Appendix B

WEST Avian Study Report

Klickitat County Energy Overlay

Environmental Impact Statement

ANALYSIS OF POTENTIAL AVIAN/WIND PLANT INTERACTIONS

IN KLICKITAT COUNTY, WASHINGTON

Supplement to the

KLICKITAT COUNTY PROGRAMMATIC

ENVIRONMENTAL IMPACT STATEMENT

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INTRODUCTION

Wind has been used to commercially produce energy in the United States since the early 1980's and is considered an important source of renewable energy. Although generally considered environmentally friendly, wind plants have been associated with the death of birds colliding with turbines and other wind plant structures, especially in California, and wind plants can have negative effects on birds and other wildlife if not sited properly. Early wind energy facilities in the U.S. were often constructed in areas without an understanding of the level of avian use at those locations. Consequently, some of these facilities are located where birds are abundant and the risk of turbine collisions is relatively high. High raptor mortality documented at Altamont, California has resulted in a great deal of scrutiny of other wind plant developments. Wind projects have been delayed and sometimes stopped at new wind sites across the country due in part to avian collision concerns. Although most studies have shown both the direct and indirect effects on birds by most wind plants to be minimal, state wildlife agencies, the U.S. Fish and Wildlife Service, and environmental organizations have all expressed concern over the potential impacts of wind plants on birds. To alleviate these concerns and to address potential regional or site-specific impacts, developers must address the potential for avian collision mortality and other wildlife impacts when selecting sites for wind power development.

Klickitat County, Washington is preparing a Programmatic Environmental Impact Statement (PEIS) to assist with future siting of wind power and other power developments in the county. Because one of the major issues associated with siting of wind power developments involves the potential for impacts to birds, one component of the PEIS includes an assessment of avian resources in the county so that potential conflicts with birds can be minimized or avoided when selecting sites for future wind power development. The purpose of this report is to provide data on avian use of potential wind power development areas in Klickitat County.

METHODS

Avian Point Counts

Field Methods

We sampled areas with the highest potential for wind power development (Wind Class 3-6) using a modified systematic sampling design. Fifty fixed circular plots were established throughout Wind Class 3-6 areas. Forty-eight of the points were in Klickitat County, and 2 were established in Skamania County just across the Klickitat County line (Figure 1). The plots were located so that regions (i.e., $\leq$ or > 1.5 miles from Columbia River, west of U.S. 97, between U.S. 97 and Rock Creek, east of Rock Creek) as well as representative habitats (e.g., riparian, shrub-steppe, cropland) within the project area were included in the sample. The surveys were conducted at each plot once every 2 weeks, starting in mid-April and continuing through mid-July. This time period covered late migration and the breeding season for most raptors and other birds in the project area. Most point count stations were established along public roads.

Avian use surveys were conducted to estimate the temporal and spatial use of the project area by birds. The data collected consisted of counts of bird use of circular plots around observation points during a specific survey period. All birds detected by sight or sound during each survey were recorded. Estimated distance to each bird observed was recorded to the nearest meter. The radius of the circular plots was up to 2,625 feet (800 m) depending on the limitations of the terrain. Each plot was surveyed for 20 minutes each survey day. An equal effort was used for all plots.

The behavior of each bird observed and the habitat in which or over which the bird occurred were recorded. Approximate flight height at first observation was recorded to the nearest meter and the approximate lowest and highest flight heights were also recorded. Any comments or unusual observations were also noted. Locations of raptors, other large birds, and any species of concern seen were recorded on the field maps by observation number. Plot surveys were scheduled to cover all daylight hours. During a set of surveys, each

plot was visited once. A pre-established schedule was developed prior to the field surveys to ensure that each station was surveyed approximately the same number of times each period of the day and to efficiently utilize personnel time by minimizing travel time between plots.

Data Analysis

Avian Abundance

Species lists were generated by season including all observations of birds detected regardless of their distance from the observer. Seasons were defined as follows: April 15 to May 31 - Spring migration, and June 1 through July 15 – Summer/Breeding season. The number of birds seen during each point count survey was standardized to a unit area and unit time surveyed. The standardized unit time was 20 minutes and the standardized unit area was 2.01 km^2 (800-m radius view shed for each station). For example, if four raptors were seen during the 20 minutes at a point with a viewing area of 2.01 km^2, these data would be standardized to 4/2.01 = 1.98 raptors/km^2 in a 20-minute survey. For the standardized avian use estimates, only observations of birds detected within 800 m of the observer were used.

Estimates of avian use (expressed in terms of number of birds/plot/20-minute survey) were tabulated to compare differences in avian use between 1) avian groups, 2) seasons, 3) habitat, and 4) geographic location within the county. The magnitude of avian use among the survey plots was examined to determine possible locations of relatively high avian use within the study area.

Avian Diversity and Richness

The total number of unique species was calculated by season. The mean number of species observed per survey (i.e., per station per 20-minute survey) was used as an index to avian richness in the study area. Mean number of species per survey was tabulated to illustrate and compare differences between seasons.

Avian Flight Height/Behavior

The rotor-swept height of many of the newer generation turbines ranges from approximately 30 to 100 m above ground. We used this range to approximate the percentage of birds flying below, within and above typical rotor swept heights and in comparing differential risk of collision between bird groups. The first flight height recorded was used to estimate percentages of birds flying below, within and above the rotor swept height (RSH) of turbines.

Avian Risk Index

A relative index to collision risk (*R*) was calculated for bird species observed in the project area using the following formula:

$$R = A*P_f*P_t$$

Where A = mean relative use for species *i* averaged across all surveys, P_f = proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period), and P_t = proportion of all flight height observations of species *i* within the rotor-swept height (RSH). This index does not account for differences in behavior other than flight characteristics (i.e., flight heights and proportion of time spent flying).

Habitat and Landscape Effects on Avian Use

Data were used to compare relative use between regions of Klickitat County. The study area was divided into the following three strata: west of U.S. 97, between U.S. 97 and Rock Creek, and east of Rock Creek (Figure 1). Each of these strata were further divided into those areas within 1.5 miles of the Columbia River and >1.5 miles from the Columbia River. This resulted in a total of 6 strata. The distance of 1.5 miles from the Columbia River was selected as this distance generally includes all areas from the river to the top of the rim north of the river, whereas areas >1.5 miles are generally north of the top of the rim.

Effect of habitat was also analyzed on two different scales. Riparian areas usually contain the most abundant and diverse avian communities in the arid West and may largely influence bird abundance.

Therefore, we looked at avian use as a function of whether or not riparian zones were present within the survey plot. We also looked at avian use as a function of the dominant habitat present within the plot. Habitats examined included agricultural cropland, shrub steppe, grasslands (including Conservation Reserve Program [CRP] fields), woodlands (including riparian areas) and developed areas.

Impact Predictions

Predictions of the number of collisions per turbine were calculated by avian group for each of the six regions investigated in Klickitat County. Final avian use and mortality data are currently available for three new-generation wind plants outside California, including the Foote Creek Rim, Wyoming wind plant (Johnson *et al.* 2000a, Young *et al.* 2003), the Buffalo Ridge, Minnesota wind plant (Johnson *et al.* 2000b), and the Vansycle, Oregon wind plant (Erickson *et al.* 2001a). To estimate potential raptor mortality within Klickitat County, the average raptor fatality rate and raptor use estimate from the three wind plants discussed above was determined. The raptor use estimate for each of the six regions in Klickitat County was divided by the mean raptor use estimate at the three existing wind plants, and this number was multiplied by the mean raptor fatality estimate for the three wind plants. Similar calculations were conducted to estimate waterfowl mortality within Klickitat County. Passerine (songbird) use data are collected at most wind plants during the day, yet available evidence indicates that a large proportion of the passerine mortality at wind plants involves nocturnal migrants (e.g., Johnson *et al.* 2002). As a result, there is little correlation between passerine use estimates obtained from diurnal observations and passerine collision mortality at wind plants. Also, there has been relatively low variability in passerine mortality estimates at wind plants in the Midwest and west (0 to 2 passerine fatalities per turbine per year). Therefore, rather than attempting to use passerine data collected during the field study to estimate collision mortality, we used the mean passerine mortality estimate presented in Erickson *et al.* (2001b) derived from passerine collision mortality studies at several existing new-generation wind plants.

Data Compilation and Storage

A database was developed to store, organize and retrieve field observation data. Data from field forms were keyed into electronic data files using a pre-defined format to facilitate subsequent QA/QC and data analysis. All field data forms, field notebooks, and electronic data files were retained for reference.

Quality Assurance/Quality Control (QA/QC)

QA/QC measures were implemented at all stages of the study, including field surveys, data entry, data analysis and report preparation. At the end of each survey day, each observer was responsible for inspecting their data forms for completeness, accuracy, and legibility. Data forms were reviewed to insure completeness and legibility and any problems detected were corrected. Any changes made to the data forms were initialed and dated by the individual making the change. Data were entered into electronic database files (Microsoft ACCESS), queried and reviewed for inconsistencies. Any irregular codes detected, or any data suspected as questionable, were discussed with the observer and study team leader. All changes made to the raw data were documented for future reference.

Aerial Raptor Nest Surveys

Field Methods

Aerial raptor nest surveys were conducted to supplement existing information on nest location and density and to assess the status of the potentially affected nesting population. Sufficient data to characterize raptor nest density were obtained by sampling the area of interest. The nest search area included a systematic sample of blocks representing approximately 23% of the area with the greatest potential for wind power development (i.e., Wind Class 3-6) (Figure 2). The approximate total area of the Klickitat County study area within these Wind Classes was 700 square miles. We attempted to sample approximately 160 square miles[1]. The square plots consisted of groups of 4 sections (square miles) spaced systematically across the survey area. One helicopter survey was conducted from April 24 to 29 to locate and identify active nests. Locations

[1] some areas were avoided including residences and other human developments, and areas near livestock

of inactive nests were also recorded as they may be occupied during future years. All nests, whether active or inactive, were given a unique identification number and the location recorded using a GPS unit. The aerial survey targeted buteos, eagles and falcons whose nests are observable from the air (e.g., large stick nests, falcon eyries on cliffs). Nests of ground nesting raptors such as northern harrier and short-eared owl cannot readily be detected from the air. Data were stratified after the survey so that differences in raptor nest density and species composition between areas, habitats, topography, and other variables such as distance to Columbia River could be determined.

Literature Review

To assist in making informed decisions regarding wind power effects on birds and its relevance to siting wind power facilities, an extensive literature review was conducted to summarize current knowledge of avian turbine collisions and disturbance to birds associated with wind power development in the United States. A significant amount of data and literature are becoming available regarding the expected impacts of wind energy developments on wildlife and particularly birds (Erickson *et al.* 2001b). For many wind energy development projects, standardized post-construction (operational) monitoring data have been collected along with standardized data on avian use, raptor nesting and habitat information. The ability to estimate potential bird mortality at wind plants is greatly enhanced by reviewing data collected over the past six years at these operational wind plants.

WEST previously conducted an extensive literature review of avian collision mortality associated with wind plants (see Erickson *et al.* 2001b). WEST has also recently conducted literature reviews on avian disturbance associated with wind plants (see Johnson *et al.* 2000a, 2000b). We updated these reviews to incorporate studies conducted since they were prepared, especially several relevant wind plant studies conducted in Washington and Oregon over the last 2 years.

In addition to the literature review on wind power avian impact studies, an extensive literature review was conducted to characterize bird abundance, species composition, and habitat use in Klickitat County. A combination of methods was used including searches on the Internet, library searches, contacting ornithological societies, and contacting experts in the field. The most relevant information came from wind power studies previously conducted in Klickitat County (e.g., Erickson *et al.* 1999, Jones and Stokes 1995).

Database Searches / Mapping

Information was obtained regarding the occurrence of Threatened and Endangered species (TES) from the U. S. Fish and Wildlife Service (USFWS). Information on raptor nests and nesting habitats, state special status species, and priority habitats was obtained from the Washington Department of Fish and Wildlife Priority Habitats and Species database (PHS) for all potentially suitable areas of wind power development within the project area. Further information on raptors and other special status bird species was obtained through correspondence with wildlife and habitat biologists with the Washington Department of Fish and Wildlife. Private interest groups (e.g., Audubon Society) were also contacted for appropriate data on wildlife and / or habitat. Additional sources of data included the North American Breeding Bird Survey, the North American Migration Count, the Audubon Christmas Bird Count and Columbia Hills Raptor Surveys. All data obtained were evaluated to determine their reliability, objectivity, and suitability for the project.

BPA Meta-Analysis

Bonneville Power Administration (BPA) provided funding for WEST to prepare a meta-analysis of existing data on avian use, raptor nesting and collision mortality information. Briefly, all available data collected at wind plants throughout the U.S. were analyzed and presented in a single report (Erickson *et al.* 2002). A synthesis of this information allows the various stakeholders to efficiently and effectively utilize these data and evaluate whether the existing data on avian use of wind resource areas and avian mortality at existing wind plants supports the development of more expedited and efficient methods of evaluating potential avian impacts of proposed wind projects. The results of this study were tailored to apply directly to the

Klickitat County PEIS. For example, avian use and raptor nest density data collected in Klickitat County were compared to similar data collected at wind plants where subsequent mortality data are available. From this analysis, predictions of avian mortality could be made for Klickitat County. Separate predictions were made for each region.

RESULTS

FIELD SURVEYS

Avian Point Count Surveys

Sensitive Species

Fourteen sensitive species were observed during point count surveys (Table 1). No federal or state endangered species were documented during the field study. The only federally-listed species observed was bald eagle (federal and state threatened), with three individuals observed over the 3-month study period. The only state threatened species was ferruginous hawk, with 5 observations in the spring. State candidate species observed included golden eagle (10 observations), merlin (3 observations), Lewis' woodpecker (24 observations), and loggerhead shrike (1 observation). With the exception of Lewis' woodpecker, which was fairly common in oak woodlands, the other threatened or candidate species occurred in very low numbers in the late spring and summer period. Several species being monitored by the state were observed, including Swainson's hawk (4), prairie falcon (7), turkey vulture (30), osprey (7), long-billed curlew (6), ash-throated flycatcher (7), grasshopper sparrow (7) and western bluebird (25).

Species Abundance and Composition

A total of 105 species of birds was observed during point count surveys (Appendix A). Over the course of the study, 2342 flocks comprised of 4708 individual birds were recorded. The number of birds observed by species used to obtain use and composition estimates are presented in Appendix A, and scientific names of all birds observed are reported in Appendix B. Eighty-five species were observed in spring and 85 species were observed in summer. Avian richness (defined as number of species per survey) was 4.55 / survey in the spring and 5.29 / survey in the summer (Table 2). The mean number of birds observed per survey plot was similar in the spring (11.55) and summer (12.01), and averaged 11.75 over both seasons. Use was relatively similar in the spring and summer for all avian groups (Table 3).

Small passerines were the most abundant group in spring (8.19 / survey), followed by corvids (1.22), waterbirds (0.82), raptors (0.69) and doves (0.22). Buteos had the highest use of all raptor groups (0.31 / survey), followed by small falcons (0.18) and northern harriers (0.06) (Table 3). Raptor species with the highest use in spring were red-tailed hawk (0.28 / survey), American kestrel (0.18), turkey vulture (0.06), northern harrier (0.06) and ferruginous hawk (0.02) (Table 4). Those raptors most frequently observed during surveys were red-tailed hawk (19.5% of surveys), American kestrel (15.6%), northern harrier (4.8%), turkey vulture (3.4%) and osprey (1.9%) (Table 5). Two-thirds (67%) of all raptor use of the study area in spring was comprised of two common species (red-tailed hawk and American kestrel).

The most abundant small passerines in spring were western meadowlark (1.50 / survey), European starling (0.75), white-crowned sparrow (0.68), Brewer's blackbird (0.52), and horned lark (0.50). Those passerines most frequently observed during spring surveys were western meadowlark (70.7% of surveys), horned lark (24.0%), European starling (12.7%), yellow-rumped warbler (11.5%), red-winged blackbird (11.5%) and mountain bluebird (11.5%). Corvids, although passerines, were grouped separately with larger birds. The most abundant was common raven (use = 1.07 / survey, frequency of occurrence = 29.6%), followed by black-billed magpie (0.04 / survey, 4.8% of surveys), and American crow (0.04 / survey, 2.9% of surveys).

The most common waterbirds (including waterfowl) observed were ring-billed gull (0.31 / survey) and California gull (0.18). Many gulls were observed at long distances which made species identification

difficult. When combined with observed gulls that were not identified to species, the number of gulls per survey was 0.73, much higher than for any other large bird group in the study area. After gulls, waterbirds with the highest use were Canada goose (0.04/survey), mallard (0.02), and great blue heron (0.01). The most frequently occurring waterbirds were ring-billed gull (6.3% of surveys), unidentified gull (5.3%), mallard (1.4%) and Canada goose (1.4%). The most common shorebirds in spring were killdeer (0.04/survey, 3.8% of surveys) and long-billed curlew (0.02/survey, 1.4% of surveys).

California quail (0.11/survey), chukar (0.04) and ring-necked pheasant (0.04) were the most abundant upland gamebirds in the study area, and were observed during 7.9%, 3.8% and 1.0% of all surveys. Mourning doves (0.22/survey, 14.2% of survey) were common throughout most of the study area. Lewis' woodpecker and northern flicker (both 0.05/survey, 4.3% of surveys) were the most abundant woodpeckers in the study area.

In the summer, small passerines were again the most abundant group (8.18/survey), followed by corvids (1.49), raptors (0.83), waterbirds (0.69) and doves (0.49) (Table 3). Buteos were the most abundant raptor group (0.35/survey) followed by small falcons (0.28). Raptor species with the highest use in summer were red-tailed hawk (0.32/survey), American kestrel (0.26), turkey vulture (0.05), northern harrier (0.05) and golden eagle (0.05) (Table 3). Raptors observed most frequently during summer surveys were red-tailed hawk (24.0% of surveys), American kestrel (18.3%), northern harrier (5.4%), turkey vulture (4.2%) and golden eagle (3.2%). In summer, 70% of the raptor use was comprised of red-tailed hawks and American kestrels.

The most abundant small passerines in summer were western meadowlark (1.41/survey), horned lark (1.30), cliff swallow (0.66), American goldfinch (0.51), and barn swallow (0.47). The most frequently observed small passerines were western meadowlark (67.6% of surveys), horned lark (35.6%), western kingbird (17.9%), American robin (10.9%), rock wren (10.9%) and American goldfinch (10.9%).

Use in summer by large corvids was highest for common raven (1.39/survey, 29.6% of surveys), followed by black-billed magpie (0.07/survey, 4.8%) and Stellar's jay (0.04/survey, 2.9%). The most common waterbirds observed in summer were unidentified gull (0.44/survey), ring-billed gull (0.24) and Canada goose (0.01). The waterbirds most frequently observed were unidentified gull (6.4% of surveys) and ring-billed gull (6.4%). Shorebirds with the highest use in summer were killdeer (0.04/survey, 3.2% of surveys) and spotted sandpiper (0.04/survey, 1.3%). California quail (0.07/survey) and ring-necked pheasant (0.05) were the most abundant upland gamebirds in the study area. Mourning doves (0.49/survey, 22.4% of all surveys) were one of the most common large birds observed during this period. Lewis' woodpecker (0.08/survey, 7.4% of surveys) was much more common in summer than northern flicker (0.01/survey, 0.6% of surveys).

Differences in mean abundance and frequency of occurrence among species primarily reflect differences in flocking behavior among species. Many of the most abundant species were seen on few surveys, but tended to occur in large flocks when they were observed, especially waterbirds, waterfowl, and some species of passerines.

Flight Height and Risk of Turbine Collision

During the study, 1073 flocks comprised of 2789 birds were observed flying during point count surveys (Table 6). Mean flight height for all species combined was 18.8 m. For avian groups with at least 10 observations of flying flocks, mean flight height was lowest for passerines (5.1 m), doves (6.6 m), and corvids (21.8 m). Highest mean flight heights were recorded for buteos (65.5 m), followed by eagles (57.9 m) and waterbirds (44.1 m).

For all species combined, 76.1% of all flying birds observed were below the rotor-swept height, 20.0% were within the rotor-swept height, and 3.9% were above the rotor-swept height (Table 6). Bird groups most

often observed flying within the turbine rotor-swept height were buteos (59.4%), eagles (46.7%), corvids (40.9%), and waterbirds (40.3%). For all flying raptors combined, 45.3% were observed flying within the rotor-swept height.

For species with $\geq$ 15 flying flocks recorded during surveys, the five with the greatest proportion of observations within the turbine rotor-swept height were turkey vulture (73.1%), red-tailed hawk (60.7%), unidentified gull (45.6%), common raven (42.9%), and barn swallow (21.9%). Some common species were never observed flying at the turbine rotor-swept height, including American goldfinch, Brewer's blackbird, cliff swallow, mountain bluebird, red-winged blackbird, western kingbird, and western meadowlark (Table 7).

Risk Indices

Based on our exposure index, species with the highest probability of turbine exposure were common raven (0.46), red-tailed hawk (0.15), ring-billed gull (0.14) and Vaux's swift (0.08) (Table 8). This analysis may provide insight into what species might be the most likely turbine casualties. However, this index only considers relative probability of exposure based on abundance, proportion of daily activity budget spent flying, and flight height of each species. This analysis is based on observations of birds during the daylight period and does not take into consideration flight behavior or abundance of nocturnal migrants. It also does not take into consideration varying ability among species to detect and avoid turbines, habitat selection and other factors that may influence exposure to turbine collision; therefore, the actual risk may be lower or higher than indicated by these data. For example, in the Altamont Pass WRA in California, mortality among the five most common species was not related to their abundance. American kestrels, red-tailed hawks, and golden eagles were killed more often, and turkey vultures and common ravens were killed less often than predicted based on abundance (Orloff and Flannery 1992). Similarly, at the Tehachapi Pass WRA in California, common ravens were found to be the most common large bird in the WRA, yet no fatalities for this species were documented during intensive studies (Anderson *et al.* 1996).

Habitat Effects on Avian Use

The highest use by buteos occurred in shrub-steppe and forested habitats (riparian and upland trees), but there was no significant difference in buteo use among habitats (Figure 3). Plots that contained riparian habitat had significantly higher use by buteos than plots without a riparian habitat component. Use of the project area by eagles was significantly higher in shrub-steppe habitats than the other three habitats examined; no use by eagles was documented in agricultural habitats. Eagle use was also significantly higher if the survey plot contained a riparian area component.

Use of the study area by large falcons (prairie falcons) was significantly higher in forested habitats than agricultural or grassland habitats; use of shrub-steppe habitats was lower than forested areas but not significantly. As with eagles, no falcons were observed in agricultural habitats during the study. Use by large falcons was also significantly higher if riparian habitats occurred within the survey plot. Small falcon use of agricultural and grassland habitats was significantly higher than use of forested areas, but was similar to use of shrub-steppe habitats. Northern harriers had significantly higher use in grassland habitats than shrub-steppe or forested areas. Use of agricultural areas was similar to grasslands. Northern harrier was the only raptor that had significantly higher use of plots not containing any riparian habitat.

For all raptor species combined, grasslands and shrub-steppe habitats had slightly higher use than agricultural or forested habitats; however, there were no significant differences in use among the 4 habitat types. Use of plots by all raptors combined was significantly higher if the plot contained at least some riparian habitat.

Passerines had similar use among all four habitat types. Use of plots by passerines was significantly higher if the plot contained at least some riparian habitat. Corvids had higher use of grasslands and shrub-steppe than agricultural or forested habitats, but the differences in use among the four habitats were not significant. Corvids also had slightly higher use in plots that did not contain a riparian area component, but the difference was not significant. Waterbirds and waterfowl had higher use of forested (i.e., riparian)

and shrub-steppe than grassland or agricultural habitats, but the differences were not significant. Use of survey plots by these groups was also much higher if the plot contained some riparian habitat.

Landscape Effects on Avian Use

In Klickitat County, buteo use of the study area was highest and similar ($P>0.15$) in the areas west of U.S. 97 and between U.S. 97 and Rock Creek (Figure 4). Use of the area east of Rock Creek was significantly lower than the other two areas ($P<0.15$). Buteo use of the area sampled in Skamania County was similar to areas east of Rock Creek. Buteo use of areas greater than and less than 1.5 miles from the Columbia River was similar (Figure 4).

Use of the area by eagles was based on observations of 10 golden eagles, 3 bald eagles, and 2 unidentified eagles (total = 15). No observations of eagles were made in Skamania County. Areas west of U.S. 97 and between U.S. 97 and Rock Creek had significantly higher use by eagles than areas east of Rock Creek. All eagles observed west of U.S. 97 and east of Rock Creek were >1.5 miles away from the Columbia River. Between U.S. 97 and Rock Creek, more eagles were observed within 1.5 miles of the Columbia River. Overall, there was no significant difference in eagle use as a function of distance from the Columbia River.

Use of the project area by large falcons was based on observations of 7 prairie falcons during the study. No large falcons were observed in Skamania County or those portions of Klickitat County west of U.S. 97. Use of the area between U.S. 97 and Rock Creek was significantly higher than the area west of U.S. 97, but was not significantly higher than areas east of Rock Creek. Similar use was observed by prairie falcons regardless of distance to the Columbia River. Small falcon observations were comprised of 96 American kestrels and 3 merlins. No small falcons were observed at the two points in Skamania County. Within Klickitat County, the area west of U.S. 97 had significantly higher use than any of the other three areas samples. Use of the areas between U.S. 97 and Rock Creek and east of Rock Creek were similar. Small falcon use of Klickitat County was similar regardless of the distance to the Columbia River. Northern harriers were not observed in Skamania County. Use of the three areas within Klickitat County by this species was similar, and distance to the Columbia River did not influence use by northern harriers.

For all raptor species combined, highest use occurred west of U.S. 97, followed by that area between U.S. 97 and Rock Creek; the lowest use occurred east of Rock Creek and in Skamania County. The use by all raptor species east of Rock Creek was significantly lower than total raptor use in the other two Klickitat County strata. Use of areas within 1.5 miles of the Columbia River was similar to use of areas >1.5 miles away from the river.

Based on total raptor abundance for the spring and summer seasons combined (Table 9), the six strata were ranked from lowest raptor use to highest raptor use as follows:

1. East of Rock Creek, >1.5 miles from Columbia River (raptor use=0.48/survey);
2. Between U.S 97 and Rock Creek, >1.5 miles from the Columbia River (raptor use=0.81/survey);
3. East of Rock Creek, $\leq$1.5 miles from the Columbia River (raptor use=1.08/survey);
4. Between U.S. 97 and Rock Creek, $\leq$1.5 miles from Columbia River (raptor use=1.09/survey)
5. West of U.S. 97, >1.5 miles from Columbia River (raptor use=1.17/survey); and
6. West of U.S. 97, $\leq$1.5 miles from Columbia River (raptor use=1.23/survey).

Songbird (passerine) use was quite variable and can be highly influenced by infrequent large flocks of birds. Songbird use between U.S. 97 and Rock Creek was significantly higher than songbird use west of U.S. 97 and east of Rock Creek. Songbird use in Skamania County was also higher than use of areas east of U.S. 97.

The highest songbird use (20.43/survey) occurred between Rock Creek and U.S. 97 within 1.5 miles of the Columbia River. Use of all other areas was <10/survey, ranging from 4.82/survey west of U.S. 97 and <1.5 miles from the Columbia River to 9.57/survey east of Rock Creek and <1.5 miles from the Columbia River. Significantly more songbirds were observed near the Columbia River than away from it.

No waterfowl or waterbirds were observed in Skamania County. In Klickitat County, highest use by these groups was west of U.S. 97, although there were no significant differences among areas. As would be expected, use near the Columbia River was substantially greater than areas away from the river. The lowest use by waterfowl and other water birds was between U.S. 97 and Rock Creek >1.5 miles from the Columbia River (use = 0.04/survey), followed by areas east of Rock Creek and >1.5 miles from the Columbia River (use = 0.11/survey). The highest use by this group (3.75/survey) occurred east of Rock Creek within 1.5 miles of the Columbia River (Table 9).

Raptor Nest Surveys

The raptor nest survey blocks encompassed a variety of habitats in Klickitat County (Appendix C). Twenty active raptor nests were located within the count blocks during the helicopter surveys, including 14 red-tailed hawk nests, 5 great-horned owl nests, and 1 prairie falcon nest (Figure 2). Other large nests observed within the count blocks included common raven (9) and American crow (2). Fifty-five inactive nests were also observed (Table 10). Nest density was calculated to be 0.087/mi^2 for red-tailed hawk, 0.031/mi^2 for great horned owl, and 0.006/mi^2 for prairie falcon. Total active raptor nest density in the county was estimated to be 0.124/mi^2. Most (78%) of the active and inactive raptor nests were located in trees. Trees most commonly used for nesting were cottonwoods (56.1% of tree nests), junipers (22%), and oaks (15%); about 1% of the nests were in locusts. Raptor nests not located in trees were either on cliffs or rocks (18%) or powerlines (4%).

The WDFW provided records for 97 historic raptor nest locations in Klickitat County (Figure 5). Records within the WDFW database do not reflect relative species abundance within the survey area because surveys are often conducted only for species of concern, such as ferruginous hawk. With the exception of ferruginous hawks and peregrine falcons, most nests are not monitored on a yearly basis, and some records date back to the 1980's. The WDFW database also contains incidental observations of raptor nest locations made by WDFW and other personnel.

Of the 97 nest locations, 80 were located within the study area analyzed in this report (Figure 5). The most common species documented by WDFW were ferruginous hawk, prairie falcon and golden eagle. Other species of note include two bald eagle nests located within 150 m of each other and five peregrine falcon eyries. Nest history information is available for some nest locations. Five golden eagle nests had fallen by 1990, and one golden eagle nest was occupied by prairie falcons. None of the historic ferruginous hawk nests were occupied during surveys conducted by the WDFW in 2002. The bald eagle nests were occupied in 1996 and 2000.

Based on the WDFW data and data collected during this study, the distribution of nests within the county varies by species. Peregrine falcon eyries and osprey nests are located along the Columbia River, while the ferruginous hawk nests are located within the grasslands of the eastern portion of Klickitat County. All of the known goshawk nests are located within the coniferous forests in the western portion of Klickitat County.

The highest density of active raptor nests (0.31/mi^2) obtained from our surveys was between Rock Creek and U.S. 97 >1.5 miles away from the Columbia River (Table 11). The next highest density occurred east of Rock Creek within 1.5 miles of the Columbia River (0.13/mi^2). Active raptor nest density east of Rock Creek and >1.5 miles from the Columbia River (0.09/mi^2) was similar to nest density west of U.S. 97 and within 1.5 miles of the Columbia River (0.06/mi^2). No active raptor nests were found in the other two strata (west of U.S. 97 and >1.5 miles from the Columbia River; between U.S. 97 and Rock Creek and <1.5 miles from the Columbia River).

LITERATURE REVIEWS

Avian Use of Klickitat County

Special Status Avian Species

Special status avian species include species listed as federal endangered, federal threatened, federal candidate, federal species of concern, state endangered, state threatened, state candidate, state species of concern, state monitor, and species designated as by the Washington Department of Fish and Wildlife as Criteria 1 priority habitat species.

Special status avian species that occur or potentially occur in Klickitat County are listed in Table 12. The information presented in Table 12 was derived from the Breeding Bird Atlas data (which started in 1987), and habitat associations using GAP Analysis ecoregion and vegetation classifications (Smith *et al.* 1997). This resource also includes Washington Department of Fish and Wildlife data from some of their projects, including their shrub-steppe bird study (15,817 records), which consisted of numerous transects scattered throughout eastern Washington which were sampled for the presence and quantity of birds in shrub-steppe habitats, and their Natural Heritage database (6,193 records), which contained detailed records of the presence of individuals or breeding sites of several sensitive species. Also included in the table are the Washington Department of Fish and Wildlife Priority Management Habitat Species, criteria 1 (PHS1) that occur or potentially occur in the Klickitat County project area. Criteria 1 indicates the species is determined to be in danger of failing, declining, or vulnerable due to factors such as limited numbers, disease, predation, exploitation or habitat loss or change (Washington Department of Wildlife 1991).

Avian species have been categorized into the following avian groups:

Waterfowl: Ducks, geese and swans
Raptors: Eagles, hawks, falcons, vultures, osprey and owls
Upland Game Birds: Grouse, pheasants, quail
Other Water Birds: Loons, grebes, coots, herons, cranes, cormorants, gulls and terns
Shorebirds: Sandpipers, phalaropes, rails
Nonpasserine Land Birds: Goatsuckers, woodpeckers, kingfishers, swifts, doves and hummingbirds
Passerines: Perching birds, including corvids, flycatchers, swallows, wrens, sparrows, warblers, finches, thrushes, nuthatches, larks, blackbirds, orioles, starlings

Occurrence of Priority Habitat Management Species

Historic data from the Washington Department of Fish and Wildlife Natural Heritage Database show avian observations of Washington Department of Fish and Wildlife Priority Species (PHS species) within the project area. PHS species that have been observed in the project area include American white pelican, bald eagle, burrowing owl, great blue heron, Merriam's wild turkey, mountain quail, purple martin, and western bluebird (Figure 6). Sources of PHS data include observations from agency biologists and credible scientists and other observers. PHS observations are mostly anecdotal in nature. The absence of a species from the PHS data does not necessarily indicate the species does not occur and/or breed within the project area. In addition to Criteria 1, PHS species may be designated as Criteria 2 and/or Criteria 3. Criteria 2 species are uncommon species, including Monitor species, occurring in forest environments that may be affected by habitat loss or change. Criteria 3 species are those in forest environments for which the maintenance of a stable population and surplus for recreation may be affected by habitat loss or change (Washington Department of Wildlife 1991).

Avian Studies Previously Conducted in the Klickitat County Project Area

Avian Baseline Studies Associated with the Mariah Energy Wind Project

Winter raptor surveys (January – March 1999) were conducted prior to development of the Mariah Energy Group Wind Project (Dames and Moore 1999), which is located along Hoctor Road northwest of Goodnoe Hills (Figure 7). The project currently consists of 5 small turbines. Surveys were designed to document raptor and especially bald eagle use, locations of bald eagle night roosts and flight routes near the site. Observations at four observation points were made once or twice daily, mostly within 30 minutes before and 90 minutes after sunrise and within 90 minutes before and 30 minutes after sunset. In-transit observations of raptors were also recorded. During the same time frame, members of the local Audubon chapter conducted surveys at 7 observation stations along Hoctor Road.

Detailed results for the 1999 winter raptor study associated with the Mariah Energy wind project is found in Dames and Moore (1999). The most common raptor species observed included unidentified hawk species (61), bald eagle (20), red-tailed hawk (19), and northern harrier (10) (Dames and Moore 1999). Most of the bald eagle observations were made at station 1 at the western end of the project area. Observations near station 1 are near the confirmed night roost site identified during the Kenetech and Cares Study (Jones and Stokes 1995). Audubon bald eagle observations along Hoctor Road were similar, with 10 bald eagle observations near station 1 and 8 observations total among the other six stations over a 32-day period. During the entire study, Audubon documented 283 raptors.

CARES Avian Baseline Surveys

In 1998 year round avian use surveys were conducted at the proposed CARES wind plant site located near the western edge of the Columbia Plateau in Klickitat County. The study area was approximately six miles southeast of Goldendale, Washington between U.S. 97 and Rock Creek. The proposed site was on a ridge approximately two miles north of the Columbia River (Figure 8). Elevation in the vicinity of the site ranged from 305 m (1,000 ft) to about 880 m (2,890 ft). Habitat at or near the site was primarily rangeland used for cattle grazing (62%) and cultivated farmland (18%). Minor vegetation classes occurring in the vicinity of the site included oak and juniper woodlands, native shrub steppes, bunch grass steppe, and riparian areas (Erickson *et al.* 1999).

Twenty-four observation stations, consisting of a 0.4-km radius circle centered on an observation point, were located within the proposed wind plant study area. Observations at each station were made on one day every two weeks throughout the year. Each station was visited for 20 minutes twice each sampling day; once during the morning (8:00 – 12:00), and once during the afternoon (12:00 – 16:00) (Erickson *et al.* 1999).

Avian Use

Seventy-three species were documented during sightings of 5,406 groups totaling 9,484 birds (Table 13). The highest number of species (54) was observed in summer (June-August), followed by spring (March-May) and fall (September-October) with 44 species recorded in each of these seasons. Only 19 species were observed during the winter (November-February) (Erickson *et al.* 1999).

Passerine Use

Passerines were the most common avian group observed throughout the year followed by raptors (Erickson *et al.* 1999). Passerines with the highest use during the spring were western meadowlark (2.00/survey), horned lark (1.27), vesper sparrow (0.66), American robin (0.50), and common raven (0.18) (Table 13). Passerines with the highest use during the summer were horned lark (1.29), western meadowlark (1.23), vesper sparrow (0.65), common raven (0.19), and cliff swallow (0.16). Passerines with the highest use during the fall were American robin (1.29), common raven (0.73), horned lark (0.68), western meadowlark

(0.28), and western bluebird (0.18). Passerine species with the highest winter use were horned lark (0.36), American robin (0.17), common raven (0.09), Townsend's solitaire (0.05), and white-winged crossbill (0.04) (Erickson *et al.* 1999).

Raptor use

Overall raptor use was highest during fall (0.38 / survey), followed by spring (0.24) and summer (0.23); use was very low during winter (0.04) (Table 13). Raptor species with the highest mean use in spring were red-tailed hawk (0.09 / survey), golden eagle (0.05), and American kestrel (0.05). Raptor species with the highest mean use during the summer were American kestrel (0.12 / survey), red-tailed hawk (0.06), and northern harrier (0.03). In fall the raptors with the highest mean use were northern harrier (0.12 / survey), red-tailed hawk (0.12), and Cooper's hawk (0.04). In winter the raptors with the highest mean use were golden eagle (0.02 / survey), followed by red-tailed hawk (0.01), prairie falcon (0.01), and bald eagle (0.01) (Erickson *et al.* 1999).

Overall, red-tailed hawk was one of the most commonly occurring species (based on mean use and % frequency of occurrence), during all seasons. American kestrel was one of the most commonly occurring species during the spring and summer, and northern harrier was one of the most commonly occurring species during summer and fall. Golden eagle was one of the most commonly occurring species in the spring and winter, and bald eagles and prairie falcons were fairly common during the winter.

Exposure to Turbines

Erickson *et al.* (1999) also recorded avian flight heights and estimated the species with the highest exposure to turbines based on mean use, proportion of activity budget spent flying, and proportion of flight heights within the rotor-swept height of turbines. This analysis was based on observations of birds during the daylight period and did not take into consideration varying ability among species to detect and avoid turbines, habitat selection and other factors that may influence risk.

During spring the species with the highest exposure index were common raven (0.058), American robin (0.058) and red-tailed hawk (0.048). Species with the highest exposure index during summer were common raven (0.063), cliff swallow (0.033), and red-tailed hawk (0.032). During fall the species with the highest exposure index were common raven (0.238), American robin (0.152), and red-tailed hawk (0.059). In winter the species with the highest exposure index were common raven (0.030), American robin (0.019), and golden eagle (0.009).

Overall, common raven had the highest exposure index during all seasons, followed by American robin in spring, fall and winter. Horned lark was one of the top five passerine species with highest exposure index during all seasons.

Red-tailed hawk had the highest exposure index for raptors during spring, summer, and fall, and was one of three raptor species with the highest exposure index during winter. Golden eagle had the highest exposure index during winter, and the second highest exposure index for raptors during spring. American kestrel was one of three raptor species with the highest exposure index during spring and summer.

Spatial use data indicated that raptor use of the CARES study area tended to be concentrated north of the rim edge, suggesting risk may be reduced if turbines are not placed on top of the rim itself (Erickson *et al.* 1999). Relatively higher use of rim edges by raptors has also been documented at other sites (Johnson *et al.* 2000a).

Avian Studies at Proposed Kenetech and CARES Wind Farm Sites

In 1993-1994, avian surveys were conducted along the Columbia Gorge region of south-central Washington. The primary geomorphological formation within the study area was a steep ridge which rose abruptly 900 vertical meters (2,800 ft) above (north of) the Columbia River and was 21 km (13 miles) long. Habitats

included primarily grassland with occasional basalt outcroppings and cliffs along the ridge (Jones and Stokes Associates 1995).

Grassland habitat in the Columbia Hills ranged from areas which have been heavily grazed and dominated by invasive weeds, such as cheatgrass (rangeland), to areas which were relatively undisturbed and contained predominantly native grasses and shrubs (shrub-steppe habitat). The greater study area was comprised of a ten-mile radius surrounding the project sites and was the focus of the nesting/breeding survey. The second study area included the project sites and lands within approximately 1 km (0.6 mile) of potential turbine and collection line locations, which was considered the area where birds would be at risk of collisions with project structures (Jones and Stokes Associates 1995).

Studies conducted included a winter raptor and waterfowl study, spring and fall avian migration surveys, a spring raptor breeding study, a summer resident avian use survey, and spring through fall fixed-point observation and transect studies. The study areas including the proposed site location and control location are shown in Figure 9. The proposed wind site was between U.S. 97 and Rock Creek, whereas the control site was located west of U.S. 97.

Winter Raptor and Waterfowl surveys

The winter raptor and waterfowl surveys were conducted in two phases: (1) over 12 days between 1 December 1993 and 12 January 1994, by Dames & Moore, and (2) during January 27-29 and February 8-12, 1994 by Jones and Stokes Associates. Subsequently, a survey was conducted over 4 days during December 8-16, 1994.

