clr, PM haze	12.6	ssw	19.2	30.22	3	82	87	1	13.9
26-Sep	8.00	2.0	0	clr	4.7	n, ssw	19.2	30.28	2	100	100	2	6.9
27-Sep	9.00	2.0	0	clr, PM haze	13.0	ssw	19.3	30.30	2	93	93	1	12.0
28-Sep	9.00	1.9	0	clr, PM haze	8.8	calm, ssw	20.6	30.21	2	95	98	3	11.2
29-Sep	9.00	1.9	0	clr, PM haze	14.4	s	19.2	30.11	3	91	93	1	4.4
30-Sep	8.83	2.3	0	clr-pc, haze	22.7	ssw	18.1	29.85	3	71	70	2	4.5
1-Oct	9.00	2.4	0	clr-mc	9.4	nne, ssw	13.5	29.89	2	100	100	2	6.7
2-Oct	9.00	1.9	0	clr-ovc	6.4	nne, ssw	9.1	29.94	3	80	98	3	2.8
3-Oct	8.15	2.0	0	pc-ovc, PM rain	2.2	calm/var	11.4	30.10	4	69	52	3	4.4
4-Oct	9.00	2.0	0	pc, PM haze	18.3	nne, nnw	10.8	30.09	3	81	94	3	4.4
5-Oct	9.00	2.0	0	pc-ovc, haze	9.0	n, ssw	15.4	29.96	3	70	55	3	6.0
6-Oct	8.50	2.0	0	pc-ovc	5.2	calm, ssw	13.9	29.95	3	83	65	3	6.6
7-Oct	9.00	2.3	0	clr-mc	15.3	n, ssw	7.5	30.21	3	100	100	3	7.0
8-Oct	9.00	2.4	0	mc-ovc, scat rain	9.0	nne, nnw	7.2	30.27	4	73	30	3	4.6
9-Oct	9.00	2.0	0	clr	6.1	calm, n-nne	10.5	30.35	2	100	100	1	2.3
10-Oct	9.00	2.1	0	pc-ovc, PM haze	4.6	nne, sw	12.0	30.24	3	100	100	2	5.8
11-Oct	9.00	1.9	0	clr, PM haze	7.7	nne, ssw	13.7	30.20	2	98	100	2	4.0
12-Oct	8.20	1.8	0	clr, PM haze	9.4	ssw	14.9	30.06	3	53	93	1	2.7
13-Oct	9.00	2.2	0	pc-mc, haze	1.8	calm, ssw	15.2	29.94	2	67	78	1	4.6
14-Oct	9.00	1.7	0	pc-ovc, haze	17.0	s	14.0	29.87	3	75	81	1	0.8

Appendix C. continued

DATE	OBS. HOURS	OBSRVR / HOUR ¹	VISITOR DISTURB ²	PREDOMINANT WEATHER ³	SPEED (KPH) ¹	WIND DIRECTION	TEMP (°C) ¹	PRESS. (IN HG) ¹	THERMAL LIFT ⁴	WEST (KM) ¹	EAST (KM) ¹	FLIGHT DISTANCE ⁵ / HOUR	BIRDS / HOUR
15-Oct	5.75	2.0	0	ovc, rain	9.4	sw	7.7	29.55	4	45	24	-	0.0
16-Oct	0.00			weather day - fog and snow									
17-Oct	8.25	1.9	0	ovc, fog	10.9	nne, sw	6.5	30.06	4	28	9	2	1.5
18-Oct	8.50	1.8	0	ovc	10.1	ssw	7.9	30.05	4	95	38	3	2.6
19-Oct	8.50	1.9	0	pc-ovc	21.5	ssw, w	9.9	29.97	4	52	24	2	0.6
20-Oct	8.50	1.9	0	clr-pc	11.8	var	8.7	30.21	4	100	99	1	0.9
21-Oct	8.50	1.8	0	clr, haze	3.1	calm/var	6.3	30.31	3	100	100	2	0.8
22-Oct	8.50	2.0	0	clr-pc, haze	17.7	ssw	5.7	30.22	3	99	98	3	2.1
23-Oct	7.00	1.0	0	clr-ovc, haze	10.1	ssw	8.9	30.18	2	100	89	1	0.6
24-Oct	8.50	1.9	0	pc-mc, AM haze	22.6	sw	5.6	29.77	4	77	35	1	1.1
25-Oct	8.50	1.9	0	pc-ovc, PM haze	11.7	sw	4.3	30.26	4	98	81	3	1.8
26-Oct	7.25	2.0	0	pc-ovc, PM rain	17.7	s	5.3	30.25	4	67	15	2	1.1

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: 2006.

