Stateline Wind Project Wildlife Monitoring Final Report

July 2001 –December 2003

Prepared for:

FPL Energy
Stateline Technical Advisory Committee
Oregon Department of Energy

December 2004

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Report Reference:

Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final Report, July 2001 – December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

1.0 INTRODUCTION

This report contains comprehensive results of the avian and bat monitoring program conducted at the Stateline Wind Project. Data and results are representative of the Oregon and Washington facilities. Data were collected during the monitoring period: July 2001 through December 2003.

The Stateline Wind Project was developed, constructed, and is operated by FPL Energy Vansycle LLC (FPL Energy). It is located in Umatilla County, Oregon and Walla Walla County, Washington, and was built in multiple phases between the years 2001 and 2002.

The Washington facilities were studied in 1994, 1995, 1999-2001 and analyzed and permitted in 2000 and 2001 under the Walla Walla County conditional use permit process. Subsequently, 273 wind turbine generators (Vestas V47 660-kilowatt [kW]), capable of producing approximately 180 megawatts (MW) were constructed in 2001 (referred to as Washington Stateline 1 area). At the same time, underground collector cables, a substation, and transmission lines that deliver power to the western power grid system were constructed in Washington. In 2002, FPL Energy submitted an application and required environmental analysis data to amend the Walla Walla County Conditional Use Permit to enable the construction of an additional 29 turbines (FPL Energy *et al.* 2002), which were not constructed during the timeframe of the monitoring studies reported in this document.

The Oregon facilities were studied in 1994, 1995, 1999-2001 and initially analyzed and permitted in 2001 using the Oregon Energy Facility Siting Council (OEFSC) site certificate process administered by the Oregon Department of Energy (ODOE). Subsequently, 126 wind turbine generators (Vestas V47 660-kW), capable of producing approximately 83 MW were constructed in 2001 and are located in the Oregon Stateline 1 area. Upon completion, FPL Energy submitted an application to amend the Stateline Wind Project site certificate, requesting authorization to construct an additional 60 wind turbine generators. In 2002, the Stateline Wind Project site certificate amendment (Amendment #1) was granted by OEFSC and FPL Energy constructed 55 of the 60 authorized wind turbine generators. These 60 turbines are referred to as the Oregon Stateline 2 area. A third phase of expansion was permitted and authorized in Oregon in 2003. This project permit was the second amendment (Amendment #2) of the Stateline Wind Project site certificate and is referred to as the Stateline 3 area. The remaining 5 turbines approved within the Oregon Stateline 2 area as well as the turbines in the Stateline 3 area had not been constructed during the time frame of the monitoring studies reported in this document.

Each permitting agency required specific pre-construction studies and impact analyses to meet their standards. There was general consistency among the agencies. The primary objective in the Washington TAC monitoring plan (WWMP) was to “estimate the number of avian and bat fatalities attributable to wind turbine collisions for the entire Project on an annual basis". The primary objectives in the Oregon Wildlife Monitoring Plan (OWMP) were to “determine whether the facility causes significant fatalities of birds and bats and to determine whether the facility results in a loss of habitat quality".

Operational monitoring requirements for wildlife varied slightly in the two plans. However, most components of the monitoring program were conducted in both states including:

- Standardized Carcass Searches (OWMP and WWMP requirement)
- Protocol searches and Incidental Injured Animal/Fatality Discoveries, otherwise described as the Wildlife Response and Reporting System (OWMP and WWMP requirement)
- Carcass Removal Bias Experimental Trials (OWMP and WWMP requirement)
- Observer Detection Bias Experimental Trials (OWMP and WWMP requirement)
- Avian Use Surveys (OWMP and WWMP requirement)
- Burrowing Owl Surveys (OWMP and WWMP requirement)
- Short-eared Owl Surveys (WWMP requirement)
- Raptor Nest Surveys (OWMP and WWMP requirement)

The OWMP had an additional monitoring component that was conducted in Oregon only:

- Grassland Monitoring Transect Surveys (OWMP requirement)

As of December 31, 2003, wildlife monitoring studies in Washington were completed. The Walla Walla County Community Development Department, formerly Regional Planning Department, has accepted the Technical Advisory Committee's[1] (TAC) recommendations that the monitoring effort has fulfilled FPL Energy's permit requirements. However, the TAC remains operative and receives monitoring results collected from the Stateline Wind Project on an annual basis. In Oregon, this report is being submitted to the ODOE for compliance with the conditions in the Stateline Wind Project site certificate. Some components of the study described in this document for the existing turbines are ongoing, including the Wildlife Response and Reporting System (WRRS) for documentation and reporting of incidentally discovered injured animal and bird and bat fatalities, grassland bird displacement studies, and raptor nest monitoring studies. If additional turbines are built, additional monitoring studies will be required (OEFSC 2003). This monitoring report does not include detailed information about previously implemented and ongoing mitigation. Mitigation is discussed in various permit documents administered by the OEFSC and the Walla Walla County Regional Planning Department. For example, some potential turbine locations in saddles of ridges were dropped from consideration due to higher avian collision risk. In addition, habitat improvement projects are underway that will enhance or expand grassland habitat for a variety of wildlife. Temporarily disturbed habitat resulting from construction is being restored and weeds are being controlled.

[1] TAC is a Committee formed to oversee the wildlife monitoring program and to advise Walla Walla County. Members, including the landowners, a County official, a local Audubon representative, Washington Department of Fish and Wildlife, U.S. Fish and Wildlife, and FPL Energy.

2.0 STUDY AREA AND PROJECT DESCRIPTION

The Stateline project area is in a semi-arid environment in the Columbia Basin Province. Precipitation averages 25 to 38 centimeters annually, most of which falls from October through March. Average annual air temperature is 10 to 12 degrees Celsius, and the average frost-free period is 135 to 170 days. It is situated on privately-owned land zoned Exclusive Farm Use in Umatilla County, Oregon and Primary Agriculture in Walla Walla County, Washington. Elevation of the turbine strings ranges from approximately 274 m (900 ft) near turbine string WSB to 533 m (1,750 ft) near the northern portion of the project (Figure 1). The land is currently used for dryland (not irrigated) wheat production and cattle grazing. Wheat is generally grown on a two-year rotation cycle - fields are rested (fallow) in alternation with crop production (seeding, tilling, harvesting). Portions of the Stateline wind-leased lands that were previously farmed have been placed in the Conservation Reserve Program (CRP) during the past twenty years. Some fields have been taken out of the CRP through the various enrollment cycles and these fields are now being grazed. Land cover of the Stateline landscape is a mosaic of large wheat fields, native bunchgrass on deep and shallow soil, non-native mature CRP grassland (crested wheatgrass), and narrow bands of sagebrush along major riparian corridors such as Vansycle Canyon. Trees are very limited in the uplands. Scattered trees (black locust, *Robinia pseudoacacia*) that were planted during early settlement can be found intermittently on dry sites; native trees are limited to moist drainages and consist of willows (*Salix* spp.) and scattered cottonwoods (*Populus* spp.). Wildlife habitat types in the wildlife monitoring study area (search plots, etc.) are described elsewhere in this report.

The wind project consists of 454 Vestas V-47 wind turbines, rated at 660 kW each, with 273 turbines located in Washington and 181 turbines located in Oregon. Turbines are mounted on 50-m (165-ft) tubular steel towers (Figure 2). The rotor diameter of the three-bladed turbines is 47 m (154 ft), resulting in a rotor swept area (RSA) of 1735 m^2. The maximum height above ground to the top of the RSA is 72 m (242 ft). The minimum height above ground to the lower portion of the RSA is 27 m (88 ft) (Figure 2). The V-47 wind turbines operate at wind speeds from 10 to 90 kilometers per hour (kph) (8 to 56 miles per hour [mph]), at a relatively constant (± 10%) speed of 28.5 revolutions per minute (rpm).

Approximately 140 of the wind turbines are lit with obstruction lighting. Turbines located at the end of turbine strings are lit, and typically every fourth turbine within a string is also lit (Figure 1). Each lit turbine is equipped with Honeywell L-865 medium intensity red/white dual lighting, with white strobe during the day (40 flashes per minute), and red flashing at night (20-40 flashes per minute). The red lights also operate during dense fog conditions occurring during the daylight periods.

3.0 METHODS

Detailed protocols have been developed for the monitoring studies and can be found in FPL Energy *et al.* (2001), OEFSC (2001, 2002, and 2003), in Erickson *et al.* (2003a), and in the Stateline Washington TAC meeting minutes and recommendations memos submitted to the Washington permitting agency in 2002 and 2003. The methods are summarized in this report.

3.1 Seasons

This study uses the following dates for defining seasons[2]:

Season	Dates
Spring/Migration	March 16 to May 15
Summer/Breeding	May 16 to August 15
Fall/Migration	August 16 to October 31
Winter	November 1 to March 15

3.2 Avian and Bat Fatality Study

This section describes methods for the various components of the avian and bat fatality study, including methods for standardized search plot delineation and sampling design, carcass searching, carcass removal and observer detection trials, fatality estimation, and the Wildlife Response and Reporting System (WRRS) consisting of reporting incidental finds and FPL Energy protocol searches of a sample of turbines (see section 3.2.6).

3.2.1 Standardized Search Plots

The original study design called for carcass searching at turbines and permanent guyed meteorological towers. However, turbine locations were the focus of carcass searches on standardized search plots because all permanent meteorological towers were subsequently designed to be unguyed structures, eliminating avian mortality due to collision with wires, and the need to search these structures for casualties. Bird mortality at a tall unguyed monopole structure is expected to be extremely low, but not necessarily zero.

Turbine search plots were rectangular in shape and typically contained three turbines, but some contained one, two, or four turbines (Figure 1, Figure 3, Appendix A1 – A4 and Appendix B1 - B3). Plot boundaries were delineated a minimum distance of 63 meters from the turbines. Stateline 1 turbine towers are typically spaced slightly over 70 m apart within a string. The survey plot boundary extended to the center point of the turbines adjacent to the survey turbine. Stateline 2 turbine towers were approximately 105 m apart, so a smaller portion of the area around adjacent turbines was sampled in this case. The area of a typical three-turbine plot was approximately 0.3 hectares (0.8 acres). The sampling design used in 2001-2002 and in 2003 for standardized carcass searches is described below.

3.2.1.1 Standardized Carcass Search Sampling Design, 2001-2002

The sampling framework for the 2001 and 2002 standardized searches consisted of 399 (273 in Washington, 126 in Oregon) turbines that were in operation by January 1, 2002 in the Stateline Wind Project. Turbine plots representative of the entire project area were systematically selected and surveyed in Washington (20 plots, 60 turbines) and Oregon (21 plots, 64 turbines) (Appendix A-1 and A-2, Figure 1). Approximately 13 hectares (33 acres) were surveyed during each search period[3], with approximately 7 hectares (17 acres) in Oregon and 6 hectares (16 acres) in Washington. The 20 plots in Washington comprised approximately 27%[4] of the

[2] Carcass removal studies often overlapped seasons

[3] Based on calculations of the total area within 63 m of the sampled turbines.

[4] Approximate sampling fractions based on calculations of the total area within 63 m of all turbines.

possible search area in Washington and the 21 plots in Oregon comprised approximately 58%[4] of the possible search area in Oregon.

Construction for the Washington portion of the project started in late summer 2001. A total of 292 turbine searches[5] were conducted in Washington from late July through December 31, 2001 (Table 1 and Appendix B-1). Not all plots were searched an equal number of times because some of the turbine strings and circuits were still being constructed and tested before being fully operational during this period. Standardized searches on the Oregon sample of turbine plots began in January 2002 shortly after all Oregon turbines became operational; 1162 and 1176 turbine searches[5] were conducted in Oregon and Washington, respectively, between January 1 and December 2002 (Appendix B-2).

3.2.1.2 Standardized Carcass Search Sampling Design, 2003

The sampling framework for the 2003 standardized searches consisted of 454 (273 in Washington, 181 in Oregon) turbines that were in operation by January 1, 2003 in the Stateline Wind Project (Stateline 1 and 2 Facility). Turbine plots representative of the entire project area were systematically selected and surveyed in Washington (20 plots, 60 turbines) and Oregon (30 plots, 93 turbines) (Appendix A-3 and A-4, Figure 1). The 2003 plots were different than those surveyed in 2001 and 2002. Approximately 40 acres were surveyed during each search period[3], with approximately 24 acres in Oregon and 16 acres in Washington. The 20 plots in Washington comprised approximately 27%[4] of the possible search area in Washington and the 30 plots in Oregon comprised approximately 57%[4] of the possible search area in Oregon. Approximately 1,779 and 1,250 turbine searches[5] were conducted in Oregon and Washington, respectively, between January 1 and December 2003 (Table 1 and Appendix B-3).

3.2.2 Standardized Searches

Personnel trained in proper search techniques ("the searchers") conducted standardized carcass searches by walking parallel transects. Searches were conducted within rectangular search plots with the long axis of the plot centered on the turbine string. All area within a minimum of 63 meters from turbines was searched. Transects were set at 6 meters apart in the area to be searched. Searchers walked at a rate of approximately 45 to 60 meters per minute along each transect searching both sides out to three meters for casualties. All fatalities that meet one of the following criteria were included in the fatality estimates, unless cause of death was determined not to be wind project related:

- Intact – a carcass that is completely intact, is not badly decomposed and shows no sign of being fed upon by a predator or scavenger
- Scavenged – an entire carcass that shows signs of being fed upon by a predator or scavenger, or portions of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.)
- Feather Spot – 10 or more feathers at one location indicating predation or scavenging

[5] If a plot contains 3.5 turbines and was searched 3 times, the number of turbine searches would be reported as 10.5

Some casualties that were discovered and used in fatality rate estimation may not be wind project-related because cause of death could not be determined. Natural mortality and predation occurs, but the level of this background mortality in the project area was not studied. Including non-project-related casualties in calculations for fatality estimates may contribute to overestimation of project-related fatality rates. For data reporting and analysis, the turbine nearest the fatality was assumed the turbine responsible for the fatality.

3.2.3 Observer Detection Bias Experimental Trials

The objective of observer detection bias experimental trials[6] is to estimate the percentage of actual bird and bat fatalities that searchers are able to find. These trials were conducted in the same area in which standardized searches occurred in both grassland/shrub-steppe and cultivated agriculture habitat types. Trials were conducted in each season of each monitoring year. Estimates of observer detection rates were used to adjust the number of carcasses found, correcting for detection bias. Each season, approximately 10 bird carcasses of two size classes (20 total carcasses) were distributed at plots classified into one of two habitat types (grassland/shrub-steppe and cultivated agriculture).

Personnel conducting searches did not know when trials were scheduled, but became aware once a trial bird was found. Personnel were not aware of how many trial carcasses were placed within a search plot. Before the beginning of a standardized search, observer detection trial carcasses were placed at random locations. Each non-domestic carcass was discreetly marked so that it could be identified as a searcher efficiency trial carcass after it was found. The number and location of trial carcasses found during the standardized search were recorded. The number of efficiency trial carcasses available for detection during each trial was determined immediately after the trial by the person responsible for distributing the carcasses, since scavengers may have removed trial birds before searches were conducted.

3.2.4 Carcass Removal Bias Experimental Trials

The objective of carcass removal bias experimental trials[7] was to estimate the length of time avian and bat carcasses remain in the search area before being removed by scavengers or other means. Carcass removal studies were conducted during each season each monitoring year in the vicinity of the search plots. Estimates of carcass removal were used to adjust carcass counts for removal bias. "Carcass removal" was the disappearance of a carcass from the search area due to predation, scavenging, or other means such as farming activity.

Field crews periodically placed trial carcasses in the project area and monitored them over time to assess scavenging and removal rates. A variety of species were used in the trials. Trial carcasses were removed from a freezer 8 to 24 hours prior to start of the trial.

Planted carcasses were not placed in standardized search plots being searched that year because they might be confused with wind turbine-related fatalities, especially if these trial carcasses

[6] Observer detection bias trials are often referred to as searcher efficiency trials.

[7] Carcass removal trials are often referred to as scavenging bias trials, since most carcass removal is done by scavengers (wild or feral domestic). However, removal could also be due means other than scavengers (e.g., farming activities)

were scavenged (e.g. feathers spread out). Most of the planted carcasses were placed at turbines not searched, with a few placed near the standardized search plots but not within the plots. The planted carcasses were located randomly within the carcass removal trial plots (random distance and direction from turbine, or random location within plot). Each season within each monitoring year, approximately 10 bird carcasses of two size classes (20 total carcasses) were distributed in each of two general landcover types (grassland/shrub-steppe and cultivated agriculture). In the fall of 2003, one bat carcass removal trial was conducted using 7 fresh bat carcasses (4 hoary bats and 3 silver-haired bats).

3.2.5 Statistical Methods for Fatality Estimates

The estimate of the total number of wind facility-related fatalities is based on:

(1) Observed number of carcasses found during standardized searches during the 2002 and 2003 monitoring years for which the cause of death is either unknown or is probably facility-related.

(2) Searcher efficiency expressed as the proportion of planted carcasses found by searchers during the entire survey period

(3) Non-removal rates expressed as the estimated average probability a carcass is expected to remain in the study area and be available for detection by the searchers during the entire survey period

3.2.5.1 Definition of Variables

The following variables are used in the equations below:

- c_i the number of carcasses detected at plot i for the study period of interest (e.g., one year) for which the cause of death is either unknown or is attributed to the facility
- n the number of search plots
- k the number of turbines searched (includes the turbines centered within each search plot and a proportion of the number of turbines adjacent to search plots to account for the effect of adjacent turbines on the 63-meter search plot buffer area)
- $\bar{c}$ the average number of carcasses observed per turbine per year
- s the number of carcasses used in removal trials
- s_c the number of carcasses in removal trials that remain in the study area after 40 days
- se standard error (square of the sample variance of the mean)
- t_i the time (days) a carcass remains in the study area before it is removed
- $\bar{t}$ the average time (days) a carcass remains in the study area before it is removed
- d the total number of carcasses placed in searcher efficiency trials
- p the estimated proportion of detectable carcasses found by searchers
- I the average interval between searches in days
- $\hat{\pi}$ the estimated probability that a carcass is both available to be found during a search and is found
- m the estimated annual average number of fatalities per turbine per year, adjusted for removal and observer detection bias

3.2.5.2 Observed Number of Carcasses

The estimated average number of carcasses ($\bar{c}$) observed per turbine per year is:

$$\bar{c} = \frac{\sum_{i=1}^{n} c_i}{k}. \quad (1)$$

3.2.5.3 Estimation of Carcass Removal

Estimates of carcass removal are used to adjust carcass counts for removal bias. Mean carcass removal time ($\bar{t}$) is the average length of time a carcass remains at the site before it is removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}. \quad (2)$$

This estimator is the maximum likelihood estimator assuming the removal times follow an exponential distribution and there is right-censoring of data. In our application, any trial carcasses still remaining at 40 days are collected, yielding censored observations at 40 days. If all trial carcasses are removed before the end of the trial, then s_c is 0, and $\bar{t}$ is just the arithmetic average of the removal times. For the bat trial, carcasses were monitored every day for 20 days. Removal rates were estimated by carcass size (small and large) and season.

3.2.5.4 Estimation of Observer Detection Rates

Observer detection rates (i.e., searcher efficiency rates) are expressed as *p,* the proportion of trial carcasses that are detected by searchers. Observer detection rates were estimated by carcass size and season.

3.2.5.5 Estimation of Facility-Related Fatality Rates

The estimated per turbine annual fatality rate (m) is calculated by:

$$m = \frac{\bar{c}}{\hat{\pi}}, \quad (3)$$

where $\hat{\pi}$ includes adjustments for both carcass removal (from scavenging and other means) and observer detection bias assuming that the carcass removal times t_i follow an exponential distribution. Data for carcass removal and observer detection bias were pooled across the study to estimate $\hat{\pi}$. Under these assumptions, this detection probability is estimated by

$$\hat{\pi} = \frac{\bar{t} \cdot p}{I} \cdot \left[\frac{\exp\left(I / \bar{t} \right) - 1}{\exp\left(I / \bar{t} \right) - 1 + p} \right].$$

This formula has been independently verified by Shoenfeld (2004). The amount of data collected in 2001 at individual plots varied depending on when turbines became operational. Some plots were only surveyed once in late winter, while a few plots were searched up to 8 times between July and December 2001. Due to the variation in effort in 2001, and the effects of

seasonal differences in fatality rates, standardized estimates do not include the 2001 fatality data. Standardized fatality estimates were calculated for 2002, 2003, and the average of the two years. The potential effects of omitting the 2001 data from annual estimates of fatality rates are quantitatively and qualitatively reviewed in the discussion section. The report summarizing results from July 2001 through December 2002 did include the 2001 data in overall fatality rate calculations (Erickson et al. 2003a).

Fatality estimates were calculated for: (1) all birds, (2) small birds, (3) large birds, (4) raptors, (5) grassland birds, (6) nocturnal migrants, and (7) bats. The final reported estimates of *m* and associated standard errors and 90% confidence intervals were calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. For each iteration of the bootstrap, the plots were sampled with replacement, trial carcasses were sampled with replacement, and $\bar{c}$, $\bar{t}$, p, $\hat{\pi}$, and m were calculated. A total of 5,000 bootstrap iterations were used. The reported estimates are the means of the 5,000 bootstrap estimates. The standard deviation of the bootstrap estimates is the estimated standard error. The lower 5th, and upper 95th percentiles of the 5000 bootstrap estimates are estimates of the lower limit and upper limit of 90% confidence intervals.

Differences in observed nocturnal migrant and bat fatality rates for lit turbines, unlit turbines that are adjacent to lit turbines, and unlit turbines that are not adjacent to lit turbines were compared graphically and statistically.

3.2.6 Wildlife Response and Reporting System (WRRS)

FPL Energy's Stateline WRRS is a monitoring program set up to search for, report, and handle avian and bat casualties found by maintenance personnel. A description of this system and associated data forms used for the Stateline Wind Project is found in FPL Energy (2003). This system includes systematic searches ("WRRS protocol searches") of a turbine sample set ("WRRS protocol search plots", Appendix C) conducted by FPL Energy maintenance personnel. The WRRS also reports and documents fatalities discovered incidentally. These incidental finds may include fatalities discovered by maintenance personnel, contractors, or by others (e.g., project biologists) during field activities other than carcass searching. Incidental carcass finds that were found on standardized search plots were included in the fatality rate estimation.

No WRRS searches were conducted in 2001. Appendix C-1 contains a list of turbines that were searched ("protocol searches") in 2002 by FPL Energy on a quarterly basis using the Stateline WRRS protocol. The WRRS protocol search plots are different from and in addition to the standardized search plots. Casualties discovered incidentally by maintenance personnel or others (project biologists during other activities) were reported and documented with the WRRS. Appendix C-2 lists the turbines that were searched in 2003 using the WRRS protocol.

3.3 Avian Use Surveys and Incidental Wildlife Observations

Prior to or immediately after each standardized carcass search, observers recorded birds detected in a ten-minute period at a station. Stations were established at each standardized search plot using standard variable circular plot point count survey methods. Surveys were conducted at

various times during daylight hours. The first avian use survey was conducted the first week in August 2001, approximately when the Washington monitoring commenced.

3.4 Raptor Nest Surveys

In addition to the pre-construction surveys, aerial surveys for raptor nests were conducted by helicopter after construction in 2002 of Stateline 1 (Oregon and Washington), and also in 2003 after construction of both Stateline 1 (Oregon and Washington) and 2 (Oregon only). The objectives of raptor nest surveys were to estimate the size of the local breeding populations of some raptor species in the vicinity of the facility and to determine whether operation of the facility resulted in a reduction of nesting activity or nesting success in the local populations of "target raptor species": Swainson's hawk, ferruginous hawk, golden eagle and prairie falcon.

During surveys, information was gathered on nesting species in the study area including nest locations, timing, and success (if possible to determine). Surveys were conducted within an 8-km buffer (5-mile) of Oregon and Washington Stateline 1 turbines in 2002 and within a 3-km buffer (2-mile) of Stateline 1 and 2 turbines in 2003. The reduced survey area was agreed upon by the permitting agencies and the TAC. Two helicopter aerial surveys were conducted in 2002 and one survey was conducted in 2003. The first survey in 2002 was conducted between May 5 and 17, and the second survey was conducted between June 8 and 28. Aerial surveys in 2003 were conducted between May 6 and June 17. In addition to aerial surveys, ground surveys were also conducted during 2002 and 2003 for active ferruginous hawk and Swainson's hawk nests within 3 km (2 miles) of Stateline 1 and 2 turbines. This survey information was used to quantitatively and qualitatively assess impacts on local nesting populations and to direct mitigation efforts.

All potential raptor nests[8] were recorded, regardless of whether they were occupied. Notes were taken on the presence of adults, eggs, chicks, and fledglings. Nest structure type and other details were recorded. Nest sites were considered active during the first survey if adult birds were observed perched or flying near the nest but nest contents were not visible. Breeding pairs are defined as incubating adults, eggs, chicks, or fledglings perched at the nest. A few nests in Oregon were flown twice in 2003 because activity status was impossible to determine from the ground. Nest site locations are withheld from this report due to the sensitivity of the data.

3.5 Burrowing Owl Surveys

Burrowing owl surveys were conducted in 2002 and 2003 to document the presence of this species during the nesting season and the location of the burrowing owl activity in relation to turbine locations. The objectives were to estimate the size of the local breeding population in the vicinity of the facility and to determine whether operation of the facility results in a reduction of nesting activity or nest success in the local burrowing owl population. In 2002, burrowing owl survey methods varied between Oregon and Washington due to permitting agency requirements and differences in pre-construction baseline survey efforts. In 2003, as agreed upon by the Washington TAC, surveys in Washington followed Oregon methods.

In Washington, surveys during 2002 were conducted within 305 m (1000 ft) of turbines that were located in suitable habitat. In 2003, surveys were conducted within suitable habitat in

[8] Stick nests or eyries potentially capable of supporting nesting large birds.

association with the fatality monitoring plots. In both years, historic nest sites located outside the search plots (including the sites first discovered in 2002) were checked for activity.

In Oregon, surveys were conducted during the breeding seasons of 2002 and 2003 in suitable habitat associated with the fatality monitoring plots. Two surveys for burrowing owls were conducted in both states between June 16 and August 8 in both years. Taped burrowing owl vocalizations were played to detect response calls within and adjacent to the survey areas. Historic nest sites and habitat within 100 m of previously documented nest burrows were checked for use a minimum of two days between March 4 and August 13 as required in the OEFSC permit. Most of the first surveys were conducted by April 15 and most of the second surveys were conducted by June 17. Newly discovered 2003 active sites were also checked a minimum of two times between March 4 and August 13.

Other portions of the project area were also surveyed for other field studies being conducted during the same monitoring study period (2001-2003). New burrowing owl activity areas were recorded when discovered during those studies.

3.6 Short-eared Owl Surveys

Driving surveys along roads associated with the Stateline turbines in Oregon and Washington were conducted once during the breeding season of 2002 to document short-eared owl presence in the study area. As agreed upon by the Washington TAC, no formal short-eared owl surveys were conducted in 2003, but observations of the species were recorded while monitoring crews were on-site conducting other monitoring tasks throughout the year. In 2002, surveys were conducted on April 11 and 17 between 1600 hrs (4:00 p.m.) and darkness. Approximately 34 km (21 miles) of project roads were surveyed in 6.5 hours; most roads were traveled twice during the survey (ingress and egress). Surveys were conducted at driving speeds between 8 and 16 kph (5 and 10 mph). While accessing facility roads via public roads (Hatch Grade and Dorran Rds.), surveyors looked for short-eared owls as well.

3.7 Grassland Bird Displacement Surveys

A total of 20 transects were monitored both pre-construction (2001) and after commercial operation (2002) in Oregon at Stateline 1 turbines to estimate displacement impacts, if any exist, to grassland nesting songbirds adjacent to wind turbine strings. Transects 300 m in length were located in suitable grassland habitat and were oriented perpendicular to the turbine string. Additional transects were established and monitored in 2003 at locations where turbines have been permitted in Oregon but have not yet been built. Surveys will also be conducted in 2006 at the 20 Stateline 1 transects. If any Stateline 3 turbines are built, surveys will be conducted for an additional breeding season at the 20 Stateline 1 transects and six Stateline 3 turbines in 2008. Each transect was visited three times during the breeding seasons of 2001 and 2002. These searches were conducted between mid-April and late June. Observers recorded observations of grassland/steppe avian species within 50 m of both sides of the transect. Numbers of individual birds of each species were recorded for each transect segment.

A qualified observer walked the pre-established transects and recorded detections of grasshopper sparrows, long-billed curlews, and other grassland/steppe avian species that were either seen or

heard. The approximate distance along the transect is recorded for each detection, and the habitat type is recorded for each 50-m segment of the transect (6 segments).

A gradient analysis (Morrison *et al.* 2001) was used to determine the relationship between density of grassland/steppe avian species and distance from turbines. A "gradient analysis" assesses whether a significant or a biologically substantial relationship exists between distance from project structures and abundance or use of the area. The differences between grassland bird use during the post-construction period and pre-construction period are calculated for each 50-m segment away from the turbines. The averages of these differences for each 50-m segment are compared using *t*-tests and 95% confidence intervals.

3.8 Incidental Wildlife Observations

Additional observations of wildlife species of interest (e.g., raptors, bird and mammal species not previously documented, uncommon species) were recorded while conducting other surveys or while in-transit within the Project area and are presented in table format in section 4.9.

4.0 RESULTS

This section summarizes results of Stateline monitoring in Oregon and Washington for data collected between July 2001 and December 31, 2003. Standardized fatality estimates are based on the two complete years of study (January 1 2002 – December 31, 2003).

4.1 Bird Casualty Finds

Bird fatalities observed between July 2001 and December 31, 2003 are listed in Appendix D. Since July 2001, 232 bird fatalities comprising 35 identified species were found, with 210 associated with standardized search plots. In Washington, 92 fatalities were observed on standardized search plots, and 19 fatalities were reported incidentally off search plots. In Oregon, 118 fatalities were observed on standardized search plots, and 3 fatalities were reported incidentally off search plots. Bird fatalities on standardized search plots were found near 144 different turbines (i.e. closest turbine to fatality). The maximum number of fatalities found at any one turbine during searches in a monitoring year was 4 fatalities found closest to turbines BGC16 and BGB19 (Table 2). The average distance of bird casualties (calculated for all 232 records) to the nearest turbine was 36 m (Figure 4).

Horned larks comprised 38.6% of the fatalities on search plots (81 fatalities, Table 3, Figure 5). Golden-crowned kinglet (20 fatalities), ring-necked pheasant (18), western meadowlark (12), chukar (7) and gray (Hungarian) partridge (7), were the next most common species of fatalities (Table 3, Figure 5). Passerines comprised 75.2% of the fatalities (158), 50.0% of which were considered resident (105) and 25.2% of which were considered migrants (53, Figure 5). Upland gamebirds (15.2%, 32 fatalities) was the only other group with more than 10% of reported fatalities. Some of the fatalities may not be turbine- or facility-related, including many of the upland gamebird fatalities. It is suspected that vehicles, raptors, and other predators could have been the cause of death for some of the gamebird, meadowlark and horned lark fatalities.

Migrant passerine casualties comprised 25.2% of mortality on search plots (Figure 5) and included golden-crowned kinglet (20 fatalities), white-crowned sparrow (5), yellow-rumped warbler (4), winter wren (4), house wren (3), dark-eyed junco (3), golden-crowned sparrow (3), savannah sparrow (2), vesper sparrow (2), American pipit (1), house finch (1), MacGillivray's warbler (1), red-breasted nuthatch (1), red-winged blackbird (1), ruby-crowned kinglet (1) and Swainson's thrush (1). Using the 2002 and 2003 fatalities, approximately 20% of the migrant passerine mortality occurred in the spring, and approximately 80% occurred in the fall.

During the two and one-half year study period, 17 raptor carcasses were found, 13 of which were found in standardized search plots. Fourteen of the 17 raptors were of two species; red-tailed hawk (9 fatalities) and American kestrel (5 fatalities). The other 3 fatalities included a ferruginous hawk, Swainson's hawk, and short-eared owl. The short-eared owl was found incidentally beneath a fence more than 100 m from a turbine in 2001. It was unclear whether this fatality was turbine-related. The ferruginous hawk was an adult bird and was found on July 18, 2003 near turbine HGM13 in Oregon. The nearest active ferruginous hawk nest was approximately 0.8 km (0.5 mile from HGM13). This nest had successfully fledged 2 young in 2003. It is not known if the fatality was an adult from this nest. The Swainson's hawk was also an adult and was found on August 12, 2002 nearest to turbine HGA9. The nearest known active Swainson's hawk nest was over 3 km (2 miles) northwest of HGA9. Five of the red-tailed hawks were considered juveniles, 2 were adults, and age could not be determined for the remaining 2 (feather spots). Two of the kestrels were considered adults and age could not be determined for the 3 kestrel feather spots.