Raptors observed during the winter surveys included bald eagle, golden eagle, ferruginous hawk, prairie falcon, rough-legged hawk, red-tailed hawk, American kestrel and northern harrier. Jones and Stokes (1995) reported that most raptors present in the area were year-round residents. Rough-legged hawks migrated into the area during the winter and became one of the most common winter species, while turkey vultures and Swainson's hawks were the only raptor species that left the study area during the winter (Jones and Stokes Associates 1995).

During the first 2-day observation period more than 1,300 waterfowl were counted on the Columbia River and Rock Creek. During the second 2-day survey period (December 8-16, 1994) more than 1,700 waterfowl were observed (Jones and Stokes Associates 1995).

The Rock Creek area was identified as a concentration point for wintering waterfowl during the first winter survey period. American coot and mallard were the most numerous species in this area. Other species observed included American wigeon, Canada goose, bufflehead, northern pintail, gadwall, and northern shoveler (Jones and Stokes Associates 1995). Waterfowl counts during the second winter survey period (December 8-16, 1994) included Canada goose, common goldeneye, Barrow's goldeneye, ring-necked duck, bufflehead, hooded merganser, redhead, and mallard (Jones and Stokes Associates 1995).

The most frequently observed passerine during the winter survey was horned lark, which occurred in all habitats, most frequently along fence lines, in tilled fields, and in the open rocky areas along the ridge top. European starlings were also commonly observed, with flocks of up to 100 individuals in all study units, but more commonly occurring at the ridge face and the north plateau, where elevated perching areas were present. Other species commonly observed included American robin, house finch, dark-eyed junco, American goldfinch, western meadowlark, Brewer's blackbird, and white-crowned sparrow. Most other species of passerines were observed most frequently along roads and fence lines, shrubby areas, and other areas containing cover (Jones and Stokes Associates 1995).

Raptor Breeding Surveys

The raptor breeding period generally occurs from the beginning of April through the end of June (Jones and Stokes Associates 1995). Survey dates included May 11-16, May 18-20, and June 7-9. Nineteen nest sites were found in the primary study area for both projects. Species nesting at these sites included:

Red-tailed hawk	(10)
Golden eagle	(2)
Swainson's hawk	(2)
Northern harrier	(2)
Prairie falcon	(1)
Sharp-shinned hawk	(1)
Great-horned owl	(1)

While turkey vultures were commonly observed during the breeding survey, no nest sites were located. However, a communal roost was found near Maryhill State Park. A pair of peregrine falcons was observed on four occasions at the Rock Creek area, although an active nest was not located. During each observation the two falcons were together, indicating a strong pair bond, which usually develops as part of breeding even if reproductive attempts fail (Jones and Stokes Associates 1995).

Spring through Fall Fixed-point observations

Surveys were conducted at 16 fixed-point observation stations within the primary study area. Three control area observation stations were placed approximately 16 km (10 miles) west of the primary study area. The control area was selected for ongoing monitoring studies of avian use and mortality should development of the projects be approved, and was sited in habitats similar to those found in the primary study area.

The observation zone for conducting the avian studies was 1 km (0.6 mile) radius; incidental observations were obtainable from within a 1.6 km (1 mile) radius. Observation stations were selected to be no more than 1.6 km (1 mile) observation radius, or 3.2 km (2 miles) apart. Field surveyors sampled each station for 20 minutes, roughly once during the morning (sunrise to 10 AM), once during midday (10:01 to 14:00), and once during the afternoon (14:01 to 18:00). Transects were also surveyed while traveling between stations during each of these time periods.

Spring avian migration generally occurs from the last 2 weeks in March through the first two weeks in May (Jones and Stokes Associates 1995). Surveys within this time frame were conducted March 24-27, April 12-18, April 23-28, and May 5-8. The period of summer resident avian use generally occurs from the middle of May to late August. Survey dates within this time frame included August 24-27. Fall avian migration generally occurs from the beginning of September through the first week of November (Jones and Stokes Associates 1995). Fall Avian Migration Surveys were conducted September 7-10, September 21-24, September 28- October 1, October 5-8, October 12-15, and October 19-26.

Avian Observations

The total number of raptors observed was 568, while the total number of non-raptor species was 6,596. The most commonly observed raptor species included red-tailed hawk, (186) American kestrel (125), Northern harrier (45), golden eagle (37), and sharp-shinned hawk (32) (Table 14).

Jones and Stokes (1995) found that raptors were the most frequently observed large bird in the study area, and were observed a greater amount of time overall within the survey radius. The five most common raptor species during the spring through fall seasons were red-tailed hawk, American kestrel, turkey vulture, Swainson's hawk, and prairie falcon. Use of the primary study area by red-tailed hawks and American kestrels was two to three times greater than all other raptor species. Jones and Stokes (1995) reported that the species most susceptible to collision mortality would include golden eagles, red-tailed hawks and American kestrels.

Movements and Behavior

Jones and Stokes (1995) also recorded avian movements and behavior during fixed-point surveys. They found that season and study unit (habitat/geomorphology differences) influenced the frequency of occurrence of most of the primary species in the study area. Golden eagles occurred in the study area most frequently during summer in the ridge face study unit, which is consistent with the higher use observed off the rim edge during the CARES study. Northern harriers primarily used agricultural and rolling grassland areas, while occurring less in the steeper terrain of the ridge top and ridge face units. American kestrels, red-tailed hawks, sharp-shinned hawks and prairie falcons occurred in all study units, although in varying proportions seasonally.

Jones and Stokes (1995) concluded that bird flight direction data suggested that the area was not used as a migratory corridor. Birds did not funnel through the project area along a defined front. Instead, birds observed during the migratory seasons appeared to fly through the area on a broad front, with no detectable pattern. The majority of observations were of birds either flying through the area or foraging with no obvious seasonal patterns. While birds may migrate along an east-west migratory route along the Columbia River and along a north-south migratory route through the project area, no specific migratory corridor was detected from general observations or was detected during standardized surveys.

Migration Counts

The North American Migration Count is a nation-wide effort to monitor bird populations. This census is conducted by county and is held on the 2nd Saturday in May and the 3rd Saturday in September. The first Spring count in Klickitat County took place in 1997, and the first fall count was conducted in 1998. Klickitat County is divided into 9 sectors for the survey (Figure 10). Sectors within the project area include Klickitat River, Dallesport, Saltus Pass, Rock Creek and Alder Creek. Results for Klickitat County North American Migration Counts for the sectors within the project area are presented in Tables 15 and 16 (Hansen 2002c).

Spring Migration

During the spring migrations, Canada goose consistently had the highest count for waterfowl, followed by mallard. The majority of the geese and mallards were consistently observed in the Catherine Creek, Klickitat River and Alder Creek sectors. California quail had the highest upland game bird count each time, generally followed by chukar and ring-necked pheasant. The most abundant shorebird was killdeer, followed by spotted sandpiper and long-billed curlew. Highest counts for other water bird species were for California and ring-billed gulls. However, in spring 2002 highest counts were for great blue heron (122) and black-crowned night heron (87). Highest counts of nonpasserine land bird species consistently were for mourning dove, Vaux's swift, Lewis' woodpecker, northern flicker (red-shafted), and rock dove. Passerine species with the highest counts were European starling, red-winged blackbird, Brewer's blackbird, violet-green swallow, cliff swallow, and western meadowlark. Red-tailed hawk, American kestrel and turkey vulture consistently had the highest counts for raptors during all of the spring migration counts, generally followed by northern harrier and osprey.

Fall Migration

During the fall migration counts, Canada goose and mallard were again the most abundant waterfowl. California quail and gray partridge were the most common upland game birds, followed by chukar, ring-necked pheasant and wild turkey. Shorebirds with the highest counts were killdeer, western sandpiper, and Virginia rail. California gull, double-crested cormorant, ring-billed gull, American coot, and great blue heron were the most common water birds. Mourning dove, rock dove, and Lewis' woodpecker generally had the highest counts for nonpasserine land birds. Passerine species with the highest counts included European starling, yellow-rumped warbler (Audubon's), violet-green swallow, house sparrow, and Brewer's blackbird. The highest counts for raptor species were for turkey vulture, followed by American kestrel and red-tailed hawk.

Breeding Bird Surveys

The North American Breeding Bird Survey (BBS) is conducted at approximately 3,700 active BBS routes across the continental U.S. and Canada, of which nearly 2,900 are surveyed annually in June. Route numbers 25 (Snowden) and 26 (Bickleton) are within Klickitat County, Washington and are shown in Figure 11. Route 25 is west of U.S. 97 and Route 26 is east of Rock Creek. Each route is 24.5 miles long with 3-minute point counts conducted at 0.5-mile intervals for a total of 50 point counts. Birds seen or heard within a one-quarter mile radius are recorded. The data collected can be used to determine abundance, distribution, and population trends, as well as to identify local and continental trends or distributional shifts.

The most common bird species found on Snowden Route 25, expressed as birds per route averaged from 1966-2001, were American robin (90.6), white-crowned sparrow (61.4), European starling (49.0), tree swallow (34.0), American crow (32.4), Brewer's blackbird (32.0), black-headed grosbeak (30.2), spotted towhee (29.2), Western meadowlark (23.6), Western tanager (23.4), purple finch (22.4), and house finch (21.2) (Sauer *et al.* 2001) (Table 17). The most common bird species found on Bickleton Route 26, expressed as birds per route averaged from 1966-2001, were horned lark (72.88), western meadowlark (66.75), mountain bluebird (31.25), Brewer's blackbird (13.00), and cliff swallow (10.50) (Sauer *et al.* 2001) (Table 18).

Raptors

The most common raptor species observed on Snowden route 25 expressed as birds per route averaged from 1966-2001 were red-tailed hawk (0.8), turkey vulture (0.6), osprey (0.4), Cooper's hawk (0.2), northern goshawk (0.2), and western screech owl (0.2) (Sauer *et al.* 2001) (Table 17). The most common raptor species observed on Bickleton route 26 expressed as birds per route averaged from 1966-2001 were red-tailed hawk (3.75), American kestrel (1.75), northern harrier (0.62), short-eared owl (0.50), Swainson's hawk (0.38), and great horned owl (0.12) (Sauer *et al.* 2001) (Table 18).

Christmas Bird Counts

The National Audubon Society Christmas Bird Count (National Audubon Society 2002) is conducted annually throughout the U.S.A. and Canada and at a few other locations in the New World. Participants conduct the bird census within a designated 15-mile diameter circle on a given count day. Christmas Bird Count circles in Klickitat County are located in the vicinity of Lyle, Washington (west of U.S. 97), and Columbia Hills-Klickitat Valley, Washington (between U.S. 97 and Rock Creek) (Figure 12).

Lyle Christmas Bird Count

The Lyle Christmas Bird Count circle is divided into eight sectors (Figure 13). Of these, sectors 1 through 5 are located on the Washington side of the Columbia River in Klickitat County, and sectors 1, 3, 4 and 5 are within the project area. Data for the Lyle Christmas Bird Counts, sectors 1, 3, 4 and 5, from December 1997 through December 2001 are presented in Tables 19 through 23.

Waterfowl with consistently the highest counts included Canada goose, ring-necked duck, American wigeon, common merganser, and mallard. California quail was the most common upland game bird all years, generally followed by ring-necked pheasant. Killdeer, common snipe, and Virginia rail generally had the highest shorebird counts. Other water bird species with the highest counts were western grebe, double-crested cormorant, American coot and pied-billed grebe. Nonpasserine land bird species with the highest counts were rock dove, northern flicker and Lewis' woodpecker. Passerine species with the highest counts were Dark-eyed (Oregon) junco, European starling, and Brewer's blackbird. Raptors with the highest counts were red-tailed hawk, bald eagle, rough-legged hawk, northern harrier and American kestrel.

Columbia Hills-Klickitat Valley Christmas Bird Count

The most recent Christmas Bird Count in Columbia Hills-Klickitat Valley, Washington was conducted on 29 December 2001. The total number of birds counted was 7,959. Bird species with the highest counts included common goldeneye (716), European starling (679), Canada goose (645), dark-eyed junco (575), mallard (451), house sparrow (451), Brewer's blackbird (442), and California gull (359). Raptors with the highest counts included red-tailed hawk (36), American kestrel (23), rough-legged hawk (7), bald eagle (6), and northern harrier (6).

Data from Christmas Bird Counts in Columbia Hills-Klickitat Valley, Washington from 1996 through 2001 are presented in Table 24. Bird species with consistently the highest counts included Canada goose, mallard, greater scaup, lesser scaup, common goldeneye, rock dove, European starling, dark-eyed junco, house finch, American goldfinch, and house sparrow. Raptors with the highest counts recorded during the Christmas Bird Counts in Columbia Hills-Klickitat Valley, Washington from 1997-2000 included red-tailed hawk, American kestrel, rough-legged hawk and Northern harrier.

Columbia Hills Raptor Surveys

Spring and Fall

Spring and fall raptor surveys were initiated in 2000 to learn more about raptor presence, distribution and use of the Columbia Hills area (Johnston 2002). The survey area was divided into four quadrants, with two observers per quadrant. State highway 97 provided a boundary for the east and west quadrants, and the crest of the hills above the Columbia River separates the area into north and south slopes.

The spring raptor survey, conducted on 15 April, 2000 documented 170 raptors of 10 species. No further information regarding species types and numbers was available for this survey. The fall survey, conducted on 21 October 2000 documented 70 raptors of 7 species, including red-tailed hawk (37), American kestrel (7), golden eagle (7), northern harrier (4), rough-legged hawk (3), prairie falcon (1), hawk / eagle sp. (5), Buteo sp. (5) and Accipiter sp. (1). By the time the fall survey took place, Swainson's hawks, vultures and ospreys had already departed for their wintering destinations, and rough-legged hawks were just beginning to arrive (Johnston 2002).

Winter

An early winter raptor survey was conducted on December 12, 1998 and a late winter raptor survey was conducted on February 7, 1999. Red-tailed hawk, American kestrel and northern harrier were consistently more prevalent in each of the four quadrants during both surveys. The results of the December 1998 count are presented in Table 25 (Hansen 2002a) and the results of the February 1999 survey are presented in Table 26 (Hansen 2002b). The results for Columbia Hills Raptor surveys that we have reported were obtained from a website maintained by Bob Hansen (http://www.wvi.com/~bhansen/namcdesc.htm). Results for subsequent surveys were requested of Stuart Johnston, who refused to provide us with any additional Columbia Hills Raptor survey data.

Radar Studies

No radar studies have been conducted within Klickitat County. In the Pacific Northwest, nocturnal migration at a wind plant site has been studied only at the Stateline Windplant on the Oregon/Washington border east of Klickitat County Project (Mabee and Cooper 2000, Mabee and Cooper 2001, Mabee and Cooper 2002). The study was designed to monitor waterfowl, shorebird and passerine movements during fall and spring migrations. Marine radar was used to study nocturnal bird migration at two stations: one near the existing Vansycle Wind Project near the southeastern end of the Stateline

project area, and one to the north of the project area in Washington. Targets flying below 100 m were considered within the zone of collision risk with the turbines. For targets observed from 0-1500 m above ground level, 87% were flying above 100 m during the spring of 2001, and 94% were flying above 100 m in the fall of 2001. The northern and southern stations had very similar passage rates, suggesting no distinct differences in migration patterns throughout the project site. The overall migration rates were considered moderate compared to rates observed in other parts of the U.S. Subsequent carcass searching has shown low avian collision mortality during migration periods at this wind plant (Erickson *et al.* 2003) as well as at other windplants in the Pacific Northwest (e.g., Erickson *et al.* 2001a, Johnson *et al*. 2003).

Effects of Wind Plants on Birds

Wind plant design has changed significantly since the first large wind plants were developed in California; many of these changes have appeared to reduce risk to birds. Turbines are now typically installed on tubular steel towers instead of lattice towers and without open platforms at the top of the tower, eliminating perching opportunities for raptors and other birds. No observations have been made of raptors perched on the new turbine types during studies at Foote Creek Rim (WY) (Johnson *et al.* 2000a), Buffalo Ridge (MN) (Johnson *et al.* 2000b), Vansycle (OR) (Erickson *et al.* 2001a) and Stateline (OR/WA) (Jeffrey and Kronner 2002, pers. comm.). The nacelle, which houses the generator, drive train and gearbox on top of the tower, is typically completely enclosed. American kestrels were even observed nesting inside the nacelle of older turbines, and kestrel mortality was high, likely due to this increased use near the turbines (Howell 1997). Electrical lines between turbines and from the turbine strings to substations in new-generation wind plants are often buried underground to eliminate perching opportunities, collisions with wires, and electrocutions. Collisions with wires and electrocutions have been a common source of mortality at Altamont Pass (CA) (Orloff and Flannery 1992) and other older wind projects. Overhead lines within the wind plant have often been designed to be raptor safe and anti-perching devices are often installed (e.g., Stateline [OR/WA] wind plant [Walla Walla Regional Planning Department 2000]). Turbines are much larger, with blades moving at slower revolutions per minute (rpm) and presumably more visible than blades on the smaller older turbines. For example, the blades of the 1.5 MW turbines installed at the Klondike (OR) wind plant turn at approximately 20 rpm's, contrasted to greater than 60 rpm's for the Kenetech 56-100 downwind turbine, the most common turbine at the Altamont Pass (CA) wind plant. Blade tip speeds of both large and small turbines are still fast (often 200+ mph). Studies by Howell (1997) and Hunt (2002) provide some evidence indicating the Kenetech 56-100 turbines (100 kW, 9 m blades) have a higher associated raptor mortality rate than other turbine types, including larger turbines. Hunt (2002) attributes the higher risk in part to the blade proximity to the ground and the low altitude foraging behavior of golden eagles. The 56-100 model is a downwind turbine, with the blades on the downwind side of the nacelle, which some researchers believe may also increase risk of collision to birds that perch on the turbine; most newer-generation turbines are upwind turbines. Birds perched on this downwind turbine may be blown towards the blades when leaving the perch.

In addition to changes in technology, significant effort has been devoted to developing standardized methods for siting wind plants (NWCC 1999), monitoring for avian impacts resulting from the wind plants (Anderson *et al.* 1999, Erickson *et al.* 2000), and developing measures to mitigate impacts (Johnson *et al.* in press). Primarily due to the avian collision concerns and through the development of siting and monitoring guidelines, baseline avian use, raptor nesting and operational monitoring data (Erickson *et al.* 2001b) have been collected at many of the new developments outside California. The data have been used for prediction of wind project impacts on wildlife and habitats, and in some cases, for siting individual wind turbines at a particular site. This large and significant source of information has greatly improved our ability to predict impacts for new projects and to aid in wind plant/wind turbine siting. Raptor mortality at these new wind projects has been absent or low in all cases. Intensive monitoring programs in place at newly constructed wind projects such as the Stateline (OR/WA), Klondike (OR), and the Buffalo Mountain (TN), continue to add to the already available information for other new wind projects (e.g., Buffalo Ridge

(MN), Foote Creek Rim (WY), and Vansycle (OR)). Other wind projects such as Nine Canyon (WA) and Condon (OR), will add more information in the near future.

Substantial data on avian mortality at windplants are currently available. Of 841 avian fatalities reported from California studies (>70% from Altamont Pass, CA), 39% were diurnal raptors, 19% were passerines (excluding house sparrows and European starlings), and 12% were owls. Non-protected birds including house sparrows, European starlings, and rock doves comprised 15% of the fatalities. Other avian groups generally made up <10% of the fatalities. Outside of California, diurnal raptor fatalities comprised only 2% of the wind plant-related fatalities. Passerines (excluding house sparrows and European starlings) were the most common collision victims, comprising 82% of the 225 fatalities documented. No other group (e.g., raptors, waterfowl) comprised more than 5% of the fatalities (Table 27).

For all avian species combined, estimates of the number of bird fatalities per turbine per year from individual studies have ranged from 0 at the Searsburg, Vermont (Kerlinger 1997) and Algona, Iowa sites (Demastes and Trainer 2000) to 4.45 on the Buffalo Ridge (MN) Phase III site (Johnson *et al.* 2000b). The Phase III Buffalo Ridge (MN) site estimate was based on one field season (1999) and was greatly influenced by a fatality event involving 14 migrant warblers, vireos and flycatchers, observed during a May 17 carcass search of two turbines (Johnson *et al.* 2002). Avian fatality rates were much lower at the Buffalo Ridge (MN) Phase I and II sites, where several years of data were collected (Osborn *et al.* 2000, Johnson *et al.* 2002). Throughout the entire U.S., the average number of avian collision fatalities per turbine is 2.19 per year. We are unaware of any other fatality incident in the U.S. like the one recorded at Buffalo Ridge (MN; 14 migrants at 2 turbines during a single search). We are also not aware of any raptor fatality incident where several raptors are killed as a group during migration.

Raptor mortality has been absent to very low at all newer generation wind plants studied in the U.S. This and other information regarding wind turbine design and wind plant/wind turbine siting strongly suggests that the level of raptor mortality observed at Altamont Pass is quite unique (e.g., unique in the number and arrangement of turbines in small area, turbine types, prey availability, raptor use), and can be avoided at other locations. Raptor use (e.g., golden eagle use) may be a predictor of raptor risk (e.g., likelihood of mortality) when comparing several sites and when comparing different areas within a site. However, low raptor mortality at newer generation wind plants has resulted in low correlation between use and fatality rates at these new projects. It is possible that the new turbine designs and turbine and wind plant siting decisions made based on avian use patterns or patterns observed at other projects have resulted in reduced avian mortality. However, this has not been experimentally tested.

Wind plants with year-round waterfowl use have shown the highest waterfowl mortality, although the levels of waterfowl/waterbird mortality appear insignificant compared to the waterfowl/waterbird use of the sites. Sites within native landscapes have shown very low waterfowl use, except when significant water sources are available (e.g., San Gorgonio[CA]). Passerines comprise a large proportion of the fatalities at new wind plants, and involve both resident and migrant species. Studies of nocturnal migration at several wind plants suggest the mortality compared to the number of birds passing through the area appears low (Cooper and Mabee 2002, Johnson *et al.* 2002, McCrary *et al.* 1984).

Since few raptor species targeted during nest surveys (i.e., those visible from helicopter surveys) have been observed as fatalities at newer wind plants, correlations are very low between the number of collision fatalities and raptor nest density within 2 miles of project facilities. Raptors nesting closest to turbines likely have higher probabilities of being impacted from disturbance (construction and operation) or from collision with turbines, but data on nests very close to turbines (e.g., within ½ mile) are currently inadequate to determine the level of these impacts. The existing wind plant with the highest reported nest density is Foote Creek Rim (WY). Most of the nests within 2 miles of the wind plant are red-tailed hawks, but no red-tailed hawk fatalities have been documented at this site (Johnson *et al.* 2000a).

It has been estimated that from 100 million to well over 1 billion birds are killed annually in the United States due to collisions with human-made structures, including vehicles, buildings and windows,

powerlines, communication towers, and wind turbines. Based on current projections of 15,000 operational wind turbines in the U.S. by the end of 2001, the total annual mortality was estimated at approximately 33,000 bird fatalities per year for all species combined (Erickson et al. 2001). The majority of the fatalities were projected to occur in California where approximately 11,500 operational turbines exist, most of which are older smaller turbines (100- to 250-kW machines). Data collected outside California indicate an average of 1.83 avian fatalities per turbine per year, and 0.006 raptor fatalities per turbine per year. Based on current projections of 3,500 operational wind turbines in the U.S. by the end of 2001, excluding California, the total annual mortality was estimated at approximately 6,400 bird fatalities per year for all species combined. While there have been numerous single mortality events recorded at communication structures that document several hundred avian fatalities in one night, the largest single event reported at a wind generation facility was fourteen nocturnal migrating passerines at two turbines at the Buffalo Ridge, Minnesota, Windplant during spring migration. Based on current estimates, windplant-related avian collision fatalities probably represent from 0.01% to 0.02% (i.e., 1 out of every 5,000 to 10,000 avian fatalities) of the annual avian collision fatalities in the United States.

In Europe, wind plant-related displacement effects are considered to have a greater impact on birds than collision mortality, and several European studies have addressed this issue (Gill et al. 1996). Many groups of birds, including waterfowl, shorebirds, waders, and passerines, have shown disturbance effects ranging from 75 m to as far as 800 m away from turbines (Larsen and Madsen 2000, Peterson and Nohr 1989, Pederson and Poulsen 1991, Vauk 1990, Winkelman 1989, Winkelman 1990, Winkelman 1992). Reductions in use of up to 95% have been recorded (Winkelman 1994). Disturbance to breeding birds appears negligible and was documented during only one study (Pedersen and Poulsen 1991). Most disturbance has involved feeding, resting, and migrating birds (Crockford 1992). Avoidance of turbines by pink-footed geese differed based on turbine arrangements; the avoidance distance of turbines arranged in lines (75 to 125 m) was much lower than turbines arranged in clusters (175 – 200 m) (Larsen and Madsen 2000). For other avian groups or species or at other European wind plants, however, no displacement effects were observed (Karlsson 1983, Phillips 1994, Winkelman 1989, Winkelman 1990).

At an offshore windpark in Denmark, a before/after-control/impact (BACI) design was used to evaluate potential displacement of a large population of wintering common eiders (*Somateria mollissima*) and black scoters (*Melanitta nigra*). The wind plant did not apparently affect abundance of these populations, although eiders did not use areas within 100 m of the turbines (National Environmental Research Institute 1998).

Avian displacement associated with wind power development has not received as much attention in the U.S. At a large wind plant on Buffalo Ridge, Minnesota, abundance of shorebirds, waterfowl, upland gamebirds, woodpeckers, and several groups of passerines was found to be significantly lower at survey plots with turbines than at plots without turbines. There were fewer differences in avian use as a function of distance from turbine, however, suggesting that the area of reduced use was limited primarily to those areas within 100 m of the turbines (Johnson *et al.* 2000b). Osborn et al. (1998) reported that fewer birds and fewer species were seen at a small windplant on Buffalo Ridge relative to reference plots, and concluded that birds at Buffalo Ridge avoided flying in areas with turbines. Some birds apparently did become accustomed to turbines, as Osborn et al. (1998) also reported a mallard nest within 31 m of a turbine.

Also at Buffalo Ridge, Leddy *et al.* (1999) found that densities of male songbirds were significantly lower in Conservation Reserve Program (CRP) grasslands containing turbines than in CRP grasslands without turbines. Grasslands without turbines as well as portions of grasslands located at least 180 m from turbines had bird densities four times greater than grasslands located near turbines. Reduced avian use near turbines was attributed to avoidance of turbine noise and maintenance activities and reduced habitat

effectiveness due to the presence of access roads and large gravel pads surrounding turbines (Leddy 1996, Johnson *et al.* 2000b).

At a large wind plant in the Pacific Northwest, transect surveys conducted prior to and after construction of the windplant indicated that grassland songbird use of the area within 50 m of turbine strings was significantly lower than areas further away (WEST, unpublished data). The reduced use was attributed to temporary and permanent habitat disturbance near the turbines. At Foote Creek Rim, Wyoming, a population of mountain plovers on top of the rim was reduced from a mean of 50 during the two years prior to wind plant construction to a mean of 25 in the three years following initiation of construction. Maps of plover use based on transect data indicated that plovers may have been displaced by the wind development (Johnson *et al.* 2000a). Construction and operation of the Foote Creek Rim wind plant did not appear to cause reduced use of the wind plant and adjacent areas by most other avian groups, including raptors, corvids, or passerines (Johnson *et al.* 2000a).

At a windplant in northeast Wisconsin, there was no significant difference in the number of species or individual birds recorded during 3-minute point counts between the windplant and a reference area (Howe et al. 2002). During longer (30-minute) counts, however, the number of species, but not total numbers of individuals, was significantly higher in the reference area. Species composition was similar between the two areas, but water birds tended to be more numerous in the reference area which was closer to the shores of Green Bay. There was no significant difference in the number of species of diurnal birds before and after construction of the windplant. The number of individuals was greater before construction, however. According to Howe et al. (2002), this change was due primarily to a decline in gulls, which was caused by conditions outside of the study area and unrelated to presence of turbines.

The only report of avoidance of wind plants by raptors occurred at Buffalo Ridge, where raptor nest density on 261 km^2 of land surrounding a windplant was 5.94 / 100 km^2, yet no nests were present in the 32 km^2 windplant facility itself, even though habitat was similar (Usgaard et al. 1997). Similar numbers of raptor nests were found before and after construction of Phase 1 of the Montezuma Hills, California windplant (Howell and Noone 1992). A pair of golden eagles successfully nested 0.8 km from the Foote Creek Rim, Wyoming wind plant for three different years after it became operational (Johnson et al. 2000a), and a Swainson's hawk nested within 0.8 km of a small windplant in Oregon (Johnson et al. 2003).

Anecdotal evidence indicates that raptor use of the Altamont Pass, California wind resource area (WRA) may have increased since installation of wind turbines (Orloff and Flannery 1992, American Wind Energy Association 1995). At the National Wind Technology Center (NWTC) near Golden, Colorado, where several research turbines and met towers are present, the number of individual raptors was similar to surrounding areas. However, the mean number of raptor species detected per survey on the NWTC was nearly twice as high as surrounding areas during winter, when raptors were most abundant (Schmidt et al. 2003). The authors attributed higher use of the NWTC to increased availability of perch sites associated with the turbines and other structures. Songbirds also were relatively unaffected by the turbines. Only one species differed in abundance between the wind turbine site and undeveloped site (horned lark), but the higher numbers off-site were attributed to better habitat for this species resulting from livestock grazing, which is not allowed on the NWTC. Although displacement of birds by wind plants is not desirable where important habitats may be limited, if other suitable habitats are available, one potential benefit of avian avoidance of turbines is the reduced potential for collision mortality to occur (Crockford 1992).

DISCUSSION

IMPACT PREDICTIONS

Use of Klickitat County by birds was compared to other WRAs throughout the U.S. where data were available. Klickitat County study plots were classified as being in predominantly agricultural or native landscapes to facilitate comparisons to WRAs in similar landscape classifications as used in the BPA meta analysis (Erickson *et al.* 2002). For Klickitat County plots in agricultural landscapes, total raptor use in the spring ranked 4th out of 11 sites examined, and total raptor use in summer ranked 2nd. In the spring, WRAs

with higher total raptor abundance than Klickitat County were the Stateline wind plant on the OR/WA border and two study areas at Buffalo Ridge, MN. In the summer, the only WRA with higher total raptor use in agricultural landscapes was one of the four Buffalo Ridge, MN study sites (Table 28).

Total raptor use in Klickitat County plots located predominantly within native landscapes ranked 5th of 18 WRAs in spring and 3rd in summer. The WRAs with higher raptor use in the spring include Altamont Pass in California (2.13/survey), where total raptor use was over 3 times as high as in Klickitat County (0.69/survey), the Columbia Hills WRA within Klickitat County (0.94/survey), the Tehachapi Pass West Ridge area in California (0.76/survey), and the Foote Creek Rim WRA in Wyoming (0.74/survey). In the summer, the two WRAs with higher raptor use than in Klickitat County (0.89/survey) were the Altamont Pass site (2.38/survey) and the Columbia Hills, WA site (1.34/survey) (Table 28).

Sample sizes were not sufficient to break down total raptor use by geographic location, landscape classification (i.e., agricultural vs. native) and season for comparing regional raptor use data within Klickitat County to the BPA meta analysis data. When data from throughout the sampling area were combined, Klickitat County agricultural landscapes had buteo use similar to the average of other U.S. windplants, but buteo use of native landscapes in Klickitat County was relatively high, ranking 3rd of 18 sites in spring and 1st in summer (Table 28). Eagle use was not documented within any of the agricultural plots within Klickitat County. Eagle use of native landscapes within the county was about average compared to other U.S. windplants, ranking 9th of 18 sites in spring and tied for 5th in summer. Large falcons were also not documented within any of the Klickitat County agricultural landscape plots. Large falcon use of native landscapes in the county ranked 7th of 18 sites in spring and 5th in summer. Klickitat County had relatively high use by small falcons (virtually all American kestrels), ranking 1st in both the spring and summer among agricultural areas, 2nd in the spring of 18 WRAs in native habitats, and 3rd in the summer among the 18 native landscape WRAs. Use of agricultural areas by northern harriers was very low in Klickitat County, ranking 10th of 11 sites in both the spring and summer. Northern harrier use of native landscapes was higher, ranking 2nd in spring and 4th in summer.

Use of plots within agricultural landscapes of Klickitat County by waterfowl and waterbirds was relatively low in spring (9th of 11 sites) and about average in summer (5th of 11 WRAs). In native landscapes, waterfowl and waterbird use was higher, ranking 4th of 18 sites in spring and 3rd in summer. Sites with higher use by waterfowl and waterbirds included portions of the San Gorgonio Pass WRA in California and a reference area for the Foote Creek Rim, Wyoming wind plant.

The above data apply to all areas sampled within Klickitat County. For spring and summer use combined, the lowest raptor use in Klickitat County occurred east of Rock Creek and >1.5 miles from the Columbia River. Of 29 WRA sites examined, this area ranked 12th in terms of total raptor use. In that area east of Rock Creek but <1.5 miles from the Columbia River and both areas between U.S. 97 and Rock Creek, total raptor use ranked 3rd of the 29 WRAs examined, with higher use occurring at Altamont Pass, California and the Columbia Hills, WA WRA. For both areas west of U.S. 97, total raptor use ranked second only to raptor use at Altamont Pass, California. Most of the raptor use in Klickitat County is by red-tailed hawks and American kestrels, two common species that comprised 70% of all raptor use of the study area. These two species have also been the most common raptor species documented during other avian studies of Klickitat County.

Data for this study were collected in the spring and summer. Although data are not available for the study plots in fall and winter, some evaluation of avian use during these seasons can be made by examining data collected at other WRAs. When raptor use data were combined for 29 wind plants, highest use occurred in the fall (0.58/20-minute survey/plot) followed by spring (0.52), summer (0.45) and winter (0.35) (Table 29). For buteos, use in spring (0.22) is very similar to fall use (0.22). Buteo use in the summer (0.19) is slightly higher than winter use (0.16). Eagle use of WRAs is very similar in the spring (0.05), fall (0.06) and winter (0.05); use in the summer is lower (0.03). Use of WRAs by both large and small falcons is also highest in the

fall. Higher use in the fall of most areas likely reflects an influx of migrants as well as increased raptor populations due to recruitment. Use of wind plants by northern harriers is highest in the spring (0.08) and lowest in the winter (0.03).

Seasonal use by raptors was also examined using data collected at other proposed windpower developments within Klickitat County (Table 30). For all raptors combined, highest use of Klickitat County occurred in the summer (0.98 / 20-minute survey / plot), use in spring (0.76) and fall (0.79) were very similar, and use in winter was lowest (0.26 / survey). Seasonal use varied by raptor group. Buteos had the highest use in spring (0.31), although use in the summer (0.28) and fall (0.29) were similar. Winter buteo use was relatively low (0.10). Eagle use of the three Klickitat County WRAs was highest in the winter (0.10 / survey) followed by summer (0.09), spring (0.06) and fall (0.04 / survey). Use of Klickitat County by large falcons was very low, ranging from 0.01 / survey in the fall and winter to 0.05 / survey in the spring. Small falcons had highest use in the summer (0.39), followed by spring (0.16), fall (0.10) and winter (0.004). Northern harriers had the highest use in the fall (0.16 / survey) and relatively similar use in the spring (0.05), summer (0.07),and winter (0.04).

Raptor use of Klickitat County is highest in the summer when most data were collected for this study. Spring use of Klickitat County is similar to use in the fall, and winter use is much lower than the other three seasons. Although higher use may occur in the winter for eagles, the winter use in Klickitat County (0.10 / survey) is low and is not significantly higher than use documented in the spring (0.08) or summer (0.09). Some differences in species composition also occur between seasons. For example, Swainson's hawks are not present in winter while rough-legged hawks only spend the winters in the county. These species comprise only a fraction of buteo use of Klickitat County, as red-tails are the primary buteo in the area. Therefore, data collected on raptor use in the spring and summer supplemented with the other data sets that have been generated at other projects in Klickitat County should be suitable for assessing relative risk to raptors from turbine collisions for the Programmatic EIS.

This conclusion is supported by the results of the meta-analysis (Erickson *et al.* 2002), which showed that for most raptor groups (i.e., all raptors combined, buteos, golden eagles, northern harriers, large falcons), baseline avian use data collected during one season (spring, summer or fall) appear adequate for making overall wind plant impact predictions (e.g., low, moderate or high relative mortality). This appears to be especially true for sites in agricultural settings.

Raptor nest data do not indicate significant differences in raptor nest densities between Klickitat County and other existing wind project areas. In comparison to other WRAs throughout the U.S., total raptor nest density in Klickitat County is similar to but somewhat lower then at Klondike, Oregon (0.158 / mi^2), where no raptor mortality was documented during a one-year fatality monitoring study, and Buffalo Ridge, Minnesota (0.153 / mi^2), where the only documented raptor mortality over a 6-year period was a single red-tailed hawk (Osborn *et al.* 2000, Johnson *et al.* 2002). Raptor nest density in Klickitat County is lower than at the Stateline Windplant on the Oregon / Washington border (0.213 / mi^2), where raptor mortality has also been relatively low. Total raptor nest density is higher in Klickitat County than at some other regional WRAs, including Condon, Oregon (0.060 / mi^2), Nine Canyon, Washington (0.033 / mi^2), and Zintel Canyon, Washington (0.080 / mi^2) (Table 31). No raptor mortalities have been documented at any of those areas with operational turbines.

Based on the use estimates for Klickitat County, we predict that annual raptor collision mortality would range from 0.02/turbine east of Rock Creek and >1.5 miles from the Columbia River to 0.06/turbine west of U.S. 97 and $\leq$1.5 miles from the Columbia River (Table 32). Because of their relatively high use of Klickitat County and susceptibility to collisions at other windplants, we predict that small falcons (i.e., American kestrels) would comprise nearly 2/3 (66.2%) of all raptor mortality at Klickitat County wind

plants. Large falcons (i.e., prairie falcons) would comprise approximately 9.8% of the raptor fatalities, buteos would comprise approximately 5.5%, eagles would comprise 3.8%, northern harriers would comprise 2.6%, and other raptor species would comprise 12.8% of the mortality (Table 32).

CONCLUSIONS

Based on the results of the field studies, literature review of avian use of Klickitat County, and existing knowledge about avian / windplant interactions, the following conclusions were made to guide placement of wind developments within Klickitat County.

- We did not attempt to identify any areas within Klickitat County that should be off limits to windpower development. Instead, we have provided estimates of raptor and other bird mortality that might be associated with developments anywhere in the study area. These predictions can then be used by regulators and the public to define acceptable and unacceptable areas of development within the county.

- Available evidence indicates that collision mortality would likely be reduced by siting turbines where the lowest avian use occurs. Raptor collision mortality would therefore likely be lowest in areas east of Rock Creek and greater than 1.5 miles from the Columbia River. Mortality would likely be highest in those areas west of U.S. 97 and within 1.5 miles of the Columbia River. This does not necessarily mean that areas west of U.S. 97 are unsuitable for development. Although collision mortality may be higher in that area, avian impacts could be minimized by siting fewer turbines in those areas with highest avian use. A development plan could be implemented that would encourage major development in the eastern portion of the county while allowing for smaller-scale developments in the western portion of the county.

- Mortality could be reduced by siting turbines away from the Columbia River and other riparian areas. Bird use data indicate that collision mortality would be higher along the Columbia River. We used a 1.5-mile cutoff as a maximum distance, but the actual distance between the river and the top of the rim varies along the river. We believe that windplants sited north of the top of the rim overlooking the Columbia River would have lower collision mortality than windplants sited along the face of the ridge or adjacent to the Columbia River. Furthermore, bird use is concentrated along other riparian areas (e.g., Rock Creek) within Klickitat County, and most raptor nests are within riparian areas. Therefore, windplants sited within 0.5 miles of these areas would likely have higher associated collision mortality than windplants sited >0.5 miles from riparian areas.

- Available bird use data, especially raptor use data, collected within Klickitat County as well as at other Pacific Northwest WRAs, indicate that avian collision mortality could be reduced by siting facilities in agricultural landscapes rather than native landscapes such as shrub-steppe or oak habitats. Therefore, wind development plans formulated to minimize avian impacts should attempt to maximize wind development in agricultural areas.

- Areas of nesting habitat for sensitive raptor species such as peregrine falcons and golden eagles, and nesting buffers should be defined on a case by case basis, and these areas should be avoided when siting new wind plants.

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Table 1. Sensitive species observed during fixed-point surveys from 15 April 2002 through 12 July 2002.

Species	Status	Observations		Total Number Observed
		Spring	Summer	
Bald Eagle	FT, ST	3	0	3
Golden Eagle	SC	3	7	10
Ferruginous Hawk	ST	5	0	5
Swainson's Hawk	SM	1	2	4
Prairie Falcon	SM	4	3	7
Merlin	SC	0	3	3
Turkey Vulture	SM	14	16	30
Osprey	SM	4	3	7
Lewis' Woodpecker	SC	11	13	24
Long-billed Curlew	SM	5	1	6
Ash-throated Flycatcher	SM	0	7	7
Loggerhead Shrike	SC	1	0	1
Bank Swallow		6	0	6
Grasshopper Sparrow	SM	3	4	7
Western Bluebird	SM	20	5	25

FT Federal Threatened
ST State Threatened
SC State Candidate
SM State Monitor

Table 2. Mean use, mean # species / survey, total number of species, and total number of fixed-point surveys conducted by season and overall for the Klickitat County Project Site.

Season	Number of visits	Mean Use[a]	# Species/ Survey[b]	# Species	# Surveys Conducted
Spring	4	11.55	4.55	85	223
Summer	3	12.01	5.29	85	171
Overall	7	11.75	4.87	105	394

[a] # observations per 20-minute survey

[b] % of 20-minute surveys species / group is recorded

Table 3. Mean use, percent composition and percent frequency of occurrence for avian groups by season for the Klickitat County Project Site.