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	9.00	0	0	0	0	1	1	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
25-Aug	9.00	0	0	1	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	8	0.9
26-Aug	9.00	3	0	1	0	2	3	0	1	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	2	0	1	17	1.9		
27-Aug	8.75	2	1	0	0	12	9	0	1	0	0	0	0	5	0	0	0	1	0	0	1	0	0	0	0	0	0	0	32	3.7	
28-Aug	9.00	2	0	0	0	9	8	0	0	0	0	0	0	4	0	0	0	0	0	0	2	0	0	1	0	0	0	0	26	2.9	
29-Aug	9.00	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.2	
30-Aug	6.25	0	0	0	0	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.3	
31-Aug	8.25	1	2	1	0	3	1	0	1	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	12	1.5	
1-Sep	9.00	1	0	2	0	11	9	0	0	0	0	0	0	3	0	0	1	1	0	0	1	0	1	0	0	0	0	0	30	3.3	
2-Sep	9.00	2	1	1	0	18	11	2	1	0	0	0	0	3	0	0	0	0	0	0	1	0	1	0	0	0	0	0	41	4.6	
3-Sep	9.00	2	0	0	0	14	6	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	3.1	
4-Sep	9.00	0	0	0	0	11	8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	22	2.4	
5-Sep	9.00	0	0	1	0	48	7	1	1	0	1	0	0	3	0	0	2	0	0	0	2	0	0	1	0	0	0	3	70	7.8	
6-Sep	9.00	1	1	6	0	36	3	2	0	1	0	0	0	2	0	0	0	0	0	0	2	1	2	0	0	0	0	0	57	6.3	
7-Sep	8.50	1	1	2	0	34	14	0	0	0	0	0	0	5	0	0	1	0	0	0	2	0	1	2	0	0	0	1	64	7.5	
8-Sep	9.00	2	2	2	0	41	12	2	1	0	0	1	0	6	0	0	1	2	0	0	6	2	0	1	0	0	0	1	82	9.1	
9-Sep	9.00	0	0	1	0	19	4	2	0	0	0	0	0	4	0	0	0	1	0	0	2	0	0	0	0	0	0	0	33	3.7	
10-Sep	9.00	1	1	1	0	18	10	0	1	1	0	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	38	4.2	
11-Sep	9.00	0	2	4	0	36	7	3	0	0	0	0	0	9	0	0	0	2	0	0	1	1	0	1	0	0	0	0	66	7.3	
12-Sep	9.00	4	1	0	0	17	8	0	0	1	0	0	0	9	0	0	0	0	0	0	1	4	0	0	0	0	0	0	45	5.0	
13-Sep	9.00	0	0	2	0	13	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	20	2.2	
14-Sep	0.00																														
15-Sep	4.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.3	
16-Sep	9.00	4	9	2	0	17	7	2	3	0	0	0	1	3	0	0	3	4	0	0	0	0	0	0	0	0	0	4	59	6.6	
17-Sep	9.00	1	1	4	0	8	3	0	2	0	0	0	0	8	0	0	1	0	0	0	0	1	0	0	0	0	0	0	29	3.2	
18-Sep	5.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	
19-Sep	9.00	4	1	1	0	9	7	0	5	1	8	0	0	3	0	0	8	2	0	0	0	1	0	0	1	0	0	9	60	6.7	
20-Sep	9.00	0	0	0	0	6	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1.0	
21-Sep	8.75	0	1	5	0	18	6	1	2	1	0	0	0	13	0	0	2	1	0	0	0	0	0	0	0	0	0	0	50	5.7	
22-Sep	9.00	2	5	9	0	44	16	0	6	1	1	3	0	27	0	0	2	3	0	0	0	2	0	1	0	0	0	3	125	13.9	
23-Sep	8.75	2	4	7	0	48	22	0	19	1	1	0	1	23	0	0	5	1	1	0	2	0	0	1	0	0	0	7	145	16.6	
24-Sep	9.00	0	0	8	0	16	0	0	1	0	0	0	0	10	0	0	0	1	0	0	0	1	0	0	0	0	0	0	37	4.1	

