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# A Survey of Birds and Bats at a Proposed Wind Energy Site, Bear River Ridge, Humboldt County, California

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*Mad River Biologists*

*Eureka, California*

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Wind Energy Site on Bear River Ridge,  
Humboldt County, California*

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DRAFT REPORT

Prepared For:

Shell Wind Energy, Inc.  
Houston, Texas

Prepared By:

Sean E. McAllister  
David M. Fix

Mad River Biologists  
417 Second Street  
Eureka, California 95501

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## Background

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Shell Wind Energy, Inc. (SWE) is the proponent of a wind energy project at Bear River Ridge, Humboldt County, California. The project proposed by SWE would involve the installation and operation of approximately 25-35 two-megawatt wind turbines placed along Bear River Ridge, over a 6-mile stretch, for the purpose of generating wind power.

A key element in pre-development studies for a wind energy project risk assessment involves collection of baseline information about avian and bat use in the project area. Shell Wind Energy has committed to this level of study through contracts with local experts and consultation with government agencies.

Mad River Biologists (MRB) was contracted by Oscar Larson Associates on behalf of Shell Wind Energy Inc. in summer 2004, during the pre-planning stage of what is now known publicly to be a proposed wind energy project. Initially, however, no specifications regarding a wind energy facility were included in the original contract scope of work. Rather, the focus was on the potential impacts to wildlife from meteorological towers (“met towers”) and their associated guy wires, which would be constructed by SWE in early 2005 in order to monitor wind and guide in determining the feasibility of a wind energy project. Initially, the scope was limited to a general inventory of raptors and other birds during a single fall migration period (fall 2004). Gradually, several additional phases were added to the scope of work, including a survey for bats, mortality monitoring at met towers, and additional bird surveys that would ultimately span all seasons.

Following the first fall migration surveys, a first interim report was submitted. The next phase captured the spring migration and summer of 2005, and included the first bat surveys and met-tower mortality monitoring. The second fall migration period (2005) was followed by a second interim report; then, a second spring/summer (2006) survey was completed; and, finally, a winter survey period (2006/2007) was added. This final report combines the results from all of the phases mentioned above.

Additionally, in 2007 Mad River Biologists conducted a raptor nest survey during the nesting season, a wetland investigation and a rare plant survey; the results of those studies are reported separately.

## Introduction

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As it lies within the greater Bear River Ridge and Branstetter Ridge region of “mountain prairies” (Harris 2005), the proposed project area is of particular value to a suite of bird species whose habitats are of localized occurrence in Humboldt County and, indeed, in northwestern California.

Prior to the present study, most of what was understood of the occurrence and comparative seasonal abundance of birds on Bear River Ridge derived from the explorations of recreational birders. Dating back to the ornithological work of Atwell in the late 1920s, but certainly much more frequent since the late 1960s and early 1970s, visits by knowledgeable bird enthusiasts have resulted in a set of records that point to more or less consistent, long-term use by open-country raptors and songbirds.

In his scholarly and well-regarded regional work *Northwestern California Birds*, Harris (2005) provided considerable information about both regularly occurring and rarely detected birds encountered on Bear River Ridge. His description of a suggested auto tour contains the following section, valuable for its support concerning use of the area by raptors:

“Search these open slopes for wintering raptors. Red-tailed Hawks, Northern Harriers, and American Kestrels are common every year, and Rough-legged Hawks are common in some years but almost unknown in other years. Ferruginous Hawks are regular, but rare. Golden Eagles are year-around

residents and Bald Eagles are possible in Jan-Feb. Peregrine and Prairie falcons are rare possibilities. White-tailed Kites and Red-shouldered Hawks are more likely along the timber/grassland edges.”

Harris’s data set for the site contains reports across many decades, and contains a large amount of information that was ultimately distilled into his regional guide book. In addition to mentioning the notable use of the area by raptors, Harris touches on the disjunct population of Horned Larks, stating, “The best place for the larks is along the first 2-3 miles on the eastern end of Bear River Ridge Road.” This adequately describes the situation reported in the current study.

Harris mentions, as well, some of the outstanding rarities—species unexpected and highly sought by birders in Humboldt County—that have been discovered in the course of birding at Bear River Ridge. Among these have been Tufted Duck (Cape Ranch Pond), Mississippi Kite (on neighboring Cape Ridge), Cassin’s Kingbird, Clark’s Nutcracker, Mountain Bluebird, Northern Wheatear, Chestnut-collared Longspur, and Snow Bunting.

Additional existing information regarding bird use in the study area can be gleaned from the Humboldt County Breeding Bird Atlas (*Hunter, et al. 2005*), the North American Breeding Bird Survey (BBS) archives, and the California Natural Diversity Database (CNDDDB).

Using data from more than 1,000 point counts, over a two and a half-year period, this report describes general avian use of the study area, highlighting sensitive areas and species. We also report on the occurrence of bats using results from acoustic monitoring.

This information is presented as an aid to permitting agencies for guidance in the determination of the potential impacts to birds and bats from the proposed project, and, further, to provide guidance to the project proponent regarding appropriate measures that would minimize these impacts. Additionally, this report provides baseline information for comparative purposes for post-construction studies.

## Objectives

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Objectives of this study were to obtain baseline data on birds and bats within the area under consideration by SWE for a wind energy facility. We aimed to document bird and bat species composition, and spatial and temporal use by diurnal birds, in order to provide pertinent information for the permitting process for the development of the facility. Specifically, we sought answers to the following key questions:

- What is the composition of bird and bat species which use the study area?
- Are there specific locations within the study area that receive relatively high use by diurnal birds?
- What, if any species of special concern occur within the study area?
- How does bird use vary seasonally within the study area?

## **Acknowledgements**

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Field work was performed by Sean McAllister, David Fix, Jessica Stauffer, Kerry Ross and Elias Elias. Dana Ostfeld performed the bat vocalization analysis and helped write the sections summarizing use by bats. The Bear River Power Company, LLC (landowners) provided courteous and friendly access to the study area. Marty McClelland was instrumental in the planning process. Laura Bradley of Scotia Pacific Company and Sandra Hunt-Von Arb of Pacific Northwest Biologists provided local information and expertise regarding Golden Eagles and other raptors. Scott Osborne and Jeff Dayton of California Department of Fish and Game and Gary Falxa and Amedee Brickey of the U.S. Fish and Wildlife Service provided guidance with survey methods. Peter Sanzenbacher and Brian Cooper of Alaska Biological Research provided valuable references and guidance.



## Study Area

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### General Features

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Bear River Ridge divides the Bear River and Eel River valleys in Humboldt County, California, about 14 miles south of Humboldt Bay. The ridge runs 15 miles east to west between the town of Rio Dell and a point on the coast known as False Cape, 5 miles north of Cape Mendocino. From sea level, a 500-ft. bluff rises abruptly, giving way to the more gently sloping grassy ridge line, which peaks in elevation mid way toward the Eel River at around 2600 feet.

The entire ridge is within privately owned grazing lands but is narrowly transected by two public roads – one paved, the other mostly unpaved. Broadly speaking, the north slopes and some protected southerly vales or benches are variably forested with maturing Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*), and grand fir (*Abies grandis*). Stands of these species approach and, in places, attain the crest of the ridge, though rarely crossing over it. Much of this forest, which is in private ownership, has been locally harvested for timber at least once historically, some of which occurred during the study period. Within and about this conifer stand a minor and irregularly distributed hardwood component is present, comprised mostly of California bay laurel (*Umbellularia californica*), red alder (*Alnus rubra*), red elderberry (*Sambucus racemosa*), cascara (*Rhamnus purshiana*), and associated evergreen and deciduous species typical of the region. Most of the crest and nearly all of the south-facing slopes of Bear River Ridge comprise distinctly—indeed, dramatically—open, treeless country, in which the chief cover type is a mixture of native and exotic grasses admixed with annual and perennial forbs. Absent from the highest portions of the ridge and its satellite knolls, but conspicuous at midslope to the south and west, is a community of coastal scrub or “soft chaparral” composed of several species, the most notable of which are coyote brush (*Baccharis pilularis*), blue blossom (*Ceanothus thyrsiflorus*), and poison-oak (*Toxicodendron diversiloba*). This shrub community is irregular and patchy in its distribution, occurring as stringers, clumps, and widely spaced shrubs.

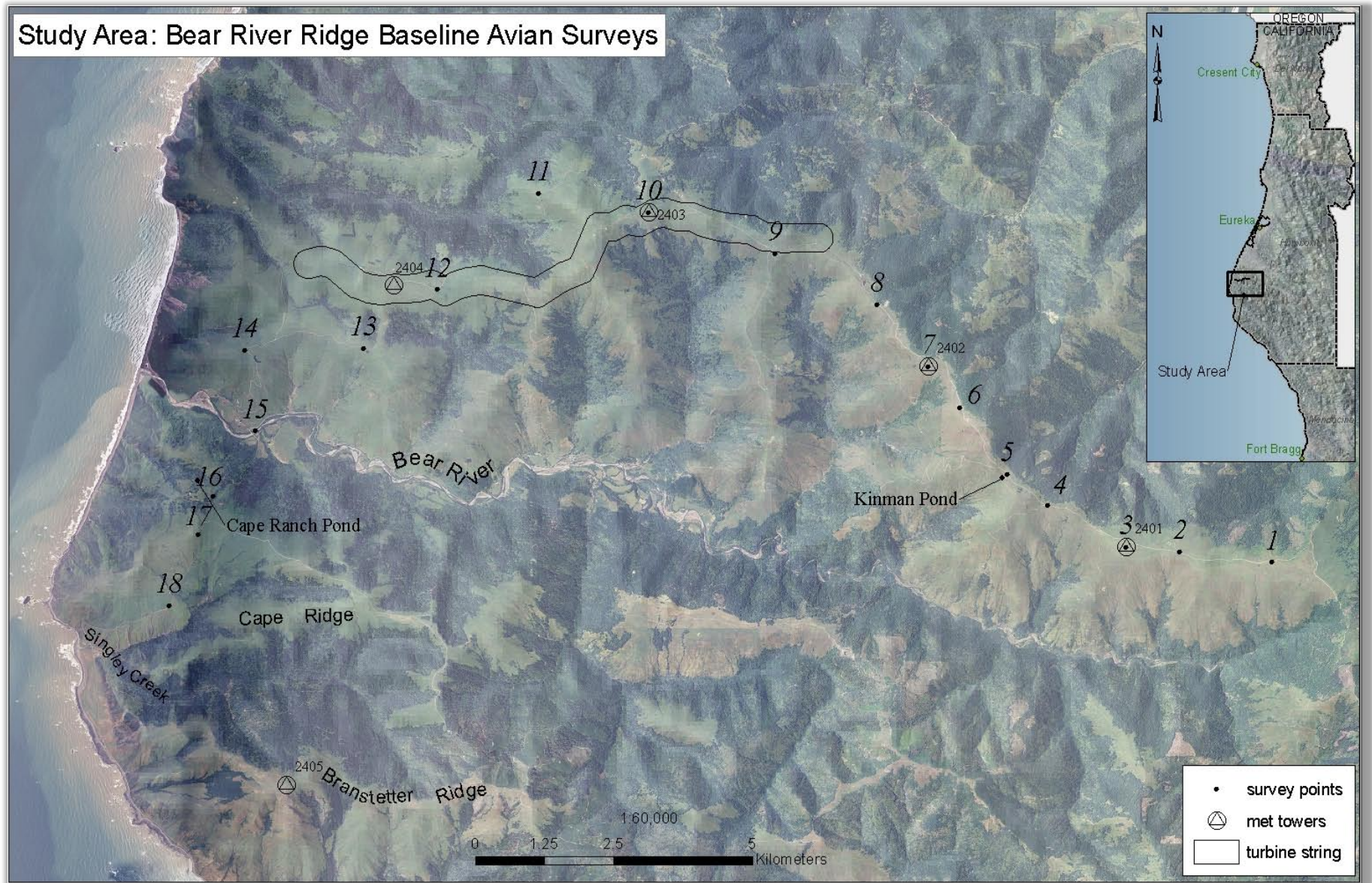
Three bodies of open water within the study area are notable. They are the Bear River, a relatively small, perennial stream which hosts anadromous fish; a rather large lily-pond, known as Cape Ranch Pond, nestled between two outcrops and surrounded by riparian scrub dominated by red alder and willows; and a small, exposed spring-fed pond near the peak of the ridge, known as Kinman Pond, named after an early trapper in the area. Kinman Pond is surrounded by a corral and provides drink for cattle and wildlife and stopover habitat for occasional migrant shorebirds and waterfowl. It becomes nearly dry in late summer. Aside from a few sparsely placed ranch homes and barns and miles of wire fence, there is little development. Vehicular traffic is light.