In 2002, 4 of 6 raptor fatalities on standardized search plots were discovered on string HGA. The other two fatalities were located at two other strings (HGH and WSA). A fire that burned Hatch Grade Canyon (located Northwest of Washington Stateline) and adjacent slopes may have increased prey availability (e.g., pocket gophers and deer mice) and increased raptor use. There were also some relatively large groups of raptors observed in the project area in early September 2002. For example, on September 6, 2002, a large kettle (group) of Swainson's hawks (approximately 25) was observed near string HGB soaring on thermals. On September 3, a group of 7 red-tailed hawks and a group of 7 Swainson's hawks were observed hunting in agriculture fields near HGA in conjunction with active field cultivation. In 2003, no raptor fatalities were found at HGA. In 2003, 3 of 7 raptor fatalities were discovered on the string BGB, with the other 4 fatalities located at 4 different strings (HGJ, HGS, HGM, HGL). All 3 were American kestrels, with fatalities observed in May, June, and July. No raptor fatalities were discovered in 2002 at BGB.

Fatalities reported in 2002 and 2003 were found throughout the year, but rates appeared lowest in the winter and highest in October during fall migration (Figure 6). When considering all birds, fatalities do not appear strongly localized and have been found throughout the wind project (Figure 7). Raptor fatalities have been observed primarily in the summer and early fall (Figure 6), with no fatalities in the winter months. All raptor fatalities in 2002 occurred in the Washington portion of the project area (8 fatalities), while all raptor fatalities in 2003 occurred in the Oregon portion of the project (8 fatalities, Figure 8). However, one injured (and successfully rehabilitated) raptor was found in Oregon in 2002, and the one short-eared owl fatality found near the fence was found in 2001.

None of the bird species found is listed as Federal or State Threatened or Endangered. One grasshopper sparrow and one ferruginous hawk were found in Oregon and both these species are listed in Oregon as a State Sensitive status species (Table 3).

4.2 Bat Casualty Finds

Bat fatalities observed between July 2001 and December 31, 2003 are listed in Appendix E. During this period, 150 bat fatalities were found, 128 of which were found on standardized search plots. Of the 128 bats, silver-haired bats comprised 50.0%, hoary bats comprised 46.1% and little and big brown bats each comprised less than 2 perecent (Table 4 and Figure 9). These fatalities were found near 100 different turbines (i.e. closest turbine to fatality, Figure 10). The maximum number of fatalities found at any one turbine during searches was 4 fatalities found closest to turbine PB30 (Table 5). The average distance from bat casualties to the nearest turbine was 19 m (Figure 4).

The 150 bat carcasses were examined to determine age and gender, if possible. Aging and sexing of fatalities followed criteria in Anthony (1988) and Racey (1988). For hoary bats, 68 % were adults, 28 % were juveniles, and 4% were unidentified to age. For silver-haired bats, 60% were adults, 36% were juveniles, and 4% were unidentified to age. Fewer bats were in good enough condition to determine gender. Of the 32 hoary bats where sex could be determined, 53% were males and 47% were females. Of the 18 silver-haired bats where sex could be determined, 83% were males and 17% were females.

Bat fatalities reported in 2002 and 2003 were found primarily during fall, an apparent migration period for hoary and silver-haired bats, with mortality peaking during September (Figure 11). Peak mortality of silver-haired bats appeared to be earlier than hoary bats. Bat fatalities were observed throughout the wind project (Figure 10).

None of the bat species found are Federal or State Threatened or Endangered. Silver-haired bats were found in both Oregon and Washington and this species is listed as an Oregon Sensitive status species (Table 4).

4.3 WRRS Casualty Finds

WRRS casualty finds (from protocol searches and incidental finds by FPL Energy and other contractors) that were not found on standardized search plots are listed in Appendix D-3 and E-3.

4.3.1 Birds

Thirty bird fatalities (12 horned larks, 5 red-tailed hawks, 2 white-crowned sparrows, 2 gray partridge, 2 ring-necked pheasants, 2 European starlings, 1 Canada goose, 1 white-throated swift, 1 chukar, 1 golden-crowned kinglet, and a short-eared owl feather spot) were found incidentally or during a WRRS protocol search and reported between July 2001 and December 2003 (Appendix D-3). In 2002, an injured Swainson's hawk was found and was successfully rehabilitated and released. The short-eared owl feather spot was found 103 meters from the nearest turbine at the base of a fencepost along a barbed wire fence in 2001. It is not clear from this evidence if this was a turbine-related fatality. It was 38 m outside the formal search area. During the 2.5-year period, two red-tailed hawks, 4 horned larks, 1 European starling, and 1 ring-

necked pheasant were found incidentally (not during a scheduled search) within a standardized carcass search plot (Appendix D-1 and D-2). These fatalities contributed to estimation of annual bird fatality rates.

4.3.2 Bats

Twenty-seven bat fatalities (13 hoary bats, 11 silver-haired bats, 1 big brown bat, and 2 unidentified bats) were also reported incidentally or found during a WRRS protocol search between July 1, 2001 and December 2003 (Appendix E-3). Five of the incidental finds (2 silver-haired bats, 1 hoary bat, 1 big brown bat, and an unidentified bat) were discovered on standardized search plots (Appendix E-1 and E-2). Most incidental finds were discovered by FPL Energy personnel or contractors and were reported using the WRRS. WRRS fatalities found on the standardized search plots were included in estimation of annual bat fatality rates.

4.4 Observer Detection Bias Experimental Trials

A total of 156 medium/large and 171 small trial carcasses were used in detection trials, representing approximately 40 different species. In 2001, two trials were conducted in both the fall and winter season. In 2002, two trials were conducted in the winter, spring and summer seasons each and three trials were conducted in the summer. In 2003, five trials were conducted in the winter, three trials were conducted in the summer and two were conducted in both the spring and fall. Overall, observers detected 78% of the medium/large carcasses and 42% of the small carcasses (Table 6). Detection rates for large birds were slightly higher in cultivated agriculture (86%) than in grassland (71%), whereas detection rates for small birds were similar in cultivated agriculture (39%) and grassland (43%). In agriculture, detection rates were lowest in the summer for both large birds (68%) and small birds (28%). In grassland, detection rates were highest in the winter for both large birds (83%) and small birds (48%).

4.5 Carcass Removal Bias Experimental Trials

In 2001, one trial was conducted in both the fall and winter (winter trial started in 2001 and ended in 2002). In 2002 and 2003, two trials were conducted in both the spring and fall, and three trials were conducted in both the summer and winter. Scavenging and carcass removal data for 430 carcasses representing over 40 different bird species were recorded. Mean removal time is estimated at 35.7 days (31.0, 41.4)[9] for large birds and 16.7 days (14.7, 19.0)[9] for small birds. For large birds, 62.4% remained until day 14 of the trial, 45.5% remained until day 30, and 34.2% were still present on day 40 of the trial (Table 7, Figure 12). For small birds, 43.3% remained on day 14, 17.1% lasted until day 30, and 11.5% of small birds remained until day 40 of the trial.

Seven bat carcasses that were fresh when collected during standardized searches were monitored on a daily basis for 20 days in the fall of 2003. The mean time to removal was 16.5 days. and 29% of the carcasses (2) were remaining on day 20 (Figure 13). Results of the bat scavenging study were not used in the adjusted estimates of bat fatalities due to small sample sizes.

[9] upper and lower limits of 90% confidence intervals (bootstrapping)

4.6 Fatality Estimates

Fatality estimates, standard errors, and confidence intervals for: (1) all birds, (2) small birds, (3) large birds, (4) raptors, (5) grassland birds, (6) nocturnal migrants, and (7) bats are found in Table 8 and Figure 14. Estimates, standard errors and confidence intervals were calculated from bootstrap distributions. These fatality estimates are adjusted for carcass removal and observer detection bias. Fatality estimates extrapolated to the entire Stateline Facility (454 turbines) are presented for some bird groups, bird species and bat species in sections 4.6.4 (raptors), 4.6.5 (grassland birds), 4.6.6 (nocturnal migrants) and 4.6.7 (bats). Based on the average number of days between searches, the estimated average probability a small bird casualty will remain until a scheduled search and will be found is 0.275 (0.241, 0.327)[10]. The estimated average probability a large bird casualty will remain until a scheduled search and will be found is 0.660 (0.612, 0.693)[10]. Estimates extrapolated to the entire facility (454 wind turbines) for some species and taxonomic (e.g., grassland birds) and migrant groups (e.g., nocturnal migrants) are provided in sections 4.6.4 – 4.6.7.

4.6.1 Small Birds

One hundred fifty small bird fatalities were observed on search plots between January 1, 2002 and December 31, 2003. Small bird fatality estimates were approximately 21% lower in 2003 compared to 2002 (Figure 14). The estimated number of small bird fatalities per turbine per year and associated 90% confidence limits for the Stateline Wind Facility using the two complete years of study is 1.70 (1.33, 1.96)[10] (Table 8). Horned larks and golden-crowned kinglets were the most commonly observed fatalities with estimated fatality rates of 0.89 and 0.20 per turbine per year respectively.

4.6.2 Large Birds

Fifty large birds were observed on search plots between January 1, 2002 and December 31, 2003. Large bird fatality estimates were approximately 18% higher in 2003 compared to 2002 (Figure 14). The estimated number of large bird fatalities per turbine per year and associated 90% confidence limits for the Stateline Wind Facility using the two complete years of study is 0.23 (0.17, 0.29) [10] (Table 8).

4.6.3 All Birds

The fatality estimate for all birds was obtained by summing the estimates for small and large birds. All-bird fatality estimates were approximately 17% lower in 2003 compared to 2002 (Figure 14). Estimated bird fatalities and associated 90% confidence limits for the Stateline Wind Facility using the two complete years of study is 1.93 bird fatalities per turbine per year (1.56, 2.20)[10] (Table 8). Three European starlings, which are not protected under the Migratory Bird Treaty Act, were included in the estimate. By excluding the starlings, our estimate is approximately 1.89 bird fatalities per turbine per year. The estimated number of bird fatalities per turbine per year at plots located in cultivated agriculture ranged from 1.67 in 2002 to 2.13 in 2003, yielding a two-year average of 1.90 fatalities per turbine per year. The estimated number of bird fatalities per turbine per year at plots located in grassland habitats ranged from 2.32 in 2003 to 1.65 in 2003, yielding a two-year average of 1.98 fatalities per turbine per year.

[10] upper and lower limits of 90% confidence intervals (bootstrapping)

4.6.4 Raptors

Thirteen raptor casualties were discovered on standardized search plots between January 1, 2002 and December 31, 2003. Raptor fatality estimates were approximately equal in 2002 and 2003 (Figure 14). The estimated number of raptor fatalities per turbine per year and associated 90% confidence limits for the Stateline Wind Facility using the two complete years of study is 0.060 (0.028, 0.099)[11] (Table 8), resulting in an estimated 27 raptor fatalities per year for the entire facility (454 wind turbines). Based on composition of observed fatalities, red-tailed hawks and American kestrels are estimated to comprise over 80% of the total average annual raptor fatalities. In 2001 no raptors were recorded on search plots. In 2002, all raptor fatalities that were observed on standardized search plots were found in Washington, while in 2003 all were observed in Oregon.

4.6.5 Grassland Birds

Between January 1, 2002 and December 31, 2003, 131 grassland bird casualties[12] were observed on the standardized search plots. Grassland bird fatality estimates were approximately 18% lower in 2003 compared to 2002 (Figure 14). The estimated number of grassland bird fatalities per turbine per year and associated 90% confidence limits for the Stateline Wind Facility using the two complete years of study is 1.28 (0.98, 1.62)[11], or approximately 580 per year for the entire facility (454 wind turbines). The highest fatality rate for individual grassland bird species is horned lark (0.89 fatalities/turbine/year, 400/year for the 454 wind turbines), followed by ring-necked pheasant (0.13 fatalities/turbine/year, 60/year) and western meadowlark (0.11 fatalities/turbine/year, 50/year). No other single species is estimated to comprise more than 5% of grassland bird fatalities. By eliminating non-native upland gamebirds, grassland bird fatality estimates are 1.10 per turbine per year based on the two complete years of study.

4.6.6 Nocturnal Migrants

Forty-nine likely nocturnal migrant songbird fatalities[13] were observed on the standardized search plots between January 1, 2002 and December 31, 2003. Nocturnal migrant fatality estimates were very similar among years (Figure 14). The estimated number of nocturnal migrant fatalities per turbine per year and associated 90% confidence limits for the Stateline Wind Facility using the two complete years of study is 0.55 (0.39, 0.68), or approximately 250 per year for the entire facility (454 wind turbines). Golden-crowned kinglets were the most common nocturnal migrant observed, with total estimates per year of 90 per year for the entire facility. Most of the migrant passerine fatalities (approximately 80%) occurred in the fall.

4.6.7 Bats

One hundred and three bat fatalities (including three that were found injured and died later) were observed on search plots between January 1, 2002 and December 31, 2003. Bat fatality estimates in 2003 were approximately two times higher than in 2002 (Figure 14). Adjustments for observer detection bias and removal bias for bats were made using the estimates for small

[11] upper and lower limits of 90% confidence intervals (bootstrapping)

[12] Includes all grassland nesting birds including upland gamebirds, as well as casualties identified as "unidentified bird", "unidentified passerine", "unidentified sparrow"

[13] Includes all nocturnal migrant passerines, as well as casualties identified as "unidentified bird", "unidentified passerine", "unidentified sparrow". Spring and fall season horned lark and meadow lark casualities were not included as "migrants" because it was not known if the individual bird was a year-round resident in the Stateline project or a migrating individual nesting elsewhere and passing through Stateline.

birds, although the one fall trial using seven bat fatalities suggests scavenging rates may be similar or lower than for small birds (Figure 10 and 11). The estimated number of bat fatalities per turbine per year and associated 90% confidence limits for the Stateline Wind Facility using the two complete years of study is 1.12 (0.84, 1.35)[14] (Table 8 and Figure 14), resulting in an estimated 500 bat fatalities per year for the entire facility. Silver-haired (250/year for the 454 wind turbines) and hoary bats (230/year for the 454 wind turbines) are estimated to comprise most of the fatalities.

4.7 Lighting Effects and Other Analyses

Observed nocturnal migrant and bat fatality rates for lit turbines, unlit turbines that are adjacent to lit turbines, and unlit turbines that are not adjacent to lit turbines were similar ($p>0.10$, Figure 15). Pearson correlations were calculated among the all bird, bat, and nocturnal migrant fatality rates by plot. The largest observed correlation ($r=0.31$) was between bats and nocturnal migrants, but none of the associations were statistically significant ($p>0.10$). This analysis suggests the locations of bird fatalities in general, and nocturnal migrants are not strongly associated with the locations of bat fatalities in the Stateline Wind Project.

Fatality rates were calculated by turbine string to investigate relationships between location within the wind project and bird and bat fatality rates (Figure 16). Relatively low variation in bird fatality rates among strings was observed for all birds combined, with no apparent outliers (very high or very low rates). Higher variation was observed in bat fatality rates among strings with no bat fatalities observed at three turbine strings and two strings with fatality rates approximately 2.5 times higher than the mean. It cannot be confirmed whether specific factors associated with these five strings are the cause of perceived lower or higher bat mortality, or if it is random chance. One of the strings with a higher bat fatality rate, BGC, is located in the southeast corner of the project area at a lower elevation (approximately 350 feet) than the HGA string, also with a higher bat fatality rate, which is located in the northern portion of the project site.

4.8 Avian Use Surveys

A standard 10-minute point count survey was conducted in conjunction with each carcass search. Approximately 1,600 counts were conducted between August 2001 and December 2003. Results of the surveys are reported in Tables 9-12. These data provide information on the species composition and levels of diurnal use of the project site. Fifty species were identified during the point counts at the Stateline Project Site (Table 9, August 2001 – December 2003).

4.8.1 Avian Use and Frequency of Occurrence by Species

A total of 5,125 individual bird detections within 2,429 separate groups of birds were recorded from August 2001 through December 2003 (Table 10) during the point count surveys. Slightly over 81% of the observations were of horned larks, western meadowlarks, Canada geese, and common ravens. All other species comprised less than 5% of the observations.

[14] upper and lower limits of 90% confidence intervals (bootstrapping)

Mean use estimates (number of birds/10-minute survey) were calculated (using detections within 800m of each point) by species (Table 11). Canada goose (0.141/survey), common raven (0.097), red-tailed hawk (0.040), gray partridge (0.039), chukar (0.034), northern harrier (0.022), ring-necked pheasant (0.015), mallard (0.015), Swainson's hawk (0.014), rough-legged hawk (0.013), and American kestrel (0.010) were the large bird species with the highest overall use. The small bird species with the highest use were horned lark (1.649), western meadowlark (0.334), European starling (0.041), and white-crowned sparrow (0.018). Horned lark, western meadowlark, and common raven were the only species observed on more than 5% of the surveys.

4.8.2 Avian Use by Seasons and Groups

Passerines were the most abundant group with 86.0% of the observations, while all other groups each comprised less than 7% of the observations (Figure 17).

Passerines - Passerines were the most abundant avian group observed during all seasons (Figure 18). Passerines showed higher abundance in the summer (2.833) compared to spring (2.239), fall (2.266) and winter (1.680).

Raptors - Raptor use was second highest to passerines in the spring (0.143) and summer (0.129), third to passerines and upland gamebirds in the fall (0.085) and third to passerines and waterfowl in the winter (0.104) (Figure 18). Raptors made up less than 5% of avian use (Figure 17).

Waterfowl/Waterbirds - The majority of waterfowl/waterbird use occurred in the winter, and consisted primarily of several groups of Canada geese. A large group of American white pelicans (40) was observed outside the 800-m view shed during the summer. In the spring, a large group of unidentified gulls (30) was also observed outside the 800-m view shed.

4.9 Incidental Wildife Observations

A total of 1,007 individual bird detections within 223 separate groups were recorded incidentally from August 2001 through December 2003 (Table 12). Over 64% of the observations were of American pipits, sandhill cranes, and Canada geese, but they only made up 3% of the groups. All other species comprised less than 8% of the observations. Red-tailed hawks and Swainson's hawks were the most frequently observed raptors.

A total of 170 mammal detections within 101 groups were recorded incidentally (Table 12). Washington ground squirrels, white-tailed jackrabbit, and mule deer made up 87% of the observations.

A total of 10 reptile detections were recorded including 7 northern pacific rattlesnakes, 2 yellow-bellied racers, and a gopher snake (Table 12).

4.10 Raptor Nest Surveys

Burrowing owl nesting activity is described in a section 4.11 below. No golden eagle or prairie falcon nests were observed in the survey area during the 2002 and 2003 aerial surveys and none were documented prior to construction (FPL Energy and CH2M Hill 2000, FPL Energy 2001). Table 13 provides summary results for the 2001 pre-construction and the 2002-2003 post-

construction surveys. Three buteo species were documented – red-tailed, ferruginous and Swainson's hawk. A very similar number of active buteo nests was observed in 2001 prior to completion of construction compared to 2002 within 8 km (5 miles, 30 nests versus 32 nests) and within 3 km (2 miles, 11 nests versus 12 nests) of the Stateline 1 turbines (Table 13). In 2003, the enlarged survey buffer (inclusive of Stateline 1 and 2 turbines) added one additional buteo nest site that was located outside of the original Stateline 1 2001 and 2002 3 km (2 mile) buffer. There were a similar number of active buteo nests from 2001 (before most of the construction occurred) through 2003 within 3 km (2 miles) of the turbines; the largest number of active nests for all buteo species combined were observed in 2003.

One ferruginous hawk nest in Washington and three in Oregon were monitored from the ground to determine their success. These nests occurred within two miles of Stateline 1 and Stateline 2 turbines (Table 14). The nest in Washington was active and successfully fledged young in 2001 and 2002, but vandals shot both adult birds in 2003 early in the nesting season. Similar vandalism was periodically documented in a two-county area of eastern Oregon from 1997 through 2003. This was reported to the state and federal wildlife enforcement agents and an investigation is on-going. One historic ferruginous hawk nest in Oregon that was successful in 2001 and 2002 was used in 2003 by great-horned owls. The second nest was active all three years and was successful in 2001 and 2003 but not in 2002. The third nest was not active in 2001 but was active and successful in 2002 and 2003.

Two Swainson's hawk nests were monitored from the ground in 2001 and 2002 (Table 14). One historic nest in Oregon (#82, active intermittently since 1988) was active but not successful in 2001 or 2002. In 2003 the old nest was repaired by Swainson's hawks but was later abandoned. In 2001, 2002, and 2003 a common raven nested nearby, possibly impacting the pair of Swainson's (interactions between the species were noted by field biologists). In addition, the historic nest tree has been dying for several years, resulting in weak branches and weak nest support. The other nest within 3 km (2 miles, #11) monitored in 2001 and 2002 was not active in 2003. It was active in 2001 but later abandoned and did not produce young. In 2002 it was not active. The nest showed sign of having recent repair in 2003, and an adult Swainson's hawk was near the nest early in the season, but the nest was not used. Great-horned owls were observed in the area and nested nearby.

Three additional nests were located within the 2-mile buffer area in 2003. One new Swainson's hawk nest was found in Washington approximately 3 km (2 miles) from the nearest turbine, near an historic Swainson's hawk nest site. It was successful (fledged young), but the number of young successfully fledged could not be confirmed due to difficulty in accessing the site from the ground. Two new Swainson's hawk nest sites were found in Oregon within 3 km (2 miles) of the turbines; one having been used by ferruginous hawks several years prior (#150, Kronner, field notes 1987-1996). Table 14 describes proximity to turbines for the two new nests. Nest #139 was constructed by Swainson's hawks and had some activity early to mid-season but was later abandoned. Nest #150 was active and successfully produced two young but just prior to fledging, one young and one of the adults were found dead from gunshots. Both were found on the ground under the nest. This was reported to the state and federal wildlife law enforcement agents and an investigation is on-going.

In summary, nesting by sensitive raptor species and common buteo raptor species after construction of Stateline 1 and 2 was slightly higher than the year prior to construction. Species have shifted locations somewhat over the monitoring period. As of 2003, sensitive species are still nesting in the area at approximately the same levels. Common ravens are somewhat more abundant than noted historically (K. Kronner, pers. comm) prior to construction and one new nest was discovered. In 2003 vandals reduced the number of successful ferruginous hawk nests and reduced the number of young fledged at one Swainson's hawk nest from two potentially fledged to one fledged.

4.11 Burrowing Owl Surveys

Monitoring of nesting burrowing owls consisted of conducting surveys in habitat near turbines and checking historic nest sites, some not located near the turbines (Section 3.5). Table 15 displays the active sites documented prior to the first monitoring year in 2002 and includes new sites discovered during the monitoring or during other on-site activities.

In 2002, five historic burrowing owl nest sites initially discovered in 2001 or earlier were checked for activity (two in Washington, three in Oregon). One of two historic nest sites in Washington was active again in 2002 (ID 1, Table 15). A complex of three burrows was located 112 m (367 ft) from turbine HGF-1. It was not possible to determine if there were one or two breeding pairs. Ten birds were seen on June 16 in 2002, and most were juveniles. The other historic nest site in Washington was approximately 400 m (1,300 ft) east of turbine string PB along a closed farm road (ID 3). The specific burrows were not active in 2002, but a new site (a different complex of burrows) with three burrows was found in 2002 just south of this historic site. Two adults were observed there during the June 19, 2002 survey; none were observed July 1, 2002. In Oregon, three historic nest sites were checked. One of the three sites was active. A new active site was discovered in 2002 during pre-construction surveys for the Stateline expansion (FPL Energy 2002). The site was very near (396 m [1,300 ft]) one of the two, inactive historic sites.

In 2002 two new active burrowing owl nest sites were found during surveys in Washington. On June 23, a new site was found with observations of one adult and one juvenile at one new burrow located approximately 180 m (587 ft) from turbine HGH-9 (ID 4, Table 15). One owl (age unknown) was detected at a nearby new burrow located 229 m (752 ft) from turbine HGH-9. Three (unknown age) owls were observed at the same site (but not at the same burrow) during the second survey conducted on July 9. The other new site (burrows) was found on June 26 approximately 111 m (365 ft) from HGC-14 (ID 5). One adult was observed. Two adults were observed at the same site during the second survey conducted on July 5. Due to the limited survey corridor size it is not known if the birds were present in the adjacent landscape in previous years.

In 2003 no new burrowing owl nest sites were located while conducting the surveys in and adjacent to the fatality monitoring plots. Two historic nest sites and the new 2002 nest sites were checked. One of these sites (111 m, 365 ft from HGF-1) that had been active since 2000 could not be confirmed as active in 2003 (ID 1, Table 15), but several active burrows (likely two pairs of owls) were discovered within 299 m (980 ft) of the original site (ID 2). The other historic nest site located 488 m (1,600 ft) east of turbine string PB that was active prior to construction but not

during the 2001-2002 construction/operations period was active in 2003 (ID 3), as well as a nearby nest site that was first discovered in 2002. Further north, near a project access road, approximately 2 km (1.25 miles) from the nearest turbine, a new active nest site was discovered (ID 6).

In Oregon, one historic nest site that was last active in 1999 (prior to construction) remained inactive in 2003 (ID 7, Table 15). A coyote den was noted in the nearby area. Another site that was active in 2001 during construction of an underground electrical line 1.6 km northwest of turbine string BGB was not active in 2002 or 2003 (ID 8). A nearby nest site first discovered in 2002 was not active in 2003 (ID 9). However, two nest sites were discovered within approximately 400 m (1300 ft) of the 2002 nest site in 2003; one was abandoned due to some grassland (CRP) tilling (ID 10), the other successfully produced young (ID 11). Another new nest site was discovered within 305 m (1,000 ft) of BGB-16 while conducting walking transects for presence of Washington ground squirrels (ID 12). Further east, a nest site active in 2001 and 2002 was active again in 2003 (ID 13).

Sample sizes for statistically determining impacts to burrowing owls are limited. Based on this limited information, burrowing owl nesting activity appears to have continued at similar levels for at least two years after construction of Stateline 1 and 2 compared to the year prior to construction, with some apparent natural shifts in nest site locations independent of the facility and its associated human activity.

4.12 Short-eared Owl Surveys

In 2002 no owls were detected during project surveys. A project site security guard said he observed short-eared owls flying from areas near turbine strings HGE and HGF over Hatch Grade Road west to turbine string HGG. Three short-eared owls were observed while biologists conducted other monitoring tasks. Observations were recorded near turbines WSA-45, WSB-58, and HGJ-44 in the May-June period in grassland.

In 2003, two short-eared owls were observed on March 7 between turbine strings BGB and WSB. This is near where one was seen during the pre-construction surveys conducted in 2002 (FPL Energy 2002).

4.13 Grassland Bird Displacement Surveys

Table 16 contains the mean number of observations recorded during pre-operation and during the first year of operation for four species (grasshopper sparrow, horned lark, savannah sparrow, and western meadowlark) and for all grassland passerines combined. Grassland species combined had very similar overall use estimates in the pre and post-construction periods (0.578 observations/survey to 0.583 observations/survey). Two species had estimated increases in use during the post-construction period (horned lark and savannah sparrow) while the other two species showed decreases (grasshopper sparrow and western meadowlark). Only grasshopper sparrow had a statistically significant change[15] ($p<0.10$), with a decrease in use of approximately 40% (0.139/5,000 m^2 to 0.083/5,000 m^2) in 2002.

[15] Two-tailed test on the difference between pre- and post-construction use.

Based on preliminary data, grassland passerines as a group showed a statistically significant decline ($p<0.10$) in use in the first 50-m sub-segment (Table 17 and Figure 19); 0.717/survey versus 0.300/survey. Estimates of grassland passerine use during the breeding season were similar before and after construction in the other sub-segments. Grasshopper sparrows and western meadowlarks showed a significant decrease in use within the first 50 m of the turbines (Table 17, Figures 19 and 20), although sample sizes were very low for grasshopper sparrows. Grasshopper sparrow use was low in the second sub-segment pre-construction (0.083/survey) but since no grasshopper sparrows were observed during the operational surveys in the second sub-segment, the effect was considered statistically significant. Horned lark displacement was not apparent.

Transects were located in areas where construction impacts were expected to be as minimal as possible, yet typical for a wind project. However, on average approximately 25 m of the first 50 m of the transect (50% of the first sub-segment) is currently disturbed either permanently (road and turbine pad) or temporarily by the road shoulder, underground trenching between turbines, or other activities. It is believed reduced use in the first two 50-m subsegments by grasshopper sparrow and in the first subsegment by western meadowlark, is due mostly to temporarily and permanently disturbed habitat near the turbines. Although temporarily disturbed areas were reseeded, this revegetation is not likely to produce similar habitat to pre-construction conditions for several years.

These preliminary results suggest a relatively small-scale impact of the wind facility on grassland passerines, with a large portion of the impact due to the direct loss of habitat from turbine pads and roads and temporary disturbance of habitat between turbines and road shoulders. The level of displacement to grassland birds from the development of the Stateline wind facility and its associated operations will be further elucidated after future surveys are conducted. These surveys are scheduled to be conducted in 2006 and will provide a better understanding of the effects of revegetation on the temporarily disturbed areas and the potential habituation of the bird species to the turbines.

5.0 SUMMARY/DISCUSSION

5.1 Assumptions

The 2001 fatality data were not included in the calculation of fatality estimates because of difficulty in incorporating the highly variable search efforts within a portion of two seasons (fall and winter). The 2001 data was included in calculations of the fatality estimates in the 2001-2002 annual report (Erickson et al. 2003a), and contributed to the lower annual fatality estimate in that report. The overall mortality estimates for raptors would also be less if 2001 data were included, since no raptor fatalities were observed in search plots in 2001. Reasonably consistent data (7 or 8 searches) were gathered at six plots from August through December 2001 (Appendix B-1). At these six plots, 6 bird (all small) and 19 bat carcasses were observed. Using this very limited information from six months of data collection, 2001 bird fatality rates would be less than the average of the estimates from 2002 and 2003. Estimated bat fatality rates would be higher than the average of the estimates from the 2002 and 2003, based on the limited information collected in 2001.

All bird casualties observed within standardized search plots in 2002 and 2003 were included in the fatality estimates. True cause of death is unknown for most of these fatalities. Several of the horned lark fatalities are suspected to be caused by vehicles (e.g., vehicles from wind turbine maintenance personnel, other vehicles) and not by wind turbines, given the locations of the finds near public and private roads. There is likely some background[14] mortality that is included in the fatality rate estimates. An unknown number of the fatalities likely are caused by other factors not related to the wind facility (e.g., caused by raptors, coyotes, and long-tailed weasels). No comparable background information on natural fatality rates is known for the Stateline Wind Facility.

A few wind project studies have provided information on background mortality. During a four-year study at Buffalo Ridge (Minnesota), 2,482 fatality searches were conducted on study plots without turbines to estimate reference mortality in the study area, and 31 avian fatalities comprising 15 species were found (Johnson *et al.* 2000). Reference mortality consisted of eight upland gamebirds, seven doves, five sparrows, three waterfowl, three raptors, two blackbirds, one waterbird, one shorebird, and one unidentified bird. The exact cause of death of many birds found in reference plots could not be determined; however, most appeared to have been caused by predators or vehicles. Reference mortality was estimated to average 1.1 fatalities per plot per year, compared to 0.98, 2.27, and 4.45 fatalities per turbine search plot per year in the Phase 1, 2 and 3 wind plants, respectively (Johnson *et al.* 2000). Some pre-project carcass searches were conducted at a proposed wind project in Montana (Harmata *et al.* 1998). Three bird fatalities were found, two presumed raptor kills and another from an unknown cause during 8 searches of 5 transects, totaling 17.61 km per search. On average, approximately 5.6 km of transect is searched within every three-turbine search plot at Stateline. Therefore, the amount of transect searched at the Montana site per search was equivalent to searching approximately 9 turbines at Stateline. The background estimate for observed mortality would be approximately 0.33 per turbine plot per year, which is unadjusted for scavenging and searcher efficiency. This

[14] fatalities that were caused by factors unrelated to the Stateline Wind Project (e.g., predator kills, farm equipment collisions)

background mortality information from Minnesota and Montana suggest that the estimates of bird fatality rates likely include some avian fatalities not related to turbine collision, and this factor alone would lead to an over-estimate of true avian collision mortality at wind plants. However, avian behavioral changes after a wind facility is built (e.g., avoidance) are not calculated into the background fatality estimates at Buffalo Ridge and Montana.

No adjustments were made for fatalities possibly occurring outside of the rectangular plot boundaries. Plot boundaries were established a minimum distance of 63 m from the turbines and can extend up to 94 m at the end of the strings (Figure 3). This search plot distance was selected based on results of other studies (Higgins *et al.* 1996) where this distance appeared to capture a very large percentage of fatalities at turbines of similar sizes. Based on the distribution of fatalities as a function of distance from turbines (Figure 4), a small percentage of bird fatalities likely were located outside the search plots and would have been missed. The distribution of bat fatalities at this site (Figure 4) and at other sites (e.g., Erickson *et al.* 2003b, Johnson *et al.* 2003a, Kerlinger and Kerns 2004) suggest bat casualties are located closer to turbines than bird casualties. This factor alone would lead to an underestimate of bird and to a lesser extent of bat fatality rates. Neither this factor, nor a factor for reference or background mortality, was accounted for in the fatality estimates.

