FALL 2012 RAPTOR MIGRATION STUDIES AT CHELAN RIDGE, WASHINGTON

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INTRODUCTION

The Chelan Ridge Raptor Migration Project in north-central Washington is an ongoing effort to monitor long-term trends in populations of raptors using this north Cascades migratory flyway (Smith et al. 2008a). HawkWatch International (HWI), in partnership with the Okanogan and Wenatchee National Forests (OWNF), initiated standardized counts of the autumn raptor migration through this region in 1997, with full-season counts commencing in 1998. The Falcon Research Group (FRG), in cooperation with HWI and OWNF, initiated a trapping and banding program at the site in 1999. HWI and OWNF took over coordinating the banding program in 2001, and these collaborative efforts have been maintained since. To date, our observers have recorded 19 species of migratory diurnal raptors at the site, with counts ranging between ~1,500–2,900 migrants per season. The 2012 season marked the 15th consecutive, full-season count and the 14th consecutive season of banding at the site. This report summarizes the 2012 results.

The Chelan Ridge project was 1 of 8 long-term, annual migration counts and 1 of 4 migration banding studies conducted or co-sponsored by HWI in North America during 2012. The primary objective of these efforts is to track long-term population trends of diurnal raptors in western North America and around the Texas Gulf Coast region (Hoffman and Smith 2003; Smith et al. 2001, 2008 a, b). Raptors can serve as important biological indicators of ecosystem health (Bildstein 2001) and long-term migration counts can be a cost effective and efficient method for monitoring regional status and trends of multiple raptor species (Zalles and Bildstein 2000).

In coordination with the long-term counting and banding efforts, HWI has and will continue to explore related research activities to further help provide valuable information about migratory behavior of raptors, as well as identify species' ranges, migratory routes and connectivity, and track changes in raptor health and populations (e.g., Hoffman et al. 2002, Lott and Smith 2006, Goodrich and Smith 2008, DeLong and Hoffman 2004, McBride et al. 2004). In addition, these migration studies offer unique opportunities for the public to learn about raptors and the natural environment, and providing such opportunities are another important component of the Chelan Ridge Raptor Migration Project.

STUDY SITE

Chelan Ridge is located approximately 21 km north–northwest of the village of Chelan, on the Chelan / Okanogan County border, as well as on the border between the Okanogan and the Wenatchee National Forests (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, on to Black Canyon Road (USFS Road 4010) west–southwest until it ends, then on to 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. Mitchell Creek Basin fills the east–west view and is often a common place to first spot raptors. This basin is approximately 3.5 km wide, and on the southern side of the basin is Goff Peak, which is a major landmark. 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. The view further to the east extends across the Columbia River and Waterville Plateau, while towards the west, a ridgeline (known as Cooper Ridge) extends into the Sawtooth Wilderness. The view to the north into Black Canyon is constrained by a backdrop of dark-green forest of lodgepole (*Pinus contorta*) and Ponderosa pine (*Pinus ponderosa*), and this dark contrast makes spotting migrant raptors difficult. Although the northern view is unobstructed, Black Canyon does have blind spots that are invisible from the lookout where raptors can be lost. Farther north, the view extends across Methow Valley and into the Pasayten Wilderness. To the southeast, migrant raptors often fly through a gap between the lookout and Cooper Mountain. Thus,

allowing some migrants to pass the lookout undetected but are later spotted rising on thermals above the horizon near Cooper Mountain. The south view extends across Lake Chelan and into the Wenatchee National Forest.

The lookout's southwestern slope is a cliff face of 70–80 degrees that drops about 65 m into Mitchell Creek Basin. This cliff face creates excellent updrafts on days of moderate to strong south winds, which allow for extremely close looks at migrants as they fly nearby.

Two trapping and banding stations are located approximately 1 and 2.25 km southeast of the count site (Figure 1). The North station is located on the northwest flank of Cooper Mountain in the same area used by the FRG crew in 1999 and by HWI/OWNF since 2001. The South station is located in a saddle on the southwest flanks of Cooper Mountain in an area used regularly since 2001.

METHODS

STANDARDIZED COUNTS

Two official or designated observers, relieved or supplemented by other trained staff and volunteers, conducted standardized daily counts of migrating raptors from a single traditional observation site. For both official observers, Joshua Collette and Kelsey Navarre, this was their first season of raptor migration counting at the Chelan Ridge site (see Appendix A for a complete history of observer participation). Multi-purpose crewmember Jonathan Roatch also routinely assisted with the counts, while other crewmembers, USFS staff, and visitors assisted on occasion as well.

Weather permitting, observations usually began at 0800 H and ended between 1600 and 1700 H 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 H 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 updated through 2012 follows Farmer et al. (2007). In comparing 2012 annual statistics against means and 95% confidence intervals for previous seasons, we equate significance with a 2012 value falling outside the bounds of the confidence interval for the associated mean.

TRAPPING AND BANDING

The trappers operated the two traditional banding stations daily (weather permitting) from late August through late October, generally between 0800 and 1700 H 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, usually quicker.

RESULTS AND DISCUSSION

WEATHER

Inclement weather forced the site to close on 18 October. (See Appendix C for daily weather records, as well as Appendix E for comparisons of annual start and end dates.) Five additional days were also precluded from operation, and one day was severely hampered (reduced obs. time to ≤ 4 hours; Appendix C). In September, many of the weather days were due to smoke hazard and poor visibility from regional forest fires, but during the mid to late October time period, weather days resulted from heavy precipitation of rain and snow (Appendix C). For comparison, on an average seasonal basis (i.e., 1997-2011) inclement weather prevented 4.6, and severely hamper 1.9 days of observations in a given season.

During the active observation periods, skies were recorded as predominantly fair 69% of the times, 21% as transitional (i.e., changed from fair or partly cloudy to mostly cloudy or overcast during the day, or vice versa), and 10% as mostly cloudy to overcast. In comparison, the averages for the site were 48% fair, 30% transitional, and 21% as mostly cloudy or overcast, showing that clear and sunny skies predominated and increased dramatically this past season. And with less cloud cover, precipitation, and an increase in temperatures (i.e., 14.9˚ C for the seasonal average vs. 12.3˚ C as the long-term seasonal average), the dry conditions seemed to fuel the abundance of regional forest wild fires during the month of September. Thus, the visibility for raptor observations during the 2012 fall season was especially affected (i.e., 69% vs. 39 % on average) by haze, caused by local and regional fires, as well as some fog later in the season. Visibility affected by rain or snow this past season was fairly negligible (4% vs. 13% on average). Interestingly however, despite the extreme haze and smoke conditions caused by fires, observers ranked the season's visibility above average looking towards both the east (76% vs. 64%, on average) and west (70% vs. 61%, on average). Unsurprisingly though, due to the season's increased temperatures and clearer skies, observers also rated thermal lift good to excellent way above average (i.e., 67% vs. 43%, respectively). Since thermal lift conditions were favorable for raptors to gain high altitudes, some raptors may not have been detected considering also the tremendous amount of haze and smoke. Sometimes, the presence of background contrast in the sky (e.g., clouds) helps to detect high-flying birds as well. Thus, the above average of clear blue skies during the 2012 fall season could have caused raptors to be missed, which is difficult to measure without estimating observer bias (e.g., radar).

Similar to previous years, wind conditions in 2012 were again primarily light (< 12 kph), albeit they were above average (occurring on 83 % of the active observation days vs. 68%, on average). Moderate (12-29 kph) winds were below average (17% vs. 30%, on average), and high winds (≥ 29 kph) did not occur, which are usually rare at this site anyway (i.e., 2%, on average). In previous years, the daily wind patterns covered directions from the S-SW (46.9% of the days) or the wind started in the S-W for a major part of the day then switching to N-E for the remainder of the observation period (10.5%). The third most common pattern was winds from the SE-SW (8.2%) as primary directional location. This past season, winds came from variable S-W directions at substantial rates; S-SW (31% vs. 46.9%, see above), S-W (23% vs. 5.1%, on average), and S-W for one part and then N-E for another part of the day (17% vs. 10.5%, see above), as well as were Calm/Variable (12% vs. 5.6%). Winds were also recorded from the

N-E (4% vs. 1.8%); SE-SW/Calm and Variable (4% vs. 0.2%); SE-SW for one and then NW-NE for another portion of the day (4% vs, 4.6%), SW-NW (4% vs. 3.2%), and N-E/Calm and Variable (2% vs. 1.4%). Thus, although still relatively comparable with previous wind speeds and directions, winds this past season were considerably lighter and less moderate with a higher percentage of winds being calm and variable, but variable S-W winds remained the primary direction for the 2012 season.

In summary, the season was highly affected by local wildland fires throughout September, and early winter snow caused the site to end nine days earlier than planned. Wind directions were comparable with previous directional trends, but were lighter and slightly more variable. Light winds and warm temperatures allowed for an above average rating of excellent thermal lift. Excellent thermal lift is favorable for raptor migration as it allows birds to gain lift without much energy expenditure. However, because the winds were more variable and calm, it is unknown how those conditions at the site affected migratory raptor behavior potentially causing raptors to concentrate less along an established route and migrating more broadly, choosing different migratory pathways. In addition, hazardous smoke caused observers to leave the site at times and migration activity may not have stopped during those days. The days with heavy smoke and haze, coupled with excellent thermal lift, and new inexperienced observers to the site could have caused some birds to go undetected.

OBSERVATION EFFORT

During this past season, observers were able to count on 52 of 65 possible days between 23 August and 26 October, which was significantly below the 1998-2011 long term average (60 ± 95% CI of 1.9 days, Appendix E). The number of observation hours (446.22) was also significantly below average (493.42 ± 21.653 hrs). However, the 2012 average of 2.2 observers per hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) was slightly higher than the long-term average (2.04 ± 0.109 observers/hour).

FLIGHT SUMMARY AND TRENDS

Observers counted 1,565 migrating raptors of 16 species during the 2012 season (Table 1; see Appendix D for daily count records), which is a 25% decrease compared to the long term average (Table 1; see Appendix E for annual count summaries). The highlight of the season was a record high count of 117 Rough-legged Hawks (Appendix E). Turkey Vulture counts were also significantly above average (Table 1). However, counts of most all the other species were significantly below average, except for Broad-winged and Swainson's Hawks, which were non-significantly below average (Table 1). Even more troubling, observers recorded record low counts for American Kestrels, a species of recent continental concern (*cf.* Journal of Raptor Research 2009, Vol. 43, No. 4), a tied record low count of only one Bald Eagle, and near record lows for Ospreys and Cooper's Hawks (Appendix E). During 2011, a record low of 130 Cooper's Hawks were counted. This past season's count of 133 wasn't much of a change (Appendix E).

The flight consisted of 51% accipiters, 26% buteos, 6% eagles, 4% harriers, 3% falcons, 3% vultures, 2% Ospreys, and 5% unknown raptors (Table 1). The proportion of buteos, vultures, and unknown raptors were above average; whereas, the proportion of accipiters, falcons, eagles, harriers, and Ospreys were all below average (Figure 2). As expected, Sharp-shinned Hawks were the most commonly observed species (34% of the total), followed by Red-tailed Hawks (13%), Cooper's Hawks (9%), Rough-legged Hawks (8%), Golden Eagles (6%), Northern Harriers (4%), and Turkey Vultures (at 3%). The remaining species each made up only 2% or less of the total count.

Population Trends.—Regression analyses of the adjusted passage rates through 2012 revealed significant ($P \leq 0.10$) declines for Northern Harriers (Fig. 3), American Kestrels (Fig. 7) and adult Golden Eagles continued to show a quadratic decline in recent years (Fig. 6). A significant quadratic pattern of decline was also emerging for Peregrine Falcons (Fig. 7) and similarly, Sharp-shinned and Red-tailed Hawks were beginning to show marginal significant declines (Figs. 4 & 5, respectively).