Most of the area is under active agricultural operations in the form of cattle production and timberland management.

The area proposed for development is roughly centered within the overall study area. The landform is open and rolling, with few abrupt slope breaks. Trees are essentially absent. Surface rock is sparse, most often taking the form of low (0.5-2 m) mounded outcrops which are weathered and grown with lichens. These outcrops are of size insufficient to provide substantial habitat for raptors, although Western Meadowlarks, Savannah and Grasshopper Sparrows and Horned Larks use them as exposed singing perches. A larger outcrop occurs down-slope, south of the western terminus of the proposed turbine string; this outcrop, together with a storm-broken Douglas-fir growing at its base, provides perch habitat for Golden Eagles, Red-tailed Hawks, and other raptors.



Figure 1.



## Environmental Conditions

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The near-coastal situation of the study area, abetted by its topographical prominence and its position on the North Pacific storm track, causes it to receive moderate and, often, high winds throughout much of the year.

In a broad sense, two types of large-scale air movement may be noted. Typically, during fair weather in late spring, summer and fall, cooler, denser marine air moves inland to replace air heated and made less dense by solar radiation and re-radiation from the ground; these onshore breezes may occur steadily during daylight hours for many days or even weeks. During the late fall, winter, and spring, low pressure systems originating in the Gulf of Alaska or over the central North Pacific contribute substantial wind energy. Reception of this energy is greatest at and shortly following the arrival of frontal systems, in which the cyclonic circulation is most pronounced along the leading edge, creating powerful, gusty southeast and southerly winds, often accompanied by substantial precipitation; these winds may continue for hours or, in some cases, days. Wind velocity and amplitude tends to diminish as storms pass generally eastward through the study area, with south winds giving way to southwesterly or westerly breezes, and then, often, a return to northwesterly or northerly winds as fair skies return. This regime is hardly peculiar to the study area, as it is typical of the entire region.

Fog is common in the study area, particularly during periods of otherwise fair weather. It can be noted that “blowing fog” is frequent; as moist marine air moves inland, it rises, and as it rises, it may become supersaturated and reach the dew point, such that condensation (and, often, drizzle) occurs. Moving eastward and inland, the air mass typically warms once more, and the moisture it contains again turns to vapor.

Snow occurs essentially annually in the study area, but it is strictly a winter or early spring phenomenon, is seldom long-lasting, and accumulations of but a few inches are the rule.

Average annual rainfall in the surrounding area is 40-60 inches. Temperatures along the coast are quite stable, with highs averaging around 60°F, but rarely reaching up to 80°F, however, inland areas, including the more eastern portion of the study area, occasionally reach near triple digits.

## Methods

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### Avian Point Counts

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#### Field Methods

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Within the area that was initially considered by SWE for turbine placement, eighteen survey points were established. Survey points were established along roads at approximately 1-mile intervals, depending on visibility relative to topography and vegetative cover. All but two of the survey points (#15 and #16) were located upon the ridge top. This is highly exposed, virtually non-forested, open habitat. Conversely, survey points #15 and #16 were located below ridgelines, where water bodies and associated riparian habitats were surveyed to document the occurrence of species which might not be detected from ridge-top points, but which likely pass through the project area. Point #15 is situated at valley bottom along Bear River at Branstetter Bridge, and #16 is on a largely wooded midslope shortly above Cape Ranch Pond.

All surveys were performed by experienced observers, skilled at identifying the birds of the region by sight and sound, and who are proficient at accurately estimating vertical and horizontal distances. All surveys were conducted between September 1, 2004 and March 15, 2007. During each point count, observers recorded all birds detected within a 1-mile radius. This allowed observers to record distant



raptors and other large visible birds, although most passerines and other small birds toward the outer confines of the survey perimeter would not be detected. Binoculars and spotting scopes were used as needed for identification.

Each point was surveyed twice per month during spring and summer and once per week during fall and winter, except when inclement weather was prohibitive. Except for winter, which was surveyed only in one year, each season was surveyed in two years. Each point was surveyed for 15 minutes during daylight hours, generally between mid-morning and late afternoon. Starting locations were alternated irregularly, but generally surveys began at either point #1, #10, #11 or #18 for logistical purposes. The direction in which the surveyor traveled to subsequent points was also alternated. The starting time and location of surveys was frequently dictated by environmental conditions. For example, fog or low clouds restricted the visibility at certain survey points at certain times, particularly early in the day, and surveyors consequently chose more suitable points.

All birds observed were recorded on field data sheets. Flight paths of all large birds (e.g., raptors, waterfowl, ravens) and flocks (>5 individuals) of all birds were drawn directly on field maps. Flight heights were estimated and divided into 5 categories which were developed based on the height of the met towers (160-180 ft.) and divisions reasonable for an observer to estimate; (1) ground level, (2) 1-200 ft., (3) 200-500 ft., (4) 500-1000 ft., (5) >1000 ft. Because birds detected might change their flight altitude in the course of an observation, a single detection could be recorded in more than one category. When distinguishable, age and sex were recorded. Nearest distance from observer was approximated using estimations checked against field maps. Behaviors (e.g., soaring, gliding, perching, etc.) were recorded for all mapped bird observations. Double counting of individual birds or flocks was avoided during individual point counts and across multiple points when it was reasonably obvious that such was the case.

Weather conditions were recorded at the end of each point count; temperature and wind speed were measured with a handheld weather meter, and cloud cover and ceiling height were estimated.

## Analysis of Results

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Avian use of the study area is described in this report using these key elements:

**Mean Use** - the average number of birds detected per 15-minute point count.

**Species Composition** - the mean use by a species or group, divided by the mean use by all birds, and presented as a percentage of the overall composition.

**Species Richness** – the number of species observed in a sample

**Frequency of Occurrence** - percentage of all point counts for which a species or group was detected.

**Spatial Use** – comparison of use at each survey point; inside and outside the turbine zone; use of vertical space using bird height estimates.

**Seasonal Use** – comparison of use among seven ecological seasonal periods, as defined by Harris (2005). Each seasonal period contains 52 or 53 days. They are as follows:

- Early Spring Migration -- 25 January-17 March
- Spring Migration -- 18 March-8 May
- Summer -- 9 May-30 June
- Early Fall Migration -- 1 July-21 August
- Mid Fall Migration -- 22 August-12 October
- Late Fall Migration -- 13 October-3 December
- Winter -- 4 December -24 January

## Bat Acoustic Monitoring

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### Field Methods

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Acoustic monitoring for bats was conducted between 15 March and 5 November, 2005, using an Anabat II detector (Titley Electronics, Ballina, New South Wales, Australia). The detector was placed at fifteen different locations at or near Bear River Ridge (figure), and programmed to run between 1900 and 0800 hours local time.

Anabat detectors detect and record the ultrasonic echolocation calls of bats, inaudible to humans. They use frequency division to transform echolocation calls into audible signals, and zero-crossing analysis (ZCA) to view the spectral content in the form of a frequency-time spectrogram. Zero-crossing extracts the frequency of when sounds (in this case, bat calls) oscillate around an equilibrium, or zero point. To enable its speed and data efficiency, the zero-crossing algorithm only keeps track of when a signal (the sound wave) crosses the zero position, averaging the frequency content and dispensing amplitude information (Szewczak 2000, [www.sonobat.com/zero-crossingFAQ.html](http://www.sonobat.com/zero-crossingFAQ.html)). ZCA derives a frequency measurement from the reciprocal of the time period between successive zero-crossings of the input signal (where the wave form crosses from the positive to negative or negative to positive). Although ZCA provides no information on the harmonic structure or amplitude envelope, it has the advantage of producing accurate time and frequency output very rapidly and in real time. The Anabat detector was coupled with an Anabat compact flash storage Zero-Crossing Analysis Interface Module (ZCAIM, Titley Electronics, Ballina, N.S.W., Australia) so that data could be recorded directly to compact flash memory cards. Data was subsequently downloaded to a computer's hard disk with the program CFCread.

### Analysis of Results

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An "echolocation call" is defined as a single, continuous vocalization separated from all other calls by silence (also called a pulse). A string of calls contained within a single file makes up a "sequence." Definitions of what constitutes a "bat pass" differ among biologists; this analysis used a widely accepted definition of bat pass, which is a sequence of two or more echolocation calls recorded as a single bat flies through air space and is detected by an acoustic detector. Unfortunately, given the limited information that the Anabat detector provides and the call similarity among species of bats, it is not always possible to determine a bat species from their call. Bats with unique echolocation calls were grouped to an individual species level, but those with overlapping echolocation calls were combined into more general groups. For example, the hoary bat (*Lasiurus cinereus*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), and Mexican free-tailed bat (*Tadarida brasiliensis*) all have unique call characteristics, so their calls were all identified to individual species. However, six species of bats, each comprising three confusing sets of two species, exhibit similar vocal characteristics and, often, cannot be distinguished on the basis of call. These are big brown bat (*Eptesicus fuscus*) and silver-haired bat (*Lasiorycteris noctivagans*); little brown bat (*Myotis lucifugus*) and long-legged myotis (*Myotis volans*); and California myotis (*Myotis californicus*) and Yuma myotis (*Myotis yumanensis*).

## Mortality Monitoring at Met Towers

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During each regular survey, a search was conducted around the base of each of the 5 met towers, and their associated guy wire sets, for dead or injured animals. The searches were conducted from the center point at the base of the tower, spiraling outward to beyond the base of the guy wires for a minimum of five minutes. Dead animals located were collected for identification.

## Habitat Analysis

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A simple habitat analysis was performed for each of the 18 point count areas, using ortho-rectified digital aerial photographs in GIS software (*ArcMap 9.0*). Within the 1-mile radius survey area from each survey point, habitat was delineated into 4 categories: conifer forest; open grassland; riparian; open water. Each category was then represented as a percentage of the total area for each point count survey area. Additionally, the distance from each survey point center to the nearest forest edge and nearest exposed water body of  $\geq 1$  acre, within 1 mile, was measured.