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
25-Sep	9.00	5 5	12	0	37	9	0	15	0	0	0	0	26	0	0	1	5	0	0	1	2	1	1	1	0	0	4	125	13.9
26-Sep	8.00	2 0	2	0	22	13	0	2	0	0	0	0	8	0	0	0	2	1	0	0	1	0	2	0	0	0	0	55	6.9
27-Sep	9.00	1 1	5	0	54	13	0	3	0	0	0	0	19	0	0	0	3	0	0	2	3	1	1	0	0	2	108	12.0	
28-Sep	9.00	2 0	5	0	43	8	0	6	0	0	0	0	33	0	0	0	2	0	0	0	0	0	0	0	0	0	2	101	11.2
29-Sep	9.00	1 3	0	0	24	2	0	1	0	0	0	0	8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	40	4.4
30-Sep	8.83	0 0	3	0	13	5	0	0	0	0	0	0	15	0	0	0	2	0	0	0	0	0	1	1	0	0	0	40	4.5
1-Oct	9.00	1 3	5	0	21	5	1	2	1	0	0	0	14	0	0	0	2	0	0	1	1	1	1	0	0	0	1	60	6.7
2-Oct	9.00	0 0	2	0	7	1	0	1	0	0	0	0	10	0	0	0	2	0	0	0	0	0	1	0	0	0	1	25	2.8
3-Oct	8.15	1 1	2	0	7	1	0	0	0	0	0	0	20	0	0	0	2	0	0	0	1	0	0	0	0	0	1	36	4.4
4-Oct	9.00	0 0	1	0	7	3	0	4	0	0	0	0	14	0	0	1	6	0	0	0	1	0	0	0	0	0	3	40	4.4
5-Oct	9.00	1 2	8	0	14	0	2	4	0	0	0	0	11	0	3	0	8	0	0	0	0	0	0	0	1	0	0	54	6.0
6-Oct	8.50	1 1	1	0	16	6	0	3	0	0	0	0	10	0	1	1	14	0	0	0	2	0	0	0	0	0	0	56	6.6
7-Oct	9.00	0 1	7	0	15	1	3	2	0	1	0	0	20	0	1	3	7	0	0	0	1	0	0	0	0	0	1	63	7.0
8-Oct	9.00	0 0	0	0	5	1	1	1	0	0	0	0	18	0	1	4	9	0	0	0	1	0	0	0	0	0	0	41	4.6
9-Oct	9.00	0 0	0	0	4	0	2	0	0	0	0	0	2	0	0	0	12	0	0	0	1	0	0	0	0	0	0	21	2.3
10-Oct	9.00	0 0	0	0	18	0	0	1	0	0	0	0	14	0	3	0	16	0	0	0	0	0	0	0	0	0	0	52	5.8
11-Oct	9.00	0 0	2	0	5	1	0	2	1	0	0	0	12	0	3	0	6	1	0	0	1	0	0	0	0	0	2	36	4.0
12-Oct	8.20	0 0	2	0	5	0	1	0	0	0	0	0	2	0	3	1	7	0	0	0	1	0	0	0	0	0	0	22	2.7
13-Oct	9.00	0 0	3	0	6	1	0	0	0	0	0	0	8	0	6	2	12	0	0	0	0	0	0	0	0	0	3	41	4.6
14-Oct	9.00	0 0	1	0	0	1	0	0	0	0	0	0	1	0	2	1	1	0	0	0	0	0	0	0	0	0	0	7	0.8
15-Oct	5.75	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-Oct	0.00																												
17-Oct	8.25	0 0	0	0	2	1	0	0	0	0	0	0	7	0	1	1	0	0	0	0	0	0	0	0	0	0	0	12	1.5
18-Oct	8.50	0 0	0	0	3	1	0	0	0	0	0	0	6	0	0	8	2	0	0	1	0	0	0	0	0	0	1	22	2.6
19-Oct	8.50	0 0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	5	0.6
20-Oct	8.50	0 0	1	0	3	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	8	0.9
21-Oct	8.50	0 0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	7	0.8
22-Oct	8.50	0 0	1	0	1	0	2	2	0	0	0	0	2	0	0	0	9	0	0	0	1	0	0	0	0	0	0	18	2.1
23-Oct	7.00	0 0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	4	0.6
24-Oct	8.50	0 0	0	0	2	0	0	0	0	0	0	0	2	0	0	3	0	1	0	0	1	0	0	0	0	0	0	9	1.1
25-Oct	8.50	0 0	0	0	1	1	2	0	0	0	0	0	2	0	2	3	2	1	0	0	0	0	0	0	0	0	1	15	1.8
26-Oct	7.25	0 0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	2	2	0	0	1	0	0	0	0	0	0	8	1.1
Total	529.93	50 50	127	0	854	270	31	97	11	12	4	2	441	0	28	57	157	8	0	29	34	9	20	3	3	0	52	2349	4.4

