Central Valley Bird Club Bulletin

SPECIAL DOUBLE ISSUE

Central Valley Winter Raptor Surveys: 2007—2010

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A Special Issue on Central Valley Raptor Ecology

I am especially gratified as President of the club to introduce this collection of papers stemming from the winter raptor surveys. This project was a brainchild of Zach Smith who sought to replicate similar surveys that had been conducted in Oregon. With Ed Pandolfino on board to help raise funds, organize volunteers, analyze data, and write the reports, Zach's vision was quickly realized. From 2007 to 2010, a dedicated team of birders, nearly all of whom are club members, scoured the countryside to count wintering raptors and characterize their habitats.

The results, included here, and in two papers published elsewhere (Pandolfino et al., Western Birds 42:62-84, 2011; Pandolfino et al., Journal of Raptor Research 45:38-45, 2011), are astonishing and a true testament to the power of high quality citizen science. The project is a model for what the Central Valley Bird Club aspires to promote. Without paid staff, our club is bound by the limitations of volunteerism. Fortunately, we have many talented club members that provide a great potential for future projects. I invite ideas for future projects and especially your willingness to provide your time and skills to realizing this potential.

As you will read in the following papers, this project is not just an excellent example of what citizen science can accomplish. It also fulfills a critical need for demonstrating the importance of the Central Valley, and especially grassland habitats, to wintering raptors, as well as for documenting key aspects of raptor ecology. Many of the General Plans of the various counties within the Central Valley have marked open rangelands for future development and fragmentation. This project was born out of a dire need to showcase these lands as nationally important for wintering raptors. To this end, the project has succeeded in laying out solid data and conclusions to support grassland conservation for raptors, which of course will also provide many other biological, ecosystem, and public benefits.

John Sterling

Central Valley Winter Raptor Survey (2007-2010): Overview and Methods

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RATIONALE AND PURPOSE

The great majority of research conducted on the ecology of birds has focused on the breeding season. For many species, however, and for raptors in particular, understanding habitat use and requirements in the non-breeding winter season may be even more important for conserving viable populations. Post-fledging mortality among raptors is extraordinarily high during their first winter of life, with rates of loss during their first year ranging from 50-80% (Newton 1979, Johnsgard 1990). Even for adult birds, it is crucial to emerge from winter in excellent physical condition to endure the stress of migration to the breeding grounds and to meet the high energy demands of raising young (Bildstein 2006). Thus, the quality of habitat in wintering areas may be as important, or more important, than breeding habitat in maintaining populations for some species.

Christmas Bird Count (CBC) data confirm that California's Central Valley (CV) harbors an extraordinary abundance and diversity of wintering raptors. CBC circles in the CV consistently record numbers that rank among the highest of any area in North America for the White-tailed Kite (*Elanus leucurus*), Northern Harrier (*Circus cyaneus*), Red-tailed Hawk (*Buteo jamaicensis*), and American Kestrel (*Falco sparverius*) (Root 1988, Pandolfino 2006, Pandolfino and Suedkamp-Wells 2009). At least 15 species of diurnal raptors commonly winter in the CV. No other region on the continent, with the possible exception of the coastal plains of Texas, supports a comparable abundance and diversity of wintering raptors. Despite this importance, there have been few studies of winter habitat use by raptors in the CV. All prior studies focused either on a small subset of the CV (Koplin 1973, Warner and Rudd 1975, Wilkinson and Debban 1980, Temeles 1986, Reeves and Smith 2004, Goerrissen 2005), on specific taxa or group of raptors (Erichsen et al. 1996, Smallwood et al. 1996), or on a specific habitat types such as rice (Elphick 2004).

Given the abundance of wintering raptors that use the CV, recent trends in land use are alarming and may have large scale impacts on raptor populations. In the past 30 years, agricultural land in the CV has been urbanized at higher rates than any other region of the United States (Johnson and Hayes 2004, Lubell et al. 2009), and population growth will likely continue well into this century (State of California 2007). During this same period, even more land has been converted from cattle ranching and other relatively passive uses to more intense agricultural practices such as

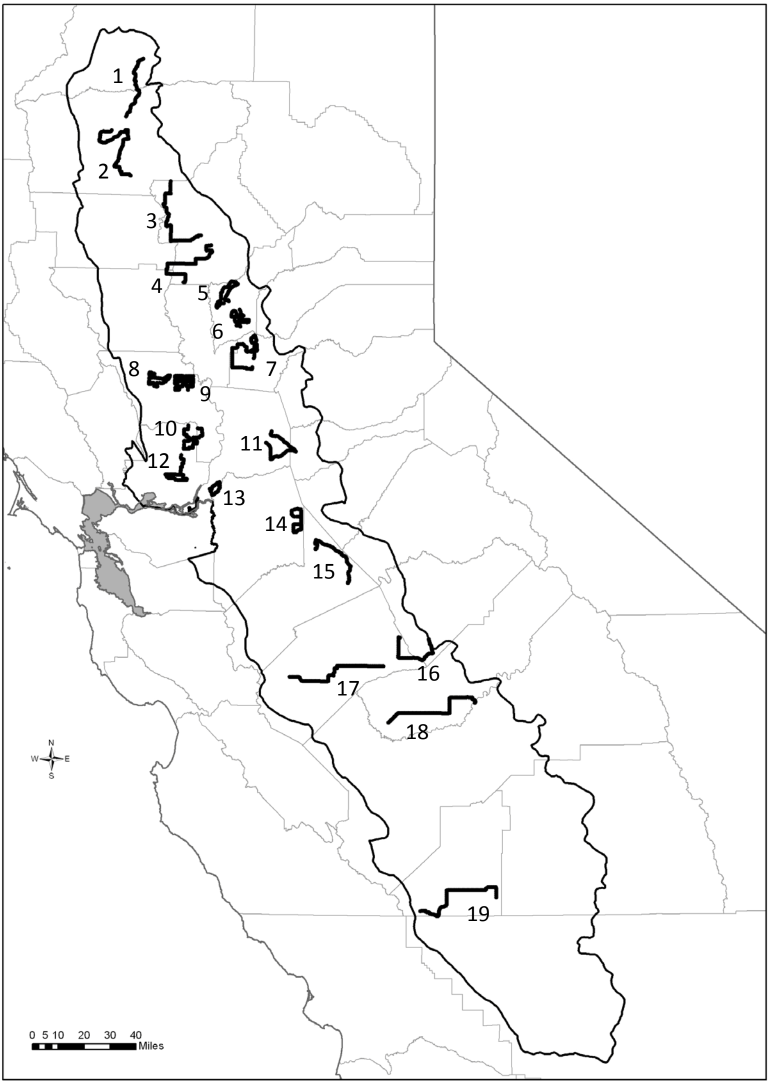

Figure 1. The Central Valley, California, and the 19 survey routes used to assess habitat associations of diurnal wintering raptors, 2007-2010. (1 = Shasta, 2 = Tehama, 3 = Butte North, 4 = Butte South, 5 = Yuba, 6 = Beale, 7 = Lincoln, 8 = Dunnigan Hills, 9 = Woodland, 10 = Davis, 11 = Folsom, 12 = Jepson, 13 = Delta, 14 = Linden, 15 = Oakdale, 16 = LeGrand, 17 = Los Banos, 18 = Madera, 19 = Kings).

vineyards and orchards (California Department of Conservation 2008, Volpe et al. 2010, The Nature Conservancy, unpubl. data). Impacts from this loss of grassland habitat may be responsible for the observed decline of many grassland-associated raptors and other bird species in the CV (Pandolfino 2011).

Because of the significance of winter habitat to raptor population stability, the continental importance of the CV to wintering raptors, and the rapid changes in land use occurring in this region, we felt it was urgent to understand the habitat associations of wintering raptors in the CV. We wanted to assess these associations throughout the CV for most species of wintering raptors, and for all the typical habitat types found in the CV. Clearly, accomplishing such an ambitious goal would not have been possible without employing "citizen science"— utilizing a large group of skilled, dedicated volunteers following a standard protocol over multiple years. The results of this effort have led to two prior publications (Pandolfino et al. 2011a, 2011b), and the other articles in this issue expand on those results to examine topics that encompass effects of riparian elements on raptor habitat associations, raptor behavior, and estimates of raptor populations.

STUDY AREA AND METHODS

Survey Routes and Survey Methodology

We defined the CV as the valley floor up to 300 m above sea level, including a portion of the San Francisco Bay-Delta region in Sacramento, Solano, and San Joaquin Counties. We established 19 roadside survey routes throughout the valley (Figure 1). Routes were not distributed randomly but instead systematically selected to include: 1) broad geographic coverage and representation of all major CV land cover types, 2) roads bisecting mostly open country so birds could be more easily detected, and 3) roads having low to moderate traffic so observers could devote the time needed to detect and identify perched and flying raptors. Average route length was 59 km (range 44-81).

Two volunteer observers conducted each survey, at least one of which had extensive experience at raptor identification. Surveys were conducted monthly (December through February) during three winters from 2007 to 2010. Surveys began at 0800–1000 PST and ended no later than 1500 PST. Observers drove each route in the same direction each time and occasionally stopped to identify birds or allow traffic to pass. Surveys were postponed or interrupted for heavy fog, precipitation, high winds (> 30 kph or Beaufort scale 4) or any condition that limited visibility to less than 500 m.

Observers recorded all raptors seen within 500 m of the survey road and assigned each observation to one of two distance categories: 1) roadside, if the bird was perched immediately along the survey road, or 2) beyond the roadside out to 500 m, including flying and perching birds. This separation allowed assessment of any roadside bias in habitat associations. For each raptor seen, we noted where possible: species, age, sex, behavior (perched or flying), color morph, perch type, side of the road it was seen on, and

Table 1. Numbers and densities of diurnal raptors observed in the Central Valley of California during winter 2007-2010.

			Birds(x100)/block		
			2007-08	2008-09	2009-2010
Species	Obs.	%	X±SE[a]	X±SE	X±SE
Red-tailed Hawk	7950	51%	29 ± 1	27 ± 1	34 ± 1
American Kestrel	3622	23%	13 ± 1	13 ± 1	16 ± 1
Northern Harrier	1396	9.0%	4.9 ± 0.3	4.0 ± 0.3	7.0 ± 0.4
Ferruginous Hawk	630	4.1%	2.4 ± 0.2	2.2 ± 0.2	2.1 ± 0.2
White-tailed Kite	468	3.0%	1.8 ± 0.2	1.5 ± 0.2	1.8 ± 0.2
Red-shouldered Hawk[b]	444	2.9%	—[b]	—	—
Bald Eagle	276	1.8%	1.0 ± 0.2	0.9 ± 0.1	1.0 ± 0.1
Prairie Falcon	232	1.5%	0.7 ± 0.1	0.9 ± 0.1	0.7 ± 0.1
Accipiter spp.[b]	144	0.9%	—[b]	—	—
Rough-legged Hawk	143	0.9%	0.8 ± 0.1	0.5 ± 0.1	0.06 ± 0.03
Golden Eagle[c]	95	0.6%	—[c]	—	—
Merlin[c]	80	0.5%	—[c]	—	—
Peregrine Falcon[c]	33	0.2%	—[c]	—	—
Osprey[c]	33	0.2%	—[c]	—	—

[a] = Mean and standard error
[b] = Excluded from analyses by Pandolfino et al. (2011) because of strong association with woodland areas, which made consistent detection difficult.
[c] = Excluded from analyses in Pandolfino et al. (2011) due to low numbers.

location (nearest 0.1 mi based on odometer readings) from the start of the survey. The bird's behavior and location along the survey route (shortest perpendicular distance from the bird to the road) were recorded at the time when first sighted. Volunteers also recorded the temperature, wind speed (Beaufort Scale estimate) and direction, and cloud cover at the beginning and at the end of each survey.

Habitat Assessment

In order to assign each raptor observation to a specific habitat, we established habitat blocks on both sides of each survey road, beginning

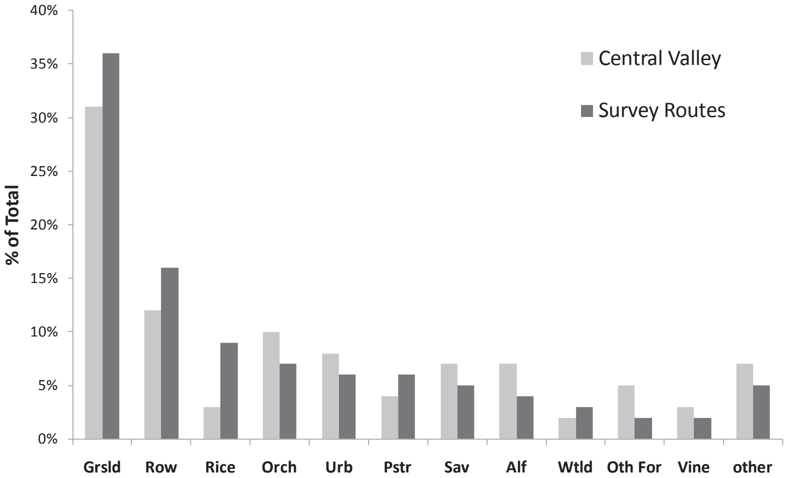

Figure 2. The proportion of habitat types in the CV as a whole and those sampled during our assessment of habitat associations of diurnal raptors wintering in the Central Valley of California, 2007-2010. (Grsld = grassland, Row = row crop, Orch = orchard, Urb = urbanized, Pstr = irrigated pasture, Sav = savannah, Alf = alfalfa, Wtld = wetland, Oth For = other forage, Vine = vineyard).

from the start of each route. Blocks measured 500 m x 800 m, with one of the 800 m sides abutting the road, and were spaced continuously along the survey route. We recorded UTM coordinates and odometer readings at the center point of the roadside leg of each block. We assigned a dominant habitat type to each block using the habitat categories described below. At the start of each winter survey period we drove each route and noted any changes in dominant habitats in each block. The odometer of the vehicle used for habitat assessment was calibrated to the odometers of each raptor survey vehicle in order to accurately assign raptor observations to the correct habitat block.

Habitat Categories

We assigned a dominant habitat to each block from one of 12 habitat categories. We chose these categories because they best described the dominant land cover types encountered along the routes. The habitats covered were generally representative of the CV as a whole (Figure 2) (California GAP Analysis Project 1998, California Department of Conservation 2008, U.S. Department of Agriculture 2008 and 2009). For planted crops, our assessments did not differentiate the stage of development, which ranged from recently planted to post-harvest stubble. In general, the CV consists of flat, open country, and this was the case in nearly all blocks.

Visibility was limited within a block was only in some areas of oak savannah and mature orchards. The habitat types are described below in order of their relative extent (high to low) within survey routes.

Grassland — Non-irrigated lands dominated by grasses and herbaceous forbs (including areas grazed, ungrazed, and burned) and small amounts of grasslands interspersed with salt-tolerant shrubs (mainly *Atriplex* spp.) in some areas of the San Joaquin Valley. We characterized grassland as ungrazed if the area appeared to have not been grazed for at least a year and the grasses were >15cm tall.