The carcass removal and observer detection trial carcasses are believed to be reasonably representative of actual fatalities and the protocol for the carcass removal trials are designed to simulate actual fatalities as much as possible. It would be preferred to use "fresh" trial carcasses that have not been frozen in carcass removal trials, although this is not practical. Rock doves and hen pheasants comprised most of the moderate to large sized birds used in the trials. Game bird chicks and house sparrows represented most of the small birds. Native bird carcasses that meet suitability criteria for trials were used when available. They were obtained from local wildlife rehabilitators and state agencies or were collected as road-kills (all authorized with permits). The trial carcasses were frozen; most were in the freezer for less than 6 months. The carcasses were left at room temperature for approximately 8 to 24 hours before the trial began. Ravens were observed in a few cases following the technicians who were placing carcasses for searcher efficiency and carcass removal trials. In a few instances, these trial carcasses were removed very quickly by these scavengers. This visual cue by scavengers has the potential to bias carcass removal rates, and lead to subsequent bias in fatality rates. In future carcass removal studies when ravens and other scavengers are cueing in on personnel who are placing trial carcasses, carcasses should be placed randomly before daybreak to reduce or eliminate this source of bias.

In most fatality monitoring studies, including Nine Canyon (Washington) and Stateline, small birds were used to represent bats for carcass removal. In a few studies, very fresh bat carcasses (estimated to die the previous night) were available for use in some trials (Johnson *et al.* 2003a). These two studies suggest similar to lower scavenging rates on bat carcasses compared to small bird carcasses; however, sample sizes were low, especially at Stateline, and the bat trial carcasses, although believed to have died within the past 24 hours, may have had characteristics slightly different from a fresh bat carcass that could influence attractiveness to scavengers. Research regarding this issue is being coordinated by Bat Conservation International at two wind energy facilities in the eastern U.S., with participation by WEST Inc. (Erickson et al. 2004a).

For this study, bird carcass removal data from the entire study period was used for bats, since the overall mean removal time estimate (16.7 days) was very similar to the estimates for the fall (17.0 days) when the majority of the bat fatalities occurred.

Carcass removal rates at the Stateline Wind Project were low relative to most other wind projects, including Buffalo Ridge, Minnesota, Foote Creek Rim, Wyoming, and Nine Canyon, Washington (Erickson *et al.* 2003b), and were similar to the nearby Vansycle Wind Project (Erickson *et al.* 2000). Observer detection rates for the Stateline Facility were similar to rates at the Vansycle Wind Project (Erickson *et al.* 2000). Potential variation in carcass removal rates should be considered when designing mortality studies.

5.2 Bird Fatality Estimates

The overall bird fatality rate observed at Stateline (1.93 per turbine per year based on average of 2002 and 2003 estimates [Table 8]) is slightly lower than the average bird fatality rates reported for new generation wind projects in the U.S. (2.11 per turbine per year, Erickson *et al.* 2004b). Fatality estimates on a per turbine basis may be misleading when comparing different wind energy projects, since turbine sizes vary among projects. For example, the Vestas V-47 turbines at Stateline are 0.66-kW turbines with a rotor swept area of approximately 1735 m^2. In comparison, the turbines at Nine Canyon are 1.3-MW turbines with a rotor swept area of 3019 m^2. Fatality estimates for smaller turbines may be less per turbine than for larger turbines, but this may be misleading since it would take more small turbines to generate the same amount of electricity. Therefore, to better account for differences in turbine size and output, other metrics have been proposed (Erickson et al. 2004b, Smallwood and Thelander 2004). One such metric for comparing fatality rates among sites is on a per MW capacity output per year. Using this metric, the Stateline bird fatality estimate per MW capacity per year (2.9) is slightly below the average for new generation wind projects in the U.S (3.05, Erickson *et al.* 2004b), and within the range reported for sites in the Columbia Basin and Rocky Mountain region (Figure 21). Bird fatality estimates at new projects have been fairly consistent, with the possible exception of the Buffalo Mountain Tennessee site (Figure 21). The OWMP stated "The certificate holder shall calculate the "all birds" estimate and the "small birds" estimate for all species and, separately, for only those species protected by law". In this case, "protected by law" means species protected under the Migratory Bird Treaty Act and upland gamebirds protected under state law. Three European starlings, which are not protected under the MBTA or other regulations, were included in the Stateline fatality estimate. By excluding these, the fatality estimate for the Stateline Wind Project for all other birds would be approximately 1.89 fatalities per turbine per year or 2.8 fatalities per MW capacity per year. By excluding these three European starlings, small bird fatality estimates would be 1.65 fatalities per turbine per year or 2.5 fatalities per MW capacity per year.

5.3 Relative Risk of Collision and Species Impacts

Fatality rates alone do not provide information on what species are most susceptible to collision. Comparing the ratio of % composition of fatalities to relative abundance among species is useful for understanding the relative risk of collision with turbines of individual species (Anderson *et al.* 1999). Species commonly observed during avian use surveys but infrequently found as a fatality may be considered less susceptible to collision. Species commonly observed as a fatality, but infrequently observed during avian use surveys may be considered more susceptible

to collision. Species that are commonly observed as a fatality may also be commonly observed during avian use surveys. Some example species that fall into these different "susceptibility" categories are discussed below. Nearly 40% of bird fatalities observed on search plots were composed of horned larks, a very common yearlong resident songbird, and over half of the bird observations from point counts were horned larks. This suggests that horned larks are the most commonly found fatality and fatality rates appear in proportion to their abundance. Horned larks are year-round residents from southern British Columbia east to southern Manitoba, south along the west coast of the United States to Mexico, and to the east coast. Horned larks are one of the most common birds observed in the Columbia Plateau, which is the Breeding Bird Survey (BBS) physiographic province between the Rocky Mts. and the Cascade Range in Washington, Oregon, Idaho, and Nevada (Sauer *et al.* 2003). Crudely extrapolating BBS data collected in the Columbia Plateau, similar to the approach used in Bart (2004 in press), it is estimated that approximately 10,000,000 to 20,000,000 million horned larks exist within the Columbia Plateau. Based on observations over several years in the Stateline wind facility area, the numbers fluctuate somewhat from season to season, and in winter they are commonly observed in larger flocks than in spring or summer. No other individual species comprised more than 10% of the fatalities.

The next most abundant fatality, golden-crowned kinglet, does not breed in the vicinity of the Stateline project, and was not observed during diurnal avian use surveys. This species likely was migrating through the project area at night. This songbird nests primarily in coniferous forests and is often found in dense stands of spruce and fir trees. The golden-crowned kinglet breeds in Alaska, Canada, and mountains of the Pacific Northwest and Rocky Mountain region. This species winters in southern Canada, throughout the United States (excluding southern Florida), and south to Central America. During the avian baseline study conducted in 1994-1995 for the Vansycle and Stateline wind projects (FPL Energy *et al.* 2001) golden-crowned kinglets were not observed in the Oregon or Washington Wind Resource Area where point counts were conducted during the one-year study but they were observed during spring and fall while surveyors were in-transit to and from the avian plots. In Oregon, they were observed along access roads in canyons where more trees and shrubs provide cover for migrating birds.

There are also a few species, including common ravens and rough-legged hawks, that were commonly observed during avian use surveys but no fatalities were observed, suggesting these species may be less susceptible to collision. Common ravens do not appear very susceptible to collision with wind turbines in other studies as well (Erickson *et al.* 2002). Rough-legged hawks are one of the most common wintering raptors at most new generation wind projects studied in the Pacific Northwest (Erickson *et al.* 2002), but we are aware of only one fatality at a new generation wind project.

5.4 Raptor Fatalities

The thirteen raptor fatalities[15] observed on the standardized search plots equated to an overall estimate of 0.06 raptor fatalities per turbine per year for the project. If the limited search effort in 2001 had been included, the estimates would be lower, since no raptor fatalities were observed on search plots. This rate was very consistent between the 2002 and 2003 monitoring years, although composition of fatalities differed among years. Four of the five American kestrels were found in 2003, while 6 of the 9 red-tailed hawks were observed in 2002. Four additional raptor fatalities were found at turbines not searched and were documented using the WRRS. Nine of the 17 raptor fatalities were observed in Washington, all in 2001 and 2002, and the other eight raptor fatalities were found in Oregon, all in 2003. Seven of the thirteen raptor fatalities found on standardized search plots were found along two strings: HGA and BGB. However, no raptors were found on HGA in 2003 and no raptors were found at BGB in 2002. It is unclear if the perceived higher mortality at HGA and BGB in one of two years are due to factors related to that location, location and year, or to random chance.

A single adult ferruginous hawk fatality was detected on July 18, 2003 near turbine HGM13 in Oregon. The nearest active ferruginous hawk nest was approximately 0.8 km (0.5 miles) from HGM13. This nest was within 342 m (1122 feet) of turbine string HGK. This nest had successfully fledged two young in 2003. It is not known if the fatality was an adult from this nest. A single Swainson's hawk fatality, also an adult, was detected on August 12, 2002 near turbine HGA9. The nearest known active Swainson's hawk nest was over two miles northwest of HGA9. It is not possible to determine if these fatalities were local breeding birds or post-breeding transients from another region. The red-tailed hawk fatalities were a mixture of juvenile and adult birds, while the American kestrel fatalities were adults. Future nest monitoring of the target raptor species (Swainson's hawks and ferruginous hawks) will provide information on whether nests, especially those nearest the wind project, continue to be occupied.

Burrowing owls successfully nested in close proximity to turbines and no fatalities were observed during the study. Recent studies at the Altamont Pass WRA in California documented a high incidence of burrowing owl fatalities at older generation small turbines (Smallwood and Thelander 2004). Burrowing owl nest densities at the Altamont have not been measured, but the species is commonly observed residing within the WRA near turbines (Smallwood and Thelander 2004). Smallwood and Thelander (2004) suggest repowering the Altamont Pass WRA with larger taller turbines might greatly reduce burrowing owl fatalities. This information and our limited information at Stateline suggests burrowing owl collision risk at the Stateline wind facility and other new generation wind energy facilities may be lower than collision risk for smaller turbines such as those at the Altamont. The cause of the perceived differences in collision risk is unknown, but related factors may include clearance area below turbine blades and other characteristics. Repowering (replacing old turbines with new larger turbines) is currently being implemented at a limited scale within the Altamont Pass, and monitoring will provide more direct measures of the differences in risk between new and old turbines.

[15] Eleven were found during standardized searches, and two were found on a standardized search plot but not during a scheduled search (reported incidentally)

5.5 Nocturnal Migrants and Lighting

Tall lighted structures are suspected of attracting nocturnal migrating birds, especially during inclement weather (Kerlinger 2000). Lighting at communication towers is typically different than lighting at wind turbines. Communication towers commonly have more than one light location on a tower, while wind turbines have only one location for the light (on top of the nacelle, see FAA circular on lighting). Communication towers often have one red pulsating or flashing light on the top of the tower, and several solid red lights at various heights. Communication tower lighting may be more of an attractant than wind turbine lighting (Kerlinger 2003), but research and data are limited.

Nocturnal migrant and bat fatality rates for lit turbines, turbines adjacent to lit turbines, and other unlit turbines were compared. Observed fatality rates at lit turbines were slightly higher than at unlit turbines, although none of the differences were statistically significant ($p>0.10$). Based on this information, it is unlikely that lights on Stateline turbines attracted large numbers of birds or bats during this study. Similar results were found at the Nine Canyon wind project (Erickson *et al.* 2003b), which has the same lighting characteristics (red-flashing at night) but on larger and taller turbines than Stateline turbines. The Buffalo Ridge wind project (Johnson *et al.* 2002) showed a similar result for turbines similar in size to Stateline, although lighting types differ (solid red incandescent). Turbines in Phase I of the Buffalo Ridge wind project were not lit. Phase II of the project had approximately every other turbine lit (approximately 70 of 143 turbines) with solid red lights. Six of the 138 Phase III turbines along the outer boundary of the site were lit with solid red lights.

Several factors may be the cause for this lack of an association between lighting and fatalities at this location and the other locations. The height of the turbines and rotors (74 m, 242 ft) are below the heights of tall communication towers associated with large fatality events, and no large single mortality event has been reported at a wind project. Only two small events have been reported. At Buffalo Ridge in Minnesota, fourteen migrating passerine fatalities (vireos, warblers, flycatchers) were found at two turbines during a single night in May 2002 (Johnson *et al.* 2002), with one of the turbines lit and the other unlit. Approximately 25 to 30 migrating passerine fatalities (mostly warblers and vireos) were observed near three turbines and a well-lit substation at the Mountaineer wind project in West Virginia during a foggy night (Kerlinger and Kerns 2004). The data suggest that sodium vapor lamps at the substation were the primary attractant, since fatality locations were correlated with the location of the substation, and the other turbines away from the substation had few fatalities documented the morning after the event. After the lights were turned off at the substation, no events occurred. Research is currently being conducted at some communication towers in Michigan to test the effect of lighting on migrant bird mortality (Gehring pers. comm. 2004).

Some studies and observations have documented migrating birds being attracted to structure lights, especially during inclement weather, apparently leading to large mortality events at tall communication towers. Light type (solid, flashing, strobe), color (red, white), and intensity (low, medium, high) may be important factors in the attractiveness to birds, but these factors are not well understood. Solid colored, high intensity lights may be more attractive to migrating birds than other types (Manville pers. comm.). Lighting of turbines at wind projects has varied, and is

dictated by FAA requirements for a particular location. Some wind projects with turbines taller than 61 m (200 ft) have not been required to light turbines (e.g., Foote Creek Rim).

5.6 Grassland Bird Displacement

Preliminary results suggest a relatively small-scale impact of the wind facility on grassland nesting passerines, with a large portion of the impact due to direct loss of habitat from turbine pads and roads and temporary disturbance of habitat between turbines and road shoulders. Small-scale displacement impacts to grassland nesting birds have been documented in two other studies (Leddy *et al.* 1999, Johnson *et al.* 2000). The level of displacement of grassland birds by development of the Stateline wind facility and its associated operations will be further elucidated after future surveys are conducted. Although temporarily disturbed areas were reseeded, this revegetation is not likely to produce similar habitat to pre-construction conditions for several years. Additional grassland bird displacement data collected in 2006 and possibly in 2008 will provide better information on impact levels and causes (e.g., loss of habitat or displacement from turbines and vehicles). Several other studies of indirect impacts to grassland songbirds are on-going at proposed and existing wind projects in Colorado (Ryder pers. comm.), North Dakota (Shaffer and Johnson 2003), South Dakota (WEST 2004), and Montana (Erickson and Hazelwood 2004), and these should provide a better understanding of impacts, including estimation of effects for several individual species.

5.7 Raptor Nesting and Owl Use

Nesting by sensitive raptor species and common buteo raptor species after Stateline 1 and 2 were constructed was slightly higher than the year prior to construction. Species shifted locations somewhat over the monitoring period. Based on extensive monitoring using helicopter flights and ground observations, sensitive species still nested in the area at approximately the same levels. Burrowing owls were present in similar locations to those documented during pre-construction investigations. New nest sites were discovered in the wind facility after construction, though some of these were likely natural fluctuations of site selection within the landscape. Short-eared owls were not a common species detected during the pre-construction surveys or after construction within and adjacent to the wind facility. A few were found during supplementary wildlife surveys conducted after construction.

5.8 Bat Fatality Estimates

The overall bat fatality rate for Stateline (1.12 per turbine per year) is below the average bat fatality rates reported for new generation wind projects in the U.S. (1.5 per turbine per year). Similarly, the Stateline bat fatality estimate per MW capacity per year (1.7) is below the average rate for new generation wind projects in the U.S. (2.1) and is within the range reported for the sites in the Pacific Northwest and the West (Figure 22). Bat fatality estimates at new projects are more variable (Figure 22) than bird estimates, with the highest estimates occurring at sites in the east (Nicholson 2003, Kerlinger and Kerns 2004).

Species composition was similar to composition at other sites in the Pacific Northwest (Johnson *et al.* 2004). Only one bat casualty (silver-haired bat on May 15th 2003) was found between January 1 and June 30, 2002 and 2003 in Oregon or Washington during standardized searches. Virtually all bat fatalities were found in the late summer and fall during the time period when both silver-haired and hoary bats are migrating and these two species comprised 96.1% of the

fatalities. Little is known about the details of hoary bat and silver-haired bat migration in Oregon and Washington (Hayes and Waldien 2000). Fatality rates at this project and other projects in the West and Midwest are much lower than estimates from two of the most recently studied wind projects in the East (Kerlinger and Kerns 2004, Nicholson 2003). Bat Conservation International (BCI), the American Wind Energy Association (AWEA), the U.S. Fish and Wildlife Service, and the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) have initiated a research effort to understand bats and wind turbine interactions and how bat fatalities can be prevented or minimized. FPL Energy is participating in this research effort. Funding has been provided to support BCI in coordinating the research.

5.9 Additional Monitoring

Components of the study will be continued, including: 1) the Wildlife Response and Reporting System (WRRS) for documentation and reporting of incidentally discovered bird fatalities for the duration of the project, 2) grassland bird displacement studies, 3) fatality monitoring in the Stateline 2 area in 2006, and 4) raptor nest monitoring studies. There are also requirements for additional standardized fatality monitoring, grassland bird displacement, and raptor nest surveys if new turbines are built (OEFSC 2003).

6.0 ACKNOWLEDGEMENTS

We would like to thank FPL Energy for funding and other support for this project. We would especially like to thank Tara Dinman, Denny George, Vito Giarrusso, Jim Lindsay, Rick Lynn, Don Miller, Joanie Stewart, and Anne Walsh of FPL Energy. We would like to thank all the landowners in the project area for their continued cooperation in allowing property access. We thank helicopter pilot Cliff Hoeft of South County Helicopters, Inc., who safely and unobtrusively negotiated the helicopter near raptor nests. We appreciate the comments, support, and meeting attendance of the Stateline Washington Technical Advisory Committee members including Mark Grandstaff[16] (Washington Department of Fish and Wildlife), Howard Browers[16] (U.S. Fish and Wildlife Service), Mike Denny[16] (Blue Mountain Audubon), Shirley Muse (Blue Mountain Audubon), Denny George (FPL Energy)[16], Jim Lindsay (FPL Energy), Anne Walsh (FPL Energy), Vito Giarrusso (FPL Energy), Hugh Preston[16] (landowner), Cliff Bracher[16] (landowner), Pete Harvey[16] (Whitman College, landowner), Connie Krueger and Ken Kuhn (Walla Walla County Regional Planning Department), Dennis Olsen and Tamra Mabbott (Umatilla County Department of Resources Services and Development), Chris Brong (U.S. Fish and Wildlife Service),and Lynn Thompkins (Blue Mountain Wildlife Rehabilitation Center). We are very appreciative of Lynn Thompkins' successful rehabilitation of the injured Swainson's hawk. We also appreciate report comments and support from John White and Tom Meehan of the Oregon Department of Energy, and Mark Kirsch, Kevin Blakley, and Gail McEwen of the Oregon Department of Fish and Wildlife. Finally, we want to acknowledge the field personnel who conducted the carcass searches, often under very difficult environmental conditions (see page v for the list of project participants).

16 indicates this person is a primary voting member of the Stateline Technical Advisory Committee

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Table 1. Total effort for standardized search plots surveys from July 2001 through December 2003.

State	Year	# Turbines Completely Searched[a]	Effective # Turbines Searched[b]	# Plot Searches	Effective # Turbine Searches
Washington					
	2001	60	73.5	81	292
	2002	60	73.5	320	1176
	2003	60	73.5	340	1249.5
total		180	220.5	741	2717.5
Oregon					
	2002	64	73	350[c]	1161.5
	2003	93	104.75	509	1778.75
total		157	177.75	859	2940.25
Overall total		337	398.25	1600	5657.75

[a] # turbines that are searched at least 63 m in all directions

[b] Most adjacent turbines within a string are slightly over 70 m apart for Stateline 1 and turbine plots were extended to the adjacent turbines. Stateline 2 turbines are 105 m apart, and plots were not extended to the adjacent turbines.

[c] One survey period was missed for two turbines due to construction and maintenance activities in the area.

Table 2. List of turbines and number of avian fatalities observed in standardized search plots from July 2001 through December 2003.

2001/2002				2003			
Turbine	# Fatalities	Turbine	# Fatalities	Turbine	# Fatalities	Turbine	# Fatalities
HGA7	3	HGD4	1	BGB19	4	HGJ24	1
HGC14	3	HGD5	1	BGC16	4	HGJ36	1
HGC24	3	HGD6	1	HGJ23	3	HGJ37	1
HGH16	3	HGG3	1	HGJ25	3	HGJ40	1
PB30	3	HGH17	1	HGS27	3	HGK4	1
PB39	3	HGH18	1	HGS35	3	HGK5	1
BGB16	2	HGJ12	1	HGA1	2	HGK6	1
BGB23	2	HGJ18	1	HGC19	2	HGK7	1
HGA22	2	HGJ35	1	HGC20	2	HGK11	1
HGB13	2	HGJ40	1	HGE2	2	HGK12	1
HGJ21	2	HGJ7	1	HGJ10	2	HGL3	1
HGL2	2	HGJ8	1	HGJ11	2	HGL5	1
HGM2	2	HGK9	1	HGK13	2	HGL6	1
HGM18	2	HGL1	1	HGM11	2	HGM13	1
HGM9	2	HGM14	1	HGN5	2	HGM8	1
HGN8	2	HGM17	1	HGN7	2	HGS12	1
HGN9	2	HGM8	1	HGS18	2	HGS29	1
PB29	2	PB15	1	HGS51	2	HGS31	1
PB41	2	PB16	1	PB67	2	HGS37	1
PB50	2	PB17	1	PB78	2	HGS47	1
WSA19	2	PB28	1	WSA38	2	HGS48	1
WSA21	2	PB40	1	BGB18	1	HGS59	1
WSA44	2	PB53	1	BGB22	1	PB11	1
WSB16	2	PB76	1	BGC14	1	PB12	1
WSB45	2	PB81	1	BGC15	1	PB35	1
BGB17	1	PB87	1	BGC17	1	PB47	1
BGB19	1	PB95	1	HGB7	1	PB79	1
BGC17	1	PB97	1	HGC17	1	PB80	1
BGC18	1	WSA22	1	HGC21	1	PB91	1
BGC19	1	WSA43	1	HGC32	1	WSA16	1
HGA20	1	WSB29	1	HGE4	1	WSA37	1
HGA6	1	WSB31	1	HGG11	1	WSA39	1
HGA9	1	WSB46	1	HGH11	1	WSA40	1
HGB11	1	WSB47	1	HGJ3	1	WSB10	1
HGB12	1	WSB48	1	HGJ4	1	WSB24	1
HGB4	1	WSB52	1	HGJ12	1	WSB55	1
HGC23	1	WSB53	1	HGJ13	1	WSB57	1
HGC25	1			HGJ18	1		

Table 3. Summary of avian fatality composition based on fatalities observed in standardized search plots from July 2001 through December 2003.

	Fatalities found on Standardized Search Plots					All Fatalities				
Species	2001	2002	2003	Total	% Comp.	2001	2002	2003	Total	% Comp.
horned lark	3	43	35	81	38.6	3	47	39	89	38.4
golden-crowned kinglet	2	4	14	20	9.5	2	4	15	21	9.1
ring-necked pheasant	0	4	14	18	8.6	0	5	14	19	8.2
western meadowlark	1	5	6	12	5.7	1	5	6	12	5.2
chukar	0	2	5	7	3.3	0	3	5	8	3.4
gray partridge	0	4	3	7	3.3	0	6	3	9	3.9
red-tailed hawk	0	4	2	6	2.9	0	6	3	9	3.9
American kestrel	0	1	4	5	2.4	0	1	4	5	2.2
European starling	0	2	3	5	2.4	0	3	3	6	2.6
white-crowned sparrow	0	4	1	5	2.4	0	6	1	7	3.0
unidentified passerine	2	1	1	4	1.9	2	1	1	4	1.7
winter wren	0	2	2	4	1.9	0	2	2	4	1.7
yellow-rumped warbler	0	2	2	4	1.9	0	2	2	4	1.7
dark-eyed junco	1	0	2	3	1.4	1	0	2	3	1.3
golden-crowned sparrow	1	1	1	3	1.4	1	1	1	3	1.3
house wren	0	2	1	3	1.4	0	2	1	3	1.3
unidentified bird	0	1	2	3	1.4	0	1	2	3	1.3
savannah sparrow	0	1	1	2	1.0	0	1	1	2	0.9
vesper sparrow	0	2	0	2	1.0	0	2	0	2	0.9
American pipit	0	0	1	1	0.5	0	0	1	1	0.4
black-billed magpie	0	1	0	1	0.5	0	1	0	1	0.4
Canada goose	0	0	0	0	0.0	0	1	0	1	0.4
ferruginous hawk[a]	0	0	1	1	0.5	0	0	1	1	0.4
grasshopper sparrow[b]	0	1	0	1	0.5	0	1	0	1	0.4
great blue heron	0	1	0	1	0.5	0	1	0	1	0.4
house finch	0	1	0	1	0.5	0	1	0	1	0.4
MacGillivray's warbler	0	1	0	1	0.5	0	1	0	1	0.4
mallard	0	1	0	1	0.5	0	1	0	1	0.4
northern flicker	0	0	1	1	0.5	0	0	1	1	0.4
red-breasted nuthatch	0	0	1	1	0.5	0	0	1	1	0.4
red-winged blackbird	0	1	0	1	0.5	0	1	0	1	0.4
rock dove	0	0	1	1	0.5	0	0	1	1	0.4
ruby-crowned kinglet	0	1	0	1	0.5	0	1	0	1	0.4
short-eared owl	0	0	0	0	0.0	1	0	0	1	0.4
Swainson's hawk[b]	0	1	0	1	0.5	0	1	0	1	0.4
Swainson's thrush	0	1	0	1	0.5	0	1	0	1	0.4
unidentified sparrow	0	1	0	1	0.5	0	1	0	1	0.4
white-throated swift	0	0	0	0	0.0	1	0	0	1	0.4
Total (35 identified species)	10	96	104	210	100.0	12	110	110	232	100.0

[a]Oregon Sensitive-critical: Species for which listing as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation activities are not taken.

[b]Oregon Sensitive-vulnerable: Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring.

Table 4. Summary of bat fatality composition based on fatalities observed in standardized search plots from July 2001 through December 31, 2003.

	Fatalities found in Standardized Search Plots					All Fatalities				
Species	**2001**	**2002**	**2003**	**Total**	**% Comp.**	**2001**	**2002**	**2003**	**Total**	**% Comp.**
silver-haired bat[a]	12	13	39	64	50.0	14	19	40	73	48.7
hoary bat	12	13	34	59	46.1	14	20	37	71	47.3
big brown bat	1	1	0	2	1.6	1	1	0	2	1.3
unidentified bat	0	1	1	2	1.6	1	1	1	3	2.0
little brown bat	0	1	0	1	0.8	0	1	0	1	0.7
Total	25	29	74	128	100.0	30	42	78	150	100.0

[a] Oregon Sensitive-undetermined: Animals in this category are species whose status is unclear. They may be susceptible to population decline of sufficient magnitude that they could qualify for endangered, threatened, critical or vulnerable status, but scientific study will be required before a judgment can be made.

Table 5. List of turbines and number of bat fatalities observed in standardized search plots from July 2001 through December 2003.

2001/2002				2003			
Turbine	# Fatalities	Turbine	# Fatalities	Turbine	# Fatalities	Turbine	# Fatalities
PB30	4	PB28	1	HGA1	3	HGJ12	1
HGC14	3	PB29	1	HGA14	3	HGJ18	1
BGC18	2	PB31	1	HGA15	3	HGJ32	1
PB53	2	PB40	1	HGK5	3	HGJ38	1
BGB17	1	PB41	1	PB23	3	HGJ40	1
BGB21	1	PB42	1	PB94	3	HGJ44	1
BGC16	1	PB50	1	HGA16	2	HGL4	1
BGC17	1	PB6	1	PB11	2	HGL5	1
HGB1	1	PB76	1	PB68	2	HGM5	1
HGC10	1	PB84	1	PB86	2	HGM14	1
HGC11	1	PB88	1	WSB55	2	HGS13	1
HGC23	1	PB97	1	WSB56	2	HGS36	1
HGC25	1	WSA19	1	BGB18	1	HGS37	1
HGD4	1	WSA44	1	BGB19	1	PB10	1
HGD6	1	WSA45	1	BGB23	1	PB22	1
HGJ14	1	WSB16	1	BGC13	1	PB24	1
HGK2	1	WSB19	1	BGC16	1	PB45	1
HGM16	1	WSB4	1	BGC17	1	PB46	1
HGM4	1	WSB46	1	HGA2	1	PB84	1
HGM9	1	WSB52	1	HGB8	1	PB85	1
PB15	1	WSB53	1	HGC4	1	PB93	1
PB16	1	WSB54	1	HGC5	1	WSA14	1
PB18	1	WSB7	1	HGC20	1	WSA15	1
PB27	1			HGC30	1	WSB10	1
				HGH10	1	WSB22	1
				HGH12	1	WSB25	1
				HGJ3	1	WSB48	1
				HGJ5	1	WSB50	1

Table 6. Results of observer detection trials conducted July 2001 through December 2003.

	2001/2002		2003		Overall	
Season	# Placed	% Found	# Placed	% Found	# Placed	% Found
			Large Birds			
Agriculture						
Winter	13	92%	11	91%	24	92%
Spring	11	100%	5	60%	16	88%
Summer	10	60%	12	75%	22	68%
Fall	5	100%	10	100%	15	100%
Subtotal	39	87%	38	84%	77	86%
Grassland						
Winter	15	80%	9	89%	24	83%
Spring	10	80%	6	67%	16	75%
Summer	12	67%	9	44%	21	57%
Fall	10	60%	8	75%	18	67%
Subtotal	47	72%	32	69%	79	71%
Overall	86	79%	70	77%	156	78%
			Small Birds			
Agriculture						
Winter	14	36%	11	36%	25	36%
Spring	7	86%	7	29%	14	57%
Summer	9	11%	16	38%	25	28%
Fall	5	40%	10	60%	15	53%
Subtotal	35	37	44	41%	79	39%
Grassland						
Winter	11	45%	12	50%	23	48%
Spring	7	43%	6	33%	13	38%
Summer	13	46%	11	45%	24	46%
Fall	19	47%	13	31%	32	41%
Subtotal	50	46%	42	40%	92	43%
Overall	85	42%	86	41%	171	42%

Table 7. Results of carcass removal trials conducted July 2001 through December 2003.

	Medium/Large Birds					Small Birds				
			% remaining					% remaining		
year	# birds	Mean	Day 40	Day 30	Day 14	# birds	Mean	Day 40	Day 30	Day 14
Fall										
2001	10	18.4	10.0%	10.0%	40.0%	10	11.7	0.0%	0.0%	30.0%
2002	19	36.3	31.6%	47.4%	63.2%	21	19.7	9.5%	23.8%	57.1%
2003	20	38.3	40.0%	40.0%	60.0%	20	17.0	15.0%	15.0%	45.0%
Subtotal	49	32.3	30.6%	36.7%	57.1%	51	17.0	9.8%	15.7%	47.1%
Winter										
2001	10	32.4	40.0%	40.0%	50.0%	10	27.8	20.0%	30.0%	70.0%
2002	20	44.0	45.0%	50.0%	60.0%	20	18.1	15.0%	25.0%	40.0%
2003	30	23.5	13.3%	40.0%	53.3%	30	12.3	0.0%	6.7%	40.0%
Subtotal	60	30.0	28.3%	43.4%	55.0%	60	16.3	8.3%	16.7%	45.0%
Spring										
2002	20	45.6	45.0%	45.0%	70.0%	20	16.4	15.0%	20.0%	35.0%
2003	19	29.7	21.1%	47.4%	68.4%	21	12.9	0.0%	4.8%	38.1%
Subtotal	39	36.4	33.3%	46.2%	69.2%	41	14.5	7.3%	12.2%	36.6%
Summer										
2002	30	58.9	53.3%	60.0%	66.7%	30	35.1	36.7%	36.7%	63.3%
2003	35	36.4	34.3%	48.6%	71.4%	35	9.3	2.9%	8.6%	25.7%
Subtotal	65	44.9	43.1%	53.8%	69.2%	65	19.3	18.5%	21.5%	43.1%
Overall	213	35.7	34.2%	45.5%	62.4%	217	16.7	11.5%	17.1%	43.3%

Table 8. Annual fatality rate estimates based on Stateline monitoring in 2002 and 2003.