Mean Use (#/20 minute survey)		
Species/Group	**Spring**	**Summer**
Waterfowl / Waterbirds	0.822	0.692
Shorebirds	0.072	0.064
Accipiters	0.010	0.006
Buteos	0.305	0.349
Northern Harriers	0.058	0.054
Eagles	0.029	0.051
Large Falcons	0.014	0.019
Small Falcons	0.183	0.279
Unidentified Falcon	0.005	0.000
Other - Raptor	0.082	0.074
Raptors / Vultures	0.685	0.833
Passerines	8.185	8.179
Corvids	1.221	1.494
Gamebirds	0.195	0.122
Doves / Pigeons	0.216	0.494
Other Birds	0.149	0.131
Unidentified Bird	0.005	0.000
Subtotal	11.550	12.010

Group Composition (%)		
Species/Group	**Spring**	**Summer**
Waterfowl / Waterbirds	7.118	5.765
Shorebirds	0.624	0.534
Accipiters	0.083	0.053
Buteos	2.643	2.909
Northern Harriers	0.499	0.454
Eagles	0.250	0.427
Large Falcons	0.125	0.160
Small Falcons	1.582	2.322
Unidentified Falcon	0.042	0.000
Other - Raptor	0.708	0.614
Raptors / Vultures	5.931	6.939
Passerines	70.864	68.108
Corvids	10.572	12.437
Gamebirds	1.686	1.014
Doves / Pigeons	1.873	4.110
Other Birds	1.290	1.094
Unidentified Bird	0.042	0.000

Table 3 (*continued*). Mean use, percent composition and percent frequency of occurrence for avian groups by season for the Klickitat County Project Site.

	% Frequency	
Species/Group	**Spring**	**Summer**
Waterfowl / Waterbirds	12.019	10.897
Shorebirds	5.769	3.846
Accipiters	0.962	0.641
Buteos	22.356	25.321
Northern Harriers	4.808	5.449
Eagles	2.404	3.846
Large Falcons	1.442	1.923
Small Falcons	15.625	18.910
Unidentified Falcon	0.481	0.000
Other - Raptor	5.288	5.449
Raptors / Vultures	42.308	46.154
Passerines	94.231	96.154
Corvids	37.260	34.295
Gamebirds	10.817	8.974
Doves / Pigeons	14.183	22.436
Other Birds	10.577	11.859
Unidentified Bird	0.481	0.000

Table 4. Avian species observed within 800 m of observer and estimated mean use[a] for large and small birds on the Klickitat County Project Site (April 15, 2002 – July 12, 2002).

Large Birds			
Spring		Summer	
Species/Group	Use[a]	Species/Group	Use
common raven	1.072	common raven	1.391
ring-billed gull	0.308	mourning dove	0.494
red-tailed hawk	0.276	unidentified gull	0.436
unidentified gull	0.245	red-tailed hawk	0.324
mourning dove	0.216	American kestrel	0.260
American kestrel	0.183	ring-billed gull	0.237
California gull	0.178	Lewis' woodpecker	0.080
California quail	0.108	California quail	0.071
turkey vulture	0.063	black-billed magpie	0.071
black-billed magpie	0.063	turkey vulture	0.054
northern harrier	0.058	northern harrier	0.054
Lewis' woodpecker	0.053	ring-necked pheasant	0.045
red-shafted flicker	0.048	golden eagle	0.045
American crow	0.043	killdeer	0.032
Stellar's jay	0.043	Stellar's jay	0.026
chukar	0.043	spotted sandpiper	0.026
Canada goose	0.038	osprey	0.019
killdeer	0.038	prairie falcon	0.019
ring-necked pheasant	0.038	Swainson's hawk	0.019
long-billed curlew	0.024	merlin	0.019
ferruginous hawk	0.019	common nighthawk	0.019
osprey	0.019	Canada goose	0.013
mallard	0.019	red-shafted flicker	0.006
unidentified woodpecker	0.019	American crow	0.006
bald eagle	0.014	chukar	0.006
golden eagle	0.014	long-billed curlew	0.006
prairie falcon	0.014	Cooper's hawk	0.006
great blue heron	0.014	unidentified buteo	0.006
wood duck	0.014	unidentified eagle	0.006
belted kingfisher	0.014	Forster's tern	0.006
spotted sandpiper	0.010	unidentified bird	0.005
Cooper's hawk	0.005		
sharp-shinned hawk	0.005		
rough-legged hawk	0.005		
Swainson's hawk	0.005		
unidentified falcon	0.005		
American coot	0.005		
gray partridge	0.005		
red-breasted sapsucker	0.005		

Table 4 (*continued*). Avian species observed within 800 m of observer and estimated mean use[a] for large and small birds on the Klickitat County Project Site (April 15, 2002 – July 12, 2002).

Small Birds			
Spring		**Summer**	
Species/Group	**Use[a]**	**Species/Group**	**Use**
western meadowlark	1.495	western meadowlark	1.407
European starling	0.752	horned lark	1.295
white-crowned sparrow	0.680	cliff swallow	0.657
Brewer's blackbird	0.524	American goldfinch	0.506
horned lark	0.498	barn swallow	0.471
American goldfinch	0.471	western kingbird	0.311
cliff swallow	0.356	Brewer's blackbird	0.256
yellow-rumped warbler	0.337	violet-green swallow	0.244
red-winged blackbird	0.317	northern rough-winged swallow	0.231
mountain bluebird	0.296	mountain bluebird	0.224
barn swallow	0.240	house finch	0.205
violet-green swallow	0.221	unidentified swallow	0.192
western kingbird	0.180	American robin	0.179
house finch	0.178	red-winged blackbird	0.147
unidentified swallow	0.159	unidentified finch	0.141
dark-eyed junco	0.149	white-crowned sparrow	0.122
unidentified warbler	0.106	chipping sparrow	0.122
American robin	0.101	Bullock's oriole	0.122
Vaux's swift	0.101	rock wren	0.115
western bluebird	0.096	unidentified passerine	0.115
rock wren	0.084	Vaux's swift	0.103
unidentified passerine	0.079	yellow-rumped warbler	0.090
chipping sparrow	0.067	western wood-pewee	0.090
northern rough-winged swallow	0.063	lark sparrow	0.077
spotted towhee	0.063	dark-eyed junco	0.051
vesper sparrow	0.060	spotted towhee	0.051
western tanager	0.058	western tanager	0.051
unidentified sparrow	0.038	song sparrow	0.045
golden-crowned kinglet	0.034	lazuli bunting	0.045
Bullock's oriole	0.034	Wilson's warbler	0.038
bank swallow	0.029	brown-headed cowbird	0.038
pine siskin	0.029	ash-throated flycatcher	0.038
song sparrow	0.029	lesser goldfinch	0.038
tree swallow	0.029	western bluebird	0.032
black-capped chickadee	0.024	vesper sparrow	0.032
Cassin's finch	0.024	grasshopper sparrow	0.026
Say's phoebe	0.024	unidentified flycatcher	0.026
savannah sparrow	0.024	unidentified hummingbird	0.026
Bewick's wren	0.019	Cassin's finch	0.019

Table 4 (*continued*). Avian species observed within 800 m of observer and estimated mean use[a] for large and small birds on the Klickitat County Project Site (April 15, 2002 – July 12, 2002).

Small Birds

Spring		Summer	
Species/Group	**Use[a]**	**Species/Group**	**Use**
Brewer's sparrow	0.014	savannah sparrow	0.019
grasshopper sparrow	0.014	golden-crowned kinglet	0.013
unidentified flycatcher	0.014	pine siskin	0.013
Wilson's warbler	0.014	Bewick's wren	0.013
brown-headed cowbird	0.010	Olive-sided Flycatcher	0.013
Olive-sided Flycatcher	0.010	unidentified sparrow	0.006
unidentified bluebird	0.010	tree swallow	0.006
house sparrow	0.005	black-capped chickadee	0.006
loggerhead shrike	0.005	Say's phoebe	0.006
red-breasted nuthatch	0.005	Brewer's sparrow	0.006
ruby-crowned kinglet	0.005	unidentified bluebird	0.006
Townsend's warbler	0.005	red-breasted nuthatch	0.006
western wood-pewee	0.005	Townsend's warbler	0.006
Rufous hummingbird	0.005	black-headed grosbeak	0.006
unidentified hummingbird	0.005	common yellowthroat	0.006
lark sparrow	0.002	eastern kingbird	0.006
canyon wren	0.013	house wren	0.006
golden-crowned sparrow	0.013	solitary vireo	0.006
Hammond's flycatcher	0.013	Veery	0.006
yellow-breasted chat	0.013	willow flycatcher	0.006
		yellow warbler	0.006

[a] # observations per 20-minute survey

Table 5. Avian species observed within 800 m of observer and estimated frequency of occurrence for large and small birds on the Klickitat County Project Site (April 15, 2002 – July 12, 2002).

Large Birds			
Spring		**Summer**	
Species/Group	**% freq.[a]**	**Species/Group**	**% freq.**
common raven	29.6	common raven	27.2
red-tailed hawk	19.5	red-tailed hawk	24.0
American kestrel	15.6	mourning dove	22.4
mourning dove	14.2	American kestrel	18.3
California quail	7.9	Lewis' woodpecker	7.4
ring-billed gull	6.3	unidentified gull	6.4
unidentified gull	5.3	ring-billed gull	5.8
northern harrier	4.8	black-billed magpie	5.8
black-billed magpie	4.8	northern harrier	5.4
red-shafted flicker	4.3	California quail	5.1
Lewis' woodpecker	4.3	turkey vulture	4.2
ring-necked pheasant	3.8	ring-necked pheasant	3.8
killdeer	3.8	killdeer	3.2
turkey vulture	3.4	golden eagle	3.2
Stellar's jay	2.9	Stellar's jay	2.6
American crow	2.9	prairie falcon	1.9
unidentified woodpecker	1.9	Swainson's hawk	1.9
osprey	1.9	merlin	1.9
ferruginous hawk	1.9	common nighthawk	1.9
prairie falcon	1.4	osprey	1.3
mallard	1.4	spotted sandpiper	1.3
long-billed curlew	1.4	red-shafted flicker	0.6
Canada goose	1.4	American crow	0.6
bald eagle	1.4	long-billed curlew	0.6
wood duck	1.0	Canada goose	0.6
golden eagle	1.0	chukar	0.6
chukar	1.0	Cooper's hawk	0.6
California gull	1.0	unidentified eagle	0.6
belted kingfisher	1.0	unidentified buteo	0.6
unidentified falcon	0.5	Forster's tern	0.6
unidentified bird	0.5		
Swainson's hawk	0.5		
spotted sandpiper	0.5		
sharp-shinned hawk	0.5		
rough-legged hawk	0.5		
red-breasted sapsucker	0.5		
great blue heron	0.5		
gray partridge	0.5		
Cooper's hawk	0.5		
American coot	0.5		

Table 5 (*continued*). Avian species observed within 800 m of observer and estimated frequency of occurrence for large and small birds on the Klickitat County Project Site (April 15, 2002 – July 12, 2002).

Small Birds			
Spring		**Summer**	
Species/Group	**% freq.**	**Species/Group**	**% freq.**
western meadowlark	70.7	western meadowlark	67.6
horned lark	24.0	horned lark	35.6
European starling	12.7	western kingbird	17.9
yellow-rumped warbler	11.5	American robin	10.9
red-winged blackbird	11.5	rock wren	10.9
mountain bluebird	11.5	American goldfinch	10.9
white-crowned sparrow	10.8	mountain bluebird	10.6
western kingbird	9.1	barn swallow	9.3
American robin	8.7	Bullock's oriole	9.0
Brewer's blackbird	7.9	western wood-pewee	9.0
rock wren	7.5	cliff swallow	8.0
spotted towhee	6.3	yellow-rumped warbler	7.7
barn swallow	5.8	Brewer's blackbird	7.7
vesper sparrow	5.3	red-winged blackbird	7.1
dark-eyed junco	5.3	house finch	6.4
unidentified passerine	5.0	unidentified swallow	6.4
American goldfinch	4.8	chipping sparrow	6.4
cliff swallow	4.3	lark sparrow	6.4
house finch	3.8	western tanager	5.1
western bluebird	3.4	Vaux's swift	5.1
unidentified swallow	3.4	spotted towhee	4.5
western tanager	2.9	song sparrow	4.5
song sparrow	2.9	violet-green swallow	4.5
golden-crowned kinglet	2.9	northern rough-winged swallow	4.5
chipping sparrow	2.9	lazuli bunting	4.5
unidentified sparrow	2.4	white-crowned sparrow	3.8
Bullock's oriole	2.4	Wilson's warbler	3.8
black-capped chickadee	2.4	brown-headed cowbird	3.8
violet-green swallow	1.9	ash-throated flycatcher	3.5
Say's phoebe	1.9	vesper sparrow	3.2
savannah sparrow	1.9	dark-eyed junco	3.2
Bewick's wren	1.9	western bluebird	2.6
Wilson's warbler	1.4	unidentified flycatcher	2.6
Vaux's swift	1.4	grasshopper sparrow	2.6
unidentified flycatcher	1.4	unidentified hummingbird	2.6
Brewer's sparrow	1.4	Cassin's finch	1.9
unidentified warbler	1.0	lesser goldfinch	1.9
unidentified bluebird	1.0	unidentified passerine	1.3
tree swallow	1.0	golden-crowned kinglet	1.3
Olive-sided Flycatcher	1.0	savannah sparrow	1.3
northern rough-winged swallow	1.0	Bewick's wren	1.3

Table 5 (*continued*). Avian species observed within 800 m of observer and estimated frequency of occurrence for large and small birds on the Klickitat County Project Site (April 15, 2002 – July 12, 2002).

Small Birds			
Spring		**Summer**	
Species/Group	**% freq.**	**Species/Group**	**% freq.**
grasshopper sparrow	1.0	yellow-breasted chat	1.3
brown-headed cowbird	1.0	Hammond's flycatcher	1.3
bank swallow	1.0	canyon wren	1.3
western wood-pewee	0.5	black-capped chickadee	0.6
unidentified hummingbird	0.5	Say's phoebe	0.6
Townsend's warbler	0.5	Brewer's sparrow	0.6
Rufous hummingbird	0.5	unidentified bluebird	0.6
ruby-crowned kinglet	0.5	tree swallow	0.6
red-breasted nuthatch	0.5	Olive-sided Flycatcher	0.6
pine siskin	0.5	Townsend's warbler	0.6
loggerhead shrike	0.5	red-breasted nuthatch	0.6
house sparrow	0.5	pine siskin	0.6
Cassin's finch	0.5	yellow warbler	0.6
lark sparrow	0.2	willow flycatcher	0.6
		Veery	0.6
		unidentified finch	0.6
		solitary vireo	0.6
		house wren	0.6
		golden-crowned sparrow	0.6
		eastern kingbird	0.6
		common yellowthroat	0.6
		black-headed grosbeak	0.6
		unidentified sparrow	0.3

[a] % of 20-minute surveys species/group is recorded

Table 6. Flight height characteristics by avian group during fixed-point surveys.

Group	# flocks flying	# birds flying	Mean flight height(m)	% birds flying	Relation to rotor-swept height		
					below	within	above
Waterfowl/Waterbirds	69	295	44.1	88.6	47.5	40.3	12.2
Shorebirds	9	9	21.5	36.0	55.6	44.4	0.0
Accipiters	3	3	10.3	100.0	100.0	0.0	0.0
Buteos	121	138	65.5	79.8	29.7	59.4	10.9
Eagles	12	15	57.9	100.0	40.0	46.7	13.3
Large Falcons	7	7	63.1	100.0	42.9	42.9	14.3
Small Falcons	66	76	24.5	76.8	76.3	22.4	1.3
Unidentified Falcon	2	2	26.5	66.7	50.0	50.0	0.0
Northern Harriers	20	22	23.1	84.6	77.3	13.6	9.1
Other - Raptor	27	33	58.3	89.2	30.3	63.6	6.1
Raptors/Vultures	258	296	49.8	81.5	47.0	45.3	7.8
Corvids	146	462	21.8	85.4	48.3	40.9	10.8
Gamebirds	3	4	1.0	6.6	100.0	0.0	0.0
Passerines	520	1630	5.1	51.1	93.4	6.6	0.0
Doves/Pigeons	41	65	6.6	51.6	98.5	1.5	0.0
Other Birds	26	27	8.7	51.9	92.6	7.4	0.0
Unidentified Bird	1	1	1.0	100.0	100.0	0.0	0.0
Subtotal	1073	2789	18.8	59.5	76.1	20.0	3.9

Table 7. Flight height characteristics by species observed during fixed-point surveys.

Species	# groups flying	# birds flying	% birds flying	Relation to rotor-swept height		
				below	within	above
rough-legged hawk	1	1	100.0	0.0	100.0	0.0
long-billed curlew	3	3	50.0	0.0	100.0	0.0
common nighthawk	1	1	33.3	0.0	100.0	0.0
Vaux's swift	12	37	100.0	18.9	81.1	0.0
turkey vulture	20	26	86.7	26.9	73.1	0.0
great blue heron	2	3	100.0	33.3	66.7	0.0
Swainson's hawk	3	3	75.0	33.3	66.7	0.0
red-tailed hawk	92	107	81.7	28.0	60.7	11.2
golden eagle	7	10	100.0	30.0	60.0	10.0
unidentified buteo	21	23	71.9	39.1	52.2	8.7
ferruginous hawk	4	4	80.0	25.0	50.0	25.0
unidentified falcon	2	2	66.7	50.0	50.0	0.0
ring-billed gull	26	100	99.0	45.0	49.0	6.0
unidentified gull	29	147	99.3	34.0	45.6	20.4
common raven	126	438	88.7	45.7	42.9	11.4
prairie falcon	7	7	100.0	42.9	42.9	14.3
bald eagle	3	3	100.0	33.3	33.3	33.3
merlin	3	3	100.0	66.7	33.3	0.0
mallard	2	3	75.0	66.7	33.3	0.0
osprey	7	7	100.0	42.9	28.6	28.6
tree swallow	3	7	100.0	71.4	28.6	0.0
unidentified swallow	20	59	93.7	74.6	25.4	0.0
barn swallow	30	114	91.2	78.1	21.9	0.0
American kestrel	63	73	76.0	76.7	21.9	1.4
American crow	4	6	60.0	83.3	16.7	0.0
killdeer	6	6	46.2	83.3	16.7	0.0
violet-green swallow	11	84	100.0	84.5	15.5	0.0
European starling	29	122	75.3	85.2	14.8	0.0
northern harrier	20	22	84.6	77.3	13.6	9.1
unidentified passerine	13	32	91.4	87.5	12.5	0.0
Lewis' woodpecker	15	15	62.5	93.3	6.7	0.0
mourning dove	41	65	51.6	98.5	1.5	0.0
horned lark	91	185	48.2	99.5	0.5	0.0
Cooper's hawk	2	2	100.0	100.0	0.0	0.0
Forster's tern	1	1	100.0	100.0	0.0	0.0
Rufous hummingbird	1	1	100.0	100.0	0.0	0.0
bank swallow	2	6	100.0	100.0	0.0	0.0
golden-crowned sparrow	1	2	100.0	100.0	0.0	0.0
lesser goldfinch	3	6	100.0	100.0	0.0	0.0
red-breasted sapsucker	1	1	100.0	100.0	0.0	0.0
sharp-shinned hawk	1	1	100.0	100.0	0.0	0.0
unidentified bird	1	1	100.0	100.0	0.0	0.0
unidentified eagle	2	2	100.0	100.0	0.0	0.0

Table 7 (*continued*). Flight height characteristics by species observed during fixed-point surveys.

Species	# groups flying	# birds flying	% birds flying	Relation to rotor-swept height		
				below	within	above
unidentified finch	1	22	100.0	100.0	0.0	0.0
unidentified hummingbird	5	5	100.0	100.0	0.0	0.0
cliff swallow	26	176	99.4	100.0	0.0	0.0
unidentified sparrow	6	9	90.0	100.0	0.0	0.0
American goldfinch	21	158	89.3	100.0	0.0	0.0
Brewer's blackbird	28	134	87.0	100.0	0.0	0.0
California gull	5	31	83.8	100.0	0.0	0.0
pine siskin	2	8	80.0	100.0	0.0	0.0
northern rough-winged swallow	8	37	75.5	100.0	0.0	0.0
Cassin's finch	2	6	75.0	100.0	0.0	0.0
western kingbird	38	61	67.8	100.0	0.0	0.0
belted kingfisher	1	2	66.7	100.0	0.0	0.0
wood duck	1	2	66.7	100.0	0.0	0.0
black-billed magpie	13	15	62.5	100.0	0.0	0.0
ash-throated flycatcher	4	4	57.1	100.0	0.0	0.0
unidentified flycatcher	4	4	57.1	100.0	0.0	0.0
mountain bluebird	25	58	50.9	100.0	0.0	0.0
Olive-sided Flycatcher	1	2	50.0	100.0	0.0	0.0
savannah sparrow	4	4	50.0	100.0	0.0	0.0
white-crowned sparrow	8	79	49.1	100.0	0.0	0.0
red-winged blackbird	16	37	41.6	100.0	0.0	0.0
dark-eyed junco	6	15	38.5	100.0	0.0	0.0
western bluebird	4	9	36.0	100.0	0.0	0.0
western tanager	6	7	35.0	100.0	0.0	0.0
Bullock's oriole	8	9	34.6	100.0	0.0	0.0
unidentified bluebird	1	1	33.3	100.0	0.0	0.0
house finch	7	19	27.5	100.0	0.0	0.0
unidentified woodpecker	1	1	25.0	100.0	0.0	0.0
vesper sparrow	4	5	25.0	100.0	0.0	0.0
Canada goose	3	8	23.5	100.0	0.0	0.0
Stellar's jay	3	3	23.1	100.0	0.0	0.0
yellow-rumped warbler	7	13	15.5	100.0	0.0	0.0
lazuli bunting	1	1	14.3	100.0	0.0	0.0
western meadowlark	55	85	13.9	100.0	0.0	0.0
lark sparrow	1	2	13.3	100.0	0.0	0.0
brown-headed cowbird	1	1	12.5	100.0	0.0	0.0
ring-necked pheasant	2	2	12.5	100.0	0.0	0.0
American robin	6	6	12.2	100.0	0.0	0.0
spotted towhee	2	2	9.5	100.0	0.0	0.0

Table 7 (*continued*). Flight height characteristics by species observed during fixed-point surveys.

Species	# groups flying	# birds flying	% birds flying	Relation to rotor-swept height		
				below	within	above
red-shafted flicker	1	1	9.1	100.0	0.0	0.0
California quail	1	2	5.9	100.0	0.0	0.0
chipping sparrow	2	2	5.9	100.0	0.0	0.0
American coot	0	0	0.0	N/A	N/A	N/A
Bewick's wren	0	0	0.0	N/A	N/A	N/A
Brewer's sparrow	0	0	0.0	N/A	N/A	N/A
Hammond's flycatcher	0	0	0.0	N/A	N/A	N/A
Say's phoebe	0	0	0.0	N/A	N/A	N/A
Townsend's solitaire	0	0	0.0	N/A	N/A	N/A
Townsend's warbler	0	0	0.0	N/A	N/A	N/A
Veery	0	0	0.0	N/A	N/A	N/A
Wilson's warbler	0	0	0.0	N/A	N/A	N/A
black-capped chickadee	0	0	0.0	N/A	N/A	N/A
black-headed grosbeak	0	0	0.0	N/A	N/A	N/A
canyon wren	0	0	0.0	N/A	N/A	N/A
chukar	0	0	0.0	N/A	N/A	N/A
common yellowthroat	0	0	0.0	N/A	N/A	N/A
double-crested cormorant	0	0	0.0	N/A	N/A	N/A
eastern kingbird	0	0	0.0	N/A	N/A	N/A
golden-crowned kinglet	0	0	0.0	N/A	N/A	N/A
grasshopper sparrow	0	0	0.0	N/A	N/A	N/A
gray partridge	0	0	0.0	N/A	N/A	N/A
house sparrow	0	0	0.0	N/A	N/A	N/A
house wren	0	0	0.0	N/A	N/A	N/A
loggerhead shrike	0	0	0.0	N/A	N/A	N/A
red-breasted nuthatch	0	0	0.0	N/A	N/A	N/A
rock wren	0	0	0.0	N/A	N/A	N/A
ruby-crowned kinglet	0	0	0.0	N/A	N/A	N/A
solitary vireo	0	0	0.0	N/A	N/A	N/A
song sparrow	0	0	0.0	N/A	N/A	N/A
spotted sandpiper	0	0	0.0	N/A	N/A	N/A
unidentified warbler	0	0	0.0	N/A	N/A	N/A
western wood-pewee	0	0	0.0	N/A	N/A	N/A
willow flycatcher	0	0	0.0	N/A	N/A	N/A
yellow warbler	0	0	0.0	N/A	N/A	N/A
yellow-breasted chat	0	0	0.0	N/A	N/A	N/A
Subtotal	1073	2789	59.5	76.1	20.0	3.9

Table 8. Mean exposure indices calculated by species observed during fixed-point surveys at the Klickitat County Project Site.

Species	Overall mean use	% flying	% flying within RSA	Exposure Index
common raven	1.209	88.7	42.9	0.460
unidentified gull	0.327	99.3	45.6	0.148
red-tailed hawk	0.297	81.7	60.7	0.147
ring-billed gull	0.277	99.0	49.0	0.135
Vaux's swift	0.102	100.0	81.1	0.082
barn swallow	0.339	91.2	21.9	0.068
European starling	0.430	75.3	14.8	0.048
unidentified swallow	0.173	93.7	25.4	0.041
turkey vulture	0.059	86.7	73.1	0.037
American kestrel	0.216	76.0	21.9	0.036
violet-green swallow	0.231	100.0	15.5	0.036
golden eagle	0.027	100.0	60.0	0.016
unidentified passerine	0.095	91.4	12.5	0.011
long-billed curlew	0.016	50.0	100.0	0.008
prairie falcon	0.016	100.0	42.9	0.007
northern harrier	0.056	84.6	13.6	0.006
Swainson's hawk	0.011	75.0	66.7	0.005
tree swallow	0.019	100.0	28.6	0.005
osprey	0.019	100.0	28.6	0.005
great blue heron	0.008	100.0	66.7	0.005
ferruginous hawk	0.011	80.0	50.0	0.004
American crow	0.027	60.0	16.7	0.003
mallard	0.011	75.0	33.3	0.003
killdeer	0.036	46.2	16.7	0.003
bald eagle	0.008	100.0	33.3	0.003
merlin	0.008	100.0	33.3	0.003
common nighthawk	0.008	33.3	100.0	0.003
rough-legged hawk	0.003	100.0	100.0	0.003
Lewis' woodpecker	0.065	62.5	6.7	0.003
mourning dove	0.335	51.6	1.5	0.003
horned lark	0.839	48.2	0.5	0.002
unidentified buteo	0.003	71.9	52.2	0.001
unidentified falcon	0.003	66.7	50.0	0.001
western meadowlark	1.457	13.9	0.0	0.000
American goldfinch	0.486	89.3	0.0	0.000
cliff swallow	0.485	99.4	0.0	0.000
white-crowned sparrow	0.441	49.1	0.0	0.000
Brewer's blackbird	0.409	87.0	0.0	0.000
mountain bluebird	0.265	50.9	0.0	0.000

Table 8 (*continued*). Mean exposure indices calculated by species observed during fixed-point surveys at the Klickitat County Project Site.

Species	Overall mean use	% flying	% flying within RSA	Exposure Index
red-winged blackbird	0.245	41.6	0.0	0.000
western kingbird	0.236	67.8	0.0	0.000
yellow-rumped warbler	0.231	15.5	0.0	0.000
house finch	0.190	27.5	0.0	0.000
American robin	0.135	12.2	0.0	0.000
northern rough-winged swallow	0.135	75.5	0.0	0.000
dark-eyed junco	0.107	38.5	0.0	0.000
California gull	0.102	83.8	0.0	0.000
rock wren	0.098	0.0	N/A	0.000
California quail	0.092	5.9	0.0	0.000
chipping sparrow	0.091	5.9	0.0	0.000
Bullock's oriole	0.071	34.6	0.0	0.000
western bluebird	0.069	36.0	0.0	0.000
black-billed magpie	0.066	62.5	0.0	0.000
unidentified finch	0.060	100.0	0.0	0.000
unidentified warbler	0.060	0.0	N/A	0.000
spotted towhee	0.058	9.5	0.0	0.000
western tanager	0.055	35.0	0.0	0.000
vesper sparrow	0.048	25.0	0.0	0.000
ring-necked pheasant	0.041	12.5	0.0	0.000
western wood-pewee	0.041	0.0	N/A	0.000
Stellar's jay	0.036	23.1	0.0	0.000
song sparrow	0.036	0.0	N/A	0.000
lark sparrow	0.034	13.3	0.0	0.000
red-shafted flicker	0.030	9.1	0.0	0.000
Canada goose	0.027	23.5	0.0	0.000
chukar	0.027	0.0	N/A	0.000
unidentified sparrow	0.025	90.0	0.0	0.000
Wilson's warbler	0.025	0.0	N/A	0.000
golden-crowned kinglet	0.025	0.0	N/A	0.000
Cassin's finch	0.022	75.0	0.0	0.000
brown-headed cowbird	0.022	12.5	0.0	0.000
pine siskin	0.022	80.0	0.0	0.000
savannah sparrow	0.022	50.0	0.0	0.000
lazuli bunting	0.019	14.3	0.0	0.000
unidentified flycatcher	0.019	57.1	0.0	0.000
grasshopper sparrow	0.019	0.0	N/A	0.000
ash-throated flycatcher	0.016	57.1	0.0	0.000
bank swallow	0.016	100.0	0.0	0.000
lesser goldfinch	0.016	100.0	0.0	0.000

Table 8 (*continued*). Mean exposure indices calculated by species observed during fixed-point surveys at the Klickitat County Project Site.

Species	Overall mean use	% flying	% flying within RSA	Exposure Index
Bewick's wren	0.016	0.0	N/A	0.000
Say's phoebe	0.016	0.0	N/A	0.000
black-capped chickadee	0.016	0.0	N/A	0.000
spotted sandpiper	0.016	0.0	N/A	0.000
unidentified hummingbird	0.014	100.0	0.0	0.000
Olive-sided Flycatcher	0.011	50.0	0.0	0.000
unidentified woodpecker	0.011	25.0	0.0	0.000
Brewer's sparrow	0.011	0.0	N/A	0.000
belted kingfisher	0.008	66.7	0.0	0.000
unidentified bluebird	0.008	33.3	0.0	0.000
wood duck	0.008	66.7	0.0	0.000
Cooper's hawk	0.005	100.0	0.0	0.000
golden-crowned sparrow	0.005	100.0	0.0	0.000
Hammond's flycatcher	0.005	0.0	N/A	0.000
Townsend's warbler	0.005	0.0	N/A	0.000
canyon wren	0.005	0.0	N/A	0.000
red-breasted nuthatch	0.005	0.0	N/A	0.000
yellow-breasted chat	0.005	0.0	N/A	0.000
Forster's tern	0.003	100.0	0.0	0.000
Rufous hummingbird	0.003	100.0	0.0	0.000
red-breasted sapsucker	0.003	100.0	0.0	0.000
sharp-shinned hawk	0.003	100.0	0.0	0.000
unidentified bird	0.003	100.0	0.0	0.000
unidentified eagle	0.003	100.0	0.0	0.000
American coot	0.003	0.0	N/A	0.000
Veery	0.003	0.0	N/A	0.000
black-headed grosbeak	0.003	0.0	N/A	0.000
common yellowthroat	0.003	0.0	N/A	0.000
eastern kingbird	0.003	0.0	N/A	0.000
gray partridge	0.003	0.0	N/A	0.000
house sparrow	0.003	0.0	N/A	0.000
house wren	0.003	0.0	N/A	0.000
loggerhead shrike	0.003	0.0	N/A	0.000
ruby-crowned kinglet	0.003	0.0	N/A	0.000
solitary vireo	0.003	0.0	N/A	0.000
willow flycatcher	0.003	0.0	N/A	0.000
yellow warbler	0.003	0.0	N/A	0.000
Townsend's solitaire	0.000	0.0	N/A	0.000
double-crested cormorant	0.000	0.0	N/A	0.000

Table 9. Mean spring and summer avian use by geographic region of Klickitat County.

	West of U.S. 97		U.S. 97 to Rock Creek		East of Rock Creek	
Avian Group	**≤1.5mi from Columbia**	**>1.5 mi from Columbia**	**≤1.5mi from Columbia**	**>1.5 mi from Columbia**	**≤1.5 mi from Columbia**	**>1.5 mi from Columbia**
Accipiters	0	0	0	0	0	0.010
Buteos	0.323	0.567	0.385	0.425	0.458	0.203
Eagles	0.135	0.033	0.125	0.058	0.031	0.007
Large falcons	0	0	0.083	0.017	0.031	0.011
Small falcons	0.563	0.367	0.115	0.246	0.375	0.155
N. Harriers	0.042	0.117	0.063	0.050	0.031	0.056
All Raptors	1.229	1.167	1.094	0.808	1.083	0.476
Waterfowl	1.969	0.575	2.688	0.038	3.750	0.109
Passerines	4.821	8.571	20.429	7.957	9.571	6.500

Table 10. Raptor nests observed during aerial helicopter surveys of Klickitat County, Washington or documented by Washington Department of Fish and Wildlife.

Species	Number in Count Blocks	Nest Density (no./square mile)
Red-tailed Hawk	14	0.087
Prairie Falcon	1	0.006
Great Horned Owl	5	0.031
TOTAL RAPTOR NESTS	20	0.124
Inactive Nests	55	0.341
Common Raven	9	0.056

Table 11. Raptor nest density by geographic region of Klickitat County.

Raptor Nests

	Nest Count				Density (#/mile^2)	
Region	active and inactive	# nests active	# raptor nests active	approximate area searched (miles^2)	all nests active/inactive	raptor active
eaway	40	12	7	80	0.50	0.15	0.09
eriver	13	3	2	16	0.81	0.19	0.13
maway	25	10	8	26	0.96	0.38	0.31
mriver	4	1	0	6	0.67	0.17	0.00
waway	0	0	0	12	0.00	0.00	0.00
wriver	7	2	1	16	0.44	0.13	0.06
Total	89	37	27	156	0.57	0.24	0.17

Table 12. Occurrence of special status avian species in Klickitat County.

Group/Species	Status[a]	Breeding Habitat	Klickitat County Breeding Occurrence	Seasons of Occurrence[b]
Raptors				
Bald eagle (*Haliaeetus leucocephalus*)	ST FT PHS1	Water, wetlands and shoreline habitats as well as all other habitats along major rivers and shorelines. Peripheral in scattered locations in parts of the steppe, ponderosa pine, oak and interior douglas-fir zones.	Possible and probable breeding evidence near the Columbia River.	SPRING FALL WINTER
Golden eagle (*Aquila chrysaetos*)	SC PHS1	Subalpine fir, interior douglas-fir, ponderosa pine, oak and adjacent steppe zones. Nesting habitat includes large rocky cliffs.	Breeding evidence and suitable habitat throughout Klickitat County.	SPRING SUMMER FALL WINTER
Swainson's hawk (*Buteo swainsonii*)	SM AW	Steppe zones and prairie habitats. Nests in wooded riparian corridors or windbreaks and forages in agricultural fields and steppe vegetation.	Possible breeding evidence in south central Klickitat County.	SPRING SUMMER
Ferruginous hawk (*Buteo regalis*)	ST FSC AW	Steppe vegetation. Nests on cliffs, high bluffs, utility towers, trees, or on the ground.	Breeding evidence in south central Klickitat County.	SPRING WINTER
Northern goshawk (*Accipiter gentilis*)	SC FSC PHS1	All forest zones above ponderosa pine and all conifer forests except early seral stage and open forest in the ponderosa pine zone.	Most breeding evidence and habitats occur in northwest Klickitat County.	
Peregrine falcon (*Falco peregrinus*)	SS FSC PHS1	Coastal cliffs and rocks.	Rare, however a pair has nested at Beacon Rock for several years.	SPRING FALL WINTER
Prairie falcon (*Falco mexicanus*)	SM AW PHS3	All habitat in steppes zones except for development and agriculture. Nests on cliffs and large, rocky outcroppings.	Breeding evidence in south and eastern Klickitat County.	SPRING SUMMER FALL WINTER
Merlin (*Falco columbarius*)	SC PHS1	Rare in Washington, unlikely to breed in Klickitat county.	No breeding records.	SPRING SUMMER FALL WINTER
Burrowing owl	SC FSC PHS1	Steppe zones and irrigated farmland. Nest sites include rocky outcroppings, ground-squirrel burrows, drainage pipes, and artificial burrows provided by wildlife groups.	Confirmed breeding evidence in southern and eastern Klickitat County.	SPRING
Turkey vulture (*Cathartes aura*)	SM	Forest zones below interior western hemlock, plus adjacent steppe zones. Nests in small caves or ledges on high cliffs.	Possible and probable breeding evidence and habitat through most of Klickitat County.	SPRING SUMMER FALL

Table 12 (*continued*). Occurrence of special status avian species in Klickitat County.

Group/Species	Status[a]	Breeding Habitat	Klickitat County Breeding Occurrence	Seasons of Occurrence[b]
Osprey (*Pandion haliaetus*)	SM	Water / wetlands and shoreline habitat below the subalpine fir and mountain hemlock zones.	Confirmed and probable breeding evidence along the Columbia River.	SPRING SUMMER FALL
Upland Game Birds				
Western sage grouse (*Centrocercus urophasianus phaios*)	ST FC PHS1,3 AW	Steppe habitats (except sparse vegetation) in the central arid steppe, big sage / fescue, and three-tip sage zones.	No breeding evidence documented in Klickitat County.	
Other Water Birds				
American White Pelican (*Pelecanus erythrorhynchos*)	PHS1,2			SUMMER
Common Loon (*Gavia immer*)	PHS1,2	Breed on large wooded lakes with large populations of fish.	No breeding evidence in Klickitat county	SPRING FALL
Sandhill crane (*Grus canadensis*)	SE AW PHS1	Marshy areas, irrigated fields, and grassy areas at only two sites in Washington, which were mostly in the interior douglas-fir zone, with parts of the lower subalpine fir zone and upper ponderosa pine zone.	Confirmed and probable breeding evidence at Conboy Lake National Wildlife Refuge in northwestern Klickitat County.	SPRING
Shorebirds				
Long-billed curlew (*Numenius americanus*)	SM AW	Grasslands and shrub savannas, sparse vegetation in all steppe zones within its range limits. Nests in grassy patches between shrub-dominated areas.	Confirmed and probable breeding evidence in southern and eastern Klickitat County.	SPRING SUMMER
Nonpasserine Land Birds				
Lewis' woodpecker (*Melanerpes lewis*)	SC PHS1	Open forests and woody riparian corridors in the ponderosa pine zone and below, especially in oak groves.	Confirmed and probable breeding evidence and habitat in areas throughout Klickitat County.	SPRING SUMMER FALL WINTER
Passerines				
Loggerhead shrike (*Lanius ludovicianus*)	SC FSC PHS1	Shrub-steppe habitats, especially alternating patches of shrub-steppe and grassy areas. Shrub and shrub savanna in the big sage / fescue, central arid steppe, canyon grassland, bitterbrush and three-tip sage zones.	Possible breeding evidence and habitat in eastern Klickitat County.	SPRING FALL WINTER

Table 12 (*continued*). Occurrence of special status avian species in Klickitat County.

Group/Species	Status[a]	Breeding Habitat	Klickitat County Breeding occurrence	Seasons of Occurrence[b]
Western bluebird (*Sialia mexicana*)	SM	Locally common in open conifer forests, farmlands and in steppe habitats in eastern Washington, in the ecotone between forest and steppe zones.	Confirmed and probable breeding evidence and habitat throughout Klickitat County.	SPRING SUMMER FALL WINTER
Ash-throated flycatcher (*Myiarchus cinerascens*)	SM	Riparian and oak woodlands in southern Klickitat County. Core zones were ponderosa pine, oak, three-tip sage, Klickitat meadow steppe, bitterbrush and canyon grasslands.	Confirmed and probable breeding evidence and habitat in areas of Klickitat County.	SPRING SUMMER
Gray flycatcher (*Empidonax wrightii*)	SM AW	Open pine forests with grassy or no understory in eastern Washington.	Confirmed and probable breeding evidence and habitat in areas throughout Klickitat County.	SPRING
Grasshopper sparrow (*Ammodramus savannarum*)	SM	Sparse vegetation, grassland, shrub savanna, shrublands, tree savanna, and Conservation Reserve grasslands in steppe zones.	Habitat and possible breeding evidence in south and eastern Klickitat County.	SPRING SUMMER FALL
Sage sparrow (*Amphispiza belli*)	SC PHS1 AW	Sagebrush landscapes of the Columbia Basin, limited by the presence of mature big sagebrush stands and hot, dry conditions.	No breeding evidence in Klickitat County, some habitat near the northeast county line.	SPRING FALL
Bank swallow (*Riparia riparia*)		Areas near water or wetlands below the lower treeline. Steppe, oak and ponderosa pine. Highly colonial.	Possible breeding evidence along the Columbia River and other rivers in south Klickitat County.	SPRING
Purple Martin (*Progne subis*)	PHS1	Nests colonially in holes in trees or (mostly) in man-made martin houses, primarily near water.	No breeding evidence documented in Klickitat County.	SUMMER

[a] FE Federal Endangered,
FT Federal Threatened
FC Federal Candidate
FSC Federal Species of Concern
SE State Endangered
ST State Threatened
SC State Candidate
SS State Sensitive
SM State Monitor
AW High priority on Audubon Watchlist, Washington, Columbia Plateau
PHS Washington Department of Fish and Wildlife Priority Species List

[b] Seasonal information derived from breeding bird data, CARES studies, NAMC data, CBC data, and all other surveys presented in this report.