Row crop — Annual crops grown mainly in the spring and summer. Often the crop type was unknown during surveys because many fields had been plowed for winter and consisted of bare dirt.

Rice — Generally consistent with the distribution of this crop in the CV, all routes containing rice were in the southern Sacramento Valley. Most rice is flooded in the winter in the CV (Central Valley Joint Venture 2006). Non-flooded rice fields were either burned or supported dry stubble.

Orchard — Various-aged stands of woody perennial crops such as walnuts, almonds, and apricots.

Urbanized — Areas in which at least 50% of the land area consisted of residential or rural-residential uses or small areas of industrial development or office complexes.

Pasture — Irrigated areas of grasses and other herbaceous species used for grazing but not tilled or harvested (e.g., for hay production).

Savannah — Scattered oaks, mainly blue oak (*Quercus douglasii*), in a grassland matrix with 10-30% tree canopy; most occurred on routes along the eastern edge of the CV.

Alfalfa — Harvested and un-harvested fields of alfalfa at all stages of development.

Wetland — Natural and man-made wetlands.

Other Forage — Hay and winter wheat in a range of growth and management stages from recently planted to post-harvest stubble.

Vineyard — Wine and table grape vineyards of varying ages, with most having typical supporting structures.

Other — A diverse group of uses of limited extent, such as fallow fields, mowed grass, open water, golf courses, oak forests, eucalyptus stands, landfills, and riparian woodland and scrub areas.

SUMMARY OF RESULTS FROM PRIOR PUBLICATIONS

We briefly summarize results from previous publications resulting from this research, as context for the other papers presented in this issue of the Central Valley Bird Club Bulletin.

Results from Wintering Raptor Habitat Use Study

During the three winters encompassing 2007–2010 we recorded 16,033 observations of diurnal raptors in the CV with 15,546 (97%) of these identified to species (Pandolfino et al. 2011a; Table 1). Species densities did not vary significantly between years except for slightly higher densities of Red-tailed Hawks and American Kestrels and dramatically lower densities of Rough-legged Hawk (*Buteo lagopus*) in 2009-2010. Such large between-year fluctuations in the winter abundance of Rough-legged Hawks has been observed frequently across its winter range (Bechard and Swem 2002).

Many species showed positive associations that were statistically significant ("preferred") or significant negative associations ("avoided") with various habitat types. The Ferruginous Hawk (*Buteo regalis*), Rough-legged Hawk, and Prairie Falcon (*Falco mexicanus*) all preferred grasslands and avoided urbanized areas and areas of intense agriculture such as orchards, rice, and row crops. All three of these species occurred in grazed grassland at higher densities than in ungrazed grassland. The White-tailed Kite and Northern Harrier were significantly more abundant in ungrazed than grazed grassland. The kite, harrier, and Bald Eagle (*Haliaeetus leucocephalus*) preferred wetlands, and the harrier and eagle also preferred rice. The kite and harrier also preferred alfalfa and other forage. The Red-tailed Hawk and American Kestrel preferred irrigated pasture and alfalfa and avoided urbanized areas, row crop, orchard, and savannah. American Kestrels showed the strongest preference for alfalfa. Red-tailed Hawks showed the strongest preference for wetlands and rice. When we compared habitat associations between raptors along the roadside and away from the road, we found no significant difference for any species in any habitat with the exception of American Kestrel in rice. Roadside kestrels preferred rice, whereas kestrels away from the road avoided this habitat.

Some of the key conservation implications from this work were:

1) Grassland-associated species were often exclusively associated with that habitat and negatively associated with urbanized areas and intense agricultural uses; these same species appear to prefer grazed over ungrazed grassland;
2) Most wetland-associated species were also associated with rice, suggesting that this habitat serves a wetland surrogate for winter raptors;
3) Alfalfa was important to many raptor species; and
4) Raptors universally avoided urbanized habitats, row crops, vineyards, and orchards—all land uses that are increasing in the CV mostly at the expense of grassland.

Results from Study of Differences in Habitat Selection among Male and Female Kestrels

As noted above, American Kestrels showed positive associations with alfalfa and other forage crops such as hay and winter wheat, as well as grassland, irrigated pasture, and rice. We found that male and female kestrels showed very different habitat associations (Pandolfino et al. 2011b), as has been seen in prior studies of wintering kestrels (Smallwood and Bird 2002 and references therein). Female American Kestrels preferred alfalfa, forage crops, and grassland. In contrast, male American Kestrels preferred only grassland and were less abundant than females in alfalfa, other forage crops, and grassland. Males occurred at higher densities than females in most habitats that were avoided by the species, such as orchards, urbanized areas and oak savannah. Our findings that females seem to occupy higher quality habitats in winter are consistent with observations from elsewhere in North America.

ACKNOWLEDGEMENTS

The work presented in this series of papers would not have been possible without the devotion of considerable time and effort by the volunteers who helped run the surveys: Steve Abbott, Roger Adamson, Dan Brown, Ken Burton, Walt Carnahan, Chuck Carroll, Helene Cavoir, Debbie Daley, Bruce & Kathy Deuel, Julie Dinsdale, J. Frank, Alan England, Tim Fitzer, B. Getty, Jim Groesser, Ed Harper, Ken Hashagen, Lois Hoy, Scott & Liam Huber, Sami LaRocca, John Lewis, E. Long, Len Mackenzie, Joe Medley, Zach Miller, Frances Oliver, Harold & Sue Reeve, Phil Robertson, Jeff Seay, Mike Skram, Dan Stewart, Steve & Priscilla Summers, Craig Swolgaard, Dave Wagner, Heath Wakelee, Bruce Webb, Gary Woods, Lowell Young, and Bob & Carol Yutzy. We are grateful for logistical support and funding received from the Central Valley Bird Club and for funding received from Altacal Audubon Society, California Rangeland Conservation Coalition, California Rice Commission, Sacramento Audubon Society, San Joaquin Audubon Society, Sierra Foothills Audubon Society, Stanislaus Audubon Society, U. S. Fish and Wildlife Service, and Yolo Audubon Society.

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Central Valley Winter Raptor Survey (2007-2010): Variation in Grassland Raptor Density among Survey Routes

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Information on the relative quality of habitats for raptors across a large geography as the Central Valley (CV) provides a basis for identifying priority areas where limited conservation resources can be focused most effectively. For this purpose, we examined our data across all 19 CV raptor survey routes by habitat type and species to see if a certain routes showed significantly higher densities for a given habitat than others. We found no significant differences in raptor densities among routes for all habitat types except grassland. Significant route-to-route variations for some species in grassland are summarized here.

STUDY AREA AND METHODS

Survey methods are described in the accompanying overview and methods paper (Pandolfino and Smith 2011). We determined the average densities (birds per 40 ha block) of each raptor in each habitat and compared the densities between routes for each species. In each case, we determined the 95% confidence interval around the average densities using the Data Analysis Package of Microsoft Excel.

RESULTS AND DISCUSSION

We found no significant differences in the density of raptors between survey routes for any habitat except grassland. Four species showed significant route-to-route variation in grassland: the Red-tailed Hawk, Ferruginous Hawk, Rough-legged Hawk, and Prairie Falcon. Interestingly, the last three species are also the only ones that show a positive association with grassland and with no other habitat type (Pandolfino et al. 2011). Figures 1-4 show the variation in density of these four species across the 14 routes that include at least 1,000 ha of grassland habitat. Figure 5 directly compares the three grassland specialist species (Ferruginous Hawk, Rough-legged Hawk, and Prairie Falcon) across routes individually and in total. Three routes (Linden, Oakdale, and LeGrand) consistently showed high densities of these raptors, all of which are in the northeast corner of the San Joaquin Valley in eastern San Joaquin, Stanislaus, Merced, and western Mariposa counties (Figure 6). We then compared the density of the three grassland specialists in grassland from those three northeast San Joaquin Valley routes to grassland density on all other routes (Figure 7). For each

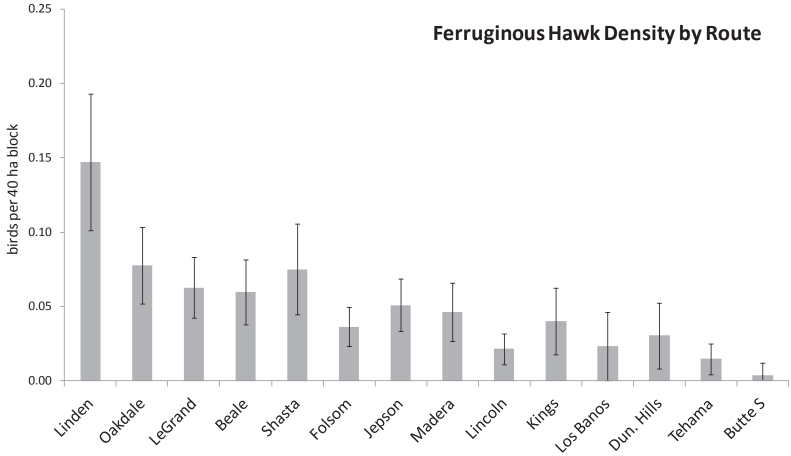

Figure 1. Comparison of density (birds per 40 ha block) of Ferruginous Hawks in grassland habitat across 14 survey routes. Error bars represent 95% confidence interval.

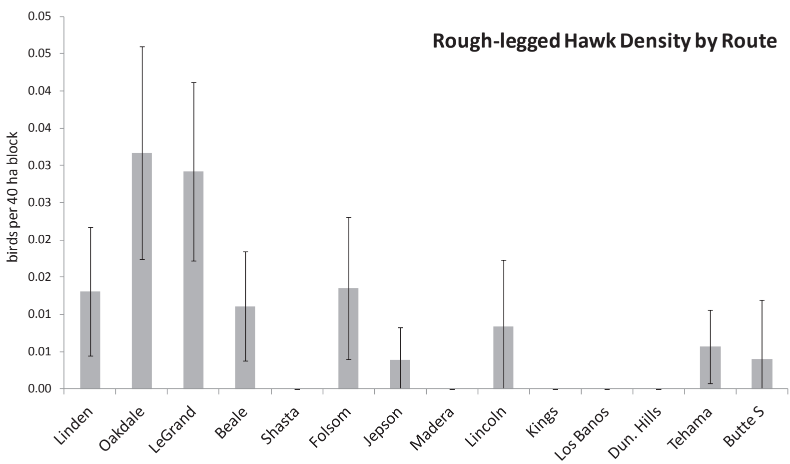

Figure 2. Comparison of density (birds per 40 ha block) of Rough-legged Hawks in grassland habitat across 14 survey routes. Error bars represent 95% confidence interval.

species, the grassland density on those three routes was significantly higher than that observed in grassland from all other routes.

While there are differences in prey preference among the four species that showed significant route-to-route variation (Johnsgard 1996), there is also considerable overlap (Craighead and Craighead 1956, Bildstein 1987, Bechard and Schmutz 1995, Steenhof 1998). They also overlap in hunting styles, with the three Buteos primarily using perches to hunt, but Prairie

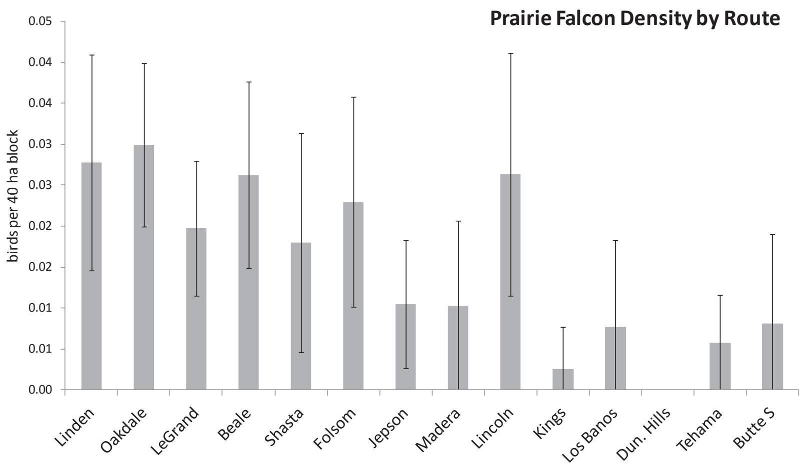

Figure 3. Comparison of density (birds per 40 ha block) of Prairie Falcons in grassland habitat across 14 survey routes. Error bars represent 95% confidence interval.

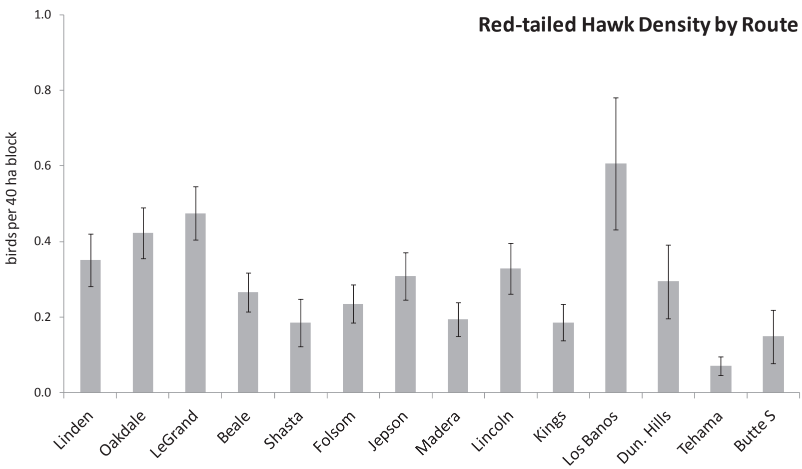

Figure 4. Comparison of density (birds per 40 ha block) of Red-tailed Hawks in grassland habitat across 14 survey routes. Error bars represent 95% confidence interval.

Falcons also frequently hunting from perches. Therefore, it is not surprising that all four species might find the same type of grasslands attractive. Our study was not designed to determine habitat use or prey productivity, but it is reasonable to assume that the higher densities of these raptors in certain grasslands are correlated with foraging success. While this use may be related to greater rodent abundance in these areas, the interplay between rodent abundance and hunting success is complex (Craighead and Craighead

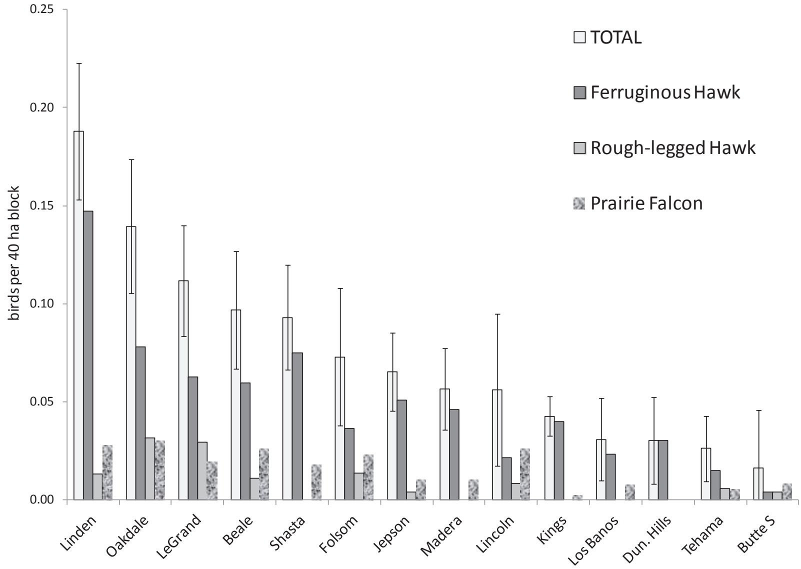

Figure 5. Comparison of density (birds per 40 ha block) of Ferruginous Hawks, Rough-legged Hawks, Prairie Falcons, and the sum of all three (TOTAL) in grassland habitat across 14 survey routes. Error bars shown only for TOTAL and represent 95% confidence interval.