Northern Harriers at this site began showing steady declines last year (Hawks and Mika 2012$_a$), so we will continue to monitor this species at this and other western North American sites for similar trends. Evidence for widespread American Kestrel population declines continued, and HWI scientists, along with many other North American researchers and Citizen Scientists are teaming up with the Peregrine Fund to help investigate reasons for the declining trends (http://kestrel.peregrinefund.org/). Population declines for Golden Eagles have also been a recent concern (cf. Farmer et al. 2008 and Katzner et al. 2012). Data from this site (Fig. 6), as well as from our Bonney Butte, Oregon and Goshute Mountains, Nevada sites suggested the declines were attributed to lower number of adults (cf. Hawks and Mika 2013 and Hawks and Mika 2012$_b$, respectively). Last year, Peregrine Falcon populations at Chelan Ridge demonstrated a significant increase in trends (Hawks and Mika 2012$_a$, Fig. 7). Thus, the emerging quadratic pattern may be indicative of a population beginning to stabilize, but only time will tell as we continue to monitor this species. Nevertheless, this species recovery has definitely been a great conservation success story thus far. The emergence of marginally significant declines for both Sharp-shinned (p-value = 0.053,) and Red-tailed Hawks (p-value = 0.083) also suggest further closer monitoring, but with caution since little of the variation is explained by their models (r^2 = 0.259 and 0.213, respectively). Red-tailed Hawks, however, began to show significant declines at our Bonney Butte, Oregon site (Hawks and Mika 2013) so we will continue to closely monitor this species at this regional scale.

Three species showed significant population increases; Turkey Vultures (Fig. 3), Broad-winged Hawks (Fig. 5), and Rough-legged Hawks (Fig. 5). Turkey Vultures at this site have been increasing for a number of years (see previous reports), but at our Bonney Butte, Oregon site, they have only recently begun to do so in a significant manner (Hawk and Mika 2013). Last year, Broad-winged Hawks showed a marginally significant linear decrease (Hawks and Mika 2012$_a$). This year, Broad-winged Hawks are showing a pattern of a significant quadratic increase (Fig. 5). However, with less than ten birds observed every year (Appendix E), these trends seem rather weak and we will continue to monitor this more eastern North American species to see if it continues to remain stable around the low numbers at seen at western sites in recent years. The significant quadratic increase for Rough-legged Hawks (Fig. 5) was most likely influenced by the record 117 species count this past season (Appendix E).

Age Ratios

During the season, only one Bald Eagle, an adult, was observed (Table 2). Otherwise, immature : adult ratios were above average for Sharp-shinned Hawks, Northern Goshawks, and Golden Eagles, but below average for the remainder of species where age classes could be differentiated (Table 2). With Northern Harriers and Peregrine Falcons, the total count of immature birds usually outnumbers adults but this past season identified immatures and adults were relatively equal for both species (Table 2). These numbers however, could be somewhat misleading because of the high percentage of birds we were unable classify (see % Unknown Age, Table 2). Thus, we exercise caution when using these data to extract annual reproductive effort due to the large year-to-year variation of birds without a definitive age classification. In addition, other sources of variation in age ratios especially at Chelan Ridge are weather effects on migration and observer error in these estimates. Analysis of the ratios to understand long-term changes may be more insightful. Furthermore, Golden Eagle declines at this (Fig. 6) and two other HWI sites were attributed to declines in adult birds. Thus, differentiating gender and being able to attribute long-term declines among age classes can be insightful.

Seasonal Timing

The combined-species median passage date of 26 September was significantly later than the long-term average by five days (Table 3). In the past, the long-term combined-species seasonal distribution normally illustrates an approximation of a bell-shaped pattern with a slight dip during the 16 through 20 September, 5-day period; whereas this past season, birds came through quite erratically (Fig. 8), which was most likely due to the effect of fire activity on observational efforts (see weather discussion above).

Most species-specific passage date medians, however, shifted to an earlier date between one and fourteen days, while four species (e.g., Turkey Vultures, Ospreys, Red-tailed Hawks, and American Kestrels) moved through between one and twelve days later compared to previous averages (Table 3). Age-specific median dates generally followed the same pattern except that immature Red-tailed Hawks moved through three days early, and both age groups of Golden Eagles (adults and immatures) moved through five and four days later, respectively, compared to the long-term average (Table 4). Documenting both age-specific passage dates of Golden Eagles migrating through later this season (Table 4) contrasts with the overall timing of Golden Eagles arriving a few days early (Table 3), but the discrepancy does not factor in the percentage of Golden Eagles we were unable to age (Table 2).

RESIDENT RAPTORS

Six resident Red-tailed Hawks were identified throughout the season; one adult light morph with molt, one adult light morph without molt, one adult dark morph that showed up later in the season, and three immature light morphs were among them.

An immature Turkey Vulture was seen on numerous days beginning 04 September through 02 October. 01 September was the first day the crew observed a local resident Turkey Vulture and that bird was not identified as being an immature or an adult, so it is unknown whether that bird was the same immature that was observed most of the season.

Three resident immature Golden Eagles were observed on three separate occasions; 23 and 26 August, as well as 04 October. A Golden Eagle of unknown age was observed on 06 October. Whether any of these birds were the same individuals is unknown.

Two local resident Ospreys were observed on 23 August and one local resident followed on 29 August. Otherwise, there was no other resident Ospreys observed throughout the season.

At least one resident Sharp-shinned Hawk was seen regularly on 21days throughout the season, beginning 24 August through 07 October. Birds were not able to be identified to age or gender so it is unknown whether these were the same birds or not. Similarly, at least one resident Cooper's Hawk was also regularly observed on 21 days throughout the season, beginning on 23 August through 10 October; and likewise, the resident Cooper's Hawks were also never aged or sexed so whether there was more than one Cooper's Hawk is unknown.

For the first three days in August, at least one immature Peregrine Falcon was observed. After that, a Peregrine Falcon of unknown age was seen for an additional seven more days through 25 September. Again, it is unknown if this was the same bird as the one from early in the season. A resident Merlin of unknown gender or age visited the observation site during seven days beginning 10 September through 02 October. During the early stages of the season through 12 September, at least two American Kestrels were seen. Male kestrels were observed on 25 and 29 August, as well as 03 September, a female was seen on 26 August, and American Kestrels of unknown gender were seen on 27 August and on the 01, 05, and 12 September.

TRAPPING EFFORT

Trapping occurred on 48 of 54 days between 23 August and 17 October, with efforts totaling 468.55 station hours (Appendix G, as well as Appendix F for daily trapping results). Due to fires and weather this past season, the number of trapping days and station hours were significantly shortened (Appendix G). The reduction in station hours, however, is a reflection of small crews in recent years. Based on the average capture rates and success estimated for 2012 (Table 5), trapping efficiency is still being maintained.

TRAPPING AND BANDING RESULTS

A total of 522 raptors of eleven species were captured and banded, which is well below average (Table 5, Appendix G). In fact, only two species capture totals were above average; Rough-legged Hawks and Golden Eagles (Table 5). Overall, the most frequently captured species were Sharp-shinned Hawks (67.0% of captures), Cooper's Hawks (19.3%), Red-tailed Hawks (4.8%), and Merlins (3.8%); all other species each made up <2% of the total number of captured birds.

Comparing accipiter gender and age ratios revealed only one discrepancy compared to the averages from previous years. Normally, more male Northern Goshawks are captured than females (Table 6). This past season, male and females were captured at equal rates (Table 6). Monitoring deviations in annual sex and age ratios, and especially with a focus on long term estimates through banding helps better track changes in reproductive effort (e.g., major changes in sex ratios, or the lack of young being produced) or migratory behavior (e.g., major changes in adult gender being captured or observed).

Measures of accipiter body physiology revealed that most of the birds that were captured had rather lean body conditions with low levels of estimated wing pit fat deposits (Table 7). In addition, most Sharp-shinned and Cooper's Hawks were captured without food in their crops. However, from the six young Northern Goshawks that were captured, results indicate that although they were relatively lean and lacking wing pit fat, most were being captured with food in their crop (Table 7), suggesting that foraging was somewhat successful. In addition to these traditional methods of examining raptor migratory physiology, we are beginning to investigate the use of blood metabolite assays in plasma to also gain insights of physiological and caloric needs of raptors while undergoing migration through these sites.

ENCOUNTERS WITH PREVIOUSLY BANDED BIRDS

Throughout this past year, we received notification of five band recoveries: One Cooper's Hawk, three Sharp-shinned Hawks, and one Red-tailed Hawk (Table 8). All the birds, except for an adult female Sharp-shinned Hawk (Band # 1623-24058), were found dead of unknown causes (Table 8), a relatively common occurrence. The adult female Sharp-shinned was found injured near Carson City, Nevada, but was subsequently released. We attempted to contact the person who reported the band but no phone calls were returned. Birds that fly through the Chelan Ridge site can be recovered within two flyways, along the Pacific Coast and the Intermountain (cf. Hoffman et al. 2002). Most birds (Table 8) were recovered within the Pacific Coast Flyway but flyway distinction can sometimes overlap (cf. Hoffman et al. 2002). Both of the female Sharp-shinned Hawks (Table 8) were recovered along the flyway borders (Hoffman et al. 2002). Therefore it is difficult to determine if these birds were using the Intermountain or some eastern section of the Pacific Coast Flyway.

Unfortunately this past season no "foreign recaptures" of birds banded under someone else's authorization or from previously banded birds were encountered (Appendix G). All these records are important to learn about potential causes of mortality or injury to raptors, fly usage and migration patterns, and additional information on raptor longevity and survivorship.

VISITOR PARTICIPATION AND PUBLIC OUTREACH

A total of 87 individuals visited the site during the season outside of any organized event. The largest single visitation day happened on 22 September as part of the Chelan Ridge Hawk Migration Festival. Activities included an opportunity to see raptors up close and in the hand prior to their release back into the wild after being banded. Multiple local groups and individuals from various western states interested in hawks came to engage in education activities and other festivities. The festival was sponsored by Methow Valley Ranger District of the US Forest Service, North Central Washington Audubon Society, and HawkWatch International. Throughout the season most visitors came from the surrounding Washington communities, but others came from Oregon, California, Wisconsin, Massachusetts, North Carolina, and Florida.

During the 2012 season, 446 hourly assessments of visitor disturbance resulted in the following disturbance ratings: 96.7% of the time the observers ranked their efforts as not being disturbed at all and 3.3% of the time, crews dealt with low visitor disturbance. Therefore, with various levels of visitation, anywhere from individuals to bigger groups, visitor disturbance this past season was relatively negligible.

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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: 1998–2011 versus 2012.

	COUNTS			RAPTORS/100 HOURS		
SPECIES	1998–2011[1]	2012	% Change	1998–2011[1]	2012	% Change
Turkey Vulture	38 ± 8.2	51	+34	8.1 ± 1.63	12.4	+53
Osprey	40 ± 6.9	27	-33	10.0 ± 1.87	7.2	-28
Northern Harrier	105 ± 19.4	68	-35	24.5 ± 4.82	15.9	-35
White-tailed Kite	0 ± 0.1	0	-100	–	–	
Sharp-shinned Hawk	804 ± 97.5	531	-34	208.8 ± 30.34	154.7	-26
Cooper's Hawk	236 ± 33.2	133	-44	65.9 ± 8.95	42.2	-36
Northern Goshawk	31 ± 6.4	22	-29	7.1 ± 1.38	6.2	-12
Unknown small accipiter[2]	46 ± 19.8	88	+89	–	–	
Unknown large accipiter[2]	9 ± 3.4	11	+26	–	–	
Unknown accipiter	63 ± 41.3	20	-68	–	–	
TOTAL ACCIPITERS	1264 ± 238.5	805	-36	–	–	
Red-shouldered Hawk	0 ± 0.1	0	-100	–	–	
Broad-winged Hawk	5 ± 1.0	4	-20	2.5 ± 0.64	2.2	-16
Swainson's Hawk	6 ± 2.7	4	-38	2.3 ± 1.02	1.0	-56
Red-tailed Hawk	309 ± 48.1	204	-34	75.1 ± 11.74	60.3	-20
Ferruginous Hawk	0 ± 0.1	0	-100	0.1 ± 0.16	0.0	-100
Rough-legged Hawk	29 ± 7.2	117	+303	17.1 ± 3.77	90.3	+430
Unidentified buteo	52 ± 20.6	71	+38	–	–	
TOTAL BUTEOS	428 ± 85.1	400	-7	–	–	
Golden Eagle	115 ± 19.3	90	-22	25.2 ± 4.20	22.3	-12
Bald Eagle	7 ± 2.5	1	-86	1.6 ± 0.55	0.3	+83
Unidentified eagle	2 ± 1.9	0	-100	–	–	
TOTAL EAGLES	133 ± 23.5	91	-31	–	–	
American Kestrel	55 ± 13.1	8	-85	15.0 ± 4.16	2.5	-83
Merlin	41 ± 5.8	24	-41	9.7 ± 1.72	6.6	-32
Prairie Falcon	9 ± 2.6	6	-31	2.2 ± 0.59	1.9	-13
Peregrine Falcon	9 ± 2.9	4	-54	2.2 ± 0.64	1.4	-36
Unknown small falcon[2]	4 ± 1.6	2	-44	–	–	
Unknown large falcon[2]	2 ± 0.9	2	+10	–	–	
Unknown falcon	2 ± 1.1	1	-46	–	–	
TOTAL FALCONS	129 ± 27.2	47	-63	–	–	
Unidentified raptor	93 ± 36.6	76	-18	–	–	
GRAND TOTAL	2098 ± 237.1	1565	-25	–	–	

[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: 1998–2011 versus 2012.