	# Fatalities /Turbine/Year	SE	90% Confidence Intervals[a] LL	UL
All Birds				
2002	2.09	0.26	1.64	2.49
2003	1.77	0.27	1.27	2.16
Overall	1.93	0.20	1.56	2.20
Small Birds				
2002	1.88	0.26	1.43	2.27
2003	1.51	0.26	1.04	1.90
Overall	1.70	0.19	1.33	1.96
Grassland Birds				
2002	1.51	0.23	1.07	1.85
2003	1.12	0.24	0.70	1.55
Overall	1.28	0.18	0.98	1.62
Nocturnal Migrant Passerines and Unidentified Passerines				
2002	0.57	0.12	0.38	0.77
2003	0.53	0.13	0.31	0.73
Overall	0.55	0.09	0.39	0.68
Large Birds				
2002	0.21	0.05	0.14	0.29
2003	0.26	0.06	0.15	0.35
Overall	0.23	0.04	0.17	0.29
Raptors				
2002	0.060	0.031	0.019	0.114
2003	0.060	0.030	0.017	0.115
Overall	0.060	0.021	0.028	0.099
Bats				
2002	0.72	0.15	0.46	0.94
2003	1.51	0.26	1.08	1.94
Overall	1.12	0.16	0.84	1.35

[a] An interval computed from the sample data by a method that has a 90% probability of producing an interval containing the true value of the parameter being estimated (Moore 1995).

Table 9. List of avian species observed during fixed-point surveys (July 2001 through December 2003).

Species/Group	Scientific Name	Species/Group	Scientific Name
American white pelican	*Pelecanus erythrorhyncos*	house finch	*Carpodacus mexicanus*
Canada goose	*Branta canadensis*	lark sparrow	*Chondestes grammacus*
mallard	*Anas platyrhynchos*	red-winged blackbird	*Agelaius phoeniceus*
ring-billed gull	*Larus delawarensis*	rock wren	*Salpinctes obsoletus*
American kestrel	*Falco sparverius*	savannah sparrow	*Passerculus sandwichensis*
Cooper's hawk	*Accipiter cooperii*	Say's phoebe	*Sayornis saya*
ferruginous hawk	*Buteo regalis*	snow bunting	*Plectrophenax nivalis*
golden eagle	*Aquila chrysaetos*	tree swallow	*Tachycineta bicolor*
merlin	*Falco columbarius*	vesper sparrow	*Pooecetes gramineus*
northern harrier	*Circus cyaneus*	violet-green swallow	*Tachycineta thalassina*
prairie falcon	*Falco mexicanus*	western bluebird	*Sialia mexicana*
red-tailed hawk	*Buteo jamaicensis*	western kingbird	*Tyrannus verticalis*
rough-legged hawk	*Buteo lagopus*	western meadowlark	*Sturnella neglecta*
Swainson's hawk	*Buteo swainsoni*	white-crowned sparrow	*Zonotrichia leucophrys*
American crow	*Corvus brachyrhynchos*	winter wren	*Troglodytes troglodytes*
American goldfinch	*Carduelis tristis*	yellow-headed blackbird	*Xanthocephalus xanthocephalus*
American pipit	*Anthus rubescens*	chukar	*Alectoris chukar*
American robin	*Turdus migratorius*	gray partridge	*Perdix perdix*
barn swallow	*Hirundo rustica*	ring-necked pheasant	*Phasianus colchicus*
Bewick's wren	*Thryomanes bewickii*	mourning dove	*Zenaida macroura*
black-billed magpie	*Pica pica*	unidentified duck	
Brewer's blackbird	*Euphagus cyanocephalus*	unidentified gull	
cliff swallow	*Petrochelidon pyrrhonota*	unidentified buteo	
common raven	*Corvus corax*	unidentified raptor	
dark-eyed junco	*Junco hyemalis*	unidentified bluebird	
European starling	*Sturnus vulgaris*	unidentified finch	
golden-crowned kinglet	*Regulus satrapa*	unidentified passerine	
grasshopper sparrow	*Ammodramus savannarum*	unidentified sparrow	
gray-crowned rosy finch	*Leucosticte arctoa*	unidentified swallow	
horned lark	*Eremophila alpestris*	unidentified bird	

Table 10. Bird observations and groups recorded during avian use surveys conducted July 2001 through December 2003.

	2001		2002		2003		Total	
Group/Species	obs.	groups	obs.	groups	obs.	groups	obs.	groups
WaterfowlWaterbirds								
American white pelican	0	0	40	1	6	1	46	2
Canada goose	118	5	31	3	214	3	363	11
mallard	0	0	0	0	30	1	30	1
ring-billed gull	0	0	6	1	12	3	18	4
unidentified duck	0	0	0	0	10	1	10	1
unidentified gull	0	0	30	1	0	0	30	1
Subtotal	118	5	107	6	272	9	497	20
Raptors								
Accipiters								
Cooper's hawk	0	0	0	0	1	1	1	1
Buteos								
ferruginous hawk	0	0	5	4	7	7	12	11
red-tailed hawk	1	1	76	59	44	31	121	91
rough-legged hawk	3	3	9	9	15	15	27	27
Swainson's hawk	1	1	42	15	20	16	63	32
unidentified buteo	3	2	33	28	34	27	70	57
Subtotal	8	7	165	115	120	96	293	218
northern harrier	1	1	26	24	17	16	44	41
Eagles								
golden eagle	0	0	6	5	0	0	6	5
Falcons								
American kestrel	0	0	4	4	18	15	22	19
merlin	0	0	0	0	1	1	1	1
prairie falcon	0	0	2	2	3	3	5	5
Subtotal	0	0	6	6	22	19	28	25
unidentified raptor	0	0	0	0	1	1	1	1
Raptor Subtotal	**9**	**8**	**203**	**150**	**161**	**133**	**373**	**291**

Table continues on next page.

Table 10 (continued)

Group/Species	2001 obs.	2001 groups	2002 obs.	2002 groups	2003 obs.	2003 groups	Total obs.	Total groups
Passerines								
American crow	0	0	1	1	0	0	1	1
American goldfinch	0	0	12	4	1	1	13	5
American pipit	0	0	0	0	14	2	14	2
American robin	0	0	1	1	1	1	2	2
barn swallow	0	0	1	1	6	3	7	4
Bewick's wren	0	0	1	1	0	0	1	1
black-billed magpie	0	0	2	1	8	1	10	2
Brewer's blackbird	0	0	0	0	2	1	2	1
cliff swallow	0	0	2	1	0	0	2	1
common raven	4	4	107	75	158	98	269	177
dark-eyed junco	0	0	0	0	12	9	12	9
European starling	0	0	18	3	62	13	80	16
golden-crowned kinglet	0	0	0	0	2	2	2	2
grasshopper sparrow	0	0	3	2	5	4	8	6
gray-crowned rosy finch	0	0	0	0	1	1	1	1
horned lark	42	29	1281	550	1601	706	2924	1285
house finch	0	0	0	0	1	1	1	1
lark sparrow	0	0	0	0	1	1	1	1
red-winged blackbird	0	0	1	1	0	0	1	1
rock wren	0	0	2	2	5	4	7	6
savannah sparrow	0	0	2	2	3	3	5	5
Say's phoebe	0	0	1	1	1	1	2	2
snow bunting	0	0	0	0	16	1	16	1
tree swallow	0	0	1	1	0	0	1	1
unidentified bluebird	0	0	3	1	0	0	3	1
unidentified finch	0	0	1	1	0	0	1	1
unidentified passerine	0	0	3	3	10	6	13	9
unidentified sparrow	0	0	2	2	9	7	11	9
unidentified swallow	0	0	0	0	3	2	3	2
vesper sparrow	0	0	0	0	6	6	6	6
violet-green swallow	0	0	12	1	0	0	12	1
western bluebird	0	0	0	0	2	1	2	1
western kingbird	0	0	5	4	2	1	7	5
western meadowlark	10	7	231	193	362	287	603	487
white-crowned sparrow	0	0	5	3	31	9	36	12
winter wren	0	0	2	2	0	0	2	2
yellow-headed blackbird	0	0	0	0	1	1	1	1
Subtotal	56	40	1700	857	2326	1173	4082	2070

Table continues on next page.

Table 10 (continued)

	2001		2002		2003		Total	
Group/Species	obs.	groups	obs.	groups	obs.	groups	obs.	groups
Doves								
mourning dove	0	0	0	0	2	1	2	1
Upland gamebirds								
chukar	0	0	23	4	41	6	64	10
gray partridge	0	0	33	5	41	5	74	10
ring-necked pheasant	0	0	13	12	15	10	28	22
Subtotal	0	0	69	21	97	21	166	42
unidentified bird	**0**	**0**	**0**	**0**	**5**	**5**	**5**	**5**
Total	**183**	**53**	**2079**	**1034**	**2863**	**1342**	**5125**	**2429**

Table 11. Mean use (#/survey) and % frequency of occurrence (% of surveys where species was observed) by year conducted July 2001 through December 2003.

	Use (#/survey)			% Frequency of Occurrence		
Species	'01-'02	'03	mean	'01-'02	'03	mean
horned lark	1.482	1.885	1.649	46.44	57.00	50.82
western meadowlark	0.269	0.426	0.334	18.19	25.31	21.14
Canada goose	0.079	0.228	0.141	0.42	0.24	0.34
common raven	0.077	0.125	0.097	6.13	9.06	7.34
European starling	0.018	0.073	0.041	0.30	1.29	0.72
red-tailed hawk	0.046	0.032	0.040	3.69	2.24	3.09
gray partridge	0.033	0.048	0.039	0.51	0.59	0.54
chukar	0.023	0.049	0.034	0.41	0.71	0.53
northern harrier	0.023	0.020	0.022	2.24	1.88	2.09
white-crowned sparrow	0.005	0.037	0.018	0.31	1.06	0.62
ring-necked pheasant	0.013	0.018	0.015	1.13	1.06	1.10
mallard	0.000	0.035	0.015	0.00	0.12	0.05
Swainson's hawk	0.016	0.011	0.014	1.38	0.94	1.20
rough-legged hawk	0.013	0.012	0.013	1.31	1.18	1.26
American kestrel	0.004	0.019	0.010	0.41	1.41	0.82
snow bunting	0.000	0.019	0.008	0.00	0.12	0.05
American goldfinch	0.012	0.001	0.008	0.41	0.12	0.29
violet-green swallow	0.012	0.000	0.007	0.10	0.00	0.06
American pipit	0.000	0.016	0.007	0.00	0.24	0.10
unidentified passerine	0.003	0.012	0.007	0.30	0.71	0.47
dark-eyed junco	0.000	0.014	0.006	0.00	1.06	0.44
unidentified sparrow	0.002	0.011	0.006	0.20	0.82	0.46
black-billed magpie	0.002	0.009	0.005	0.10	0.12	0.11
unidentified buteo	0.004	0.005	0.004	0.41	0.47	0.44
grasshopper sparrow	0.003	0.006	0.004	0.20	0.47	0.31
ring-billed gull	0.006	0.001	0.004	0.10	0.12	0.11
western kingbird	0.005	0.002	0.004	0.41	0.12	0.29
rock wren	0.002	0.006	0.004	0.21	0.47	0.32
barn swallow	0.001	0.007	0.004	0.10	0.35	0.21
vesper sparrow	0.000	0.007	0.003	0.00	0.71	0.29
savannah sparrow	0.002	0.004	0.003	0.21	0.36	0.27
unidentified bird	0.000	0.006	0.002	0.00	0.59	0.24
golden eagle	0.004	0.000	0.002	0.41	0.00	0.24
prairie falcon	0.002	0.002	0.002	0.20	0.24	0.22
unidentified bluebird	0.003	0.000	0.002	0.10	0.00	0.06
ferruginous hawk	0.001	0.002	0.002	0.10	0.24	0.16
unidentified swallow	0.000	0.004	0.001	0.00	0.24	0.10

Table continues on next page.

Table 11 (continued)

	Use (#/survey)			% Frequency of Occurrence		
	'01-'02	'03	mean	'01-'02	'03	mean
winter wren	0.002	0.000	0.001	0.20	0.00	0.12
cliff swallow	0.002	0.000	0.001	0.10	0.00	0.06
American robin	0.001	0.001	0.001	0.10	0.12	0.11
Say's phoebe	0.001	0.001	0.001	0.10	0.12	0.11
western bluebird	0.000	0.002	0.001	0.00	0.12	0.05
golden-crowned kinglet	0.000	0.002	0.001	0.00	0.24	0.10
Brewer's blackbird	0.000	0.002	0.001	0.00	0.12	0.05
mourning dove	0.000	0.002	0.001	0.00	0.12	0.05
American crow	0.001	0.000	0.001	0.10	0.00	0.06
red-winged blackbird	0.001	0.000	0.001	0.10	0.00	0.06
tree swallow	0.001	0.000	0.001	0.10	0.00	0.06
unidentified finch	0.001	0.000	0.001	0.10	0.00	0.06
Bewick's wren	0.001	0.000	0.001	0.10	0.00	0.06
merlin	0.000	0.001	0.000	0.00	0.12	0.05
gray-crowned rosy finch	0.000	0.001	0.000	0.00	0.12	0.05
house finch	0.000	0.001	0.000	0.00	0.12	0.05
lark sparrow	0.000	0.001	0.000	0.00	0.12	0.05
yellow-headed blackbird	0.000	0.001	0.000	0.00	0.12	0.05

Table 12. Avian and mammal observations and groups recorded incidentally between avian use surveys conducted July 2001 through December 2003.

Group / Species	Groups	Obs
Avian Species		
American pipit	1	325
sandhill crane	2	225
Canada goose	4	99
red-tailed hawk	46	72
killdeer	1	47
Swainson's hawk	28	45
long-billed curlew	14	22
northern harrier	20	20
loggerhead shrike	11	16
American kestrel	12	15
prairie falcon	10	14
common raven	2	13
grasshopper sparrow	12	12
gray partridge	1	12
burrowing owl[a]	7	11
ferruginous hawk	10	10
rough-legged hawk	9	9
short-eared owl	5	6
chukar	1	4
common nighthawk	4	4
golden eagle	3	3
gray-crowned rosy finch	2	3
Vaux's swift	1	3
bald eagle	2	2
merlin	2	2
northern shrike	2	2
sage thrasher	2	2
sharp-shinned hawk	2	2
golden-crowned kinglet	1	1
great-horned owl	1	1
house wren	1	1
lark sparrow	1	1
Lincoln's sparrow	1	1
unidentified buteo	1	1
white-crowned sparrow	1	1
Avian Subtotal	**223**	**1007**
Mammal Species		
Washington ground squirrel[b]	19	51
white-tailed jack rabbit[c]	58	49
mule deer[d]	6	40
coyote	3	9
unidentified deer	1	5
badger	3	4
deer mouse	7	7
pocket gopher	2	2
long-tailed weasel	1	1
white-tailed deer	1	1
Mammal Subtotal	**101**	**170**
Reptile Species		
northern pacific rattlesnake	6	7
yellow-bellied racer	2	2
gopher snake	1	1
Reptile Subtotal	**9**	**10**

[a] Also, nest with two different droppings no actual individuals seen (no changes to table).
[b] Also, nine sightings of holes or droppings (no changes to table).
[c] Also, seven sightings of dropping or tracks and four dead carcasses (no changes to table).
[d] Also, a lot of urine and feces at a station during one survey (no changes to table).

Table 13. Summary of number of active buteo nests within 5 miles of Stateline 1 turbines and number of active and successful buteo nests within 2 miles of Stateline 1 and 2 turbines.

	Within 5 miles of Stateline 1 turbines		Within 2 miles of Stateline 1 turbines			Within 2 miles of Stateline 1 and 2 turbines	
	2001[a]	2002	2001	2002	2002	2003	2003
	#	#	#	#	#	#	#
Species	**Active**	**Active**	**Active**	**Active**	**Successful**	**Active**	**Successful**
Washington							
Red-tailed hawk	9	11	5	7	na[b]	5	na
Ferruginous hawk	1	1	1	1	1	1	0
Swainson's hawk	5	6	0	0	0	1	1
subtotal	15	18	6	8		7	
Oregon							
Red-tailed hawk	6	5	1	1	na	3	na
Ferruginous hawk	5	5	2	2	1	2	2
Swainson's hawk	4	4	2	1	0	2	1
subtotal	15	14	5	4		7	
Overall							
Red-tailed hawk	15	16	6	8	na	8	na
Ferruginous hawk	6	6	3	3	2	3	2
Swainson's hawk	9	10	2	1	0	3	2
Total	**30**	**32**	**11**	**12**		**14**	

[a] for the 2001 nest monitoring: Washington turbine string construction started in March whereas Oregon turbine string construction started after the nest season.

[b] not applicable. Note: in 2002 and 2003 only special status species were monitored for success

Table 14. Ferruginous hawk and Swainson's hawk nesting data for nests active in 2001, 2002, or 2003 that were located within 2 miles of Stateline 1 or 2 turbines.

Species and record #	Distance from nearest turbine string (Stateline 1 or 2)	2001 (pre-construction)	2002 (pre-construction data for Stateline 2, post-construction data for Stateline 1)	2003 (post-construction data for both Stateline 1 and Stateline 2)
Washington				
Ferruginous hawk (#5)	~1 mile from HG-A string	Successful 2 young fledged	Successful unknown # of young fledged, likely 2	Active but not successful, adult birds shot
Swainson's hawk (#144)	~2 miles from PB string	Not active	Not active	New one discovered nearby in 2003, near the historic nest site. Active, successful, unknown # of young fledged (not able to access nest site)
Oregon				
Ferruginous hawk (#21)	~ 1/2 mile from HG-J string	Successful 3 young fledged	Successful 4 young fledged	Used by GHOW in 2003
Ferruginous hawk (#15)	1,122 ft. from HG-K string	Successful 2 young fledged	Active but not successful	Successful 2 young fledged
Ferruginous hawk (#137)	~1.75 miles from Stateline 2 turbines[a]. Not within 2-miles of Stateline 1 turbines.	Not active	Successful 2 young fledged	Successful 1 or 2 fledged
Swainson's hawk (#11)	~1 and ¾ miles from HG-K string, near Stateline 2 turbines	Active but not successful	Not active	Bird in area near nest, nest had signs of being repaired, nest not considered active, (great horned owls roosting in same tree grove)
Swainson's hawk (#82)	~1/4 mile from HG-K and HG-J strings	Active but not successful, raven nest nearby	Active but not successful, raven nest nearby	Not active, nest was repaired slightly early in the season (tree is dying, has poor supporting branches).
Swainson's hawk (#139)	Near farm residence, ~1,700 ft from HGJ	---	---	New nest in 2003. Active, constructed nest but did not lay eggs, nest abandoned
Swainson's hawk (#150)	Near public road, ~2 miles from HGJ	--	--	New nest in 2003 Successful, one adult and one juvenile (ready to fledge) was shot by vandals. May have successfully fledged one young.

[a] Stateline 2 was constructed fall of 2002, after the raptor nesting season.

Table 15. Burrowing owl locations discovered and monitored during the Stateline Monitoring Study 2002-2003.

Table ID	State Located	Historic Nest Site Active Prior To The First Monitoring Year (2002)	Nest Site Location Description and Activity Status (approximate distance to nearest turbine)
1	WA	Yes	Between turbine strings HGE & HGF, 112 meters to HGF-1. Nesting owls present during construction in 2001 and also during operation in 2002. Specific site not active in 2003, but new site close to this site active in 2003 (#2).
2	WA	No	Down the draw from historic HGE & HGF site, new in 2003. Close to #1, may be same individuals.
3	WA	Yes	Activity area 400 meters east of turbine string PB. Historic (1996-1999, K. Kronner pers. comm.) nest sites nearby. Site may support two separate pairs. Specific site not active in 2002, but new site was discovered and active in 2002. Both new site and original site active in 2003.
4	WA	No	Located approximately 180 to 230 meters to turbine HGH 9, new in 2002. Surveyed in 2003, not active
5	WA	No	111 meters to HGC-14, first discovered in 2002 (the area was not surveyed prior to 2002) Surveyed in 2003, not active.
6	WA	No	North of Nine Mile Substation west of access road, new in 2003. Greater than 2 km from a turbine
7	OR	Yes	Along Warm Springs Rd., near WSA. Last active in 1999, two years prior to construction..
8	OR	Yes	Near underground elect. line 1.6 km northwest of BGB. Active in 2001, but not active in 2002 or 2003, but nearby sites active in 2003.
9	OR	No	Near underground elect. line northwest of BGB (the area was not surveyed prior to 2002). Active in 2002 but not in 2003. Site within 650 m of turbine BGB-16
10	OR	No	West of BGB-16 First discovered in 2003 in a new CRP field, area was later plowed, site was abandoned. Site nearby to #9 and #11.
11	OR	No	Approximately 300 meters northwest of BGB-16 First discovered in 2003. In native grassland (pasture)
12	OR	No	305 meters northeast of BGB-16, new in 2003. Area previously surveyed in 2000, 2001 and 2002
13	OR	Yes	Historic - near Raymond Gulch, east of Butler Grade Road (not located near Stateline 1 or 2 turbines). Active in 2001, 2002 and 2003.

Table 16. Mean index of bird density for pre- and post- construction and the differences. Standard errors and 90% confidence intervals for the difference based on each year of surveys (pre-construction surveys in 2001, post-construction surveys in 2002).

Species/Group	Pre Mean[a]	Post mean[a]	Diff mean[a]	Std. Err.	90% Conf Ints[b] LCL	UCL
grasshopper sparrow	0.139	0.083	-0.056[c]	0.026	-0.101	-0.011
horned lark	0.289	0.350	0.061	0.062	-0.046	0.168
Savannah sparrow	0.025	0.047	0.022	0.016	-0.006	0.050
western meadowlark	0.122	0.092	-0.031	0.031	-0.085	0.023
Subtotal Grassland	0.578	0.583	0.006	0.084	-0.139	0.151

[a] # observations/survey/5,000 m^2

[b] Student's t distribution intervals with 19 degrees of freedom. Degrees of freedom is the sample size minus 1, (= 19).

[c] significantly different than 0 and negative, suggesting a negative impact due to the wind facility

Table 17. Mean index of bird density for pre- and post- construction and the differences. Standard errors and 90% confidence intervals for the difference by sub-segment based on each year of surveys (pre-construction surveys in 2001, post-construction surveys in 2002).

Species/Group	Subsegment	Pre-mean	Post-mean	Diff-mean	Std. Err	90% LCL	90% UCL
grasshopper sparrow	1: 0-50 m	0.300	0.017	-0.283[a]	0.103	-0.462	-0.105
	2: 51-100 m	0.083	0.000	-0.083[a]	0.041	-0.154	-0.012
	3: 101-150 m	0.083	0.083	0.000	0.054	-0.094	0.094
	4: 151-200 m	0.117	0.067	-0.050	0.065	-0.163	0.063
	5: 201-250 m	0.150	0.100	-0.050	0.070	-0.170	0.070
	6: 251-300 m	0.100	0.233	0.133	0.082	-0.008	0.275
horned lark	1: 0-50 m	0.333	0.283	-0.050	0.165	-0.334	0.234
	2: 51-100 m	0.367	0.333	-0.033	0.143	-0.280	0.214
	3: 101-150 m	0.283	0.267	-0.017	0.078	-0.152	0.119
	4: 151-200 m	0.167	0.217	0.050	0.091	-0.108	0.208
	5: 201-250 m	0.183	0.333	0.150	0.089	-0.003	0.303
	6: 251-300 m	0.400	0.667	0.267	0.191	-0.064	0.598
savannah sparrow	1: 0-50 m	0.033	0.000	-0.033	0.033	-0.091	0.024
	2: 51-100 m	0.017	0.033	0.017	0.029	-0.034	0.067
	3: 101-150 m	0.017	0.000	-0.017	0.017	-0.045	0.012
	4: 151-200 m	0.050	0.033	-0.017	0.051	-0.105	0.072
	5: 201-250 m	0.017	0.083	0.067	0.046	-0.013	0.146
	6: 251-300 m	0.017	0.133	0.117	0.056	0.021	0.213
western meadowlark	1: 0-50 m	0.050	0.000	-0.050[a]	0.027	-0.097	-0.003
	2: 51-100 m	0.067	0.067	0.000	0.042	-0.072	0.072
	3: 101-150 m	0.150	0.100	-0.050	0.074	-0.177	0.077
	4: 151-200 m	0.100	0.067	-0.033	0.041	-0.105	0.038
	5: 201-250 m	0.167	0.183	0.017	0.092	-0.142	0.176
	6: 251-300 m	0.200	0.133	-0.067	0.107	-0.252	0.118
Subtotal Grassland	1: 0-50 m	0.717	0.300	-0.417[a]	0.206	-0.774	-0.060
	2: 51-100 m	0.533	0.467	-0.067	0.184	-0.384	0.251
	3: 101-150 m	0.533	0.450	-0.083	0.125	-0.300	0.133
	4: 151-200 m	0.450	0.383	-0.067	0.132	-0.294	0.161
	5: 201-250 m	0.517	0.717	0.200	0.122	-0.011	0.411
	6: 251-300 m	0.717	1.183	0.467	0.276	-0.011	0.944

[a] significantly different than 0 and negative, suggesting a negative impact due to the wind facility

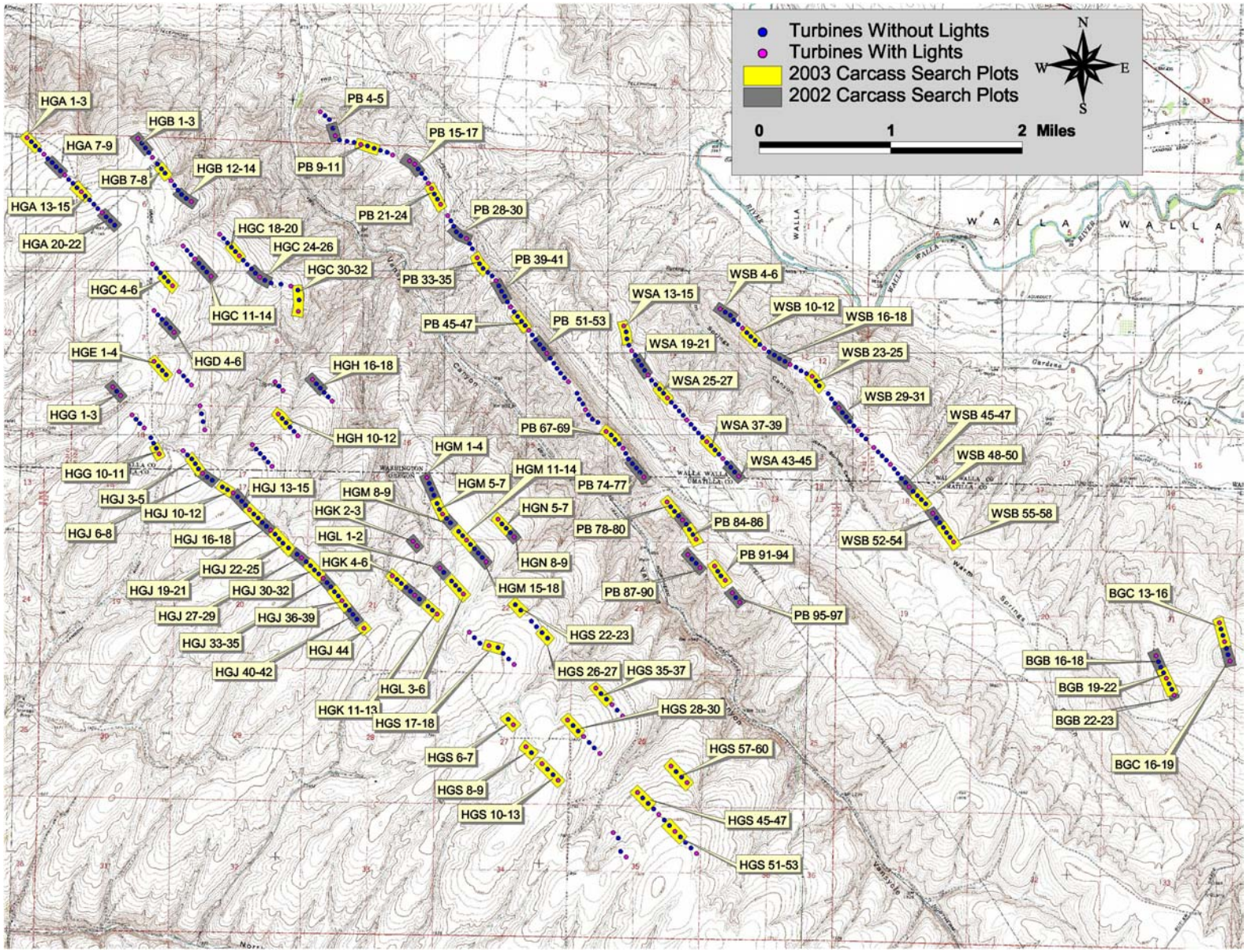


Figure 1. Location of 2002 and 2003 standardized carcass search plots.

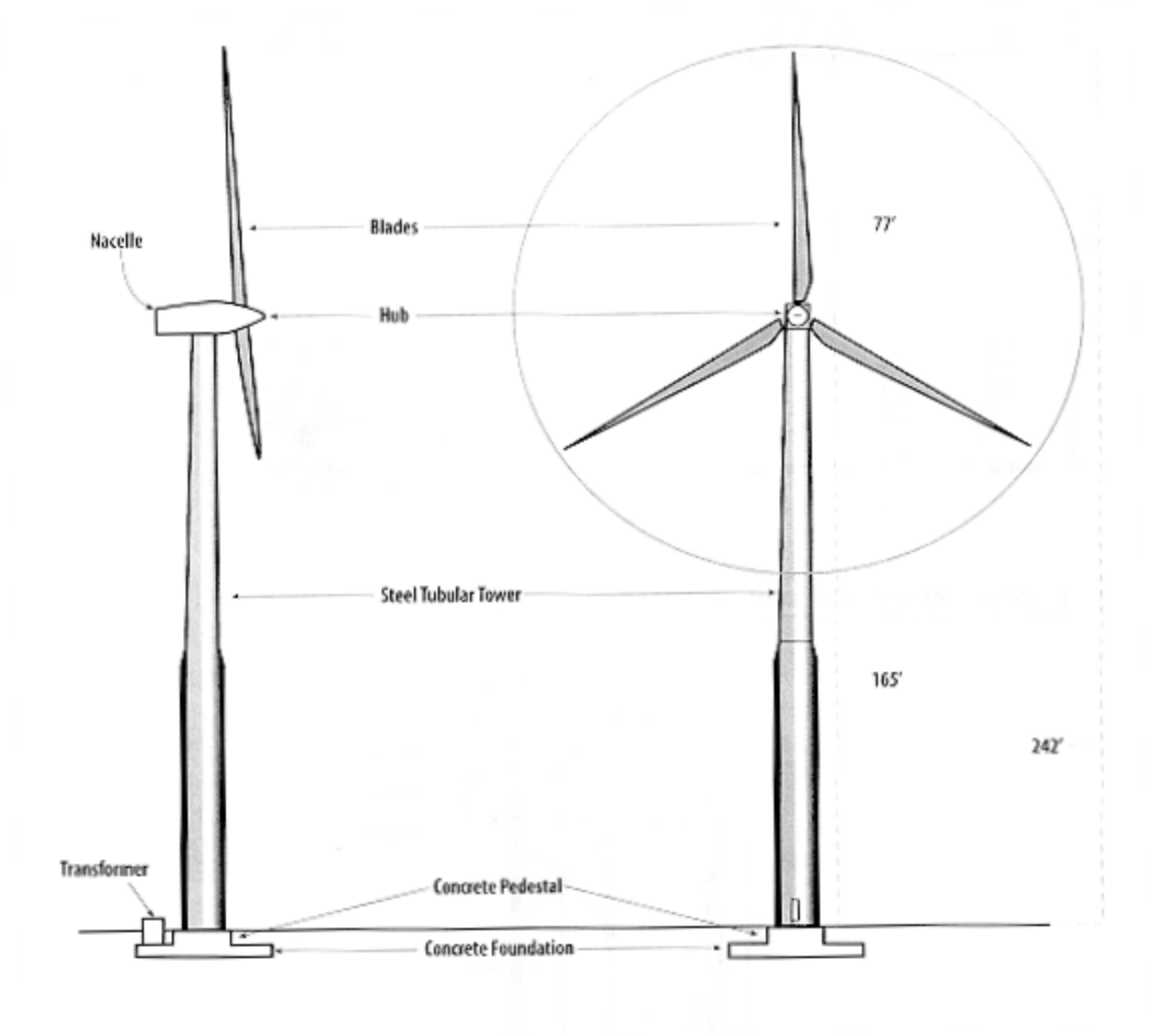


Figure 2. Diagram of the dimensions and components of the Stateline Wind Turbines.