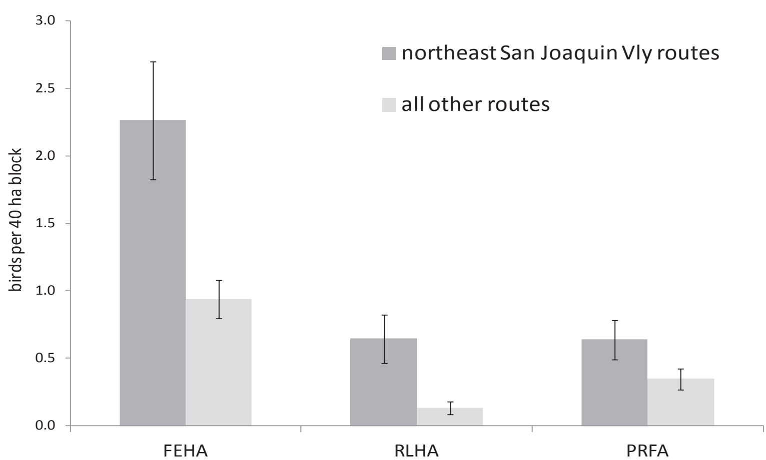

Figure 7. Comparison of density (birds per 40 ha block) of Ferruginous Hawks, Rough-legged Hawks, and Prairie Falcons in grassland habitat of the three northeast San Joaquin Valley routes (Linden, Oakdale, and LeGrand) and all other survey routes. Error bars represent 95% confidence interval.

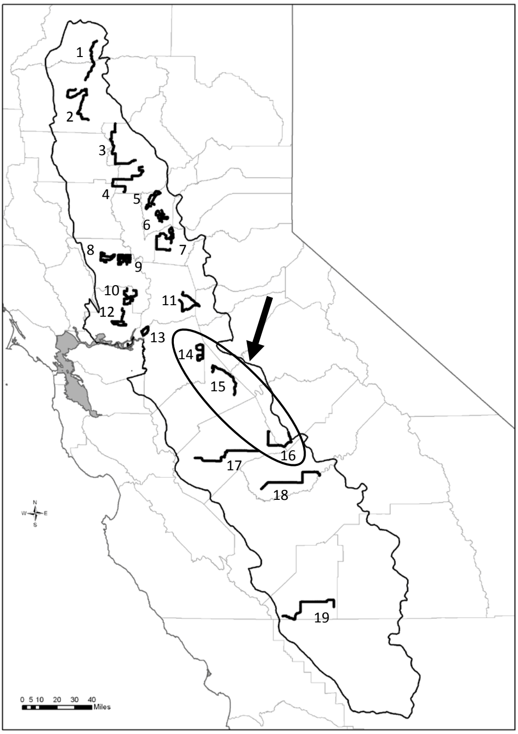

Figure 6. Map of all 19 survey routes with three routes (Linden, Oakdale, and LeGrand) on the northeastern edge of the San Joaquin Valley circled. (1 = Shasta, 2 = Tehama, 3 = Butte North, 4 = Butte South, 5 = Yuba, 6 = Beale, 7 = Lincoln, 8 = Dunnigan Hills, 9 = Woodland, 10 = Davis, 11 = Folsom, 12 = Jepson, 13 = Delta, 14 = Linden, 15 = Oakdale, 16 = LeGrand, 17 = Los Banos, 18 = Madera, 19 = Kings).

1956, Baker and Brooks 1981, Johnson and Horn 2008) with many factors in the habitat influencing one aspect or the other.

Our results suggest that some grassland areas may support many more raptors than others. Therefore, it is important to know what factors affect abundance, so that conservation efforts can be focused on the most productive habitats. To this end, we intend to examine a large set of variables (soil type and depth, rainfall, temperature, patch size, proximity to other habitats, etc.) to see if we can produce a model that can be used to predict which grasslands will support the highest concentrations of raptors in the CV.

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Central Valley Winter Raptor Survey (2007-2010): Effects of the Presence of Riparian Elements on Habitat Associations

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As a part of our Central Valley wintering raptor study, we assessed the most common habitat type present in each of the areas surveyed. In addition, we also noted any survey blocks that contained a significant riparian element with a stream course and adjacent riparian vegetation. A few blocks where riparian was dominant were included in the "other" habitat category (see Pandolfino and Smith 2011a) because there were too few of them to produce statistically relevant results. Having this additional information about each block allowed us to assess whether the presence of a riparian element within otherwise open country might have a significant effect on raptor habitat associations. Because we also gathered data on Loggerhead Shrikes (*Lanius ludovicianus*) during our surveys, we also were able to look for effects of riparian on habitat associations for this species in grassland areas. We are unaware of any prior studies that have examined this question across a large geographic area, for a variety of dominant habitat types, or for a variety of raptor species.

STUDY AREA AND METHODS

Survey methods are described in the accompanying overview and methods paper (Pandolfino and Smith 2011a). We determined the average density of each species (birds per 40 ha block) in each habitat type and compared the densities in blocks with a riparian element to those without a riparian element for each habitat. In each case, we determined the 95% confidence interval around the average density using the Data Analysis Package of Microsoft Excel.

RESULTS AND DISCUSSION

Densities of Red-tailed Hawks (Figure 1) and most other species were not significantly affected by the presence of a riparian element in any habitat type. Ferruginous Hawks, however, were significantly less abundant in grassland blocks containing a riparian element than in grassland blocks that lacked a riparian element (Figure 2). Similarly, the Rough-legged Hawks and Prairie Falcon, which like the Ferruginous Hawk were positively associated exclusively with grassland (Pandolfino et al. 2011), also occurred at lower density in grassland when a riparian element was present than in areas

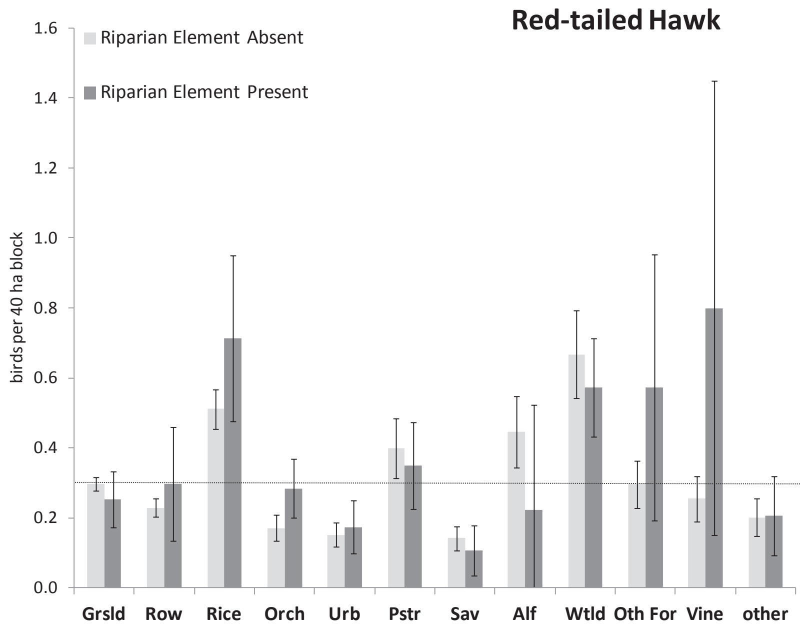

Figure 1. Comparison of density (birds per 40 ha block) of Red-tailed Hawks when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. (Grsld = grassland, Row = row crop, Orch = orchard, Urb = urbanized, Pstr = irrigated pasture, Sav = savannah, Alf = alfalfa, Wtld = wetland, Oth For = other forage, Vine = vineyard).

lacking riparian, although the decreases were not statistically significant (Figure 3).

The three grassland raptor species, Ferruginous Hawk, Rough-legged Hawk, and Prairie Falcon, all strongly favor open country, so perhaps the simple presence of a wooded element nearby makes the grassland less attractive. Alternatively, the Red-tailed Hawk's tolerance of riparian areas and its habitat-generalist nature may increase the potential for competition between this much more abundant raptor and the three strongly grassland-associated species when a riparian element is present, thus causing the true grassland specialists to avoid such areas. Finally, it also is possible that grasslands near riparian areas may support different soil types or depths, plant composition, wind, or temperature conditions that may affect raptor use.

In order to see if the simple presence of an elevated perching element within grassland could influence the density of these species, we also compared raptor densities between grassland blocks that included utility poles to those without utility poles (Figure 4). All three of the grassland-specialist raptors, Ferruginous and Rough-legged Hawks and Prairie Fal-

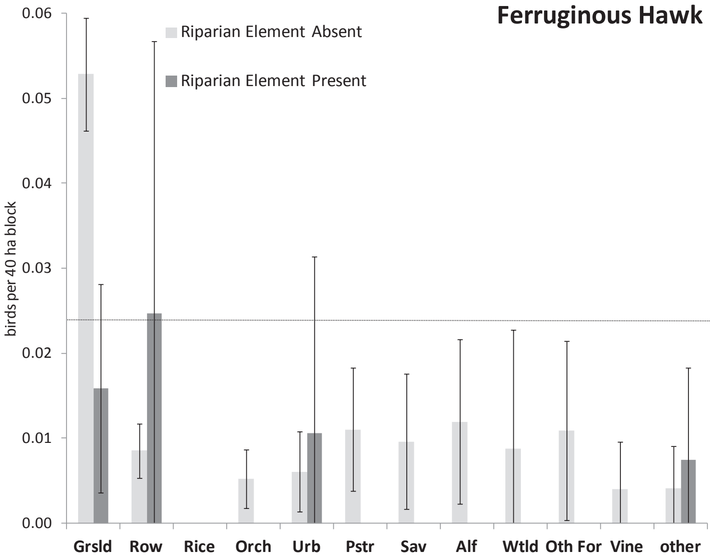

Figure 2. Comparison of density (birds per 40 ha block) of Ferruginous Hawks when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. Habitat codes are as noted in Figure 1 legend.

cons were present in significantly lower densities in grassland that included utility poles than in those lacking poles. This finding was particularly interesting for Prairie Falcons, which frequently use these poles as perches (Pandolfino and Smith 2011b).

Avoidance of grasslands with utility poles by the three most grassland-associated species suggests that the presence of a vertical element within an otherwise open landscape, or the perch opportunities it may provide to competitors, may influence the behavior of these raptors. Red-tailed Hawks showed no preference among lands with and without poles, and American Kestrels, which frequently perch on utility poles and wires, was the only species that occurred at a significantly higher density in grassland where poles were present. Because we observed significant differences in raptor density among grassland on different routes (Pandolfino and Smith 2011c), it also was important to rule out any bias among the routes for presence or absence of utility poles in grassland. A comparison of all routes in grassland showed that the distribution of poles in grassland did not differ among routes ($\chi^2_{20\ df} = 24$, $p = 0.25$), thereby indicating that differences in pole availability did not affect raptor densities among routes.

The grassland-associated Loggerhead Shrike also showed a marked lower density in grassland with riparian habitats than where riparian was absent. Shrike densities also were non-significantly lower when riparian

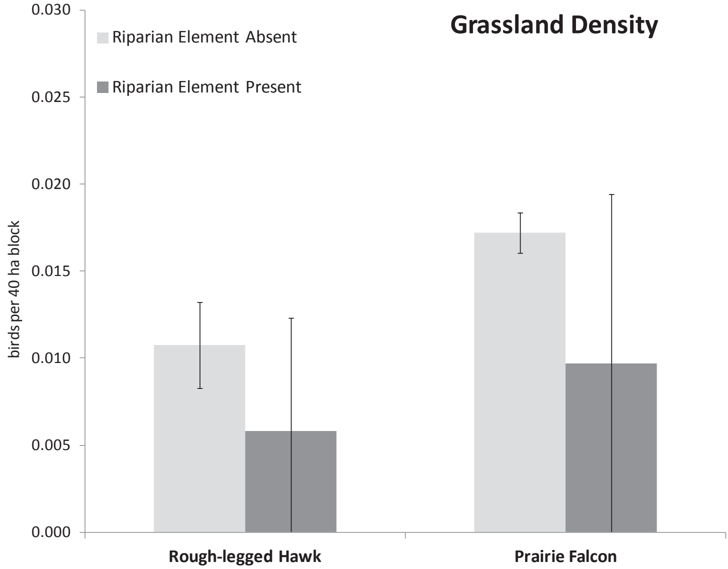

Figure 3. Comparison of density (birds per 40 ha block) of when a riparian element was absent or present in grassland habitat. Error bars represent 95% confidence interval.

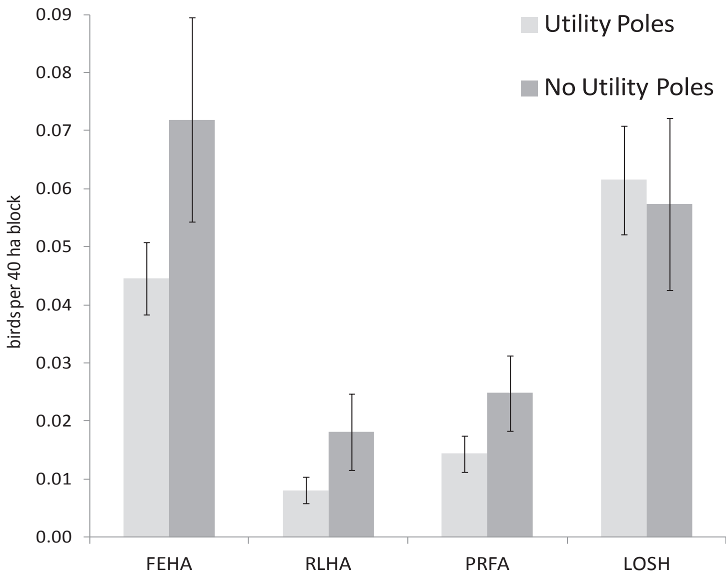

Figure 4. Comparison of density (birds per 40 ha block) of when utility poles (U. Poles) were absent or present in grassland habitat. Error bars represent 95% confidence interval. (FEHA = Ferruginous Hawk, RLHA = Rough-legged Hawk, PRFA = Prairie Falcon, LOSH = Loggerhead Shrike).