## Results and Discussion

### Avian Point Counts

#### General Results

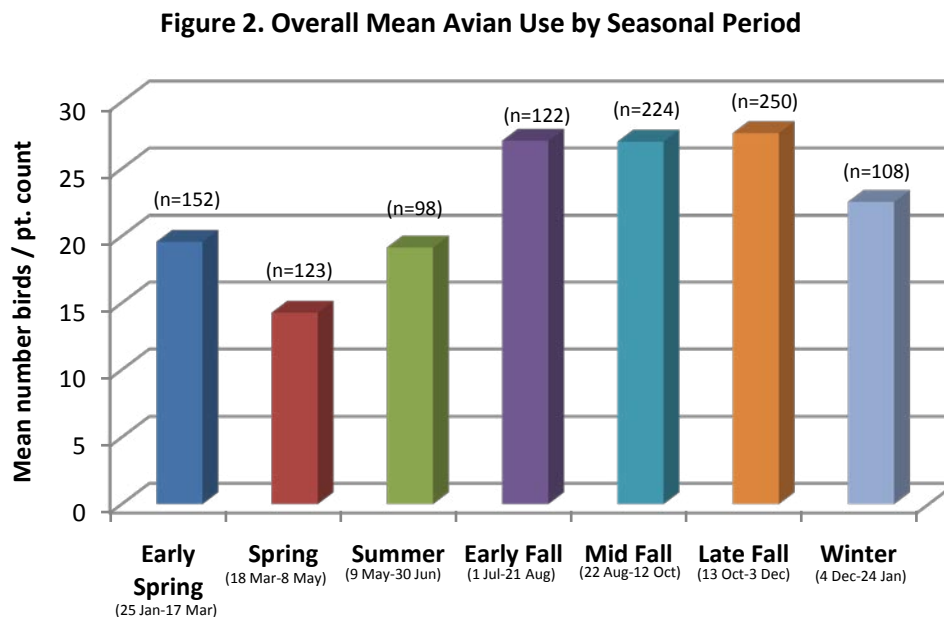
Each of the 18 points was surveyed an average of 59 times (range = 57-62) for a total of 1,067 point counts. Temperatures ranged from 40°-96°F (mean=60°). Average wind speed measured during surveys ranged from 0-30 mph (mean=6 mph), with gusts measured up to 42 mph. A total of 31,668 individual birds of at least 148 different species (list, Appendix E) were counted, including the introduced European Starling. Starlings, which occurred irregularly in exceptionally large flocks (up to 1,000), were excluded from analyses, except where noted, as inclusion would skew sensitive data. This was the only non-native species detected, and accounted for 21% of all birds recorded. Omitting starling, the total number of birds recorded was 25,046 (147 species). The overall average number of birds detected per 15-minute point count (mean use) was 23.47. Additionally, 17 non-specific groups (birds not identified to the species level) were also tallied.

#### Seasonal Use

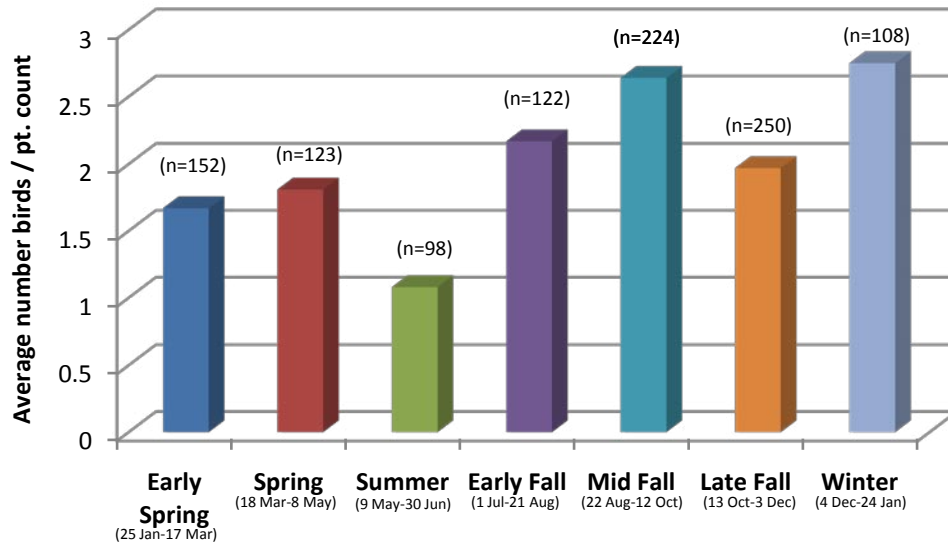
Overall, mean use was greatest during the three fall periods with only slight variation. Late fall had the highest use with 27.66 birds detected per point count, followed by early fall (27.09); mid fall (27.02); winter (22.56); early spring (19.57); summer (19.15); and spring (14.27) (Figure 2).

It should be noted that the spring migration event carries well into the summer period, as defined in this report. This is reflected not only in our results, but also in the results of a nocturnal migration study at Bear River Ridge in spring 2007 (*Sanzenbacher et al. 2008a*), which revealed a peak in late May.

We feel it is likely that, had we conducted the winter period surveys over the same two-year period as the rest of the surveys, instead of during only a single winter (2006/2007), significantly more individual birds may have been counted per survey for the winter period. This is because a region-wide incursion of Pine Siskins and Red Crossbills occurred in fall and winter 2005; this phenomenon did not repeat during the study period.



**Figure 3. Raptor & Vulture Mean Use by Seasonal Period**



Relative seasonal use by raptors and vultures produced no surprises. The winter and mid fall periods each averaged greater than 2.5 birds per point count. The period of lowest use by this group was summer, when most birds are nesting, and one bird per point count was the average (Figure 3).

### Spatial Use

Six survey points (#8-13), located within 1 mile of the proposed turbine string, are collectively referred to as the ‘turbine zone’.

Survey points nearest water bodies (#5, #15, #16) had the highest species richness and overall use by birds. It can be noted that these points occur outside of the turbine zone (Figure 4)

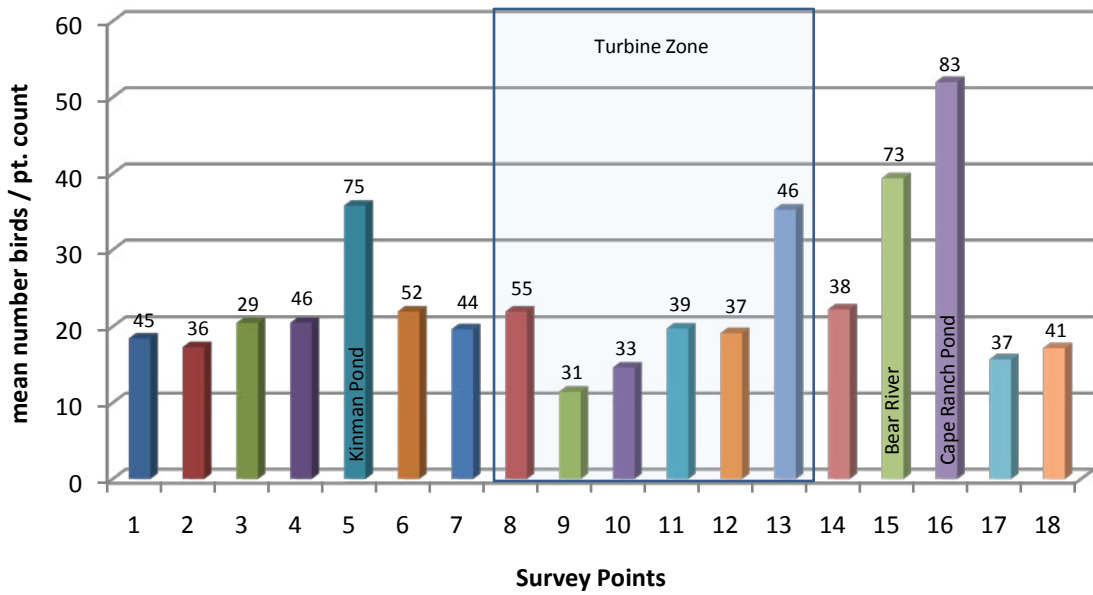
Within the turbine zone, point #8 had the greatest species richness, and points #12 and 13 received the highest use.

Nine bird species were detected at all 18 points: Turkey Vulture, Northern Harrier, Red-tailed Hawk, American Kestrel, Common Raven, Barn Swallow, American Robin, European Starling, and Pine Siskin. An additional five species were detected at all but one point: Northern Flicker, Steller’s Jay, American Pipit, Savannah Sparrow, and Western Meadowlark.

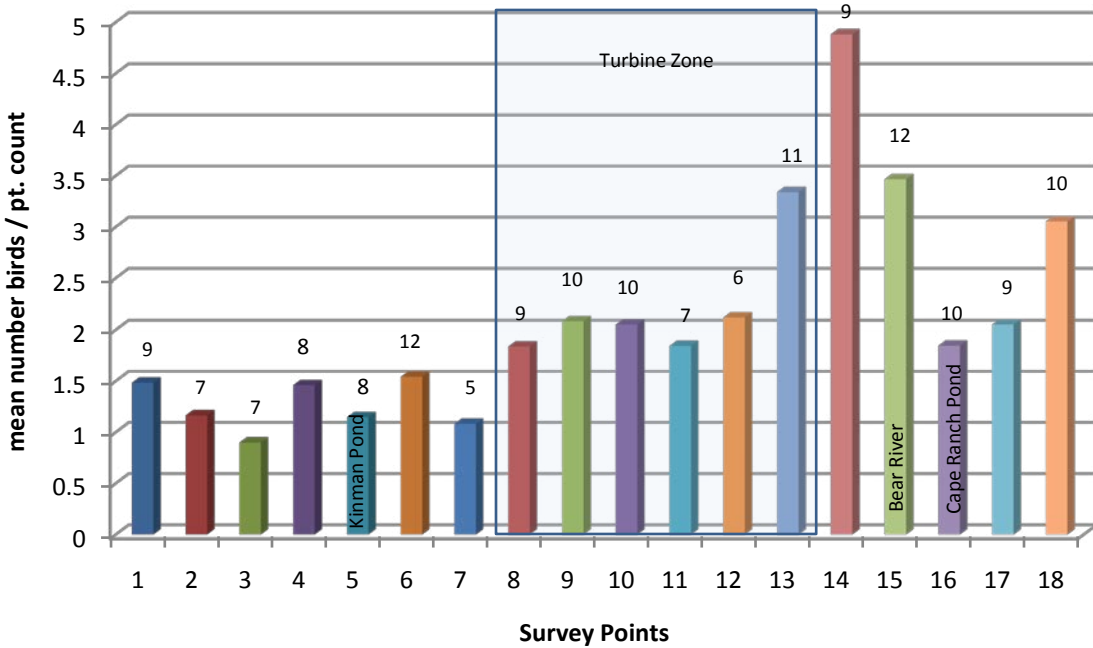
Among all observations of raptors, other large birds and flocks of 5 or greater birds, 21% were observed on the ground (or water), 64% were within 1-200 feet above ground (met-tower “zone”), 11% were within 200-500 ft., 3% were within 500-1000 ft. and <1% were above 1000 feet. Although the rotor-swept area of a wind turbine (125-375 feet above ground) does not fit well into these categories -- spanning two of them -- it can be noted that the vast majority of birds were observed within those two categories.