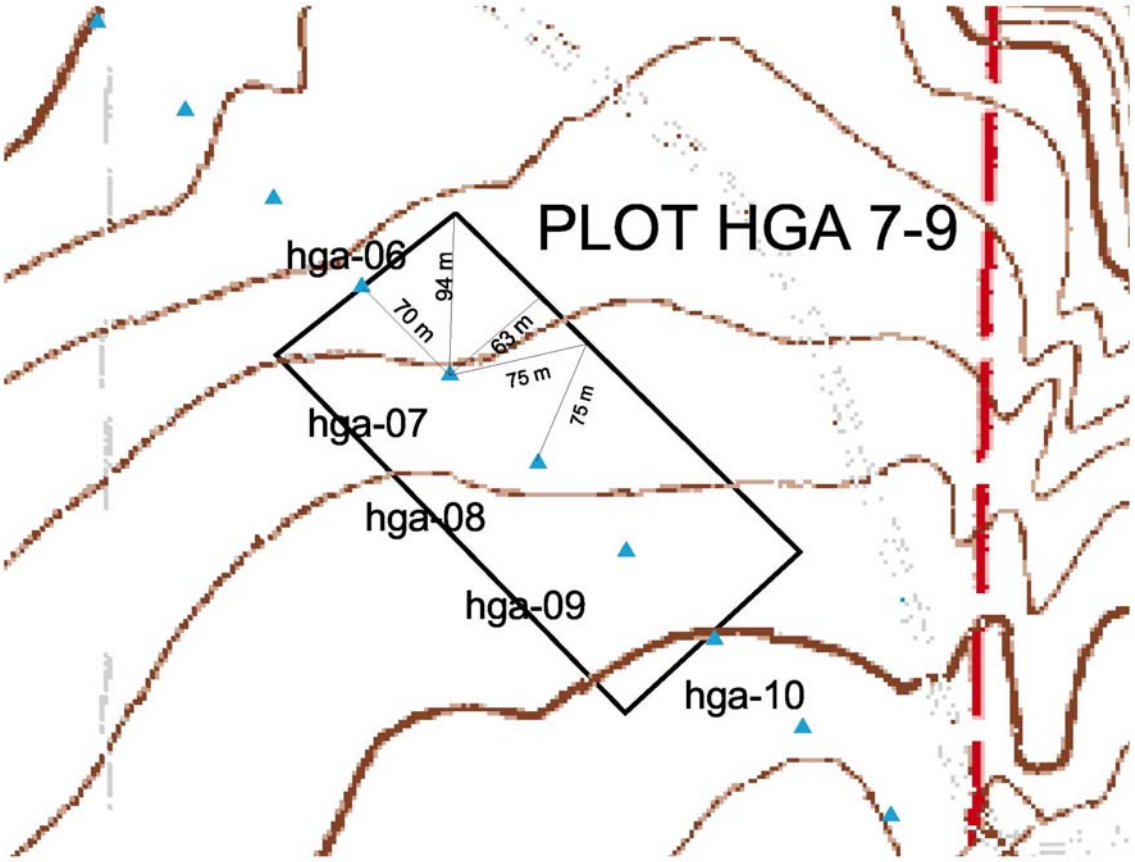


Figure 3. Example carcass search plot HGA 7-9 including dimensions.

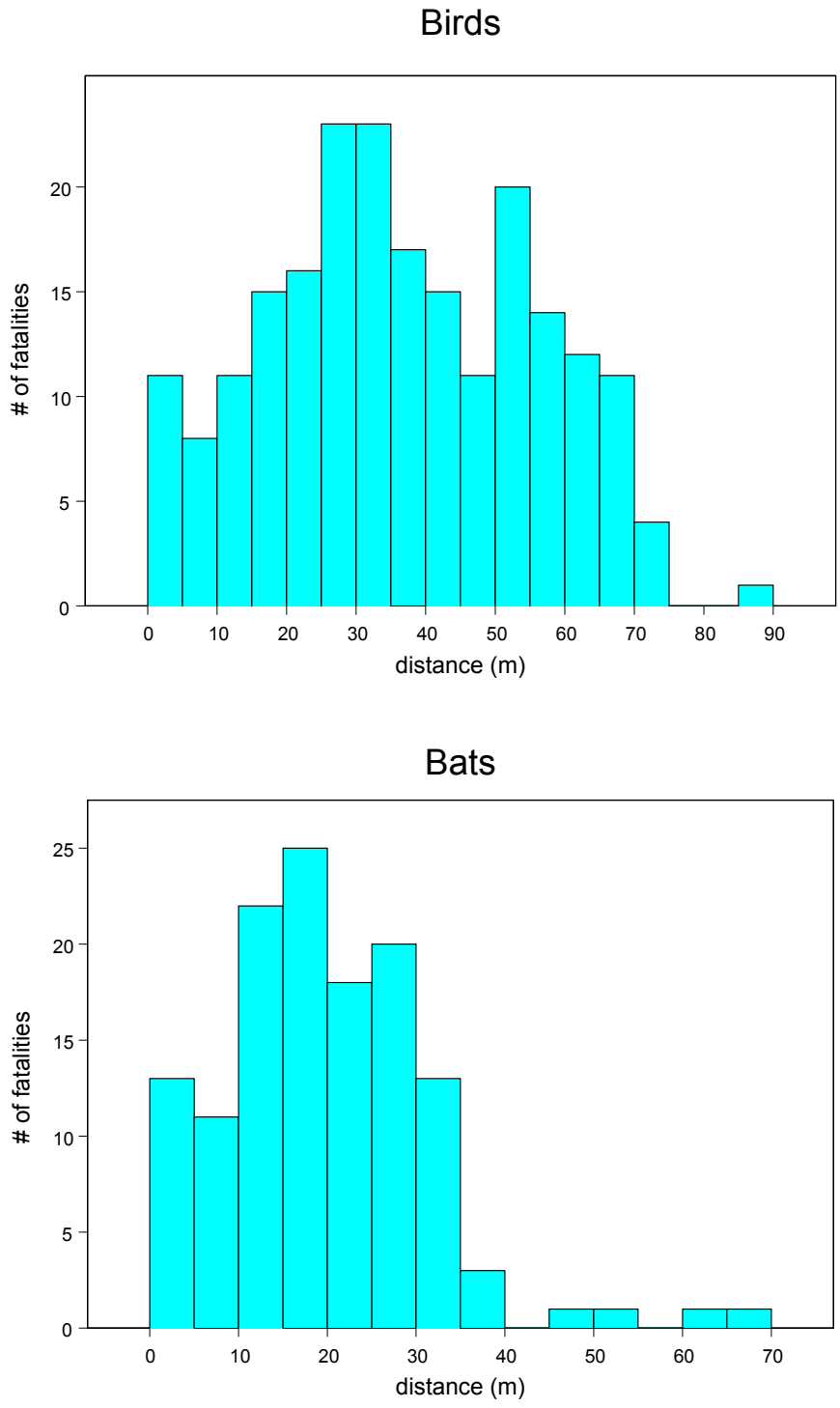
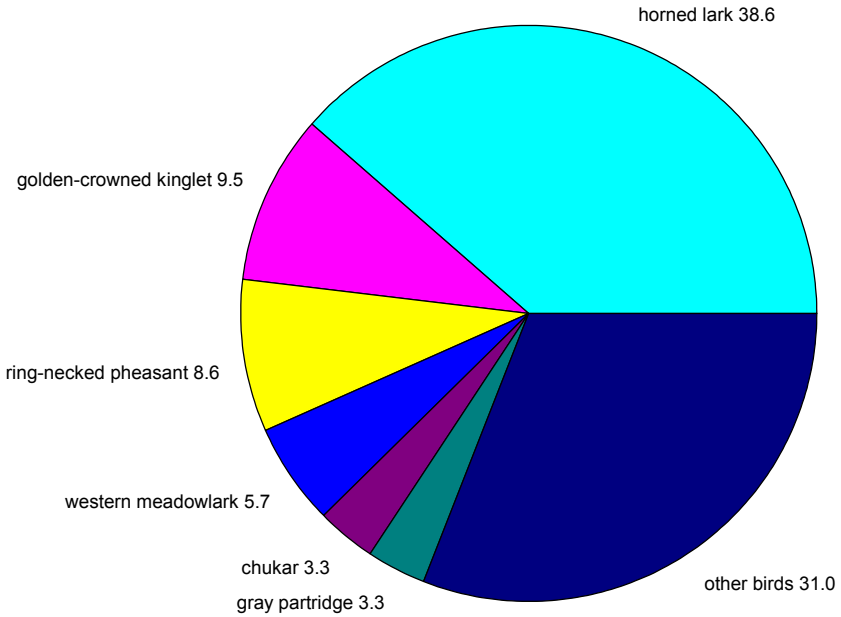


Figure 4. Distribution of distances from turbines to casualties for birds and bats found from July 2001 - December 2003.



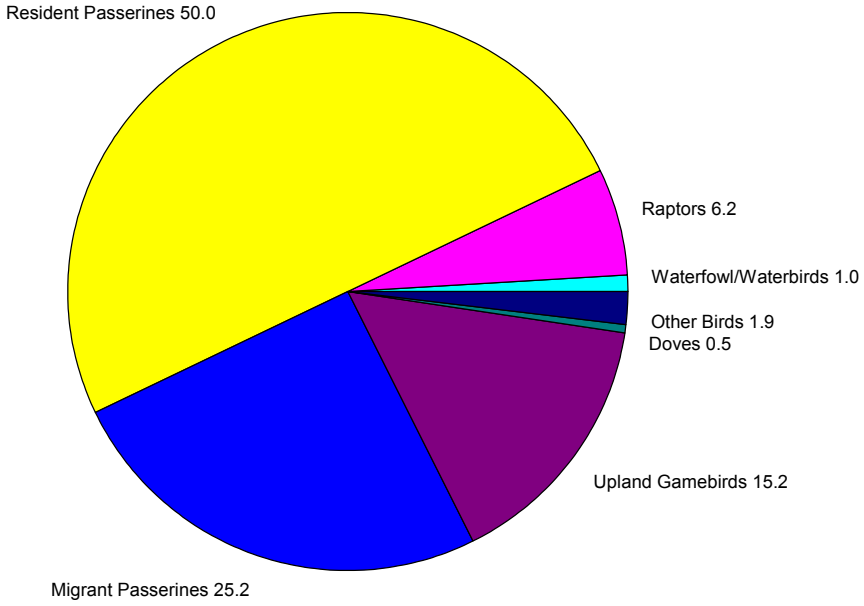
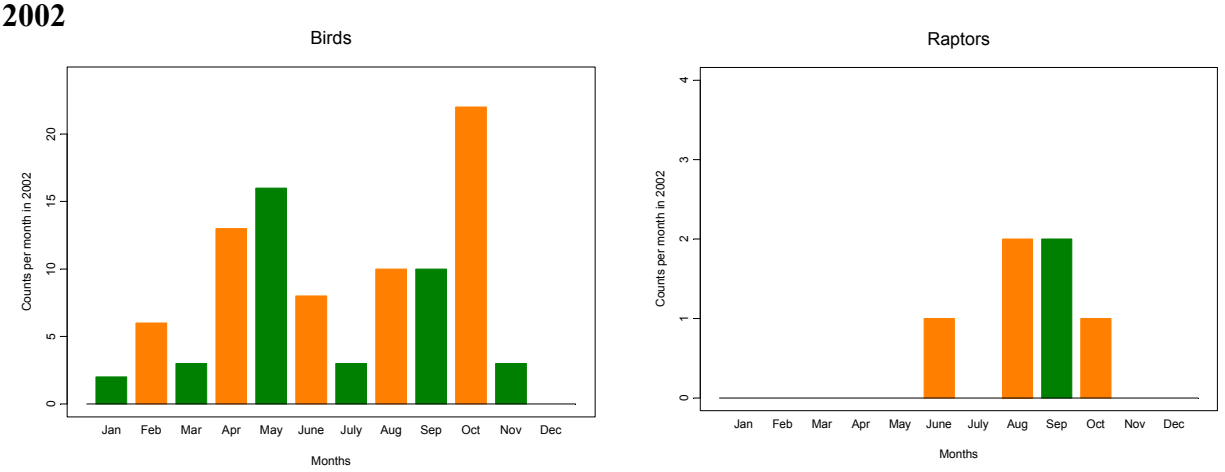
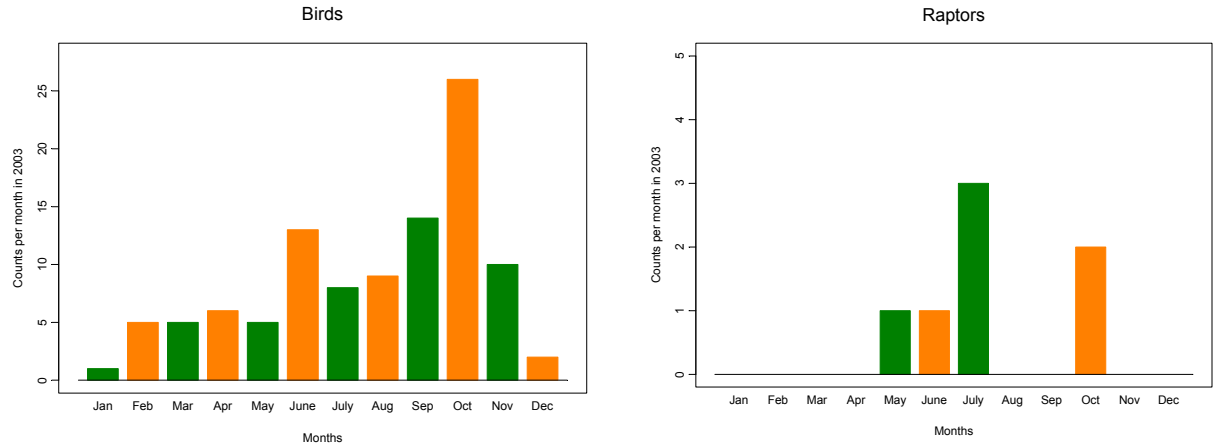


Figure 5. The percent of fatalities for avian species and taxonomic groups (July 2001 – December 2003).

2002



2003



Combined

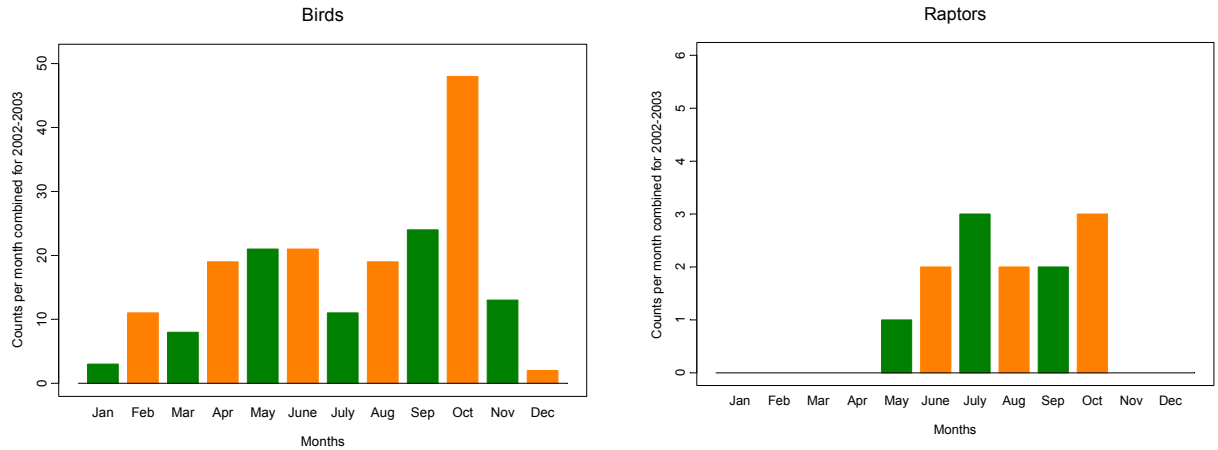


Figure 6. Distribution of all bird and raptor fatalities by month for each year (January 2002 – December 2003).

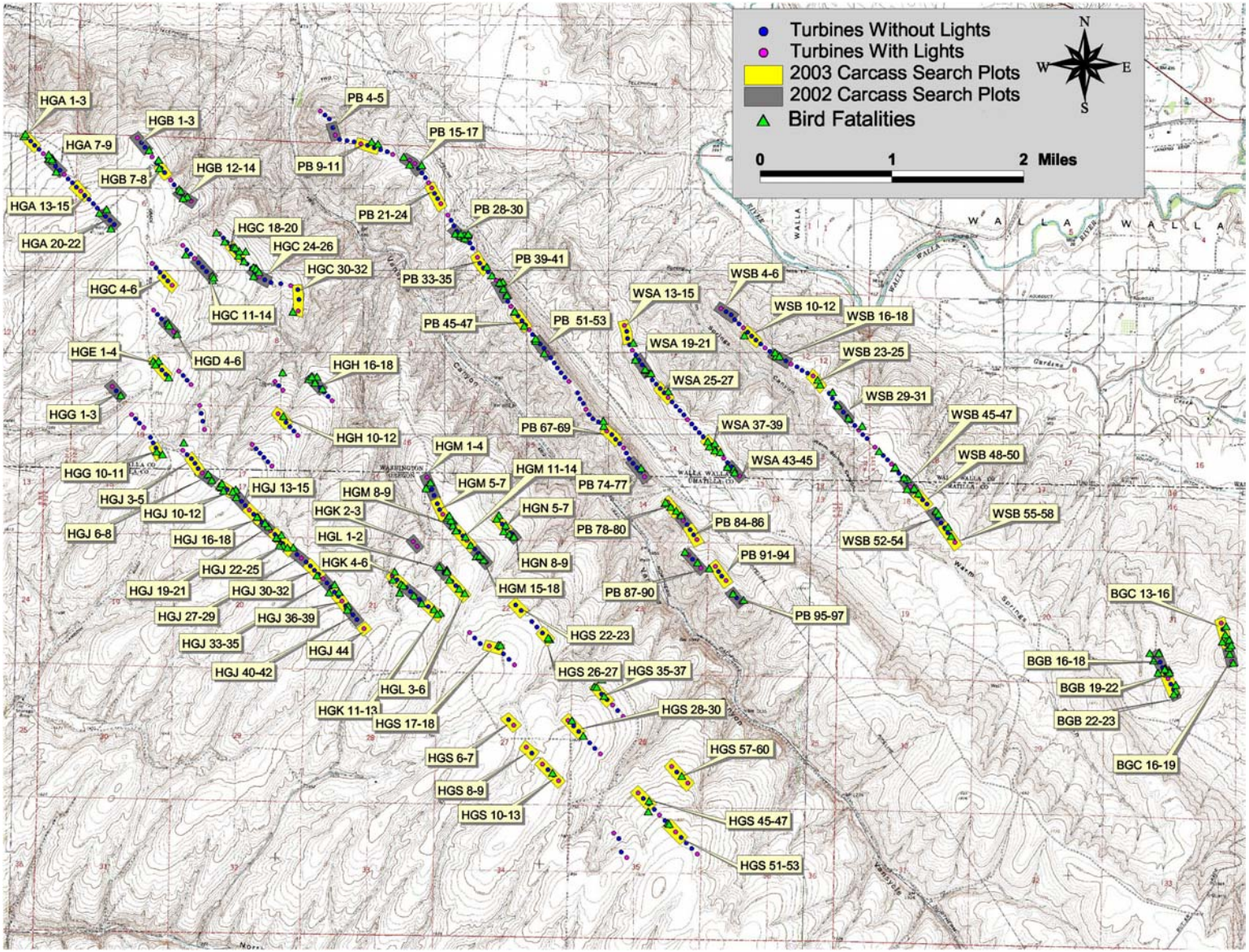


Figure 7. Distribution of bird fatalities in the Stateline Wind Project (July 2001 – December 2003)

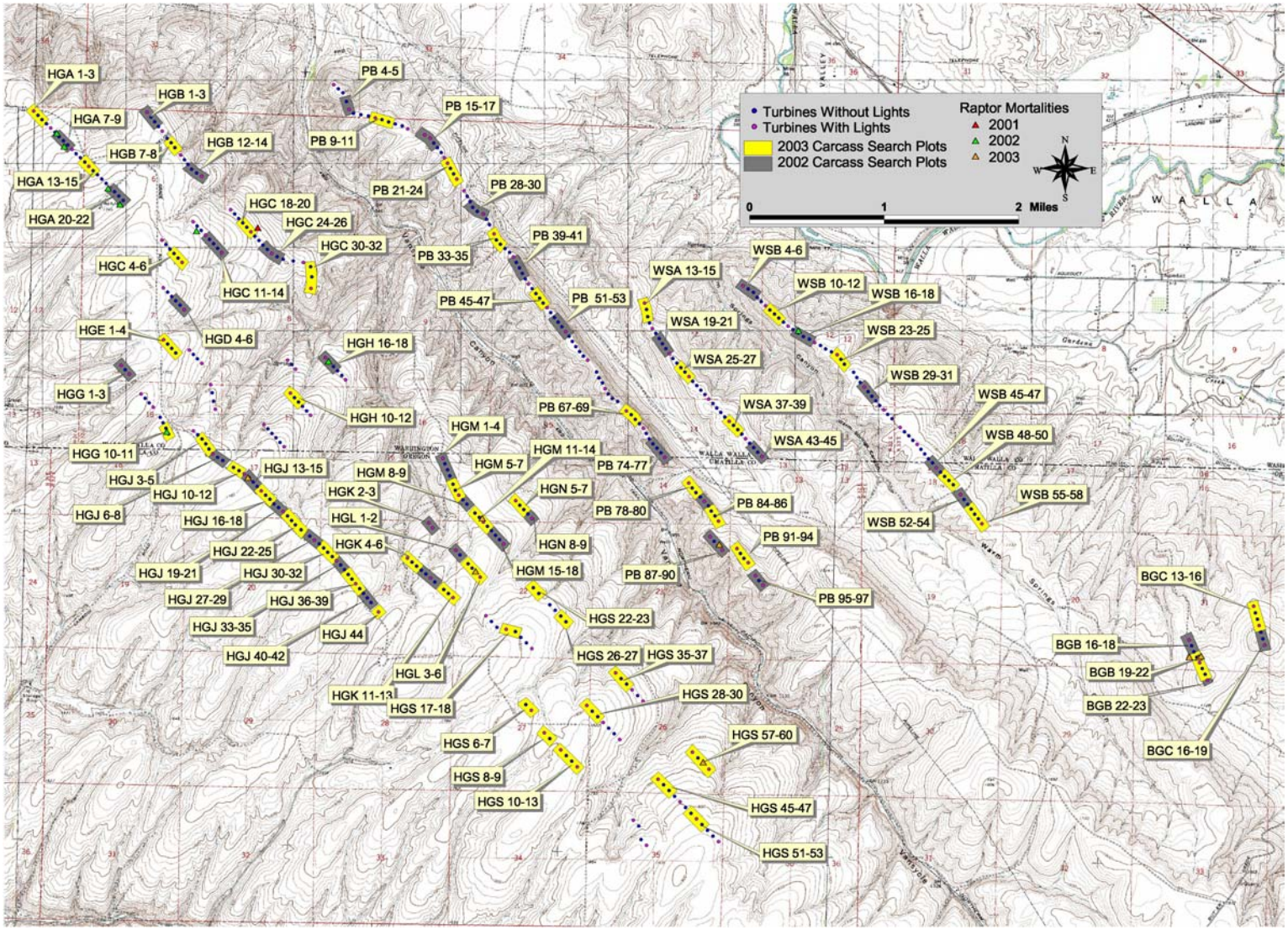


Figure 8. Distribution of raptor fatalities in the Stateline Wind Project (July 2001 – December 2003)

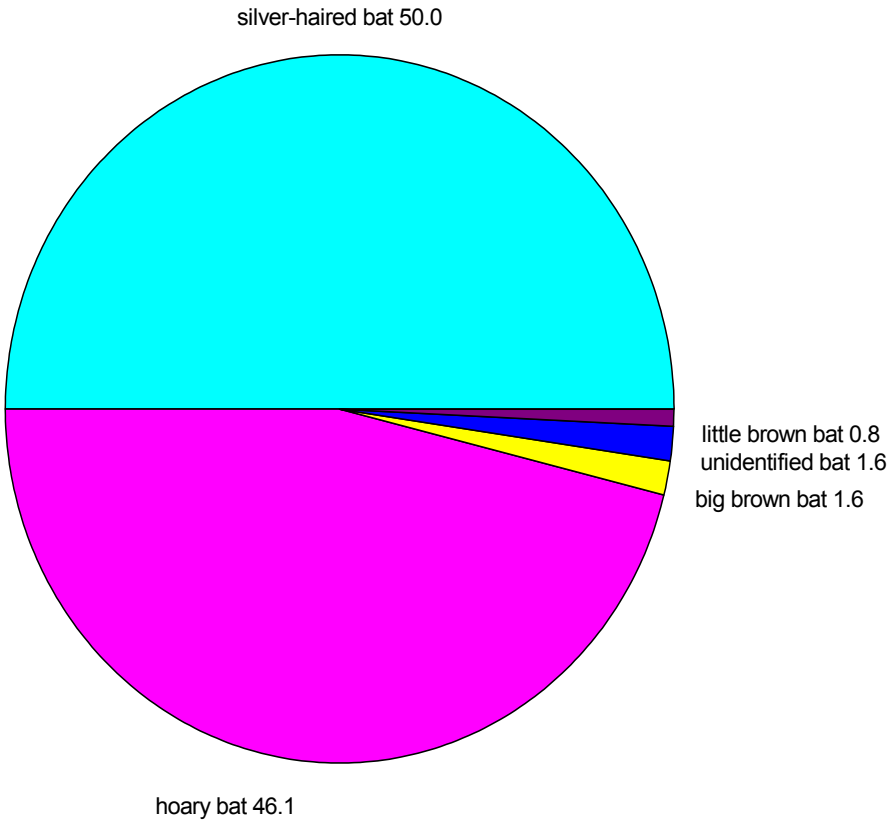


Figure 9. The percent of fatalities for bat species (July 2001 - December 2003).

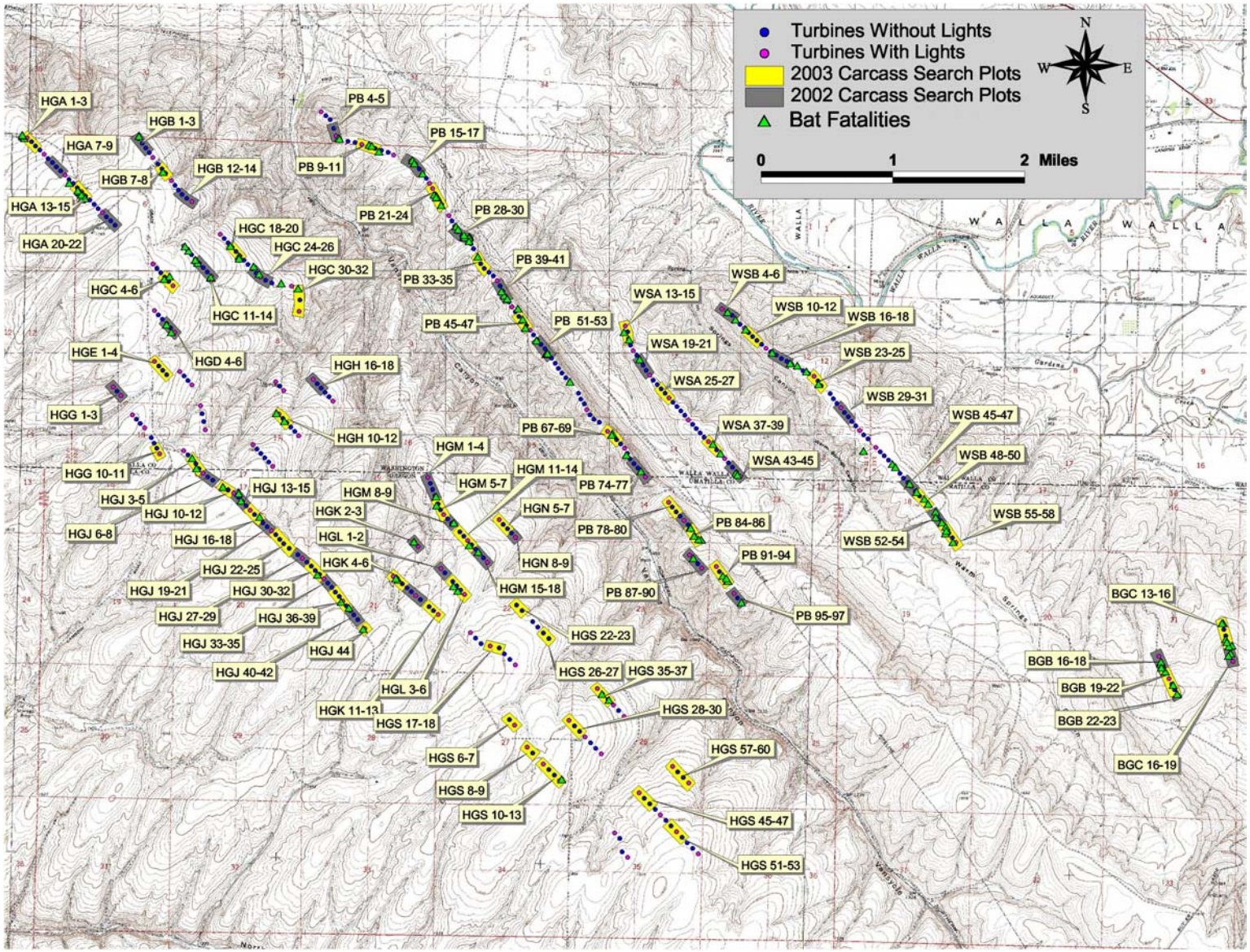
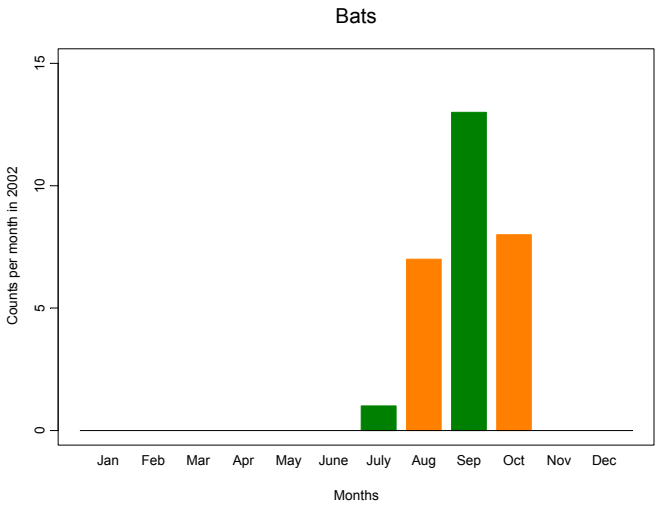
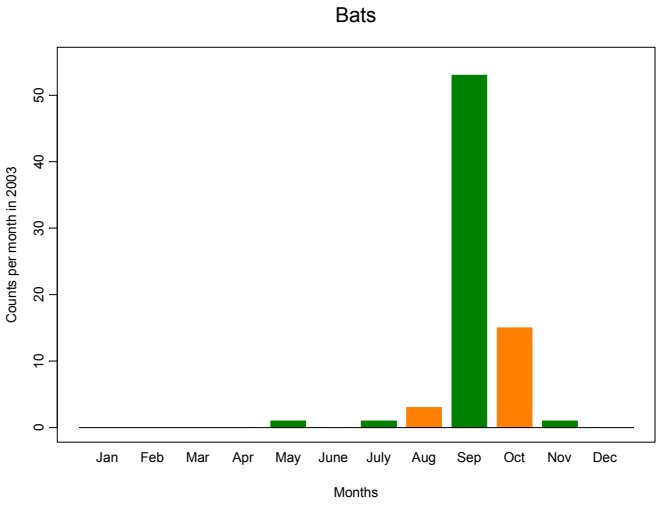


Figure 10. Distribution of bat fatalities in the Stateline Wind Project (July 2001 - December 2003)

2002



2003



COMBINED

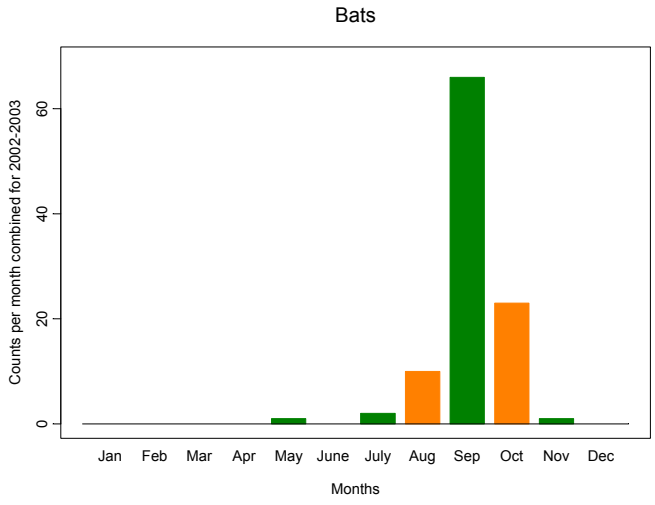


Figure 11. Distribution of bat fatalities by month for each year and combined years (January 2002 – December 2003).