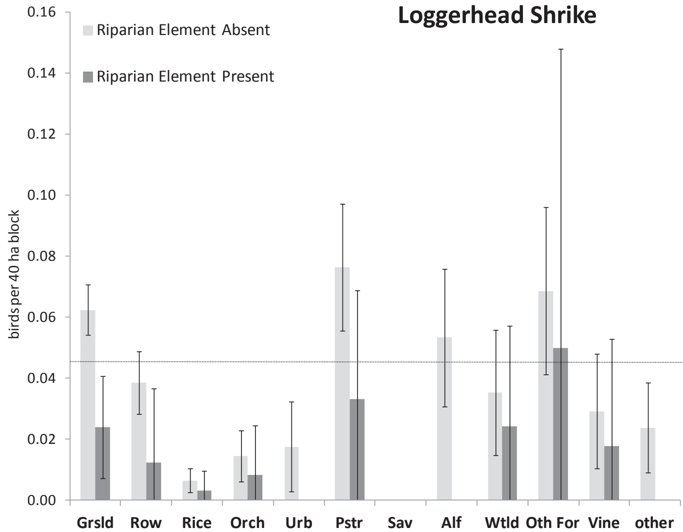

Figure 5. Comparison of density (birds per 40 ha block) of Loggerhead Shrikes when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. Habitat codes are as noted in Figure 1 legend.

habitat was present in all eight of the other habitat types where densities could be compared (Figure 5). The presence of riparian woodland or scrub may increase risk of attack by predators, making such areas less attractive, consistent with a general avoidance of wooded areas shown by this species (Bohall-Wood 1987, Smith and Kruse 1992, Gawlik and Bildstein 1993). Loggerhead Shrikes showed no significant difference between grassland with or without poles.

We omitted the Red-shouldered Hawks (*Buteo lineatus*), Cooper's Hawk (*Accipiter cooperii*), and Sharp-shinned Hawk (*Accipiter striatus*) from full analyses in prior work (Pandolfino et al. 2011), because of low detection rates. These species all are known to be strongly associated with riparian habitats (Curtis et al. 2006, Bildstein and Meyer 2000, Dykstra et al. 2008). Therefore, we examined our data for any sign of riparian effects for the Red-shoulder Hawk and accipiters (both species combined; Figure 6. Despite limited data, these species seemed to strongly favor the presence of a riparian element. For Red-shouldered Hawks, the presence of riparian habitat increased density significantly within grassland. In the "other" habitat category, which includes blocks dominated by riparian habitat and other wooded habitats, densities of Red-shouldered Hawks were non-significantly higher in every habitat type when a riparian element was present. We found similar results for accipiters, with densities non-signifi-

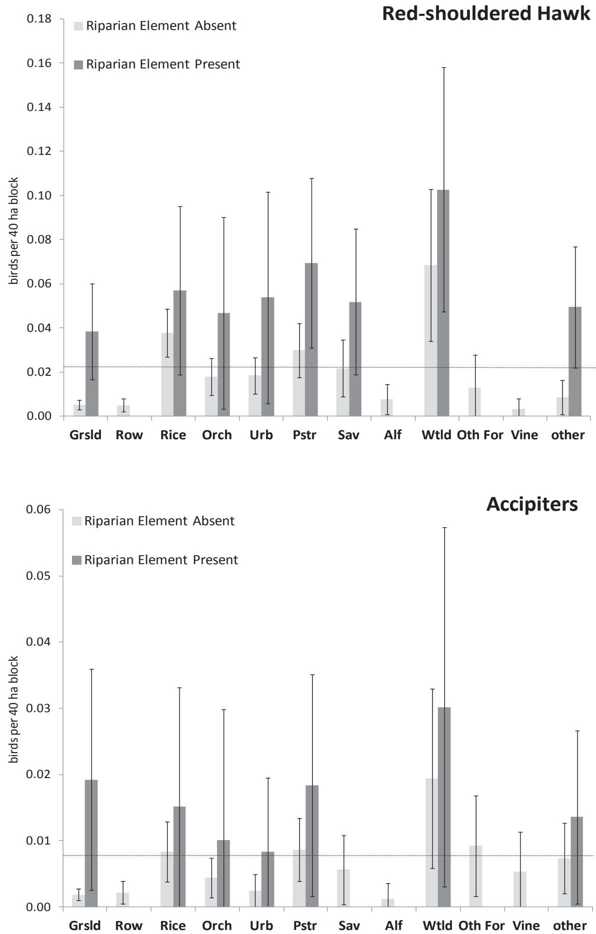

Figure 6. Comparison of density (birds per 40 ha block) of Red-shouldered Hawks and Accipiters (Cooper's and Sharp-shinned hawks combined with unidentified Accipiters) when a riparian element was absent or present in various habitat types. Error bars represent 95% confidence interval. The horizontal line represents the overall average density across all habitat types. Habitat codes are as noted in Figure 1 legend.

cantly higher in every habitat type where a comparison could be made, with that difference approaching significance for grassland.

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Central Valley Winter Raptor Survey (2007-2010): Perch Selection and the Influence of Weather on Raptor Behavior

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Nearly all raptors spend most of their day on a perch, and most hunt from a perch either as their primary strategy or as one of several strategies. While there are many studies of raptor perch behavior, few are recent, and none have studied perch preference and behavior in the Central Valley (CV). As part of the protocol for the CV Winter Raptor Survey (Pandolfino et al. 2011, Pandolfino and Smith 2011), we recorded behavior when each bird was first seen (flying or perched and perch type). This allowed us to compare frequency of flying versus perching and the type of perches used by each species. We also recorded data on wind speed and cloud cover, and report on effects of those weather conditions on raptor behavior.

STUDY AREA AND METHODS

Survey methods are described in the accompanying overview and methods paper (Pandolfino and Smith 2011). We used all observations for each species to determine the relative frequency (percent of observations) of flying or perching and perch use. Analyses were based on the behavior seen when the bird was first observed. To assess effects of wind speed on behavior, we computed the average Beaufort Scale (Table 1) wind speed by averaging the wind speed estimate at the beginning and end of routes. Likewise, we averaged sky conditions at the start and end of surveys using a scale similar to that used for Breeding Bird Surveys (0 = clear, few clouds, 1 = partly cloudy, 2 = cloudy or overcast, 4 = fog or smoke, 5 = drizzle). Average sky conditions of 0 or 0.5 were considered sunny, and values above 0.5 were considered cloudy. Surveys were not conducted, however, when wind speed was consistently at Beaufort Scale 4 or above or when fog or rain impaired visibility to less than 500 m.

Table 1. Beaufort Scale of Wind Speed.

Beaufort No.	Indicators of Wind Speed	Wind speed (km/hr)
0	Smoke rises vertically	< 2
1	Wind direction shown by smoke drift	2-5
2	Wind felt on face; leaves rustle	6-12
3	Leaves, small twigs in constant motion	13-19
4	Raises dust and loose paper, small branches move	20-29

To determine wind effects on behavior, we plotted the percent of birds seen in flight versus wind speed and conducted linear regression analysis to look for significant relationships, using $p < 0.05$ to indicate a significant effect.

Perch sites were assigned to seven categories:

Ground: the ground, rock outcrop, or very low vegetation such as rice stubble.
Fence: fence post or fence wire.
Utility Pole: the top or cross bar of a utility pole (but not high-voltage electrical towers).
Utility Wire: utility line, including both transmission and distribution lines
Tree: Live or dead tree or large woody shrub.
Other: high voltage electrical towers and any other man-made structures not included in other categories.

RESULTS AND DISCUSSION

Flying versus Perching

Northern Harriers were the most aerial of the species we observed, with 80% of harriers observed in flight (Figure 1). This is consistent with prior studies (Craighead and Craighead 1956 and Bildstein 1987) who also observed a higher proportion of harriers in flight than for any other raptor studied. This species hunts almost exclusively by low patrolling flights (Smith et al. 2011). Turkey Vultures also forage almost exclusively by searching during long soaring flights, therefore, our observation that they were observed in flight more than three-fourths of the time was expected.

The three open-county Buteos, the Red-tailed, Ferruginous, and Rough-legged Hawk showed different tendencies, with Rough-legged Hawks the most likely to be seen flying and Red-tailed Hawks the least likely. These observations also are consistent with prior studies (Craighead and Craighead 1956, Schnell 1968, Bildstein 1987) that compared those two species. No prior work directly compared this aspect of behavior for Ferruginous Hawks to the other two Buteos so our finding that this species' flight-vs.-perched tendency was intermediate between Red-tailed and Rough-legged hawks appears to be new.

Thirty-five percent of White-tailed Kites we observed were flying, in general agreement with time budget studies in winter in northwestern California, in which kites spent approximately 20% of daylight hours in flight (Koplin et al. 1980). American Kestrels were among the most likely species to be seen perched, with 79% of our observations of perched birds. Prior studies found between 69 and 89% of American Kestrels perched (Craighead and Craighead 1956, Rudolph 1982, Bildstein 1987), and time budget studies

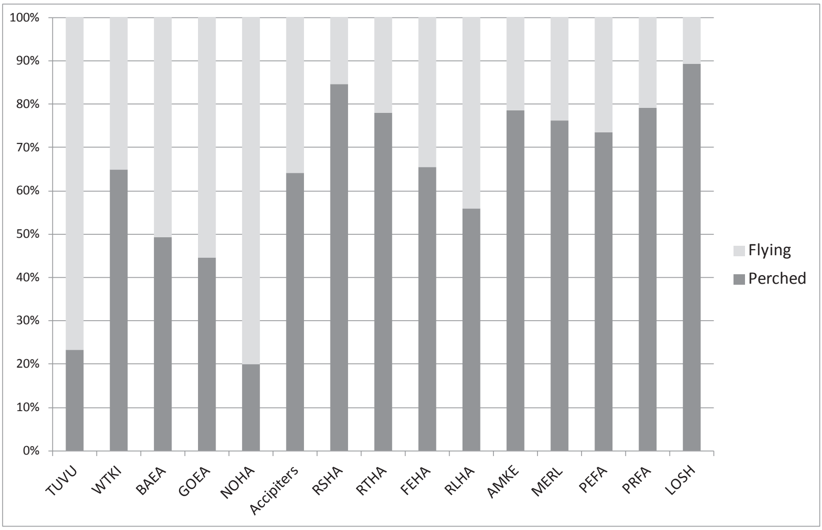

Figure 1. Comparison of behavior, flying or perched, for a variety of species. (TUVU = Turkey Vulture, WTKI = White-tailed Kite, BAEA = Bald Eagle, GOEA = Golden Eagle, NOHA = Northern Harrier, Accipiters = Cooper's, Sharp-shinned hawks and all unidentified Accipiters, RSHA = Red-shouldered Hawk, RTHA = Red-tailed Hawk, FEHA = Ferruginous Hawk, RLHA = Rough-legged Hawk, AMKE = American Kestrel, MERL = Merlin, PEFA = Peregrine Falcon, PRFA = Prairie Falcon, LOSH = Loggerhead Shrike).

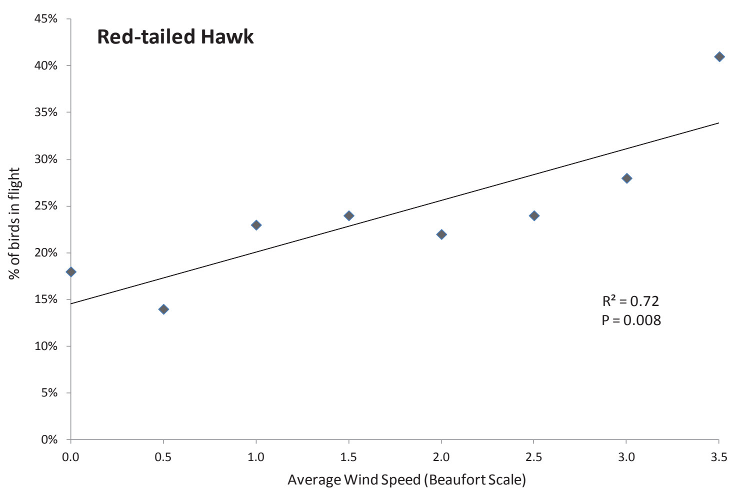

Figure 2. Scatter plot of percent of Red-tailed Hawks seen in flight versus wind speed. The trendline,R-squared value, and p-value are based on linear regression analysis.

in California estimated that they spend less than 7% of the daylight hours in flight (Koplin et al. 1980). Although kestrels frequently hunt while hovering, perch-hunting is the most common and energy-efficient strategy (Smallwood and Bird 2002).

We observed Prairie Falcons perching in the large majority of observations. This result may seem surprising in light of several breeding season studies (reviewed by Johnsgard 1990 and Steenhof 1998), which suggested that soaring or low level, "ambush" flights are common hunting strategies for this falcon. Enderson (1964), however, found that in winter and in particular when prey was abundant, most Prairie Falcons frequently used perches and initiated most hunting attempts from those perches. Loggerhead Shrikes were perched during a larger proportion of observations (89%) than any other species we recorded, consistent with prior studies from California (Craig 1978, Morrison 1980) and elsewhere (Bohall-Wood 1987, Yosef 1996).

Effects of Weather on Flying vs. Perching

We obtained sufficient data on four species (Turkey Vulture, Northern Harrier, Red-tailed Hawk, and American Kestrel) to assess effects of wind and sky cover on behavior. Bildstein (1987) also examined the effects of wind and sky cover on behavior of the harrier, Red-tailed Hawk, and the kestrel in winter in Ohio and his results provide interesting comparisons

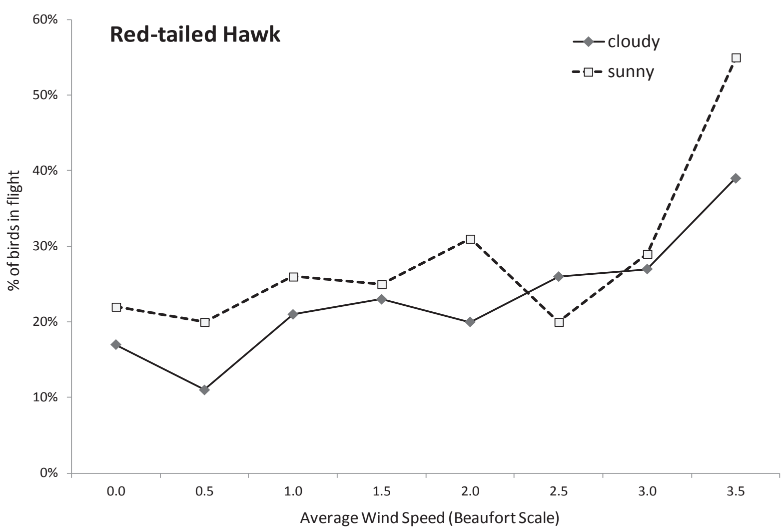

Figure 3. Percent of Red-tailed Hawks seen in flight versus wind speed for sunny and cloudy conditions.