**Figure 4. Overall Mean Avian Use and Species Richness by Survey Point**  
 (numbers above bars indicate richness; total number species = 147)



**Figure 5. Raptor and Vulture Mean Use and Species Richness by Survey Point**  
 (numbers above bars indicate richness; total number species = 17)



## Species Composition

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Because European Starling appears as a clear outlier, we have excluded the species from the composition analysis (and other analyses, as indicated) to avoid skewing sensitive data. Among the other 147 species, only 8 made up more than half (52%) of all birds detected: Pine Siskin (12%); American Robin (9%); Common Raven (8%); Western Meadowlark (7%); American Pipit (7%); Red-tailed Hawk (3%); Brewer's Blackbird (3%); Barn Swallow (3%). Appendix A provides full details of composition by seasonal period.

## Frequency of Occurrence

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Frequency of occurrence is the percent of point counts for which a species or group was detected, indicating the overall prevalence of the species or group without relevance to abundance.

Overall, five species were detected during more than 25% of all point counts. They are: Common Raven (52%); Red-tailed Hawk (43%); Western Meadowlark (34%); Northern Flicker (26%) and, Turkey Vulture (25%) (Appendix B).

At least in some cases, the frequency of occurrence calculation might be more accurately described as frequency of observation, given that detection rates may be more influenced by behavior than mere presence. For instance, Northern Flicker is only rarely seen during these point counts, but it is frequently heard as it vocalizes loudly year-around. It could be that other common resident forest species, Hutton's Vireo for example, which is generally less conspicuous, actually occurs more frequently than our results suggest.

## Species Group Results

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### *Waterfowl*

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Fifteen species of waterfowl were recorded during the study period. Nearly all of these (83%) were detected from station #5 (on Kinman Pond) (31%) or #16 (on Cape Ranch Pond) (53%). Most of the remaining observations were of overflights. Comprising this total were 2 species of geese, 8 species of dabbling ducks, and 5 species of diving ducks. Unsurprisingly, the Mallard--among the most widespread and abundant ducks in the Northern Hemisphere--was the most commonly detected waterfowl. Waterfowl were observed during all seasonal periods. Mean use peaked at 2.9 during late fall and was lowest (0.25) during the spring period. Frequency of occurrence throughout the study area was steady, averaging 9% overall and ranging from 7% to 11%, seasonally. Waterfowl comprised nearly 6% of all birds. Flock size ranged from 1-73.

### *Upland Gamebirds*

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Four species of upland gamebirds were detected in the study area. Of these, California Quail was by far the most frequently detected and most numerous; notably, they were detected from 14 of the 18 survey points. Sooty Grouse (resident in very small numbers at the northern fringe of the study area), Wild Turkey (possibly resident along Bear River), and Mountain Quail (heard distantly from station #1, but apparently not resident in the study area) round out this list. This group occurred during 6.28% of point counts, but represents less than 1% of all birds. Upland gamebirds were not observed at four of the eighteen survey points (#2, 3, 17 and 18).

### *Loons, Grebes, Cormorants, and Herons*

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Owing to lack of marine habitat and scarcity of freshwater habitat, birds in these 4 families were only infrequently detected in the study area. One flock of Pacific Loon was observed in flight over station

#18 and represents the only detection for this family. One grebe species, Pied-billed Grebe, was observed only at Cape Ranch Pond (point #16) in groups of 1-6 individuals, and was detected there during 22 of 58 counts at that point. Double-crested cormorants were observed only as flyovers on three occasions. No other cormorant species were observed or expected. Three species of herons and egrets were observed during the study; Great Blue Heron, Great Egret, and Black-crowned Night Heron. Most (83%) of these were observed on Kinman Pond (point #5) or Bear River (#15).

It is suspected that, while individuals or flocks of these species likely overfly Bear River Ridge in migration or as they commute to and from foraging sites, they either occur at low densities and/or generally fly at high altitudes.

## Raptors

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Our results indicate that the study area is well used by numerous species of raptors. Counting the Turkey Vulture—now classified as more closely allied to storks than to raptors, but nevertheless employing wide-ranging aerial foraging techniques—17 species were observed during the study period (Figures 8 & 9). Use by this group occurred during 69% of all point counts and averaged 2.07 birds per count throughout the study area, and 2.22 birds per count in the turbine zone. This level of use is comparatively high based on results from 17 other similar studies in native landscapes (*Erickson, et al. 2002*), where the overall average for raptors and vultures for all seasons was estimated at 0.43 birds per point count. That estimate, however, is limited to observations within 800 meters of fixed survey points, whereas we surveyed a fixed area based on a 1-mile radius. Adjusting for this, the mean use estimate for Bear River Ridge study area is 1.62 birds per point count. Still, only one site considered by Erickson et al. (2002), the well-studied Altamont Pass, had higher values, with an overall average of 2.42 birds per count.

Within the Bear River Ridge study area, raptor/vulture use was highest (4.89 birds per count) at point #14 (Figure 5). This exceptionally high level of use was noted during the earliest surveys and was consistent throughout the study. The two survey points nearest #14 (#13 and #15) had the next highest use (3.36 and 3.47, respectively) among all survey points, further supporting the importance of this portion of the study area, for this particular group of birds. To help visualize spatial use within the study area, Figure 7 (page 24) depicts relative use by raptors and vultures geographically, using only data from observations  $\leq 800$  meters from survey points, for better comparison with other studies (see *Erickson, et al. 2002*).

Together, Red-tailed Hawks (38%) and Turkey Vultures (28%) composed two-thirds of all observations within this group; American Kestrel (11%) and Northern Harrier (9%) exhibited considerable, but more moderate use of the study area; Rough-legged Hawk (3.8%), Ferruginous Hawk (2.4%), Golden Eagle (1.5%), and White-tailed Kite (1.4%) made mentionable use of the area, while the remaining 9 species each represent less than one percent composition of this group (Figure 8). Frequency of occurrence by these species generally mirrors percent composition, as can be expected due to the general lack of flocking by this group (mean group size = 1.45, Appendix E).

Seasonally, winter had the highest use by this group, averaging 2.75 birds per point count, followed by mid fall (2.64), early fall (2.17), late fall (1.97), spring (1.81), early spring (1.67), and summer (1.08) (Figure 3).

While some of these birds, particularly the Northern Harrier, commonly forage in low flight, our data show that most of them employ variable-altitude techniques. Further, diagrams of flights observed during point counts make it apparent that individuals may hunt over considerable areas. While our study was not strictly designed at its outset to address potential impacts to raptors or other birds from the turbine schemes now proposed for the study area, it is plain that risks to these birds should be considered.

### *Ralliformes, Shorebirds and Gulls*

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During the survey period, 3 species of rallids were detected. All of these birds—Virginia Rail, Sora, and American Coot—were confined to the marsh or semi-open water of Cape Ranch Pond. Among the less-anticipated results of our study was that 11 species of shorebirds were observed. The Killdeer was the most frequently detected (1.12% of point counts) species, and it was also observed at the most count points (5). Six of the remaining 10 species were observed only at station #5, where they resorted to the strategic oasis of habitat afforded by tiny Kinman Pond. All of those species are variably uncommon to abundant migrants and/or winter residents in northwestern California. Although we can present no data to support the contention, we feel it is likely that members of most of these species also at least occasionally overfly Bear River Ridge at night during periods of migration. Finally, a flock of eight unidentified gulls, likely Ring-billed or California Gulls was observed flying over station #8. As gulls are thought to be diurnal migrants and this was the only sighting, it would appear that overflights of the study area by gulls are only infrequent. No birds belonging to these three groups were observed during the summer period and more birds from each group were observed during late fall than any other period. On average, one bird from any of these groups was observed every four point counts (combined mean use = 0.25).

### *Owls*

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As is discussed under results of the spring 2007 breeding raptor survey (*McAllister and Stauffer 2007*), our efforts resulted in comparatively few detections of owls; only 3 species (Great Horned, Burrowing, and Short-eared) were noted, each represented by only one individual detection, however, Burrowing Owl was detected incidentally three additional times between point counts or outside of survey periods. It is quite possible both that other species make use of the study area and that greater numbers occur than were detected. The secrecy, noiseless flight, and nocturnal habits of owls render them challenging to survey as a group. As was noted previously, the apparent absence of Barn Owls and Western Screech-Owls from what would appear to be suitable habitat was a puzzling and unanticipated result.

### *Passerines and Other Species Groups*

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Other birds detected in the study area included (in part) 3 species of hummingbird, 6 species of woodpecker, 6 species of flycatcher, 4 species of vireo, 3 species of jay, 2 species of large corvid (American Crow and Common Raven, the latter numerous and conspicuous), 6 species of swallows, including the California State-Sensitive Purple Martin; 5 species of thrush, 9 species of warbler, 9 species of sparrow, 2 species of longspur, and 5 species of icterid, including the common Western Meadowlark. Eighty-five species total, make up this group. All but eleven of these (all swifts, hummingbirds, woodpeckers and kingfishers) are passerines. As a group, passerines alone account for 82% of all birds detected. Some of these species are chiefly forest or forest-edge birds, while others either live in open country or venture to forage or fly through it.

## Bat Acoustic Monitoring

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A total of 336 passes was analyzed. Bat passes were detected on ten nights from at least six locations (Table 3). The barn below Bunker Hill had the greatest number (188) of bat passes. Five bats were identified definitively – fringed myotis, long-eared myotis, big brown bat, hoary bat (*Lasiurus cinereus*), and Mexican free-tailed bat. The silver-haired bat (*Lasionycterus noctivagans*) might have been detected, but could not be confidently separated from big brown bat. The Yuma myotis or California myotis was also detected, or more likely, both, as well as the little brown myotis and/or the long-legged myotis.

These results confirm the presence of bats within the study area, which was previously undocumented. Furthermore, they provide us with at least a partial list of bat species that use the area. Of the 8-10 species detected, four are listed as Federal Species of Concern and two of those are also listed by the California Department of Fish and Game as Species of Concern. Two of the species, hoary bat and silver-haired bat, are migratory, tree-roosting bats. Bat species with these life history traits have been found to be especially prone to collision with wind turbines.

## Species of Special Concern

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Two bird species, considered worthy of special attention owing to their resident status in the study area and relative sensitivity to impacts from wind turbines, are addressed in detail below.

### Golden Eagle (*Aquila chrysaetos*)

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The Golden Eagle is listed as a Species of Special Concern by the CDFG. It occurs primarily in western North America from Alaska to south-central Mexico (*Kochert et al. 2002*). It is known from a variety of habitats throughout California, including resident and breeding populations in Humboldt County, where occurrences are mostly outside of the fog belt (Hunter et al. 2005). In Humboldt County, nesting and wintering habitat includes rolling foothills and mountain areas where cliff-walled canyons and large trees in open areas provide habitat for nest sites.

Golden Eagles are known to nest within and around the project area. Long-term monitoring in the vicinity of the proposed turbine string has been conducted by the Scotia Pacific Company (SCOPAC) and Pacific Northwest Biologists (PNWB) for Sierra Pacific Industries (SPI), on the properties under management by these lumber companies. A query of the California Natural Diversity Database did not return any golden eagle occurrences other than those provided by SCOPAC and SPI, which are discussed in detail below.

Golden Eagle was detected on 26 occasions during the course of 62 visits to the survey area between 2004 and 2007, occurring at 11 of the 18 points surveyed. More than one-third of the observations were made from survey point #13. These observations were generally associated with a large rock outcrop and/or a broken-top tree that occur in proximity to each other approximately ½-mile southeast of that point. Overall mean use of the study area by this species was 0.03 birds per 15-minute point count, was highest (0.06) during the winter period and lowest (0.01) during the summer period. Other similar studies resulted in a combined overall average of 0.07 birds per 20-minute count within 800 meters (*Erickson et al. 2002*). Adjusting our results for comparison, by omitting observations made beyond 800 meters, overall mean use by Golden Eagle was 0.02 birds per 15-minute count.