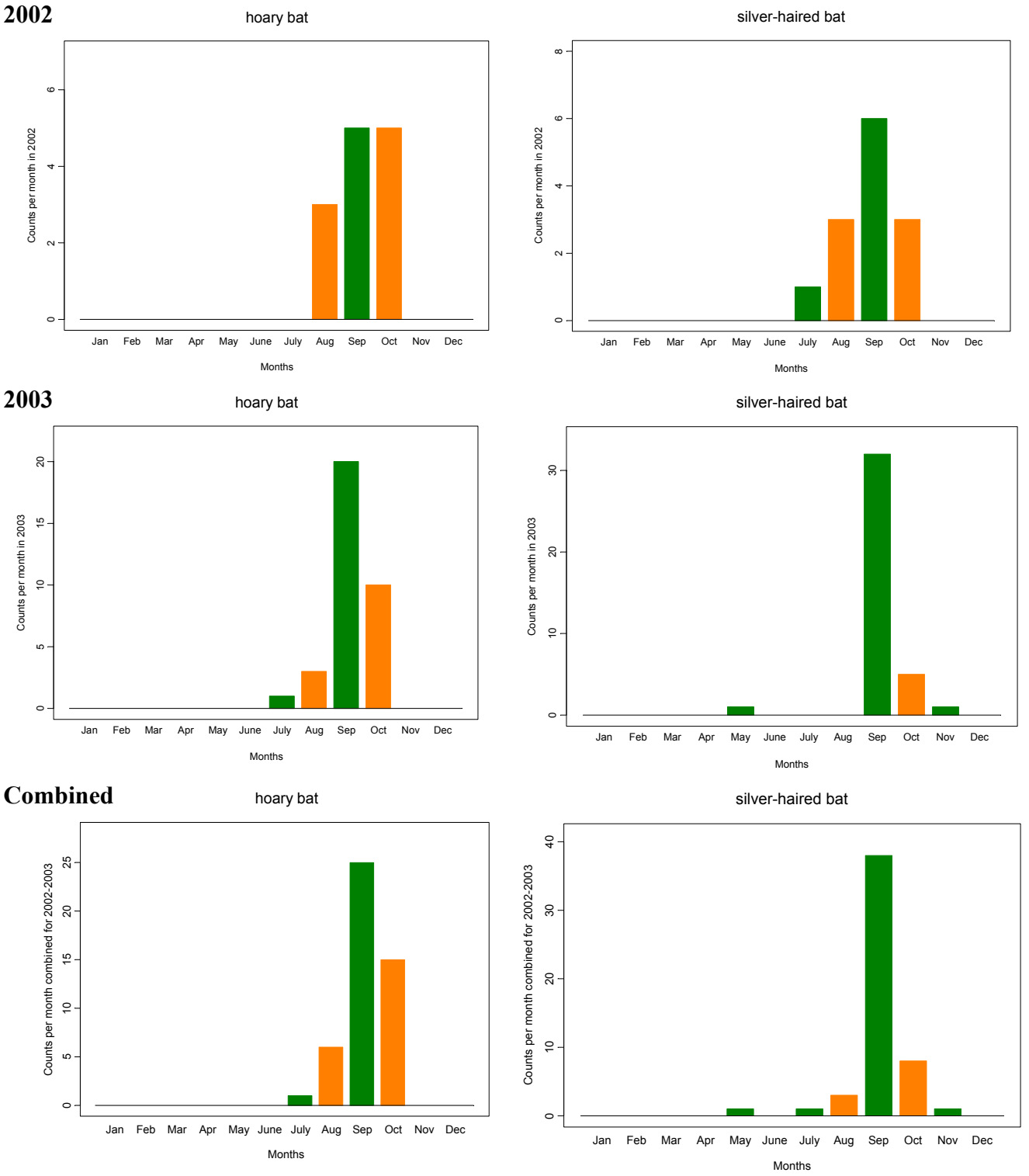


Figure 11 (cont). Distribution of bat fatalities by month for each year (January 2002 - December 2003) and combined years.

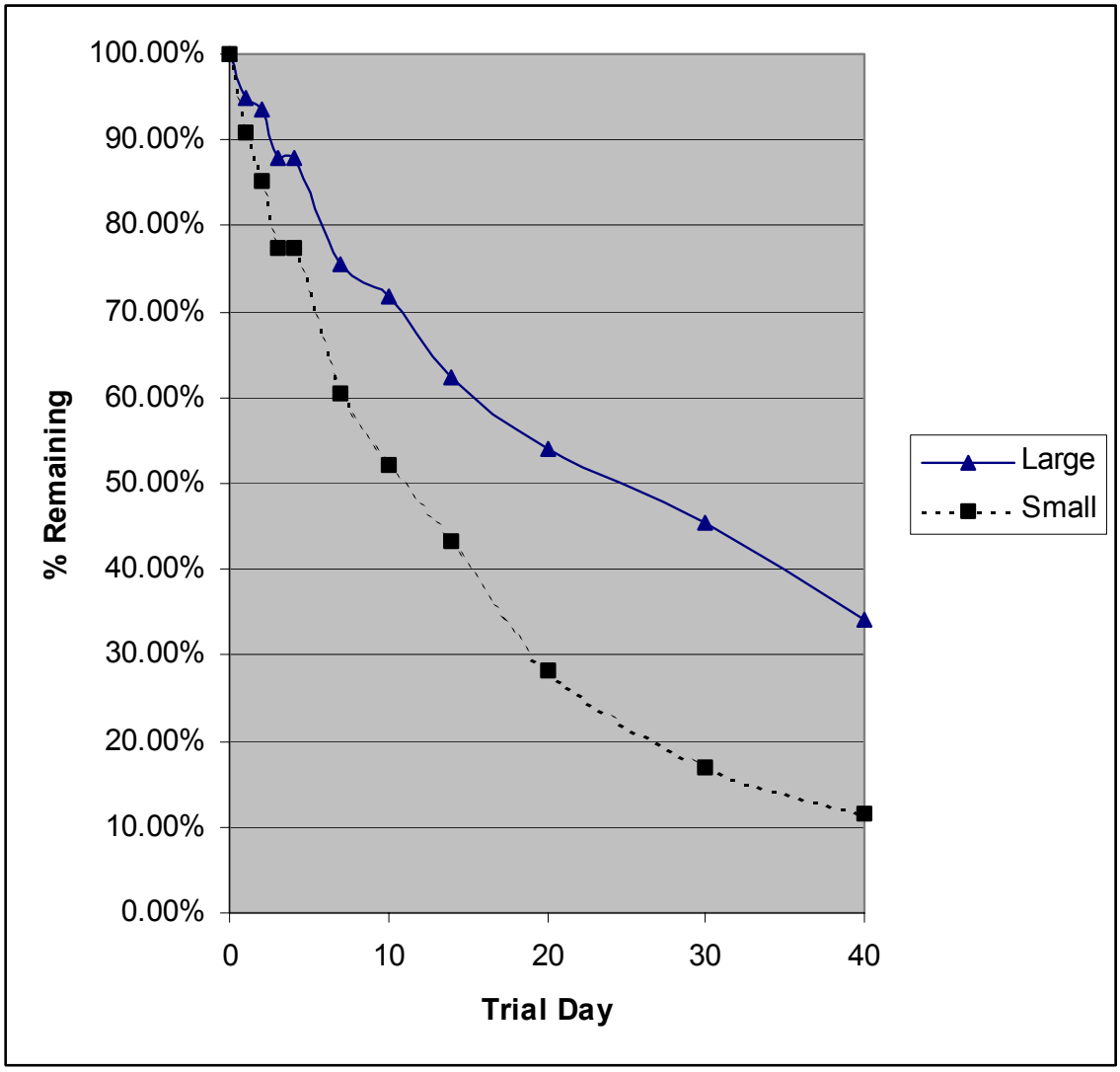


Figure 12. Results of avian carcass removal trials conducted July 2001 - December 2003.

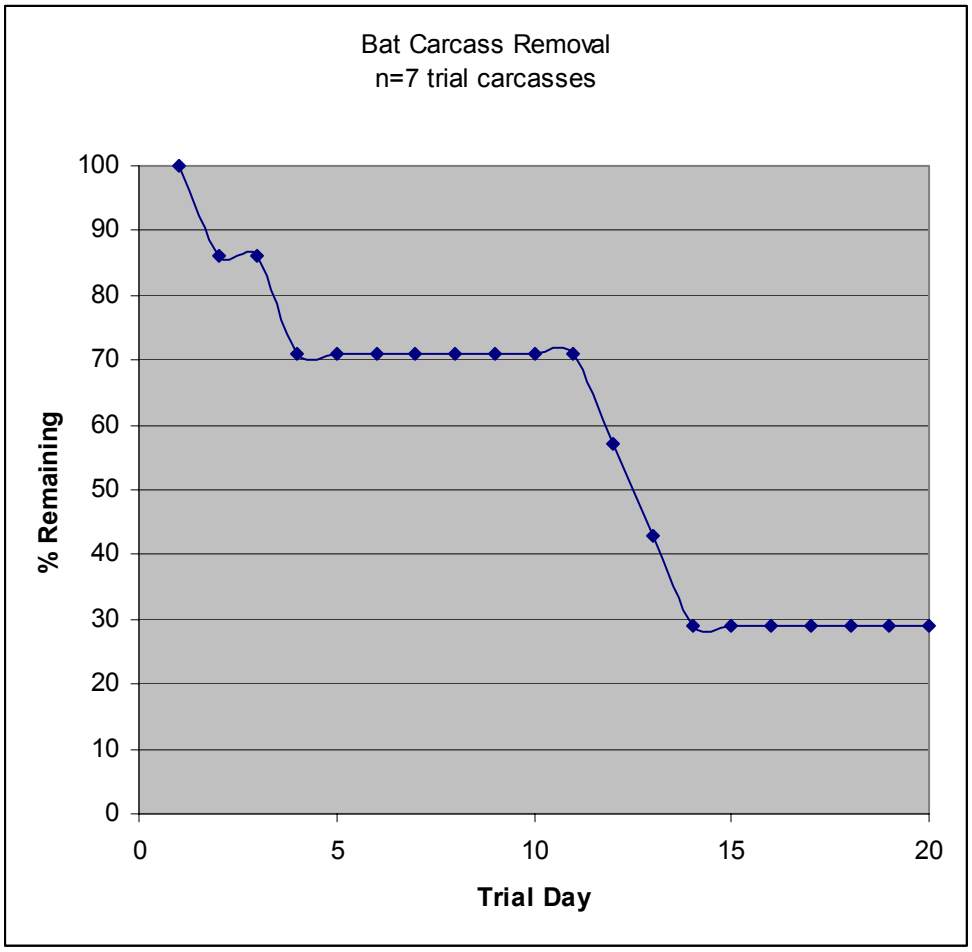


Figure 13. Results of bat carcass removal trials conducted fall 2003.

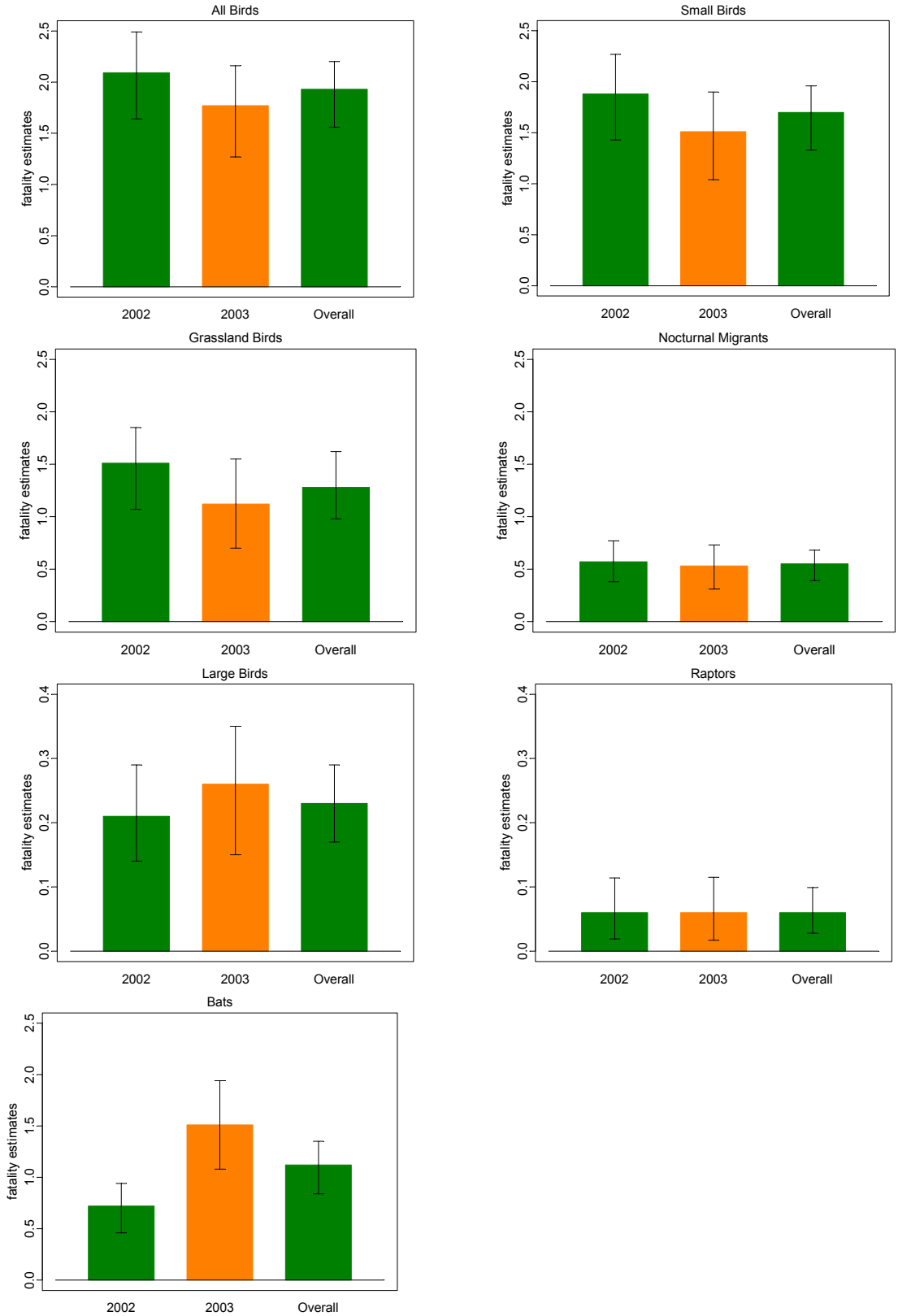
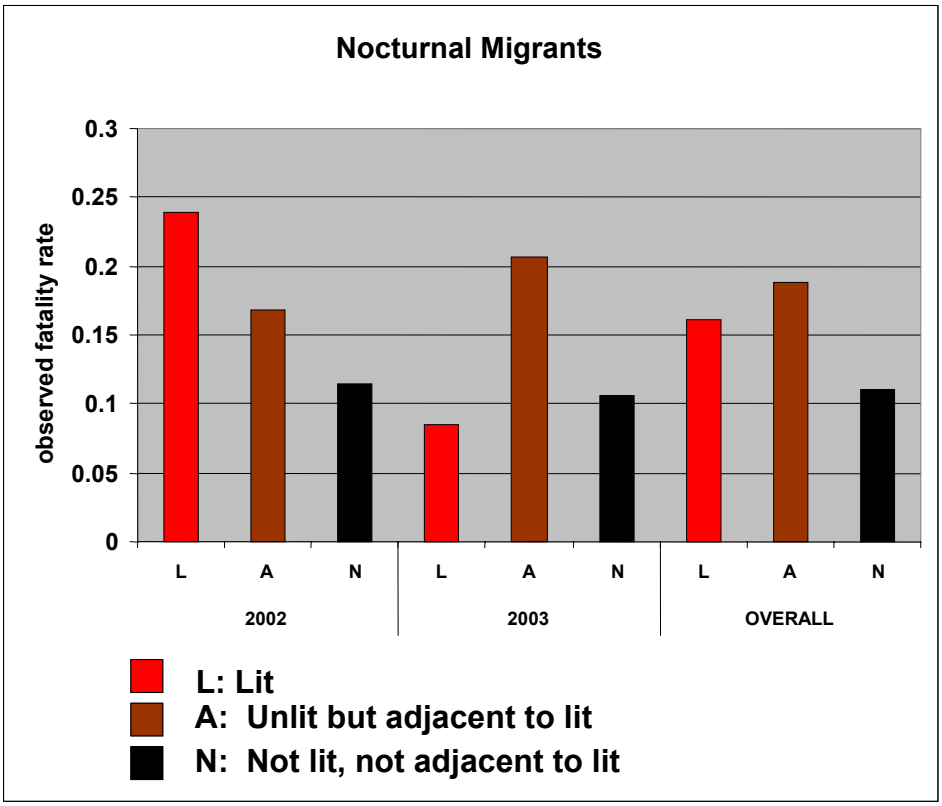


Figure 14. Annual and overall fatality estimates (#/turbine/year adjusted for biases) for taxonomic and size classes of birds (January 2002 - December 2003).



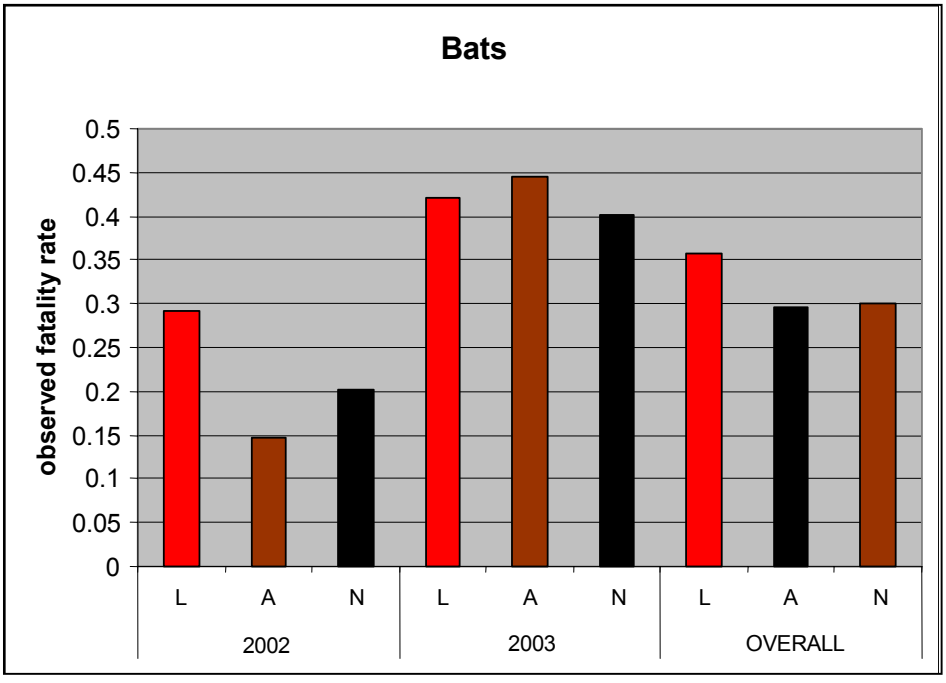
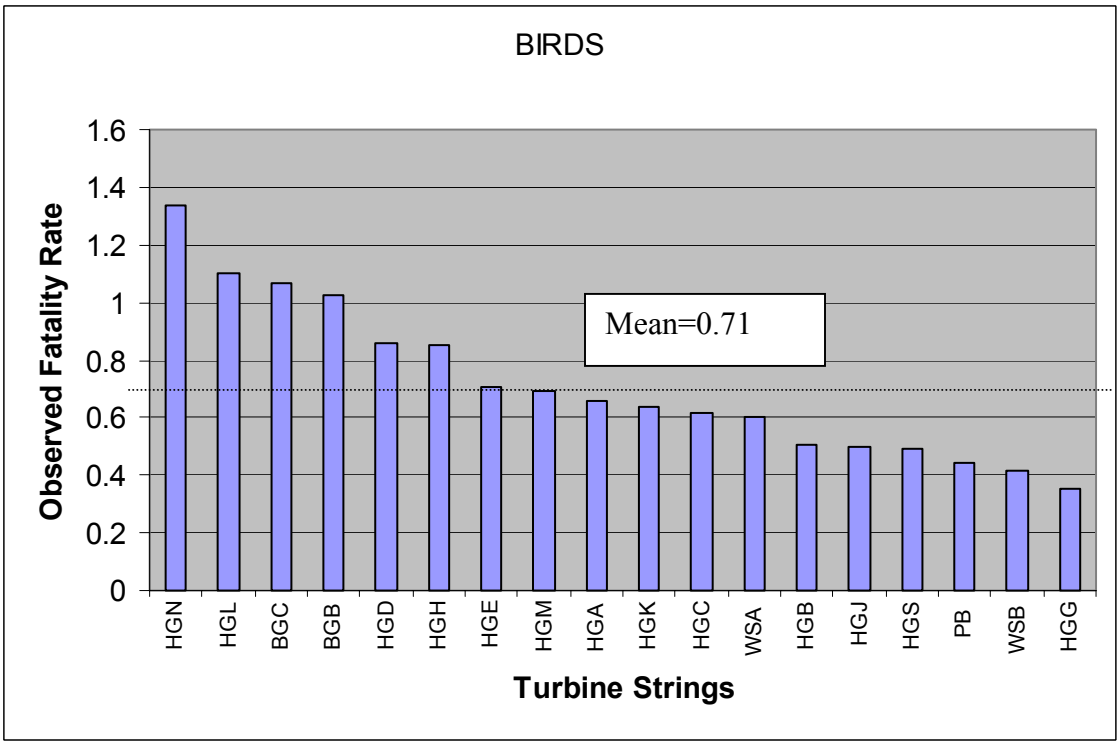


Figure 15. Observed nocturnal migrant and bat fatality rates (#/turbine/year) for lit turbines "L", unlit but adjacent to lit turbines "A", and unlit turbines not adjacent to lit turbines "N" (January 2002 - December 2003).



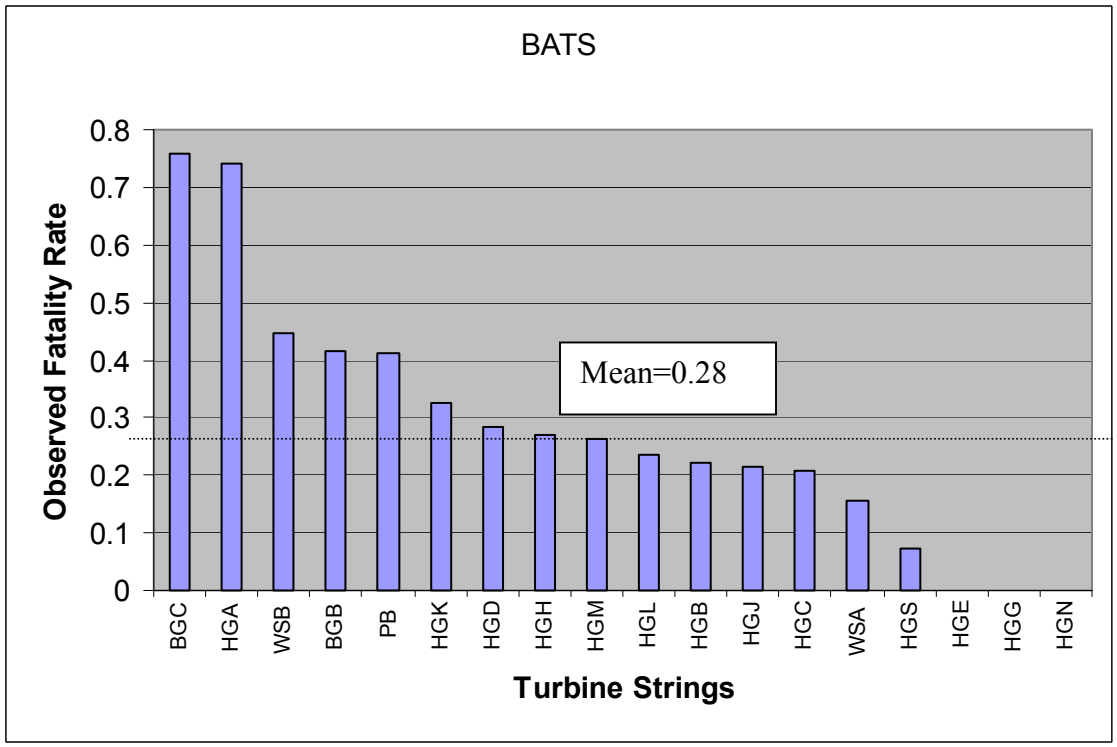


Figure 16. Observed fatality rates (#/turbine/year) by turbine string in 2002 and 2003.

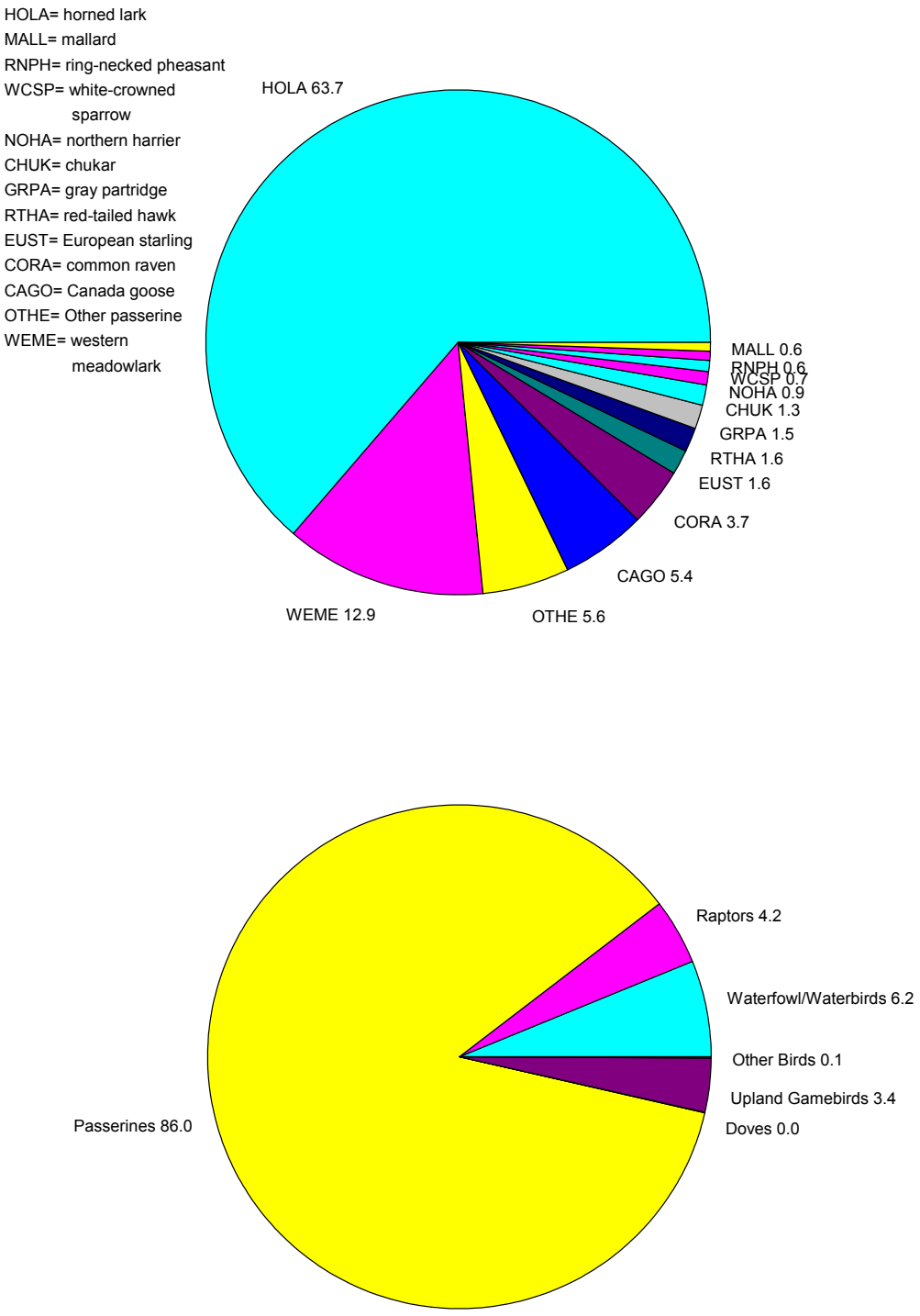


Figure 17. The percent composition of avian use for avian species and taxonomic groups (July 2001 - December 2003).

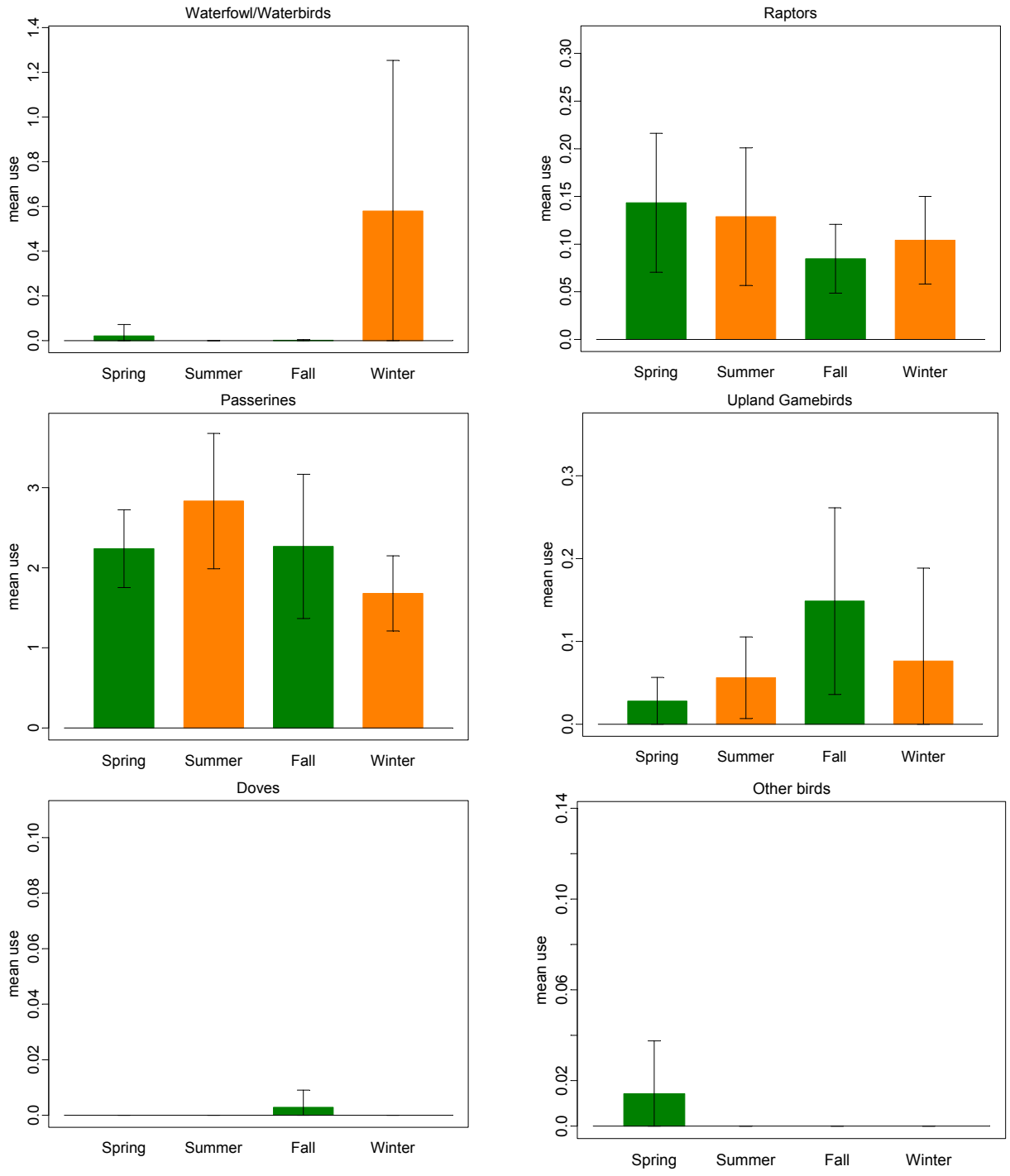


Figure 18. Avian use (#/10-minute survey) by season for taxonomic groups for entire study period (July 2001 - December 2003).