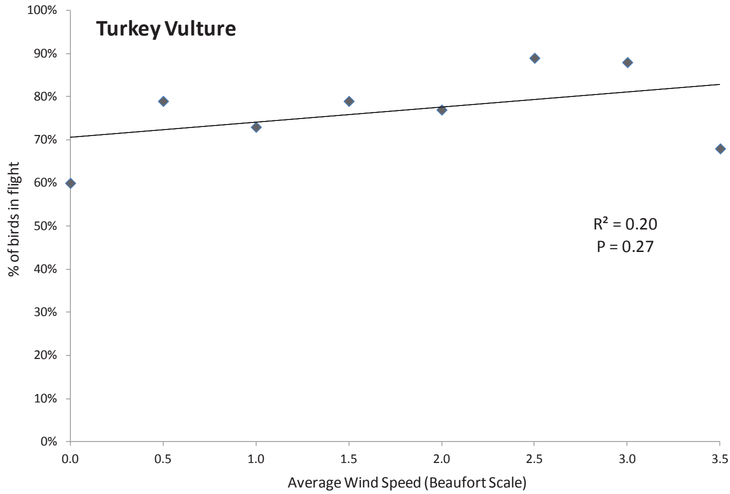

Figure 4. Percent of Turkey Vultures seen in flight versus wind speed. The trendline, R-squared value, and p-value are based on linear regression analysis.

with ours. Red-tailed Hawks showed a significant positive correlation between wind speed and proportion of birds in flight (Figure 2). Bildstein (1987) showed that a significantly higher percent of Red-tailed Hawks flew when wind speeds exceeded 10 km/hour (roughly equivalent to Beaufort number 2). Presumably, higher winds provide added lift which makes soaring more efficient for this large hawk. We also found that at nearly all wind speeds, a higher percent of Red-tailed Hawks flew on sunny days than on cloudy ones (Figure 3), again consistent with Bildstein (1987). Sunny conditions can create thermals (columns of rising warmer air) which this species uses to aid in soaring (Preston and Beane 2009). Bildstein (1987), however, found no consistently significant effect of sunny conditions on flight versus perch frequency for any of the other species he studied.

Turkey Vultures rely nearly exclusively on soaring flight to forage and make ample use of thermals and winds to increase flight efficiency (Kirk and Mossman 1998). Therefore, increases in wind speed and sunny days should cause a higher proportion of vultures to be flying. When we examined the effects of wind speed, we found no significant correlation across the full spectrum of wind speeds (Figure 4). However, when we removed data for the windiest conditions (Beaufort number = 3.5) the correlation became positive and significant ($R^2 = 0.72$, $P = 0.01$). It may be that the beneficial effects of increasing wind speed are lost above a certain level for this vulture. When we compared the proportion of birds in flight on sunny and cloudy conditions (Figure 5), we found that the proportion was consistently

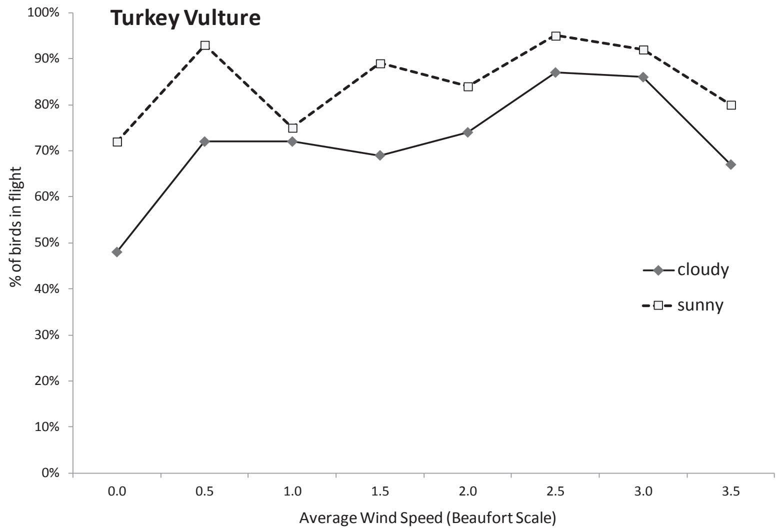

Figure 5. Percent of Turkey Vultures seen in flight versus wind speed for sunny and cloudy conditions.

higher on sunny days, consistent with increased access to thermals.

Bildstein (1987) found a significantly larger proportion of American Kestrels in flight when wind speeds were over 10 km/hour. Our results were consistent with that observation (Figure 6) with a significant positive correlation between wind speed and proportion of flying observations. The higher wind speed presumably allows kestrels to hover more efficiently or may make flying insect prey easier to capture as insects may be less able to evade kestrels under windy conditions. We found no consistent effect of sky cover on the frequency of flying by American Kestrels. We also found no significant effects of either wind or sun on Northern Harriers, also consistent with Bildstein (1987).

Perch Type Selection

We recorded the presence or absence of utility poles and fences, but no other perch types, in the habitat blocks we surveyed. Utility poles were present in 85% of the blocks surveyed and fences were present in 82%. Only 3% of habitat blocks lacked both fences and utility poles and 70% included both. Because we did not quantify overall perch abundance, it is not possible to determine statistical significance of the perch use we observed. That is, we cannot say with certainty that particular types of perches were selected more often than others in comparison to their availability. However, the pattern of perch selection for each species was qualitatively

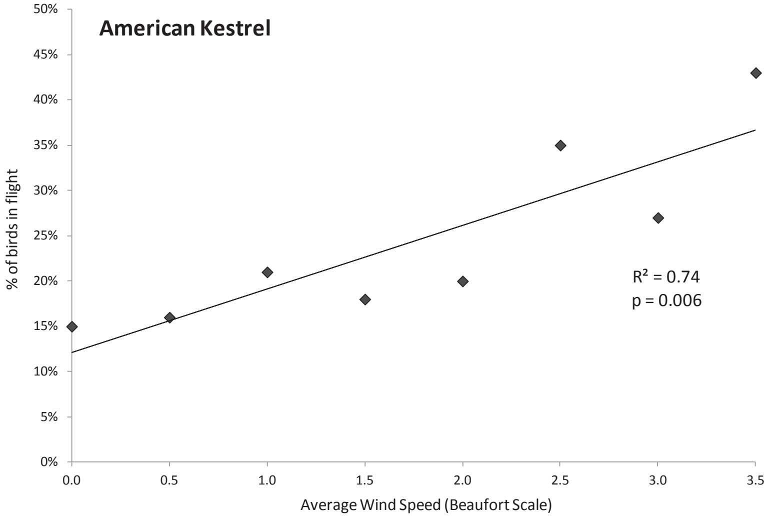

Figure 6. Percent of American Kestrels seen in flight versus wind speed. The trendline, R-squared value, and p-value are based linear regression analysis.

consistent from year to year and from route to route, supporting the likelihood that observed perch use is reflective of the species' preference.

The four species of Buteo differed in their use of perches (Figure 7). Red-tailed Hawks used higher perches, including trees and utility poles, much more frequently than Ferruginous Hawks or Rough-legged Hawks. Ferruginous and Rough-legged Hawks perched on the ground or on fences in more than half of all observations, respectively, whereas Red-tailed Hawks used the ground or a fence in only 14% of observations. Direct comparison of percentages between different study sites is complicated by the different proportions of perch types in each area. However, the relative preference for trees or poles for Red-tailed Hawks versus ground or fence for Rough-legged Hawks has been shown by Bildstein (1987) and Schnell (1968) for Rough-legged Hawks and by Plumpton and Anderson (1997, 1998) for Ferruginous Hawks. Langley (1999) and Fischer et al. (1984) concluded that Red-tailed Hawks prefer poles over trees, whereas Leyhe and Ritchison (2004) found the opposite. We found slightly more Red-tailed Hawks using poles than trees, but without having quantified availability of perch types, we can't determine if the difference reflects active selection by the species. Red-shouldered Hawks, a species closely associated with riparian and other wooded habitats (Dykstra 2008), perched mainly in trees (61%).

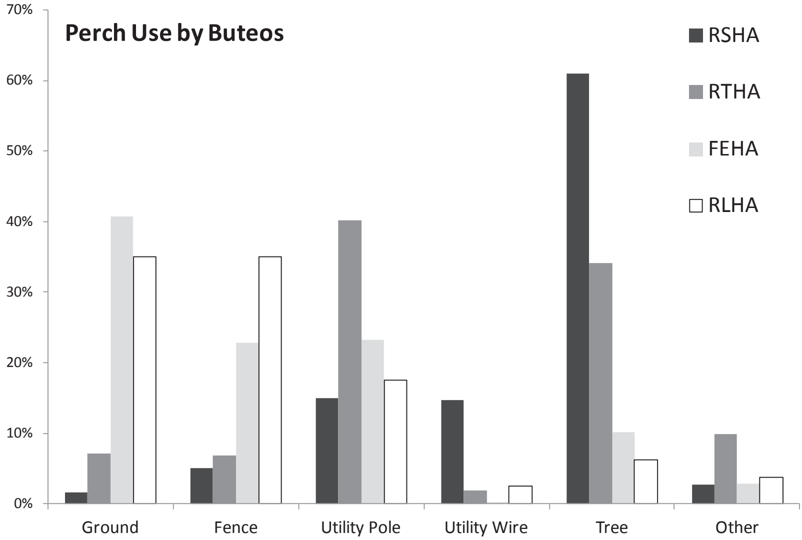

Figure 7. Perch type selection (% of perched birds using each perch type) for Red-shouldered Hawk (RSHA), Red-tailed Hawk (RTHA), Ferruginous Hawk (FEHA), and Rough-legged Hawk (RLHA).

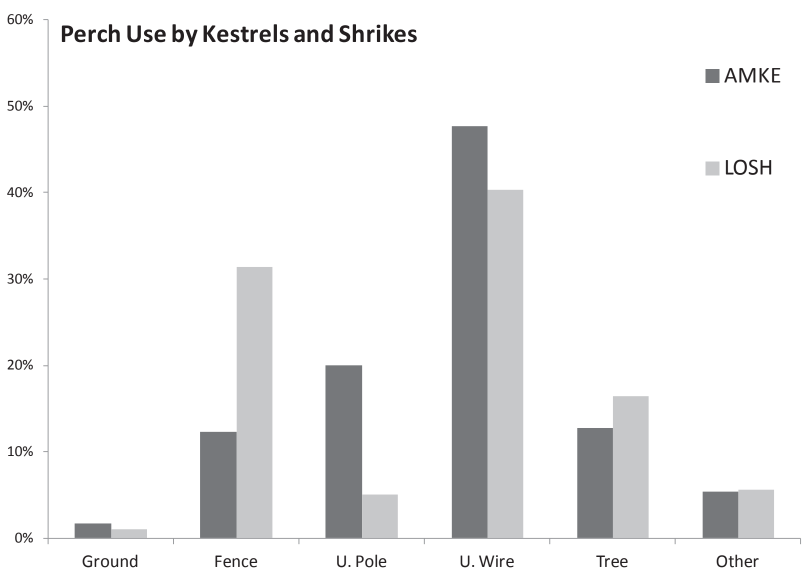

Figure 8. Perch type selection (% of perched birds using each perch type) for American Kestrel (AMKE) and Loggerhead Shrike (LOSH).

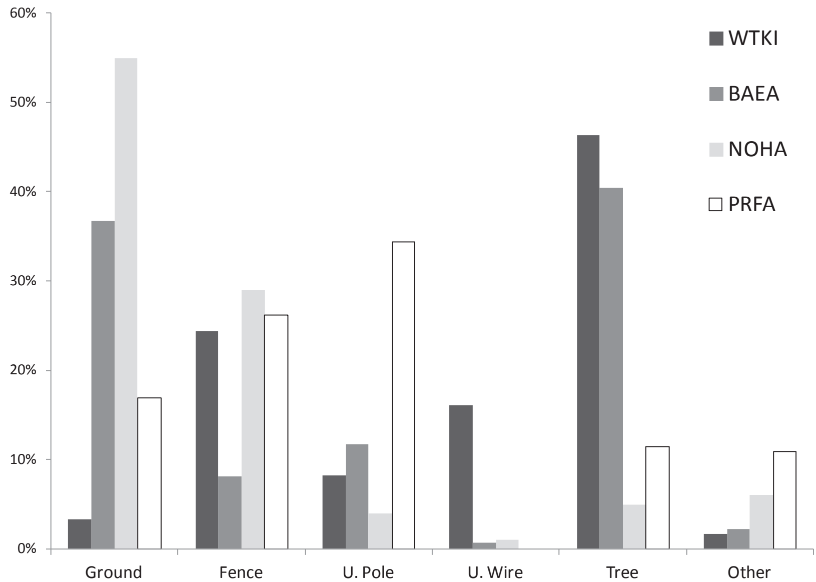

Figure 9. Perch type selection (% of perched birds using each perch type) for White-tailed Kite (WTKI), Bald Eagle (BAEA), Northern Harrier (NOHA), and Prairie Falcon (PRFA).

American Kestrels and Loggerhead Shrikes show considerable overlap in their prey selection, and their perch preferences also were similar (Figure 8). Both species perched on utility wires more often than any other perch type, consistent with prior work on American Kestrels (Bildstein and Grubb 1980, Bildstein 1987, Fischer et al. 1984) and Loggerhead Shrikes (Bildstein and Grubb 1980, Bohall-Wood 1987, Gawlik and Bildstein 1993). The greatest difference we observed among these species was in perch height, with American Kestrels perching much more often than shrikes on utility poles and shrikes more often using fences. Although we found slightly more shrikes than kestrels in trees, shrikes were almost exclusively found in smaller trees and large shrubs.

Of the Northern Harriers observed perched, 84% were either on the ground or on fences (Figure 9), similar to the proportion (92%) found by Bildstein (1987) for those same perches. We found White-tailed Kites using trees as their primary perch, with fences and utility wires next-most common. Prairie Falcons generally avoided trees, perching on utility poles most often. They also used fences frequently and were often found on the ground (usually on rock outcrops). Prairie Falcons used high tension towers (in the "Other" category) in 10% of the observations, more than any other raptor. We are aware of no previous research that quantified perch selection for either the White-tailed Kite or Prairie Falcon. Bald Eagles, which were found

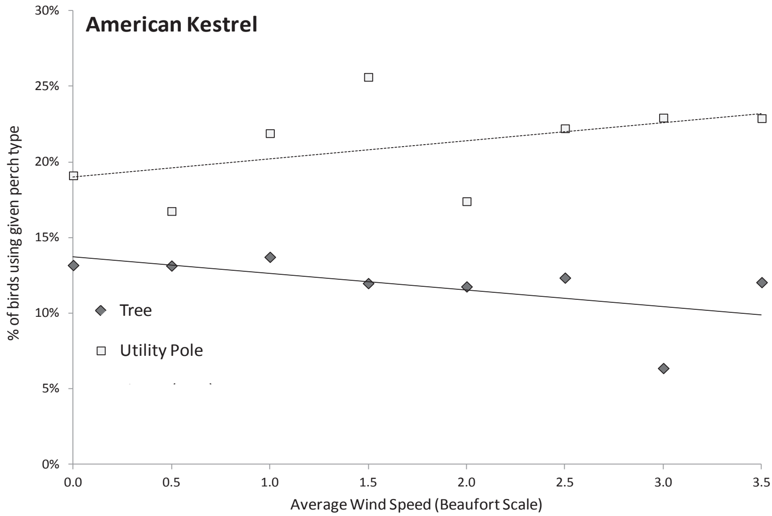

Figure 10. Percent of perched American Kestrels using trees or utility poles as perches versus wind speed. The trend lines are based linear regression analysis.

in rice much more often than other habitat types (Pandolfino and Smith 2011), were frequently seen perched on the berms between flooded rice fields. Over half of the perched Bald Eagles we observed were on the ground.