Nesting raptor surveys, conducted during the 2007 breeding season, resulted in 2 separate Golden Eagle sightings (6/6/07 and 6/7/07). The first sighting was of a foraging eagle in the vicinity of raptor survey station #6 (observation point only) and the second was of 2 eagles foraging in the vicinity of station #5 (playback station).

Humboldt County Breeding Bird Atlas reports (1995-1999) confirmed breeding by golden eagle in 3 survey blocks, probable breeding in 1 block, and possible breeding in 9 blocks within the project region (Hunter et al. 2005). This data was primarily provided by SCOPAC and SPI (details follow).

Monitoring by SCOPAC biologists has resulted in the identification of 7 golden eagle territories in the project region, the boundaries of which were approximated based on extensive behavioral observations in conjunction with analyses of topographic features near known nest sites. Although golden eagle territories identified by SCOPAC were located within the general project area, none was reported for the immediate project area. The nearest known golden eagle territory is located approximately 3.5 miles southeast of the eastern terminus of the proposed turbine string alignment. The territories comprise 12 nest site locations (alternate locations were used in some years within many of the territories). Of the known nest sites, 3 sites were active in 2007, 8 were inactive, and the status of 1 was unknown (L. Bradley pers. com., McAllister and Stauffer 2007).

Monitoring conducted by PNWB on SPI property in the vicinity of the project occurred in the Davis Creek and Hollister Creek drainages in 2005 and 2007 in conjunction with timber harvest plans under consideration for those areas. In 2005, a pair of golden eagles was detected copulating in a ridge-side prairie on the Russ Ranch on 17 February, and a single golden eagle flew up Davis Creek at tree-top level on 11 April. The California Department of Fish and Game was consulted following both sightings, and survey efforts in the areas where the detections occurred were intensified. However, no subsequent behaviors suggestive of nesting were observed (PNWB 2005). In 2007, an occupancy visit on 16 March, a helicopter nest search on 30 April, protocol surveys (March-July), and a stand search on 19 July failed to produce evidence of nesting in the survey area (Sierra Pacific Industries 2007).

Based on our own observations and information provided by PNWB/SPI, we feel it is likely that at least one active Golden Eagle pair/territory exists west of the territories documented by SCOPAC, and likely south of the proposed turbine string, perhaps in the Singley Creek or Davis Creek drainages.

### Horned Lark (*Eremophila alpestris* ssp.)

Of particular interest to ornithologists is the presence of a small population of Horned Larks, known from the general area since at least the late 1920s (Harris 1991). The Horned Lark is a ground-nesting bird of open habitats. These songbirds are widely distributed in the Northern Hemisphere and are abundant elsewhere in North America but, as they are open country obligates largely tied to short grass and barrens, they are scarce and local as breeding birds in northwestern California. The heart of their range in Humboldt County coincides with the proposed project area.

In North America, the Horned Lark is divided into 15 subspecies. It is unclear which subspecies occurs in the study area, but it is likely either "California Horned Lark" (*E.a. actia*, (hereafter *actia*)) or "Streaked Horned Lark" (*E.a. strigata*, (hereafter *strigata*)). A range map for *actia* (Zeiner, et al. 1988-90) indicates that Bear River Ridge is within the extreme northern edge of the range, and furthermore, information obtained from the Museum of Vertebrate Zoology at Berkeley apparently supports this (R. Moore, pers. comm.). However, Grinnell (1931), who studied 4 specimens collected from the Bear River Ridge population, seemed confident they were *strigata*. The U.S. Fish and Wildlife Service (2007) present conflicting information regarding the range of *strigata* (ref). Photographs and song recordings of breeding male Horned Larks obtained during our study at Bear River Ridge were sent to a Horned Lark researcher at Oregon State University. Plumage characteristics from the photographs left the researcher less than convinced that the birds were *actia*, and preliminary results of the song analysis revealed that the sonograms, though not identical to those of Willamette Valley, Oregon *strigata*, were close enough to warrant further investigation (R. Moore, pers. comm.).

Subspecies *strigata* was listed as a "candidate" for listing under the federal Endangered Species Act on October 30, 2001 and retains that status still. It is listed by the Washington Department of Natural Resources as Endangered. In Oregon, it is not yet listed by the State, but the Oregon National Heritage



Program has listed it as “imperiled” (*U.S. Fish and Wildlife Service 2007*). California has no listing for the *strigata* subspecies, however subspecies *actia* is listed as a Species of Special Concern by the California Department of Fish and Game.

Regardless of the taxonomy, the Bear River Ridge population of Horned Larks appears to be part of a disjunctive or peripheral, if not entirely isolated population. They are present year-round in very low densities at Bear River Ridge. The species has also been observed, at least on one occasion, immediately south on Cape Ridge (*Hunter et al. 2005*). The species is not known to breed anywhere else in northwestern California.

During the course of our study we observed Horned Larks in every month of the year. We obtained a daily high count of 17 individuals on 10 September, 2004 and more than half (52%) of all sightings were from September-November. It is unknown to what degree this apparent seasonal increase is due to the arrival of fall migrants from elsewhere versus the presence of hatch-year birds from within the Bear River Ridge population. The distribution of Horned Larks within the study area was very localized, with all but 2 birds (98%) observed east of the turbine zone at points 1-7, and nearly half (47%) were from a single point (#2).

Nesting by Horned Larks was first recorded at Bear River Ridge in 1929, when about 50 pairs were reported (*Grinnell 1931*).

**The Streaked Horned Lark Breeds in Northwestern California.**—Through the special effort and generosity of Mr. George D. Atwell, of Eureka, the Museum of Vertebrate Zoology possesses four horned larks from Humboldt County which I identify as *Otocoris alpestris strigata*. Mr. Atwell collected these on the prairie-topped divide at about 1800 feet altitude between Bear River and Eel River in Humboldt County about seven miles from Capetown. The birds there numbered about fifty pairs in the early summer of 1929. One of the birds, a male, no. 63976, was taken on May 9 with a nest and four fresh eggs which Mr. Atwell collected. Another of the four birds is a juvenile (no. 63983) not quite fully grown, taken June 2. In so far as known to Mr. Atwell in May and June, 1929, this colony, occupying a territory about one by one-half mile in extent, was the only one in Humboldt County.

While perhaps not extreme for *strigata*, the three adult males collected by Mr. Atwell are, together, as regards both measurements and color tones, much nearer that race than any other; indeed I cannot distinguish one of them from a breeding male from Salem, Oregon. The juvenile is darker colored than any juvenile, of whatever race, I have seen from elsewhere in California. J. GRINNELL,—Museum of Vertebrate Zoology, University of California, Berkeley, December 7, 1930.

Not more than 7 Horned Lark pairs have been recorded at Bear River Ridge in modern times (pers. obs. and *S. Harris* pers. comm.) Although males sing aerial flight songs, these birds are otherwise notably terrestrial, and would appear to be at comparatively low risk from wind power turbines.

### Mortality Monitoring at Met Towers

In early spring 2005, four met towers (2401, 2402, 2403 and 2404) were erected in the study area and one (2405) was located outside of the study area, on Branstetter Ridge. The four towers that occur in the study area were surveyed for dead or injured animals on each regularly scheduled point count visit. The fifth tower was surveyed only during visits to collect meteorological data (approximately monthly).

Five birds were found dead beneath towers, only at sites 2401 and 2403, and only during the 2005 fall period.



It may be reasonably assumed that scavengers, becoming aware of this new prey resource, made more frequent visits to the met towers, resulting in the subsequent lack of mortalities discovered by surveyors.

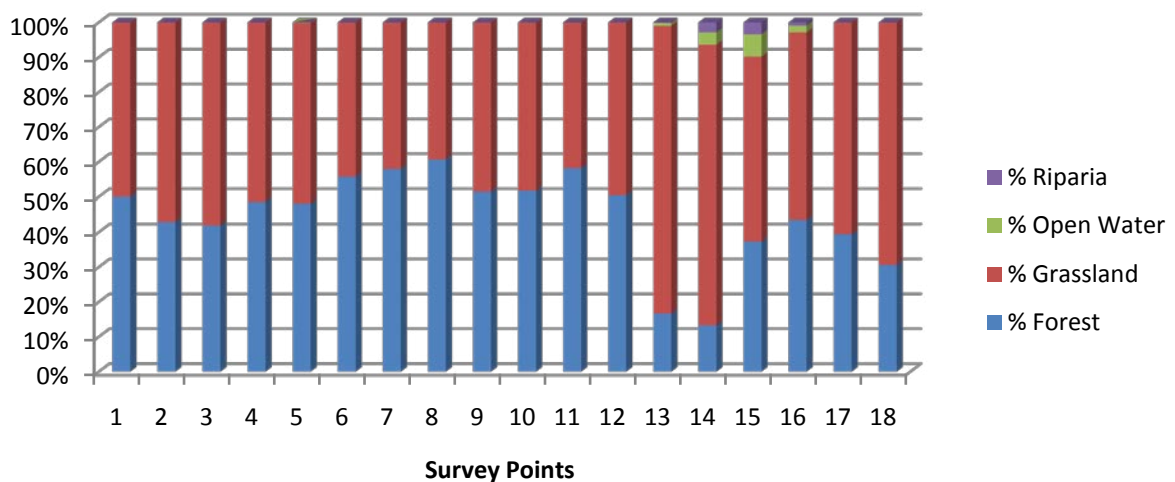
**Table 1. Bird Mortalities at Met Towers**

Date	Site	Species	Comments
14-Sep-05	2401	Savannah Sparrow	Body intact
14-Sep-05	2403	Spotted Sandpiper	Wing only; possibly remains of a Falcon kill
27-Sep-05	2403	Fox Sparrow	Body fresh and intact; probably few hours
27-Sep-05	2403	Swainson's Thrush	Body intact but stiff; probably more than 12 hours
13-Oct-05	2401	Fox Sparrow	Body intact but partly decayed; probably at least several days

### Habitat Analysis

Overall, the habitats within the survey areas are represented by roughly equal portions of grassland (55%) and conifer forest (44%), with only a very small fraction represented by open water (0.7%) and riparian habitat (0.4%). Survey points (areas) #13 and #14 had the most grassland (80% and 82%, respectively) and the least conifer forest (13% and 17%, respectively). Coincidentally, these areas, along with point #15, also received the highest level of use by raptors and vultures, but it is unknown whether or not this has statistical significance. Conversely, the area associated with survey point #8 contains the greatest amount (61%) of conifer forest and the smallest amount (39%) of grassland among all points. Point #8 ranked highest in species richness, when the three points involving open water (#5, 15 and 16) were excluded. Although this correlation has not been tested for statistical significance, it would seem intuitive that the greater presence of forest habitat would result in greater species diversity. However, survey point #8 is also closest (32 m) to forest habitat than any other survey point, suggesting that the high species richness may be due to a detectability factor, given that forest birds would be more easily heard from the survey point, compared to other points.