	Total and Age-classified Counts								Immature : Adult	
	1998–2011 Average			2012			% Unknown Age		Ratio	
	Total	Imm.	Adult	Total	Imm.	Adult	1998–2011[1]	2012	1998–2011[1]	2012
Northern Harrier	105	36	24	68	20	21	43 ± 5.8	40	1.6 ± 0.43	1.0
Sharp-shinned Hawk	804	410	134	531	289	77	33 ± 4.1	31	3.2 ± 0.74	3.8
Cooper's Hawk	236	110	36	133	40	18	39 ± 4.5	56	3.9 ± 1.47	2.2
Northern Goshawk	31	17	4	22	6	1	32 ± 6.9	68	4.6 ± 2.51	6.0
Broad-winged Hawk	5	2	1	4	1	0	39 ± 11.5	75	1.0 ± 0.59	
Red-tailed Hawk	309	68	127	204	24	58	39 ± 4.2	60	0.5 ± 0.12	0.4
Golden Eagle	115	57	24	90	58	13	30 ± 4.7	21	2.4 ± 0.39	4.5
Bald Eagle	7	2	5	1	0	1	9 ± 8.4	0	0.5 ± 0.29	0.0
Peregrine Falcon	9	3	2	4	1	1	37 ± 12.4	50	1.3 ± 0.85	1.0

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

Table 3. First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Chelan Ridge, WA in 2012, with a comparison of 2012 and 1998–2011 average median passage dates.

	2012				1998–2011
Species	First Observed	Last Observed	Bulk Passage Dates[1]	Median Passage Date[2]	Median Passage Date[2, 3]
Turkey Vulture	31-Aug	2-Oct	10-Sep – 29-Sep	26-Sep	14-Sep ± 2.9
Osprey	30-Aug	10-Oct	8-Sep – 9-Oct	26-Sep	18-Sep ± 2.6
Northern Harrier	25-Aug	15-Oct	2-Sep – 7-Oct	12-Sep	22-Sep ± 2.2
Sharp-shinned Hawk	26-Aug	18-Oct	3-Sep – 9-Oct	16-Sep	20-Sep ± 1.9
Cooper's Hawk	28-Aug	17-Oct	31-Aug – 4-Oct	16-Sep	17-Sep ± 1.8
Northern Goshawk	4-Sep	12-Oct	5-Sep – 9-Oct	16-Sep	30-Sep ± 5.3
Broad-winged Hawk	13-Sep	19-Sep	–	–	13-Sep ± 3.2
Swainson's Hawk	1-Sep	13-Oct	–	–	16-Sep ± 5.9
Red-tailed Hawk	26-Aug	18-Oct	4-Sep – 9-Oct	27-Sep	26-Sep ± 3.0
Rough-legged Hawk	7-Oct	18-Oct	7-Oct – 17-Oct	8-Oct	14-Oct ± 2.4
Golden Eagle	25-Aug	17-Oct	16-Sep – 11-Oct	8-Oct	10-Oct ± 1.9
Bald Eagle	29-Sep	29-Sep	–	–	10-Oct ± 3.6
American Kestrel	6-Sep	27-Sep	6-Sep – 27-Sep	14-Sep	12-Sep ± 3.6
Merlin	2-Sep	18-Oct	4-Sep – 17-Oct	14-Sep	21-Sep ± 3.0
Prairie Falcon	4-Sep	11-Oct	4-Sep – 11-Oct	8-Sep	17-Sep ± 6.5
Peregrine Falcon	29-Aug	24-Sep	–	–	16-Sep ± 4.8
Total	27-Aug	18-Oct	4-Sep – 10-Oct	26-Sep	21-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: 1998–2011 versus 2012.

	ADULT		IMMATURE	
SPECIES	1998–2011[1]	2012	1998–2011[1]	2012
Northern Harrier	21-Sep ± 3.1	06-Sep	22-Sep ± 2.6	12-Sep
Sharp-shinned Hawk	02-Oct ± 1.5	30-Sep	14-Sep ± 1.6	09-Sep
Cooper's Hawk	26-Sep ± 2.0	18-Sep	12-Sep ± 1.5	06-Sep
Northern Goshawk	30-Sep ± 7.6	–	28-Sep ± 4.9	28-Sep
Red-tailed Hawk	29-Sep ± 2.3	03-Oct	17-Sep ± 3.1	14-Sep
Golden Eagle	05-Oct ± 4.0	10-Oct	04-Oct ± 2.0	08-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: 2001–2011 versus 2012.

	Capture Totals		Capture Rate[1]		Capture Success[2]	
	2001–2011[3]	2012	2001–2011[3]	2012	2001–2011[3]	2012
Northern Harrier	16 ± 4.7	8	2.3 ± 0.84	1.7	16.3 ± 3.4	14.3
Sharp-shinned Hawk	411 ± 49.7	350	59.0 ± 7.58	74.7	52.3 ± 7.3	60.5
Cooper's Hawk	113 ± 14.5	101	16.3 ± 2.35	21.6	45.1 ± 7.5	68.1
Northern Goshawk	15 ± 3.6	6	2.2 ± 0.47	1.3	54.3 ± 10.4	55.6
Broad-winged Hawk	0 ± 0.2	0	0.0 ± 0.03	0.0	1.5 ± 3.0	0.0
Red-tailed Hawk	27 ± 6.4	25	4.0 ± 1.04	5.3	8.2 ± 1.9	15.7
Rough-legged Hawk	2.6 ± 1.66	3	0.4 ± 0.24	0.6	8.4 ± 4.4	3.7
Golden Eagle	3 ± 1.1	4	0.5 ± 0.19	0.9	3.5 ± 1.7	10.6
American Kestrel	7.8 ± 2.57	2	1.1 ± 0.29	0.4	17.8 ± 7.3	26.7
Merlin	24 ± 6.1	20	3.4 ± 0.83	4.3	58.1 ± 15.5	50.0
Prairie Falcon	3 ± 1.0	2	0.3 ± 0.13	0.4	26.8 ± 13.3	0.0
Peregrine Falcon	1.9 ± 0.7	1	0.3 ± 0.12	0.2	22.1 ± 10.9	37.5
All species	625 ± 73.2	522	89.8 ± 11.82	111.4	35.0 ± 4.0	46.4

[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.

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: 2001–2011 versus 2012.

		Female		Male			
Species	Years	HY	AHY	HY	AHY	Female : Male Ratio[1]	Imm. : Adult Ratio[1]
Sharp-shinned Hawk	Avg. 2001–2011	163	61	154	33	1.2 ± 0.08	3.5 ± 0.36
	2012	140	46	137	27	1.1	3.8
Cooper's Hawk	Avg. 2001–2011	45	24	34	11	1.6 ± 0.12	2.4 ± 0.30
	2012	38	17	33	13	1.2	2.4
Northern Goshawk	Avg. 2001–2011	4	0	10	1	0.5 ± 0.09	9.7 ± 4.38
	2012	3	0	3	0	1.0	0.0

[1] Long-term values: mean ± 95% CI.

Table 7. Fall body condition indices for migrant accipiters captured at Chelan Ridge, WA: 2001–2011 versus 2012.

		Crop Fullness					Keel Muscle[1]			Wing-pit Fat[2]			
Species	Years	E	1/4	1/2	3/4	F	0	1	2	0	1	2	3
Sharp-shinned	2001–2011 mean	61.9	14.2	10.7	4.4	8.8	21	61	17	22	57	17	4
Hawk	2012	65	18	9	1	7	91	9	0	61	31	7	1
Cooper's	2001–2011 mean	73.6	9.6	7.9	3.4	5.6	40	53	7	29	49	18	4
Hawk	2012	71	12	6	1	10	98	2	0	75	15	6	4
Northern	2001–2011 mean	86.3	3.9	4.2	1.8	3.8	24	70	6	27	59	12	2
Goshawk	2012	33	0	50	0	17	100	0	0	83	0	17	0

[1] Subjective rating based on visual and tactile assessment of keel muscle mass, with 0 indicating a skinny bird, 1 indicating a moderately healthy bird, and 2 indicating a bird with a robust keel muscle.

[2] Subjective rating based on visual assessment of fat deposit in the "wing-pit" hollow directly under the wing, with 0 indicating no fat, 1 indicating a modest fat deposit, 2 indicating a deposit that mostly fills the wing-pit, and 3 indicating a bulging deposit.

Table 8. Foreign encounters of raptors banded at the Chelan Ridge Raptor Migration Project from records obtained in 2012.

Band #	Species[1]	Sex	Banding Date	Banding Age[2]	Encounter Location	Encounter Date	Encounter Age[2]	Distance (km)	Status
1075 – 01890	CH	F	08-Sep-12	HY	Glide, OR	24-Sec-12	HY	546	Found dead – unknown cause
1573 – 85173	SS	M	06-Sep-11	HY	Cambria, CA	22-Mar-12	AHY	1131	Found dead – unknown cause
1623 – 24058	SS	F	04-Oct-10	AHY	Carson City, NV	03-Mar-12	ASY	813	Found injured – released
1623 – 24533	SS	F	08-Sep-12	HY	Zillah, WA	28-Oct-12	HY	152	Found dead – unknown cause
1177 – 06086	RT	U	04-Sep-12	HY	Davis, CA	26-Oct-12	HY	875	Found dead – unknown cause

[1] CH = Cooper's Hawk; SS = Sharp-shinned Hawk; RT = Red-tailed Hawk.