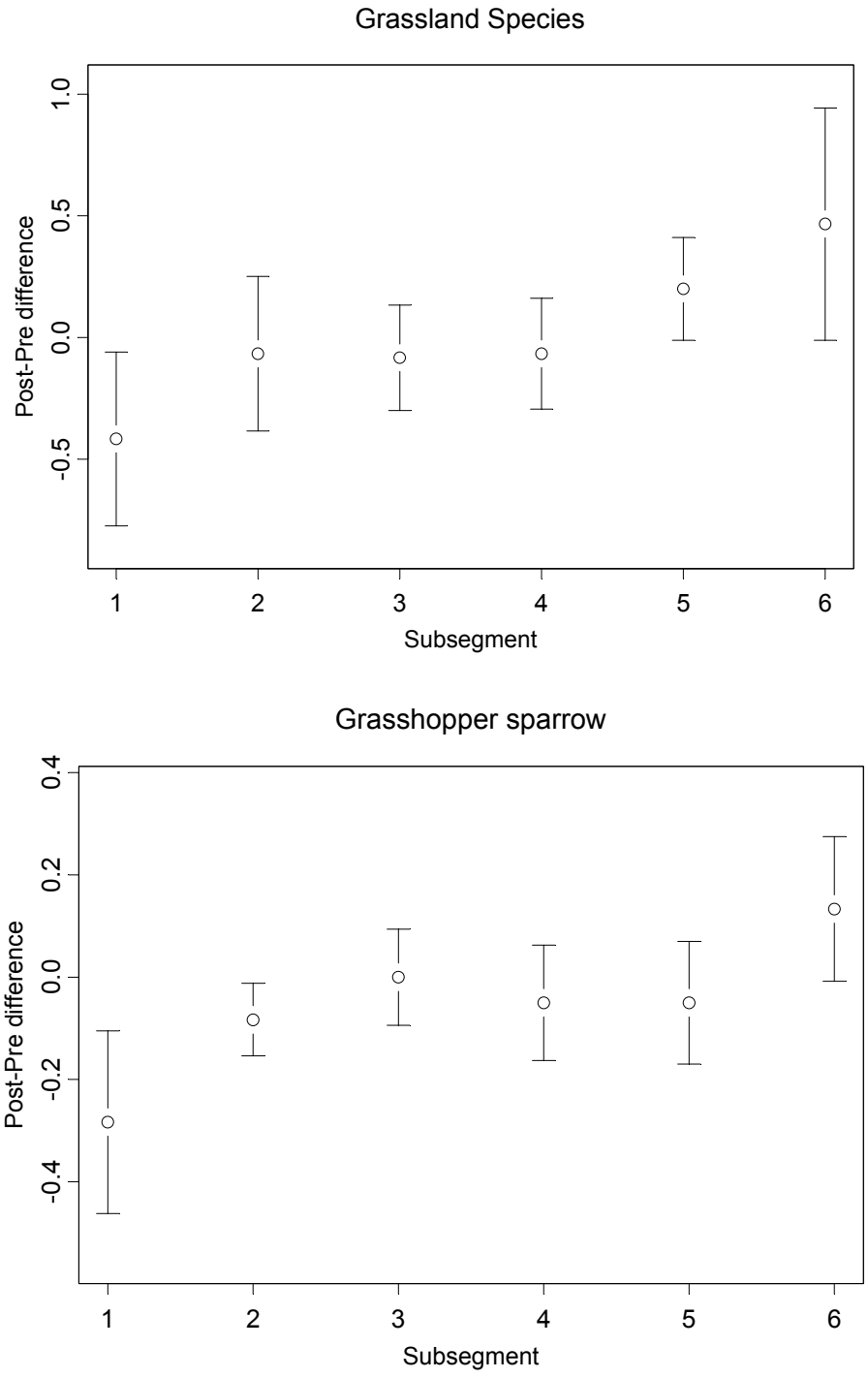


Figure 19. Differences in mean use (post-construction [2002] minus pre-construction [2001]) and 90% confidence intervals for grassland birds combined and for grasshopper sparrows. Subsegment 1: 0 – 50 m from turbine string; 2: 51-100 m; 3: 101-150 m; 4: 151-200 m; 5: 201-250 m; 6: 251-300 m. Confidence intervals that do not overlap the value 0 indicate statistically significant effects.

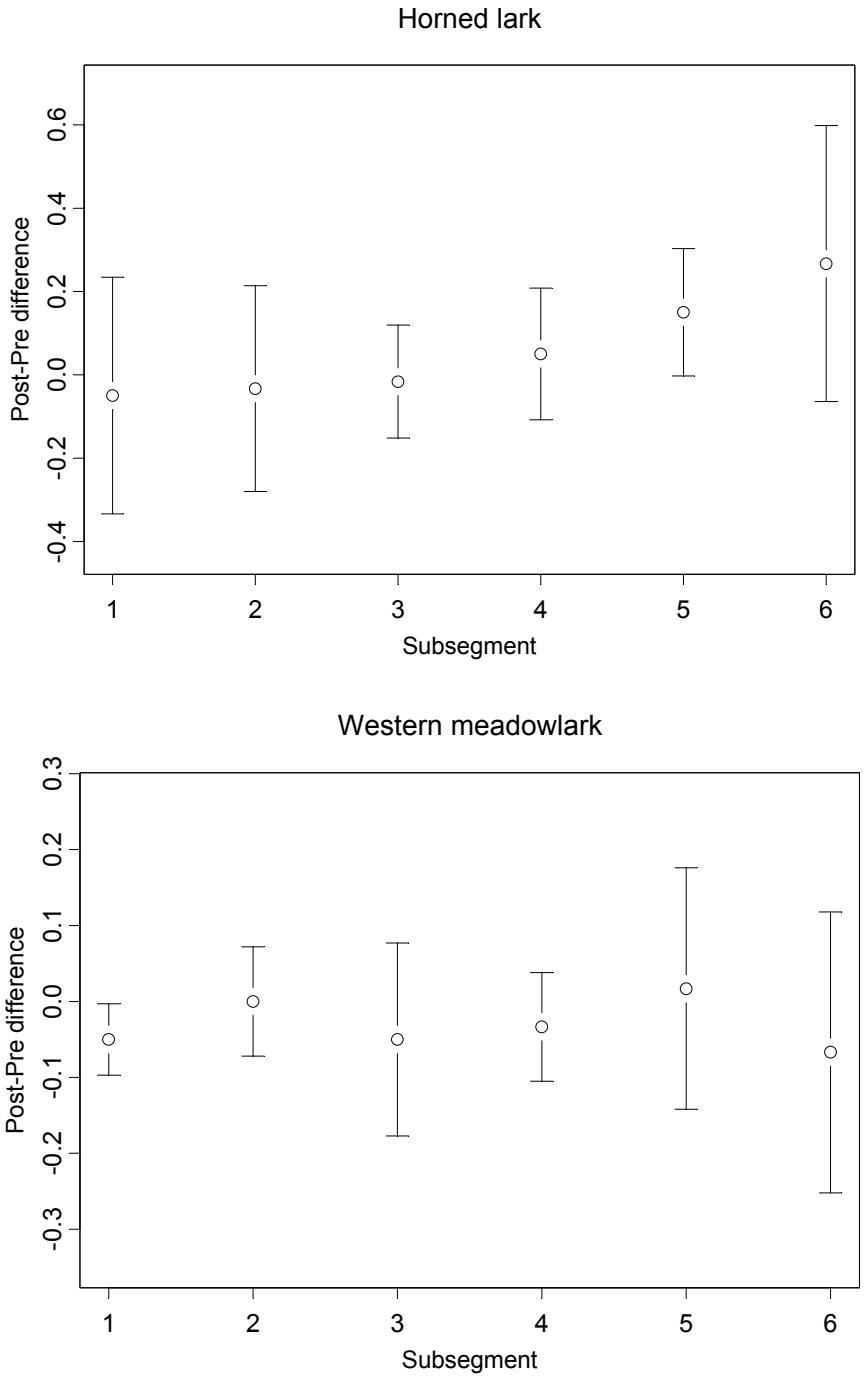
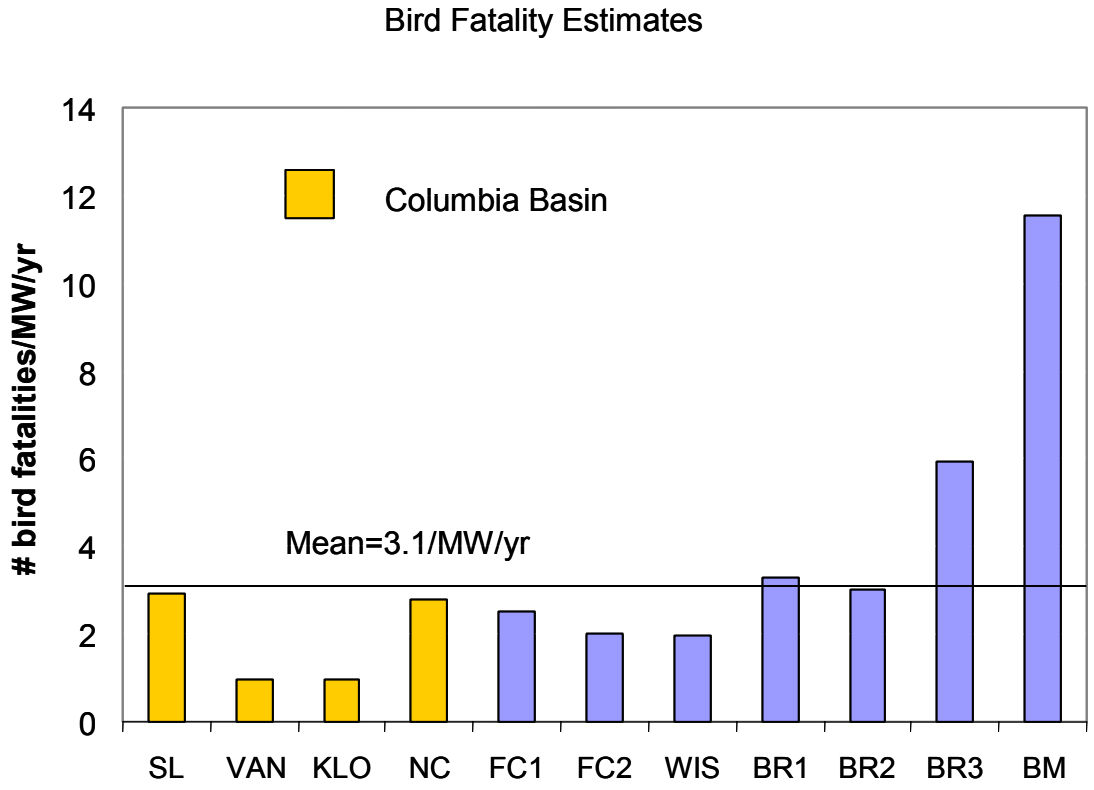


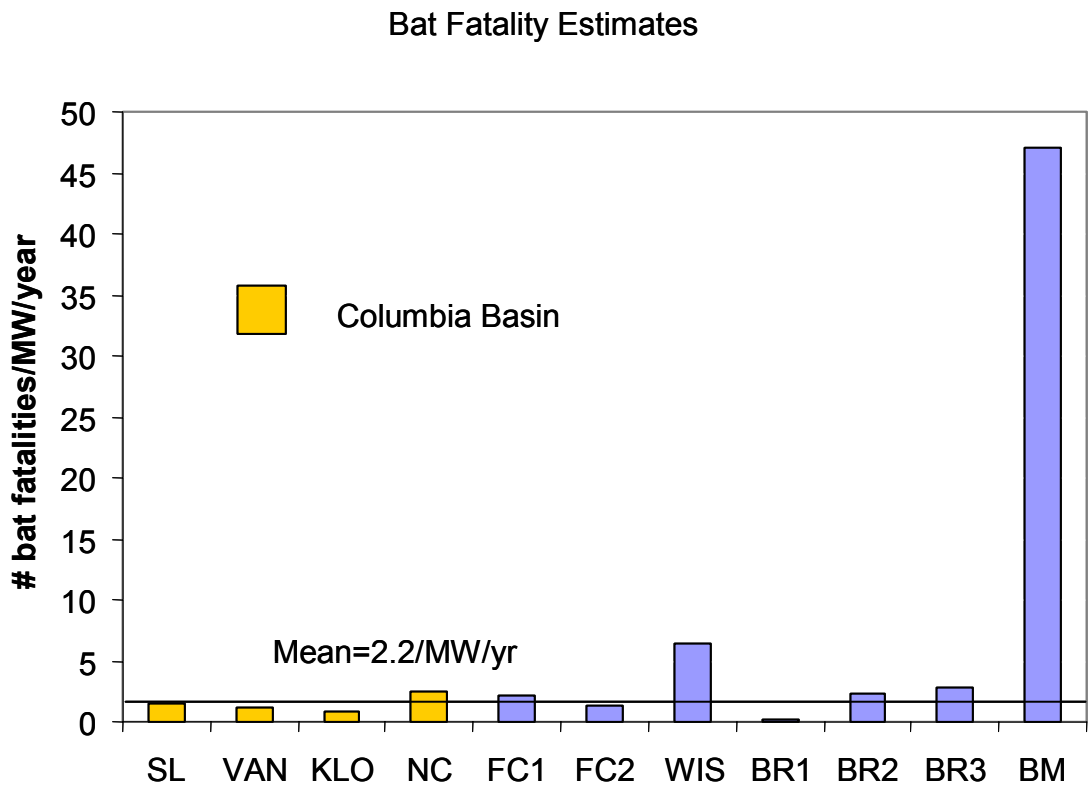
Figure 20. Differences in mean use (post-construction [2002] minus pre-construction [2001]) and 90% confidence intervals for horned lark and western meadowlark. Subsegment 1: 0– 50 m from turbine string; 2: 51-100 m; 3: 101-150 m; 4: 151-200 m; 5: 201-250 m; 6: 251-300 m. Confidence intervals that do not overlap the value 0 indicate statistically significant effects.



LEGEND

SL: Stateline Oregon and Washington, 660 kW (this report)
VAN: Vansycle Oregon, 660 kW (Erickson et al. 2000)
KLO: Klondike Oregon, 1.5 MW (Johnson et al. 2003b)
NC: Nine Canyon Washington, 1.3 MW (Erickson et al. 2003b)
FC1: Phase I Foote Creek Rim Wyoming 600 kW (Young et al. 2003)
FC2: Phase II Foote Creek Rim Wyoming 750 kW (Young et al. 2003)
WIS: MGE and WPSC turbines, Wisconsin 660 kW (Howe et al. 2002)
BR1: Phase I Buffalo Ridge Minnesota, 300 kW (Johnson et al. 2002)
BR2: Phase II Buffalo Ridge Minnesota, 750 kW (Johnson et al. 2002)
BR3: Phase IIII Buffalo Ridge Minnesota 750 kW (Johnson et al. 2002)
BM: Buffalo Mountain, Tennessee 660 kW (Nicholson 2003)

Figure 21. Standardized bird fatality estimates from new generation wind projects in the U.S. We only included studies that provided estimates adjusted for scavenging and searcher efficiency and that were conducted for a minimum of 1 year. Mean estimate weighted by MW of individual projects.



LEGEND

SL: Stateline Oregon and Washington, 660 kW (this report)
VAN: Vansycle Oregon, 660 kW (Erickson et al. 2000)
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WIS: MGE and WPSC turbines, Wisconsin 660 kW (Howe et al. 2002)
BR1: Phase I Buffalo Ridge Minnesota, 300 kW (Johnson et al. 2002)
BR2: Phase II Buffalo Ridge Minnesota, 750 kW (Johnson et al. 2002)
BR3: Phase IIII Buffalo Ridge Minnesota 750 kW (Johnson et al. 2002)
BM: Buffalo Mountain, Tennessee 660 kW (Nicholson 2003)

Figure 22. Standardized bat fatality estimates from new generation wind projects in the U.S. We only included studies that provided estimates adjusted for scavenging and searcher efficiency and that were conducted for a minimum of 1 year. Mean estimate weighted by MW of individual projects.

APPENDIX A-1 - List of Washington turbines sampled during the standardized searches from July 2001 through December 2002.

Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID	Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID
1	HGA7	AD	M	0	HGA 7-9	31	PB15	GR	D	1	PB 15-17
2	HGA8	AD	M	0	HGA 7-9	32	PB16	GR	M	1	PB 15-17
3	HGA9	AD	M	0	HGA 7-9	33	PB17	GR	M	0	PB 15-17
4	HGB1	GR	E	1	HGB 1-3	34	PB28	GR	M	0	PB 28-30
5	HGB2	GR	M	0	HGB 1-3	35	PB29	GR	M	0	PB 28-30
6	HGB3	GR	M	0	HGB 1-3	36	PB30	GR	M	1	PB 28-30
7	HGB12	GR	M	0	HGB 12-14	37	PB39	GR	M	0	PB 39-41
8	HGB13	GR	M	0	HGB 12-14	38	PB40	GR	M	0	PB 39-41
9	HGB14	GR	E	1	HGB 12-14	39	PB41	GR	M	0	PB 39-41
10	HGA20	AD	M	0	HGA 20-22	40	PB51	GR	M	0	PB 51-53
11	HGA21	AD	M	0	HGA 20-22	41	PB52	GR	M	0	PB 51-53
12	HGA22	AD	M	0	HGA 20-22	42	PB53	GR	M	1	PB 51-53
13	HGC11	GR	M	0	HGC 11-14	43	PB74	GR	M	0	PB 74-77
14	HGC12	GR	M	0	HGC 11-14	44	PB75	GR	M	0	PB 74-77
15	HGC13	GR	M	0	HGC 11-14	45	PB76	GR	M	0	PB 74-77
16	HGC14	GR	E	1	HGC 11-14	46	WSA19	GR	M	0	WSA 19-21
17	HGC24	GR	M	0	HGC 24-26	47	WSA20	GR	M	0	WSA 19-21
18	HGC25	GR	M	1	HGC 24-26	48	WSA21	GR	M	0	WSA 19-21
19	HGC26	GR	M	0	HGC 24-26	49	WSA43	GR	M	0	WSA 43-45
20	HGD4	GR	M	0	HGD 4-6	50	WSA44	GR	M	0	WSA 43-45
21	HGD5	GR	M	0	HGD 4-6	51	WSA45	GR	M	1	WSA 43-45
22	HGD6	GR	E	1	HGD 4-6	52	WSB4	GR	E	1	WSB 4-6
23	HGG1	GR	E	1	HGG 1-3	53	WSB5	GR	M	0	WSB 4-6
24	HGG2	AD	M	0	HGG 1-3	54	WSB6	GR	M	0	WSB 4-6
25	HGG3	AD	E	1	HGG 1-3	55	WSB16	GR	M	0	WSB 16-18
26	HGH16	SS	E	1	HGH 16-18	56	WSB17	GR	M	0	WSB 16-18
27	HGH17	SS	M	0	HGH 16-18	57	WSB18	GR	M	0	WSB 16-18
28	HGH18	SS	M	0	HGH 16-18	58	WSB29	GR	M	1	WSB 29-31
29	PB4	GR	D	0	PB 4-5	59	WSB30	GR	M	0	WSB 29-31
30	PB5	GR	M	1	PB 4-5	60	WSB31	GR	M	0	WSB 29-31

[a] AD=agriculture dry, GR=grassland (crested wheatgrass or native bunchgrass), SS=Shrub/steppe
[b] Turbine position: E=end-row, D=discontinuous/saddle, M=mid-row

APPENDIX A-2 - List of Oregon turbines sampled during the standardized searches from January through December 2002.

Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID	Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID
1	BGB16	GR	E	1	BGB 16-18	33	HGK10	AD	D	0	HGK 7-10
2	BGB17	GR	M	0	BGB 16-18	34	HGL1	AD	E	1	HGL 1-2
3	BGB18	GR	M	0	BGB 16-18	35	HGL2	GR/AD	D	0	HGL 1-2
4	BGB22	GR	M	0	BGB 22-23	36	HGM1	SS	E	1	HGM 1-4
5	BGB23	GR	E	1	BGB 22-23	37	HGM2	GR	M	0	HGM 1-4
6	BGC16	GR	M	1	BGC 16-19	38	HGM3	GR	M	0	HGM 1-4
7	BGC17	GR	M	0	BGC 16-19	39	HGM4	GR	M	0	HGM 1-4
8	BGC18	GR	M	0	BGC 16-19	40	HGM8	GR	M	0	HGM 8-9
9	BGC19	GR	E	1	BGC 16-19	41	HGM9	GR	D	0	HGM 8-9
10	HGJ6	AD	M	1	HGJ 6-8	42	HGM15	GR	M	0	HGM 15-18
11	HGJ7	AD	M	0	HGJ 6-8	43	HGM16	GR	M	0	HGM 15-18
12	HGJ8	AD	D	0	HGJ 6-8	44	HGM17	GR	M	0	HGM 15-18
13	HGJ13	AD	M	0	HGJ 13-15	45	HGM18	GR	E	1	HGM 15-18
14	HGJ14	AD	M	0	HGJ 13-15	46	HGN8	GR	M	0	HGN 8-9
15	HGJ15	AD	M	0	HGJ 13-15	47	HGN9	GR	E	1	HGN 8-9
16	HGJ19	AD	M	0	HGJ 19-21	48	PB77	GR	E	1	PB 74-77
17	HGJ20	AD	M	0	HGJ 19-21	49	PB81	GR	M	0	PB 81-83
18	HGJ21	AD	M	1	HGJ 19-21	50	PB82	GR	M	1	PB 81-83
19	HGJ27	GR/AD	D	0	HGJ 27-29	51	PB83	GR	M	0	PB 81-83
20	HGJ28	GR/AD	M	1	HGJ 27-29	52	PB87	GR	E	1	PB 87-90
21	HGJ29	GR/AD	M	0	HGJ 27-29	53	PB88	GR	M	0	PB 87-90
22	HGJ33	GR/AD	M	1	HGJ 33-35	54	PB89	GR	M	0	PB 87-90
23	HGJ34	GR/AD	M	0	HGJ 33-35	55	PB90	GR	E	1	PB 87-90
24	HGJ35	GR/AD	M	0	HGJ 33-35	56	PB95	GR	D	1	PB 95-97
25	HGJ40	GR/AD	M	0	HGJ 40-42	57	PB96	GR	D	0	PB 95-97
26	HGJ41	GR/AD	M	0	HGJ 40-42	58	PB97	GR	E	1	PB 95-97
27	HGJ42	GR/AD	D	0	HGJ 40-42	59	WSB45	GR	M	0	WSB 45-47
28	HGK2	AD	E	1	HGK 2-3	60	WSB46	GR	M	1	WSB 45-47
29	HGK3	AD	E	1	HGK 2-3	61	WSB47	GR	M	0	WSB 45-47
30	HGK7	AD	M	0	HGK 7-10	62	WSB52	GR	D	1	WSB 52-54
31	HGK8	AD	M	0	HGK 7-10	63	WSB53	GR	M	0	WSB 52-54
32	HGK9	AD	M	1	HGK 7-10	64	WSB54	GR	M	0	WSB 52-54

[a] AD=agriculture dry, GR=grassland (crested wheatgrass or native bunchgrass), SS=Shrub/steppe
[b] Turbine position: E=end-row, D=discontinuous/saddle, M=mid-row

APPENDIX A-3 - List of Washington turbines sampled during the standardized searches from January through December 2003.

Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID	Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID
1	HGA1	AD	E	1	HGA 1-3	31	PB10	GR	M	0	PB 9-11
2	HGA2	AD	M	0	HGA 1-3	32	PB11	GR	M	0	PB 9-11
3	HGA3	AD	M	0	HGA 1-3	33	PB21	GR	M	1	PB 21-24
4	HGA13	AD	M	0	HGA 13-15	34	PB22	GR	M	0	PB 21-24
5	HGA14	AD	M	1	HGA 13-15	35	PB23	GR	M	0	PB 21-24
6	HGA15	AD	M	0	HGA 13-15	36	PB24	GR	D	1	PB 21-24
7	HGB7	GR	M	0	HGB 7-8	37	PB33	GR	D	1	PB 33-35
8	HGB8	GR	D	0	HGB 7-8	38	PB34	GR	M	0	PB 33-35
9	HGC4	GR	M	0	HGC 4-6	39	PB35	GR	M	0	PB 33-35
10	HGC5	GR	M	0	HGC 4-6	40	PB45	GR	M	0	PB 45-47
11	HGC6	GR	E	1	HGC 4-6	41	PB46	GR	M	0	PB 45-47
12	HGC18	GR	M	0	HGC 18-20	42	PB47	GR	M	0	PB 45-47
13	HGC19	GR	M	0	HGC 18-20	43	PB67	GR	D	1	PB 67-69
14	HGC20	GR	M	1	HGC 18-20	44	PB68	GR	M	0	PB 67-69
15	HGC30	GR	M	0	HGC 30-32	45	PB69	GR	M	0	PB 67-69
16	HGC31	GR	M	0	HGC 30-32	46	WSA13	GR	E	1	WSA 13-15
17	HGC32	GR	E	1	HGC 30-32	47	WSA14	GR	M	0	WSA 13-15
18	HGE1	GR	E	1	HGE 1-4	48	WSA15	GR	M	0	WSA 13-15
19	HGE2	GR	M	0	HGE 1-4	49	WSA25	GR	M	0	WSA 25-27
20	HGE3	GR	M	0	HGE 1-4	50	WSA26	GR	M	0	WSA 25-27
21	HGE4	GR	E	0	HGE 1-4	51	WSA27	GR	M	1	WSA 25-27
22	HGG10	AD	M	0	HGG 10-11	52	WSA37	GR	M	1	WSA 37-39
23	HGG11	AD	E	1	HGG 10-11	53	WSA38	GR	M	0	WSA 37-39
24	HGH10	SS	E	1	HGH 10-12	54	WSA39	GR	M	0	WSA 37-39
25	HGH11	SS	M	0	HGH 10-12	55	WSB10	GR	M	0	WSB 10-12
26	HGH12	SS	M	0	HGH 10-12	56	WSB11	GR	M	0	WSB 10-12
27	HGJ3	AD	M	0	HGJ 3-5	57	WSB12	GR	M	0	WSB 10-12
28	HGJ4	AD	M	0	HGJ 3-5	58	WSB23	GR	M	1	WSB 23-25
29	HGJ5	AD	M	0	HGJ 3-5	59	WSB24	GR	M	0	WSB 23-25
30	PB9	GR	M	1	PB 9-11	60	WSB25	GR	D	0	WSB 23-25

[a] AD=agriculture dry, GR=grassland (crested wheatgrass or native bunchgrass), SS=Shrub/steppe
[b] Turbine position: E=end-row, D=discontinuous/saddle, M=mid-row

APPENDIX A-4 - List of Oregon turbines sampled during the standardized searches from January through December 2003.

Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID	Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	FAA Light	Carcass Plot ID
1	BGB19	GR	M	0	BGB 19-22	47	HGS6	AD	E	0	HGS 6-7
2	BGB20	GR	M	1	BGB 19-22	48	HGS7	AD	E	1	HGS 6-7
3	BGB21	GR	M	0	BGB 19-22	49	HGS8	AD	E	1	HGS 8-9
4	BGB22	GR	M	0	BGB 19-22	50	HGS9	AD	D	0	HGS 8-9
5	BGC13	GR	E	1	BGC 13-16	51	HGS10	AD	D	1	HGS 10-13
6	BGC14	GR	M	0	BGC 13-16	52	HGS11	AD	M	0	HGS 10-13
7	BGC15	GR	M	0	BGC 13-16	53	HGS12	AD	M	0	HGS 10-13
8	BGC16	GR	M	1	BGC 13-16	54	HGS13	AD	E	1	HGS 10-13
9	HGJ10	AD	D	0	HGJ 10-12	55	HGS17	AD	M	1	HGS 17-18
10	HGJ11	AD	M	0	HGJ 10-12	56	HGS18	AD	M	0	HGS 17-18
11	HGJ12	AD	M	1	HGJ 10-12	57	HGS22	AD	E	0	HGS 22-23
12	HGJ16	AD	M	1	HGJ 16-18	58	HGS23	AD	D	0	HGS 22-23
13	HGJ17	AD	M	0	HGJ 16-18	59	HGS26	AD	M	0	HGS 26-27
14	HGJ18	AD	M	0	HGJ 16-18	60	HGS27	AD	E	0	HGS 26-27
15	HGJ22	AD	M	0	HGJ 22-25	61	HGS28	AD	E	1	HGS 28-30
16	HGJ23	AD	M	0	HGJ 22-25	62	HGS29	AD	M	0	HGS 28-30
17	HGJ24	AD	M	0	HGJ 22-25	63	HGS30	AD	M	0	HGS 28-30
18	HGJ25	AD	D	0	HGJ 22-25	64	HGS35	AD	E	1	HGS 35-37
19	HGJ30	GR/AD	M	0	HGJ 30-32	65	HGS36	AD	M	0	HGS 35-37
20	HGJ31	GR/AD	M	0	HGJ 30-32	66	HGS37	AD	M	0	HGS 35-37
21	HGJ32	GR/AD	M	0	HGJ 30-32	67	HGS45	AD	E	1	HGS 45-47
22	HGJ36	GR/AD	M	0	HGJ 36-39	68	HGS46	AD	M	0	HGS 45-47
23	HGJ37	GR/AD	M	0	HGJ 36-39	69	HGS47	AD	M	0	HGS 45-47
24	HGJ38	GR/AD	M	1	HGJ 36-39	70	HGS51	AD	M	0	HGS 51-53
25	HGJ39	GR/AD	M	0	HGJ 36-39	71	HGS52	AD	M	1	HGS 51-53
26	HGJ44	GR/AD	E	1	HGJ 44	72	HGS53	AD	M	0	HGS 51-53
27	HGK4	AD	E	1	HGK 4-6	73	HGS57	AD	E	1	HGS 57-60
28	HGK5	AD	M	0	HGK 4-6	74	HGS58	AD	M	0	HGS 57-60
29	HGK6	AD	M	0	HGK 4-6	75	HGS59	AD	M	0	HGS 57-60
30	HGK11	AD	D	0	HGK 11-13	76	HGS60	AD	E	1	HGS 57-60
31	HGK12	AD	M	0	HGK 11-13	77	PB78	GR	E	1	PB 78-80
32	HGK13	AD	E	1	HGK 11-13	78	PB79	GR	M	0	PB 78-80
33	HGL3	GR/AD	D	0	HGL 3-6	79	PB80	GR	M	0	PB 78-80
34	HGL4	GR/AD	M	0	HGL 3-6	80	PB84	GR	M	0	PB 84-86
35	HGL5	GR/AD	M	0	HGL 3-6	81	PB85	GR	M	0	PB 84-86
36	HGL6	GR/AD	E	1	HGL 3-6	82	PB86	GR	E	1	PB 84-86
37	HGM5	GR	D	0	HGM 5-7	83	PB91	GR	E	1	PB 91-94
38	HGM6	GR	M	0	HGM 5-7	84	PB92	GR	M	0	PB 91-94
39	HGM7	GR	M	1	HGM 5-7	85	PB93	GR	M	0	PB 91-94
40	HGM11	GR	D	0	HGM 11-14	86	PB94	GR	D	1	PB 91-94
41	HGM12	GR	M	0	HGM 11-14	87	WSB48	GR	M	0	WSB 48-50
42	HGM13	GR	M	1	HGM 11-14	88	WSB49	GR	M	0	WSB 48-50
43	HGM14	GR	M	0	HGM 11-14	89	WSB50	GR	D	0	WSB 48-50
44	HGN5	GR	E	1	HGN 5-7	90	WSB55	GR	M	0	WSB 55-58
45	HGN6	GR	M	0	HGN 5-7	91	WSB56	GR	M	0	WSB 55-58
46	HGN7	GR	M	0	HGN 5-7	92	WSB57	GR	M	0	WSB 55-58
						93	WSB58	GR	E	1	WSB 55-58

[a] AD=agriculture dry, GR=grassland (crested wheatgrass or native bunchgrass), SS=Shrub/steppe
[b] Turbine position: E=end-row, D=discontinuous/saddle, M=mid-row

APPENDIX B-1 - List of standardized search plots surveyed and effort from July through December 2001 in Washington.

Plot ID	# Turbines Completely Searched[a]	Effective # Turbines Searched[b]	# Plot Searches	Effective # Turbine Searches
HGA 7-9	3	4	1	4
HGA 20-22	3	3.5	2	7
HGB 1-3	3	3.5	2	7
HGB 12-14	3	3.5	2	7
HGC 11-14	4	4.5	8	36
HGC 24-26	3	4	8	32
HGD 4-6	3	3.5	8	28
HGG 1-3	3	3	2	6
HGH 16-18	3	3.5	2	7
PB 4-5	2	3	2	6
PB 15-17	3	3.5	5	17.5
PB 51-53	3	4	7	13
PB 28-30	3	4	7	28
PB 39-41	3	4	7	28
PB 74-77 (74-76)	3	3.5	1	3.5
WSA 19-21	3	3.5	5	17.5
WSA 43-45	3	3.5	5	17.5
WSB 4-6	3	3.5	2	7
WSB 16-18	3	4	2	8
WSB 29-31	3	4	3	12
Total	60	73.5	81	292

[a] # turbines that are searched at least out to 63 m in all directions

[b] effective # of turbines searched. Most adjacent turbines within a string are slightly over 70 m apart, and the boundary of the standardized search plot was typically extended to this adjacent turbine.