**Figure 6. Habitat Composition**



## Incidental Wildlife Observations

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Incidental observations of wildlife between or en route to point counts, but within the study area, produced two bird species not detected during any point count. They were a single, apparent stray Pomarine Jaeger (*Stercorarius pomarinus*), observed flying west over Kinman Pond, and a pair of Lawrence's Goldfinch (*Carduelis lawrencei*) near Malfunction Junction on June 8, 2006.

Other wildlife detected in the study area include the following:

**Western Fence Lizard** (*Sceloporus occidentali*)

Western fence lizards ("blue-bellies") are fairly common in the study area around fences, rock piles and cattle guards

**Deer Mouse** (*Peromyscus maniculatus*)

One deer mouse was found nesting inside the lock box for the data logger at met tower 2405 on Branstetter Ridge. It is assumed that this and other small rodents are abundant in the study area.

**California Ground Squirrel** (*Spermophilus beecheyi*)

Surprisingly, squirrels were rarely seen during the study, although what appeared to be burrows of this species were fairly common on grazed, grassy knolls, particularly around survey point #7 and #10.

**Porcupine** (*Erithizon dorsatum*)

Porcupines were observed infrequently, usually near forest edges, but one was observed well out in the open, apparently trying to cross through a wire fence in October 2006.

**Bobcat** (*Lynx rufus*)

One bobcat was frequently observed sunning itself in the open fields near survey points #7 and #8.

**Striped Skunk** (*Mephitis mephitis*)

Observed occasionally along roadside ditches, culverts and forest edges.

**Long-tailed weasel** (*Mustela frenata*)

Long-tailed weasels were observed several times, mostly near Bunker Hill (survey point #10). On one occasion a weasel was observed using a small burrow.

**American badger** (*Taxidea taxus*)

Although rarely seen, badgers are known to be present because of the distinctive diggings and burrows they have created. These large members of the mustelid (weasel) family prey upon ground squirrels (*Spermophilus beecheyi*), Botta's pocket gophers (*Thomomys bottae*) and similar fossorial herbivorous mammals. This population occurs at what is apparently the most northern extent of the species range along the Pacific coast.

**River Otter** (*Lontra Canadensis*)

One otter was observed at Cape Ranch Pond (survey point #16) in February 2007.

**Black-tailed deer** (*Odocoileus hemionus columbianus*)

Black-tailed deer are common in the study area, frequently foraging in small bands well out into the grasslands.

**Wild Boar** (*Sus scrofa*)

Wild boar is an introduced species that is often sought by local hunters. They apparently are well established in the area, as evidenced by observations of adults with young.

**Coyote** (*Canis latrans*)

Coyotes probably occurred more frequently when sheep ranching was more common in the area. Only two were observed during the study (one was dead and hanging from a barbed wire fence), however, the presence of packs was often noted around dusk when they could be heard howling across the Bear River valley.

## General Conclusions and Recommendations

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More than 470 species of free-flying native and non-native birds have been reported from Humboldt County, representing a highly diverse array of orders and families. Fewer than a half-dozen counties in the U.S. can claim as many species within their borders. Although the somewhat limited degree of habitat diversity within the study area fails to fulfill many of the life history needs for most of these species, nevertheless, a measure of the county's birdlife diversity is reflected in our results.

Survey methods employed for this study were most appropriate for estimating use by raptors and other large birds. We feel the majority of raptors present were detected and recorded, providing a fair estimate of actual use of the study area by these birds. Although passerines and other small birds were also recorded as they were detected, many which may have been present within 1 mile but were quite distant from the observer likely remained undetected. Most of the songbirds that would be at risk of collision with wind turbines are nocturnal migrants, and would likely only risk collision during migration. Therefore, the most appropriate risk assessment for these birds would utilize radar studies, which we recommended in our interim reports, to which SWE responded by contracting with Alaska Biological Research Inc., who has reported findings from intensive radar monitoring during both spring and fall migration periods (*Sanzenbacher et al. 2008a, 2008b*).

One of the key objectives of this study was to identify sensitive areas in order to help minimize impacts. What is likely the most important discovery made during the study meets this objective. After the first fall migration survey in 2004, results indicated a high use area at the west end of Bear River Ridge (survey point #14, specifically), where mean use by raptors and other soaring birds was outstanding. Subsequent survey results continued to support this discovery. It appears that this area, around what is known as Flyblow Gulch, owing to its geographical and topographical situation, attracts raptors and vultures to the updrafts that are created from onshore wind as it collides with the landform. Not only are soaring birds attracted by this feature, as evidenced by concentrations, or "kettles" of soaring birds rarely observed elsewhere in the region, but the area also apparently provides productive hunting grounds, as many raptors were observed exhibiting hunting behavior in the varied habitats (conifer forest, coastal scrub, grazed and un-grazed grassland) which occur there. According to our early recommendations, SWE modified the proposed project by eliminating the three western-most turbines from the originally proposed turbine string alignment.

Although use was exceptionally high at Flyblow Gulch, overall use was considerably high as well. In a study by Erickson *et al.* (2002), in which results from 27 different baseline bird and bat studies were standardized and compared, reported mean use by raptors and vultures combined was well below what we found in this study. Although our results are not entirely comparable, owing to differences in survey methods and metrics used to produce use estimates between studies (for instance, Erickson *et al.* limited observations to those recorded within 800 meters, while we included observations out to 1 mile), when we adjust our data to synthesize the difference in size of sample areas, use estimates still rank second among all studies. The only study site considered by Erickson with higher raptor/vulture use estimates is Altamont Pass, one of the oldest wind energy projects in the U.S., which is now well known for its high bird mortality rates from collision with wind turbines. It must be stated, however, that significant advances have been made in the design of modern turbines, which have greatly reduced the risk of collision by birds; and, SWE has committed to equipping the proposed project with only the most modern turbines. Furthermore, although as a group, raptors and vultures exhibited relatively high use of the study area, the more sensitive species, namely Golden Eagle, used the area considerably less at Bear River Ridge (avg. 0.02 birds/point count) than at other study sites (0.07).

Certainly, in terms of daytime use by birds, the raptor/vulture group as a whole faces a considerable potential risk of negative impact from the pending installation of a wind energy facility. This is in part based on these data, which indicate Bear River Ridge is a high-use site for raptors and vultures, but also

because of the relative size and natural behaviors exhibited by this group, which results in relatively high vulnerability. However, it is also clear that, by and large, the greatest impact, should any actual significant direct impact result from the proposed project, would involve species that are common and widespread. Of the raptor/vulture group, Red-tailed Hawk especially, and also notably Turkey Vulture, were outstanding in their overall prevalence. Red-tailed Hawk ranks second among all species in frequency of occurrence (Common Raven is first), and Turkey Vulture is fifth. Red-tailed Hawk is also among the top five of all bird species in percent composition, or mean use (Appendix A).

The one species of all which had the greatest overall presence in the study area was the Common Raven (Appendix E). As members of the evolutionarily advanced *corvidae*, or crow family, Ravens have proved their intelligence and adaptability time and again. No other bird in the world has a wider distribution or shows more adaptability than the circumpolar Common Raven. It is what the naturalist Bernd Heinrich called, the *ne plus ultra* of up-and-coming birds (Heinrich 1989). It is therefore likely that impacts to the species that would seem to be the most likely victims, would not result in a significant impact at a population level, owing either to sturdy populations and/or the species' ability to avoid impacts.

Considering impacts from a different approach, species which are not especially prevalent or abundant in the study area, but which are sensitive owing to unstable or small populations, especially when combined with natural behaviors that lend to collision vulnerability, warrant close attention. For these reasons, we provided detailed information about the occurrence of Golden Eagles and Horned Larks.

Although Golden Eagles are widely understood to be vulnerable to wind turbine collision, most of the information that has produced this understanding has come from the Altamont Pass project, which is unique among wind energy projects for a variety of reasons (Erickson *et al.* 2002), and is generally not, therefore, a valid measure in developing an understanding of the potential of impacts at other sites. Furthermore, the Bear River Ridge study area appears to lie at the periphery of what might be considered a significant population of Golden Eagles. East and south of the study area, mean use by this species is likely much higher.

Consideration of Horned Larks in context of the significance of potential impacts by the proposed project presents a somewhat uncertain picture. Although it has not been adequately documented, the Bear River Ridge population appears to be isolated and small. If true, then it would follow that the population is a sensitive one. Peripheral or disjunct populations tend to be smaller; be ecologically distinctive; have restricted gene flow; and have greater extirpation risk (Leppig and White 2006). As ground-nesters, Horned Larks have the increased vulnerability of predation, especially given the presence of several notable predators in the study area: Common Raven, striped skunk, long-tailed weasel, and American badger, to name a few. Because of these considerations, it is recommended that additional research is done in order to better understand the general status of the population (e.g., size, taxonomy, range and distribution), and to document any behaviors that might contribute to risk of collision with wind turbines.

Additional monitoring of bats in the study area is also recommended, as we have set the stage by documenting presence, but cannot confidently assess potential impacts based on our limited data.

Finally, we cannot overlook the potential positive indirect effects that the proposed project could have on wildlife. Renewable energy resources are becoming increasingly popular, ultimately, because they are necessary to meet energy demands while maintaining healthy ecosystems. Balancing proximate negative impacts with ultimate positive outcomes is to become a familiar challenge.

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## Tables and Figures

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**Table 2. Bat Monitoring Summary**

<b>Survey Dates (2005)</b>	<b>Ref. # (see Fig. 6)</b>	<b>UTM_E (NAD83)</b>	<b>UTM_N (NAD83)</b>	<b>Elevation (ft)</b>	<b>Habitat Description</b>	<b>Detections?</b>	<b>General Location</b>
March 15-17	1	400732	4478598	2318	Barn, corral	Yes	Russ' barn, near station 2
May 25-31	4	396319	4481538	2410	Forest; 50m from edge	No	Near Station 7
June 23-28	2	397236	4480129	2535	Small pond	Yes	Kinman Pond
July 10-12	6	395105	4483180	1954	Small pond	No	Whatcheer Ranch
July 20 - Aug 2	11	383748	4479779	492	Forest clearing, above large pond	Yes	Cape Ranch
Aug 2-9	9	387454	4482974	1463	Open; wet meadow	Yes	Mazeppa
Aug 9-26	12	396313	4481504	2407	Ridge top; open; met mast tower	No	Met Mast 2402
Aug 26 -27	8	390149	4484859	1870	Barn	Yes	Barn below Bunker Hill
Sept. 21	3	396981	4480875	2388	Cattle guard; open, forest edge	Yes	Station 6
Sept. 22	2	397236	4480129	2535	Small pond	Yes	Kinman Pond
Sept. 27	7	391087	4485040	1850	forest clearing	Yes	Near Malfunction Junction
Oct. 4-5	5	395346	4482700	2054	Forest edge	Yes	Station 8
Oct. 12	1	400732	4478598	2318	Barn, corral	Yes	Russ' barn, near station 2
Oct 20-22	10	384040	4480375	43	Under bridge, riverside	No	Bear River / Capetown bridge
Nov. 4	11	383748	4479779	492	Forest clearing, above large pond	Yes	Cape Ranch

**Table 3. Bat Monitoring Results**

Date	3-Aug-05	4-Aug-05	27-Aug-05	21-Sep-05	22-Sep-05	27-Sep-05	4-Oct-05	5-Oct-05	Unk. Date	
Location	Mazeppa Ranch	Mazeppa Ranch	Barn Below Bunker Hill	Station 6	Kinman Pond	Near Malfunction Junction	Station 8	Station 8	Unk. Location	Total passes per bat group
40 kHz bats – Little Brown Bat and Long-legged Myotis	3	2	16	1	0	3	3	0	6	34
50 kHz bats - California Myotis and Yuma Myotis	4	8	170	2	8**	2	3	3	79	279
Long-eared Myotis	0	0	0	0	0	0	0	0	3	3
Fringed Myotis	0	0	0	1	0	0	0	0	0	1
Big Brown / Silver-haired Bat	3*	2	1	0	0	1	1	0	0	8
Hoary Bat	0	0	0	1	0	0	0	0	0	1
Mexican Free-tailed Bat	4	0	1	2	0	1	2	0	0	10
Total bat passes per Site/Survey	14	12	188	7	8	7	9	3	88	336
*One definitive Big Brown Bat										
**These are likely Yuma Myotis, which are strongly associated with open water, such as ponds										



Figure 7. Bat Monitoring Locations.