Table 13. Mean Use, Duration in Plot, and Percent Frequency of Occurrence of Birds Observed During Surveys in the CARES Study Area in 1998.

SPRING

Group	Species	#/Survey		Duration in Plot (Minutes)		
		Mean	Standard error	Mean	Standard error	% Freq.
Game Birds	Ring-necked Pheasant	0.002	0.002	0.002	0.002	0.20
	Gray Partridge	0.005	0.003	0.013	0.012	0.35
	Chukar	0.115	0.022	0.521	0.213	6.65
	TOTAL	0.122	0.021	0.536	0.210	7.19
Passerines	Cassin's Finch	0.002	0.002	0.006	0.006	0.15
	Savannah Sparrow	0.002	0.002	0.003	0.003	0.15
	Townsend's Warbler	0.002	0.002	0.002	0.002	0.15
	Unidentified Swift	0.002	0.002	0.001	0.001	0.15
	Unidentified Woodpecker	0.002	0.002	0.002	0.002	0.15
	Say's Phoebe	0.002	0.002	0.010	0.010	0.20
	Lark Sparrow	0.003	0.002	0.018	0.015	0.30
	Spotted Towhee	0.003	0.002	0.030	0.019	0.30
	Unidentified Hummingbird	0.004	0.002	0.003	0.002	0.35
	Unidentified Swallow	0.006	0.004	0.009	0.006	0.30
	Loggerhead Shrike	0.008	0.004	0.029	0.017	0.79
	Red Crossbill	0.009	0.007	0.009	0.007	0.30
	Yellow-Rumped Warbler	0.010	0.010	0.067	0.067	0.30
	Townsend's Solitaire	0.012	0.004	0.069	0.031	1.04
	Northern Flicker	0.020	0.009	0.042	0.018	1.84
	Tree Swallow	0.021	0.016	0.089	0.077	0.79
	American Goldfinch	0.024	0.012	0.025	0.012	1.04
	Chipping Sparrow	0.027	0.016	0.185	0.141	1.49
	Rock Wren	0.037	0.017	0.304	0.153	2.98
	Brown-Headed Cowbird	0.039	0.025	0.277	1.340	1.34
	Western Bluebird	0.041	0.016	0.377	0.155	1.98
	Black-Billed Magpie	0.043	0.014	0.213	0.074	3.74
	Dark-Eyed Junco	0.045	0.045	0.402	0.402	0.60
	White-Crowned Sparrow	0.045	0.045	0.446	0.446	0.89
	Unidentified Passerine	0.096	0.061	0.216	0.141	2.58
	American Pipit	0.112	0.112	1.116	1.116	0.30
	Mountain Bluebird	0.118	0.046	0.386	0.148	2.33
	Common Raven	0.177	0.039	0.373	0.099	9.74
	American Robin	0.496	0.344	1.874	0.999	9.28
	Vesper Sparrow	0.664	0.246	5.994	2.311	30.70
	Horned Lark	1.266	0.179	9.721	2.178	59.75
	Western Meadowlark	1.998	0.436	18.686	4.488	68.29
	TOTAL	5.331	0.796	40.981	9.230	86.73

Table 13 (*continued*). Mean Use, Duration in Plot, and Percent Frequency of Occurrence of Birds Observed During Surveys in the CARES Study Area in 1998.

SPRING *(continued)*

Group	Species	#/Survey		Duration in Plot (Minutes)		
		Mean	Standard Error	Mean	Standard error	% Freq.
Raptors	Sharp-Shinned Hawk	0.002	0.002	0.005	0.005	0.15
	Unidentified Raptor	0.002	0.002	0.001	0.001	0.15
	Merlin	0.002	0.002	0.001	0.001	0.20
	Cooper's Hawk	0.003	0.003	0.015	0.015	0.30
	Turkey Vulture	0.003	0.002	0.006	0.005	0.30
	Osprey	0.005	0.002	0.004	0.002	0.45
	Rough-Legged Hawk	0.005	0.003	0.007	0.006	0.50
	Prairie Falcon	0.010	0.004	0.006	0.003	0.99
	Northern Harrier	0.012	0.005	0.011	0.005	1.19
	American Kestrel	0.049	0.014	0.045	0.014	4.91
	Golden Eagle	0.052	0.016	0.049	0.012	4.07
	Red-tailed Hawk	0.093	0.011	0.166	0.034	7.04
	TOTAL	0.236	0.024	0.315	0.056	17.31
Shorebirds	Killdeer	0.005	0.003	0.003	0.002	0.30

SUMMER

Group	Species	#/Survey		Duration in Plot (Minutes)		
		Mean	Standard Error	Mean	Standard Error	% Freq.
Game Birds	Chukar	0.018	0.006	0.109	0.055	1.09
	Gray Partridge	0.022	0.022	0.036	0.036	0.30
	TOTAL	0.041	0.020	0.145	0.055	1.39
Passerines	Ash-Throated Flycatcher	0.002	0.002	0.002	0.002	0.15
	Canyon Wren	0.002	0.002	0.002	0.002	0.15
	Lazuli Bunting	0.002	0.002	0.015	0.015	0.15
	Loggerhead Shrike	0.002	0.002	0.015	0.015	0.15
	Mountain Bluebird	0.002	0.002	0.015	0.015	0.15
	Townsend's Warbler	0.002	0.002	0.003	0.003	0.15
	White-Breasted Nuthatch	0.002	0.002	0.003	0.003	0.15
	European Starling	0.002	0.002	0.002	0.002	0.20
	Savannah Sparrow	0.002	0.002	0.020	0.020	0.20
	Say's Phoebe	0.002	0.002	0.020	0.020	0.20
	Townsend's Solitaire	0.002	0.002	0.020	0.020	0.20
	Red-Breasted Nuthatch	0.003	0.002	0.019	0.012	0.25

Table 13 (*continued*). Mean Use, Duration in Plot, and Percent Frequency of Occurrence of Birds Observed During Surveys in the CARES Study Area in 1998.

SUMMER (*continued*)

Group	Species	#/Survey		Duration in Plot (Minutes)		
		Mean	Standard Error	Mean	Standard Error	% Freq.
Passerines	Brewer's Blackbird	0.003	0.003	0.006	0.006	0.15
(*continued*)	Brown-Headed Cowbird	0.003	0.003	0.030	0.030	0.15
	Golden-Crowned Kinglet	0.003	0.003	0.030	0.030	0.15
	Spotted Towhee	0.003	0.003	0.022	0.022	0.30
	Western Tanager	0.003	0.003	0.012	0.012	0.30
	Rufous Hummingbird	0.004	0.002	0.004	0.002	0.35
	Unidentified Flycatcher	0.004	0.002	0.007	0.006	0.35
	Dark-eyed Junco	0.005	0.005	0.030	0.030	0.30
	Tree Swallow	0.006	0.004	0.012	0.009	0.30
	Bullocks's Oriole	0.006	0.002	0.020	0.008	0.64
	Western Bluebird	0.007	0.006	0.054	0.039	0.45
	Lark Sparrow	0.009	0.006	0.042	0.027	0.89
	Common Nighthawk	0.010	0.010	0.038	0.038	0.60
	Yellow-Rumped Warbler	0.012	0.012	0.107	0.107	0.60
	Northern Flicker	0.014	0.005	0.036	0.017	1.39
	Gray Flycatcher	0.014	0.010	0.039	0.026	0.79
	Vaux's Swift	0.018	0.018	0.018	0.018	0.50
	Chipping Sparrow	0.020	0.008	0.068	0.039	1.44
	Red Crossbill	0.021	0.013	0.092	0.082	0.45
	Western Wood Pewee	0.025	0.008	0.106	0.048	2.18
	Unidentified Hummingbird	0.033	0.017	0.033	0.016	3.32
	Grasshopper Sparrow	0.039	0.021	0.262	0.165	3.47
	American Goldfinch	0.040	0.015	0.068	0.035	3.54
	Unidentified Passerine	0.053	0.023	0.118	0.054	2.80
	Barn Swallow	0.073	0.023	0.240	0.151	4.46
	American Robin	0.074	0.018	0.282	0.066	5.41
	Black-Billed Magpie	0.084	0.020	0.312	0.090	7.19
	Lewis' Woodpecker	0.120	0.047	0.425	0.251	5.96
	Rock Wren	0.127	0.025	0.701	0.183	9.92
	Cliff Swallow	0.156	0.077	0.536	0.175	5.21
	Common Raven	0.193	0.078	0.614	0.440	6.35
	Vesper Sparrow	0.653	0.288	5.273	2.436	29.51
	Western Meadowlark	1.225	0.422	9.736	4.080	49.69
	Horned Lark	1.290	0.244	9.508	2.217	42.63
	TOTAL	4.357	0.957	28.960	8.510	79.09

Table 13 (*continued*). Mean Use, Duration in Plot, and Percent Frequency of Occurrence of Birds Observed During Surveys in the CARES Study Area in 1998.

SUMMER (*continued*)

Group	Species	#/Survey		Duration in Plot (Minutes)		
		Mean	Standard Error	Mean	Standard Error	% Freq.
Water Birds	Unidentified Gull	0.004	0.002	0.004	0.002	0.35
Raptors	Golden Eagle	0.002		0.002		0.15
	Osprey	0.002		0.006		0.20
	Cooper's Hawk	0.006		0.007		0.60
	Prairie Falcon	0.006		0.006		0.60
	Turkey Vulture	0.006		0.010		0.60
	Northern Harrier	0.026		0.041		2.28
	Red-tailed Hawk	0.062		0.166		5.56
	American Kestrel	0.122		0.293		9.82
	TOTAL	0.232		0.532		18.20

Fall

Group	Species	#/Survey		Duration in Plot (Minutes)		
		Mean	Standard error	Mean	Standard error	% Freq.
Game Birds	Ring-necked Pheasant	0.006	0.006	0.063	0.063	0.21
	Chukar	0.075	0.029	0.460	0.192	2.81
	Gray Partridge	0.083	0.051	0.431	0.323	0.83
	TOTAL	0.165	0.054	0.953	0.439	3.85
Passerines	Hermit Thrush	0.002	0.002	0.021	0.021	0.21
	Northern Shrike	0.002	0.002	0.021	0.021	0.21
	Red-Breasted Nuthatch	0.002	0.002	0.008	0.008	0.21
	Chipping Sparrow	0.004	0.004	0.042	0.042	0.21
	Spotted Towhee	0.004	0.004	0.042	0.042	0.21
	Varied Thrush	0.004	0.003	0.023	0.020	0.42
	Vesper Sparrow	0.004	0.004	0.042	0.042	0.21
	Gray-Crowned Rosy Finch	0.006	0.004	0.025	0.017	0.38
	Say's Phoebe	0.006	0.004	0.063	0.042	0.63
	Tree Swallow	0.006	0.006	0.006	0.006	0.21
	Barn Swallow	0.008	0.008	0.008	0.008	0.21
	European Starling	0.008	0.008	0.008	0.008	0.28
	Clark's Nutcracker	0.009	0.009	0.067	0.067	0.90
	Unidentified Shrike	0.010	0.010	0.052	0.052	0.97
	Mountain Bluebird	0.015	0.015	0.077	0.077	0.42
	Unidentified Swallow	0.017	0.017	0.167	0.167	0.28

Table 13 (*continued*). Mean Use, Duration in Plot, and Percent Frequency of Occurrence of Birds Observed During Surveys in the CARES Study Area in 1998.

FALL

Group	Species	#/Survey		Duration in Plot (Minutes)		
		Mean	Standard error	Mean	Standard error	% Freq.
Passerines (*continued*)	Lewis' Woodpecker	0.019	0.014	0.015	0.010	1.25
	American Goldfinch	0.027	0.010	0.027	0.010	1.90
	Rock Wren	0.029	0.020	0.173	0.133	2.08
	Brewer's Blackbird	0.038	0.033	0.038	0.033	0.63
	Golden-Crowned Kinglet	0.038	0.021	0.212	0.110	2.50
	Yellow-Rumped Warbler	0.054	0.036	0.200	0.127	3.13
	Dark-Eyed Junco	0.091	0.061	0.783	0.574	3.29
	Northern Flicker	0.122	0.043	0.494	0.176	8.89
	Black-Billed Magpie	0.138	0.030	0.410	0.033	9.44
	Townsend's Solitaire	0.147	0.042	0.841	0.261	11.06
	Western Bluebird	0.183	0.088	0.765	0.497	3.82
	Western Meadowlark	0.283	0.188	2.086	1.482	14.93
	Unidentified Passerine	0.326	0.038	0.668	0.104	13.99
	Horned Lark	0.684	0.218	3.125	1.176	25.68
	Common Raven	0.727	0.393	3.760	3.183	20.68
	American Robin	1.292	0.653	4.702	2.321	9.03
	TOTAL	4.305	0.662	18.970	4.127	68.43
Raptors	Osprey	0.002	0.002	0.002	0.002	0.21
	Prairie Falcon	0.002	0.002	0.002	0.002	0.21
	Rough-Legged Hawk	0.002	0.002	0.002	0.002	0.21
	Unidentified Buteo	0.002	0.002	0.002	0.002	0.21
	Unidentified Raptor	0.004	0.004	0.004	0.004	0.38
	Turkey Vulture	0.013	0.008	0.015	0.009	1.04
	Golden Eagle	0.018	0.004	0.029	0.010	1.76
	American Kestrel	0.019	0.014	0.130	0.088	1.46
	Sharp-Shinned Hawk	0.021	0.010	0.033	0.015	1.88
	Unidentified. Accipiter	0.022	0.008	0.030	0.016	1.94
	Cooper's Hawk	0.039	0.018	0.063	0.037	3.08
	Red-tailed Hawk	0.115	0.018	0.298	0.020	8.86
	Northern Harrier	0.123	0.037	0.156	0.050	10.43
	TOTAL	0.380	0.066	0.766	0.164	26.33
Waterfowl	Canada Goose	0.014	0.014	0.014	0.014	0.28

Table 13 (*continued*). Mean Use, Duration in Plot, and Percent Frequency of Occurrence of Birds Observed During Surveys in the CARES Study Area in 1998.

WINTER

Group	Species	#/Survey		Duration in Plot (Minutes)		% Freq.
		Mean	Standard Error	Mean	Standard Error	
Game Birds	Chukar	0.023	0.016	0.011	0.008	0.75
	Gray Partridge	0.239	0.135	0.119	0.067	2.35
	TOTAL	0.261	0.127	0.131	0.064	3.10
Passerines	Northern Flicker	0.002	0.002	0.001	0.001	0.17
	Unidentified Woodpecker	0.004	0.004	0.002	0.002	0.35
	Northern Shrike	0.004	0.003	0.005	0.003	0.41
	American goldfinch	0.007	0.007	0.004	0.004	0.17
	European Starling	0.014	0.014	0.007	0.007	0.35
	Black-Billed Magpie	0.020	0.008	0.020	0.008	2.00
	Bohemian Waxwing	0.023	0.023	0.011	0.011	0.17
	White-Winged Crossbill	0.035	0.035	0.017	0.017	0.35
	Unidentified Passerine	0.038	0.031	0.019	0.015	0.98
	Townsend's Solitaire	0.046	0.021	0.098	0.062	3.99
	Common Raven	0.093	0.036	0.074	0.030	5.67
	American Robin	0.165	0.163	0.089	0.081	1.91
	Horned Lark	0.362	0.165	0.809	0.581	14.97
	TOTAL	0.811	0.319	1.154	0.638	29.01
Raptors	Northern Harrier	0.002	0.002	0.001	0.001	0.23
	Rough-Legged Hawk	0.002	0.002	0.001	0.001	0.23
	Bald Eagle	0.006	0.004	0.006	0.005	0.58
	Prairie Falcon	0.006	0.004	0.003	0.002	0.58
	Red-tailed Hawk	0.008	0.004	0.004	0.002	0.75
	Golden Eagle	0.018	0.008	0.033	0.020	1.79
	TOTAL	0.042	0.017	0.048	0.028	4.17

Table 14. Number of birds sighted during 1994 spring through fall fixed-point surveys the proposed Kenetech and CARES wind farm sites. (Information from Jones and Stokes 1995).

Species	Total number sighted
Golden eagle	37
Peregrine falcon	2
Prairie falcon	17
American kestrel	125
Turkey vulture	59
Northern goshawk	1
Cooper's hawk	5
Sharp-shinned hawk	32
Red-tailed hawk	186
Rough-legged hawk	1
Ferruginous hawk	3
Swainson's hawk	18
Northern harrier	45
Osprey	1
Unidentified raptor	2
Unidentified hawk, eagle or vulture	5
Unidentified hawk	12
Unidentified accipiter	9
Unidentified large falcon	6
Unidentified small falcon	2
Total Raptors sighted	568
Long-billed curlew	1
Loggerhead shrike	3
Western bluebird	101
Waterfowl	48
Other passerines	6,443
Total Non-raptors sighted	6,596

Table 15. Spring North American Migration Count Averages from 1997 through 2002.

North American Migration Count 1997-2002 Averages Season: Spring												
Group/Species	**Alder Creek**	**Alder Creek N**	**Alder Creek S**	**Catherine Creek**	**E of 97**	**Klickitat River**	**Lower Rock Creek**	**Land Stationary**	**Rock Creek**	**Simcoes**	**Upper Rock Creek**	**Totals**
Upland Game Birds												
Blue Grouse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
California Quail	3.50	14.00	10.33	12.17	0.00	4.83	10.50	0.00	11.67	5.50	24.50	97.00
Chukar	1.00	6.00	2.33	0.00	1.00	0.00	5.00	0.00	1.67	0.00	3.50	20.50
Gray Partridge	2.50	2.00	0.33	0.00	0.00	0.67	0.50	0.00	0.67	0.00	0.00	6.67
Ring-necked Pheasant	0.00	0.00	1.00	1.17	0.00	1.83	0.00	1.00	0.33	1.50	0.00	6.83
Ruffed Grouse	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Wild Turkey	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Subtotal Upland Game Birds	7.00	22.00	14.00	14.50	1.00	7.33	16.00	1.00	14.33	7.00	28.00	132.17
Nonpasserine Land Birds												
Acorn Woodpecker	0.00	0.00	0.00	1.67	0.00	0.00	0.00	2.00	0.00	0.00	0.00	3.67
Anna's Hummingbird	0.00	0.00	0.00	0.50	0.00	1.67	0.00	0.00	0.00	0.00	0.00	2.17
Band-tailed Pigeon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Belted Kingfisher	0.50	0.00	2.33	0.17	0.00	3.17	0.00	0.00	3.33	0.50	0.50	10.50
Black-chinned Hummingbird	0.00	0.00	0.00	0.17	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.83
Calliope Hummingbird	0.00	0.00	0.00	3.17	0.00	6.00	0.00	0.00	0.00	2.00	1.00	12.17
Common Poorwill	0.00	0.00	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	1.92
Downy Woodpecker	0.00	0.00	1.00	1.00	0.00	0.83	1.00	0.00	1.00	2.75	0.00	7.58
Hairy Woodpecker	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.33	0.75	1.00	3.08
Hummingbird sp.	0.00	0.00	0.33	1.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	2.08
Lewis's Woodpecker	0.00	0.00	0.33	3.50	3.00	5.17	10.00	0.00	15.67	1.00	9.50	48.17
Mourning Dove	32.50	33.00	33.67	7.17	8.00	9.83	23.50	2.00	25.00	13.50	13.50	201.67
Northern Flicker	0.00	0.00	0.00	1.33	0.00	0.67	0.50	0.00	1.00	2.00	3.00	8.50
Northern Flicker (Red-shafted)	1.00	5.00	2.67	4.50	0.00	2.17	0.50	0.00	3.00	4.50	0.00	23.33
Northern Flicker (Yellow-shafted)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pileated Woodpecker	0.00	0.00	0.00	0.50	0.00	0.33	0.00	0.00	0.00	0.50	0.00	1.33
Red-breasted Sapsucker	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Red-naped Sapsucker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00	1.25

North American Migration Count 1997-2002 Averages
Season: Spring

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	E of 97	Klickitat River	Lower Rock Creek	Land Stationary	Rock Creek	Simcoes	Upper Rock Creek	Totals
Rock Dove	10.50	0.00	7.00	2.50	0.00	2.83	2.50	0.00	2.33	0.00	2.00	29.67
Rufous Hummingbird	0.00	2.00	0.00	2.83	0.00	6.00	0.00	0.00	0.00	0.00	0.00	10.83
Vaux's Swift	1.00	0.00	0.00	24.83	0.00	56.00	1.50	2.00	171.00	2.50	6.50	265.33
White-headed Woodpecker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White-throated Swift	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.83
Woodpecker sp.	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83
Subtotal Nonpasserine Land Birds	45.50	40.00	49.00	56.33	11.00	96.67	39.50	6.00	222.67	32.25	37.00	635.92
Passerines												
American Crow	25.00	5.00	20.67	16.00	5.00	33.33	10.50	2.00	15.33	9.50	4.00	146.33
American Dipper	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.83
American Goldfinch	10.00	22.00	11.67	7.83	0.00	10.17	4.50	0.00	42.33	6.75	16.50	131.75
American Pipit	0.00	0.00	0.67	0.17	0.00	0.17	0.00	0.00	0.00	0.00	0.00	1.00
American Robin	3.00	8.00	9.00	31.67	3.00	29.67	7.00	2.00	24.00	25.25	14.00	156.58
Ash-throated Flycatcher	0.00	0.00	0.33	4.00	0.00	3.00	1.50	2.00	2.00	0.00	1.00	13.83
Bank Swallow	0.50	0.00	23.67	0.00	0.00	2.00	5.00	0.00	0.00	0.75	0.00	31.92
Barn Swallow	11.00	27.00	15.00	5.00	2.00	10.67	16.00	0.00	10.33	7.25	6.50	110.75
Bewick's Wren	1.00	0.00	7.00	0.33	0.00	0.17	1.00	0.00	2.00	0.50	1.00	13.00
Black-billed Magpie	2.50	11.00	5.00	0.00	1.00	5.67	6.50	0.00	7.00	0.75	13.00	52.42
Blackbird sp.	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.00	0.00	67.00
Black-capped Chickadee	0.50	0.00	0.00	9.50	0.00	6.67	0.00	0.00	1.67	3.75	0.00	22.08
Black-headed Grosbeak	0.00	0.00	0.67	4.83	0.00	7.33	4.00	0.00	0.00	4.25	12.50	33.58
Black-throated Gray Warbler	0.00	0.00	0.00	1.67	0.00	2.00	0.00	0.00	0.33	0.00	0.00	4.00
Bluebird sp.	0.00	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00
Brewer's Blackbird	9.50	38.00	10.67	45.33	50.00	96.17	20.00	0.00	66.33	32.50	54.50	423.00
Brewer's Sparrow	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	11.00
Brown-headed Cowbird	7.00	16.00	12.33	14.67	0.00	15.17	3.50	0.00	6.67	11.25	24.00	110.58
Bullock's Oriole	1.00	1.00	16.33	4.33	0.00	8.17	11.50	2.00	2.33	0.75	17.00	64.42
Bushtit	0.00	0.00	0.33	0.50	0.00	0.00	0.00	0.00	1.33	0.00	7.00	9.17
Canyon Wren	0.50	0.00	0.33	0.17	0.00	0.83	0.50	0.00	1.67	0.00	1.50	5.50

North American Migration Count 1997-2002 Averages
Season: Spring

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	E of 97	Klickitat River	Lower Rock Creek	Land Stationary	Rock Creek	Simcoes	Upper Rock Creek	Totals
Cassin's Finch	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	7.33	13.00	0.00	21.83
Cassin's Vireo	0.50	2.00	0.33	1.17	0.00	2.00	0.00	0.00	1.33	0.50	5.50	13.33
Cedar Waxwing	0.00	0.00	1.00	1.17	0.00	0.00	12.00	0.00	0.00	0.75	0.00	14.92
Chestnut-backed Chickadee	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.67	0.00	0.00	2.00
Chipping Sparrow	0.50	20.00	0.00	18.00	9.00	10.50	2.50	5.00	13.00	41.75	4.00	124.25
Cliff Swallow	75.50	8.00	63.33	60.50	60.00	100.50	69.00	0.00	33.33	1.00	1.50	472.67
Common Raven	2.50	7.00	8.67	8.50	2.00	10.33	19.00	0.00	16.33	5.25	17.00	96.58
Common Yellowthroat	2.50	0.00	0.00	0.50	0.00	1.33	0.00	0.00	0.00	0.50	0.00	4.83
Dark-eyed Junco	0.00	0.00	0.00	23.50	1.00	4.83	1.00	1.00	10.00	13.25	2.50	57.08
Dusky Flycatcher	0.00	4.00	0.00	0.17	0.00	0.17	0.00	0.00	2.00	0.00	1.00	7.33
Empidonax sp.	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	1.75
European Starling	22.00	3.00	27.33	72.50	20.00	105.00	22.00	5.00	24.67	35.75	57.50	394.75
Evening Grosbeak	0.00	0.00	0.00	30.67	0.00	11.17	0.00	47.00	1.33	23.25	0.00	113.42
Fox Sparrow	1.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.25	0.00	1.42
Golden-crowned Kinglet	0.50	0.00	0.00	0.67	0.00	0.17	0.00	0.00	0.00	0.75	0.00	2.08
Golden-crowned Sparrow	5.50	3.00	2.33	9.67	0.00	6.00	2.00	0.00	16.67	3.00	6.50	54.67
Grasshopper Sparrow	1.00	2.00	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.67
Gray Flycatcher	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	5.33	1.50	0.00	9.83
Gray Jay	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Hammond's Flycatcher	0.00	1.00	0.00	0.00	0.00	0.17	0.00	0.00	0.33	0.25	0.50	2.25
Hermit Thrush	1.00	0.00	0.00	0.50	0.00	0.33	0.00	0.00	1.00	0.50	0.50	3.83
Horned Lark	40.50	39.00	10.67	0.00	6.00	9.83	8.50	0.00	8.33	1.75	24.00	148.58
House Sparrow	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.83
House Finch	12.00	14.00	11.67	20.83	3.00	28.83	11.00	0.00	9.33	3.50	26.00	140.17
House Sparrow	4.00	4.00	13.33	7.00	0.00	34.00	8.50	0.00	14.33	1.25	10.00	96.42
House Wren	0.00	14.00	2.67	1.83	0.00	0.67	1.00	0.00	6.67	0.00	16.50	43.33
Hutton's Vireo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lark Sparrow	3.00	11.00	6.00	0.00	5.00	0.67	3.50	0.00	0.67	2.50	3.00	35.33
Lazuli Bunting	0.00	0.00	2.00	2.00	3.00	4.83	13.50	5.00	8.33	0.75	11.00	50.42
Lesser Goldfinch	0.00	0.00	1.00	2.17	0.00	1.67	0.50	0.00	0.33	0.00	3.00	8.67

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Season: Spring

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Lincoln's Sparrow	4.00	1.00	1.33	0.17	0.00	0.17	0.00	0.00	0.00	0.25	0.00	6.92
Loggerhead Shrike	1.00	4.00	2.00	0.00	1.00	0.00	0.00	0.00	0.33	0.00	0.00	8.33
MacGillivray's Warbler	0.00	1.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.50	2.00	4.17
Marsh Wren	0.00	0.00	0.00	0.33	0.00	0.83	0.00	0.00	0.00	0.00	0.00	1.17
Mountain Bluebird	34.50	51.00	9.67	0.00	60.00	0.00	27.50	0.00	17.67	0.50	50.00	250.83
Mountain Chickadee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.75	0.50	4.25
Nashville Warbler	0.50	1.00	0.00	14.67	0.00	4.00	1.00	0.00	4.00	4.75	4.00	33.92
Northern Rough-winged Swallow	0.00	0.00	3.00	0.50	0.00	8.00	3.00	0.00	3.00	0.00	1.00	18.50
Olive-sided Flycatcher	0.00	1.00	0.33	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	1.50
Orange-crowned Warbler	1.00	1.00	1.33	0.83	0.00	4.33	0.00	0.00	0.33	3.25	2.00	14.08
Pacific-slope Flycatcher	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Pine Siskin	0.00	0.00	0.00	8.67	0.00	20.17	0.00	0.00	2.33	4.50	0.00	35.67
Purple Finch	1.50	0.00	0.00	2.33	0.00	1.17	3.00	0.00	1.67	2.25	1.00	12.92
Purple Martin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pygmy Nuthatch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Red Crossbill	0.00	0.00	0.00	5.33	0.00	0.00	0.00	0.00	2.67	1.75	0.00	9.75
Red-breasted Nuthatch	0.00	0.00	0.00	7.00	0.00	0.50	0.50	0.00	1.67	2.75	1.00	13.42
Red-eyed Vireo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00
Red-winged Blackbird	33.00	17.00	47.33	50.17	0.00	52.83	29.00	0.00	61.33	23.25	27.00	340.92
Rock Wren	3.00	4.00	5.00	0.17	0.00	0.00	0.50	0.00	3.33	0.00	3.50	19.50
Ruby-crowned Kinglet	1.50	3.00	1.00	0.67	0.00	0.50	0.00	0.00	0.33	0.75	0.00	7.75
Sage Sparrow	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
Sage Thrasher	1.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
Savannah Sparrow	0.50	6.00	2.67	0.67	0.00	4.67	0.50	0.00	4.33	0.00	0.00	19.33
Say's Phoebe	0.00	4.00	2.00	1.17	2.00	1.67	9.50	1.00	5.00	0.00	3.00	29.33
Solitary Vireo	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Song Sparrow	2.50	0.00	16.00	3.17	0.00	8.33	2.50	0.00	3.33	11.25	3.50	50.58
Sparrow sp.	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50
Spotted Towhee	1.00	0.00	0.00	6.33	1.00	7.17	0.00	0.00	1.67	6.75	1.50	25.42
Steller's Jay	0.00	0.00	0.00	3.83	0.00	2.67	0.50	0.00	1.67	6.50	3.50	18.67

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Season: Spring

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Swainson's Thrush	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.25	0.50	1.08
Townsend's Solitaire	0.00	0.00	0.00	0.67	0.00	0.33	0.50	0.00	0.00	0.75	0.00	2.25
Townsend's Warbler	0.00	0.00	0.00	0.67	0.00	0.50	0.00	0.00	0.33	1.25	0.00	2.75
Tree Swallow	6.00	3.00	0.00	6.33	0.00	28.00	1.00	0.00	1.33	9.25	3.50	58.42
Tri-colored Blackbird	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Varied Thrush	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.33	0.75	0.00	1.25
Vesper Sparrow	0.00	15.00	2.00	0.00	2.00	4.33	2.00	0.00	5.00	0.00	0.50	30.83
Violet-green Swallow	10.50	11.00	2.33	56.33	6.00	180.33	13.00	1.00	115.33	20.25	10.50	426.58
Warbler sp.	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Warbling Vireo	1.50	4.00	4.33	0.50	0.00	4.00	0.50	0.00	5.33	2.75	0.00	22.92
Western Bluebird	0.50	9.00	0.00	8.67	8.00	10.50	2.00	0.00	9.00	10.25	8.50	66.42
Western Flycatcher	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Western Kingbird	16.50	0.00	12.67	3.17	6.00	13.83	45.50	5.00	11.00	2.00	22.00	137.67
Western Meadowlark	46.50	62.00	48.00	12.00	40.00	46.17	38.50	5.00	28.67	10.00	37.00	373.83
Western Scrub Jay	0.00	0.00	0.00	13.33	0.00	8.83	0.00	1.00	0.00	6.50	0.00	29.67
Western Tanager	1.50	1.00	2.00	10.00	1.00	14.50	6.50	0.00	6.67	7.25	21.50	71.92
Western Wood Pewee	0.00	0.00	0.00	0.67	0.00	0.83	0.50	1.00	1.67	0.50	1.00	6.17
White-breasted Nuthatch	0.00	0.00	0.00	2.83	0.00	1.17	0.00	0.00	0.67	0.50	1.50	6.67
White-crowned Sparrow	17.00	3.00	4.00	26.33	0.00	6.00	9.50	0.00	33.00	4.00	4.00	106.83
Wilson's Warbler	0.00	6.00	3.00	1.33	0.00	0.83	0.00	0.00	2.67	2.00	3.50	19.33
Winter Wren	0.50	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	2.00
Yellow Warbler	0.50	14.00	3.33	1.00	0.00	3.50	0.00	0.00	3.00	3.00	5.00	33.33
Yellow-breasted Chat	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	4.00	5.00
Yellow-headed Blackbird	3.50	0.00	2.00	0.00	0.00	4.50	0.00	0.00	0.00	0.75	7.50	18.25
Yellow-rumped Warbler	0.00	6.00	1.00	1.00	2.00	3.50	0.00	0.00	1.67	3.25	0.00	18.42
Subtotal Passerines	463.50	533.00	462.33	662.83	301.00	1015.33	464.50	85.00	706.00	454.25	604.50	5752.25
Raptors												
Accipiter sp.	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	1.00	0.50	0.00	1.67
American Kestrel	0.00	0.00	2.33	0.17	0.00	0.83	2.50	0.00	0.00	0.50	2.50	8.83
American Kestrel	5.50	9.00	1.00	1.17	12.00	7.00	3.00	0.00	13.00	2.75	8.50	62.92

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Season: Spring

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Bald Eagle	0.00	0.00	0.00	0.83	0.00	1.17	0.50	0.00	0.00	0.00	0.00	2.50
Barn Owl	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.17
Burrowing Owl	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Buteo sp.	0.50	0.00	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.50
Cooper's Hawk	0.00	0.00	0.00	0.50	0.00	0.17	0.00	0.00	1.00	0.00	0.00	1.67
Golden Eagle	0.00	0.00	0.33	0.00	0.00	1.00	1.00	0.00	3.00	0.00	2.00	7.33
Great Horned Owl	1.00	0.00	1.33	0.50	0.00	0.00	0.00	0.00	0.33	0.50	0.00	3.67
Large falcon sp.	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67
Merlin	0.00	0.00	2.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.17
Northern Harrier	2.00	5.00	1.67	0.00	1.00	3.33	1.50	0.00	5.33	0.75	0.50	21.08
Osprey	1.00	0.00	1.00	3.83	0.00	1.67	0.50	0.00	1.33	0.00	0.00	9.33
Owl sp.	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Peregrine Falcon	0.00	0.00	0.67	0.00	0.00	0.17	0.00	0.00	0.33	0.00	0.00	1.17
Prairie Falcon	0.00	0.00	0.00	0.00	0.00	0.17	1.00	0.00	0.33	0.00	0.00	1.50
Red-tailed Hawk	6.00	5.00	4.00	5.33	2.00	12.50	6.50	2.00	22.33	8.75	12.50	86.92
Rough-legged Hawk	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Sharp-shinned Hawk	0.00	0.00	0.67	0.33	0.00	0.17	0.00	0.00	0.33	0.50	1.00	3.00
Short-eared Owl	0.50	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83
Swainson's Hawk	0.00	2.00	0.33	0.00	0.00	0.17	1.00	0.00	0.00	0.00	0.00	3.50
Turkey Vulture	2.00	6.00	1.67	12.50	2.00	13.67	18.00	0.00	11.00	3.25	6.50	76.58
Western Screech Owl	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Subtotal Raptors	19.00	27.00	18.33	26.50	18.00	42.17	35.50	2.00	59.33	17.50	35.00	300.33
Shorebirds												
American Avocet	0.00	0.00	2.67	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
Black-necked Stilt	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Common Snipe	0.00	2.00	0.33	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.50	4.50
Dunlin	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.50
Killdeer	9.50	4.00	12.67	3.50	2.00	8.17	2.50	2.00	5.33	1.25	5.50	56.42
Least Sandpiper	0.00	0.00	1.67	0.00	0.00	3.83	0.00	0.00	0.00	0.00	0.00	5.50
Long-billed Curlew	3.00	0.00	2.33	0.00	0.00	0.83	0.50	0.00	2.67	0.00	0.00	9.33

North American Migration Count 1997-2002 Averages
Season: Spring

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	E of 97	Klickitat River	Lower Rock Creek	Land Stationary	Rock Creek	Simcoes	Upper Rock Creek	Totals
Sanderling	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.50
Sandpiper sp.	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
Short-billed Dowitcher	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sora	0.50	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17
Spotted Sandpiper	1.50	0.00	8.00	0.00	0.00	1.83	0.00	0.00	0.00	1.25	0.00	12.58
Upland Sandpiper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Virginia Rail	0.00	0.00	0.00	1.33	0.00	0.17	0.00	0.00	0.00	0.00	0.00	1.50
Western Phalarope	0.00	0.00	2.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	2.33
Western Sandpiper	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50
Subtotal Shorebirds	22.00	6.00	30.67	7.50	2.00	16.17	3.00	2.00	8.00	2.75	6.00	106.08
Waterfowl												
American Wigeon	0.00	0.00	0.00	0.33	0.00	1.50	0.00	0.00	0.00	0.00	0.00	1.83
Barrow's Goldeneye	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.67
Blue-winged Teal	0.50	0.00	1.33	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	2.33
Bufflehead	1.00	0.00	3.33	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	4.83
Canada Goose	54.00	0.00	38.00	33.33	8.00	39.17	8.00	12.00	11.33	0.50	0.00	204.33
Cinnamon Teal	0.00	0.00	1.67	2.00	0.00	6.17	0.00	0.00	0.00	0.25	0.00	10.08
Common Merganser	0.00	0.00	0.00	1.00	0.00	15.50	0.00	0.00	0.00	0.00	0.00	16.50
Duck sp.	0.00	0.00	2.33	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	3.83
Gadwall	0.00	0.00	0.67	0.00	0.00	3.50	0.00	0.00	0.00	0.00	0.00	4.17
Greater Scaup	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50
Greater White-fronted Goose	0.00	0.00	0.00	0.00	0.00	3.17	0.00	0.00	0.00	0.00	0.00	3.17
Green-winged Teal	0.00	0.00	1.67	1.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	3.33
Herring Gull	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Hooded Merganser	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Lesser Scaup	0.00	0.00	3.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.67
Mallard	14.50	0.00	15.33	14.00	5.00	23.67	7.00	2.00	6.33	20.00	1.00	108.83
Merganser sp.	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Northern Pintail	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00	0.00	0.25	0.00	1.42
Northern Shoveler	0.00	0.00	1.33	1.67	0.00	4.83	0.00	0.00	0.00	0.00	0.00	7.83

North American Migration Count 1997-2002 Averages
Season: Spring

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	East of 97	Klickitat River	Lower Rock Creek	Land Stationary	Rock Creek	Simcoes	Upper Rock Creek	Totals
Red-breasted Merganser	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.17
Redhead	0.00	0.00	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67
Ring-necked Duck	0.00	0.00	2.33	1.00	0.00	2.67	0.00	0.00	0.00	0.00	0.00	6.00
Ruddy Duck	0.00	0.00	0.67	0.17	0.00	0.50	0.00	0.00	0.00	0.00	0.00	1.33
Tundra Swan	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.17
Wood Duck	0.00	0.00	0.33	5.67	0.00	2.00	0.00	0.00	0.00	0.50	0.00	8.50
Subtotal Waterfowl	70.50	0.00	75.00	64.83	13.00	105.33	15.00	14.00	17.67	21.50	1.50	398.33
Other Water Birds												
American Coot	2.00	0.00	9.33	0.00	0.00	4.67	2.50	0.00	0.33	2.25	0.00	21.08
Black-crowned Night Heron	2.50	0.00	9.00	0.00	0.00	10.00	5.00	0.00	0.00	0.00	0.00	26.50
Bonaparte's Gull	0.00	0.00	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
California Gull	51.50	0.00	10.33	7.83	6.00	38.33	0.50	0.00	0.67	0.00	0.00	115.17
Caspian Tern	7.50	0.00	3.33	1.83	12.00	0.00	0.00	0.00	0.00	0.00	0.00	24.67
Clark's Grebe	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Common Loon	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Double-crested Cormorant	0.00	0.00	3.67	2.17	0.00	0.83	1.00	0.00	0.00	0.00	0.00	7.67
Eared Grebe	0.50	0.00	17.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.83
Forster's Tern	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
Glaucous-winged Gull	0.50	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33
Great Blue Heron	0.00	0.00	2.00	3.00	0.00	21.00	2.00	0.00	1.00	0.00	0.00	29.00
Green Heron	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Gull sp.	97.50	0.00	4.67	3.33	0.00	3.17	9.50	0.00	0.33	0.00	0.00	118.50
Horned Grebe	0.00	0.00	1.67	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	1.83
Pied-billed Grebe	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Ring-billed Gull	0.50	0.00	1.00	10.67	1.00	21.83	1.50	0.00	0.67	2.50	0.00	39.67
Sandhill Crane	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50
Thayer's Gull	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
Western Grebe	1.00	0.00	3.67	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	4.83
Subtotal Other Water birds	163.50	0.00	68.33	31.67	19.00	100.17	22.00	0.00	3.00	5.00	0.00	412.67
Totals	**791.00**	628.00	717.67	864.17	365.00	1383.17	595.50	110.00	1031.00	540.25	712.00	7737.75

Table 16. Fall North American Migration Count Averages, 1998 through 2002.