APPENDIX B-2 - List of standardized search plots surveyed and effort from January through December 2002.

Plot ID	# Turbines Completely Searched[a]	Effective # Turbines Searched[b]	# Plot Searches	Effective # Turbine Searches
Oregon				
BGB 16-18	3	3.5	16	56
BGB 22-23	2	2.5	16	40
BGC 16-19	4	4.5	16	72
HGJ 6-8	3	3.5	16	56
HGJ 13-15	3	4	16	64
HGJ 19-21[c]	3	3	15	45
HGJ 27-29[c]	3	3.5	15	52.5
HGJ 33-35	3	4	16	64
HGJ 40-42	3	3.5	16	56
HGK 2-3	2	2	16	32
HGK 7-10	4	4.5	16	72
HGL 1-2	2	2	16	32
HGM 1-4	4	4	16	64
HGM 8-9	2	2.5	16	40
HGM 15-18	4	4.5	16	72
HGN 8-9	2	2.5	16	40
PB 74-77 (77)	1	1	16	16
PB 81-83	3	4	16	64
PB 87-90	4	4	16	64
PB 95-97	3	3	16	48
WSB 45-47	3	3.5	16	56
WSB 52-54	3	3.5	16	56
Oregon total	64	73	350	1161.5
Washington				
HGA 7-9	3	4	16	64
HGA 20-22	3	3.5	16	56
HGB 1-3	3	3.5	16	56
HGB 12-14	3	3.5	16	56
HGC 11-14	4	4.5	16	72
HGC 24-26	3	4	16	64
HGD 4-6	3	3.5	16	56
HGG 1-3	3	3	16	48
HGH 16-18	3	3.5	16	56
PB 4-5	2	3	16	48
PB 15-17	3	3.5	16	56
PB 28-30	3	4	16	64
PB 39-41	3	4	16	64
PB 51-53	3	4	16	64
PB 74-77 (74-76)	3	3.5	16	56
WSA 19-21	3	3.5	16	56
WSA 43-45	3	3.5	16	56
WSB 4-6	3	3.5	16	56
WSB 16-18	3	4	16	64
WSB 29-31	3	4	16	64
Washington total	60	73.5	320	1176
Total	124	146.5	670	2337.5

[a] # turbines that are searched at least out to 63 m in all directions

[b] effective # of turbines searched. Most adjacent turbines within a string are slightly over 70 m apart, and the boundary of the standardized search plot was typically extended to this adjacent turbine.

[c] one survey period was missed due to construction and maintenance activities in the area

APPENDIX B-3 - List of standardized search plots surveyed and effort from January through December 2003.

Plot ID	# Turbines Completely Searched[a]	Effective # Turbines Searched[b]	# Plot Searches	Effective # Turbine Searches
Oregon				
BGB 19-22	4	5	17	85
BGC 13-16	4	4.5	17	76.5
HGJ 10-12	3	3.5	17	59.5
HGJ 16-18	3	4	17	68
HGJ 22-25	4	4.5	17	76.5
HGJ 30-32	3	4	17	68
HGJ 36-39	4	5	17	85
HGJ 44	1	1	17	17
HGK 4-6	3	3.5	17	59.5
HGK 11-13	3	3	17	51
HGL 3-6	4	4	17	68
HGM 5-7	3	4	17	68
HGM 11-14	4	4.5	17	76.5
HGN 5-7	3	3.5	17	59.5
HGS 6-7	2	2	17	34
HGS 8-9	2	2	17	34
HGS 10-13	4	4	17	68
HGS 17-18	2	2.25	17	38.25
HGS 22-23	2	2	16	32
HGS 26-27	2	2.25	17	38.25
HGS 28-30	3	3.25	17	55.25
HGS 35-37	3	3.25	17	55.25
HGS 45-47	3	3.25	17	55.25
HGS 51-53	3	3.5	17	59.5
HGS 57-60	4	4	17	68
PB 78-80	3	3.5	17	59.5
PB 84-86	3	3.5	17	59.5
PB 91-94	4	4	17	68
WSB 48-50	3	3.5	17	59.5
WSB 55-58	4	4.5	17	76.5
Oregon total	93	104.75	509	1778.75
Washington				
HGA 1-3	3	3.5	17	59.5
HGA 13-15	3	4	17	68
HGB 7-8	2	3	17	51
HGC 4-6	3	3.5	17	59.5
HGC 18-20	3	4	17	68
HGC 30-32	3	3.5	17	59.5
HGE 1-4	4	4	17	68
HGG 10-11	2	2.5	17	42.5
HGH 10-12	3	3.5	17	59.5
HGJ 3-5	3	4	17	68
PB 9-11	3	4	17	68
PB 21-24	4	4.5	17	76.5
PB 33-35	3	3.5	17	59.5
PB 45-47	3	4	17	68
PB 67-69	3	3.5	17	59.5
WSA 13-15	3	3	17	51
WSA 25-27	3	4	17	68
WSA 37-39	3	4	17	68
WSB 10-12	3	4	17	68
WSB 23-25	3	3.5	17	59.5
Washington total	60	73.5	340	1249.5
Total	153	178.25	849	3028.25

[a] # turbines that are searched at least out to 63 m in all directions

[b] effective # of turbines searched. Most adjacent turbines within a string are slightly over 70 m apart, and the boundary of the standardized search plot was typically extended to this adjacent turbine.

APPENDIX C-1 - List of Oregon and Washington turbines sampled during the WRRS protocol searches from January through December 2002.

OREGON WRRS Search Plots				WASHINGTON WRRS Search Plots			
Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	Count	Turbine ID	Dominant Habitat	Turbine Position
1	BGB20	GR	M	1	HGB5	GR	M
2	HGJ11	AD	M	2	HGB10	GR	M
3	HGJ24	GR/AD	M	3	HGC4	GR	M
4	HGJ37	GR/AD	M	4	HGC9	GR	M
5	HGK5	AD	M	5	HGC18	GR	M
6	HGK12	AD	M	6	HGD1	GR	E
7	HGL4	GR	M	7	HGE3	GR	M
8	HGM6	GR	M	8	HGE8	GR	E
9	HGM12	GR	M	9	HGG10	AD	M
10	HGN6	GR	M	10	HGH8	SS	M
11	PB79	GR	M	11	HGH13	AD	M
12	PB92	GR	M	12	HGH21	GR	E
13	WSB49	GR	M	13	PB7	GR	M
				14	PB12	GR	M
				15	PB20	GR	M
				16	PB25	GR	D
				17	PB33	GR	D
				18	PB37	GR	M
				19	PB55	GR	M
				20	PB60	GR	D
				21	PB67	GR	D
				22	PB72	GR	M
				23	WSA13	GR	E
				24	WSA17	GR	M
				25	WSA25	GR	M
				26	WSA35	GR	M
				27	WSA40	GR	M
				28	WSB9	GR	M
				29	WSB14	GR	M
				30	WSB22	GR	M
				31	WSB27	GR	M
				32	WSB35	GR	M
				33	HGA1	AD	E
				34	HGA14	AD	M

[a] AD=agriculture dry, GR=grassland, SS=Shrub/steppe (draft, and will be updated)
[b] Turbine position: E=end-row, D=discontinuous/saddle, M=mid-row

APPENDIX C-2 - List of Oregon and Washington turbines sampled during the WRRS protocol searches from January through December 2003.

OREGON WRRS Search Plots				WASHINGTON WRRS Search Plots			
Count	Turbine ID	Dominant Habitat[a]	Turbine Position[b]	Count	Turbine ID	Dominant Habitat	Turbine Position
1	BGB16	GR	E	1	HGA5	AD	M
2	BGC17	GR	M	2	HGA11	AD	M
3	HGJ7	AD	M	3	HGA20	AD	M
4	HGJ14	AD	M	4	HGB5	GR	M
5	HGJ28	GR/AD	M	5	HGB13	GR	M
6	HGJ42	GR/AD	D	6	HGC8	GR	M
7	HGK8	AD	M	7	HGC15	GR	E
8	HGL1	GR/AD	E	8	HGC23	GR	M
9	HGM3	GR	M	9	HGD2	GR	M
10	HGM16	GR	M	10	HGD5	GR	M
11	HGN9	GR	E	11	HGE7	GR	M
12	PB82	GR	M	12	HGF1	GR	E
13	PB96	GR	M	13	HGG4	AD	E
14	HGS14	AD	E	14	HGH2	SS	M
15	HGS19	AD	M	15	HGH8	SS	M
16	HGS21	AD	E	16	HGH15	SS	E
17	HGS25	AD	M	17	HGJ1	AD	E
18	HGS40	AD	E	18	PB4	GR	D
19	HGS48	AD	M	19	PB13	GR	M
20	HGS56	AD	E	20	PB19	GR	M
				21	PB26	GR	M
				22	PB37	GR	M
				23	PB43	GR	M
				24	PB52	GR	M
				25	PB73	GR	M
				26	WSA18	GR	M
				27	WSA30	GR	M
				28	WSA43	GR	M
				29	WSB7	GR	M
				30	WSB15	GR	M
				31	WSB21	GR	M
				32	WSB28	GR	M
				33	WSB33	GR	M
				34	WSB40	GR	M

[a] AD=agriculture dry, GR=grassland, SS=Shrub/steppe (draft, and will be updated)
[b] Turbine position: E=end-row, D=discontinuous/saddle, M=mid-row

APPENDIX D-1 - List of avian fatalities observed on standardized search plots in Oregon from January 2002 through December 2003.

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA Lit
01/22/2002	western meadowlark	HGM2	58	N
02/18/2002	horned lark	PB87	51	Y
02/21/2002	ring-necked pheasant	HGJ35	68	N
03/19/2002	horned lark	HGN8	14	N
04/07/2002	black-billed magpie	BGC19	42	Y
04/16/2002	horned lark	PB81	29	N
04/17/2002	horned lark	WSB52	42	Y
04/18/2002	horned lark	BGB17	69	N
04/19/2002	horned lark[a]	HGN9	24	Y
04/27/2002	horned lark	HGN8	40	N
05/03/2002	golden-crowned kinglet	PB97	55	Y
05/13/2002	horned lark	HGL1	20	Y
05/13/2002	horned lark	HGM18	20	Y
05/13/2002	horned lark	HGM18	45	Y
05/18/2002	yellow-rumped warbler	WSB45	46	N
05/19/2002	unidentified bird	HGJ40	46	N
05/21/2002	horned lark	HGM2	26	N
06/17/2002	ring-necked pheasant	HGJ18	18	N
06/17/2002	horned lark	HGJ8	11	N
06/19/2002	ring-necked pheasant	HGM9	45	N
07/21/2002	horned lark	HGM17	17	N
08/16/2002	ring-necked pheasant	HGL2	50	N
08/19/2002	grasshopper sparrow	BGC18	25	N
08/19/2002	house wren	HGM8	20	N
08/19/2002	chukar	HGM9	43	N
08/20/2002	horned lark	WSB45	44	N
09/01/2002	horned lark	HGJ21	35	Y
09/03/2002	horned lark	BGB16	88	Y
09/04/2002	mallard	HGN9	27	Y
09/15/2002	golden-crowned sparrow	WSB47	42	N
09/18/2002	white-crowned sparrow	HGJ12	60	Y
09/19/2002	unidentified sparrow	BGB16	39	Y
09/19/2002	white-crowned sparrow	HGK9	39	Y
10/02/2002	horned lark	WSB46	53	Y
10/02/2002	horned lark	WSB48	25	N
10/03/2002	golden-crowned kinglet	BGB19	66	N
10/03/2002	horned lark	BGC17	22	N
10/05/2002	ruby-crowned kinglet	HGJ21	34	Y
10/16/2002	horned lark	HGJ7	40	N
10/18/2002	gray partridge	HGL2	48	N
10/19/2002	MacGillivray's warbler	WSB53	59	N
10/21/2002	winter wren	BGB23	51	Y
10/21/2002	chukar	HGM14	6	N
11/04/2002	horned lark	PB95	10	Y
11/06/2002	European starling	BGB23	18	Y
01/03/2003	European starling[a]	HGL3	8	N
02/04/2003	ring-necked pheasant	HGK5	43	N

APPENDIX D-1 (continued).

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA Lit
02/05/2003	rock dove	HGN5	61	Y
02/07/2003	horned lark	BGB19	62	N
03/05/2003	horned lark	BGC16	42	Y
04/17/2003	horned lark	WSB55	51	N
04/20/2003	horned lark	HGN5	12	Y
04/20/2003	horned lark	HGN7	17	N
04/30/2003	unidentified passerine	HGK4	64	Y
05/05/2003	horned lark	HGS37	33	N
05/16/2003	American kestrel	BGB19	34	N
05/17/2003	red-breasted nuthatch	HGS47	34	N
05/18/2003	horned lark[a]	HGS31	9	Y
06/17/2003	horned lark	PB78	10	Y
06/17/2003	horned lark	PB78	25	Y
06/17/2003	ring-necked pheasant	HGJ40	15	N
06/17/2003	western meadowlark	HGJ25	72	N
06/18/2003	horned lark	HGL6	25.5	Y
06/18/2003	horned lark	HGM8	61	N
06/18/2003	horned lark	WSB57	31	N
06/20/2003	American kestrel	BGB19	43	N
06/20/2003	horned lark	BGC16	31	Y
06/23/2003	horned lark	HGS27	28	N
06/23/2003	horned lark	HGS27	37	N
06/23/2003	horned lark	HGS35	12	Y
07/16/2003	horned lark	HGJ12	28	Y
07/17/2003	American kestrel	BGB19	63	N
07/17/2003	American kestrel	HGS59	21	N
07/18/2003	ferruginous hawk	HGM13	35	Y
07/18/2003	horned lark	HGS48	67	N
07/18/2003	ring-necked pheasant	HGM11	3	N
08/13/2003	ring-necked pheasant	HGJ10	6	N
08/14/2003	horned lark	HGK13	48	Y
08/14/2003	ring-necked pheasant	HGJ24	32	N
08/14/2003	ring-necked pheasant	HGJ37	53	N
09/05/2003	unidentified bird	HGJ18	17	N
09/06/2003	horned lark	HGK11	54	N
09/07/2003	ring-necked pheasant	HGM11	4	N
09/09/2003	horned lark	BGC16	27	Y
09/09/2003	yellow-rumped warbler	BGC16	54	Y
09/17/2003	horned lark	HGJ10	14	N
09/18/2003	ring-necked pheasant	HGJ23	1	N
09/21/2003	yellow-rumped warbler	HGS51	27	N
09/24/2003	horned lark	HGS29	51	N
10/02/2003	golden-crowned kinglet	HGS51	23	N
10/02/2003	horned lark	HGJ25	21	N
10/02/2003	ring-necked pheasant	HGJ23	7	N
10/03/2003	golden-crowned kinglet	BGC15	19	N
10/03/2003	northern flicker	BGB18	38.5	N

APPENDIX D-1 (continued).

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA Lit
10/03/2003	savannah sparrow	BGB22	64	N
10/07/2003	golden-crowned kinglet	HGS18	46	N
10/07/2003	golden-crowned kinglet	HGS27	36	N
10/15/2003	golden-crowned kinglet	HGJ11	38	N
10/15/2003	golden-crowned kinglet	HGJ10	36	N
10/17/2003	horned lark	PB91	54	Y
10/20/2003	western meadowlark	HGJ23	59	N
10/21/2003	horned lark	HGK12	30	N
10/21/2003	red-tailed hawk	HGL5	9	N
10/23/2003	golden-crowned kinglet	HGS18	51	N
10/23/2003	winter wren	HGS35	25	Y
10/28/2003	gray partridge	PB80	21	N
10/30/2003	red-tailed hawk[a]	HGJ13	35	N
11/03/2003	golden-crowned kinglet	BGC14	64	N
11/03/2003	gray partridge	HGK6	30	N
11/03/2003	dark-eyed junco	BGC17	66	N
11/17/2003	western meadowlark	HGJ25	45	N
11/17/2003	gray partridge	HGJ36	55	N
11/19/2003	western meadowlark	HGK13	26	Y
11/19/2003	ring-necked pheasant	HGK7	32	N
11/23/2003	European starling	HGN7	32	N
11/25/2003	horned lark	HGS12	22	N
12/14/2003	chukar	PB79	2	N
12/17/2003	European starling	HGS35	44	Y

[a] found on a standardized search plot but not during scheduled search

APPENDIX D-2 - List of avian fatalities observed standardized search plots in Washington from July 2001 through December 2003.

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA LIT
08/21/2001	horned lark	PB30	39	Y
10/01/2001	golden-crowned sparrow	HGC24	56	N
10/03/2001	horned lark	PB50	25	N
10/14/2001	golden-crowned kinglet	HGC23	37	N
10/15/2001	dark-eyed junco	PB39	43	N
11/14/2001	unidentified passerine	HGB13	29	N
11/14/2001	western meadowlark	PB39	66	N
11/14/2001	horned lark	WSA22	17	Y
12/11/2001	unidentified passerine	PB16	53	Y
12/12/2001	golden-crowned kinglet	WSA44	30	N
01/14/2002	gray partridge	PB15	69	Y
02/18/2002	western meadowlark	HGD6	62	Y
02/18/2002	horned lark[a]	PB39	33	N
02/21/2002	horned lark	HGB13	23	N
02/21/2002	horned lark	HGB4	25	N
03/13/2002	unidentified passerine	HGG3	20	Y
03/22/2002	horned lark	HGB11	26	N
04/01/2002	European starling	HGA7	66	N
04/01/2002	horned lark	HGC14	32	Y
04/01/2002	western meadowlark	HGC14	66	Y
04/01/2002	horned lark	HGD4	38	N
04/02/2002	horned lark	PB29	15	N
04/17/2002	gray partridge	WSA43	39	N
04/20/2002	winter wren	HGD5	28	N
05/01/2002	white-crowned sparrow	PB17	64	N
05/01/2002	horned lark	PB28	32	N
05/01/2002	house wren	PB29	41	N
05/01/2002	horned lark	PB30	18	Y
05/02/2002	horned lark	HGC24	59	N
05/02/2002	horned lark	PB41	47	N
05/03/2002	horned lark	HGH16	17	Y
05/05/2002	horned lark	WSA19	35	N
05/07/2002	horned lark	WSB31	32	N
06/06/2002	red-tailed hawk[a]	HGH17	10	N
06/15/2002	horned lark	HGA22	6	N
06/17/2002	yellow-rumped warbler	HGH16	67	Y
06/17/2002	horned lark	HGH18	38	N
06/20/2002	horned lark	WSA21	24	N
07/16/2002	horned lark	PB76	58	N
07/18/2002	horned lark	WSB16	18	N
08/12/2002	Swainson's hawk	HGA9	27	N
08/13/2002	great blue heron	HGC25	57	Y
08/13/2002	horned lark[a]	WSA21	10	N
08/19/2002	gray partridge	HGB12	33	N
08/31/2002	red-tailed hawk	HGA20	70	N
09/04/2002	American kestrel	WSB16	24	N
09/16/2002	red-tailed hawk	HGA6	33	N

APPENDIX D-2 (continued).

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA LIT
09/16/2002	Swainson's thrush	HGA7	53	N
10/01/2002	vesper sparrow	PB30	51	Y
10/01/2002	house finch	WSA44	14	N
10/02/2002	golden-crowned kinglet	WSB29	29	Y
10/03/2002	savannah sparrow	PB41	31	N
10/03/2002	vesper sparrow	PB53	26	Y
10/04/2002	red-tailed hawk	HGA22	45	N
10/04/2002	white-crowned sparrow	HGA7	40	N
10/04/2002	western meadowlark	HGC14	50	Y
10/07/2002	red-winged blackbird	HGH16	25	Y
10/16/2002	golden-crowned kinglet	PB40	32	N
10/16/2002	western meadowlark	PB50	3	N
10/20/2002	horned lark	WSA19	17	N
11/01/2002	horned lark	HGC24	23	N
02/02/2003	ring-necked pheasant	HGG11	61	Y
02/20/2003	ring-necked pheasant[a]	HGJ3	2	N
03/01/2003	horned lark	PB35	55	N
03/01/2003	ring-necked pheasant	PB67	70	Y
03/31/2003	golden-crowned kinglet	HGE2	58	N
03/31/2003	winter wren	HGC21	53	N
04/15/2003	horned lark	WSA38	52	N
04/15/2003	horned lark	WSA39	18	N
05/12/2003	horned lark	WSA38	27	N
06/16/2003	horned lark	HGC32	54	Y
07/15/2003	western meadowlark	HGE2	1	N
07/16/2003	horned lark	WSA37	10	Y
08/11/2003	chukar	HGB7	3	N
08/11/2003	western meadowlark	HGA1	2	Y
08/12/2003	horned lark	HGC20	5	Y
08/12/2003	unidentified bird	PB67	73	Y
08/13/2003	ring-necked pheasant[b]	HGE4	67	N
09/02/2003	chukar	PB47	2	N
09/03/2003	chukar	HGC19	42	N
09/04/2003	horned lark	WSA16	63	N
09/09/2003	house wren	WSB10	58	N
09/30/2003	chukar	HGC17	0	N
10/02/2003	golden-crowned kinglet	WSB24	19	N
10/13/2003	white-crowned sparrow	PB11	55	N
10/14/2003	dark-eyed junco	HGC20	48	Y
10/14/2003	golden-crowned kinglet	HGJ4	53	N
10/15/2003	golden-crowned kinglet	HGH11	33	N
10/27/2003	golden-crowned kinglet	HGA1	31	Y
10/28/2003	golden-crowned kinglet	WSA40	21	N
10/29/2003	American pipit	HGC19	52	N
11/17/2003	golden-crowned sparrow	PB12	59	N

[a] found on a standardized search plot but not during scheduled search
[b] averaged coordinates for body parts used to determine closest turbine and distance

APPENDIX D-3 - WRRS protocol and incidental avian fatality discoveries from July 2001 through December 2003 that were not observed on standardized search plots.

Date[a]	Species	Nearest Turbine	Distance to Nearest Turbine(m)
09/20/2001	white-throated swift	WSB25	9
12/09/2001	short-eared owl	HGC20	103
01/25/2002	Canada goose	HGB6	51
03/27/2002	horned lark	PB44	2
03/27/2002	horned lark	PB44	4
04/04/2002	gray partridge	WSB38	22
04/25/2002	white-crowned sparrow	WSB34	65
04/25/2002	white-crowned sparrow	WSB26	44
05/02/2002	red-tailed hawk[b]	HGC9	30
05/07/2002	horned lark	WSA26	55
07/11/2002	horned lark	HGJ32	30
10/04/2002	ring-necked pheasant	HGE1	3
10/06/2002	chukar	HGC15	2
10/20/2002	gray partridge	WSB42	26
10/22/2002	red-tailed hawk	HGG11	18
11/01/2002	European starling[b]	PB37	0
03/13/2003	horned lark	HGM9	43
04/01/2003	horned lark	HGH8	26
07/16/2003	horned lark	WSB42	18
07/16/2003	horned lark	WSB17	25
08/05/2003	red-tailed hawk	PB89	19
09/29/2003	golden-crowned kinglet	PB29	19
	INJURED BIRDS		
04/26/2002	Swainson's hawk (injured, fully recovered and released)	HGK9	base of turbine

[a] date that project biologist identified and collected the bird. Date discovered by FPL Energy personnel or contractor was sometimes earlier.

[b] found on a WRRS protocol search plot during a protocol search

APPENDIX E-1 - List of bat fatalities found on standardized search plots in Oregon from January 2002 through December 2003.

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA LIT
07/22/2002	silver-haired bat	WSB52	19	Y
08/19/2002	silver-haired bat	BGC16	25	Y
08/19/2002	silver-haired bat	BGC18	28	N
08/19/2002	hoary bat	HGM4	27	N
08/20/2002	silver-haired bat	WSB46	27	Y
09/04/2002	big brown bat	HGM16	15	N
09/06/2002	unidentified bat[a]	HGK2	0, on blade	Y
09/20/2002	hoary bat	WSB54	18	N
09/24/2002	hoary bat	PB88	10	N
09/26/2002	silver-haired bat	PB84	35	N
09/26/2002	silver-haired bat	PB97	10	Y
10/02/2002	silver-haired bat	BGB21	25	N
10/03/2002	hoary bat	BGB17	26	N
10/03/2002	hoary bat	BGC17	52	N
10/03/2002	hoary bat	BGC18	22	N
10/05/2002	hoary bat	HGJ14	16	N
10/19/2002	silver-haired bat	WSB53	7	N
10/21/2002	silver-haired bat	HGM9	28	N
05/15/2003	silver-haired bat	PB86	63	Y
08/18/2003	hoary bat	HGS37	29	N
09/03/2003	hoary bat	PB84	21	N
09/03/2003	silver-haired bat	PB86	17	Y
09/04/2003	hoary bat	HGJ12	20	Y
09/04/2003	silver-haired bat	PB93	23	N
09/04/2003	silver-haired bat	PB94	14	Y
09/04/2003	silver-haired bat	PB94	15	Y
09/06/2003	silver-haired bat	HGJ38	22	Y
09/06/2003	silver-haired bat	HGK5	38	N
09/06/2003	unidentified bat	HGK5	18	N
09/07/2003	silver-haired bat	HGL4	12	N
09/07/2003	silver-haired bat	HGL5	9	N
09/07/2003	silver-haired bat	HGM14	11	N
09/07/2003	silver-haired bat	HGM5	3	N
09/09/2003	hoary bat	BGC16	3	Y
09/09/2003	hoary bat	BGC17	23	N
09/09/2003	silver-haired bat	BGC13	9	Y
09/10/2003	silver-haired bat	HGS36	10	N
09/17/2003	hoary bat	PB85	32	N
09/20/2003	hoary bat	BGB19	19	N
09/20/2003	hoary bat	WSB50	3	N
09/20/2003	silver-haired bat[b]	BGB18	10	N
09/23/2003	hoary bat	HGS13	33	Y
09/30/2003	silver-haired bat	HGJ44	16	Y
10/01/2003	hoary bat	PB94	35	Y
10/01/2003	silver-haired bat	WSB55	23	N

APPENDIX E-1 (continued).

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA LIT
10/03/2003	hoary bat	HGJ32	12	N
10/03/2003	hoary bat	HGJ40	27	N
10/03/2003	hoary bat	HGK5	12	N
10/03/2003	silver-haired bat	BGB23	23	Y
10/15/2003	silver-haired bat	HGJ18	25	N
10/16/2003	hoary bat	WSB55	16	N
10/16/2003	hoary bat	WSB56	13	N
10/16/2003	hoary bat	WSB56	17	N
11/19/2003	silver-haired bat	WSB48	13	N

[a] found on a standardized search plot but not during scheduled search
[b] found alive but died later the same day, most likely from internal injuries

APPENDIX E-2 - List of bat fatalities found on standardized search plots in Washington from July 2001 through December 2003.

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA LIT
08/18/2001	hoary bat	HGC25	31	Y
08/20/2001	hoary bat	HGC11	9	N
08/29/2001	hoary bat	HGD4	15	N
08/30/2001	hoary bat	HGC14	19	Y
08/30/2001	hoary bat	HGC14	20	Y
08/31/2001	hoary bat	PB29	33	N
08/31/2001	hoary bat	PB30	32	Y
08/31/2001	silver-haired bat	PB30	29	Y
08/31/2001	hoary bat	PB41	12	N
09/17/2001	little brown bat	HGC10	11	Y
09/18/2001	silver-haired bat	PB15	32	Y
09/18/2001	hoary bat	PB18	6	N
09/18/2001	hoary bat	PB27	31	N
09/18/2001	silver-haired bat	PB30	20	Y
09/20/2001	hoary bat	PB42	33	N
09/20/2001	silver-haired bat	PB50	15	N
09/20/2001	silver-haired bat	WSA44	14	N
09/27/2001	silver-haired bat[a]	PB16	3	Y
10/01/2001	silver-haired bat	HGC14	12	Y
10/01/2001	hoary bat	HGC23	31	N
10/02/2001	silver-haired bat	PB28	26	N
10/02/2001	silver-haired bat	PB40	15	N
10/03/2001	silver-haired bat	WSA45	27	Y
10/15/2001	silver-haired bat	PB31	21	N
11/15/2001	silver-haired bat	WSB19	13	Y
08/13/2002	big brown bat[a,c]	WSA19	10	N
08/30/2002	hoary bat	HGD6	16	Y
08/31/2002	hoary bat	PB6	25	N
09/01/2002	hoary bat	PB53	16	Y
09/04/2002	hoary bat	WSB4	16	Y
09/14/2002	silver-haired bat	PB30	30	Y
09/14/2002	silver-haired bat[a]	PB53	4	Y
09/15/2002	hoary bat[b]	WSB16	20	N
09/20/2002	silver-haired bat	WSB7	5	N
09/24/2002	silver-haired bat	PB76	8	N
10/22/2002	hoary bat	HGB1	23	Y
07/15/2003	hoary bat	HGH12	9	N
08/11/2003	hoary bat	HGA14	17	Y
08/11/2003	hoary bat	HGC4	23	N
09/02/2003	silver-haired bat	HGA1	5	Y
09/02/2003	silver-haired bat	HGA2	3	N
09/02/2003	hoary bat	HGA1	3	Y
09/02/2003	hoary bat	HGA14	26	Y
09/02/2003	hoary bat	HGA15	10	N
09/02/2003	hoary bat	HGA16	46	N
09/02/2003	hoary bat	HGB8	3	N
09/02/2003	hoary bat	PB22	15	N

APPENDIX E-2 (continued).

Date	Species	Nearest Turbine	Distance to Nearest Turbine(m)	FAA LIT
09/02/2003	silver-haired bat[b]	HGA14	6	Y
09/02/2003	silver-haired bat	HGA15	1	N
09/02/2003	silver-haired bat	HGA15	23	N
09/02/2003	silver-haired bat	PB11	28	N
09/02/2003	silver-haired bat	PB23	16	N
09/02/2003	silver-haired bat	PB23	23	N
09/02/2003	silver-haired bat	PB45	3	N
09/03/2003	silver-haired bat	PB68	17	N
09/04/2003	hoary bat	HGH10	4	Y
09/04/2003	silver-haired bat	WSA14	31	N
09/09/2003	silver-haired bat	WSB25	21	N
09/15/2003	hoary bat	HGA16	27	N
09/15/2003	hoary bat[a]	HGC5	65	N
09/16/2003	silver-haired bat	HGC20	27	Y
09/16/2003	silver-haired bat	HGJ3	10	N
09/19/2003	hoary bat	WSB22	10	N
09/19/2003	silver-haired bat	WSB10	29	N
09/29/2003	hoary bat	HGA1	17	Y
09/29/2003	silver-haired bat	PB10	28	N
09/29/2003	silver-haired bat	PB24	11	Y
09/29/2003	silver-haired bat	PB68	2	N
09/30/2003	hoary bat	HGC30	30	N
10/01/2003	hoary bat	WSA15	20	N
10/01/2003	silver-haired bat	HGJ5	8	N
10/13/2003	hoary bat	PB11	16	N
10/13/2003	silver-haired bat	PB23	13	N
10/14/2003	hoary bat	PB46	32	N

[a] found on a standardized search plot but not during scheduled search
[b] found alive but euthanized due to extensive injuries
[c] averaged coordinates for body parts used to determine closest turbine and distance

APPENDIX E-3 - WRRS protocol and incidental bat fatality discoveries that were not observed on standardized search plots from July 2001 through December 2003.

Date[a]	Species	Nearest Turbine	Distance to Nearest Turbine(m)
08/30/2001	unidentified bat	HGC8	22
08/30/2001	hoary bat	HGC28	8
09/25/2001	silver-haired bat	PB47	29
10/10/2001	silver-haired bat[b]	HGC18	3
10/10/2001	hoary bat	HGC20	6
05/26/2002	silver-haired bat	WSB41	2
07/11/2002	silver-haired bat	HGC7	25
08/06/2002	hoary bat	WSB49	24
08/30/2002	silver-haired bat	WSA38	22
09/11/2002	hoary bat	BGC13	25
09/14/2002	hoary bat	WSB50	5
09/14/2002	silver-haired bat	WSB20	15
09/14/2002	silver-haired bat	PB59	10
09/14/2002	silver-haired bat	PB68	1
09/14/2002	hoary bat	PB6	5
09/22/2002	hoary bat	HGJ10	10
10/2/2002	hoary bat[b]	WSA40	4
10/18/2002	hoary bat[b]	PB33	26
08/07/2003	hoary bat	PB72	18
08/14/2003	hoary bat	BGB17	30
09/30/2003	hoary bat	WSB36	17
10/01/2003	silver-haired bat	WSB42	19

[a] date that project biologist identified and collected the bird. Date discovered by FPL Energy personnel or contractor was sometimes earlier.

[b] found on a WRRS protocol search plot during a protocol search