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: 1997–2006.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	MEAN
Start Date	5-Sep	27-Aug	27-Aug	27-Aug	27-Aug	25-Aug	23-Aug	24-Aug	24-Aug	24-Aug	24-Aug
End Date	11-Oct	21-Oct	27-Oct	5-Nov	22-Oct	25-Oct	26-Oct	23-Oct	25-Oct	26-Oct	24-Oct
Observation days	29	53	61	67	55	62	59	59	62	64	60
Observation hours	204.60	382.92	504.33	505.75	439.00	491.28	509.24	507.50	502.50	512.00	483.84
Raptors / 100 hours	691.1	620.2	571.2	481.3	470.4	522.1	297.1	286.1	363.4	458.8	452.3
SPECIES	RAPTOR COUNTS										
Turkey Vulture	4	29	21	26	14	46	30	25	58	50	33
Osprey	41	24	47	71	48	57	31	34	25	50	43
Northern Harrier	115	152	167	104	91	148	66	59	113	127	114
White-tailed Kite						0	1	0	0	0	0
Sharp-shinned Hawk	311	949	932	1050	878	937	421	468	730	854	802
Cooper's Hawk	150	247	232	198	198	234	136	220	228	270	218
Northern Goshawk	38	32	50	35	16	22	17	41	13	31	29
Unknown small accipiter ¹					98	85	40	1	48	97	45
Unknown large accipiter ¹					0	10	17	6	6	11	8
Unknown accipiter	182	221	248	98	0	49	36	10	9	12	87
TOTAL ACCIPITERS	681	1449	1462	1381	1190	1337	667	746	1034	1275	1171
Broad-winged Hawk	2	7	5	5	6	9	3	2	6	4	5
Swainson's Hawk	0	8	17	2	0	7	15	5	2	2	6
Red-tailed Hawk	145	182	450	364	263	386	263	277	233	441	318
Ferruginous Hawk	0	0	0	1	0	0	0	0	0	0	0
Rough-legged Hawk	1	13	44	53	13	45	14	20	22	28	28
Unidentified buteo	75	58	148	97	83	82	39	15	29	57	68
TOTAL BUTEOS	223	268	664	522	365	529	334	319	292	532	425
Golden Eagle	105	55	141	174	105	135	142	130	130	157	130
Bald Eagle	2	2	7	15	2	8	1	2	4	8	5
Unidentified eagle	7	0	7	5	1	0	12	0	2	0	3
TOTAL EAGLES	114	57	155	194	108	143	155	132	136	165	138
American Kestrel	24	107	89	40	84	68	33	48	55	29	61
Merlin	17	55	36	26	36	38	21	39	53	34	38
Prairie Falcon	2	10	7	5	5	6	19	5	4	9	8
Peregrine Falcon	5	2	9	1	3	9	14	7	4	20	8
Unknown small falcon ¹					6	4	6	5	1	3	4
Unknown large falcon ¹					1	2	2	2	3	3	2
Unknown falcon	10	6	6	2	2	0	0	4	0	0	2
TOTAL FALCONS	58	180	147	74	137	127	95	110	120	98	121
Unidentified Raptor	178	216	218	62	112	178	134	27	48	52	116
GRAND TOTAL	1414	2375	2881	2434	2065	2565	1513	1452	1826	2349	2162

¹ Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2005.