Effects of Weather on Perch Type Selection

Of all the species analyzed, only American Kestrels showed evidence of an effect of weather on perch site selection. While the trends were non-significant, the pattern suggested a switch from perching in trees to perching on utility poles as wind speed increased (Figure 10). This same phenomenon was noted by Bildstein (1987) and may reflect a desire to choose a more stable perch in higher winds.

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Central Valley Winter Raptor Survey (2007-2010): Winter Raptor Population Estimates

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Estimating populations of birds over large geographic areas is extraordinarily difficult. As a result, there is relatively little information in the published literature beyond estimates for game birds and some species of conservation concern (Igl et al. 1999). In addition, the problems and limitations inherent in sampling populations and extrapolating those data to large areas have been well-documented and thoroughly reviewed (Ralph and Scott 1981, Bildstein 2001, Thompson 2002, Brouwer et al. 2003, Pollack et al. 2009). Even given the difficulty and uncertainty, the importance of such estimates of avian abundance makes the effort to produce them worthwhile.

The most thorough attempt to estimate North American bird populations was conducted through Partners in Flight (Rich et al. 2004) using Breeding Bird Survey (BBS) data. These authors used the average number of birds found on BBS routes during the 1990s as the basis for their estimates. They extrapolated from the area actually surveyed by the BBS routes to the entire North American region and applied adjustments based on estimates of likelihood that all birds of a particular species had been detected by the surveyors.

Although the CV Winter Raptor Survey was not designed to produce data for population extrapolations (likewise for BBS), we estimated bird densities by habitat type and determined the proportion of each habitat type within the entire CV. This allowed us to make estimates of winter populations in the CV based on a set of explicit assumptions. We also used those estimates, in conjunction with Christmas Bird Count (CBC) data, to attempt extrapolations to populations for the lower 48 United States. Using guidelines suggested by Brouwer et al. (2003), we detailed the assumptions, calculations, limitations, and probable biases inherent in our extrapolations.

METHODS

CV Winter Population Estimates

Survey methods are described in the accompanying overview and methods paper (Pandolfino and Smith 2011a). We produced CV population estimates by taking the average density observed in each habitat type, multiplying that density by the total area of that habitat type in the CV (Pandolfino et al. 2011):

[Density in each habitat (birds per ha)] X [Area of each habitat in the CV (ha)] = CV winter population in each habitat],

and then adding the numbers for each habitat type. Key assumptions inherent in these estimates are:

1. All birds of each species present in each habitat block were detected and correctly identified.
2. The densities of birds in the habitat types we surveyed were representative of densities of birds in that habitat throughout the CV.

US Winter Population Estimates

We used the population extrapolations for the CV for each year of our study as described above, in combination with CBC data (National Audubon Society 2010) from the lower 48 states, to estimate the winter populations in the US. Starting with the assumption that the estimates we made for the CV each year were accurate, we derived a CBC Detection Correction Factor which, when multiplied by the total number of each species recorded on all CBC circles that fell within the CV, would produce the same population number we derived from CV Raptor Survey data:

CBC Detection Correction Factor = (CV population estimate for a species fromraptor survey)/(Total number of a species recorded on all CV CBC circles)

In order to extrapolate from CV CBC data to CBC data for the lower 48 states, we accounted for the difference in geographic coverage of CBC circles in the lower 48, compared to the CV. We calculated a Coverage Correction Factor for each year as noted below:

Coverage Correction Factor = (Percent of the CV total area covered by CV CBC circles)/(Percent of the lower 48 states area covered by CBC circles)

We also needed to account for the difference in effort level (number of party hours) of CBC circles in the lower 48 versus the CV. We calculated an Effort Correction Factor for each year as:

Effort Correction Factor = (Average party hours per CV CBC circle)/(Average party hours per lower 48 CBC circles)

The resulting values for these correction factors are shown in Table 1.

Table 1. Annual correction factors for coverage and effort.

	Year 1	Year 2	Year 3
Coverage Correction Factor	1.57	1.56	1.63
Effort Correction Factor	1.37	1.34	1.48

For each of the three years of the CV raptor surveys, we estimated winter population of each species in the lower 48 states as:

(Total number of a species from all lower 48 CBCs) X (CBC Detection Correction Factor for a species) X (Coverage Correction Factor) X (Effort Correction Factor) = Total lower 48 winter population of a species

Key assumptions inherent in these estimates are:

1. CV population estimates from the raptor survey are accurate.
2. The efficiency of detection of a species is equal between CV CBCs and other US CBCs once adjusted for relative effort (party hours).
3. CV CBC circles are sampling habitat types in the same proportions as in the Raptor Surveys.

RESULTS AND DISCUSSION

We estimated the winter population in the CV for eight raptor species for each of the three years of our surveys (Figures 1 and 2). There were no significant year-to-year differences in numbers except for Rough-legged Hawks, which were present in very low numbers in the CV in the third winter of our surveys. Such fluctuations in wintering Rough-legged Hawk numbers are well-documented (Bechard and Swem 2002).

Potential Sources of Bias

Although we designed our surveys as area searches to attempt to count every bird in the habitat blocks, it is certain that some were missed. These open country raptors are generally visible and relatively easy to detect, but birds perched in wooded areas or hidden behind structures or vegetation could not have been detected.

In spite of using experienced observers on every route, there is always some variation from observer to observer in the ability to detect all birds present. We did not employ any methods like double-sampling (Bart and Earnst 2002) or double-observer replicates (Nichols et al. 2000) to address this effect. However, such detection bias is much more of a problem in

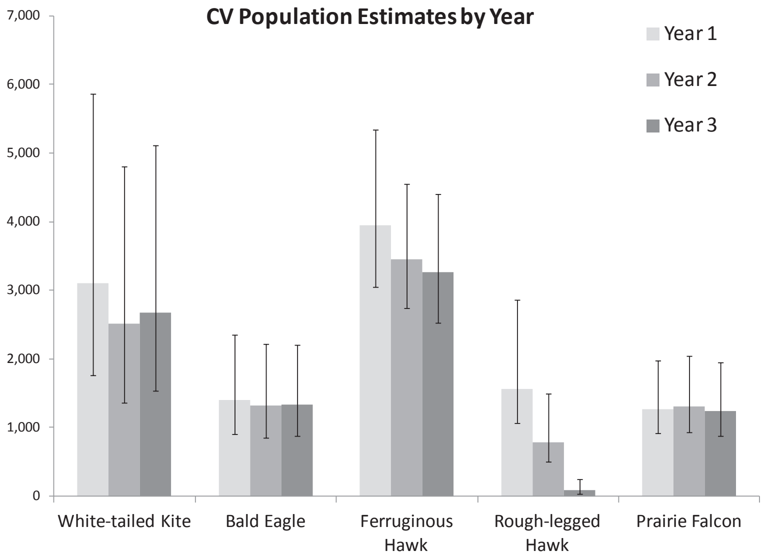

Figure 1. Winter population estimates for the CV for White-tailed Kite, Bald Eagle, Ferruginous and Rough-legged hawks, and Prairie Falcon. Error bars are based on 95% confidence intervals.

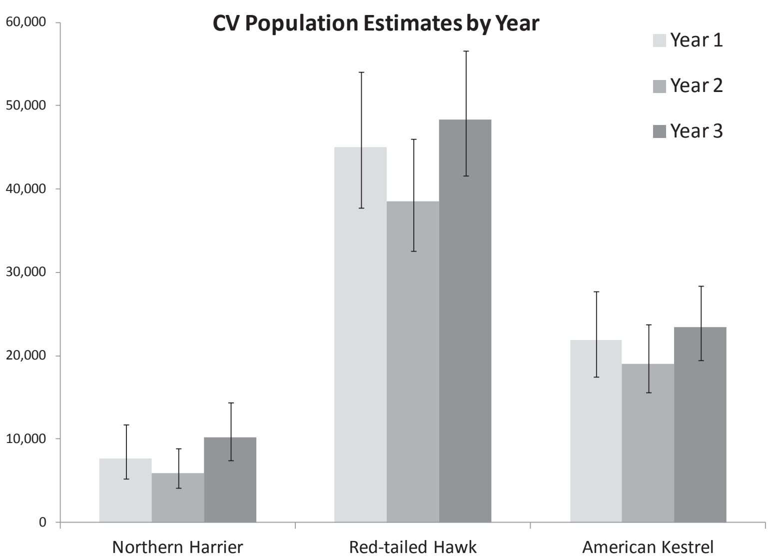

Figure 2. Winter population estimates for the CV for Northern Harrier, Red-tailed Hawk, and American Kestrel. Error bars are based on 95% confidence intervals.

surveys for smaller birds or birds which tend to skulk (Diefenbach et al. 2003). Although some raptors were undetected in our surveys, it is likely that the large majority of the target species were recorded for the following reasons:

1. surveys were designed to be thorough area searches (rather than as time-constrained point counts),
2. areas surveyed were mainly open country, and
3. habits of most of the species surveyed make them relatively visible.

Because our routes were not chosen randomly (Pandolfino et al. 2011), it is likely that the habitats we surveyed may not be representative of the habitats throughout the CV. In choosing routes we tried to incorporate habitats characteristic of the CV, but we exercised an intentional bias for areas with open country to facilitate observation of all raptors and low levels of traffic due to safety concerns. The distribution of our routes displays a bias for the Sacramento and northern San Joaquin valleys over the southern San Joaquin Valley and for open habitats such as grassland and rice over habitats such as oak savannah or orchards.

Our survey routes were all confined to roads, and it is well known that roads can affect raptor use of adjacent habitats, and thereby can introduce bias (Fuller and Mosher 1987). However, the CV is a highly developed area and most of the habitat types we surveyed are criss-crossed by roads. One important exception to this is grassland, as some grasslands in the CV consist of large roadless areas. Of these three sources of bias, the detection bias is negative and would underestimate populations, the route-selection or roadside bias may produce either a positive or a negative effect on estimates.

Our estimates of populations for the lower 48 United States include all the potential biases noted above, and also issues related to the CBC data used for extrapolation. As with our survey routes, CBC circles also were not chosen randomly chosen. We also used a correction factor for the efficiency of CBCs to detect raptors that, while it may apply to the CV, may not apply to other areas of the country due to weather, terrain, and other local factors. We also used party hours to correct for effort and this method of normalizing data across counts is also subject to valid criticism, especially at very low and very high effort levels within a count circle where the effects of added party hours on detection rates are not linear (Sauer and Link 2002).

Population Estimates for the lower 48 United States

Using data from CV and US CBCs combined with our estimates of CV winter raptor populations, we estimated US populations for eight raptors (Figure 3 and 4). Compared to two prior attempts to estimate populations for

Table 2. Comparison of our population estimates to previous estimates.

Species	Winter Estimates Low	Winter Estimates High	Winter (US+Canada) (Johnsgard 1990)	Breeding (US+Canada) (Rich et al. 2004)
White-tailed Kite	15,000	18,000		11,000
Bald Eagle	460,000	570,000		300,000
Northern Harrier	180,000	270,000	111,500	400,000
Red-tailed Hawk	1,400,000	1,700,000	350,000	2,000,000
Ferruginous Hawk	57,000	80,000	5,500	20,000
Rough-legged Hawk	290,000	680,000	49,600	300,000
American Kestrel	700,000	850,000	236,000	4,300,000
Prairie Falcon	30,000	50,000	7,800	30,000

a suite of raptor species across the continent (Table 2), our results align most closely with those of Rich et al. (2004), and are universally much higher than those of Johnsgard (1990). Johnsgard (1990) used CBC data, but it is unclear what methods he used to extrapolate from those data to total populations. His calculations were also based on data from the mid-1980s and populations of many raptors have increased since then (Hoffman and Smith 2003, Bildstein et al. 2008). Rich et al. (2004) used BBS data to estimate North American breeding populations. Their methodology is explained in detail and they include ratings of relative data quality, quantity, variance, and coverage for each species.

The estimates of Rich et al. (2004) are based on breeding season data and cover a different geographic area than used for ours. Therefore, these differences should be considered in comparing the numbers. However, with the exception of estimates for Ferruginous Hawk and American Kestrel, the numbers are close, especially given the high degree of uncertainty inherent in such extrapolations.

White-tailed Kite: Unlike all the other species analyzed here, the White-tailed Kite has a very restricted range and is almost entirely resident year-round within that range. The range of our estimates is above that of Rich et al. (2004). The fact that we used CBC data from across the continent for this localized species may make our estimate less reliable.

Bald Eagle: Population estimation for Bald Eagles are difficult in winter or in the breeding season. The breeding range includes large areas of Canada and Alaska that are not well-covered by BBS routes. In winter, though widespread, large numbers of eagles concentrate along the west coast of British Columbia and southern Alaska. The breeding population estimate of 300,000 (Rich et al. 2004) is below our range. Given that their estimates are based on data from the 1990s and ours on data from 2007-2010,

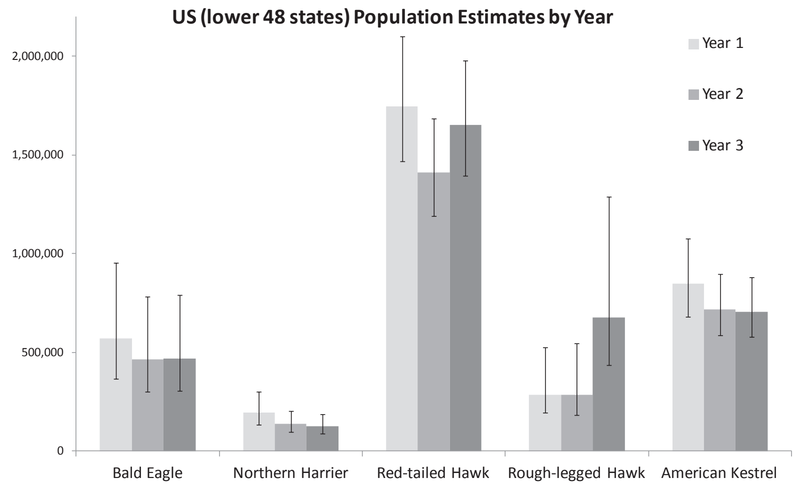

Figure 3. Winter population estimates for the lower 48 United States for Bald Eagle, Northern Harrier, Red-tailed and Rough-legged Hawk, and American Kestrel. Error bars are based on 95% confidence intervals.