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

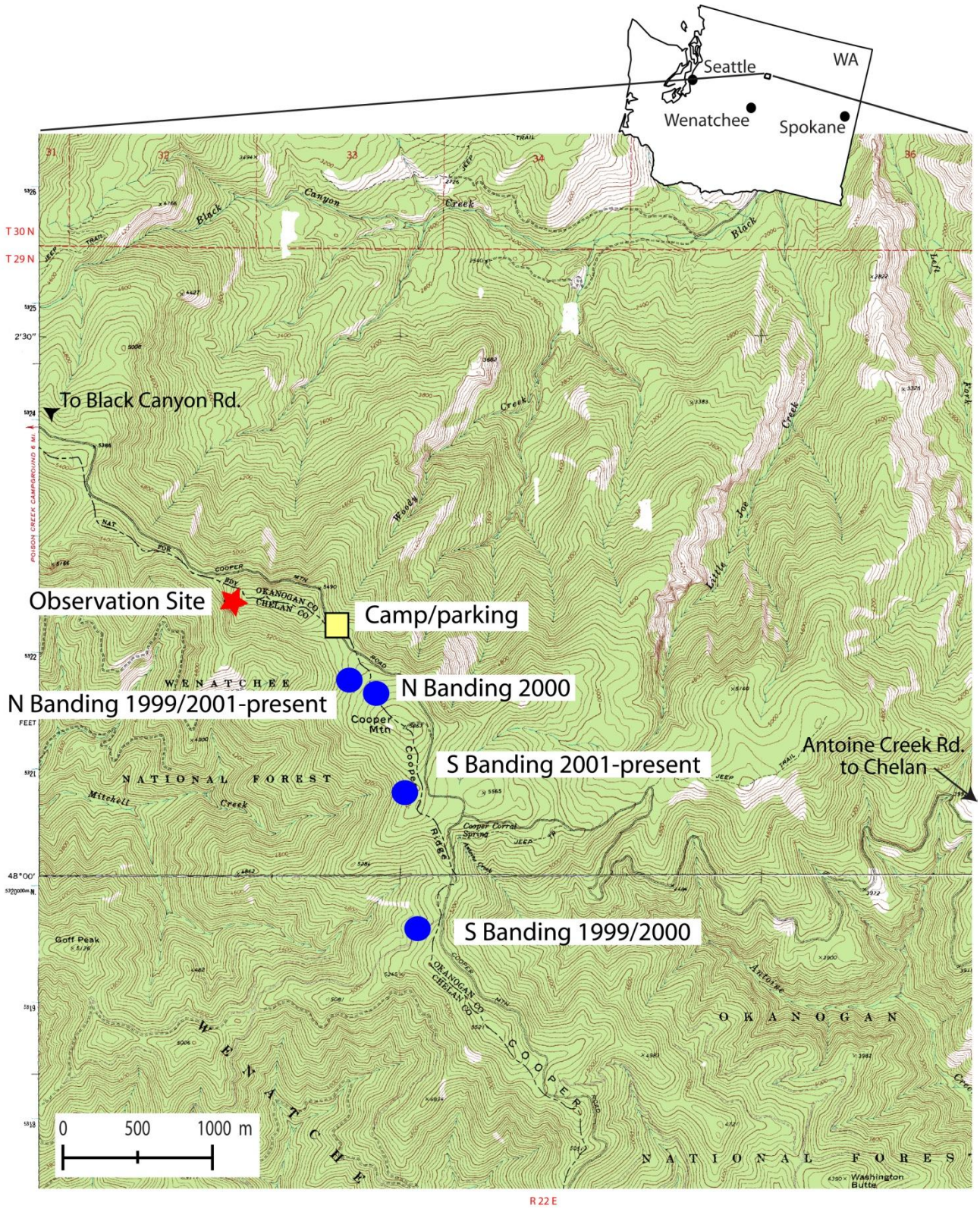

Figure 1. Location of the Chelan Ridge Raptor Migration Project count and banding sites in north-central Washington.

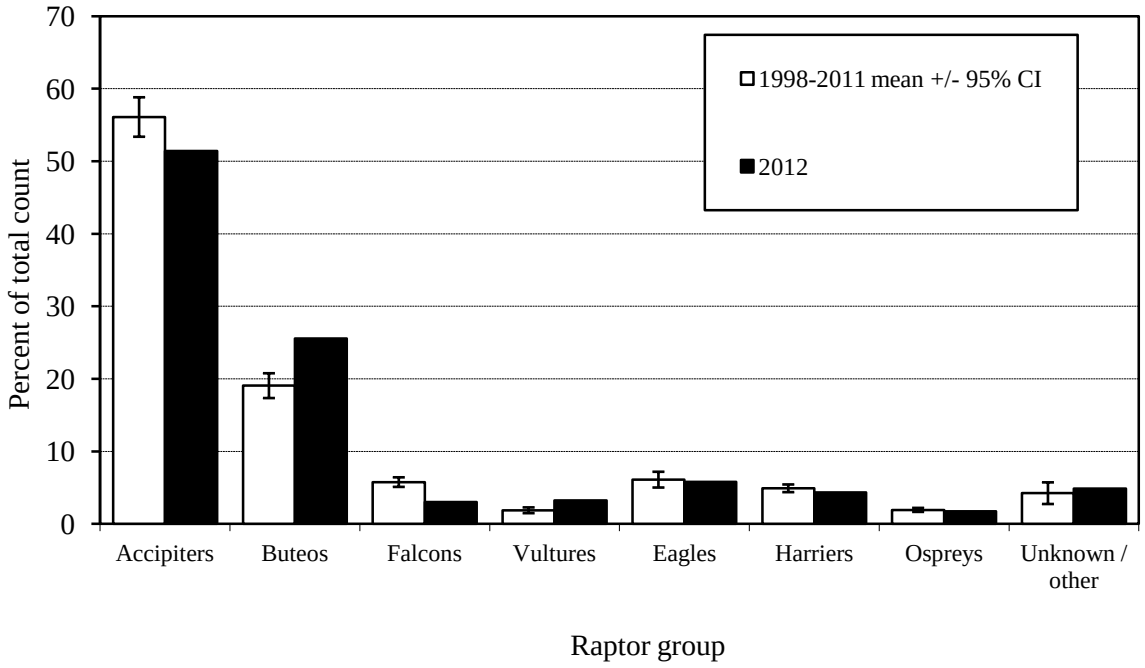

Figure 2. Fall raptor migration flight composition by major species groups at Chelan Ridge, WA: 1998–2011 versus 2012.

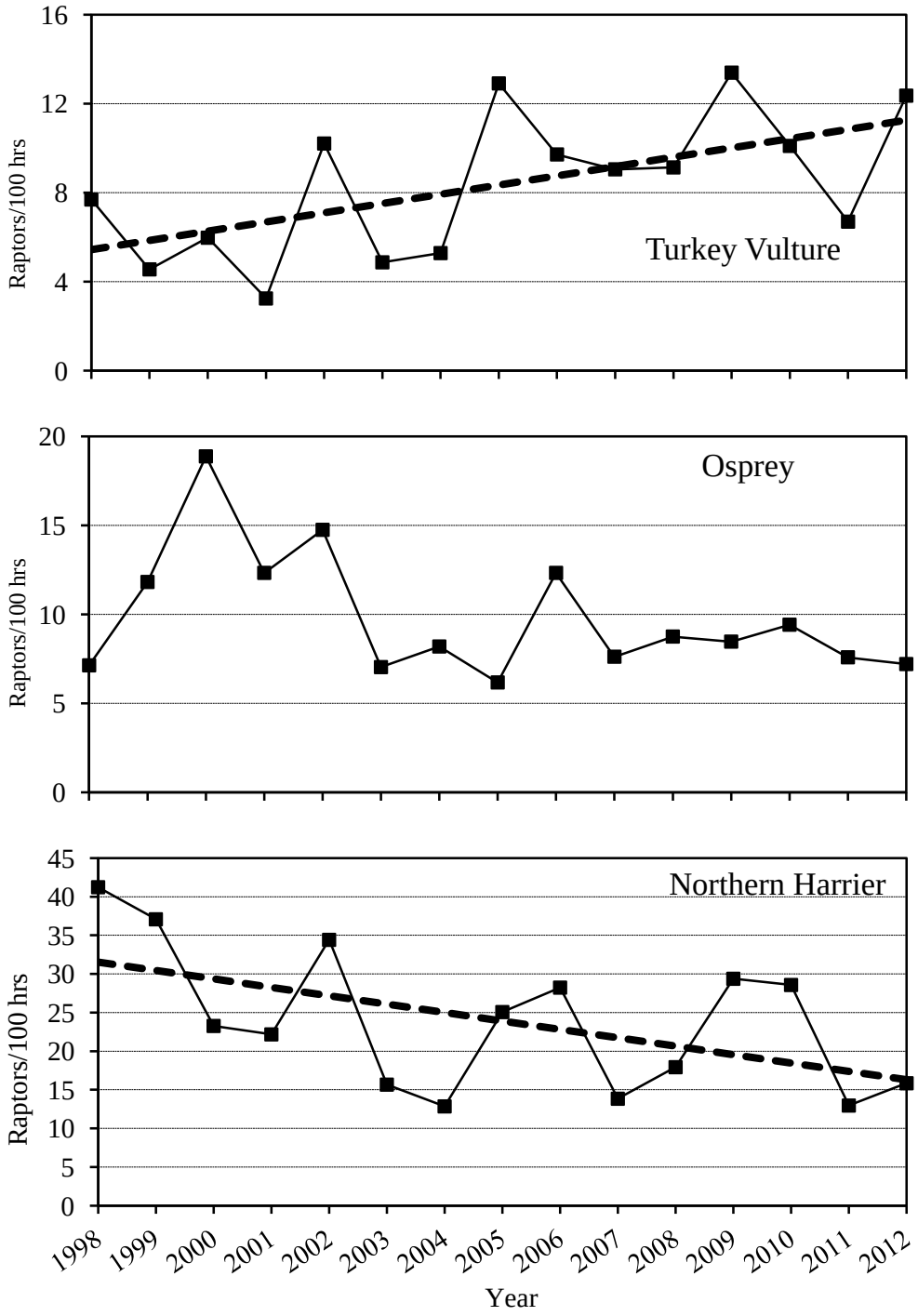

Figure 3. Adjusted fall-migration passage rates at Chelan Ridge, WA for Turkey Vultures, Ospreys, and Northern Harriers: 1998–2012. Dashed lines indicate significant linear or quadratic regressions.

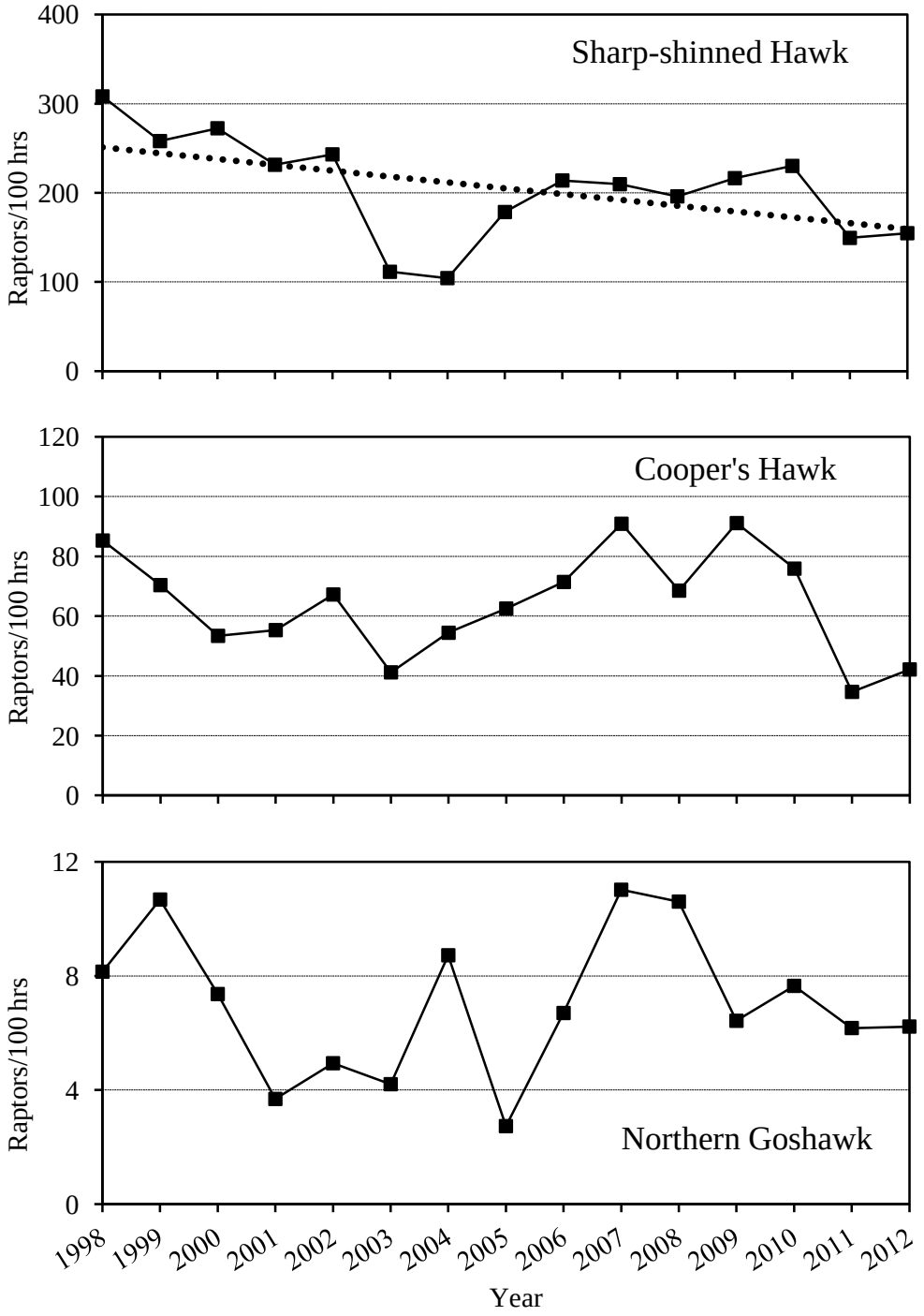

Figure 4. Adjusted fall-migration passage rates at Chelan Ridge, WA for Sharp-shinned Hawks, Cooper's Hawks, and Northern Goshawks: 1998–2012. Dashed lines indicate significant linear or quadratic regressions, dotted lines indicate near significance.