North American Migration Counts 1998-2002 Season: Fall										
Group/Species	**Alder Creek**	**Alder Creek N**	**Alder Creek S**	**Catherine Creek**	**Klickitat River**	**Lower Rock Crk**	**Rock Crk**	**Simcoes**	**Upper Rock Crk**	**Totals**
Upland Game Birds										
Blue Grouse	16.50	4.00	57.67	25.20	49.00	29.00	20.00	22.00	46.50	269.87
California Quail	12.50	39.50	0.00	0.00	2.60	3.00	0.00	0.00	0.00	57.60
Chukar	0.00	4.00	4.67	0.00	0.00	3.50	7.50	0.00	2.50	22.17
Gray Partridge	2.50	0.50	0.00	0.00	5.20	0.00	1.00	0.50	1.00	10.70
Grouse sp.	0.00	0.00	0.00	0.00	4.40	0.00	0.00	0.00	0.00	4.40
Ring-necked Pheasant	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
Ruffed Grouse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Wild Turkey	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Subtotal Upland Game Birds	31.50	48.00	62.33	26.20	61.20	35.50	28.50	23.00	50.00	366.23
Nonpasserine Land Birds										
Lewis's Woodpecker	0.00	1.00	0.00	25.00	56.00	22.00	68.50	2.75	12.00	187.25
Mourning Dove	30.50	10.50	16.33	3.20	12.60	11.00	17.50	3.50	18.00	123.13
Rock Dove	21.00	0.00	22.67	6.80	39.00	10.50	5.50	1.50	7.00	113.97
Northern Flicker (Red-shafted)	8.00	3.50	5.00	13.40	29.00	5.50	20.00	10.75	6.50	101.65
Belted Kingfisher	1.00	0.00	2.00	0.80	4.00	1.00	2.50	1.00	0.50	12.80
Downy Woodpecker	0.50	0.00	0.33	2.00	2.80	0.00	0.50	1.25	1.50	8.88
Acorn Woodpecker	0.00	0.00	0.00	3.40	0.00	0.00	0.00	0.00	0.00	3.40
Vaux's Swift	0.00	0.00	0.00	1.00	0.80	0.00	0.00	1.50	0.00	3.30
Common Poorwill	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50
Red-breasted Sapsucker	0.50	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.90
Pileated Woodpecker	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.25	0.00	0.85
Woodpecker sp.	0.50	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.70
Red-naped Sapsucker	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Hairy Woodpecker	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.20
Northern Flicker (Yellow-shafted)	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20
Subtotal Nonpasserine Land Birds	62.00	16.50	46.33	57.00	144.40	50.00	114.50	22.75	45.50	558.98

North American Migration Counts 1998-2002
Season: Fall

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	Klickitat River	Lower Rock Crk	Rock Crk	Simcoes	Upper Rock Crk	Totals
Passerines										
European Starling	16.50	24.00	8.67	118.40	398.80	58.00	88.50	36.50	80.50	829.87
House Finch	32.50	94.50	39.67	48.20	24.00	39.00	86.50	15.75	34.00	414.12
Yellow-rumped Warbler (Audubon's)	23.50	2.00	12.00	80.00	87.20	24.50	7.50	49.75	95.00	381.45
Violet-green Swallow	18.50	0.00	0.00	85.60	39.60	0.00	9.00	205.75	0.00	358.45
House Sparrow	14.00	30.00	176.33	19.00	83.20	11.50	0.50	1.75	21.00	357.28
Brewer's Blackbird	16.50	20.50	17.33	55.00	139.20	3.50	50.00	13.25	10.50	325.78
Western Bluebird	0.00	93.00	0.00	31.60	43.40	5.50	17.50	17.25	106.50	314.75
White-crowned Sparrow	36.50	52.00	71.00	18.60	14.20	19.00	35.50	34.75	15.00	296.55
American Crow	3.50	14.50	39.67	47.00	66.60	16.00	11.00	24.75	30.50	253.52
Blackbird sp.	23.00	100.00	81.67	2.00	0.00	0.00	0.00	18.75	0.00	225.42
American Goldfinch	15.50	11.50	7.00	16.80	86.60	21.00	31.00	10.25	12.00	211.65
Horned Lark	44.00	67.00	8.67	0.00	31.00	8.50	26.00	0.00	9.50	194.67
Mountain Bluebird	65.00	36.50	5.33	0.00	1.20	0.00	68.00	0.00	13.50	189.53
Western Meadowlark	25.50	20.00	11.00	11.60	25.20	22.50	42.50	2.00	8.00	168.30
American Robin	10.00	6.00	0.33	38.20	20.20	5.00	5.00	54.25	13.00	151.98
Dark-eyed Junco	14.00	6.50	0.33	24.20	40.20	4.50	4.50	25.75	13.00	132.98
Chipping Sparrow	3.00	0.50	0.00	4.80	13.80	0.00	0.00	59.50	24.00	105.60
Western Scrub Jay	0.00	0.00	0.00	37.60	31.40	5.00	0.00	10.75	5.50	90.25
Red-winged Blackbird	2.00	0.00	11.67	35.40	33.40	0.50	1.50	3.25	0.00	87.72
Common Raven	7.00	6.50	4.33	16.60	21.40	3.00	10.50	7.50	10.00	86.83
Spotted Towhee	12.00	5.00	2.33	12.00	9.60	3.50	7.50	6.25	9.50	67.68
Song Sparrow	11.00	1.50	17.67	3.40	10.40	4.00	7.00	5.50	6.00	66.47
Savannah Sparrow	6.50	15.50	3.67	6.00	13.40	8.00	1.50	0.75	11.00	66.32
Cedar Waxwing	0.50	0.00	0.00	0.00	6.20	0.00	5.00	34.25	17.50	63.45
Lesser Goldfinch	0.50	0.00	0.33	14.80	11.00	0.00	9.00	0.00	27.50	63.13
Black-billed Magpie	1.50	4.00	6.00	0.00	13.40	9.00	15.00	2.00	9.50	60.40
Steller's Jay	1.00	1.50	0.00	17.60	14.00	0.50	1.00	9.00	3.50	48.10
Sparrow sp.	16.50	18.50	6.67	1.00	3.80	0.00	0.00	0.00	0.00	46.47
Pine Siskin	1.00	3.00	0.00	14.80	14.20	0.00	0.00	2.25	2.00	37.25

North American Migration Counts 1998-2002
Season: Fall

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	Klickitat River	Lower Rock Crk	Rock Crk	Simcoes	Upper Rock Crk	Totals
Black-capped Chickadee	0.00	0.00	0.33	9.40	8.80	0.50	2.00	12.75	0.50	34.28
American Pipit	3.50	0.00	3.67	5.00	20.00	0.00	0.00	0.00	1.50	33.67
Barn Swallow	0.50	1.50	13.67	0.20	8.00	0.00	1.50	0.25	1.00	26.62
Orange-crowned Warbler	5.00	0.00	2.00	1.20	3.60	3.00	0.00	6.25	4.00	25.05
Wilson's Warbler	1.00	0.00	1.00	0.00	21.20	0.00	0.00	0.00	0.50	23.70
Red-breasted Nuthatch	0.50	0.00	0.00	14.40	1.60	0.00	0.00	4.50	2.50	23.50
Golden-crowned Sparrow	3.00	0.00	1.00	3.20	4.60	1.50	4.00	3.25	2.50	23.05
Golden-crowned Kinglet	8.50	0.00	1.00	1.80	0.00	1.50	0.00	0.00	7.00	19.80
Townsend's Solitaire	2.50	2.50	0.67	1.20	2.40	1.00	3.50	2.50	2.00	18.27
Rock Wren	1.50	1.50	2.33	0.40	1.20	7.00	2.50	0.00	0.50	16.93
Clark's Nutcracker	0.00	10.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00	16.00
Bewick's Wren	1.50	0.00	4.33	1.20	3.00	2.00	1.00	0.00	2.00	15.03
Lincoln's Sparrow	3.00	0.00	1.67	0.20	4.00	1.00	0.00	2.50	2.00	14.37
Ruby-crowned Kinglet	9.50	0.00	1.00	0.00	0.60	1.00	0.00	1.50	0.00	13.60
Yellow Warbler	0.50	0.00	4.33	0.60	4.00	0.00	0.00	1.00	2.50	12.93
Purple Finch	1.00	0.00	0.00	1.60	0.80	1.50	0.00	1.50	6.00	12.40
Brown-headed Cowbird	0.00	0.00	0.00	0.40	2.80	0.00	0.00	1.00	7.50	11.70
Mountain Chickadee	2.00	0.00	0.00	1.40	1.60	0.00	0.00	5.75	0.00	10.75
Swallow sp.	0.00	0.00	0.00	10.20	0.00	0.00	0.00	0.00	0.00	10.20
Say's Phoebe	1.50	1.00	0.33	1.00	2.60	0.50	3.00	0.00	0.00	9.93
Hermit Thrush	2.50	0.00	0.00	0.00	1.60	0.00	0.50	0.25	4.50	9.35
Cassin's Finch	0.00	0.00	0.00	0.00	0.60	0.00	0.00	6.75	1.50	8.85
White-breasted Nuthatch	1.00	0.00	0.00	3.60	2.00	0.00	0.00	1.75	0.50	8.85
Chestnut-backed Chickadee	0.00	0.00	0.00	7.40	0.00	0.00	0.00	0.00	0.00	7.40
Canyon Wren	0.00	0.50	1.00	0.60	1.80	1.00	2.00	0.00	0.00	6.90
Varied Thrush	1.00	0.00	0.00	0.00	1.80	0.50	0.00	0.00	3.50	6.80
Evening Grosbeak	0.50	0.00	0.00	1.60	0.60	0.00	0.00	3.75	0.00	6.45
Western Tanager	0.00	0.00	0.00	1.60	1.00	0.00	1.00	0.25	2.50	6.35
Fox Sparrow	2.00	0.00	0.67	0.00	0.60	0.50	0.00	1.50	1.00	6.27
House Wren	2.50	1.00	1.33	0.00	0.60	0.50	0.00	0.25	0.00	6.18
Vesper Sparrow	1.50	2.00	0.00	0.00	0.40	0.00	0.50	0.25	0.00	4.65

North American Migration Counts 1998-2002
Season: Fall

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	Klickitat River	Lower Rock Crk	Rock Crk	Simcoes	Upper Rock Crk	Totals

Warbler sp.	1.50	0.00	1.33	0.60	0.20	0.00	0.00	0.00	0.00	3.63
Sage Sparrow	0.00	2.50	0.67	0.00	0.00	0.00	0.00	0.00	0.00	3.17
Common Yellowthroat	0.00	0.00	0.33	0.20	1.60	0.00	0.00	0.00	0.50	2.63
Warbling Vireo	1.00	0.00	0.00	0.20	0.40	0.00	0.00	0.00	1.00	2.60
Nashville Warbler	0.00	0.00	0.00	0.20	1.00	0.00	0.00	1.25	0.00	2.45
American Dipper	0.00	0.00	0.00	0.00	2.20	0.00	0.00	0.00	0.00	2.20
Cassin's Vireo	0.00	0.00	0.00	0.20	0.00	0.50	0.50	0.00	0.50	1.70
Black-throated Gray Warbler	0.00	0.00	0.00	0.60	0.40	0.00	0.00	0.00	0.50	1.50
Grasshopper Sparrow	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	1.50
Northern Rough-winged Swallow	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	1.50
Yellow-rumped Warbler (Myrtle)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	1.50
Tree Swallow	0.00	0.00	0.00	0.00	0.20	0.00	0.00	1.25	0.00	1.45
Loggerhead Shrike	0.50	0.00	0.33	0.00	0.00	0.50	0.00	0.00	0.00	1.33
Winter Wren	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	1.25
Gray Jay	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00	1.20
Marsh Wren	0.50	0.00	0.33	0.00	0.20	0.00	0.00	0.00	0.00	1.03
MacGillivray's Warbler	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00
Western Wood Pewee	0.00	0.00	0.00	0.20	0.60	0.00	0.00	0.00	0.00	0.80
Swainson's Thrush	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.50	0.70
Black-throated Blue Warbler	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Brewer's Sparrow	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Empidonax sp.	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Pacific-slope Flycatcher	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.50
Pygmy Nuthatch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50
Jay sp.	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Wren sp.	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Brown Creeper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Black-headed Grosbeak	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.20
Bushtit	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.20
Red-eyed Vireo	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20
Townsend's Warbler	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.20
Subtotal Passerines	483.00	656.50	575.67	838.40	1405.60	298.00	564.50	712.50	649.00	6183.17

North American Migration Counts 1998-2002
Season: Fall

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	Klickitat River	Lower Rock Crk	Rock Crk	Simcoes	Upper Rock Crk	Totals
Raptors										

American Kestrel	6.50	16.00	4.67	2.80	9.40	7.00	30.50	4.75	5.50	87.12
Turkey Vulture	0.00	1.00	0.00	29.60	22.80	0.00	0.50	8.75	17.00	79.65
Red-tailed Hawk	5.00	3.50	2.33	9.20	8.80	6.50	14.50	3.50	7.00	60.33
Sharp-shinned Hawk	1.00	0.50	1.33	1.20	7.00	0.50	5.00	0.50	1.00	18.03
Northern Harrier	3.00	3.50	0.33	0.60	0.80	0.00	3.00	1.00	0.50	12.73
Western Screech Owl	0.00	0.50	0.00	2.20	6.80	0.00	1.00	0.00	0.00	10.50
Cooper's Hawk	0.50	0.00	0.00	0.60	1.20	0.50	1.00	0.75	0.50	5.05
Great Horned Owl	1.00	1.00	0.67	0.80	0.20	0.00	0.50	0.00	0.00	4.17
Prairie Falcon	0.00	0.00	0.00	0.00	0.00	0.50	1.00	0.50	2.00	4.00
Osprey	0.50	0.00	0.67	0.80	0.40	0.50	0.00	0.25	0.50	3.62
Golden Eagle	0.00	0.00	0.00	1.20	0.40	0.50	1.50	0.00	0.00	3.60
Accipiter sp.	0.50	0.50	0.33	0.60	0.00	0.00	0.00	0.00	0.00	1.93
Barn Owl	0.00	0.00	0.33	0.60	0.60	0.00	0.00	0.00	0.00	1.53
Barred Owl	0.00	0.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00	1.20
Merlin	0.00	0.00	0.00	0.20	0.60	0.00	0.00	0.00	0.00	0.80
Buteo sp.	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.40
Peregrine Falcon	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.40
Bald Eagle	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.20
Northern Pygmy Owl	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.20
Northern Saw-whet Owl	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.20
Burrowing Owl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal Raptors	18.00	26.50	10.67	52.60	59.40	16.00	58.50	20.00	34.00	295.67
Shorebirds										
Killdeer	1.00	10.50	6.00	2.60	3.40	4.50	1.00	1.00	2.00	32.00
Western Sandpiper	0.00	22.50	0.33	0.00	5.00	0.00	0.00	0.00	0.00	27.83
Virginia Rail	2.50	0.00	2.33	1.20	2.20	0.00	0.00	0.50	0.00	8.73
Sora	0.00	0.00	3.33	0.20	0.00	0.50	0.00	0.00	0.00	4.03
Least Sandpiper	0.00	0.50	0.00	0.00	3.40	0.00	0.00	0.00	0.00	3.90
Lesser Yellowlegs	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00

North American Migration Counts 1998-2002
Season: Fall

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	Klickitat River	Lower Rock Crk	Rock Crk	Simcoes	Upper Rock Crk	Totals
Greater Yellowlegs	0.00	2.50	0.33	0.00	0.00	0.00	0.00	0.00	0.00	2.83
Pectoral Sandpiper	0.00	1.00	1.00	0.00	0.20	0.00	0.00	0.00	0.00	2.20
Common Snipe	0.00	0.00	0.67	0.00	0.00	1.00	0.00	0.00	0.00	1.67
Spotted Sandpiper	0.00	0.00	0.67	0.20	0.40	0.00	0.00	0.00	0.00	1.27

Solitary Sandpiper	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Sandpiper sp.	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.67
Semipalmated Sandpiper	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Long-billed Dowitcher	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.40
Red-necked Phalarope	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.40
Baird's Sandpiper	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20
Semipalmated Plover	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20
Subtotal Shorebirds	3.50	41.50	15.33	4.20	15.80	6.00	1.00	1.50	2.00	90.83
Waterfowl										
Canada Goose	26.00	3.00	22.00	110.80	82.20	6.00	0.00	0.00	22.50	272.50
Mallard	34.50	1.00	19.00	9.80	13.20	4.50	3.50	14.25	2.00	101.75
American Wigeon	0.50	0.00	0.00	12.40	1.80	18.50	0.00	1.75	11.00	45.95
Green-winged Teal	8.50	1.00	1.67	6.40	13.00	1.00	0.00	1.75	0.00	33.32
Wood Duck	0.00	0.00	2.33	13.40	0.00	7.00	0.00	0.00	0.00	22.73
Northern Shoveler	0.50	0.00	0.00	2.00	3.20	0.00	0.00	5.50	0.00	11.20
Ring-necked Duck	0.00	0.00	0.00	0.20	0.40	0.00	2.00	7.00	0.00	9.60
Common Merganser	0.00	0.00	0.00	2.40	5.60	0.00	0.00	0.00	0.00	8.00
Duck sp.	2.50	0.00	5.00	0.20	0.00	0.00	0.00	0.00	0.00	7.70
Northern Pintail	0.00	0.00	2.67	0.00	2.80	0.00	0.00	1.50	0.00	6.97
Ruddy Duck	0.00	0.00	0.00	0.20	1.00	0.00	0.00	3.25	0.00	4.45
Gadwall	0.00	0.00	0.00	0.00	2.00	0.00	0.00	2.25	0.00	4.25
Lesser Scaup	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.50	0.00	3.50
Blue-winged Teal	0.00	0.00	0.00	0.40	0.20	0.00	0.00	2.00	0.00	2.60
Cinnamon Teal	1.00	0.00	0.33	0.00	0.00	0.00	0.00	1.00	0.00	2.33
Scaup sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.75	0.00	1.75
Wigeon sp.	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	1.50
Goldeneye sp.	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50

North American Migration Counts 1998-2002
Season: Fall

Group/Species	Alder Creek	Alder Creek N	Alder Creek S	Catherine Creek	Klickitat River	Lower Rock Crk	Rock Crk	Simcoes	Upper Rock Crk	Totals
Snow Goose	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.50
Redhead	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25
Subtotal Waterfowl	73.50	5.50	53.00	158.20	125.40	40.50	7.00	42.75	35.50	541.35
Other Water Birds										
California Gull	0.00	0.00	80.33	48.00	6.00	6.50	0.00	0.00	20.50	161.33
Double-crested Cormorant	5.00	0.00	18.00	8.80	14.20	1.50	0.00	0.00	13.50	61.00

Gull sp.	3.00	0.00	5.33	3.40	0.00	7.50	0.00	0.00	0.00	19.23
American Coot	0.00	0.00	2.67	5.00	7.20	0.00	2.00	1.75	0.00	18.62
Ring-billed Gull	0.00	0.00	3.67	7.00	2.40	1.50	0.00	0.00	2.00	16.57
Great Blue Heron	0.50	0.50	3.00	5.40	4.40	1.50	0.00	0.75	0.50	16.55
Sterna tern	14.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.50
Forster's Tern	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	9.00
Pied-billed Grebe	1.00	0.00	0.67	1.60	0.60	2.00	1.00	0.00	0.50	7.37
Glaucous-winged Gull	0.00	0.00	0.67	1.40	0.20	0.50	0.00	0.00	0.50	3.27
Western Grebe	0.00	0.00	1.33	0.00	1.20	0.00	0.00	0.00	0.00	2.53
Common Loon	0.50	0.00	0.33	0.00	0.60	0.00	0.00	0.00	0.00	1.43
Sabine's Gull	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	1.00	1.20
Black-crowned Night Heron	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.50	0.83
Common Tern	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50
Great Egret	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Caspian Tern	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Eared Grebe	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Horned Grebe	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Red-necked Grebe	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20
Subtotal Other Water birds	25.00	0.50	117.33	80.80	37.00	21.00	3.00	2.50	48.50	335.63
Total	678.50	768.50	870.00	1164.80	1789.40	451.00	718.50	805.00	830.50	8076.20

Table 17. North American Breeding Bird Survey data, Route 25 (Snowden) 1991 through 1998.

Breeding Bird Survey Results for Route 89025									
Group/Species	1991	1992	1993	1994	1995	1996	1997	1998	Average
Waterfowl									
Mallard	2	2	-	0	-	0	0	5	1.50
Ruddy Duck	1	0	-	0	-	0	0	0	0.17
Total Waterfowl	3	2	-	0	-	0	0	5	1.67
Raptors									
Turkey Vulture	0	3	-	0	-	0	0	0	0.50
Red-tailed Hawk	0	0	-	0	-	1	3	0	0.67
Osprey	0	2	-	0	-	0	0	0	0.33
Swainson's Hawk	0	0	-	0	-	0	0	0	0.00
Cooper's Hawk	1	0	-	0	-	0	0	0	0.17
Northern Goshawk	0	1	-	0	-	0	0	0	0.17
Total Raptors	1	6	-	0	-	1	3	0	1.83
Upland Game Birds									
California Quail	5	2	-	0	-	3	2	0	2.00
Mountain Quail	1	0	-	0	-	0	0	0	0.17
Ring-necked Pheasant	3	3	-	2	-	0	0	1	1.50
Total Upland Game Birds	9	5	-	2	-	3	2	1	3.67
Shorebirds									
Killdeer	0	0	-	0	-	0	1	1	0.33
Total Shorebirds	0	0	-	0	-	0	1	1	0.33
Nonpasserine Land Birds									
Rock Dove	6	1	-	0	-	0	0	0	1.17
Mourning Dove	2	2	-	2	-	0	0	1	1.17
Common Nighthawk	6	0	-	0	-	2	0	0	1.33
Vaux's Swift	0	1	-	0	-	0	8	0	1.50
White-throated Swift	0	0	-	4	-	0	0	0	0.67
Rufous Hummingbird	3	0	-	0	-	0	0	0	0.50
Belted Kingfisher	0	0	-	1	-	0	0	0	0.17
Red-breasted Sapsucker	1	0	-	0	-	0	0	0	0.17
Downy Woodpecker	4	0	-	0	-	0	1	0	0.83
Hairy Woodpecker	0	0	-	0	-	0	0	0	0.00
Northern Flicker (Red-shafted)	20	9	-	5	-	3	4	6	7.83
Pileated Woodpecker	1	3	-	0	-	0	0	0	0.67
Total Nonpasserine Land Birds	43	16	-	12	-	5	13	7	16.00

Table 17 (*continued*). North American Breeding Bird Survey data, Route 25 (Snowden) 1991 through 1998.

Breeding Bird Survey Results for Route 89025									
Group/Species	1991	1992	1993	1994	1995	1996	1997	1998	Average
Passerines									
Olive-sided Flycatcher	5	5	-	10	-	3	3	6	5.33
Western Wood Pewee	8	0	-	4	-	4	8	11	5.83
Willow Flycatcher	2	1	-	1	-	0	0	0	0.67
Pacific-slope Flycatcher	0	0	-	0	-	1	0	0	0.17
Cordilleran Flycatcher	0	0	-	0	-	0	1	0	0.17
Western Kingbird	1	1	-	0	-	0	0	1	0.50
Eastern Kingbird	1	0	-	0	-	0	0	0	0.17
Cassin's Vireo	0	4	-	1	-	3	3	1	2.00
Warbling Vireo	14	10	-	16	-	2	1	1	7.33
Red-eyed Vireo	0	0	-	0	-	0	0	0	0.00
Steller's Jay	7	12	-	6	-	3	3	6	6.17
Western Scrub Jay	6	12	-	5	-	6	11	9	8.17
Black-billed Magpie	0	0	-	0	-	0	0	0	0.00
American Crow	34	35	-	43	-	13	13	14	25.33
Common Raven	9	1	-	12	-	1	0	0	3.83
Tree Swallow	62	23	-	39	-	0	8	0	22.00
Violet-green Swallow	8	26	-	15	-	31	19	34	22.17
Bank Swallow	0	0	-	0	-	0	0	0	0.00
Cliff Swallow	0	0	-	0	-	7	10	17	5.67
Barn Swallow	10	18	-	4	-	3	3	0	6.33
Black-capped Chickadee	3	2	-	1	-	3	19	2	5.00
Chestnut-backed Chickadee	0	0	-	0	-	0	0	6	1.00
Red-breasted Nuthatch	2	1	-	1	-	6	5	1	2.67
White-breasted Nuthatch	2	3	-	0	-	0	0	0	0.83
Brown Creeper	0	0	-	0	-	0	0	1	0.17
Bewick's Wren	0	0	-	0	-	0	1	0	0.17
House Wren	7	12	-	6	-	8	0	7	6.67
Golden-crowned Kinglet	1	3	-	0	-	7	0	2	2.17
Ruby-crowned Kinglet	1	0	-	0	-	0	0	0	0.17
Western Bluebird	0	0	-	1	-	0	0	0	0.17
Mountain Bluebird	0	1	-	0	-	0	0	0	0.17
Swainson's Thrush	10	6	-	16	-	2	3	2	6.50
Hermit Thrush	26	11	-	29	-	10	15	7	16.33
American Robin	121	82	-	70	-	38	37	51	66.50
European Starling	15	41	-	51	-	15	26	149	49.50
Cedar Waxwing	4	1	-	11	-	2	19	0	6.17
Orange-crowned Warbler	0	0	-	0	-	1	0	3	0.67
Nashville Warbler	0	0	-	0	-	4	6	14	4.00
Yellow Warbler	9	16	-	11	-	3	0	2	6.83

Table 17 (*continued*). North American Breeding Bird Survey data, Route 25 (Snowden) 1991 through 1998.

Breeding Bird Survey Results for Route 89025									
Group/Species	1991	1992	1993	1994	1995	1996	1997	1998	Average
Passerines (*continued*)									
Audubon's Warbler	2	2	-	0	-	0	2	0	1.00
Black-throated Gray Warbler	1	0	-	0	-	5	9	7	3.67
Townsend's Warbler	0	0	-	0	-	0	3	0	0.50
Hermit Warbler	1	0	-	5	-	0	0	0	1.00
MacGillivray's Warbler	4	3	-	8	-	6	4	2	4.50
Common Yellowthroat	0	0	-	0	-	1	3	1	0.83
Wilson's Warbler	0	0	-	0	-	4	3	5	2.00
Yellow-breasted Chat	1	1	-	0	-	0	0	0	0.33
Western Tanager	32	11	-	40	-	7	7	3	16.67
Spotted Towhee	24	30	-	51	-	24	10	20	26.50
Chipping Sparrow	14	21	-	19	-	15	9	10	14.67
Lark Sparrow	1	1	-	8	-	0	0	0	1.67
Song Sparrow	4	1	-	1	-	4	3	6	3.17
White-crowned Sparrow	61	54	-	106	-	26	36	30	52.17
Golden-crowned Sparrow	0	0	-	0	-	0	0	0	0.00
Dark-eyed Junco (Oregon)	15	10	-	5	-	22	13	35	16.67
Black-headed Grosbeak	36	43	-	28	-	10	12	8	22.83
Lazuli Bunting	4	1	-	0	-	4	5	0	2.33
Red-winged Blackbird	3	9	-	3	-	10	18	3	7.67
Western Meadowlark	28	21	-	29	-	5	0	0	13.83
Brewer's Blackbird	34	23	-	52	-	11	3	1	20.67
Brown-headed Cowbird	11	9	-	8	-	19	9	20	12.67
Bullock's Oriole	0	0	-	1	-	0	0	0	0.17
Purple Finch	35	15	-	10	-	7	12	11	15.00
Cassin's Finch	0	0	-	6	-	0	0	0	1.00
House Finch	21	29	-	44	-	0	0	1	15.83
Pine Siskin	0	0	-	0	-	2	0	0	0.33
American Goldfinch	10	15	-	13	-	4	8	13	10.50
Evening Grosbeak	12	18	-	15	-	0	0	1	7.67
House Sparrow	16	4	-	22	-	11	3	15	11.83
Total Passerines	738	648	-	827	-	373	386	539	585.17
Total birds	**794**	**677**	**-**	**841**	**-**	**382**	**405**	**553**	**608.67**
Total species	**62**	**56**	**-**	**48**	**-**	**48**	**47**	**47**	**51.33**

Table 18. North American Breeding Bird Survey data, Route 26 (Bickleton) 1991 through 2001.

Breeding Bird Survey Results for Route 89026												
Group/Species	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Average**
Waterfowl												
Mallard	1	0	0	0	0	0	0	0	0	-	0	0.1
Total Waterfowl	1	0	0	0	0	0	0	0	0	-	0	0.1
Raptors												
Red-tailed Hawk	0	0	0	2	3	8	9	7	0	-	0	2.9
American Kestrel	2	7	2	8	0	0	0	3	4	-	0	2.6
Northern Harrier	0	1	2	0	0	0	0	2	3	-	0	0.8
Swainson's Hawk	0	0	0	2	1	0	0	0	0	-	0	0.3
Prairie Falcon	0	1	0	0	0	0	0	0	0	-	0	0.1
Great Horned Owl	1	0	0	0	0	0	0	0	0	-	0	0.1
Short-eared Owl	0	0	0	0	0	0	1	3	0	-	0	0.4
Total Raptors	3	9	4	12	4	8	10	15	7	-	0	7.2
Upland Game Birds												
California Quail	6	2	1	1	7	0	0	3	2	-	8	3
Chukar	0	0	0	0	0	0	0	0	0	-	0	0
Ring-necked Pheasant	5	0	0	4	2	1	1	0	1	-	0	1.4
Ruffed Grouse	0	0	0	0	0	0	0	0	0	-	0	0
Total Upland Game Birds	11	2	1	5	9	1	1	3	3	-	8	4.4
Shorebirds												
Killdeer	0	0	3	2	1	0	0	2	8	-	2	1.8
Total Shorebirds	0	0	3	2	1	0	0	2	8	-	2	1.8
Nonpasserine Land Birds												
Rock Dove	0	0	0	0	1	1	0	2	0	-	0	0.4
Mourning Dove	7	6	4	8	5	3	3	6	7	-	11	6
Common Nighthawk	0	0	1	0	6	0	0	4	1	-	0	1.2
Northern Flicker (Red-shafted)	0	0	0	0	0	1	0	1	0	-	0	0.2
Total Nonpasserine Land Birds	7	6	5	8	12	5	3	13	8	-	11	7.8
Passerines												
Dusky Flycatcher	0	0	0	0	0	0	0	0	0	-	0	0
Say's Phoebe	0	0	0	0	0	1	0	0	0	-	0	0.1
Western Kingbird	5	2	1	6	6	4	4	1	4	-	0	3.3
Loggerhead Shrike	0	1	0	2	2	2	0	3	0	-	0	1
Black-billed Magpie	2	0	0	1	0	0	0	0	0	-	0	0.3
American Crow	1	2	0	3	3	0	0	0	3	-	3	1.5
Common Raven	0	1	0	0	1	1	0	2	0	-	6	1.1

Table 18 (*continued*). North American Breeding Bird Survey data, Route 26 (Bickleton) 1991 through 2001.

Breeding Bird Survey Results for Route 89026												
Group/Species	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Average**
Passerines (*continued*)												
Horned Lark	62	35	15	63	59	74	40	263	49	-	15	67.5
Tree Swallow	0	0	0	0	2	0	0	0	0	-	1	0.3
Violet-green Swallow	0	0	0	0	0	0	0	1	0	-	0	0.1
Northern Rough-winged Swallow	0	4	0	0	0	0	0	0	0	-	0	0.4
Cliff Swallow	4	0	0	3	20	6	4	50	20	-	0	10.7
Barn Swallow	2	2	3	8	1	8	2	0	4	-	5	3.5
Western Bluebird	0	0	0	0	0	0	0	0	8	-	0	0.8
Mountain Bluebird	24	23	26	31	46	18	31	49	25	-	5	27.8
American Robin	4	5	1	1	4	5	3	1	1	-	15	4
Sage Thrasher	4	0	0	1	0	0	0	0	0	-	0	0.5
European Starling	0	0	1	12	8	13	5	3	0	-	0	4.2
Brewer's Sparrow	0	3	0	0	0	0	0	1	0	-	0	0.4
Vesper Sparrow	0	0	0	0	0	2	1	0	0	-	0	0.3
Lark Sparrow	0	0	0	1	0	0	0	0	0	-	0	0.1
Savannah Sparrow	0	0	1	1	0	0	0	0	0	-	0	0.2
Grasshopper Sparrow	0	0	0	0	0	1	0	0	0	-	0	0.1
Black-headed Grosbeak	0	0	1	0	0	1	0	0	0	-	0	0.2
Red-winged Blackbird	1	0	0	0	9	0	0	2	0	-	2	1.4
Western Meadowlark	56	22	42	42	112	104	43	72	65	-	36	59.4
Brewer's Blackbird	1	24	27	2	0	1	10	9	16	-	4	9.4
Brown-headed Cowbird	0	0	2	0	0	0	0	0	0	-	0	0.2
Bullock's Oriole	0	0	0	0	0	0	2	0	0	-	0	0.2
House Finch	0	3	2	6	1	0	16	0	0	-	0	2.8
American Goldfinch	0	3	1	1	0	0	2	1	0	-	6	1.4
House Sparrow	0	0	0	0	5	0	0	2	0	-	0	0.7
Total Passerines	166	130	123	184	279	241	163	460	195	-	98	203.9
Total birds	**188**	**147**	**136**	**211**	**305**	**255**	**177**	**493**	**221**	**-**	**119**	**225.2**
Total species	**18**	**19**	**19**	**24**	**23**	**20**	**17**	**25**	**17**	**-**	**14**	**19.6**

Table 19. National Audubon Society Christmas Bird Count, Lyle count circle, Sectors 1,3,4, and 5, conducted 16 December, 2001.

2001 Lyle Christmas Bird Count, Sunday, Dec. 16th						
Group/Species	**Catherine Creek**	**Silva Creek**	**Klickitat Canyon**	**Columbia Hills**	**Dalles-port**	**TOTALS**
Waterfowl						
Canada Goose	30			282	234	546
Ring-necked Duck	1			86	109	196
American Wigeon	15			95	27	137
Northern Pintail					125	125
Common Merganser	2		12	95		109
Lesser Scaup	67					67
Gadwall	12			9	18	39
Mallard	5				32	37
Bufflehead	7			23	4	34
Scaup, sp.					25	25
Hooded Merganser	8			9	2	19
Common Goldeneye	5		4		9	18
American Green-winged Teal					12	12
Duck, sp.	3					3
Total Waterfowl	155	0	16	599	597	1367
Raptors						
Red-tailed Hawk	5	4	7	4	4	24
Bald Eagle	1		5		1	7
Rough-legged Hawk			6			6
American Kestrel	2		1	2		5
Golden Eagle		1			1	2
Falcon, sp.					1	1
Prairie Falcon			1			1
Total Raptors	8	5	20	6	7	46
Upland Game Birds						
California Quail	10		32	25	3	70
Wild Turkey	50					50
Ring-necked Pheasant					1	1
Total Upland Game Birds	60	0	32	25	4	121
Other Water Birds						
California Gull	26		4		355	385
Western Grebe	54				2	56
Gull, sp.	55				1	56
Ring-billed Gull	8		2		40	50
Double-crested Cormorant	11		5	3	28	47
Great Blue Heron	6	1	2	1	3	13
Pied-billed Grebe				2	8	10
Horned Grebe	2				7	9
Herring Gull					5	5
Red-necked Grebe					4	4
W.x Glaucous-winged Gull	1					1

Total Other Water Birds	163	1	13	6	453	636
Shorebirds						
Virginia Rail	1					1
Total Shorebirds	1	0	0	0	0	1
Nonpasserine Land Birds						
Rock Dove	50			51	55	156
Northern Flicker	13	9	7	9	6	44
Downy Woodpecker	1	7	1		3	12
Lewis's Woodpecker	5	1		2		8
Belted Kingfisher			3	2	2	7
Hairy Woodpecker		1				1
Anna's Hummingbird			1			1
Acorn Woodpecker	1					1
Total Nonpasserine Land Birds	70	18	12	64	66	230
Passerines						
Dark-eyed (Oregon) Junco	56	141	85	47	133	462
European Starling	40		42	11	281	374
Red-winged Blackbird	45		6	66	202	319
House Sparrow	3	8	42	24	80	157
House Finch	40		82	10	12	144
Golden-crowned Sparrow	4	3	20	26	34	87
Pine Siskin	39		37		3	79
White-crowned Sparrow	1		20	28	21	70
Golden-crowned Kinglet		54	5			59
Black-capped Chickadee	2	24	8	7	16	57
Scrub Jay	8	16	10	12	8	54
Song Sparrow	1	7	13	10	18	49
Common Raven	2	22	11	4	4	43
Steller's Jay	5	33	5			43
American Crow	2	15	24		1	42
American Robin	5		1		35	41
Varied Thrush	13	9	2	3	4	31
Ruby-crowned Kinglet		6	7	9	5	27
American Goldfinch			18		8	26
Spotted Towhee	5	4	3		9	21
Winter Wren	1	14			2	17
Red-breasted Nuthatch		14	2			16
Common Redpoll	15					15
Brown Creeper	1	11				12
Hermit Thrush	1		2	3		6
Brewer's Blackbird			2		3	5
Canyon Wren	1		1	3		5
American Dipper		2	3			5
White-breasted Nuthatch	1	3	1			5
Black-billed Magpie				4		4
Lincoln's Sparrow				3		3
Western Meadowlark				3		3
Chestnut-backed Chickadee		2				2
Nuthatch, sp.	1					1
Townsend's Solitaire					1	1
Mountain Chickadee		1				1

Rock Wren					1	1
Bewick's Wren			1			1
Fox Sparrow			1			1
Townsend's Warbler			1			1
Purple Finch	1					1
Total Passerines	293	389	455	273	881	2291
Total birds	750	413	548	973	2008	4692

Table 20. National Audubon Society Christmas Bird Count, Lyle count circle, Sectors 1,3,4, and 5, conducted December 17, 2000.

2000 Lyle Christmas Bird Count, Sunday, Dec. 17th						
Group/Species	**Catherine Creek**	**Silva Creek**	**Klickitat Canyon**	**Columbia Hills**	**Dalles-port**	**TOTALS**
Waterfowl						
Canada Goose	54	10		258	116	438
Common Merganser	10		6	260		276
Ring-necked Duck				100		100
American Wigeon	48			32	4	84
Mallard	2		50		10	62
Wood Duck	45					45
Scaup,species					29	29
Greater Scaup	17					17
Duck, sp.	16					16
Gadwall	12				3	15
Common Goldeneye	3		2		6	11
Barrow's Goldeneye				10	1	11
Canvasback	11					11
Bufflehead	1			9		10
Hooded Merganser	6			2		8
Lesser Scaup	3				1	4
Redhead					2	2
Total Waterfowl	228	10	58	671	172	1139
Raptors						
Red-tailed Hawk	4	5	3	8	3	23
Bald Eagle	2	5	4			11
Golden Eagle			6	1		7
Rough-legged Hawk	1		1	2		4
American Kestrel	1			2	1	4
Large Falcon, sp.	1	1	1			3
Northern Harrier				3		3
Peregrine Falcon				2		2
Ferruginous Hawk					1	1
Sharp-shinned Hawk	1					1
Buteo, sp.					1	1
Eagle, sp.		1				1
Western Screech Owl		1				1
Total Raptors	10	13	15	18	6	62
Upland Game Birds						
California Quail	8	36	1	20	1	66
Ring-necked Pheasant				2	1	3
Total Upland Game Birds	8	36	1	22	2	69
Other Water Birds						
Double-crested Cormorant	40			39	4	83
Pied-billed Grebe	5			1	12	18
American Coot	4			4	8	16

Western Grebe	11				5	16
Gull, species	3			7	2	12
Great Blue Heron	3				2	5
Herring Gull	4					4
Ring-billed Gull	1	1				2
Horned Grebe	1					1
Black-crowned Night Heron					1	1
California Gull	1					1
W.x Glaucous-winged Gull					1	1
Glaucous-winged Gull	1					1
Total Other Water Birds	74	1	0	51	35	161
Shorebirds						
Killdeer	1			2		3
Common Snipe	1				1	2
Virginia Rail	1					1
Total Shorebirds	3	0	0	2	1	6
Nonpasserine Land Birds						
Rock Dove					147	147
Lewis's Woodpecker	48	46	3	4		101
Northern Flicker	15	16	18	13	7	69
Belted Kingfisher	4	1	2	1	2	10
Downy Woodpecker	5	1		2		8
Hairy Woodpecker		2				2
Red-naped Sapsucker		1				1
Acorn Woodpecker	1					1
Pileated Woodpecker		1				1
Mourning Dove					1	1
Total Nonpasserine Land Birds	73	68	23	20	157	341
Passerines						
Dark-eyed (Oregon) Junco	132	93	95	158	90	568
European Starling	231	27	51	57	39	405
Brewer's Blackbird	40		1	25	182	248
Scrub Jay	46	9	27	17	7	106
White-crowned Sparrow	2			46	57	105
Steller's Jay	22	52	19	3		96
House Finch			4	62	29	95
Red-winged Blackbird	7			2	68	77
American Robin	2		8	3	54	67
Song Sparrow	5	3	4	6	31	49
Black-capped Chickadee	8	14	12	7	6	47
Common Raven	7	10	16	4	5	42
Western Meadowlark			2	39	1	42
Golden-crowned Sparrow	9			4	26	39
Spotted Towhee	15	1	6	1	12	35
House Sparrow	11	7		3	11	32
Chestnut-backed Chickadee		28				28
American Goldfinch			1	25		26
Finch, sp.			25			25
Golden-crowned Kinglet	8	10		1	5	24
Lesser Goldfinch	3		15		4	22
American Crow	4		18			22

Bushtit	8		6			14
Varied Thrush	7	1	5		1	14
Ruby-crowned Kinglet	4	1	1	1	6	13
Black-billed Magpie				9		9
Canyon Wren	2	2		3	2	9
Western Bluebird				4	4	8
Red-breasted Nuthatch	1	2	5			8
Pine Siskin	2		5			7
Horned Lark				6		6
Bewick's Wren	1			1	3	5
Fox Sparrow					3	3
Hermit Thrush	1				2	3
Yellow-rumped Warbler					3	3
American Dipper			2			2
Mountain Chickadee		2				2
Marsh Wren					2	2
Yellow-rumped Warbler (Audubon's)					1	1
White-breasted Nuthatch	1					1
Total Passerines	579	262	328	487	654	2310
						0
Total birds	975	390	425	1271	1027	4088
Total species	63	29				

Table 21. National Audubon Society Christmas Bird Count, Lyle count circle, Sectors 1,3,4, and 5, conducted December 19, 1999.