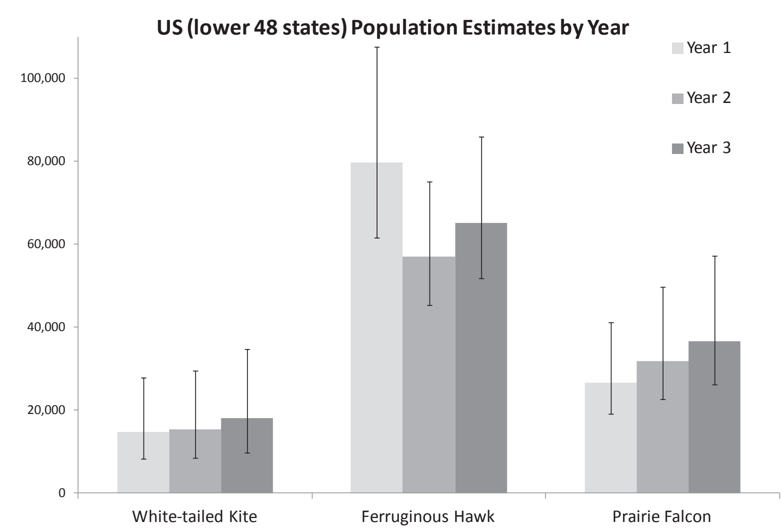

Figure 4. Winter population estimates for the lower 48 United States for White-tailed Kite, Ferruginous Hawk, and Prairie Falcon. Error bars are based on 95% confidence intervals.

the recent rapid increase in Bald Eagle populations (Buehler 2000) could account for some of this discrepancy.

Northern Harrier: Our estimate of Northern Harrier populations ranges up to 270,000, below the 400,000 estimated by Rich et al. (2004). Some of this difference may be explained by the fact that, while the breeding range lies within Canada and the US, some of the population of this species winters from Mexico well into Central America and would not be included in our estimate.

Red-tailed Hawk: As with the harrier above, our slightly lower estimate of the Red-tailed Hawk population could reflect the fact that some of the US breeding population winters in Mexico and Central America.

Ferruginous Hawk: Our estimate of the Ferruginous Hawk population is well above that of Rich et al. (2004). Earlier estimates of this species' population ranged from 6,000 to 14,000 (Bechard and Schmutz 1995), also well below our estimates. We believe our estimate is inflated due to our inclusion of survey routes in grassland areas with unusually high concentrations of this species (Pandolfino and Smith 2011b).

Rough-legged Hawk: The high arctic breeding range of the Rough-legged Hawk makes it very difficult to estimate the breeding population, as acknowledged by the low ratings given by Rich et al. (2004) to the data quality used in their estimates for this species. Since nearly the entire winter range is restricted to the lower 48 United States, this season may provide the best opportunity to assess population size. The estimate from Rich et al. (2004) falls within the lower part of our range. The high upper limit of our estimated range is due to the extrapolations based on the very low number of this species present in the CV in the third year of our surveys. Therefore, a population in the range of 300,000 is probably a good estimate.

American Kestrel: The Rich et al. (2004) estimate of over 4 million American Kestrels is much higher than ours and more than double the earlier estimate of Cade (1982). Some portion of the US/Canada breeding population winters south of the US, but probably not enough to account for the difference in our estimates. Rich et al. (2004) rate the quality of the data used highly, so their estimate may be a good one and we are unable to speculate why our estimate is so much lower than theirs.

Prairie Falcon: Rich et al. (2004) estimated a breeding population of 30,000, right at the lower end of the range from our analyses. Both estimates are well above earlier reports of a wintering population of 13,000 and 10-12,000 breeding birds (unpublished data cited in Steenhof 1998). Given that some portion of the US breeding population winters in Mexico, our estimate should be lower, rather than higher than that of Rich et al. (2004). This discrepancy may be due to the same reason noted for Ferruginous Hawks: our inclusion of routes in areas of grassland that supported unusually high numbers of grassland raptors.

Given the fact that our approach and that of Rich et al. (2004) used different datasets, from a different season, and different geographic areas, we find that the numbers agree remarkably well for most species. Our approach may have some value for making winter population esutimates in other areas and for other species where independent surveys can be used to make population estimates over a geography that includes a number of CBC circles. The approach of sing independent data to develop a detection correction factor for CBCs could allow others to make better population extrapolations from CBC data.

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Central Valley Winter Raptor Survey (2007-2010): Red-shouldered Hawk Habitat Associations

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Red-shouldered Hawks (*Buteo lineatus*) are one of the most common raptors in riparian, oak woodland, and rural/suburban habitats throughout the Central Valley (CV). In winter they frequently occur along habitat edges including roadsides adjacent to streams, canals, and the wooded borders of wetland areas (pers. obs., Dykstra et al. 2008). The species is a year-round resident in the CV, with most birds likely dispersing only short distances from breeding and natal areas (Dykstra et al. 2008). Since breeding and wintering ranges overlap, it is difficult to determine which birds are resident and which are migrants. Very little information exists on movements of Red-shouldered Hawks in California, but it is likely that some individuals undertake seasonal movements. Bloom et al. (2011) reported banded birds dispersing as far as northeastern Nevada from nests in southern California, so birds in the CV may potentially move similar distances.

Data from the Breeding Bird Survey for California (Sauer et al. 2011) and Christmas Bird Counts from the CV (Pandolfino 2006, 2008) indicate that the Red-shouldered Hawk population has increased over the last few decades. The species' adaptability to suburban and rural areas bodes well for its continued stability, even as natural habitats (i.e. riparian corridors) are reduced. While some research has been done on habitat-use during the breeding season (Rottenborn 2000, Bloom and McCrary 1996), winter habitat associations of Red-shouldered Hawks in California have never been rigorously examined.

STUDY AREA AND METHODS

Survey methods are described in the accompanying overview and methods paper (Pandolfino and Smith 2011a). We determined habitat associations by comparing the average density of Red-shouldered Hawks (birds per 40 ha block) in each habitat type to the average density over all blocks. For each habitat type we determined the 95% confidence interval around the average density using the Data Analysis Package of Microsoft Excel. Habitats in which the average density was significantly higher than the average density across all habitats, were considered preferred. Habitats in which the average density was significantly below the overall average were considered to be avoided.

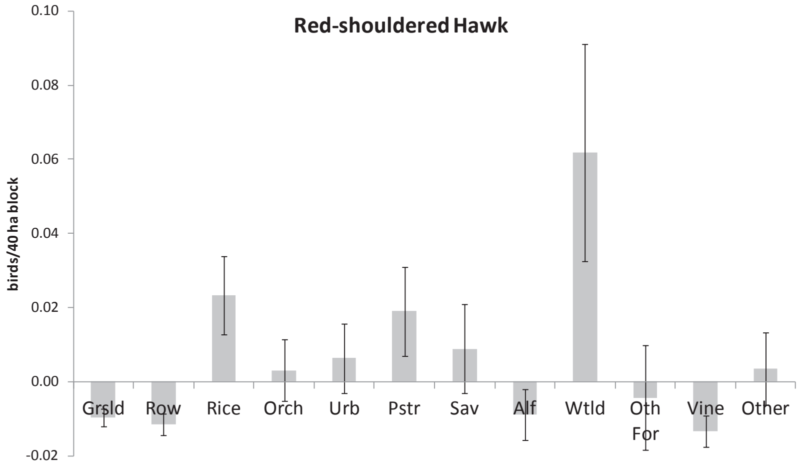

Figure 1. Differences between the densities of Red-shouldered Hawks (birds per 40 ha block) in individual habitat types compared to the average density across all habitat types. Error bars represent 95% confidence intervals. (Grsld = grassland, Row = row crop, Orch = orchard, Urb = urbanized, Pstr = irrigated pasture, Sav = savannah, Alf = alfalfa, Wtld = wetland, Oth For = other forage, Vine = vineyard).

RESULTS AND DISCUSSION

Red-shouldered Hawks preferred rice, irrigated pasture, and wetland and avoided grassland, row crop, alfalfa, and vineyards (Figure 1). In addition, the species showed a strong association with habitat blocks where a riparian component was dominant or present (see Pandolfino and Smith 2011b), consistent with other habitat studies of this species (Dykstra et al. 2008). Rice and wetland blocks in the Sacramento Valley accounted for the highest Red-shouldered Hawk densities (Smith 2011). Both natural and planted trees occur close to most of the rice and wetland areas along our routes, which provide cover and hunting perches. Our data illustrate how attractive this situation is for Red-shouldered Hawks – more than 60 % of perched Red-shouldered Hawks were observed in trees (see Pandolfino and Smith 2011c). These habitats also harbor relatively high densities of songbirds and small mammals during winter (Sterling and Buttner 2009).

We also found positive, though non-significant, associations with the urbanized habitats, consistent with what is known about the species' adaptability to human activity (Bloom et al. 1993, Bloom and McCrary 1996, Rottenborn 2000, Dykstra et al 2008) and in contrast to what was observed for nearly every other raptor we studied (Pandolfino et al. 2011). Irrigated pasture may attract Red-shouldered Hawks because of blackbird and starling flocks frequently found in this habitat.

The observed avoidance of grassland is likely due to the minimal tree cover in and around these areas, which makes this habitat less attractive for

Red-shouldered Hawks. Row crops and vineyards also were largely avoided by most other surveyed raptors (Pandolfino et al. 2011) due to presumed low prey densities and/or the difficulty of locating and capturing prey in these habitats. Alfalfa can have relatively high densities of small mammals, birds and lizards but the competition with other raptors (i.e. Red-tailed Hawks) and lack of suitable tree cover where most alfalfa is grown are likely the primary factors responsible for the observed avoidance by Red-shouldered Hawks.

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Central Valley Winter Raptor Survey (2007 – 2010): Loggerhead Shrike Habitat Associations

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While conducting the Central Valley (CV) raptor surveys (Pandolfino et al. 2011), we also recorded all Loggerhead Shrikes (*Lanius ludovicianus*) occurrences. This species could be considered an honorary raptor, as it preys on a variety of small vertebrates (birds, rodents, reptiles) and large insects. As an open country specialist, it is easily observed and deserves special attention due to the widespread population declines documented across North America (Morrison 1981, Peterjohn and Sauer 1995, Cade and Woods 1997), in California (Sauer et al. 1995, Humple 2008), and in the CV (Pandolfino 2008).

Loggerhead Shrikes use a variety of open habitats across their range, including grasslands, desert scrub, shrub-steppe, and open savannah (Yosef 1996). Habitat associations of this species have been studied in much of its breeding and wintering range, including Missouri (Kridelbaugh 1982), Virginia (Luukkonen 1987), Florida (Bohall-Wood 1987), New York (Novak 1989), South Carolina (Gawlik and Bildstein 1990 and 1993), Illinois (Smith and Kruse 1992), Arizona (Boal et al. 2003), and Mexico (Perez and Hobson 2009). We are aware of no prior studies of winter habitat associations of Loggerhead Shrike in the CV. Indeed, with the exception of work on the ecology of the San Clemente Island subspecies (*L. l. anthonyi*; see Collins 2008 and references therein), the only study of Loggerhead Shrike habitat use in California of which we are aware is a qualitative assessment of habitat types used in spring in Yolo County (Hampton and Yamamoto 2004). In his exhaustive review of taxonomy and natural history of North American shrikes, Miller (1931) included some anecdotal observations of Loggerheads in the grasslands and open agricultural lands of the San Joaquin Valley.

STUDY AREA AND METHODS

Survey methods are described in the accompanying overview and methods paper (Pandolfino and Smith 2011). We determined habitat associations by comparing the average density of Loggerhead Shrikes (birds per 40 ha block) in a given habitat type to the average density over all blocks. For each habitat type we determined the 95% confidence interval around the average density using the Data Analysis Package of Microsoft Excel. When the average density in a habitat type was significantly higher than the average density across all habitats, that habitat was considered preferred.

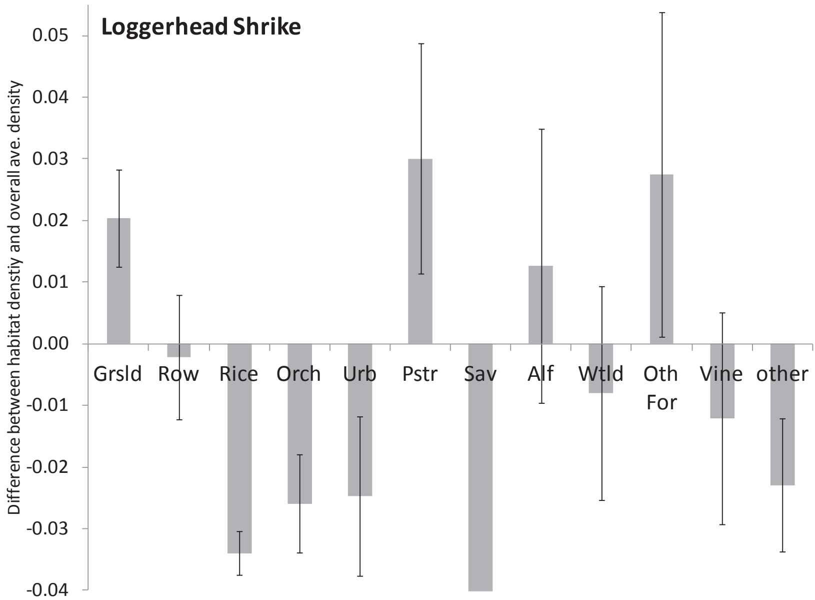

Figure 1. Differences between the density of Loggerhead Shrikes (birds per 40 ha block) in a various habitat types and the average shrike density over all habitat types. Error bars represent 95% confidence interval. (Grsld = grassland, Row = row crop, Orch = orchard, Urb = urbanized, Pstr = irrigated pasture, Sav = savannah, Alf = alfalfa, Wtld = wetland, Oth For = other forage, Vine = vineyard).

When the average density in a habitat type was significantly below the overall average, the habitat was considered to have been avoided.

RESULTS AND DISCUSSION

Loggerhead Shrikes preferred grassland, irrigated pasture, and other forage (mostly hay and winter wheat) and avoided rice, orchards, urbanized areas, and oak savannah. They also avoided the "other" habitat (a mix of habitat types present in small amounts). Most studies on habitat use by Loggerhead Shrikes have focused on the breeding season. Bohall-Wood (1987) observed no significant difference between breeding and wintering habitat, and banding data indicate that Loggerhead Shrikes are relatively sedentary in most of California (Miller 1931, Pandolfino 2008). Therefore, it is reasonable to assume that seasonal habitat requirements are similar, with the possible exception of the requirement for trees or shrubs to provide nesting sites in the breeding season (Yosef 1996).