DATE	STN.	SPECIES ¹											CAPTURES	
	HOURS	NH	SS	CH	NG	RT	RL	GE	AK	ML	PR	PG	TOTAL	/ STN HR
25-Aug	13.00	0	1	2	0	0	0	0	1	0	0	0	4	0.3
26-Aug	8.75	0	1	2	0	2	0	0	0	0	0	0	5	0.6
27-Aug	17.00	0	13	10	0	1	0	0	1	0	0	0	25	1.5
28-Aug	15.75	0	9	2	0	4	0	0	1	0	0	0	16	1.0
29-Aug	16.75	0	2	1	0	1	0	0	1	1	0	0	6	0.4
30-Aug	12.00	0	5	3	0	0	0	0	0	0	0	0	8	0.7
31-Aug	8.75	0	7	3	0	0	0	0	0	0	1	0	11	1.3
1-Sep	15.17	0	8	1	0	0	0	0	1	0	1	0	11	0.7
2-Sep	18.00	1	17	9	1	2	0	0	0	2	0	0	32	1.8
3-Sep	17.42	0	12	2	0	2	0	0	1	1	0	0	18	1.0
4-Sep	16.25	0	14	3	0	2	0	0	0	0	0	0	19	1.2
5-Sep	16.83	0	12	2	1	1	0	0	0	0	0	0	16	1.0
6-Sep	17.50	1	19	2	0	1	0	0	0	1	0	0	24	1.4
7-Sep	16.25	0	20	2	0	2	0	0	1	0	1	1	27	1.7
8-Sep	17.50	0	28	3	0	0	0	0	1	3	0	0	35	2.0
9-Sep	8.75	0	16	3	0	0	0	0	0	0	0	0	19	2.2
10-Sep	16.17	0	15	5	0	3	0	0	0	0	0	0	23	1.4
11-Sep	16.75	0	30	3	0	1	0	0	0	0	0	0	34	2.0
12-Sep	17.50	0	16	4	0	0	0	0	0	1	0	0	21	1.2
13-Sep	17.50	0	15	1	0	0	0	0	0	0	0	0	16	0.9
14-Sep	0.00													
15-Sep	0.00													
16-Sep	14.50	1	12	0	0	2	0	0	0	1	0	0	16	1.1
17-Sep	16.75	3	8	0	1	2	0	0	0	0	0	0	14	0.8
18-Sep	6.00	0	2	0	0	0	0	0	0	0	0	0	2	0.3
19-Sep	17.50	0	13	2	0	2	0	0	0	0	0	0	17	1.0
20-Sep	17.75	0	12	2	0	0	0	0	0	1	0	0	15	0.8
21-Sep	16.25	0	6	0	1	0	0	0	0	2	0	0	9	0.6
22-Sep	9.00	0	9	1	0	0	0	0	0	0	0	0	10	1.1
23-Sep	17.92	2	22	2	1	0	0	0	0	1	0	0	28	1.6
24-Sep	18.00	5	25	1	0	4	0	1	0	2	0	0	38	2.1
25-Sep	18.25	4	36	2	0	2	0	0	0	1	0	0	45	2.5
26-Sep	17.67	0	13	7	0	0	0	1	0	0	0	0	21	1.2
27-Sep	18.00	1	42	5	0	0	0	0	0	2	0	1	51	2.8
28-Sep	15.67	1	15	2	0	2	0	1	0	2	0	0	23	1.5
29-Sep	17.50	0	11	1	0	1	0	0	0	0	0	0	13	0.7
30-Sep	17.75	0	7	4	0	0	0	0	0	1	0	0	12	0.7