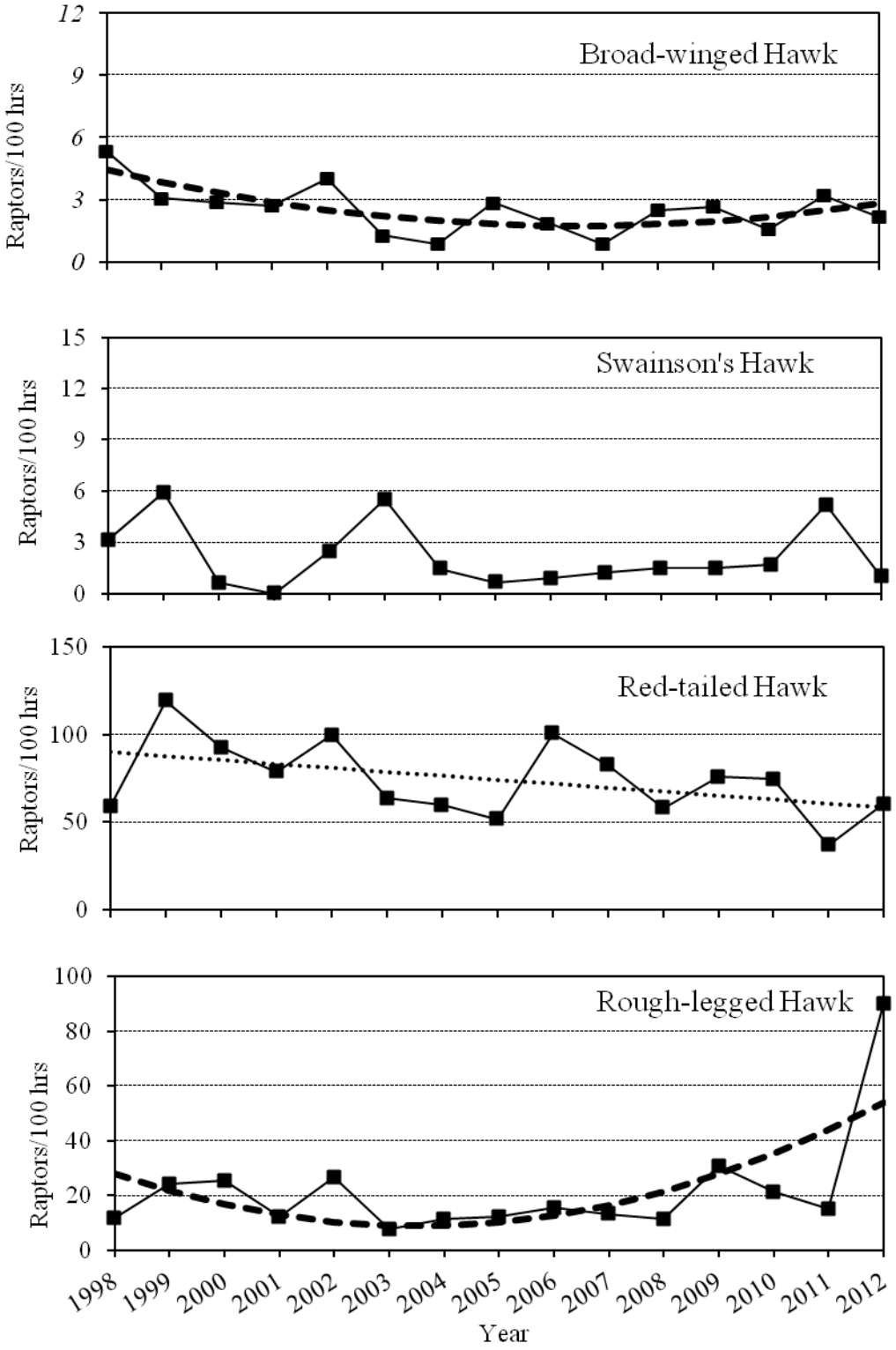

Figure 5. Adjusted fall-migration passage rates at Chelan Ridge, WA for Broad-winged, Swainson's, Red-tailed, and Rough-legged Hawks: 1998–2012. Dashed lines indicate significant linear or quadratic regressions, dotted lines indicate near significance.

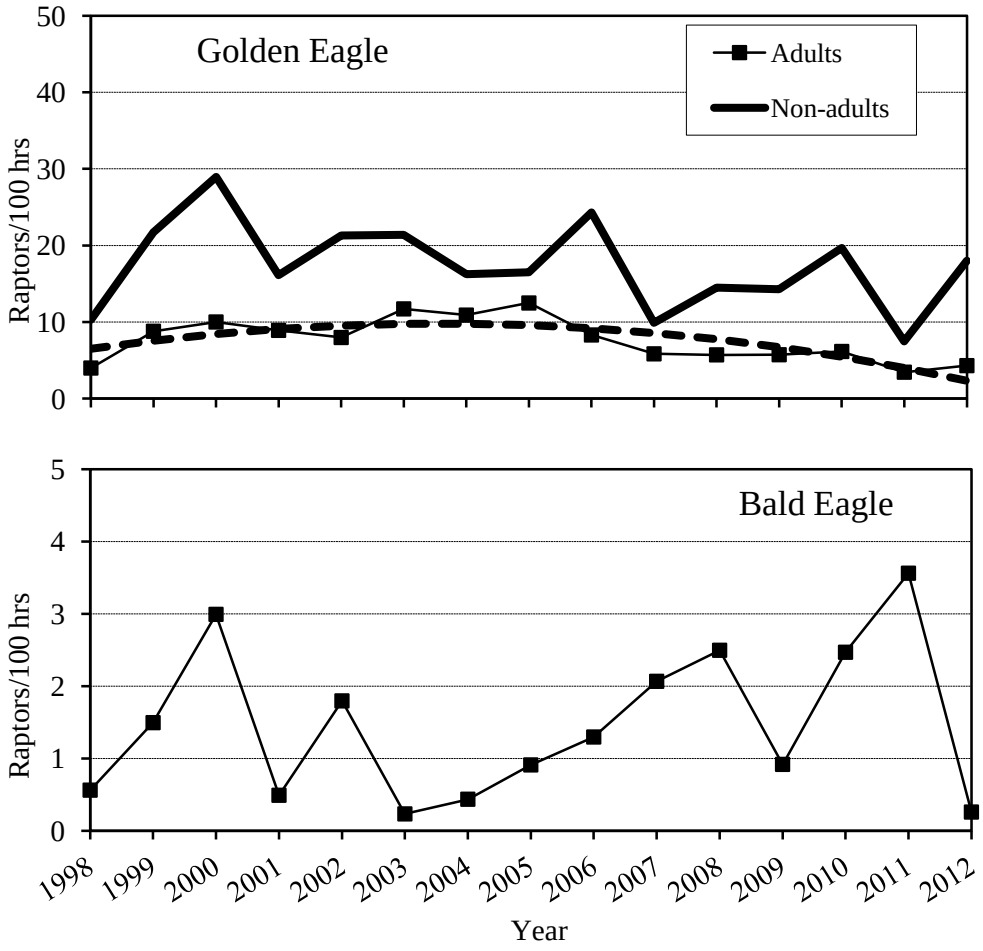

Figure 6. Adjusted fall-migration passage rates at Chelan Ridge, WA for Golden and Bald Eagles: 1998–2012. Dashed lines indicate significant linear or quadratic regressions.

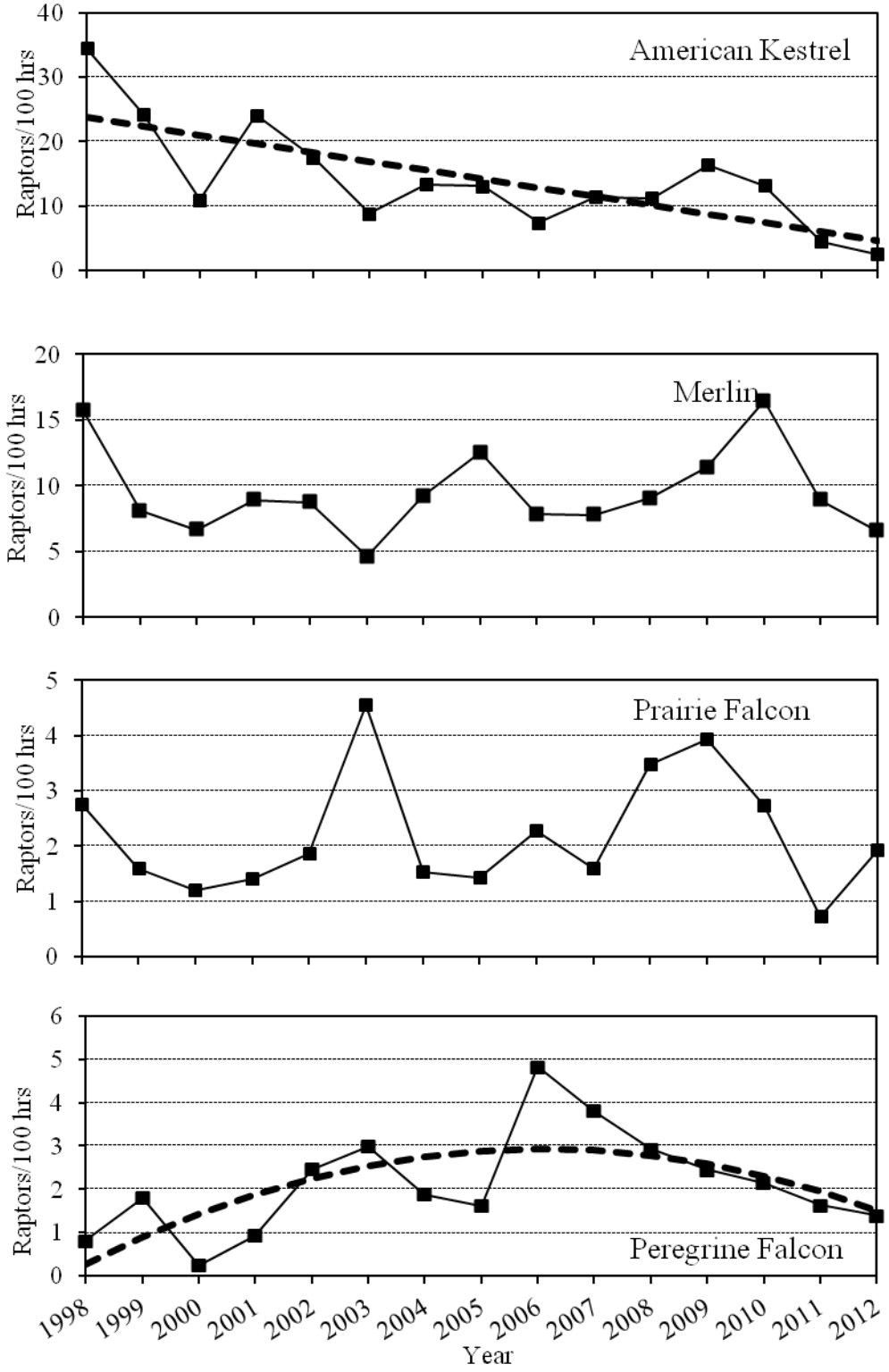

Figure 7. Adjusted fall-migration passage rates at Chelan Ridge, WA for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons: 1998–2012. Dashed lines indicate significant linear or quadratic regressions.