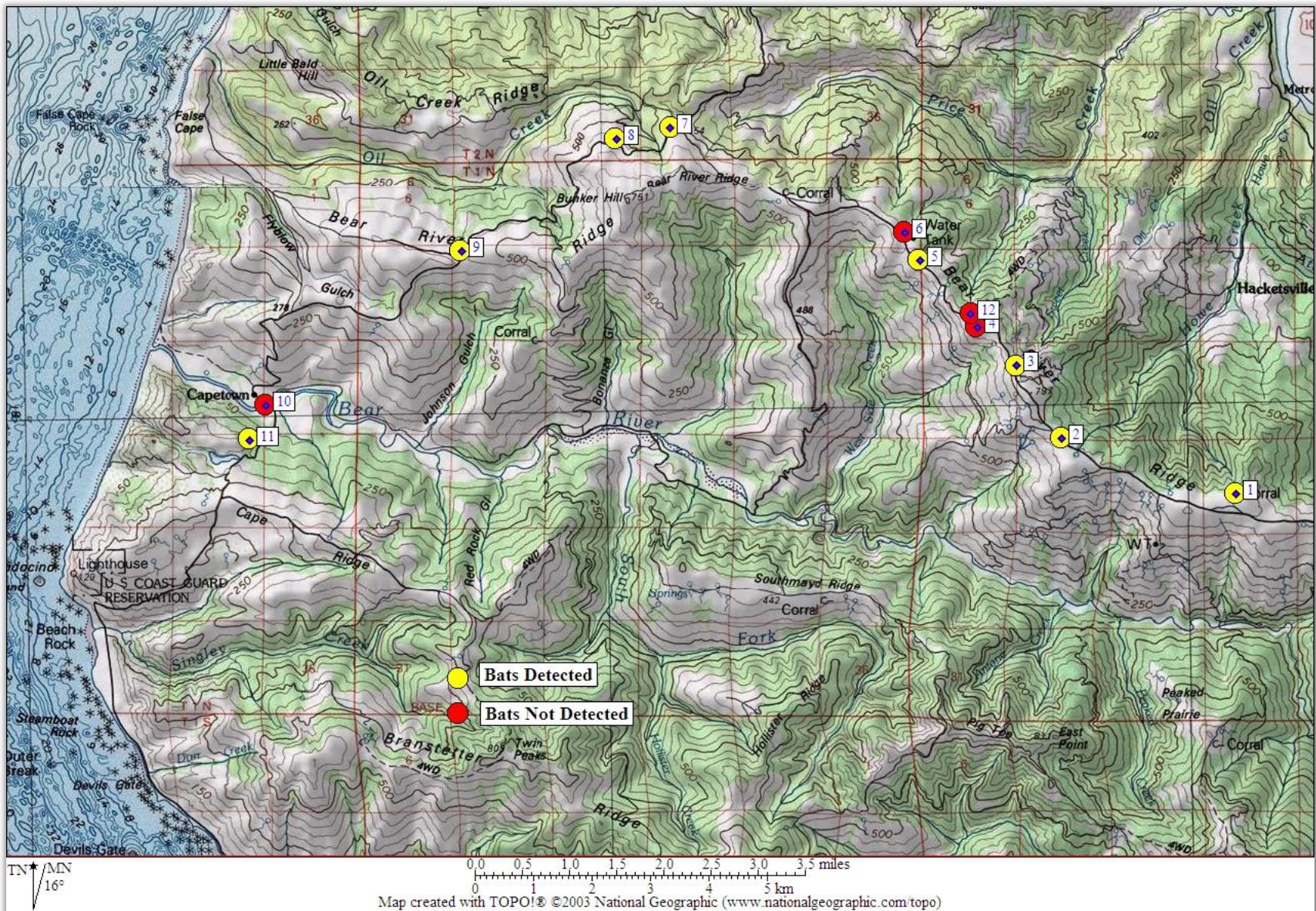
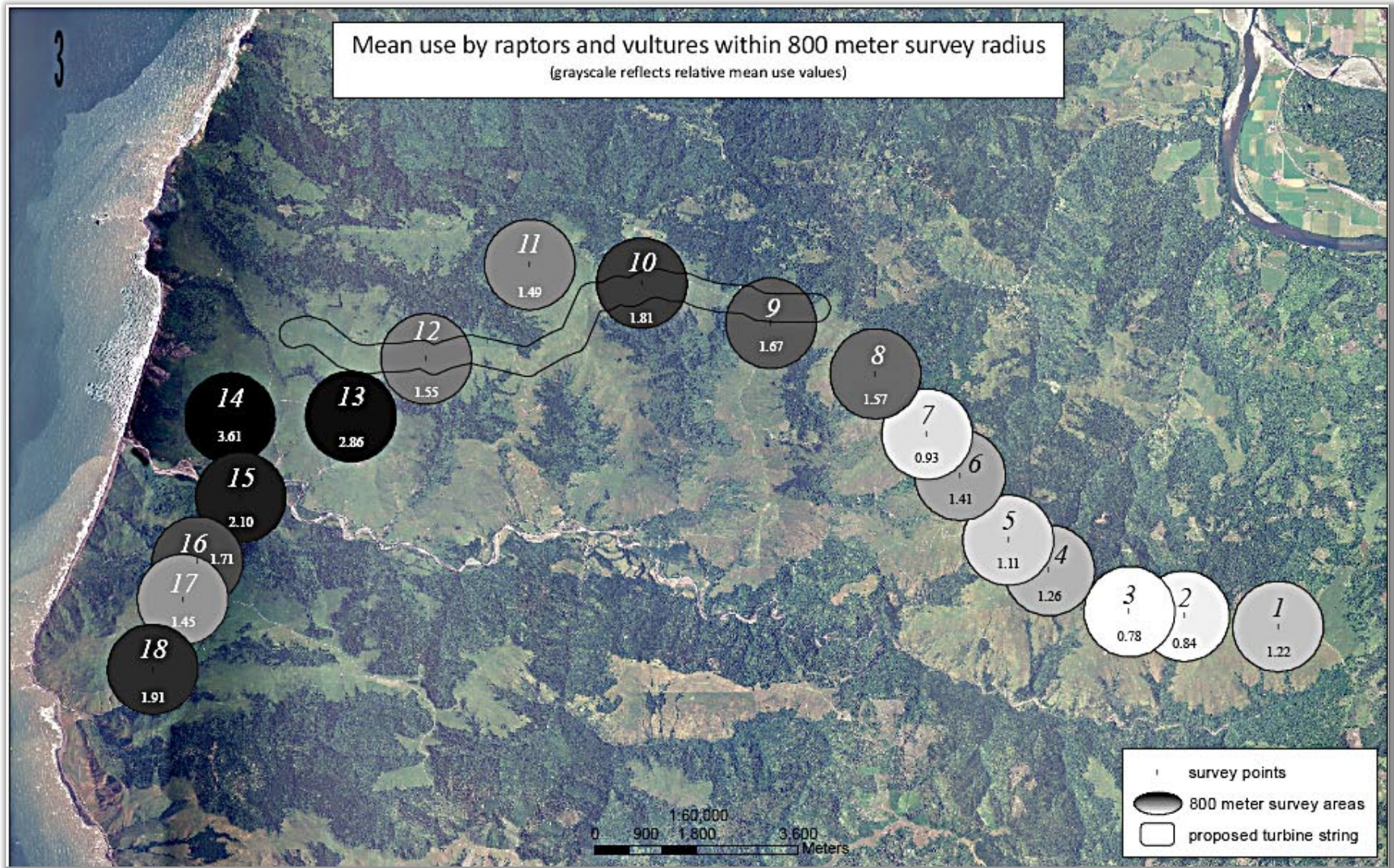
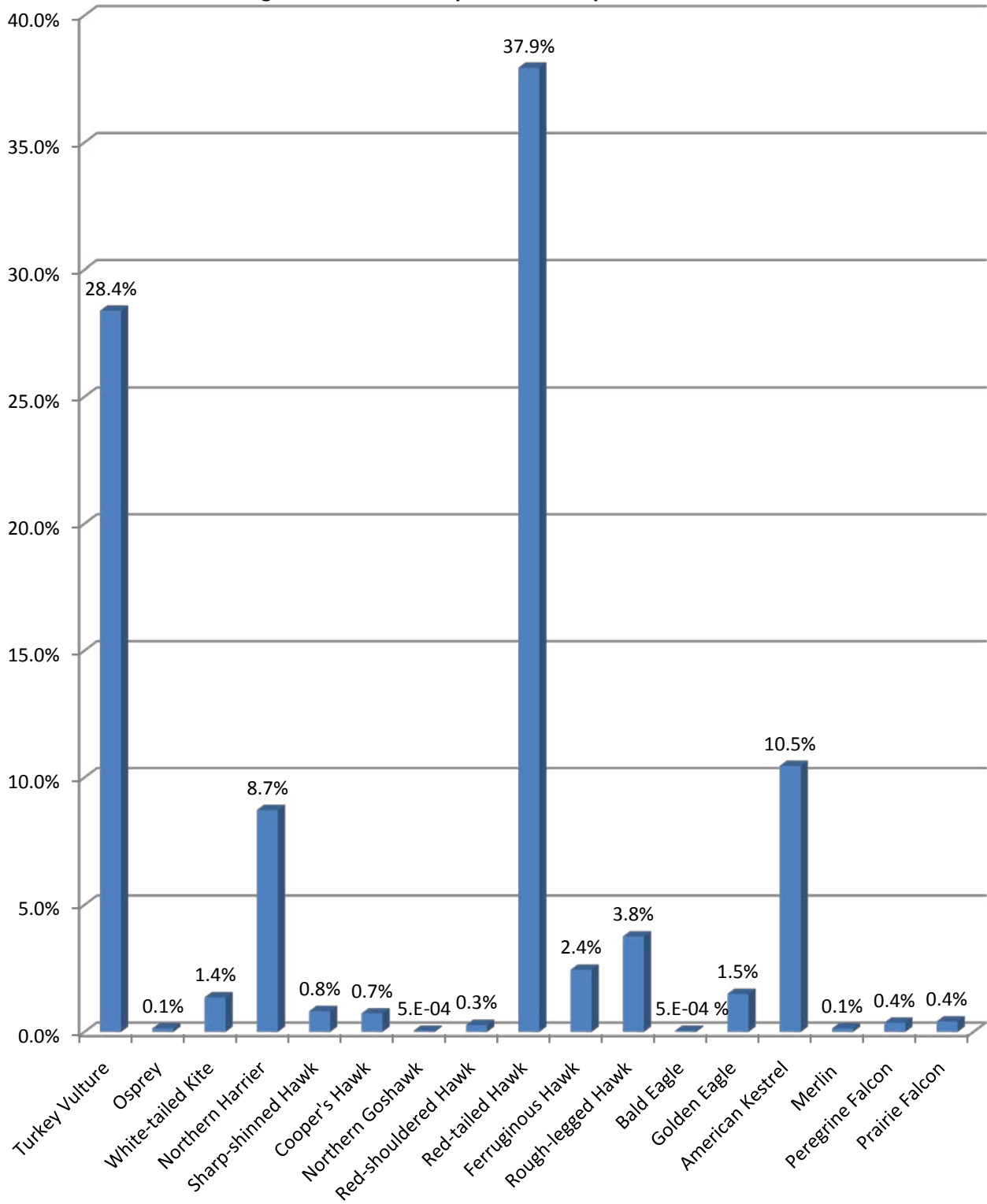