1999 Lyle Christmas Bird Count, Sunday, Dec. 19th						
Group/Species	**Catherine Creek**	**Silva Creek**	**Klickitat Canyon**	**Columbia Hills**	**Dalles-port**	**Total**
Waterfowl						
Common Merganser	70				115	185
American Wigeon	34			8	90	132
Canada Goose	28			11	79	118
Mallard	30	3	15	16		64
Ring-necked Duck	28				15	43
Common Goldeneye	1		4		22	27
Bufflehead	12			1	12	25
Lesser Scaup	21				1	22
Gadwall	14					14
Hooded Merganser	1		12			13
Barrow's Goldeneye					13	13
Wood Duck	12					12
Duck, sp.	8					8
Scaup, sp.					4	4
White-winged Scoter	3					3
Greater Scaup	2				1	3
Swan, sp.					3	3
Redhead	1					1
Eurasian Wigeon					1	1
Total Waterfowl	265	3	31	36	356	691
Raptors						
Red-tailed Hawk	7	4	5	10	5	31
Rough-legged Hawk			5	3		8
Northern Harrier			2	3	1	6
American Kestrel	2			4		6
Bald Eagle	1		4			5
Western Screech Owl		3				3
Cooper's Hawk			1	1	1	3
Peregrine Falcon	1			1		2
Golden Eagle	1			1		2
Hawk, sp. (buteo)					1	1
Total Raptors	12	7	17	23	8	67
Upland Game Birds						
California Quail	1		14	18	18	51
Ring-necked Pheasant				1	2	3
Total Upland Game Birds	1	0	14	19	20	54
Other Water Birds						
Western Grebe					40	40
Double-crested Cormorant	9				15	24
Pied-billed Grebe	2				22	24
Great Blue Heron	4				7	11
American Coot	2				7	9

Gull, species	4				1	5
Glaucous-winged Gull	1				2	3
Ring-billed Gull	2				1	3
California Gull	1				1	2
W.x Glaucous-winged Gull					1	1
Total Other Water Birds	25	0	0	0	97	122
Shorebirds						
Common Snipe	2			4		6
Killdeer					1	1
Total Shorebirds	2	0	0	4	1	7
Nonpasserine Land Birds						
Lewis's Woodpecker	81	8	28			117
Rock Dove	4				78	82
Northern Flicker	29	15	12	15	4	75
Red-breasted Sapsucker	4	1				5
Acorn Woodpecker	2					2
Downy Woodpecker				1	1	2
Pileated Woodpecker		2				2
Belted Kingfisher					1	1
Hairy Woodpecker				1		1
Total Nonpasserine Land Birds	120	26	40	17	84	287
Passerines						
Dark-eyed (Oregon) Junco	135	74	45	54	55	363
European Starling	93	2			69	164
Brewer's Blackbird				20	66	86
Chestnut-backed Chickadee		49	17			66
House Finch	2		3		57	62
Scrub Jay	27	5	18	8	3	61
Golden-crowned Kinglet	4	50				54
Golden-crowned Sparrow	22			10	14	46
Black-capped Chickadee	8	18	4	5	4	39
Common Raven	5	12	8	10	2	37
American Goldfinch	5		20	8	3	36
Steller's Jay	4	21	9	1		35
House Sparrow	10			1	21	32
Song Sparrow	8			4	18	30
Western Bluebird				24		24
White-crowned Sparrow	1		1	2	20	24
American Crow	16	3			1	20
Lesser Goldfinch	16		4			20
Ruby-crowned Kinglet	4	1		8	5	18
Red-winged Blackbird					16	16
Red-breasted Nuthatch	3	9	3			15
Spotted Towhee	9				6	15
American Robin	4	7			2	13
Pine Siskin	9				1	10
Fox Sparrow				1	7	8
Black-billed Magpie		3		5		8
Mountain Chickadee	1	7				8
Bewick's Wren	2			3	2	7
Brown Creeper		5				5

Northern Shrike			4		1	5
Sparrow, sp.					4	4
Canyon Wren	1			3		4
White-breasted Nuthatch	3	1				4
Western Meadowlark				1	3	4
Yellow-rumped Warbler (Audubon's)	3					3
Winter Wren	1	2				3
Purple Finch	3					3
Bushtit					2	2
American Dipper			2			2
Hermit Thrush				1	1	2
Yellow-rumped Warbler					1	1
Slate-colored Junco					1	1
Marsh Wren					1	1
Total Passerines	399	269	138	169	386	1361
Total birds>	824	305	240	268	952	2589

Table 22. National Audubon Society Christmas Bird Count, Lyle count circle, Sectors 1,3,4, and 5, conducted December 26, 1998.

1998 Lyle Christmas Bird Count, Saturday, Dec. 26th				
Group/Species	**Catherine Creek**	**Klickitat Canyon**	**Columbia Hills Dallesport**	**Total**
Waterfowl				
Canada Goose	26	8	459	493
Duck, sp.			161	161
American Wigeon	35	1	113	149
Mallard	18	1	79	98
Green-winged Teal			51	51
Scaup, sp.			46	46
Bufflehead	6	10	26	42
Common Merganser	10	20		30
Canvasback	18			18
Common Goldeneye	2	13	1	16
Northern Pintail	6			6
Redhead	6			6
Hooded Merganser	3	2		5
Ring-necked Duck	3			3
Northern Shoveler	1			1
Lesser Scaup			1	1
Total Waterfowl	134	55	937	1126
Raptors				
Red-tailed Hawk	13	7	15	35
Northern Harrier		8	2	10
American Kestrel	2	1	4	7
Bald Eagle	2	6		8
Rough-legged Hawk		4	1	5
Golden Eagle	1	8		9
Sharp-shinned Hawk	2		2	4
Hawk, sp. (buteo)		1	3	4
Peregrine Falcon	1		1	2
Cooper's Hawk		1		1
Merlin		1		1
Prairie Falcon			1	1
Great Horned Owl			1	1
Total Raptors	21	37	30	88
Upland Game Birds				
California Quail		14	30	44
Ring-necked Pheasant	1		3	4
Total Upland Game Birds	1	14	33	48
Other Water Birds				
American Coot	24	16	169	209
Double-crested Cormorant	36		4	40
Gull, sp.	20		10	30
Ring-billed Gull	17	1		18

Great Blue Heron	3	1	3	7
Western Grebe	2			2
Pied-billed Grebe	1		1	2
Total Other Water Birds	103	18	187	308
Shorebirds				
Killdeer	9			9
Common Snipe	1		2	3
Dunlin			3	3
Total Shorebirds	10	0	5	15
Nonpasserine Land Birds				
Northern Flicker	29	16	12	57
Rock Dove	20		17	37
Lewis's Woodpecker	9	16		25
Belted Kingfisher	1	5	1	7
Downy Woodpecker	1	5		6
Acorn Woodpecker	2			2
Hummingbird, sp.		1		1
Pileated Woodpecker		1		1
Total Nonpasserine Land Birds	62	44	30	136
Passerines				
Dark-eyed (Oregon) Junco	118	108	66	292
European Starling	48	38	75	161
Brewer's Blackbird	25	2	63	90
American Crow	38	3	25	66
House Finch	4		50	54
Steller's Jay	33	14		47
Red-winged Blackbird			36	36
American Goldfinch	2	17	12	31
Scrub Jay	11	13	5	29
Golden-crowned Sparrow		3	23	26
Common Raven	8	13	4	25
Western Bluebird	1		23	24
Black-capped Chickadee	1	17	5	23
House Sparrow	1		21	22
White-crowned Sparrow		2	18	20
Song Sparrow	3	9	7	19
Varied Thrush	4	9		13
Black-billed Magpie		6	6	12
Spotted Towhee	5	5	2	12
American Robin	4	8		12
Chestnut-backed Chickadee	12			12
Western Meadowlark			10	10
White-breasted Nuthatch	4	5		9
Northern Shrike	2	4		6
Brown Creeper	1	5		6
Canyon Wren	1		4	5
Red-breasted Nuthatch	3	1		4
Golden-crowned Kinglet		4		4
Yellow-rumped Warbler (Audubon's)	1		2	3
Mountain Chickadee		3		3
American Dipper		1		1

Hermit Thrush			1	1
Say's Phoebe			1	1
Pine Siskin	1			1
Winter Wren		1		1
Fox Sparrow			1	1
Total Passerines	331	291	460	1082
Total birds	662	459	1682	2803

Table 23. National Audubon Society Christmas Bird Count, Lyle count circle, Sectors 1,3,4, and 5, conducted 28th December, 1997.

1997 Lyle Christmas Bird Count, December 28th					
Group/Species	**R.Lake**	**K.River**	**S.Butte**	**D-port**	**Total**
Waterfowl					
Canada Goose	63	238	79	977	1357
Common Merganser	120	29		80	229
American Wigeon	31			116	147
Scaup, sp.	125				125
Greater Scaup	4			90	94
Mallard	49		11	21	81
Common Goldeneye		5		63	68
Lesser Scaup				64	64
Ring-necked Duck	5			42	47
Bufflehead	6	4	4	26	40
Wood Duck	31				31
Gadwall	15			12	27
Canvasback	15	5		7	27
Green-winged Teal	1			18	19
Northern Shoveler				15	15
Hooded Merganser	9			2	11
Northern Pintail				6	6
Red-breasted Merganser				2	2
Barrow's Goldeneye				1	1
Redhead	1				1
Total Waterfowl	475	281	94	1542	2392
Raptors					
Red-tailed Hawk	6	4	12	14	36
American Kestrel			2	8	10
Northern Harrier		1	1	7	9
Bald Eagle	7	3	1	1	12
Rough-legged Hawk			4		4
Golden Eagle	2				2
Cooper's Hawk				1	1
Peregrine Falcon	1				1
Total Raptors	16	8	20	31	75
Upland Game Birds					
California Quail	1	19	12		32
Chukar			10		10
Ring-necked Pheasant			4	3	7
Gray Partridge				4	4
Total Upland Game Birds	1	19	26	7	53
Other Water Birds					
American Coot	146	1		364	511
Double-crested Cormorant	20	13	0	11	44
Western Grebe	15	0	0	6	21
Glaucous-winged Gull	7	1		5	13
Pied-billed Grebe	1	0	0	11	12

Ring-billed Gull	3			4	7
Great Blue Heron	3	0	0	3	6
Horned Grebe	0	0	0	6	6
California Gull		5			5
Total Other Water Birds	195	20	0	410	625
Shorebirds					
Killdeer				25	25
Common Snipe	2		8		10
Least Sandpiper				4	4
Total Shorebirds	2	0	8	29	39
Nonpasserine Land Birds					
Rock Dove		37	1	87	125
Northern Flicker	21	6	12	26	65
Lewis's Woodpecker	46	6		1	53
Downy Woodpecker	2	4		2	8
Belted Kingfisher	2	1	1	2	6
Mourning Dove				5	5
Acorn Woodpecker	3				3
Pileated Woodpecker		2			2
Red-breasted Sapsucker		1			1
Hairy Woodpecker	1				1
Total Nonpasserine Land Birds	75	57	14	123	269
Passerines					
European Starling	125	37	314	160	636
Dark-eyed (Oregon) Junco	120	103	75	119	417
Red-winged Blackbird			4	310	314
American Crow	4	187		1	192
American Goldfinch		55	65	4	124
Brewer's Blackbird				102	102
House Finch	13	11	22	54	100
White-crowned Sparrow	3	4	34	43	84
House Sparrow	21	17	12	17	67
Spotted Towhee	42	13	2	8	65
Scrub Jay	31	23	1	8	63
Golden-crowned Sparrow	12	12	11	23	58
Steller's Jay	46	7	1		54
Song Sparrow	11	15	13	15	54
Golden-crowned Kinglet	38			3	41
Black-billed Magpie		1	1	33	35
Ruby-crowned Kinglet	7	7	5	11	30
Black-capped Chickadee	9	7	7	5	28
Western Meadowlark	1		3	21	25
Common Raven	11	5	4	5	25
Red-breasted Nuthatch	13	4	1		18
Yellow-rumped Warbler (Audubon's)		11		5	16
Chestnut-backed Chickadee	15				15
Varied Thrush	13				13
American Robin		10	1	1	12
Canyon Wren	1		3	4	8
Evening Grosbeak		7			7
Lesser Goldfinch	1	5			6

Horned Lark		4			4
Northern Shrike		1	1	1	3
Bewick's Wren				3	3
Hermit Thrush				2	2
American Dipper		2			2
Winter Wren	2				2
Slate-colored Junco				1	1
Say's Phoebe				1	1
White-breasted Nuthatch	1				1
Fox Sparrow	1				1
Total Passerines	541	548	580	960	2629
Total birds	1305	933	742	3102	6082

Table 24. National Audubon Society Christmas Bird Count, Columbia Hills – Klickitat Valley count circle, 1996 through 2001.

Columbia Hills-Klickitat Valley Christmas Bird Count							
	Dec. 25	Dec. 25	Jan. 02	Dec. 26	Dec. 30	Dec. 29	Average
Group/Species	**1996**	**1997**	**1999**	**1999**	**2000**	**2001**	**Count**
Waterfowl							
Canada Goose	1547	1895	1834	2378	802	645	1516.83
Canada Goose (small races)		cw		48		1	8.17
Trumpeter Swan					1		0.17
Swan, sp.				18			3.00
Wood Duck			7				1.17
Gadwall	53	1	1	1	20	70	24.33
Eurasian Wigeon		1					0.17
American Wigeon	49	8	275	6	60	93	81.83
Mallard	749	559	560	781	2773	451	978.83
Northern Shoveler	4	cw		cw	48	45	16.17
Northern Pintail	30	1	18	6	7		10.33
American Green-winged Teal	4	1	1	4	30	6	7.67
Canvasback	1		12	4	5	cw	3.67
Redhead	13	1	5	6	5	2	5.33
Ring-necked Duck	72	9	55	45	103	224	84.67
Greater Scaup	179	310	769	593	1785	117	625.50
Lesser Scaup	369	221	1211	229	364	215	434.83
Scaup, sp.	507			2586		15	518.00
Long-tailed Duck					1		0.17
Bufflehead	23	20	35	33	56	36	33.83
Common Goldeneye	253	148	224	432	1130	716	483.83
Barrow's Goldeneye	161	30	187	109	432	38	159.50
Goldeneye, sp.	36						6.00
Hooded Merganser	2	7	4	4	7	6	5.00
Red-breasted Merganser						2	0.33
Common Merganser	1		5		1		1.17
Ruddy Duck		4					0.67
Duck, sp.		91	6	18			19.17
Total Waterfowl	4053	3307	5209	7301	7630	2682	5030.33
Raptors							
Bald Eagle	3	5	8	4	3	6	4.83
Golden Eagle	5	1	4		2	2	2.33
Red-tailed Hawk	61	39	75	65	43	36	53.17
Harlan's Hawk	1						0.17
Ferruginous Hawk			1				0.17
Rough-legged Hawk	19	29	38	49	22	7	27.33
Northern Harrier	13	23	55	20	5	6	20.33
Cooper's Hawk	2	3	6	2	2	1	2.67
Sharp-shinned Hawk			2	1		3	1.00
American Kestrel	25	19	28	36	18	23	24.83
Merlin	cw	2	1	1	1		0.83
Peregrine Falcon		1	1	1	1	1	0.83
Prairie Falcon	2	5	12	4	3	4	5.00

Table 24 (*continued*). National Audubon Society Christmas Bird Count, Columbia Hills – Klickitat Valley count circle, 1996 through 2001.

Columbia Hills-Klickitat Valley Christmas Bird Count							
	Dec. 25	Dec. 25	Jan. 02	Dec. 26	Dec. 30	Dec. 29	Average
Group/Species	**1996**	**1997**	**1999**	**1999**	**2000**	**2001**	**Count**
Eagle, sp.			1				0.17
Hawk, sp.	1		2				0.50
Buteo, sp.	5	2	10	3			3.33
Accipiter, sp.	3	1		1	1		1.00
Large Falcon, sp.						1	0.17
Falcon, sp.	2	1	1				0.67
Barn Owl	2	1	cw		1		0.67
Great Horned Owl	3	6	6	2		3	3.33
Western Screech Owl	1	0	2				0.50
Northern Pygmy Owl	1					1	0.33
Long-eared Owl	cw						0.00
Short-eared Owl			1	1			0.33
Total Raptors	149	138	254	190	102	94	154.50
Upland Game Birds							
Gray Partridge	16	37	20		8	10	15.17
Chukar	2	9					1.83
Ring-necked Pheasant	16	12	8	1	4	4	7.50
Wild Turkey			3		5		1.33
California Quail	34	87	302	135	63	272	148.83
Total Upland Game Birds	68	145	333	136	80	286	174.67
Other Water Birds							
Pied-billed Grebe	1		2	1	5	2	1.83
Horned Grebe	3	10	5	1		2	3.50
Western Grebe			7	4	8	87	17.67
Double-crested Cormorant	19	29	15	49	24	24	26.67
Great Blue Heron	5	8	10	8	10	13	9.00
Pacific Loon						8	1.33
Red-throated Loon			1				0.17
Common Loon				1	3	2	1.00
Total Other Water Birds	28	47	40	64	50	138	61.17
Shorebirds							
Killdeer	19	24	16	33	4	31	21.17
Dunlin						1	0.17
Virginia Rail	1	cw	1		1	2	0.83
Common Snipe	cw	1		2	2	4	1.50
American Coot	263	22	122	9	222	225	143.83
Total Shorebirds	283	47	139	44	229	263	167.50
Gulls and Terns							
California Gull	3	1	4	3	14	359	64.00
Gull, sp.		10		3	9	7	4.83
Western Gull						2	0.33

Table 24 (*continued*). National Audubon Society Christmas Bird Count, Columbia Hills – Klickitat Valley count circle, 1996 through 2001.

Columbia Hills-Klickitat Valley Christmas Bird Count							
	Dec. 25	Dec. 25	Jan. 02	Dec. 26	Dec. 30	Dec. 29	Average
Group/Species	1996	1997	1999	1999	2000	2001	Count
Ring-billed Gull	6	5	3	6	2	12	5.67
Herring Gull	3						0.50
Glaucous-winged Gull	27	1	1	6	10	5	8.33
Glaucous-winged Gull X Western Gull (hybrid)		3	2		1		1.00
Total Gulls and Terns	39	20	10	18	36	385	84.67
Nonpasserine Land Birds							
Rock Dove	511	314	632	467	269	131	387.33
Mourning Dove	32	21	76	52	13	15	34.83
Lewis' Woodpecker		23	35	21	4	29	18.67
Belted Kingfisher	1		3	3	3	4	2.33
Downy Woodpecker	7	8	6	3	6	9	6.50
Hairy Woodpecker	6		5	1	3		2.50
White-headed Woodpecker	cw		1				0.17
Northern Flicker	55	64	81	41	47	20	51.33
Northern Flicker			1				0.17
Total Nonpasserine Land Birds	612	430	840	588	345	208	503.83
Passerines							
Say's Phoebe					2	1	0.50
Loggerhead Shrike			1				0.17
Northern Shrike	4	7	10	7	4	2	5.67
Shrike, sp.		3					0.50
Steller's Jay	26	13	37	15	11	8	18.33
Western Scrub Jay	12	21	41	15	26	37	25.33
Black-billed Magpie	61	41	79	51	24	18	45.67
American Crow	17	7	9	35	33	15	19.33
Common Raven	140	151	169	69	90	68	114.50
Horned Lark		445	76	361	225	115	203.67
Black-capped Chickadee	44	26	29	34	21	18	28.67
Mountain Chickadee	11	5	15	2	17	1	8.50
Chickadee, sp.						10	1.67
Red-breasted Nuthatch	6	8	12	8	3	1	6.33
White-breasted Nuthatch	13	10	16	5	10	2	9.33
Pygmy Nuthatch	1	2	3	12	2		3.33
Brown Creeper	3		12				2.50
Rock Wren			2	2	2	2	1.33
Canyon Wren	2	4	8	10	5	1	5.00
Bewick's Wren	7	9	6	10	9	16	9.50
Winter Wren	1	2	2			2	1.17
Marsh Wren	3	1	2	6		2	2.33
American Dipper				2	1	1	0.67
Golden-crowned Kinglet	2	63			12	4	13.50
Ruby-crowned Kinglet	2	21	13	12	15	11	12.33
Townsend's Solitaire	7	3	7	8	3	2	5.00

Table 24 (*continued*). National Audubon Society Christmas Bird Count, Columbia Hills – Klickitat Valley count circle, 1996 through 2001.

Columbia Hills-Klickitat Valley Christmas Bird Count							
	Dec. 25	Dec. 25	Jan. 02	Dec. 26	Dec. 30	Dec. 29	Average
Group/Species	**1996**	**1997**	**1999**	**1999**	**2000**	**2001**	**Count**
Hermit Thrush	cw	12	5	4	3	8	5.33
American Robin	3	25	46	25	91	35	37.50
Varied Thrush	8	4	16		22	14	10.67
European Starling	1364	1070	1763	2062	913	679	1308.50
American Pipit			1	2	80	1	14.00
Cedar Waxwing		41	1		17		9.83
Orange-crowned Warbler				cw			0.00
Yellow-rumped Warbler		19	3	2	3	3	5.00
Yellow-rumped Warbler (Audubon's)		14	1	10	22		7.83
Yellow-rumped Warbler (Myrtle)		2					0.33
Spotted Towhee	11	69	15	12	26	15	24.67
American Tree Sparrow		1					0.17
Savannah Sparrow						1	0.17
Fox Sparrow	2	3	2	cw	3	13	3.83
Song Sparrow	75	45	29	76	122	95	73.67
Lincoln's Sparrow	cw		3	3		6	2.00
Harris's Sparrow		1		1	2	2	1.00
White-crowned Sparrow	128	94	294	142	193	142	165.50
Golden-crowned Sparrow	15	19	25	49	29	169	51.00
Dark-eyed Junco (Slate-colored)		2	2	1	3		1.33
Dark-eyed Junco (Oregon)	492	614	607	332	529	575	524.83
Red-winged Blackbird	30		4	70	26	49	29.83
Western Meadowlark	32	56	225	35	49	47	74.00
Brewer's Blackbird	2	25	64	110		442	107.17
Blackbird, sp.	500			510	12	200	203.67
Brown-headed Cowbird		40	2	cw			7.00
Pine Grosbeak			1				0.17
Purple Finch	10	6	8		6		5.00
House Finch	182	188	298	426	239	210	257.17
Red Crossbill		60		1	12		12.17
Pine Siskin	5	14	30	56	51		26.00
Common Redpoll						103	17.17
Lesser Goldfinch	50	20	17	54	9	62	35.33
American Goldfinch	353	504	1011	887	591	230	596.00
Goldfinch, sp.	400						66.67
Evening Grosbeak			2		7		1.50
Carpodacus, sp.			18	48			11.00
Finch, sp.				110		14	20.67
House Sparrow	374	174	337	265	574	451	362.50
Sparrow, sp.			35	21	3		9.83
Total Passerines	4398	3964	5414	5978	4152	3903	4634.83
Total Birds	**9630**	**8098**	**12239**	**14319**	**12624**	**7959**	**10811.50**

Table 25. Results of the early winter raptor survey conducted at Columbia Hills, Klickitat County, Washington on December 12, 1998.

Species	Quadrants				Totals
	NW	***NE***	***SW***	***SE***	
Bald eagle	0	0	2	2	4
Northern harrier	22	23	7	5	57
Sharp-shinned hawk	0	1	1	0	2
Cooper's hawk	0	1	1	0	2
Accipiter sp.	0	1	0	0	1
Red-tailed hawk	29	33	17	22	101
Ferruginous hawk	0	1	0	0	1
Rough-legged hawk	6	14	4	0	24
Buteo sp.	0	2	0	4	6
Golden eagle	0	0	2	4	6
American kestrel	23	16	9	10	58
Peregrine falcon	0	0	2	1	3
Large falcon sp.	0	0	0	1	1
Hawk sp.	1	2	0	0	3
Burrowing owl	0	1	0	0	1
Totals	85	97	47	49	278
Also noted:					
Northern shrike	1	0	0	2	3

Table 26. Results of the late winter raptor survey conducted at Columbia Hills, Klickitat County, Washington on February 7, 1999.

Species	Quadrants				Totals
	NW	***NE***	***SW***	***SE***	
Bald eagle	0	5	6	7	18
Northern harrier	19	30	12	4	65
Sharp-shinned hawk	0	0	1	0	1
Accipiter sp.	2	2	0	1	5
Red-tailed hawk	6	15	21	22	70
Rough-legged hawk	4	13	1	2	20
Buteo sp.	1	0	3	2	6
Golden eagle	1	2	6	5	14
American kestrel	7	5	15	11	38
Peregrine falcon	1	0	1	0	2
Prairie falcon	0	1	5	4	10
Eagle sp.	0	1	1	1	3
Large falcon sp.	0	0	4	0	4
Diurnal raptor sp.	0	9	0	2	11
Barn owl	2	0	1	0	3
Totals	43	83	77	67	270
Also noted:					
Common Raven	18	0	23	8+	49+
Loggerhead shrike	1	0	1	0	2
Northern Shrike	0	0	2	1	3

Table 27. Wind turbine mortality estimates from studies conducted in the U.S. (from Erickson *et al.* 2001)

Study Area	State	Reference	Seasons	Dates	Turbines In study	Turbines In WRA	# bird fatalities /turbine/yr.	# raptors /turbine/yr
California								
Altamont Pass[b]	CA	Howell and Didonato (1991)	All	9/88-8/89	359	7340	na[b]	0.050
Altamont Pass[b]	CA	Howell and Didonato (1991)	All	9/90-8/91	150	7340	na[b]	0.007
Altamont Pass[b]	CA	Orloff and Flannery (1992)	All	89-90	1169	7340	na[b]	0.058
Altamont Pass[b]	CA	Orloff and Flannery (1992)	All	90-91	1169	7340	na[b]	0.023
Altamont Pass[b]	CA	Thelander (2000) pers. comm. (2000)	All	99-2000	685	5400	na[b]	0.100
Montezuma Hills	CA	Howell and Noone(1992)	All	All	237	600	na[b]	0.048
San Gorgonio	CA	McCrary *et al.* 1986a	All	1985	Not available	2947	2.307	na[a]
Outside California								
Buffalo Ridge (Phase I)	MN	Osborn *et al.* (2000)	All	1/95-12/95	50	73	0.493	0.000
Buffalo Ridge (Phase I)	MN	Johnson *et al.* (2000b)	all but winter	3/96-11/99	21	73	0.980	0.012
Buffalo Ridge (Phase I)	**MN**				**Weighted average (by years)**		**0.883**	**0.010**
Buffalo Ridge (Phase II)	MN	Johnson *et al.* (2000b)	all but winter	3/98 –11/99	40	143	2.270	0.000
Buffalo Ridge (Phase III)	MN	Johnson *et al.* (2000b)	all but winter	3/99-11/99	30	138	4.450	0.000
Buffalo Ridge Overall	**MN**				**Weighted average (by turbines)**		**2.834**	**0.002**
Foote Creek Rim (Phase I)	WY	Johnson *et al.* (2001)	All	11/98-10/00	69	69	1.750	0.036
Green Mt, Searsburg	VT	Kerlinger(1997)	Summer, fall	6/97-10/97	11	11	0.000	0.000
IDWGP, Algona	IA	Demastes and Trainer (2000)	Fall,winter, spring	10/98-6/99	3	3	0.000	0.000
Ponnequin	CO	Kerlinger (2001) pers. comm. (2001)	All	11/98-11/00	29	29	na	0.000
Somerset County	PA	Kerlinger (2001) pers. comm. (2001)	All	6/00 – 1/01	8	8	0.000	0.000
Vansycle	OR	Erickson *et al.* (2000b)	All	11/98-10/99	38	38	0.630	0.000

[a] not applicable

[b] although all bird estimates reported, no scavenging or searcher efficiency conducted for small birds (e.g., passerines).

Table 28. Mean avian use estimates (estimated # / 20-min survey) for several study areas.

ALL RAPTORS

		MEAN USE (#/20-minute survey)					Rank	
Wind Resource Area	**Subarea**	**SPR**	**SUM**	**FALL**	**WIN**	**OVER**	**SPR**	**SUM**
Agricultural Landscapes								
Buffalo Ridge	Phase I	0.646	0.431	0.761	0.133	0.424	5	5
Buffalo Ridge	Phase II	0.841	0.694	0.827	0.100	0.523	2	1
Buffalo Ridge	Phase III	0.638	0.537	0.845	0.181	0.484	6	3
Buffalo Ridge	Reference	0.681	0.524	0.690	0.444	0.555	3	4
Condon	Condon	0.528	0.325	0.293	0.453	0.400	7	9
Klondike	Klondike	0.468	0.389	0.386	0.566	0.468	9	7
Nine Canyon	Nine Canyon	0.354	0.199	0.156	0.312	0.258	10	11
Stateline / Vansycle	Reference	1.104	0.401	0.336	0.662	0.602	1	6
Stateline / Vansycle	Stateline / Vansycle	0.524	0.333	0.260	0.494	0.410	8	8
Zintel Canyon	Zintel Canyon	0.194	0.299	0.700	0.507	0.443	11	10
Klickitat County	agricultural sites	0.654	0.583			0.611	4	2
Average		0.598	0.413	0.525	0.385	0.457		
Native/Grassland Landscapes								
Altamont Pass	Altamont Pass	2.125	2.375	3.375	2.063	2.424	1	1
Cares	Cares	0.577	0.632	0.813	0.263	0.522	6	5
Columbia Hills	Columbia Hills	0.935	1.335	0.775	0.263	0.750	2	2
Foote Creek Rim	Foote Creek Rim	0.735	0.702	0.839	0.239	0.562	4	4
Foote Creek Rim	Foote Creek Rim UV	0.464	0.518	0.608	0.224	0.417	8	6
Foote Creek Rim	Morton's Pass Reference	0.480	0.329	0.287	0.153	0.279	7	8
Foote Creek Rim	Simpson's Ridge	0.373	0.280	0.261	0.123	0.233	9	9
Maiden	Maiden	0.280	0.398	0.617	0.288	0.382	10	7
San Gorgonio Pass	Phase I High Elevation	0.000	0.103	0.133	0.162	0.114	17	13
San Gorgonio Pass	Phase I Low Elevation	0.024	0.024	0.030	0.232	0.103	16	14
San Gorgonio Pass	Phase I Medium Elevation	0.119	0.175	0.050	0.143	0.128	13	11
San Gorgonio Pass	Phase I Water Area	0.231	0.024	0.132	0.150	0.128	11	14
San Gorgonio Pass	Phase II Low Elevation	0.000	0.011	0.052	0.006	0.016	17	16
San Gorgonio Pass	Phase II Water Area	0.167	0.000	0.084	0.130	0.094	12	17
Tehachapi Pass	East Slope	0.031	0.013	0.075	0.096	0.060	15	15
Tehachapi Pass	Middle Ridge	0.084	0.160	0.203	0.545	0.301	14	12
Tehachapi Pass	West Ridge	0.756	0.218	2.080	0.297	0.725	3	10
Klickitat County	grassland / shrub steppe / tree	0.693	0.893			0.813	5	3
Average		0.448	0.455	0.613	0.316	0.447		

Table 28 (*continued*). Mean avian use estimates (estimated # / 20-min survey) for several study areas.

BUTEOS

		MEAN USE (#/20-minute survey)					Rank	
Wind Resource Area	**Subarea**	**SPR**	**SUM**	**FALL**	**WIN**	**OVER**	**SPR**	**SUM**
Agricultural Landscapes								
Buffalo Ridge	Phase I	0.381	0.289	0.622	0.133	0.316	2	3
Buffalo Ridge	Phase II	0.372	0.341	0.561	0.033	0.277	3	2
Buffalo Ridge	Phase III	0.313	0.264	0.519	0.118	0.271	4	5
Buffalo Ridge	Reference	0.287	0.396	0.414	0.264	0.332	6	1
Condon	Condon	0.139	0.079	0.108	0.211	0.144	9	11
Klondike	Klondike	0.230	0.232	0.200	0.401	0.288	8	6
Nine Canyon	Nine Canyon	0.083	0.071	0.037	0.191	0.111	10	10
Stateline / Vansycle	Reference	0.805	0.268	0.227	0.531	0.447	1	4
Stateline / Vansycle	Stateline / Vansycle	0.253	0.179	0.136	0.287	0.223	7	7
Zintel Canyon	Zintel Canyon	0.083	0.139	0.233	0.285	0.204	10	9
Klickitat County	agricultural sites	0.300	0.200			0.240	5	7
Average		0.295	0.226	0.306	0.245	0.261		
Native/Grassland Landscapes								
Altamont Pass	Altamont Pass	0.636	0.375	0.876	0.699	0.644	1	2
Cares	Cares	0.247	0.225	0.258	0.103	0.190	5	7
Columbia Hills	Columbia Hills	0.370	0.327	0.319	0.103	0.248	2	4
Foote Creek Rim	Foote Creek Rim	0.253	0.336	0.336	0.039	0.211	4	3
Foote Creek Rim	Foote Creek Rim UV	0.165	0.263	0.237	0.032	0.155	7	6
Foote Creek Rim	Morton's Pass Reference	0.152	0.135	0.064	0.024	0.081	8	10
Foote Creek Rim	Simpson's Ridge	0.123	0.115	0.060	0.012	0.066	10	11
Maiden	Maiden	0.212	0.274	0.204	0.081	0.177	6	5
San Gorgonio Pass	Phase I High Elevation	0.000	0.056	0.058	0.143	0.079	15	13
San Gorgonio Pass	Phase I Low Elevation	0.017	0.000	0.000	0.040	0.018	14	15
San Gorgonio Pass	Phase I Medium Elevation	0.095	0.175	0.000	0.143	0.113	11	8
San Gorgonio Pass	Phase I Water Area	0.000	0.000	0.000	0.010	0.004	15	15
San Gorgonio Pass	Phase II Low Elevation	0.000	0.000	0.000	0.000	0.000	15	15
San Gorgonio Pass	Phase II Water Area	0.056	0.000	0.000	0.011	0.014	12	15
Tehachapi Pass	East Slope	0.000	0.013	0.046	0.052	0.032	15	14
Tehachapi Pass	Middle Ridge	0.047	0.063	0.141	0.136	0.104	13	12
Tehachapi Pass	West Ridge	0.137	0.157	0.240	0.193	0.184	9	9
Klickitat County	grassland / shrub steppe / tree	0.304	0.385			0.352	3	1
Average		0.156	0.161	0.167	0.107	0.149		

Table 28 (*continued*). Mean avian use estimates (estimated # / 20-min survey) for several study areas.

EAGLES

		MEAN USE (#/20-minute survey)					Rank	
Wind Resource Area	**Subarea**	**SPR**	**SUM**	**FALL**	**WIN**	**OVER**	**SPR**	**SUM**
Agricultural Landscapes								
Buffalo Ridge	Phase I	0.007	0.000	0.008	0.000	0.003	5	3
Buffalo Ridge	Phase II	0.015	0.000	0.002	0.017	0.009	4	3
Buffalo Ridge	Phase III	0.040	0.000	0.000	0.014	0.012	1	3
Buffalo Ridge	Reference	0.030	0.000	0.000	0.028	0.015	2	3
Condon	Condon	0.000	0.012	0.043	0.020	0.020	6	1
Klondike	Klondike	0.000	0.008	0.000	0.000	0.002	6	2
Nine Canyon	Nine Canyon	0.000	0.000	0.015	0.000	0.003	6	3
Stateline / Vansycle	Reference	0.029	0.000	0.010	0.010	0.011	3	3
Stateline / Vansycle	Stateline / Vansycle	0.000	0.000	0.006	0.019	0.008	6	3
Zintel Canyon	Zintel Canyon	0.000	0.000	0.000	0.000	0.000	6	3
Klickitat County	agricultural sites	0.000	0.000			0.000	6	3
Average		0.012	0.002	0.008	0.011	0.008		
Native/Grassland Landscapes								
Altamont Pass	Altamont Pass	0.438	0.063	0.500	0.375	0.333	1	5
Cares	Cares	0.128	0.031	0.035	0.101	0.075	4	9
Columbia Hills	Columbia Hills	0.040	0.142	0.050	0.101	0.091	8	2
Foote Creek Rim	Foote Creek Rim	0.301	0.194	0.311	0.187	0.234	2	1
Foote Creek Rim	Foote Creek Rim UV	0.214	0.122	0.287	0.189	0.197	3	3
Foote Creek Rim	Morton's Pass Reference	0.141	0.073	0.121	0.123	0.113	5	4
Foote Creek Rim	Simpson's Ridge	0.122	0.036	0.067	0.104	0.082	6	8
Maiden	Maiden	0.000	0.000	0.000	0.031	0.012	11	11
San Gorgonio Pass	Phase I High Elevation	0.000	0.048	0.075	0.000	0.028	11	7
San Gorgonio Pass	Phase I Low Elevation	0.000	0.000	0.000	0.000	0.000	11	11
San Gorgonio Pass	Phase I Medium Elevation	0.024	0.000	0.000	0.000	0.004	10	11
San Gorgonio Pass	Phase I Water Area	0.042	0.000	0.000	0.067	0.032	7	11
San Gorgonio Pass	Phase II Low Elevation	0.000	0.000	0.000	0.000	0.000	11	11
San Gorgonio Pass	Phase II Water Area	0.000	0.000	0.000	0.000	0.000	11	11
Tehachapi Pass	East Slope	0.000	0.000	0.000	0.000	0.000	11	11
Tehachapi Pass	Middle Ridge	0.000	0.000	0.000	0.000	0.000	11	11
Tehachapi Pass	West Ridge	0.000	0.018	0.000	0.000	0.004	11	10
Klickitat County	grassland / shrub steppe / tree	0.036	0.063			0.052	9	5
Average		0.082	0.044	0.085	0.075	0.070		

Table 28 (*continued*). Mean avian use estimates (estimated # / 20-min survey) for several study areas.

LARGE FALCONS

		MEAN USE (#/20-minute survey)					Rank	
Wind Resource Area	**Subarea**	**SPR**	**SUM**	**FALL**	**WIN**	**OVER**	**SPR**	**SUM**
Agricultural Landscapes								
Buffalo Ridge	Phase I	0.000	0.000	0.000	0.000	0.000	2	2
Buffalo Ridge	Phase II	0.000	0.000	0.000	0.000	0.000	2	2
Buffalo Ridge	Phase III	0.000	0.000	0.012	0.000	0.002	2	2
Buffalo Ridge	Reference Area	0.000	0.000	0.000	0.028	0.010	2	2
Condon	Condon	0.000	0.000	0.014	0.000	0.003	2	2
Klondike	Klondike	0.000	0.008	0.000	0.018	0.009	2	1
Nine Canyon	Nine Canyon	0.021	0.000	0.000	0.000	0.003	1	2
Stateline / Vansycle	Reference Area	0.000	0.000	0.000	0.002	0.001	2	2
Stateline / Vansycle	Stateline / Vansycle	0.000	0.000	0.000	0.005	0.002	2	2
Zintel Canyon	Zintel Canyon	0.000	0.000	0.022	0.021	0.012	2	2
Klickitat County	agricultural sites	0.000	0.000			0.000	2	2
Average		0.002	0.001	0.005	0.007	0.004		
Native/Grassland Landscapes								
Altamont	Altamont	0.000	0.020	0.021	0.010	0.013	9	7
Cares	Cares	0.024	0.014	0.004	0.010	0.012	4	9
Columbia Hills	Average	0.030	0.037	0.020	0.010	0.022	2	3
Foote Creek Rim	Foote Creek Rim	0.034	0.029	0.037	0.010	0.024	1	4
Foote Creek Rim	Foote Creek Rim UV	0.024	0.044	0.034	0.001	0.023	4	2
Foote Creek Rim	Morton's Pass Reference	0.030	0.061	0.052	0.003	0.032	2	1
Foote Creek Rim	Simpson's Ridge	0.009	0.016	0.031	0.002	0.013	8	8
Maiden	Maiden	0.000	0.010	0.038	0.050	0.029	9	11
San Gorgonio Pass	Phase I High Elevation	0.000	0.000	0.000	0.000	0.000	9	13
San Gorgonio Pass	Phase I Low Elevation	0.000	0.014	0.000	0.016	0.010	9	9
San Gorgonio Pass	Phase I Medium Elevation	0.000	0.000	0.000	0.000	0.000	9	13
San Gorgonio Pass	Phase I Water Area	0.021	0.024	0.032	0.000	0.016	6	5
San Gorgonio Pass	Phase II Low Elevation	0.000	0.000	0.010	0.006	0.004	9	13
San Gorgonio Pass	Phase II Water Area	0.000	0.000	0.065	0.042	0.029	9	13
Tehachapi Pass	East Slope	0.000	0.000	0.000	0.000	0.000	9	13
Tehachapi Pass	Middle Ridge	0.000	0.000	0.000	0.000	0.000	9	13
Tehachapi Pass	West Ridge	0.000	0.010	0.000	0.000	0.003	9	11
Klickitat County	grassland / shrub steppe / tree	0.018	0.024			0.021	7	5
Average		0.011	0.017	0.020	0.009	0.014		

Table 28 (*continued*). Mean avian use estimates (estimated # / 20-min survey) for several study areas.