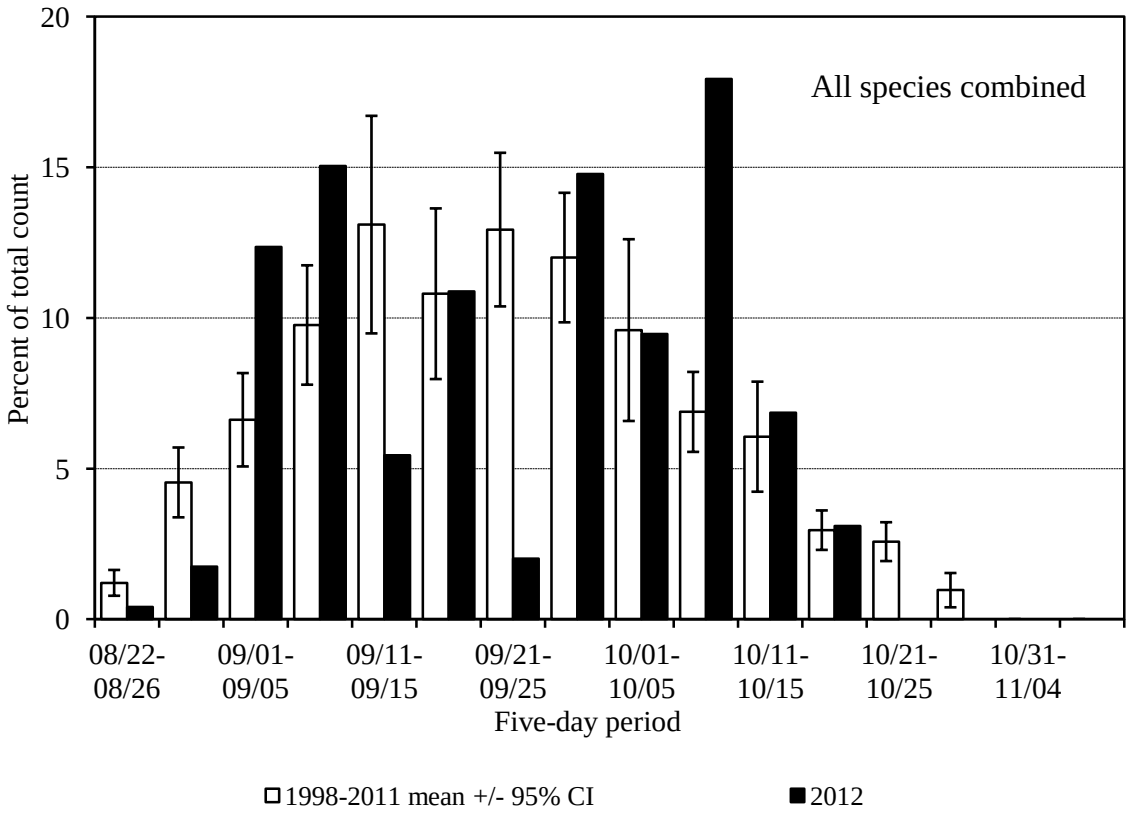

Figure 8. Combined-species passage volume by five-day periods for migrating raptors at Chelan Ridge, WA: 1998–2011 versus 2012.

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

1997: Single observer throughout: Dan Rossman (0)

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

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

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

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

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

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

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

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+).

2007: Two observers throughout: Dayna Hawes (1), Shaun Hyland (0), Angela Winter (0), with assistance from Rob Spaul (2+), Ben Vang-Johnson (1+), and Richard Hendrick (4+).

2008: Two observers throughout: Grace Eger (0), Brian Connely (0), Leif Baierl (0), with assistance from Rob Spaul (2+).

2009: Two observers throughout: Brian Connely (1), Craig Waythomas (+), and Marie-Catherine Fournier (+).

2010: Two observers throughout: Brian Connely (2), Craig Waythomas (1+), and Marie-Catherine Fournier (1+).

2011: Two observers throughout: Chadette Pfaff (4), Michael Oliveira (0), and Kathryn Walpole (0).

2012: Two observers throughout: Joshua Collette (0), Kelsey Navarre (0), and Jonathan Roatch (0).

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[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	*Cathartes aura*	TV	U	U	NA
Osprey	*Pandion haliaetus*	OS	U	U	NA
Northern Harrier	*Circus cyaneus*	NH	AM AF I Br U	AM AF U	NA
White-tailed Kite	*Elanus leucurus*	WK	A, I, U	U	NA
Sharp-shinned Hawk	*Accipiter striatus*	SS	A I U	U	NA
Cooper's Hawk	*Accipiter cooperii*	CH	A I U	U	NA
Northern Goshawk	*Accipiter gentilis*	NG	A I U	U	NA
Unknown small accipiter	*A. striatus* or *cooperii*	SA	U	U	NA
Unknown large accipiter	*A. cooperii* or *gentilis*	LA	U	U	NA
Unknown accipiter	*Accipiter* spp.	UA	U	U	NA
Broad-winged Hawk	*Buteo platypterus*	BW	A I U	U	D L U
Swanson's Hawk	*Buteo swainsoni*	SW	U	U	D L U
Red-tailed Hawk	*Buteo jamaicensis*	RT	A I U	U	D L U
Ferruginous Hawk	*Buteo regalis*	FH	A I U	U	D L U
Rough-legged Hawk	*Buteo lagopus*	RL	U	U	D L U
Unknown buteo	*Buteo* spp.	UB	U	U	D L U
Golden Eagle	*Aquila chrysaetos*	GE	I, S, NA, A, U[4]	U	NA
Bald Eagle	*Haliaeetus leucocephalus*	BE	I, S1, S2, NA, A, U[5]	U	NA
Unknown eagle	*Aquila* or *Haliaeetus spp.*	UE	U	U	NA
American Kestrel	*Falco sparverius*	AK	U	M F U	NA
Merlin	*Falco columbarius*	ML	AM Br U	AM Br U	NA
Prairie Falcon	*Falco mexicanus*	PR	U	U	NA
Peregrine Falcon	*Falco peregrinus*	PG	A I U	U	NA
Unknown small falcon	*F. sparverius* or *columbarius*	SF	U	U	NA
Unknown large falcon	*F. mexicanus* or *peregrinus*	LF	U	U	NA
Unknown falcon	*Falco* 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: 2012.

Date	Obs. Hours	Obsrvrs / Hour[1]	median Visitor Disturb[2]	Predominant Weather[3]	Wind Speed (kph)[1]	Wind Direction	Temp (°C)[1]	Barom. Press. (in Hg)[1]	median Thermal Lift[4]	Visib. West (km)[1]	Visib. East (km)[1]	median Flight Distance[5]	Birds / Hour
23-Aug	6.58	2.8	0	clr, haze AM	8.4	se-sw, nw-ne	15.6	29.96	2	100	100	4	0.2
24-Aug	9.00	2.4	0	clr, pc Mid-day	6.9	s-sw	14.8	30.12	2	100	100	4	0.1
25-Aug	9.00	2.0	0	clr, haze PM	3.8	se-sw, calm/var	17.0	30.01	1	100	100	2	0.7
26-Aug	9.00	2.4	0	pc, mc PM, haze PM	6.0	s-w, n-e	21.0	29.91	2	87	85	2	0.3
27-Aug	9.00	1.9	0	clr, haze	17.0	s-w	17.8	30.05	3	87	77	2	0.2
28-Aug	9.00	2.0	0	ovc, mc PM, pc PM, haze	9.5	s-sw	18.5	30.00	3	72	76	2	0.1
29-Aug	9.00	2.0	0	pc	10.5	s-sw	14.3	30.08	2	95	100	1	0.3
30-Aug	8.88	2.1	0	clr, pc, mc	8.4	s-sw	15.4	29.99	2	96	96	1	1.9
31-Aug	9.00	2.0	0	pc, clr PM	6.9	s-w	15.9	29.97	2	100	99	3	2.7
01-Sep	9.00	2.9	0	clr, pc Mid-day	12.1	s-w, n-e	13.8	-	2	99	100	1	2.2
02-Sep	9.00	2.5	0	pc	9.4	s-w	15.2	-	2	99	100	1	4.1
03-Sep	9.00	2.1	0	clr, pc, mc early PM	4.4	calm/var	16.8	-	2	98	100	1	3.0
04-Sep	8.00	2.3	0	clr, pc Mid-day	7.9	s-w, n-e	19.2	30.25	1	100	100	2	10.5
05-Sep	9.00	2.0	0	pc, haze	7.3	s-w	17.6	30.08	2	76	87	1	7.6
06-Sep	9.00	2.0	0	clr	3.1	clam/var	16.0	30.21	2	100	100	1	3.3
07-Sep	9.00	2.0	0	clr	4.9	s-w	19.8	30.33	2	100	100	1	6.0
08-Sep	9.00	2.4	0	clr, mc, ovc PM, haze	7.5	s-sw	20.2	30.21	2	88	87	1	6.7
09-Sep	8.50	2.9	0	mc, clr, haze	15.3	s-w	17.7	29.87	3	74	72	1	2.2
10-Sep	9.00	2.1	0	pc, clr AM, haze	18.6	s-w	10.2	29.96	3	58	78	2	0.9
11-Sep	9.00	2.0	0	clr, haze	9.2	s-w, n-e	9.4	30.20	3	27	28	1	0.7
12-Sep	9.00	2.1	0	clr AM, pc PM, haze	6.0	calm/var	11.8	30.41	2	26	38	2	2.2
13-Sep	7.00	1.9	0	clr AM, pc mc PM, haze	9.6	s-w	15.0	30.38	3	33	29	1	6.7
14-Sep	0.00			Weather Day: smoke from fires									
15-Sep	9.00	2.0	0	mc, ovc, haze	7.6	s-sw	19.6	30.19	2	45	53	3	7.4
16-Sep	9.00	2.9	0	clr, haze	7.2	s-w, n-e	17.9	30.28	2	30	65	2	4.8
17-Sep	9.00	2.4	0	clr, haze	5.3	calm/var	20.4	30.27	2	20	52	2	2.1
18-Sep	3.25	2.0	0	clr, haze	12.0	sw-nw	18.3	30.20	3	12	11	1	0.3
19-Sep	9.00	1.9	0	clr, haze	5.5	se-sw, calm/var	22.2	30.25	3	25	27	1	3.9
20-Sep	0.00			Weather Day: smoke from fires									
21-Sep	0.00			Weather Day: smoke from fires									
22-Sep	0.00			Weather Day: smoke from fires									
23-Sep	6.00	1.8	0	pc AM, clr PM, haze	5.1	n-e	20.0	30.17	2	11	14	1	1.3
24-Sep	9.00	2.0	0	clr, haze	10.3	s-sw	20.9	30.13	3	19	20	2	2.4
25-Sep	9.00	2.0	0	clr, pc AM, haze	6.1	calm/var	18.5	30.08	2	63	50	3	8.1
26-Sep	9.00	2.0	0	pc, haze	9.4	s-w, n-e	15.9	30.17	2	71	68	2	7.8
27-Sep	9.00	2.0	0	clr, haze	11.3	s-w	16.5	30.18	3	51	54	1	4.2
28-Sep	9.00	2.0	0	pc AM, ovc, haze, rain early PM	7.3	s-w	17.4	30.06	4	35	36	1	0.9
29-Sep	9.00	2.0	1	mc, ovc Mid-day, haze	9.5	s-sw	16.6	30.18	3	80	81	2	4.4
30-Sep	9.00	3.3	0	clr, haze	10.3	s-w, n-e	14.9	30.38	2	65	84	3	6.1
01-Oct	9.00	2.0	0	pc, mc Mid-day, haze	16.5	sw-nw	17.5	30.26	2	52	80	2	1.7
02-Oct	9.00	2.0	0	clr, pc PM	16.7	se-sw, nw-ne	8.5	30.00	2	73	88	2	5.4
03-Oct	9.00	2.0	0	clr, haze	7.7	s-w, n-e	8.5	30.35	2	69	72	1	1.7
04-Oct	9.00	2.00	0	clr, haze	4.4	calm/var	7.2	30.27	2	72	79	2	2.7
05-Oct	9.00	2.0	0	clr	4.5	n-e, calm/var	7.3	30.32	2	77	81	3	0.4
06-Oct	9.00	1.9	0	clr, haze	5.6	n-e	9.9	30.29	2	86	91	2	3.2
07-Oct	9.00	2.8	0	clr, haze	7.6	s-sw	14.1	30.12	2	56	89	2	8.7
08-Oct	9.00	2.0	0	pc, haze	8.2	s-w, n-e	14.7	29.99	2	55	92	2	6.1
09-Oct	9.00	1.9	0	clr, haze	10.0	s-sw	15.6	30.08	2	77	99	2	13.6
10-Oct	9.00	1.9	0	clr, haze	6.4	s-sw	14.5	29.94	2	70	85	2	4.7