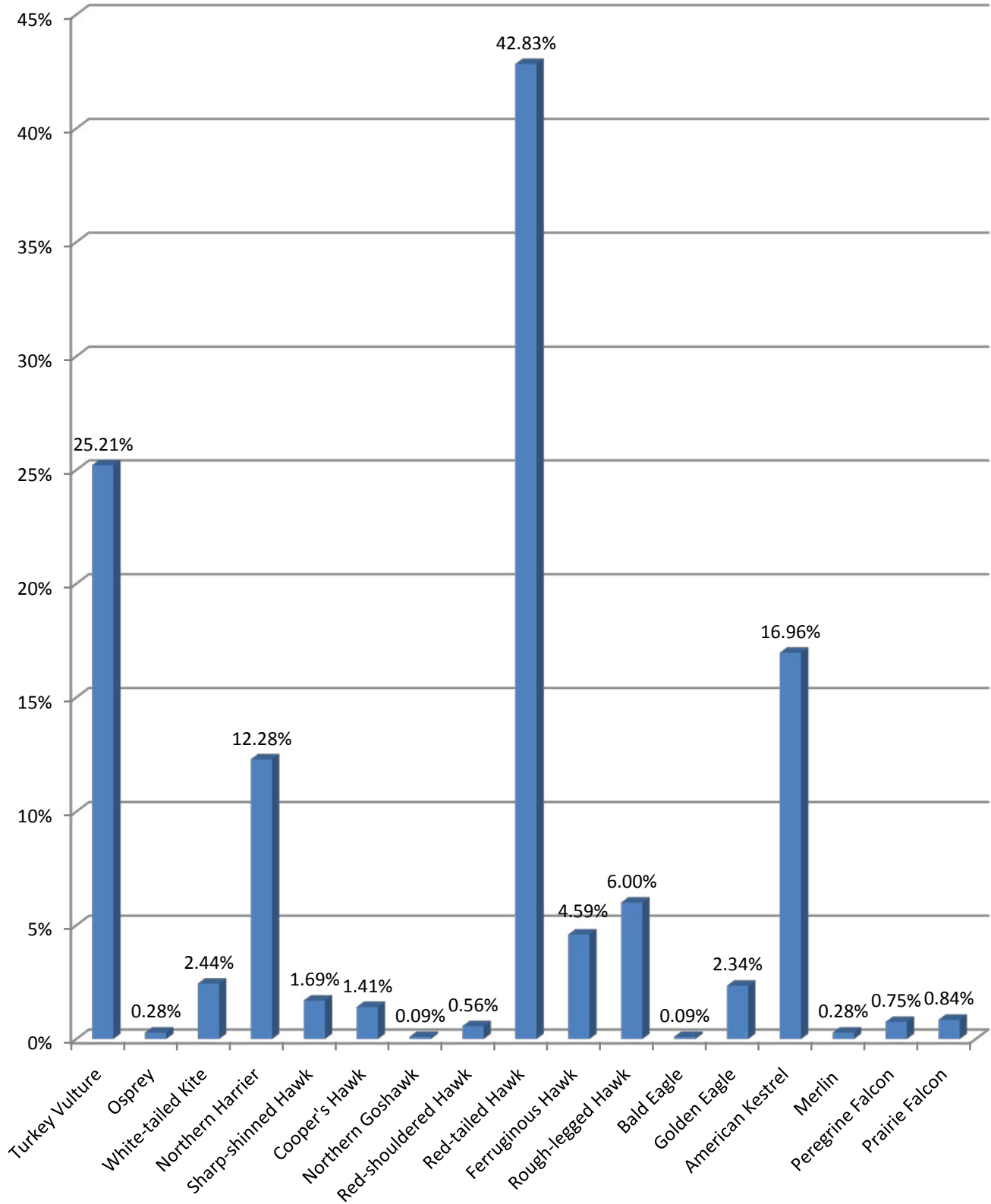
Figure 8.



**Figure 9. Percent Composition of Raptors and Vultures**

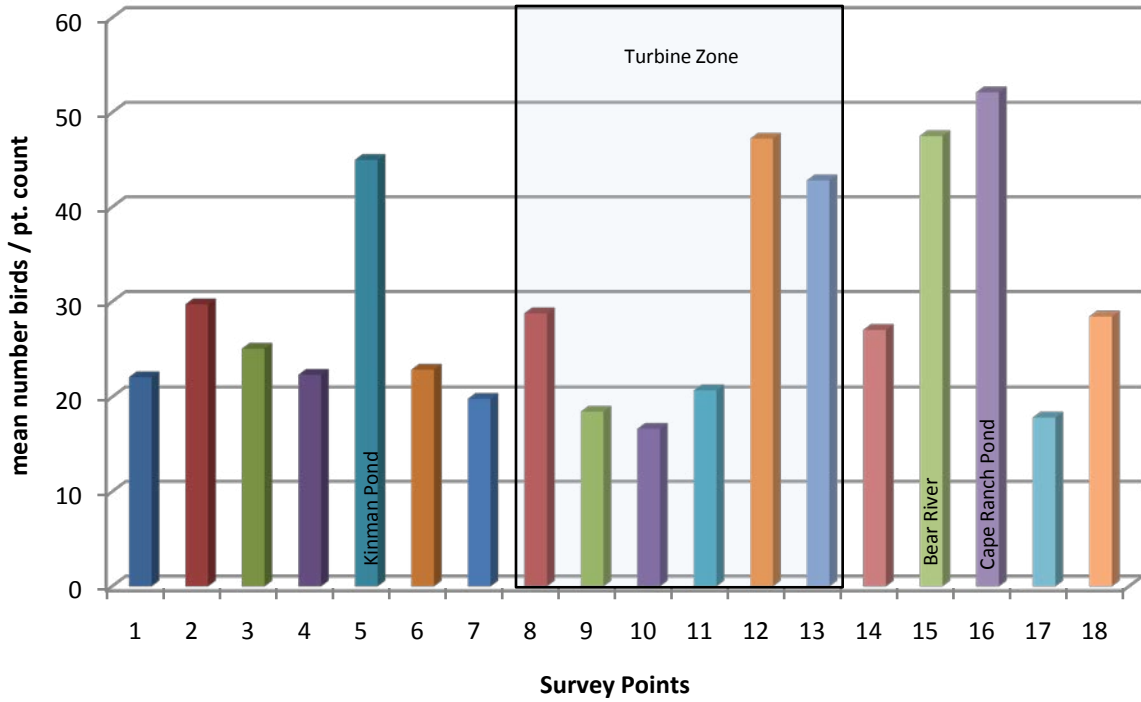


**Figure 10. Frequency of Occurrence by Raptors & Vultures**

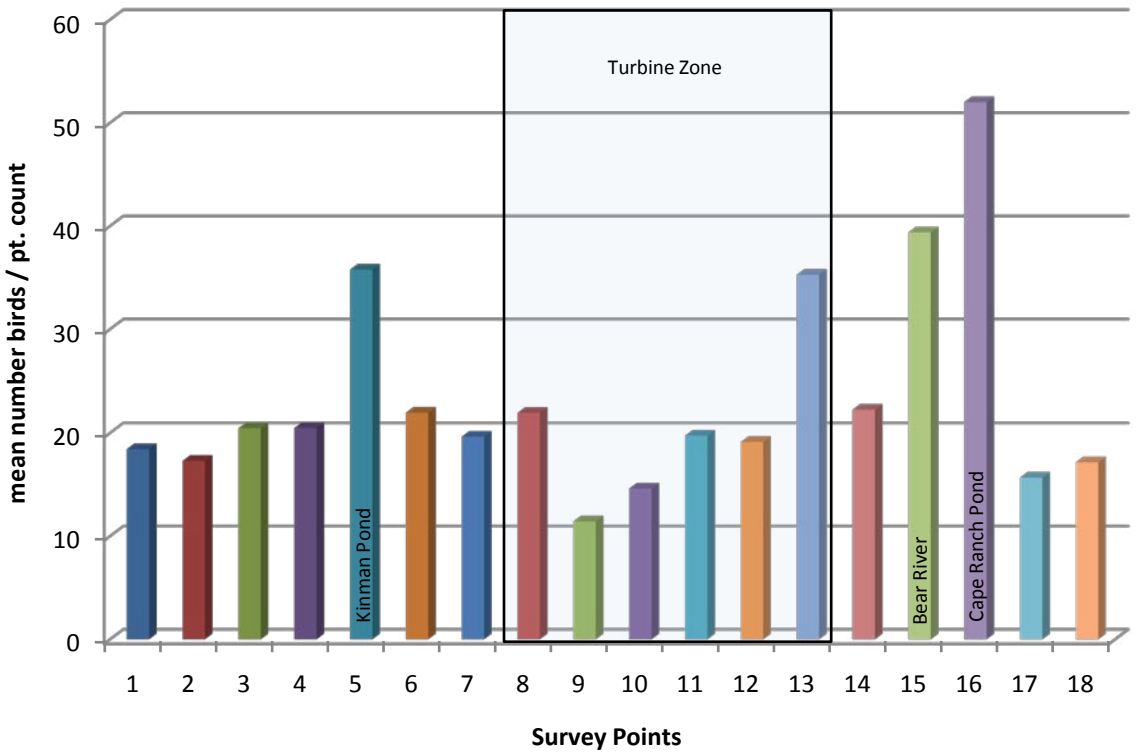




**Figure 11. Mean Avian Use by Survey Point Including European Starling**



**Figure 12. Mean Avian Use by Survey Point Excluding European Starling**





**Table 4. Avian Survey Point Count Location Information**

<b>Station</b>	<b>Easting (UTM/NAD83)</b>	<b>Northing (UTM/NAD83)</b>	<b>Elevation (ft.)</b>	<b>Distance to Forest Edge (m)</b>	<b>Distance to Open Water (m)</b>
1	402520	4478093	2129	154	1938
2	400860	4478278	2296	372	1917
3	399894	4478355	2292	410	1868
4	398476	4479087	2334	69	867
5	397748	4479626	2362	90	50
6	396894	4480775	2473	68	1390
7	396313	4481504	2407	119	1852
8	395399	4482573	2049	32	450
9	393551	4483470	2033	363	1671
10	391266	4484184	2294	221	4100
11	389284	4484511	1758	196	4600
12	387454	4482839	1469	225	3220
13	386122	4481819	1463	162	1430
14	383978	4481786	759	347	1167
15	384174	4480379	36	62	0
16	383407	4479239	705	0	1135
17	383148	4478574	964	335	1872
18	382618	4477333	858	202	3214