SMALL FALCONS

		MEAN USE (#/20-minute survey)					Rank	
Wind Resource Area	**Subarea**	**SPR**	**SUM**	**FALL**	**WIN**	**OVER**	**SPR**	**SUM**
Agricultural Landscapes								
Buffalo Ridge	Phase I	0.094	0.079	0.072	0.000	0.050	4	4
Buffalo Ridge	Phase II	0.063	0.023	0.072	0.000	0.031	8	10
Buffalo Ridge	Phase III	0.088	0.111	0.071	0.024	0.066	5	3
Buffalo Ridge	Reference Area	0.067	0.033	0.113	0.014	0.048	6	8
Condon	Condon	0.146	0.135	0.085	0.076	0.104	2	2
Klondike	Klondike	0.095	0.054	0.143	0.045	0.076	3	7
Nine Canyon	Nine Canyon	0.035	0.022	0.015	0.009	0.018	10	11
Stateline / Vansycle	Reference Area	0.066	0.063	0.012	0.009	0.033	7	6
Stateline / Vansycle	Stateline / Vansycle	0.036	0.028	0.023	0.022	0.026	9	9
Zintel Canyon	Zintel Canyon	0.028	0.065	0.383	0.104	0.140	11	5
Klickitat County	agricultural sites	0.254	0.333			0.301	1	1
Average		0.072	0.061	0.099	0.030	0.059		
Native/Grassland Landscapes								
Altamont	Altamont	0.125	0.130	0.150	0.013	0.089	5	4
Cares	Cares	0.107	0.276	0.055	0.004	0.100	7	2
Columbia Hills	Columbia Hills	0.208	0.507	0.137	0.004	0.192	1	1
Foote Creek Rim	Foote Creek Rim	0.085	0.079	0.068	0.000	0.048	8	5
Foote Creek Rim	Foote Creek Rim UV	0.024	0.049	0.024	0.000	0.021	11	8
Foote Creek Rim	Morton's Pass Reference	0.128	0.021	0.014	0.000	0.030	4	9
Foote Creek Rim	Simpson's Ridge	0.067	0.055	0.037	0.000	0.033	9	7
Maiden	Maiden	0.041	0.021	0.213	0.031	0.068	10	9
San Gorgonio Pass	Phase I High Elevation	0.000	0.000	0.000	0.000	0.000	14	14
San Gorgonio Pass	Phase I Low Elevation	0.007	0.010	0.030	0.170	0.074	13	13
San Gorgonio Pass	Phase I Medium Elevation	0.000	0.000	0.050	0.000	0.010	14	14
San Gorgonio Pass	Phase I Water Area	0.168	0.000	0.100	0.073	0.076	3	14
San Gorgonio Pass	Phase II Low Elevation	0.000	0.011	0.013	0.000	0.005	14	12
San Gorgonio Pass	Phase II Water Area	0.111	0.000	0.019	0.076	0.051	6	14
Tehachapi Pass	East Slope	0.021	0.000	0.000	0.011	0.008	12	14
Tehachapi Pass	Middle Ridge	0.000	0.058	0.038	0.371	0.162	14	6
Tehachapi Pass	West Ridge	0.000	0.012	0.066	0.026	0.027	14	11
Klickitat County	grassland / shrub steppe / tree	0.169	0.266			0.227	2	3
Average		0.070	0.083	0.060	0.046	0.068		

Table 28 (*continued*). Mean avian use estimates (estimated # / 20-min survey) for several study areas.

NORTHERN HARRIER

		MEAN USE (#/20-minute survey)					Rank	
Wind Resource Area	**Subarea**	**SPR**	**SUM**	**FALL**	**WIN**	**OVER**	**SPR**	**SUM**
Agricultural Landscapes								
Buffalo Ridge	Phase I	0.130	0.063	0.025	0.000	0.042	9	9
Buffalo Ridge	Phase II	0.282	0.301	0.119	0.042	0.163	1	1
Buffalo Ridge	Phase III	0.188	0.135	0.183	0.010	0.107	6	2
Buffalo Ridge	Reference Area	0.267	0.074	0.101	0.083	0.116	2	6
Condon	Condon	0.229	0.030	0.033	0.114	0.095	3	11
Klondike	Klondike	0.143	0.087	0.043	0.103	0.093	8	3
Nine Canyon	Nine Canyon	0.215	0.069	0.089	0.102	0.110	4	7
Stateline / Vansycle	Reference Area	0.174	0.069	0.071	0.051	0.080	7	7
Stateline / Vansycle	Stateline / Vansycle	0.189	0.076	0.083	0.084	0.099	5	5
Zintel Canyon	Zintel Canyon	0.056	0.084	0.061	0.097	0.080	11	4
Klickitat County	agricultural sites	0.100	0.033			0.060	10	10
Average		0.187	0.099	0.081	0.069	0.099		
Native/Grassland Landscapes								
Altamont Pass	Altamont Pass	0.031	0.001	0.040	0.001	0.014	3	9
Cares	Cares	0.030	0.064	0.228	0.042	0.084	4	3
Columbia Hills	Average	0.069	0.072	0.083	0.042	0.062	1	2
Foote Creek Rim	Foote Creek Rim	0.022	0.024	0.037	0.001	0.018	7	6
Foote Creek Rim	Foote Creek Rim UV	0.007	0.014	0.016	0.000	0.008	9	8
Foote Creek Rim	Morton's Pass Reference	0.012	0.018	0.032	0.000	0.013	8	7
Foote Creek Rim	Simpson's Ridge	0.029	0.052	0.036	0.001	0.025	5	5
Maiden	Maiden	0.028	0.092	0.125	0.094	0.089	6	1
San Gorgonio Pass	Phase I High Elevation	0.000	0.000	0.000	0.000	0.000	10	10
San Gorgonio Pass	Phase I Low Elevation	0.000	0.000	0.000	0.005	0.002	10	10
San Gorgonio Pass	Phase I Medium Elevation	0.000	0.000	0.000	0.000	0.000	10	10
San Gorgonio Pass	Phase I Water Area	0.000	0.000	0.000	0.000	0.000	10	10
San Gorgonio Pass	Phase II Low Elevation	0.000	0.000	0.000	0.000	0.000	10	10
San Gorgonio Pass	Phase II Water Area	0.000	0.000	0.000	0.000	0.000	10	10
Tehachapi Pass	East Slope	0.000	0.000	0.000	0.000	0.000	10	10
Tehachapi Pass	Middle Ridge	0.000	0.000	0.010	0.005	0.004	10	10
Tehachapi Pass	West Ridge	0.000	0.000	0.000	0.000	0.000	10	10
Klickitat County	grassland / shrub steppe / tree	0.048	0.060			0.055	2	4
Average		0.015	0.022	0.036	0.011	0.021		

Table 28 (*continued*). Mean avian use estimates (estimated # / 20-min survey) for several study areas.

WATERFOWL AND WATER BIRDS

		MEAN USE (#/20-minute survey)					Rank	
Wind Resource Area	**Subarea**	**SPR**	**SUM**	**FALL**	**WIN**	**OVER**	**SPR**	**SUM**
Agricultural Landscapes								
Buffalo Ridge	Phase I	7.298	0.303	5.839	10.300	6.371	2	3
Buffalo Ridge	Phase II	8.086	1.997	10.129	4.681	5.713	1	1
Buffalo Ridge	Phase III	6.165	0.942	8.979	0.583	3.352	3	2
Buffalo Ridge	Reference	6.112	0.264	8.460	2.375	3.738	4	4
Condon	Condon	0.014	0.000	0.029	0.000	0.008	10	10
Klondike	Klondike	0.000	0.019	0.357	30.125	11.376	11	9
Nine Canyon	Nine Canyon	0.417	0.043	0.017	0.907	0.424	5	7
Stateline / Vansycle	Reference	0.028	0.000	0.000	2.258	0.852	8	10
Stateline / Vansycle	Stateline / Vansycle	0.350	0.083	0.000	0.000	0.079	6	6
Zintel Canyon	Zintel Canyon	0.056	0.042	0.422	34.875	13.186	7	8
Klickitat County	agricultural sites	0.025	0.100			0.070	9	5
Average		2.853	0.369	3.423	8.611	4.510		
Native/Grassland Landscapes								
Cares	Cares	0.000	0.007	0.017	0.077	0.034	10	10
Foote Creek Rim	Foote Creek Rim	0.416	0.224	0.056	0.224	0.221	8	5
Foote Creek Rim	Foote Creek Rim UV	0.858	0.032	0.000	0.002	0.151	6	9
Foote Creek Rim	Morton's Pass Reference	0.036	0.049	0.007	0.041	0.035	9	8
Foote Creek Rim	Simpson's Ridge	0.600	0.978	0.901	0.043	0.549	7	2
Maiden	Maiden	0.000	0.156	0.000	0.000	0.039	10	6
San Gorgonio Pass	Phase I High Elevation	0.000	0.000	0.000	0.000	0.000	10	11
San Gorgonio Pass	Phase I Low Elevation	11.001	0.600	0.060	4.917	3.840	3	4
San Gorgonio Pass	Phase I Medium Elevation	0.000	0.000	0.000	0.000	0.000	10	11
San Gorgonio Pass	Phase I Water Area	30.771	4.942	8.221	57.693	29.712	1	1
San Gorgonio Pass	Phase II Low Elevation	0.904	0.000	0.000	2.804	1.202	5	11
San Gorgonio Pass	Phase II Water Area	13.973	0.122	15.129	14.779	11.053	2	7
Tehachapi Pass	East Slope	0.000	0.000	0.000	0.000	0.000	10	11
Tehachapi Pass	Middle Ridge	0.000	0.000	0.000	0.000	0.000	10	11
Tehachapi Pass	West Ridge	0.000	0.000	0.000	0.007	0.003	10	11
Klickitat County	grassland / shrub steppe / tree	1.012	0.833			0.905	4	3
Average		3.723	0.497	1.626	5.372	2.984		

Table 29. Mean raptor use estimates (number / 20 minutes / plot) by season for 29 Wind Resource Areas in the U.S.

Group	Spring	Summer	Fall	Winter
Buteos	0.215	0.192	0.218	0.164
Eagles	0.053	0.027	0.056	0.052
Large Falcons	0.009	0.011	0.014	0.008
Small Falcons	0.070	0.074	0.118	0.039
Northern Harrier	0.081	0.057	0.053	0.032
All Raptors	0.515	0.451	0.580	0.347

Table 30. Mean raptor use estimates (number / 20 minutes / plot) at other WRAs in Klickitat County.

Buteos				
Location	**Spring**	**Summer**	**Fall**	**Winter**
Cares	0.247	0.225	0.258	0.103
Columbia Hills	0.370	0.327	0.319	0.103
Mean	0.31	0.28	0.29	0.103
Eagles				
Location	**Spring**	**Summer**	**Fall**	**Winter**
Cares	0.128	0.031	0.035	0.101
Columbia Hills	0.040	0.142	0.050	0.101
Mean	0.08	0.09	0.04	0.101
Large Falcons				
Location	**Spring**	**Summer**	**Fall**	**Winter**
Cares	0.024	0.014	0.004	0.010
Columbia Hills	0.030	0.037	0.020	0.010
Mean	0.05	0.03	0.01	0.010
Small Falcons				
Location	**Spring**	**Summer**	**Fall**	**Winter**
Cares	0.107	0.276	0.055	0.004
Columbia Hills	0.208	0.507	0.137	0.004
Mean	0.16	0.39	0.10	0.004
Northern Harrier				
Location	**Spring**	**Summer**	**Fall**	**Winter**
Cares	0.030	0.064	0.228	0.042
Columbia Hills	0.069	0.072	0.083	0.042
Mean	0.05	0.07	0.16	0.042
All Raptors				
Location	**Spring**	**Summer**	**Fall**	**Winter**
Cares	0.577	0.632	0.813	0.263
Columbia Hills	0.935	1.335	0.775	0.263
Mean	0.76	0.98	0.79	0.263

Table 31. Raptor nesting data for U.S. Wind Resource Areas.

Agricultural Sites

Stateline, OR/WA	
Species	**Density (#/mi2)**
Ferruginous Hawk	0.034
Swainson's Hawk	0.034
Red-tailed Hawk	0.079
Great Horned Owl	0.067
TOTAL	0.213

Condon, OR	
Species	**Density (#/mi2)**
Red-tailed Hawk	0.040
Unidentified Raptor	0.020
TOTAL	0.060

Klondike, OR	
Species	**Density (#/mi^2)**
Red-tailed Hawk	0.083
Swainson's Hawk	0.042
Great Horned Owl	0.042
TOTAL	0.158

Nine Canyon, WA	
Species	**Density (#/mi^2)**
Swainson's Hawk	0.033
TOTAL	0.033

Zintel Canyon, WA	
Species	**Density (#/mi^2)**
Swainson's Hawk	0.040
Red-tailed Hawk	0.020
Ferruginous Hawk	0.020
TOTAL	0.080

Buffalo Ridge, MN	
Species	**Density (#/mi^2)**
Swainson's Hawk	0.074
Red-tailed Hawk	0.059
Ferruginous Hawk	0.005
Great Horned Owl	0.015
TOTAL	0.153

Klickitat County, WA	
Species	**Density (#/mi^2)**
Red-tailed Hawk	0.087
Prairie Falcon	0.006
Great Horned Owl	0.031
TOTAL	0.124

Table 31 (*continued*). Raptor nesting data for U.S. Wind Resource Areas.

Native Landscapes

Columbia Hills, WA	
Species	**Density (#/mi^2)**
Red-tailed Hawk	0.180
Golden Eagle	0.020
Swainson's Hawk	0.040
Prairie Falcon	0.020
Sharp-shinned Hawk	0.020
Great Horned Owl	0.020
TOTAL	0.300
Ponnequin, CO	
Species	**Density (#/mi^2)**
Swainson's Hawk	0.059
TOTAL	0.059
Maiden, WA	
Species	**Density (#/mi^2)**
Red-tailed Hawk	0.042
Swainson's Hawk	0.052
Ferruginous Hawk	0.031
Prairie Falcon	0.031
Great Horned Owl	0.021
TOTAL	0.178
Foote Creek Rim, WY	
Species	**Density (#/mi^2)**
Red-tailed Hawk	0.022
Golden Eagle	0.035
Great Horned Owl	0.014
TOTAL	0.271
Klickitat County, WA	
Species	**Density (#/mi^2)**
Red-tailed Hawk	0.087
Prairie Falcon	0.006
Great Horned Owl	0.031
TOTAL	0.124

Table 32. Predicted bird collision fatality estimates for Klickitat County

Group	West of U.S. 97		U.S. 97 to Rock Creek		East of Rock Creek	
	<1.5mi from Col. River	>1.5mi from Col. River	<1.5mi from Col. River	>1.5mi from Col. River	<1.5mi from Col. River	>1.5mi from Col. River
Accipiters	0.000[a]	0.000	0.000	0.000	0.000	0.000
Buteos	0.002	0.003	0.002	0.002	0.003	0.001
Eagles	0.003	0.001	0.003	0.001	0.001	0.000
Large falcons	0.000	0.000	0.013	0.003	0.005	0.002
Small falcons	0.048	0.031	0.010	0.021	0.032	0.013
N. Harriers	0.001	0.002	0.001	0.001	0.000	0.001
Other raptors	0.005	0.005	0.005	0.005	0.005	0.005
All Raptors	0.058[b]	0.042	0.034	0.033	0.046	0.022
Waterfowl	0.041	0.012	0.057	0.001	0.079	0.002
Passerines	1.600[c]	1.600	1.600	1.600	1.600	1.600
All Birds	1.699	1.654	1.691	1.634	1.725	1.624

[a] estimate calculated by multiplying the average fatality rate estimate from Foote Creek Rim, Buffalo Ridge and Vansycle by the ratio of use for this area divided by average use from Foote Creek Rim, Buffalo Ridge and Vansycle. This approach was used for all groups except for "all raptors", passerines, and all birds.

[b] sum of raptor group estimates

[c] average estimate based on data in Erickson et al. (2001)

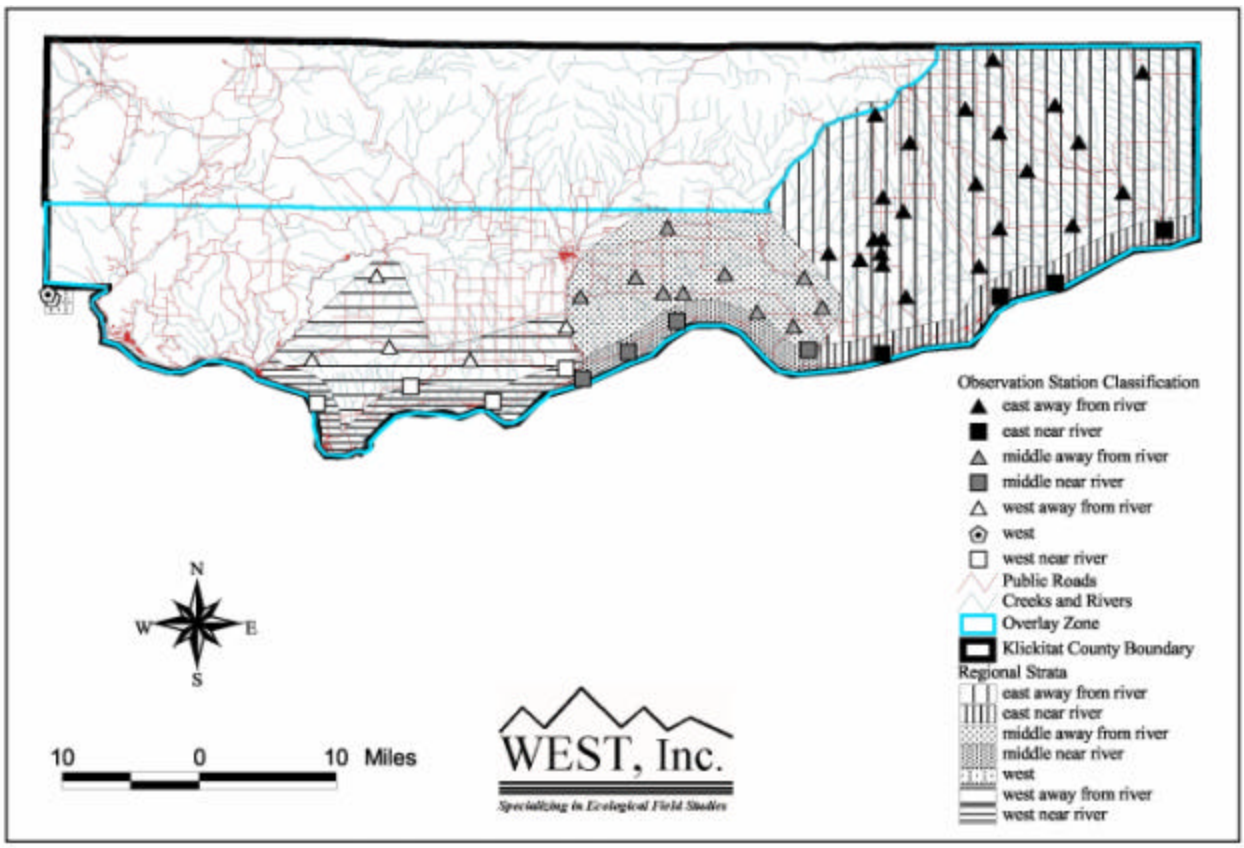


Figure 1. Avian survey points and geographic regions used for data analysis.

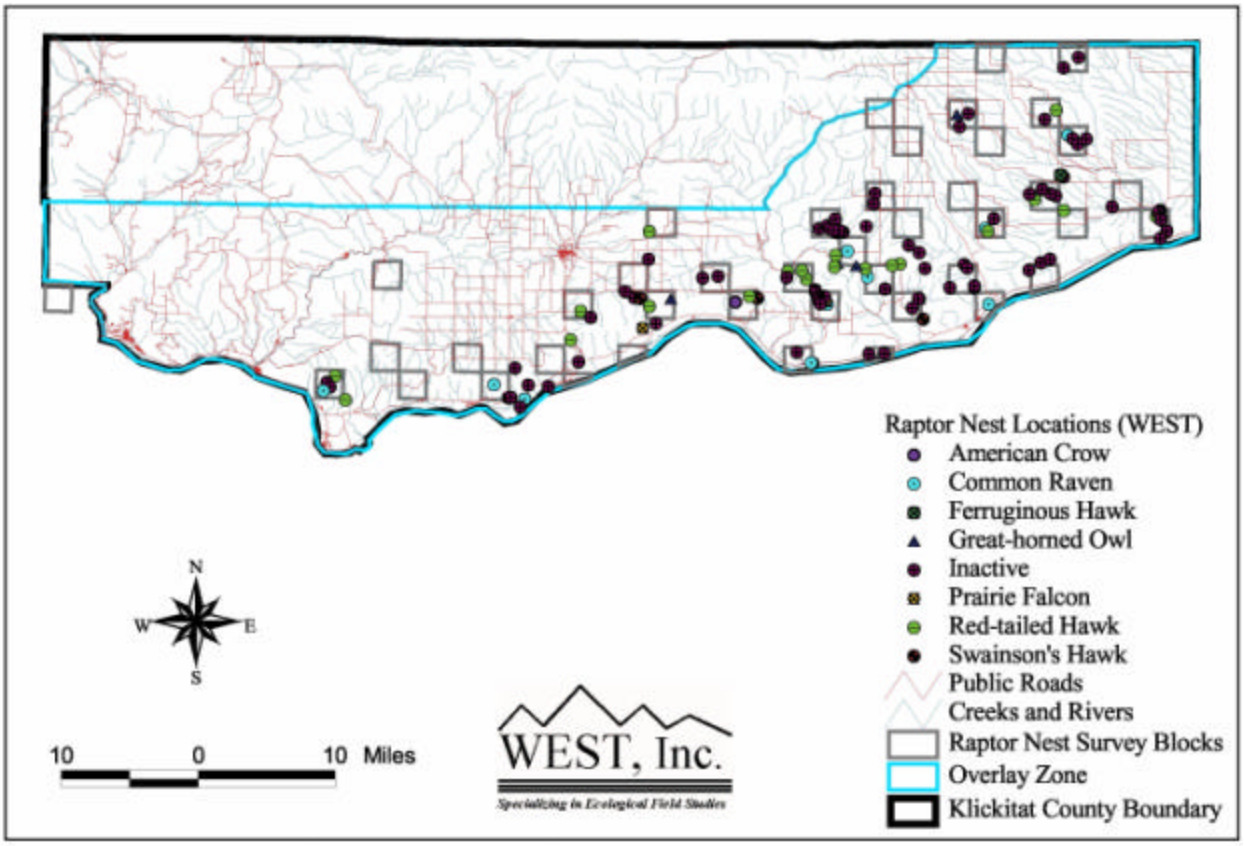
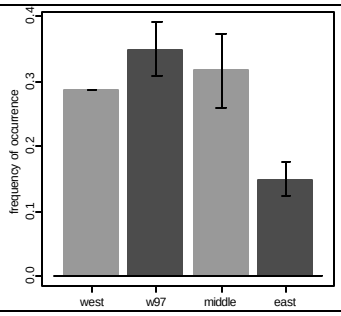
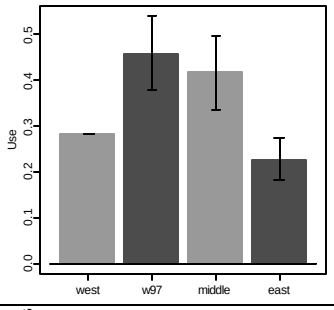
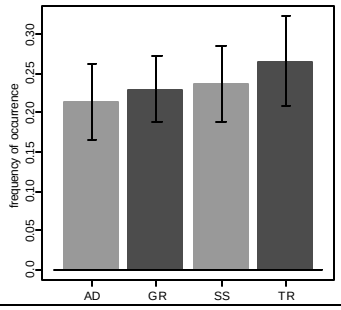
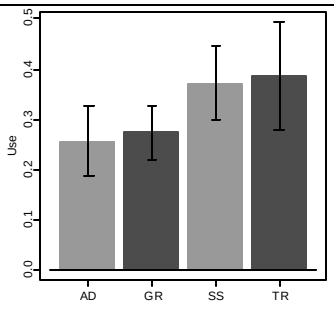
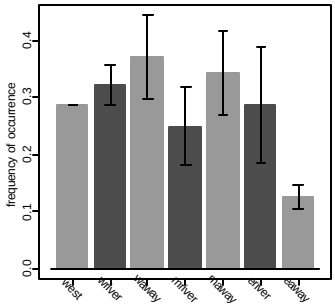
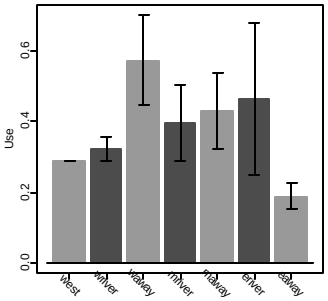
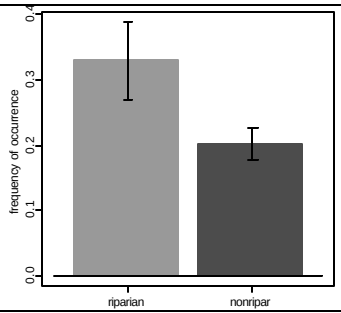
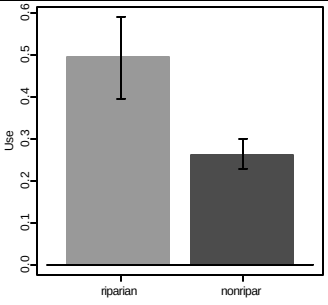
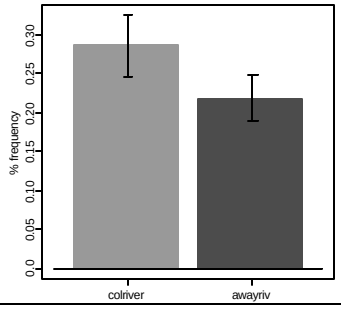
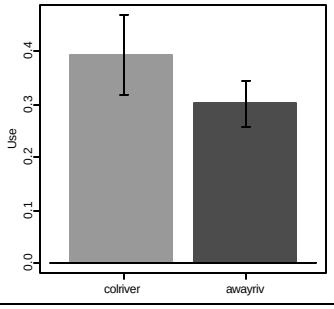


Figure 2. Locations of raptor nests and raptor survey blocks in Klickitat County.

Figure 3. Avian use and frequency of occurrence by habitat and region within Klickitat County.

	east vs. middle p=0.0021 east vs. west 97 p=0.0016		east vs. middle 0.0296 east vs. west 97 0.0233
			
	eaway vs. eriver 0.0588 eaway vs. maway 0.0005 eaway vs. mriver 0.1390 eaway vs. waway 0.0021 eaway vs. wriver 0.0221		eaway vs. eriver 0.0450 eaway vs. maway 0.0137 eaway vs. mriver 0.1335 eaway vs. waway 0.0030 waway vs. wriver 0.1386
	p=0.0221		0.0064
			
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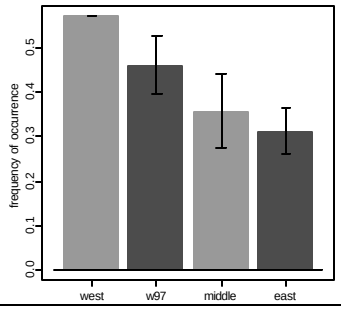
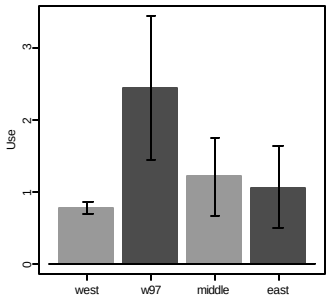
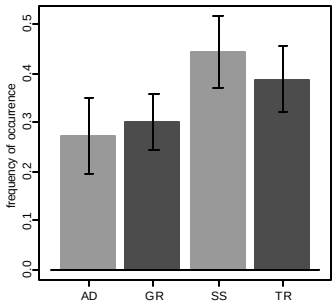
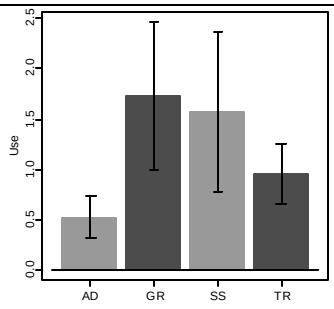
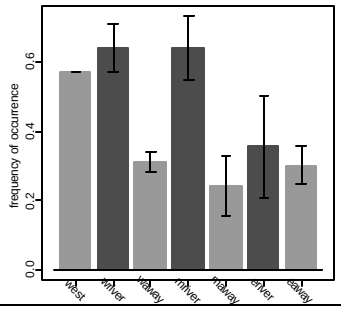
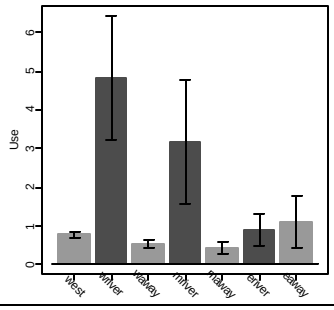
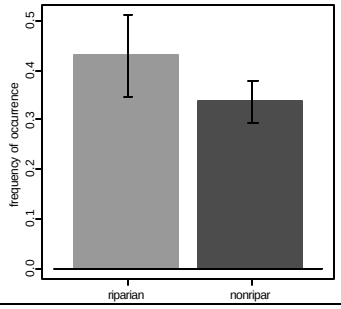
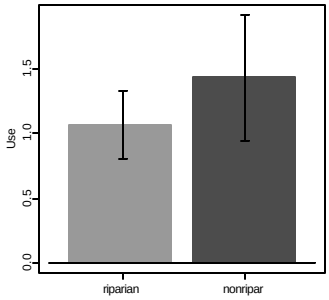
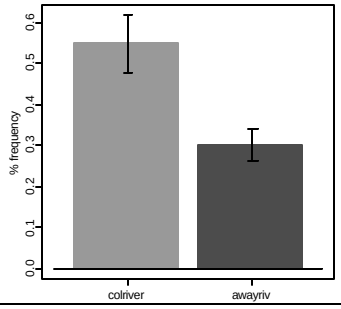
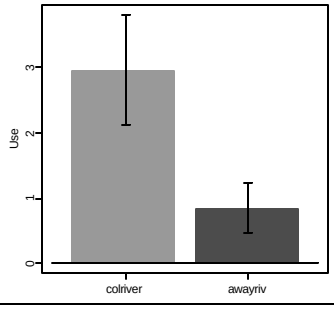
			
	AD vs. SS 0.1036 GR vs. SS 0.1171		
	eaway vs. mriver 0.0137 eaway vs. west 0.1438 eaway vs. wriver 0.0137 eriver vs. mriver 0.1052 eriver vs. wriver 0.1052 maway vs. mriver 0.0082 eriver vs. west 0.0894 eriver vs. wriver 0.0082 mriver vs. waway 0.0511 waway vs. wriver 0.0511		eaway vs. mriver 0.1356 eaway vs. wriver 0.0092 eriver vs. wriver 0.0328 maway vs. mriver 0.0719 eriver vs. wriver 0.0051 mriver vs. waway 0.1263 waway vs. wriver 0.0150 west vs. wriver 0.0712
			
	0.0043		0.0143
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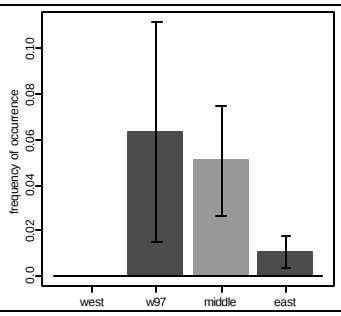
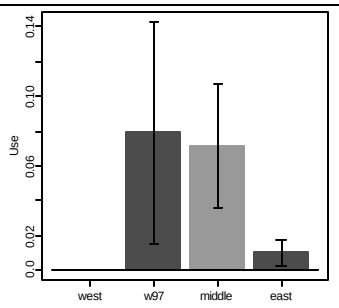
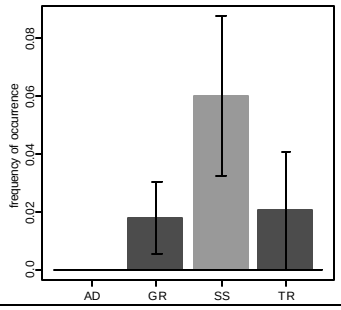
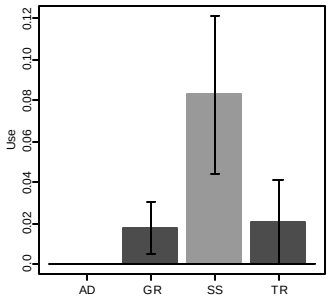
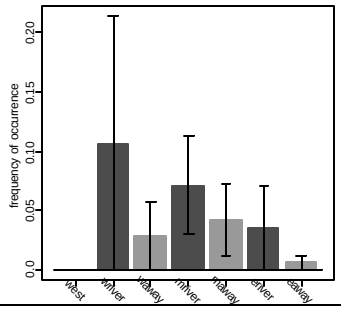
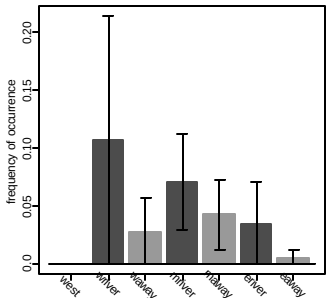
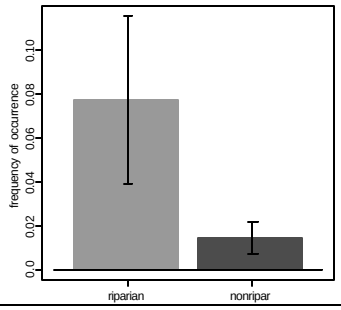
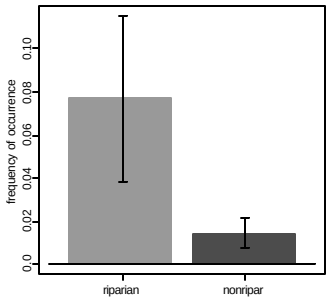
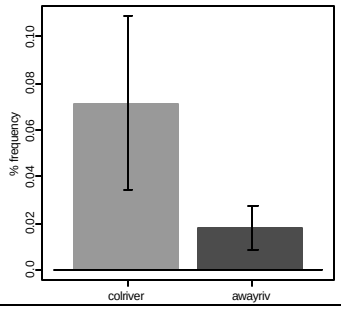
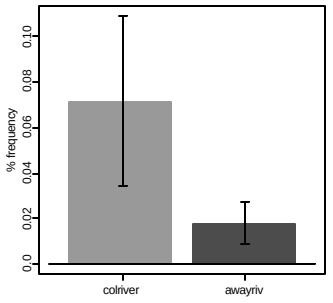
	east vs. middle 0.1343 east vs. west 97 0.0947		east vs. middle 0.0944 east vs. west 97 0.1054
	AD vs. SS 0.0618 GR vs. SS 0.1281		AD vs. SS 0.0550 GR vs. SS 0.0821
	eaway vs. mriver 0.1427 eaway vs. wriver 0.0256 west vs. wriver 0.1322		eaway vs. mriver 0.0910 eaway vs. wriver 0.0239 waway vs. wriver 0.1212 west vs. wriver 0.1332
	0.0157		0.0206
	0.0452		0.0402
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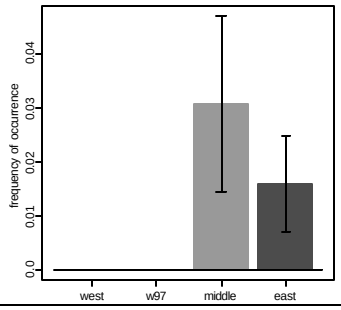
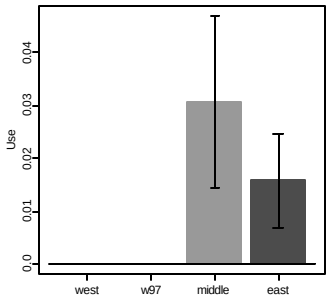
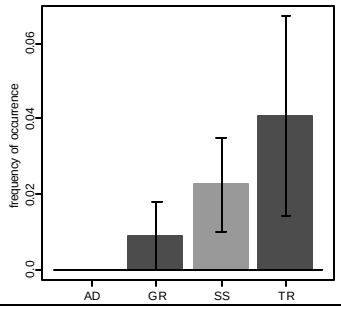
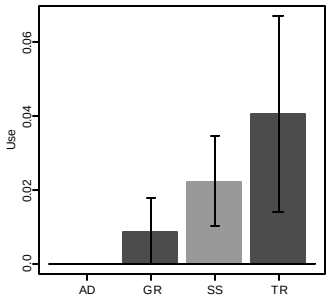
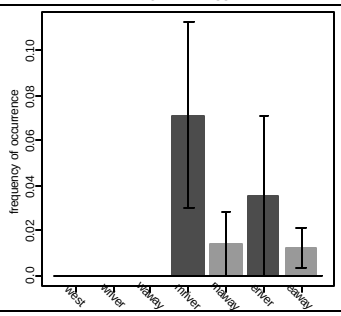
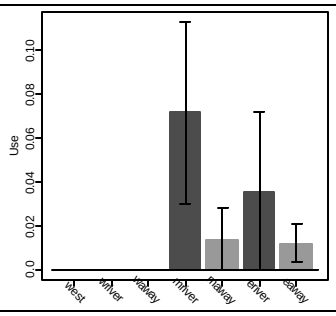
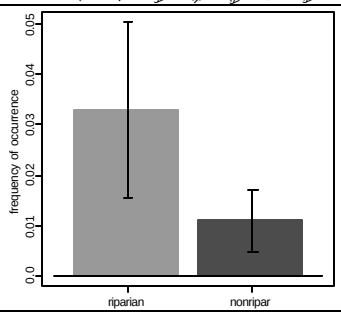
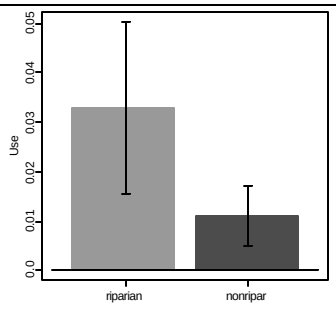
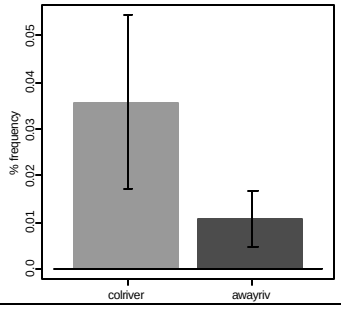
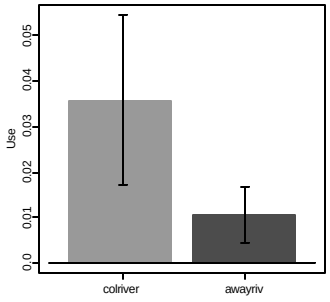
	middle vs. west 97 0.1276		middle vs. west 97 0.1276
	AD vs. TR 0.0756 GR vs. TR 0.1294		AD vs. TR 0.0756 GR vs. TR 0.1294
	eaway vs. mriver 0.0197 maway vs. mriver 0.0375 mriver vs. waway 0.0225 mriver vs. west 0.0738 mriver vs. wriver 0.0299		eaway vs. mriver 0.0197 maway vs. mriver 0.0375 mriver vs. waway 0.0225 mriver vs. west 0.0738 mriver vs. wriver 0.0299
	0.1380		0.1380
	0.0998		0.0998
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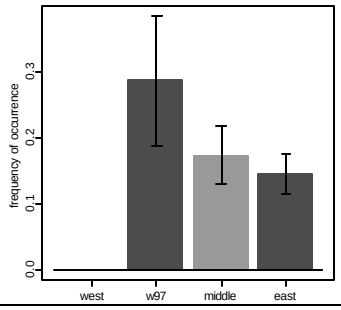
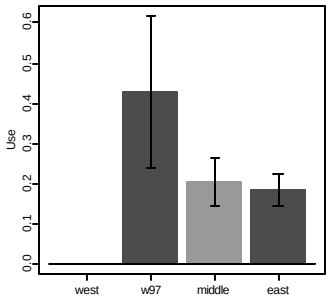
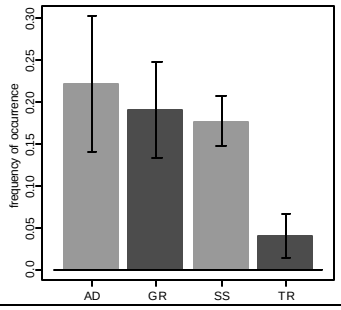
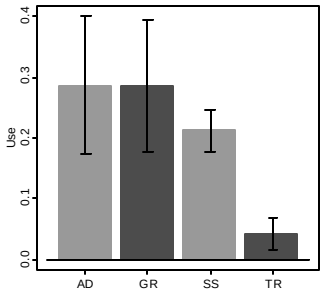
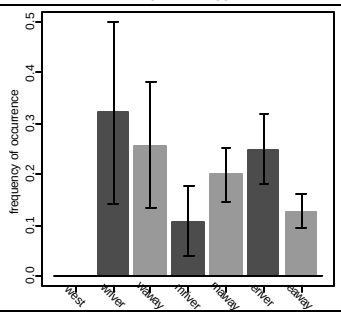
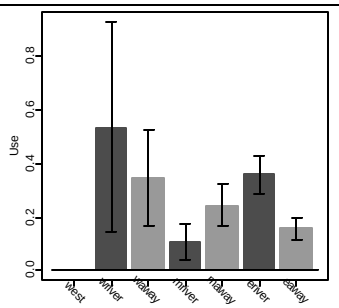
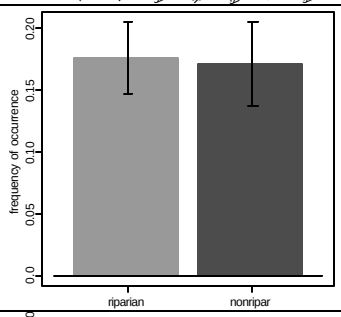
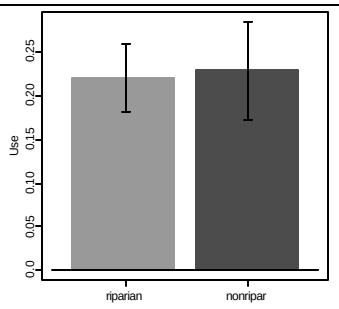
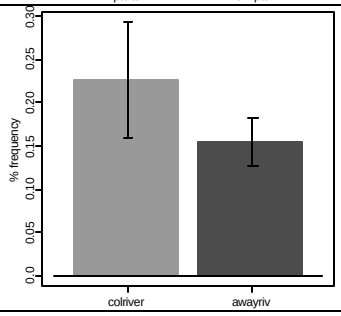
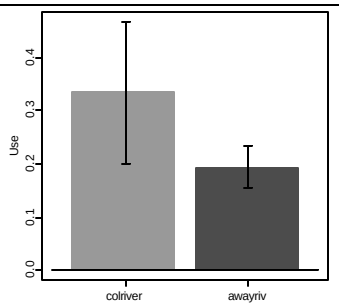
	east vs. west 97 0.0563 west 97 vs. west 0.0552		east vs. west 97 0.0410 middle vs. west 97 0.0853 west 97 vs. west 0.0730
	AD vs. TR 0.0568 GR vs. TR 0.0850 SS vs. TR 0.1071		AD vs. TR 0.1085 GR vs. TR 0.0822
	eaway vs. wriver 0.0622 eriver vs. west 0.1299 mriver vs. wriver 0.1123 waway vs. west 0.1074 west vs. wriver 0.0534		eaway vs. wriver 0.0239 eriver vs. wriver 0.1047 mriver vs. wriver 0.0486 west vs. wriver 0.0443
			