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	15	2	2	1	0	0	0	0	0	0	20	1.2
2-Oct	16.83	0	4	0	2	2	0	0	0	0	0	0	8	0.5
3-Oct	16.50	0	4	0	0	0	0	0	0	1	0	0	5	0.3
4-Oct	17.75	0	0	0	0	0	0	1	0	0	0	0	1	0.1
5-Oct	16.58	3	3	1	3	1	0	0	0	1	0	0	12	0.7
6-Oct	8.75	0	3	2	2	1	1	1	0	0	0	0	10	1.1
7-Oct	17.75	2	4	1	2	1	0	0	0	0	0	0	10	0.6
8-Oct	12.25	0	2	0	0	0	0	0	0	1	0	0	3	0.2
9-Oct	8.25	0	3	0	0	2	0	0	0	1	0	0	6	0.7
10-Oct	8.25	1	1	0	0	1	0	0	0	0	0	0	3	0.4
11-Oct	7.58	1	3	0	1	1	0	1	0	1	0	0	8	1.1
12-Oct	16.50	0	5	0	0	0	2	0	0	0	0	0	7	0.4
13-Oct	8.58	0	4	0	0	0	0	0	0	0	0	0	4	0.5
14-Oct	16.83	1	1	0	0	0	2	0	0	0	0	0	4	0.2
15-Oct	8.33	0	1	1	0	0	0	0	0	0	0	0	2	0.2
16-Oct	0.00													
17-Oct	6.00	0	1	0	1	0	1	0	0	0	0	0	3	0.5
18-Oct	7.50	0	1	0	0	0	0	0	0	0	0	0	1	0.1
19-Oct	7.50	0	1	1	1	2	0	0	0	0	0	0	5	0.7
20-Oct	8.00	1	3	0	0	1	0	0	0	2	0	0	7	0.9
21-Oct	15.25	0	2	0	3	0	0	0	0	1	0	0	6	0.4
22-Oct	13.25	0	2	0	2	0	0	0	0	1	0	0	5	0.4
Total	797.33	28	556	100	24	50	6	6	8	31	3	2	814	1.0

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: 1999–2006.

	1999 ¹	2000 ¹	2001	2002	2003	2004	2005	2006	MEAN	TOTAL
First trapping day	28-Aug	2-Sep	30-Aug	27-Aug	23-Aug	25-Aug	25-Aug	25-Aug		
Last trapping day	16-Oct	14-Oct	17-Oct	19-Oct	25-Oct	18-Oct	22-Oct	22-Oct		
Number of stations	2	2	2	2	2	2	2	2	2	
Trapping days	47	42	44	54	56	53	56	56	51	
Station hours	388	?	612.75	837.25	803.31	699.56	828.19	797.33	709.48	
Captures / stn. hour	5.7	?	8.6	8.1	7.3	5.0	7.5	10.2	7.5	
SPECIES	RAPTOR CAPTURES									
Northern Harrier	4	3	10	13	11	6	12	28	10.9	87
Sharp-shinned Hawk	139	125	341	459	394	237	389	556	330	2640
Cooper's Hawk	42	46	107	127	100	58	137	100	90	717
Northern Goshawk	14	10	12	13	9	16	11	24	14	109
Red-tailed Hawk	11	8	22	29	20	16	11	50	21	167
Rough-legged Hawk	0	1	1	2	1	0	5	6	2.0	16
Golden Eagle	0	1	2	0	4	2	2	6	2	17
American Kestrel	3	0	8	10	17	5	6	8	7	57
Merlin	6	4	17	21	25	10	49	31	20	163
Prairie Falcon	1	1	3	4	4	1	0	3	2	17
Peregrine Falcon	0	0	2	0	4	1	1	2	1	10
All species	220	199	525	678	589	352	623	814	500	4000
Recaptures ²	0	0	0	0	0	0	0	0	0	0
Foreign Recaptures ³	0	0	0	1	0	0	0	2	0.4	3
Foreign Encounters ⁴	0	1	5	2	1	1	4	11	3.1	25

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.