Appendix C. continued

Date	Obs. Hours	Obsrvrs / Hour[1]	median Visitor Disturb[2]	Predominant Weather[3]	Wind Speed (kph)[1]	Wind Direction	Temp (°C)[1]	Barom. Press. (in Hg)[1]	median Thermal Lift[4]	Visib. West (km)[1]	Visib. East (km)[1]	median Flight Distance[5]	Birds / Hour
11-Oct	9.00	2.0	0	clr, pc mc PM, haze	15.5	s-sw	13.4	29.95	2	82	85	1	6.0
12-Oct	9.00	2.0	0	ovc, haze	8.5	s-sw	12.9	29.81	4	60	65	1	0.3
13-Oct	6.75	1.9	0	ovc, rain	10.6	s-sw	10.4	30.08	4	62	78	2	0.9
14-Oct	0.00			Weather Day: fog/rain									
15-Oct	7.25	2.0	0	clr AM, ovc PM	22.2	s-w	9.2	29.81	4	95	99	1	1.5
16-Oct	8.00	2.0	0	clr AM, pc PM	29.5	s-w	4.2	29.75	3	100	100	2	0.5
17-Oct	8.00	2.0	0	pc, mc	9.0	s-sw	5.3	30.14	2	99	100	2	2.5
18-Oct	8.00	2.5	0	ovc AM, mc PM, haze	15.7	s-sw	7.1	30.06	3	86	82	1	2.1
19-Oct	0.00			Weather Day									
20-Oct	0.00			Weather Day									
21-Oct	0.00			Weather Day									
22-Oct	0.00			Weather Day									
23-Oct	0.00			Weather Day									
24-Oct	0.00			Weather Day									
25-Oct	0.00			Weather Day									

[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: 2012.

	OBS.	SPECIES[1]																											BIRDS
DATE	HOURS	TV	OS	NH	WK	SS	CH	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/HOUR
23-Aug	6.58	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	1	1	0.2
24-Aug	9.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.1
25-Aug	9.00	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	6	0.7
26-Aug	9.00	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.3
27-Aug	9.00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0.2
28-Aug	9.00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
29-Aug	9.00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0.3
30-Aug	8.88	0	1	0	0	8	4	0	1	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	17	1.9
31-Aug	9.00	1	0	1	0	2	10	0	1	0	0	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	3	24	2.7
1-Sep	9.00	0	0	0	0	12	3	0	1	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	20	2.2
2-Sep	9.00	1	1	4	0	12	3	0	2	0	0	0	0	1	7	0	0	1	1	0	0	0	1	0	0	0	1	0	2	37	4.1
3-Sep	9.00	0	0	3	0	20	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	27	3.0
4-Sep	8.00	0	0	9	0	29	12	1	11	1	1	0	0	0	9	0	0	4	1	0	0	0	1	1	0	1	0	0	3	84	10.5
5-Sep	9.00	1	0	3	0	40	4	3	6	0	0	0	0	0	5	0	0	2	0	0	0	0	2	0	0	0	0	0	2	68	7.6
6-Sep	9.00	0	0	4	0	18	4	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	30	3.3
7-Sep	9.00	0	0	4	0	31	3	0	1	0	2	0	0	0	2	0	0	2	0	0	0	2	3	2	1	0	0	0	1	54	6.0
8-Sep	9.00	2	1	1	0	34	5	0	1	1	0	0	0	1	6	0	0	2	0	0	0	1	2	0	0	0	0	0	3	60	6.7
9-Sep	8.50	0	1	1	0	12	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	2.2
10-Sep	9.00	1	0	0	0	4	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0.9
11-Sep	9.00	0	0	1	0	3	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.7
12-Sep	9.00	0	1	2	0	12	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	20	2.2
13-Sep	7.00	4	0	5	0	18	8	2	0	0	0	0	1	0	6	0	0	0	1	0	0	1	1	0	0	0	0	0	0	47	6.7
14-Sep	0.00																													
15-Sep	9.00	5	0	3	0	20	11	4	5	2	1	0	0	0	8	0	0	1	1	0	0	1	3	0	0	0	0	0	2	67	7.4
16-Sep	9.00	9	0	0	0	13	5	0	3	0	0	0	0	0	6	0	0	5	1	0	0	0	0	0	1	0	0	0	0	43	4.8
17-Sep	9.00	0	0	0	0	5	5	1	2	0	0	0	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	19	2.1
18-Sep	3.25	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.3
19-Sep	9.00	0	3	4	0	13	5	0	1	0	1	0	3	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	35	3.9

Appendix D. continued

DATE	OBS. HOURS	SPECIES[1] TV	OS	NH	WK	SS	CH	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	BIRDS /HOUR
20-Sep	0.00																														
21-Sep	0.00																														
22-Sep	0.00																														
23-Sep	6.00	0	1	1	0	4	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.3
24-Sep	9.00	0	4	0	0	7	1	0	0	0	0	0	0	0	5	0	0	0	3	0	0	0	1	0	1	0	0	0	0	22	2.4
25-Sep	9.00	7	2	2	0	27	8	0	4	1	1	0	0	0	14	0	0	2	1	0	0	0	0	0	0	0	0	0	4	73	8.1
26-Sep	9.00	6	5	2	0	28	8	0	6	1	0	0	0	0	11	0	0	0	2	0	0	1	0	0	0	0	0	0	0	70	7.8
27-Sep	9.00	0	3	1	0	16	2	1	2	0	2	0	0	0	7	0	0	0	2	0	0	1	0	0	0	0	0	0	1	38	4.2
28-Sep	9.00	1	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8	0.9
29-Sep	9.00	8	0	1	0	12	0	0	4	0	0	0	0	0	4	0	0	3	3	1	0	0	0	0	0	0	0	0	4	40	4.4
30-Sep	9.00	1	0	0	0	17	4	2	6	0	0	0	0	0	10	0	0	3	3	0	0	0	1	0	0	0	0	0	8	55	6.1
1-Oct	9.00	3	0	0	0	4	2	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	1	2	15	1.7
2-Oct	9.00	1	1	2	0	14	4	0	6	0	5	0	0	0	5	0	0	5	1	0	0	0	1	0	0	0	0	0	4	49	5.4
3-Oct	9.00	0	0	1	0	3	0	0	2	0	0	0	0	0	3	0	0	1	4	0	0	0	0	1	0	0	0	0	0	15	1.7
4-Oct	9.00	0	0	0	0	6	1	0	3	0	0	0	0	0	6	0	0	2	3	0	0	0	0	0	0	0	0	0	3	24	2.7
5-Oct	9.00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	4	0.4
6-Oct	9.00	0	0	2	0	8	1	1	1	0	1	0	0	0	7	0	0	2	6	0	0	0	0	0	0	0	0	0	0	29	3.2
7-Oct	9.00	0	0	3	0	5	0	0	1	0	0	0	0	0	9	0	37	2	12	0	0	0	1	1	0	0	0	0	7	78	8.7
8-Oct	9.00	0	0	1	0	11	3	0	4	1	0	0	0	0	7	0	8	2	5	0	0	0	0	0	0	1	1	0	11	55	6.1
9-Oct	9.00	0	2	1	0	15	5	3	7	2	3	0	0	0	19	0	39	16	7	0	0	0	1	0	0	0	0	0	2	122	13.6
10-Oct	9.00	0	1	1	0	11	1	0	1	0	1	0	0	0	3	0	10	5	6	0	0	0	0	0	0	0	0	0	2	42	4.7
11-Oct	9.00	0	0	0	0	11	1	1	3	0	0	0	0	0	7	0	10	5	14	0	0	0	0	1	0	0	0	0	1	54	6.0
12-Oct	9.00	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0.3
13-Oct	6.75	0	0	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	6	0.9
14-Oct	0.00																														
15-Oct	7.25	0	0	1	0	7	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	11	1.5
16-Oct	8.00	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0.5
17-Oct	8.00	0	0	0	0	2	1	0	0	0	1	0	0	0	1	0	5	1	3	0	0	0	2	0	0	0	0	0	4	20	2.5

Appendix D. continued

	OBS.	SPECIES[1]																											BIRDS
DATE	HOURS	TV	OS	NH	WK	SS	CH	NG	SA	LA	UA	RS	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	SF	LF	UF	UU	TOTAL	/HOUR
18-Oct	8.00	0	0	0	0	7	0	0	0	0	0	0	0	0	1	0	7	1	0	0	0	0	1	0	0	0	0	0	0	17	2.1
19-Oct	0.00																														
20-Oct	0.00																														
21-Oct	0.00																														
22-Oct	0.00																														
23-Oct	0.00																														
24-Oct	0.00																														
25-Oct	0.00																														
Total	446.22	51	27	68	0	531	133	22	88	11	20	0	4	4	204	0	117	71	90	1	0	8	24	6	4	2	2	1	76	1565	3.5

[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: 1997–2012.

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Start Date	5-Sep	27-Aug	27-Aug	27-Aug	27-Aug	25-Aug	23-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
Observation days	29	53	61	67	55	62	59	59	62
Observation hours	204.60	382.92	504.33	505.75	439.00	491.28	509.24	507.50	502.50
Raptors / 100 hours	691.1	620.2	571.2	481.3	470.4	522.1	297.1	286.1	363.4
SPECIES									
Turkey Vulture	4	29	21	26	14	46	30	25	58
Osprey	41	24	47	71	48	57	31	34	25
Northern Harrier	115	152	167	104	91	148	66	59	113
White-tailed Kite	0	0	0	0	0	0	1	0	0
Sharp-shinned Hawk	311	949	932	1,050	878	937	421	468	730
Cooper's Hawk	150	247	232	198	198	234	136	220	228
Northern Goshawk	38	32	50	35	16	22	17	41	13
Unknown small accipiter[1]	–	–	–	–	98	85	40	1	48
Unknown large accipiter[1]	–	–	–	–	0	10	17	6	6
Unknown accipiter	182	221	248	98	0	49	36	10	9
TOTAL ACCIPITERS	681	1,449	1,462	1,381	1,190	1,337	667	746	1,034
Red-shouldered Hawk	0	0	0	0	0	0	0	0	0
Broad-winged Hawk	2	7	5	5	6	9	3	2	6
Swainson's Hawk	0	8	17	2	0	7	15	5	2
Red-tailed Hawk	145	182	450	364	263	386	263	277	233
Ferruginous Hawk	0	0	0	1	0	0	0	0	0
Rough-legged Hawk	1	13	44	53	13	45	14	20	22
Unidentified buteo	75	58	148	97	83	82	39	15	29
TOTAL BUTEOS	223	268	664	522	365	529	334	319	292
Golden Eagle	105	55	141	174	105	135	142	130	130
Bald Eagle	2	2	7	15	2	8	1	2	4
Unidentified eagle	7	0	7	5	1	0	12	0	2
TOTAL EAGLES	114	57	155	194	108	143	155	132	136
American Kestrel	24	107	89	40	84	68	33	48	55
Merlin	17	55	36	26	36	38	21	39	53
Prairie Falcon	2	10	7	5	5	6	19	5	4
Peregrine Falcon	5	2	9	1	3	9	14	7	4
Unknown small falcon[1]	–	–	–	–	6	4	6	5	1
Unknown large falcon[1]	–	–	–	–	1	2	2	2	3
Unknown falcon	10	6	6	2	2	0	0	4	0
TOTAL FALCONS	58	180	147	74	137	127	95	110	120
Unidentified Raptor	178	216	218	62	112	178	134	27	48
GRAND TOTAL	1,414	2,375	2,881	2,434	2,065	2,565	1,513	1,452	1,826