The preference we observed for grassland, pasture, and hay (other forage) is consistent with prior studies both in winter (Bohall-Wood 1987, Bartgis 1992, and Gawlik and Bildstein 1993) and the breeding season

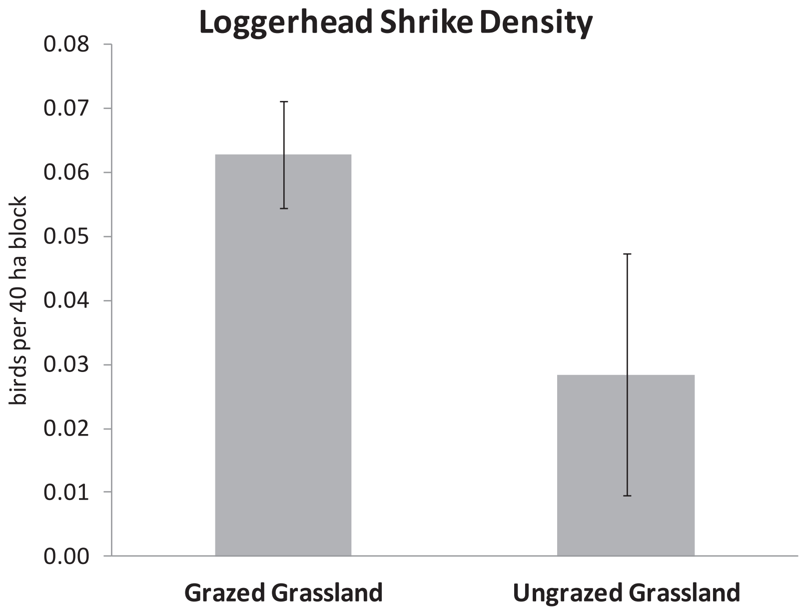

Figure 2. Comparison of density (birds per 40 ha block) of Loggerhead Shrikes in grazed and ungrazed grasslands. Error bars represent 95% confidence interval.

(Kridelbaugh 1982, Luukkonen 1987, Bohall-Wood 1987, Novak 1989, Gawlik and Bildstein 1990, Smith and Kruse 1992, Fornes 2004, and Walk et al. 2006). Avoidance of urban areas was also reported by Bohall-Wood (1987), Smith and Kruse (1992), Boal et al (2003), and Fornes (2004). No prior studies assessed habitat associations with rice or orchards. We found no significant preference or avoidance for row crops. Gawlik and Bildstein (1993) found that Loggerhead Shrikes used row crops most of all habitat types in winter in South Carolina, whereas Walk et al. (2006) found a negative association with row crops in the breeding season in Illinois.

We never observed a Loggerhead Shrike in oak savannah, in spite of surveying over 5,000 ha of this habitat three times per year over three winters across much of the CV (in Shasta, Tehama, Yuba, Placer, Sacramento, Merced, and Mariposa counties). This result is consistent with our personal experience in the CV and with results from CBC circles and Breeding Bird Survey routes in the area. During our surveys, most shrikes were found in pasture and hay fields in the southern Sacramento Valley, grasslands at the edges of the valley, or in grasslands with *Atriplex* shrubs in the San Joaquin Valley. While this species makes use of savannah habitats in other parts of its range (Bohall-Wood 1987, Yosef 1996), this does not seem to be the case in the CV.

The avoided other-habitat category includes many habitat types, but most support woody vegetation (oak woodland or riparian-dominated blocks).This may explain the negative association, as Loggerhead Shrikes consistently avoid wooded areas in this and other studies (Bohall-Wood 1987, Smith and Kruse 1992, Gawlik and Bildstein 1993). Shrikes may be avoiding such areas because of higher predation risk from woodland raptors such as Red-shouldered Hawks or accipiters or to reduce competition with other species with overlapping prey preferences such as Western Scrub-Jays (Hampton and Yamamoto 2004).

Like three of the four raptor species that preferred grassland (Ferruginous Hawk, Rough-legged Hawk, and Prairie Falcon; Pandolfino et al. 2011), Loggerhead Shrikes also preferred grazed grassland over ungrazed grassland (Figure 2). This use is consistent with a number of studies showing that this species is more likely to choose areas with short rather than tall grass (Bohall-Wood 1987, Boal et al. 2003, Fornes 2004). Perez and Hobson (2009) found that resident shrikes in Mexico in winter were more likely to occupy areas of open ground and short grass than migrant shrikes, suggesting that was the superior habitat type.

Our findings suggest that conservation of Loggerhead Shrikes in the CV depends on retaining large areas of low intensity agriculture, including cattle ranching and forage crop production. This species showed a consistent preference for grassland and irrigated pasture, both of which are associated directly with cattle ranching. Forage crops such as alfalfa, hay, and winter wheat were used by shrikes and all are grown mostly in support of cattle ranching and dairy operations. The fastest-growing land uses in the CV, urbanization, orchards, and vineyards, were all avoided by shrikes. Therefore, there is some urgency to finds ways to support the continuing viability of less intense land uses in the CV.

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Central Valley Region Bird Highlights: December 2010 through February 2011

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Five adult and three young **Trumpeter Swans** were in the rice fields of southern Butte County on 11 December – 12 January (JSn, BWb). Merced County is the southernmost part of the normal range for white geese and swans in the valley. In Kings County where white geese are rare, two **Snow Geese** were at the Jersey Ponds on 12 December and three were at Corcoran Ponds in addition to 14 **Ross's Geese** at Utica and 6th Avenue on 8 January (MSy). In the foothills, a juvenile **Snow** and an adult **Ross's Goose** were at Comanche Lake in Amador County from 14 December through the winter (DMr). Barrow's Goldeneye are locally distributed and although found each winter at several traditional sites, they are rare elsewhere. One was in the canal below Turlock Lake on 22 December (fide HR) in Stanislaus County. Always a fun bird to find, a **Eurasian Green-winged Teal** was at the Yolo Bypass Wildlife Area on 29 January (DES, SW). A lingering **Long-tailed Duck** remained in the bay off Benicia on 3 December (the duck stayed through December) along with a **Red-throated Loon** and a first winter male **Black Scoter** (EPi) for a great trio of rare waterbirds for Solano County. Another **Long-tailed Duck** was in the Delta off West Sherman Island Road on 1 December (JHm) for one of few Sacramento County records. The **Brown Pelican** found there in November was seen again on 2 December (JSL).

A **Pacific Loon** at Comanche Lake on 28 February (JCS, JSL, JLx, KPa, FO, DMr+) was in both Amador and Calaveras Counties, as was nearby a **Red-necked Grebe** that was a first Amador County record. Both of these species are rare inland, but have been found nearly annually in large bodies of water in the region. Another **Pacific Loon** was on Folsom Lake on 21 January (BWb) in Placer County. **Red-throated Loon** is even more rare inland than the previous species, so one at Folsom Lake on 11 February (WEH) was an exciting find for Sacramento County. **Common Loons** are rare on the valley floor away from a few traditional locations, so one at Ming Lake in Bakersfield on 1 December (MMcQ) was noteworthy and was joined by three **Horned Grebes** and one **Red-breasted Merganser** (seen again on 29 December). The O'Neill Forebay in Merced County is one of the valley hotspots for **Red-breasted Mergansers** and three there on 6 December (PJM, DMo) was fairly typical. One was found at Laguna West lakes in Elk Grove on 3-8 January (AEn+) for a rare Sacramento County record away from the Delta region.

A **Zone-tailed Hawk** was seen by a fortunate few near Babel Slough in Yolo County on 22 January (RM, MP) and again on 24 January over the Pocket area of Sacramento (AEn, photos of distant bird). This rare species has been increasing in southern California in recent decades and with

Figure 1. Western Kingbird (*Tyrannus verticalis*) near Davis, Yolo County, on 4 December 2010. *Photo by John Sterling*

several coastal records from Monterey to Sonoma counties within the past decade, it seems a likely candidate to be found more often in the Central Valley.

Mountain Plovers are highly local in their Central Valley distribution. A flock of 16 found in southern Sutter County on 4-5 December (TG) was the first record for that county in many decades. A **Snowy Plover** found on 30 December (JH) at Woodward Reservoir in Stanislaus County was unexpected as this species normally winters in the valley only in salt ponds in the Tulare Basin. A rare wintering **Wilson's Phalarope** was at the Jersey Ponds in Kings County on 12 December (MSy). A **Franklin's Gull** near Woodland on 4 December (TEa) was the first winter record locally and perhaps for the Central Valley. **Mew Gulls** are rare away from the Delta and the Sacramento/Yolo County region, so on at the O'Neill Forebay on 6 December (PJM, DMo) was noteworthy. Two were found in Kings County on 12 December (MSy) with one at Corcoran Res. and the other in a flooded field west of 10th Avenue. The second Tulare County record was established by a first-cycle **Mew Gull** at the Toledo Pit ponds on 8 February (SDS). In Amador County, one was at the Ione WTP on 24 December – 15 January (DMr), and another at Comanche Lake on 28 February (JCS, JSL, JLx, KPa, FO, DMr+). One was at Pardee Dam in Calaveras County on 15 January+ (DMr+). Four more below the dam at Black Butte Reservoir on 5 January (JCS, JSL) was an unexpected find in Tehama County. Kutras Lake in Redding, Shasta County, is a regular hotpot for this species, but one was not found there until 18 January (RBr). **Lesser Black-backed Gull** records have been piling up in the past few years. A third-cycle bird was at the

Nimbus Fish Hatchery from 9 January through the end of winter (BG+) to establish the second record from that location in Sacramento County. **Thayer's Gulls** were reported widely throughout the region from Yolo/ Sacramento to Kern counties. Along the Feather River at the fish hatchery in Oroville, a first-cycle **Glaucous-winged Gull** joined the crowd on 10 December (JBg) in Butte County. As expected, the Yolo Landfill and Davis WTP had visits from **Glaucous Gulls** with two there on 13 December (SCH). An adult was photographed flying over Sacramento on 1 February (DB). Last but not least was a **Slaty-backed Gull** at the Davis WTP on 5 February (JCS, TEa+ photos) and again on 19 February (TEa, SCH photos). This would be the second record for Yolo County and the valley if accepted by the CBRC.

Stanislaus County's first **White-winged Dove** was along Grayson Road from 2 January through the end of winter (JD+). A **Yellow-bellied Sapsucker** in Cameron Park on 20 December (SAbb) and another in El Dorado Hills on 26-27 February (MGg+) were great finds for El Dorado County. An immature was near the McConnell State Recreation Area in Merced County on 22 January (ADeM). An adult **Yellow-bellied Sapsucker** in Chico on 2 January was a first for Butte County, and that same day a **Red-naped Sapsucker** was found in the same area (both MSk). Both remained for several days. Another **Red-naped Sapsucker** was found at South Shore Comanche Park in Calaveras County on 2 January (JRow) and seen several times later in the month.

Figure 2. Sage Thrasher (*Oreoscoptes montanus*) near Clarksburg, Yolo County, 4 January 2011. *Photo by John Sterling*

The **Tropical Kingbird** discovered in Davis during the fall was still present on 31 December (SCH) but could not be refound afterwards. Winter reports of **Western Kingbirds** in California have routinely been rejected in decades past, but there have been several documented records in the past few years in the Central Valley. This year one was near Davis on 4 December (TG, JCS photo). More typical for winter was an **Eastern Phoebe** at the San Luis NWR found in November that remained through the winter (SSa). Another was along the Sacramento River north of Natomas on 26-29 December (DKo+). A third **Eastern Phoebe** was also at the Kern NWR on 11 January - 6 February (MS). A fourth **Eastern Phoebe** near Westley on 2-8 January (JD+) was only the second Stanislaus County record. Another rare but regular winter visitor, two **Vermilion Flycatchers** were found with one at the Visalia Valley Oaks golf course on 6 January through the end of the winter (JLk+) and another at the Tule Elk State Park on 21 February (DMo) in Kern County. The **Steller's Jay** found in Sacramento in the fall was still present on 27 February (DAi). Exceptionally rare in winter in California, a **Warbling Vireo** on Putah Creek upstream of Lake Solano Campground in Solano County on 20 December (RAd) was unexpected. Much more expected, but still rare in winter, a **Cassin's Vireo** was along the Kings River in Fresno County on 26 December (BBr). **Mountain Chickadees** are rare winter visitors to the valley floor, and one was in Sacramento on 21 February (JP). **Sage Thrashers** are rare but regular during winter, but one along the Sacramento River on 4-19 January (GML+) provided one of few recent reports for Yolo County.

It is an understatement to state that it was a slow winter for longspur reports with only a single report of 1-2 **McCown's Longspurs** at County Line Road in Colusa and Yolo counties on 24 January (SCH). A **Black-and-White Warbler** in Bakersfield on 15 December (KL) was the only one reported. The best eastern warbler of the winter was the **Northern Parula** along Lake Ming in Bakersfield on 7 December – 27 February (SDS). Photos proved that this bird was different from the one found on 30 November about a mile away (RAB). More unusual than the previous two eastern species, a male **MacGillvray's Warbler** in south Sacramento on 26 December (CCo) provided one of few winter records for the valley and northern California. Also rare in winter, a **Wilson's Warbler** was at the Sacramento Bufferlands on 19 February (CCo, DKo). **Summer Tanagers** have been found with increasing regularity at all seasons in the valley. One found in Hart Park, Bakersfield in the fall was refound on 15 December (AS). Another was at Roeding Park in Fresno from 30 January to the end of the winter (EE+). The big star of the winter though was the Central Valley's and San Joaquin County's first **Painted Bunting**. An immature male, it visited a backyard feeder in Stockton from 1-7+ February (CP) and was seen and photographed by many. **Lark Buntings** are rare, but regular winter visitors in the Central Valley grasslands. One was near Lake Ming in Bakersfield on 15 December (JW) and another was near Lake Success, Tulare County from 4 January

Figure 3. Painted Bunting (*Passerina ciris*) in Stockton, San Joaquin County, 7 February 2011. *Photo by John Sterling*

Figure 4. Harris's Sparrow *(Zonotrichia querula*) near the Gristmill Access, American River Parkway, Sacramento County, 12 February 2011. *Photo by Linda Pittman*

(JLD+) through the end of the winter (along with a **Black-throated Sparrow**). King County's first **Swamp Sparrow** found in November was still present on 3 December at the Hanford WTP (JSy). Another was at the San Luis NWR on 6-30 December (PJM, DMo+) in Merced County. A **Harris's Sparrow** appeared on a backyard along the American River in Sacramento County on 31 January and remained through February (JML). Orioles are rare in the valley during winter. A **Hooded Oriole** in West Sacramento, Yolo County, on 26 December (DMh) and perhaps the same bird was seen on 25 January in Natomas, Sacramento County (DB). There was an influx of **Evening Grosbeaks** through the winter with most records in well-established suburban area with ornamental fruiting trees. Flocks were reported in Chico, Sacramento, Davis and Woodland.

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