Appendix E. Continued

	2006	2007	2008	2009	2010	2011	2012	MEAN
Start Date	24-Aug	24-Aug	24-Aug	23-Aug	23-Aug	23-Aug	23-Aug	23-Aug
End Date	26-Oct	27-Oct	27-Oct	25-Oct	23-Oct	25-Oct	18-Oct	24-Oct
Observation days	64	62	64	60	58	58	52	60
Observation hours	512.00	520.00	557.85	507.74	477.17	484.92	446.22	493.42
Raptors / 100 hours	458.8	413.3	365.2	457.9	446.8	261.9	350.7	429.3
SPECIES								
Turkey Vulture	50	42	48	70	44	31	51	38
Osprey	50	31	37	36	36	33	27	40
Northern Harrier	127	60	82	127	114	56	68	105
White-tailed Kite	0	0	0	0	0	0	0	0
Sharp-shinned Hawk	854	880	875	852	841	587	531	804
Cooper's Hawk	270	363	269	332	249	130	133	236
Northern Goshawk	31	49	48	27	30	25	22	31
Unknown small accipiter[1]	97	45	33	87	59	16	88	46
Unknown large accipiter[1]	11	3	19	12	7	5	11	9
Unknown accipiter	12	8	8	38	26	22	20	63
TOTAL ACCIPITERS	1,275	1,348	1,252	1,348	1,212	785	805	1,264
Red-shouldered Hawk	0	0	0	0	0	1	0	0
Broad-winged Hawk	4	2	5	6	4	6	4	5
Swainson's Hawk	2	4	5	5	5	13	4	6
Red-tailed Hawk	441	378	304	341	315	135	204	309
Ferruginous Hawk	0	0	0	0	0	0	0	0
Rough-legged Hawk	28	22	25	48	37	22	117	29
Unidentified buteo	57	29	10	20	14	40	71	52
TOTAL BUTEOS	532	435	349	420	375	216	400	428
Golden Eagle	157	82	111	93	109	45	90	115
Bald Eagle	8	10	12	4	10	15	1	7
Unidentified eagle	0	0	0	1	0	3	0	2
TOTAL EAGLES	165	92	123	98	119	63	91	133
American Kestrel	29	47	47	59	47	15	8	55
Merlin	34	40	44	45	63	37	24	41
Prairie Falcon	9	6	17	14	11	4	6	9
Peregrine Falcon	20	16	13	7	10	8	4	9
Unknown small falcon[1]	3	0	2	9	4	0	2	4
Unknown large falcon[1]	3	1	1	5	0	0	2	2
Unknown falcon	0	1	0	2	1	1	1	2
TOTAL FALCONS	98	111	124	141	136	65	47	129
Unidentified Raptor	52	30	22	85	96	20	76	93
GRAND TOTAL	2,349	2,149	2,037	2,325	2,132	1,270	1,565	2,098

[1] Designations used for the first time in 2001.

Appendix F. Daily capture totals of migrating raptors at Chelan Ridge, WA: 2012.

	STN	SPECIES[1]													CAPTURES
DATE	HOURS	NH	SS	CH	NG	BW	RT	RL	GE	AK	ML	PR	PG	TOTAL	/STN HR
25-Aug	8.50	0	2	5	0	0	0	0	0	0	0	0	0	7	0.8
26-Aug	8.50	0	2	1	0	0	0	0	0	0	0	0	0	3	0.4
27-Aug	8.75	0	4	0	0	0	0	0	0	0	0	0	0	4	0.5
28-Aug	8.75	0	6	1	0	0	0	0	0	0	0	1	0	8	0.9
29-Aug	8.50	0	3	1	0	0	0	0	0	0	0	0	0	4	0.5
30-Aug	5.00	0	6	2	0	0	0	0	0	0	0	0	0	8	1.6
31-Aug	0.00														
1-Sep	7.00	0	4	1	0	0	1	0	0	0	0	0	0	6	0.9
2-Sep	8.50	0	10	6	0	0	1	0	0	0	0	0	0	17	2.0
3-Sep	8.75	0	7	1	0	0	0	0	0	0	0	0	0	8	0.9
4-Sep	8.00	2	19	4	0	0	3	0	0	1	0	0	0	29	3.6
5-Sep	18.00	0	27	3	0	0	0	0	0	0	3	1	0	34	1.9
6-Sep	18.00	1	15	6	0	0	2	0	0	1	1	0	0	26	1.4
7-Sep	18.00	0	28	8	0	0	1	0	0	0	2	0	0	39	2.2
8-Sep	18.00	0	31	8	0	0	1	0	0	0	2	0	0	42	2.3
9-Sep	9.00	0	8	2	1	0	1	0	0	0	1	0	0	13	1.4
10-Sep	9.00	0	4	2	0	0	1	0	0	0	0	0	0	7	0.8
11-Sep	8.75	0	2	5	1	0	1	0	0	0	0	0	0	9	1.0
12-Sep	8.50	0	7	0	0	0	0	0	0	0	0	0	0	7	0.8
13-Sep	8.75	2	9	3	0	0	0	0	0	0	0	0	0	14	1.6
14-Sep	0.00														
15-Sep	8.75	1	13	6	0	0	1	0	0	0	0	0	0	21	2.4
16-Sep	9.00	0	5	2	0	0	3	0	0	0	0	0	0	10	1.1
17-Sep	9.00	0	11	4	0	0	3	0	0	0	0	0	0	18	2.0
18-Sep	17.66	0	9	6	0	0	2	0	0	0	1	0	0	18	1.0
19-Sep	11.83	0	13	7	0	0	1	0	0	0	0	0	0	21	1.8
20-Sep	0.00														
21-Sep	0.00														
22-Sep	0.00														

Appendix F. continued

Date	Stn Hours	Species[1] NH	SS	CH	NG	BW	RT	RL	GE	AK	ML	PR	PG	Total	Captures / Stn Hr
23-Sep	8.66	0	4	0	0	0	0	0	0	0	0	0	1	5	0.6
24-Sep	9.00	0	5	0	0	0	0	0	0	0	0	0	0	5	0.6
25-Sep	8.58	0	8	4	0	0	0	0	0	0	1	0	0	13	1.5
26-Sep	8.83	0	5	1	1	0	1	0	0	0	0	0	0	8	0.9
27-Sep	8.83	0	7	4	0	0	0	0	0	0	0	0	0	11	1.2
28-Sep	8.58	0	4	0	0	0	0	0	0	0	0	0	0	4	0.5
29-Sep	12.58	0	20	1	0	0	0	0	0	0	0	0	0	21	1.7
30-Sep	13.66	0	8	1	0	0	1	0	0	0	1	0	0	11	0.8
1-Oct	8.58	0	6	0	0	0	0	0	0	0	0	0	0	6	0.7
2-Oct	8.50	0	1	0	0	0	0	0	0	0	0	0	0	1	0.1
3-Oct	8.50	0	3	0	0	0	0	0	0	0	0	0	0	3	0.4
4-Oct	8.50	0	1	0	0	0	0	0	0	0	0	0	0	1	0.1
5-Oct	8.50	0	2	2	0	0	0	0	0	0	1	0	0	5	0.6
6-Oct	16.84	0	5	0	1	0	0	0	0	0	2	0	0	8	0.5
7-Oct	8.41	0	6	0	0	0	0	2	0	0	2	0	0	10	1.2
8-Oct	8.30	0	2	2	0	0	1	0	0	0	0	0	0	5	0.6
9-Oct	8.50	2	7	0	1	0	0	0	2	0	1	0	0	13	1.5
10-Oct	8.08	0	2	1	1	0	0	0	1	0	0	0	0	5	0.6
11-Oct	8.00	0	2	0	0	0	0	0	1	0	0	0	0	3	0.4
12-Oct	8.30	0	1	0	0	0	0	0	0	0	0	0	0	1	0.1
13-Oct	6.33	0	1	0	0	0	0	0	0	0	0	0	0	1	0.2
14-Oct	0.00														
15-Oct	7.25	0	1	1	0	0	0	0	0	0	1	0	0	3	0.4
16-Oct	7.00	0	1	0	0	0	0	0	0	0	1	0	0	2	0.3
17-Oct	7.75	0	3	0	0	0	0	1	0	0	0	0	0	4	0.5
Total	468.55	8	350	101	6	0	25	3	4	2	20	2	1	522	1.0 Avg

[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: 1999–2012.

	1999[1]	2000[1]	2001	2002	2003	2004	2005	2006
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
Trapping days	47	42	44	54	56	53	56	56
Station hours	388	?	612.8	837.3	803.3	699.6	828.2	797.33
Captures / stn. hour	5.7	?	8.6	8.1	7.3	5.0	7.5	10.2
SPECIES	RAPTOR CAPTURES							
Northern Harrier	4	3	10	13	11	6	12	28
Sharp-shinned Hawk	139	125	341	459	394	237	389	556
Cooper's Hawk	42	46	107	127	100	58	137	100
Northern Goshawk	14	10	12	13	9	16	11	24
Broad-winged Hawk	0	0	0	0	0	0	0	0
Red-tailed Hawk	11	8	22	29	20	16	11	50
Rough-legged Hawk	0	1	1	2	1	0	5	6
Golden Eagle	0	1	2	0	4	2	2	6
American Kestrel	3	0	8	10	17	5	6	8
Merlin	6	4	17	21	25	10	49	31
Prairie Falcon	1	1	3	4	4	1	0	3
Peregrine Falcon	0	0	2	0	4	1	1	2
All species	220	199	525	678	589	352	623	814
Recaptures[2]	0	0	0	0	0	0	0	0
Foreign Recaptures[3]	0	0	0	1	0	0	0	2
Foreign Encounters[4]	0	1	5	2	1	1	4	15

Appendix G. Continued

	2007	2008	2009	2010	2011	2012	MEAN	TOTAL
First trapping day	25-Aug	24-Aug	24-Aug	25-Aug	22-Aug	25-Aug	24-Aug	
Last trapping day	16-Oct	23-Oct	24-Oct	22-Oct	20-Oct	17-Oct	19-Oct	
Number of stations	2	2	2	2	2	2	2	
Trapping days	51	60	58	54	52	48	54.6	
Station hours	716.12	836.48	632.76	520.66	496.08	468.55	709.89	
Captures / stn. hour	9.4	9.1	10.5	12.1	11.1	11.1	9.0	
SPECIES	RAPTOR CAPTURES							
Northern Harrier	12	18	24	29	8	8	15.5	186
Sharp-shinned Hawk	450	503	419	396	373	350	411.2	5137
Cooper's Hawk	138	140	128	113	96	101	113.1	1433
Northern Goshawk	16	29	10	15	15	6	15.5	200
Broad-winged Hawk	0	0	1	0	0	0	0.1	1
Red-tailed Hawk	33	22	34	27	26	25	27.1	342
Rough-legged Hawk	1	2	9	1	1	3	2.6	33
Golden Eagle	2	5	5	3	5	4	3.5	43
American Kestrel	3	13	9	8	4	2	7.8	91
Merlin	15	25	21	30	19	20	23.9	293
Prairie Falcon	4	5	3	1	0	2	2.5	32
Peregrine Falcon	1	2	2	3	3	1	1.9	22
All species	675	764	665	631	550	522	624.7	7813
Recaptures[2]	1	0	0	7	3	0	1.0	11
Foreign Recaptures[3]	2	0	1	1	0	0	0.7	8
Foreign Encounters[4]	12	7	9	9	9	5	6.9	82

[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.