			
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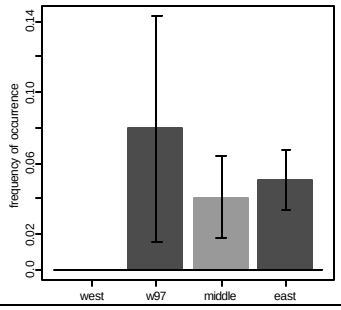
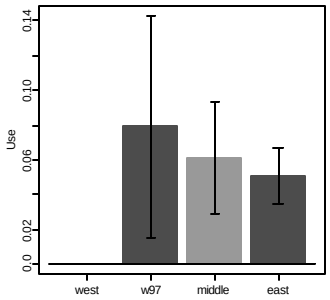
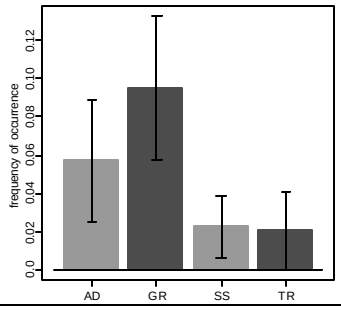
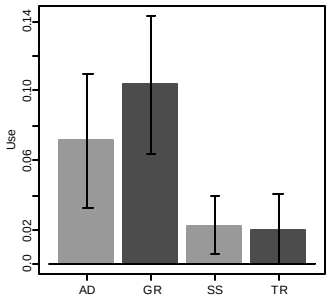
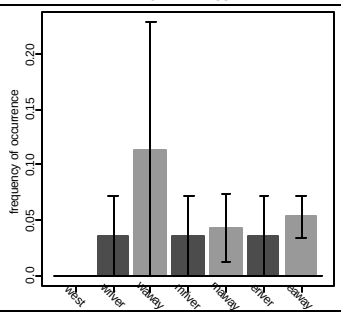
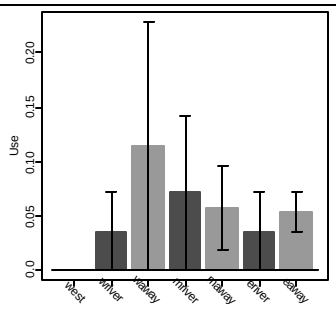
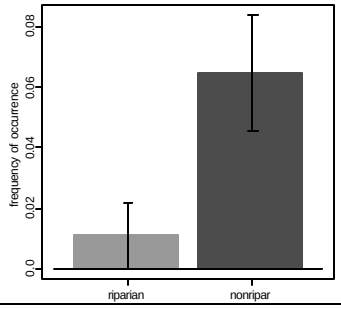
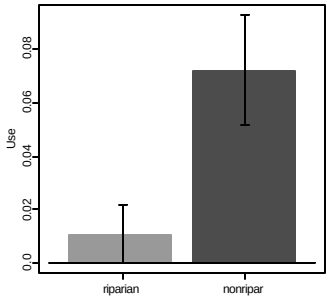
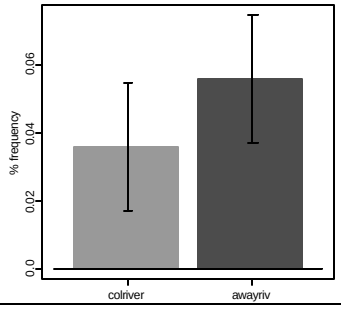
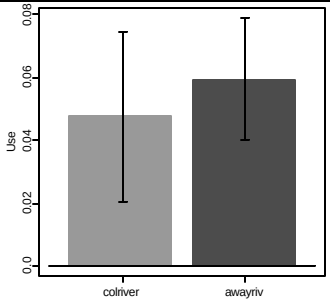
			
	GR vs. SS 0.0510 GR vs. TR 0.1294		GR vs. SS 0.0404 GR vs. TR 0.1120
			
	0.1231		0.1022
			
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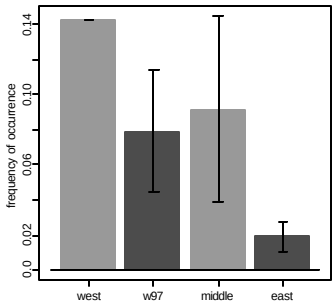
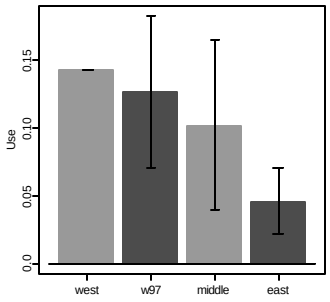
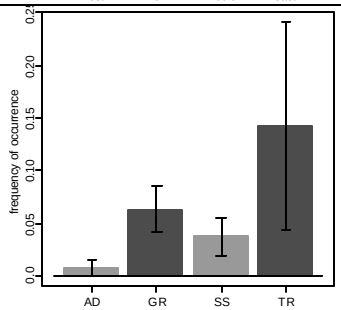
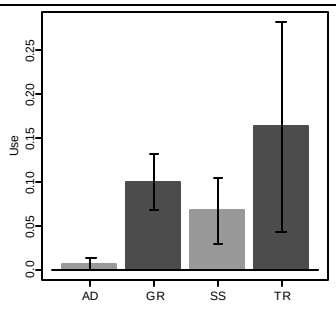
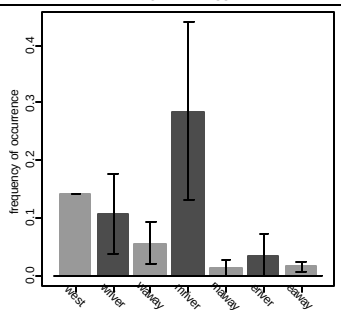
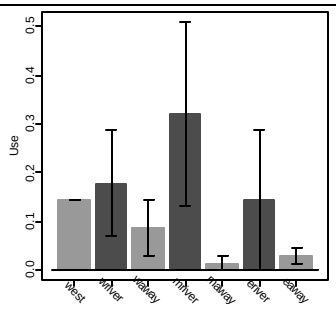
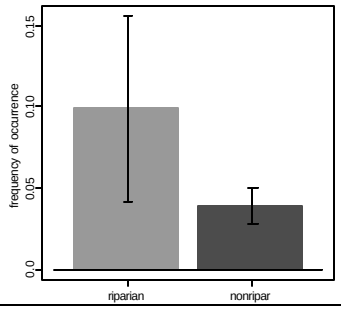
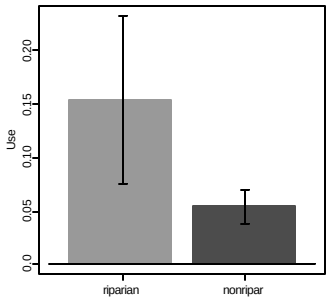
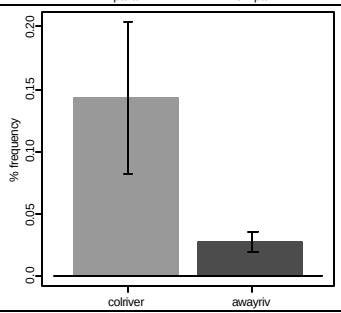
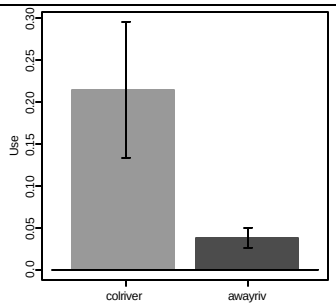
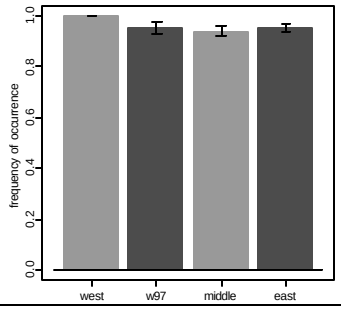
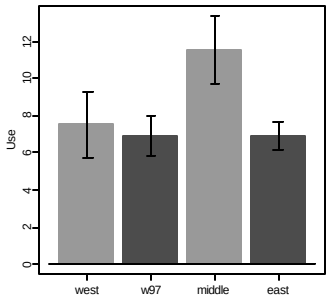
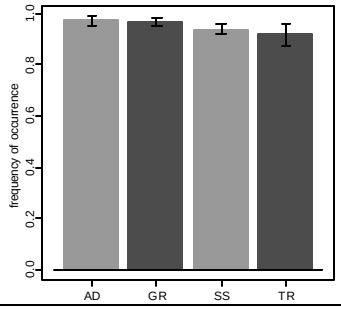
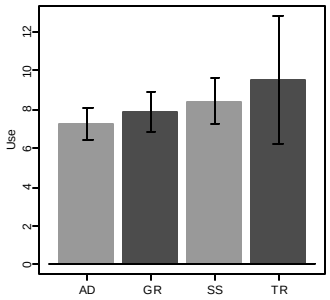
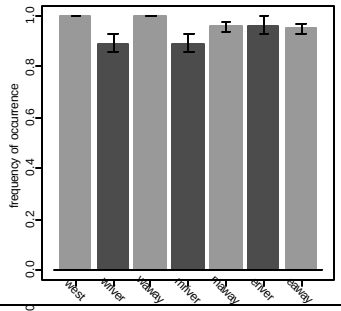
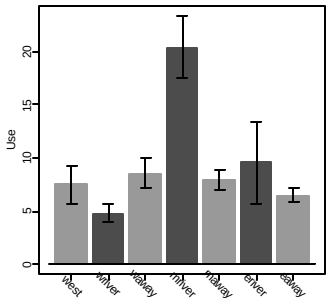
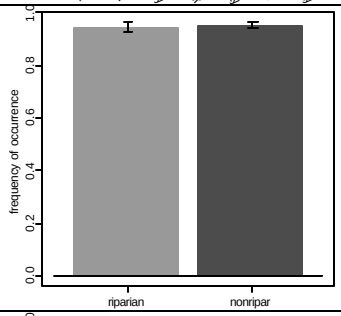
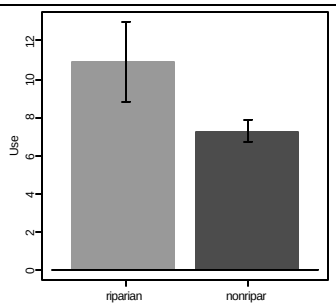
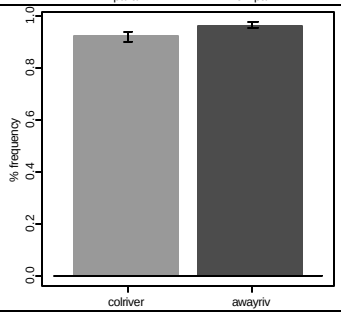
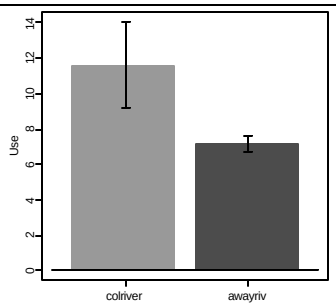
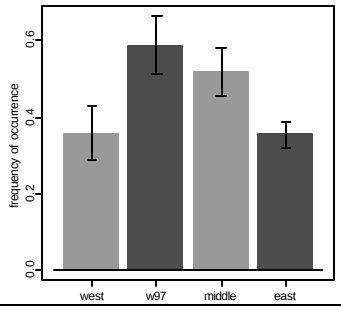
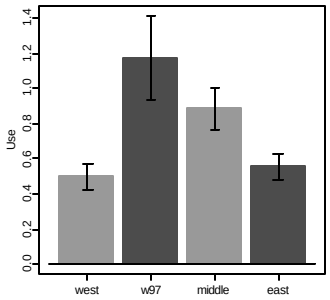
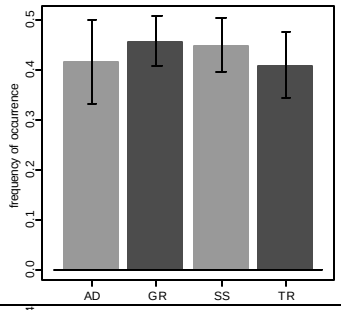
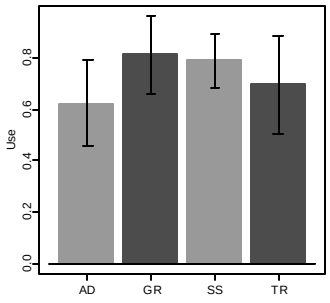
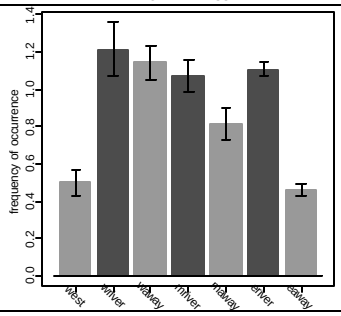
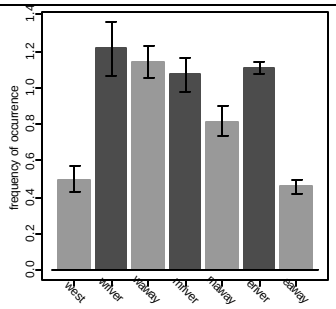
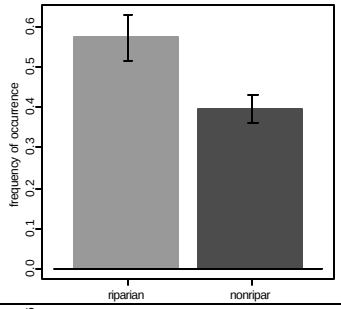
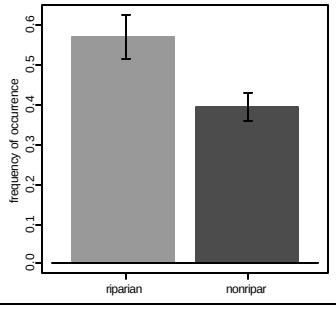
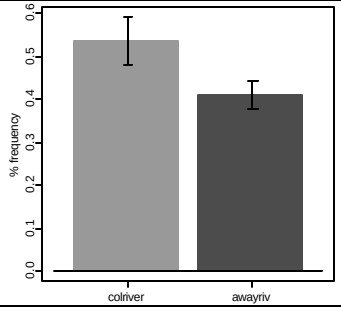
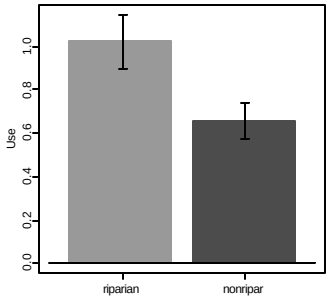
	east vs. middle 0.0637		
			AD vs. TR 0.0600
			eaway vs. mriver 0.0008 eaway vs. wriver 0.0720 eriver vs. mriver 0.0976 maway vs. mriver 0.0011 eriver vs. wriver 0.0694 mriver vs. waway 0.0230
			0.0594
			0.0008
OTHER RAPTORS			

 frequency of occurrence 0.0 0.2 0.4 0.6 0.8 1.0 west w97 middle east		 Use 0 2 4 6 8 10 12 west w97 middle east	
 frequency of occurrence 0.0 0.2 0.4 0.6 0.8 1.0 AD GR SS TR		 Use 0 2 4 6 8 10 12 AD GR SS TR	
 frequency of occurrence 0.0 0.2 0.4 0.6 0.8 1.0		 Use 0 5 10 15 20	
 frequency of occurrence 0.0 0.2 0.4 0.6 0.8 1.0 riparian nonripar		 Use 0 2 4 6 8 10 12 riparian nonripar	
 % frequency 0.0 0.2 0.4 0.6 0.8 1.0 colriver awayriv		 Use 0 2 4 6 8 10 12 14 colriver awayriv	
PASSERINES			

 frequency of occurrence 0.0 0.2 0.4 0.6 west w97 middle east		 Use 0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 west w97 middle east	
 frequency of occurrence 0.0 0.1 0.2 0.3 0.4 0.5 AD GR SS TR		 Use 0.0 0.2 0.4 0.6 0.8 AD GR SS TR	
 frequency of occurrence 0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4		 frequency of occurrence 0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4	
 frequency of occurrence 0.0 0.1 0.2 0.3 0.4 0.5 0.6 riparian nonripar		 frequency of occurrence 0.0 0.1 0.2 0.3 0.4 0.5 0.6 riparian nonripar	
 % frequency 0.0 0.1 0.2 0.3 0.4 0.5 0.6 colriver awayriv		 Use 0.0 0.2 0.4 0.6 0.8 1.0 riparian nonripar	
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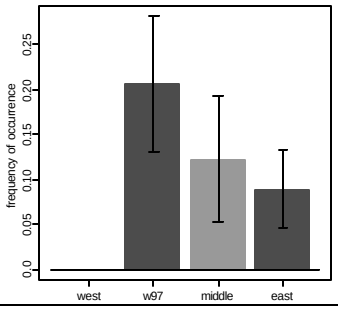
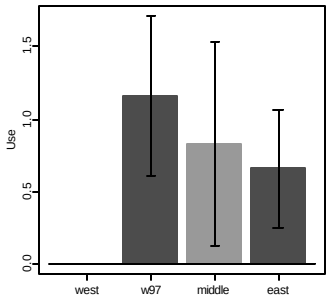
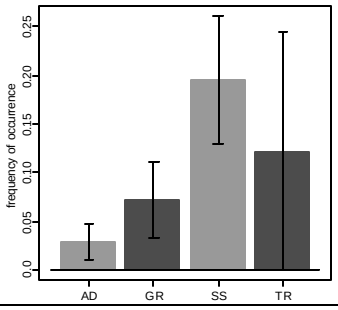
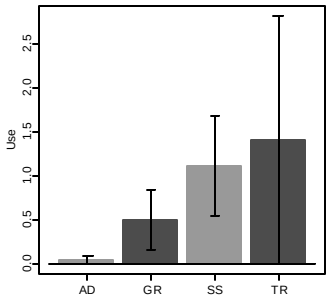
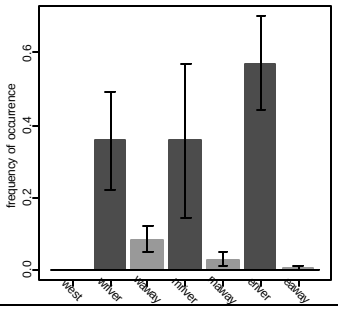
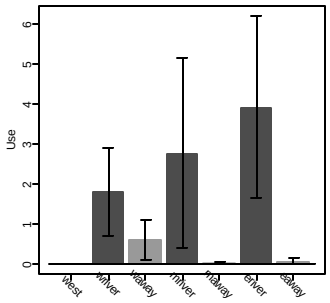


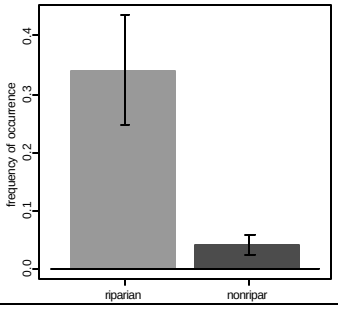


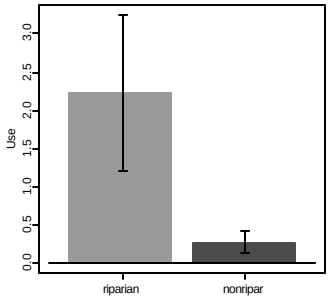


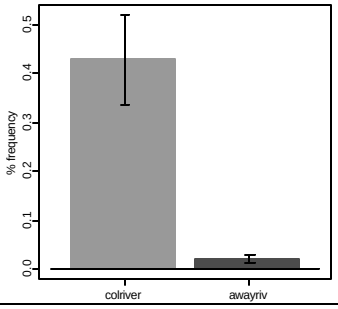


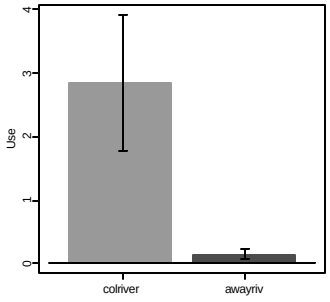












WATERFOWL/WATERBIRDS

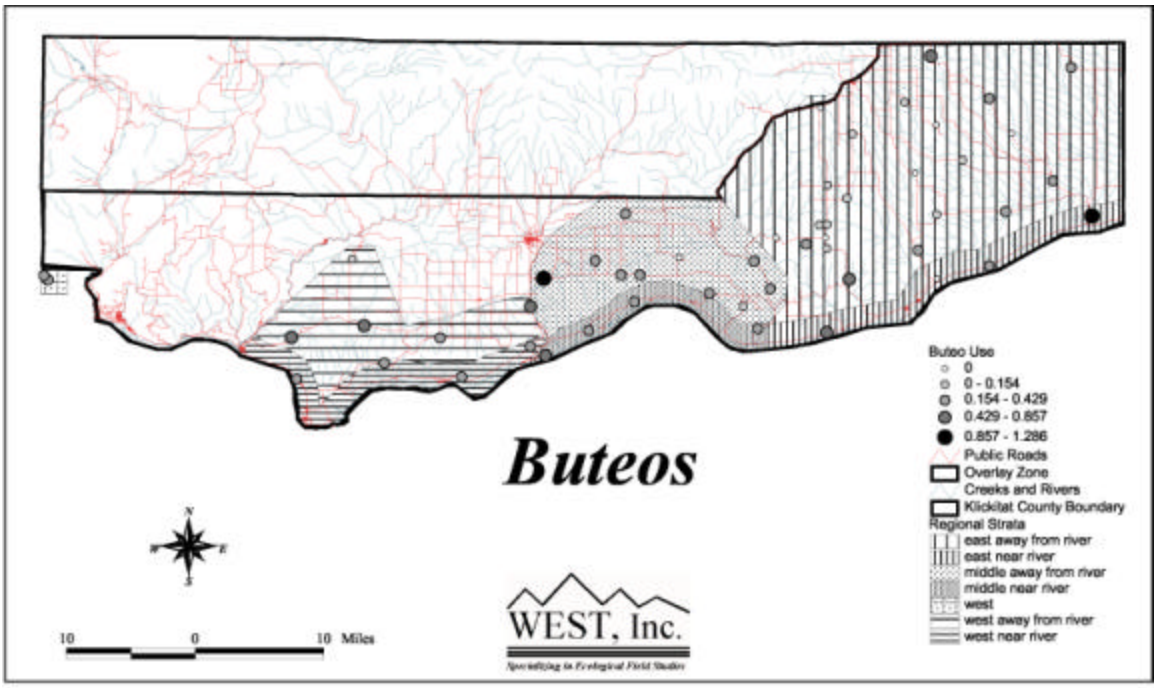


Figure 4. Avian use (#/20-minute survey) by station (mid-April thru mid-July, 2002).

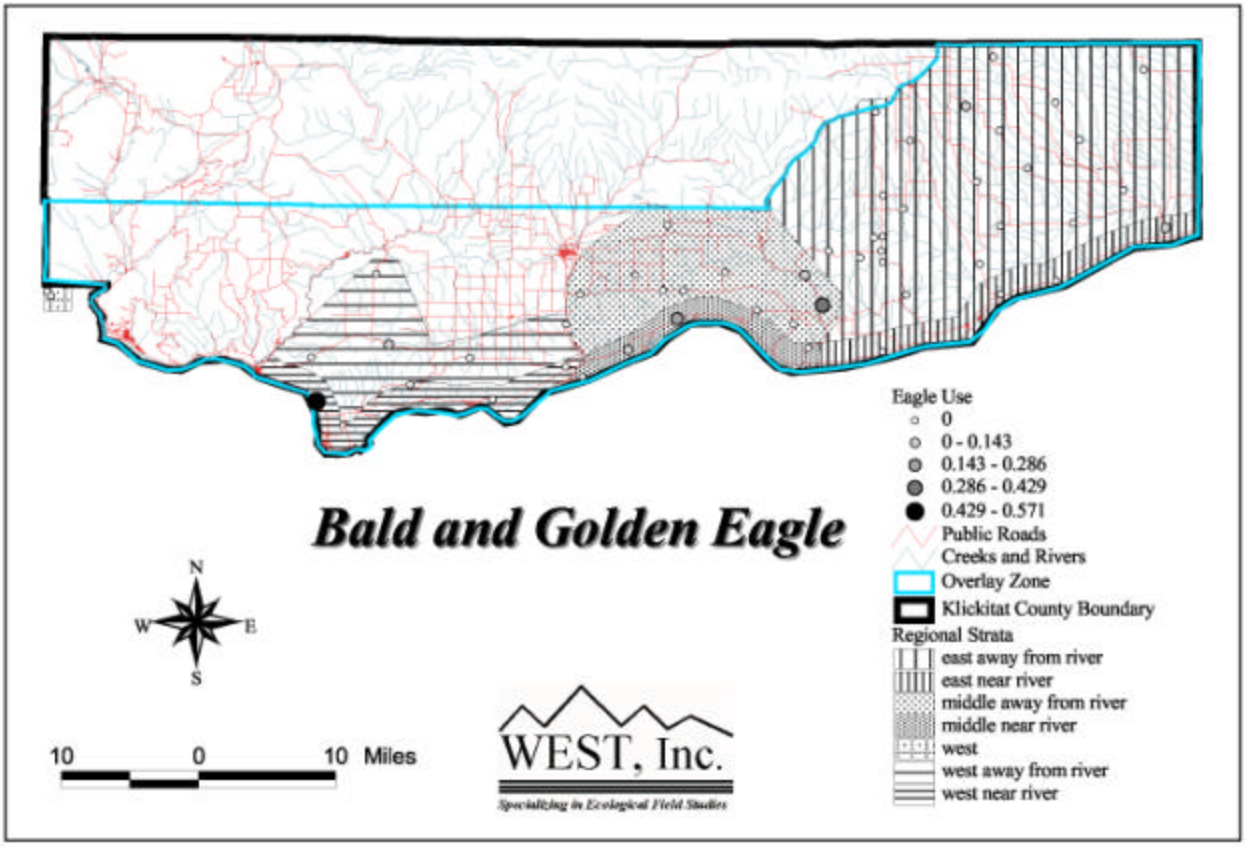


Figure 4. Avian use (# / 20-minute survey) by station from mid-April thru mid-July, 2002.

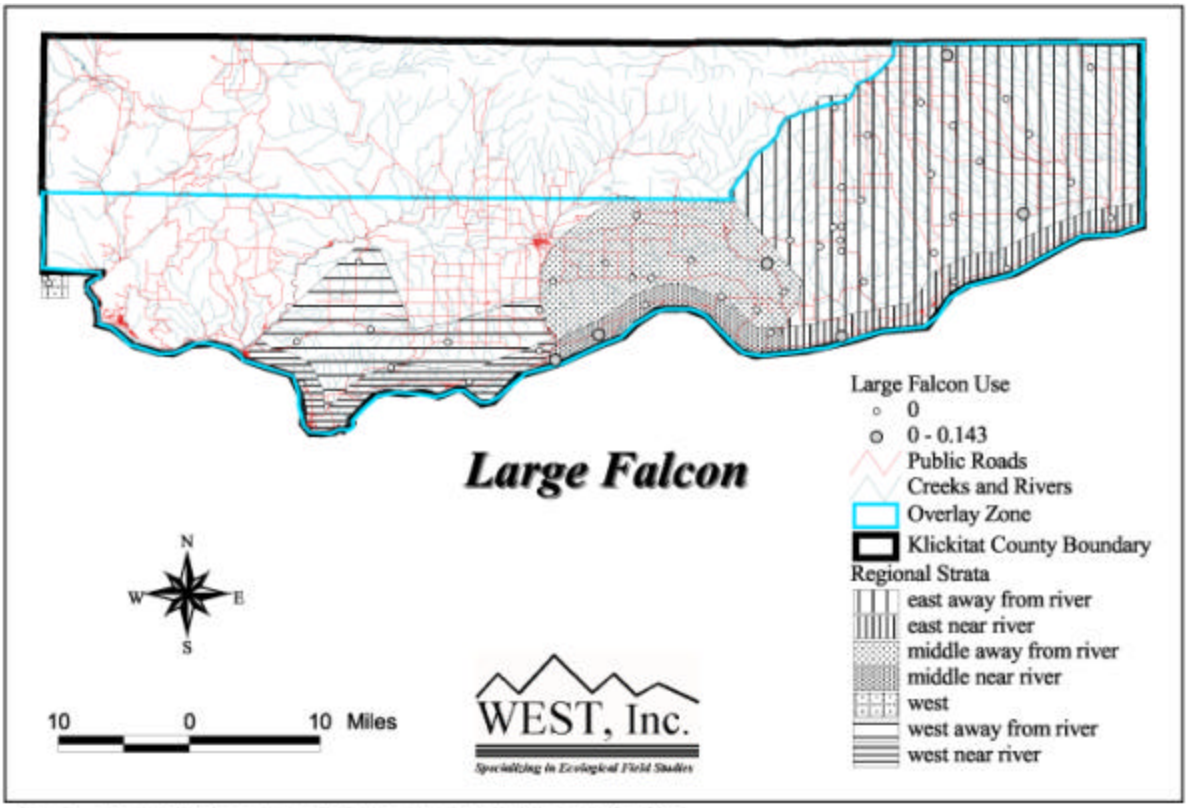


Figure 4. Avian use (# / 20-minute survey) by station from mid-April thru mid-July, 2002.

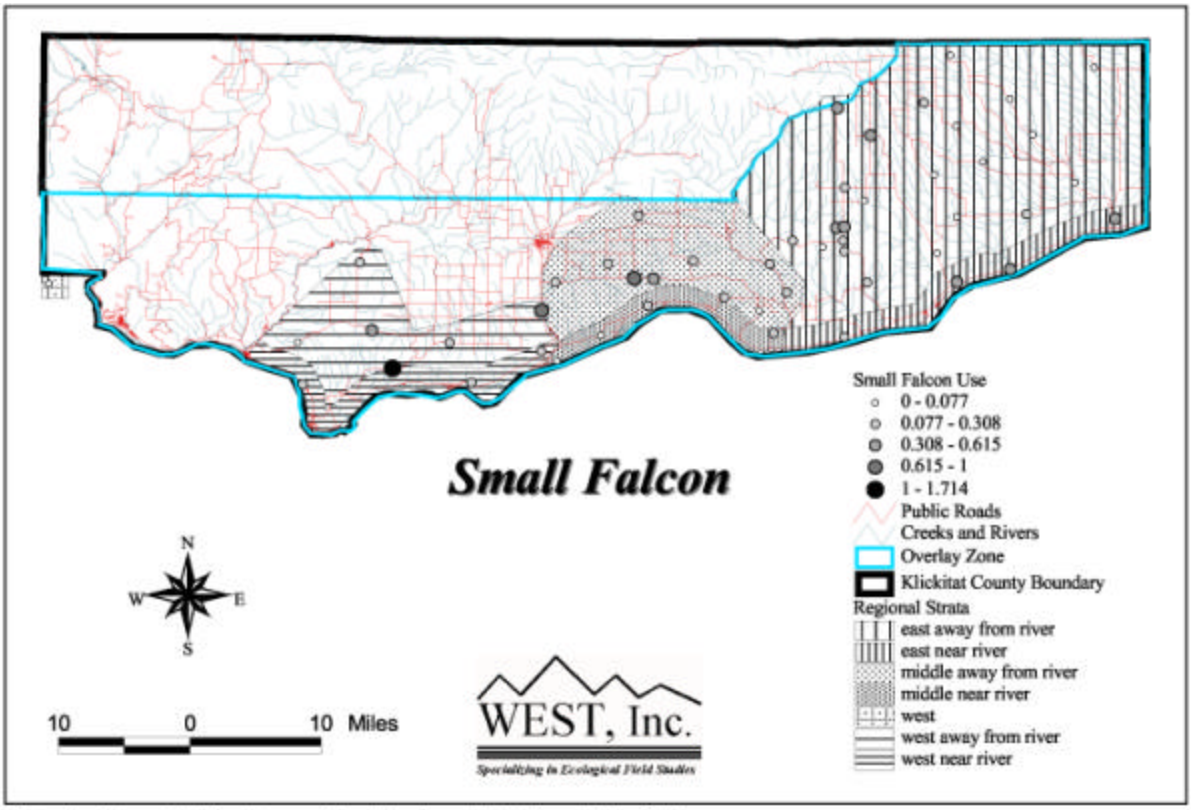


Figure 4. Avian use (# / 20-minute survey) by station from mid-April thru mid-July, 2002.

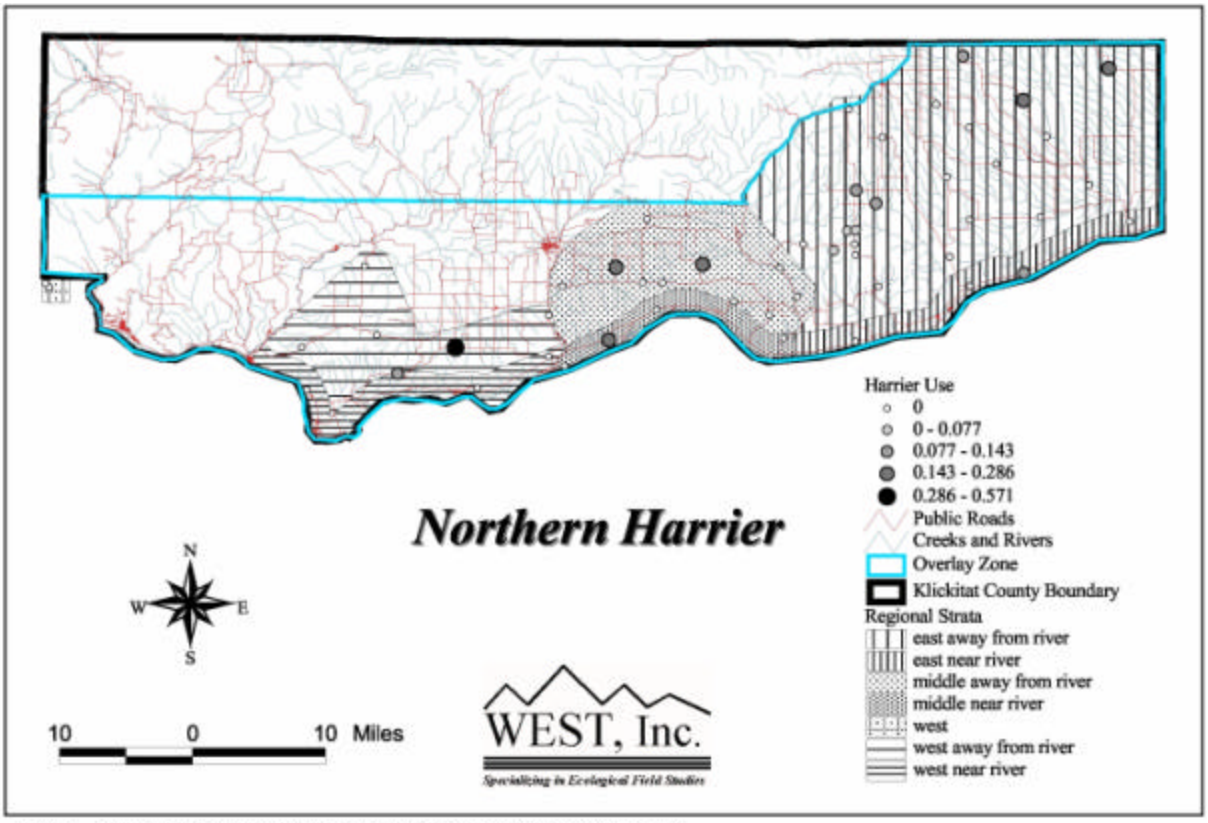


Figure 4. Avian use (# / 20-minute survey) by station from mid-April thru mid-July, 2002.

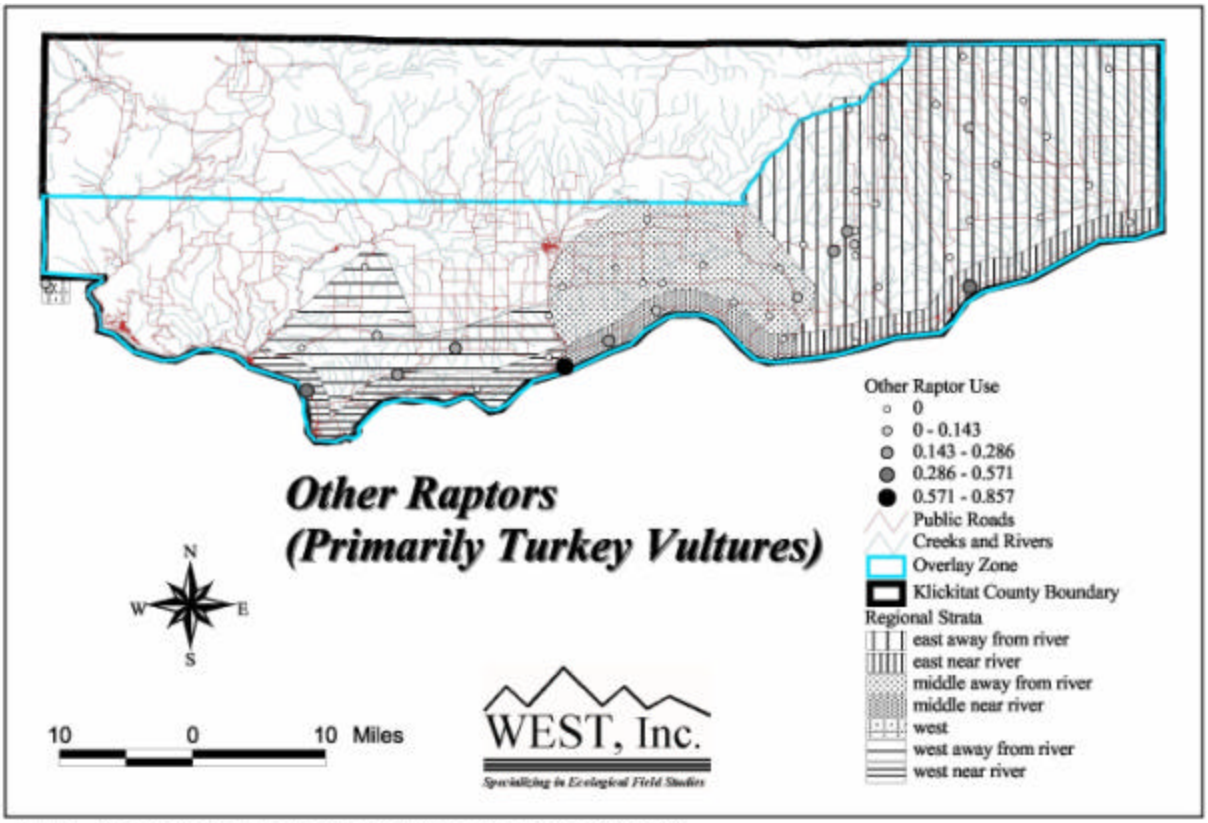


Figure 4. Avian use (# / 20-minute survey) by station from mid-April thru mid-July, 2002.

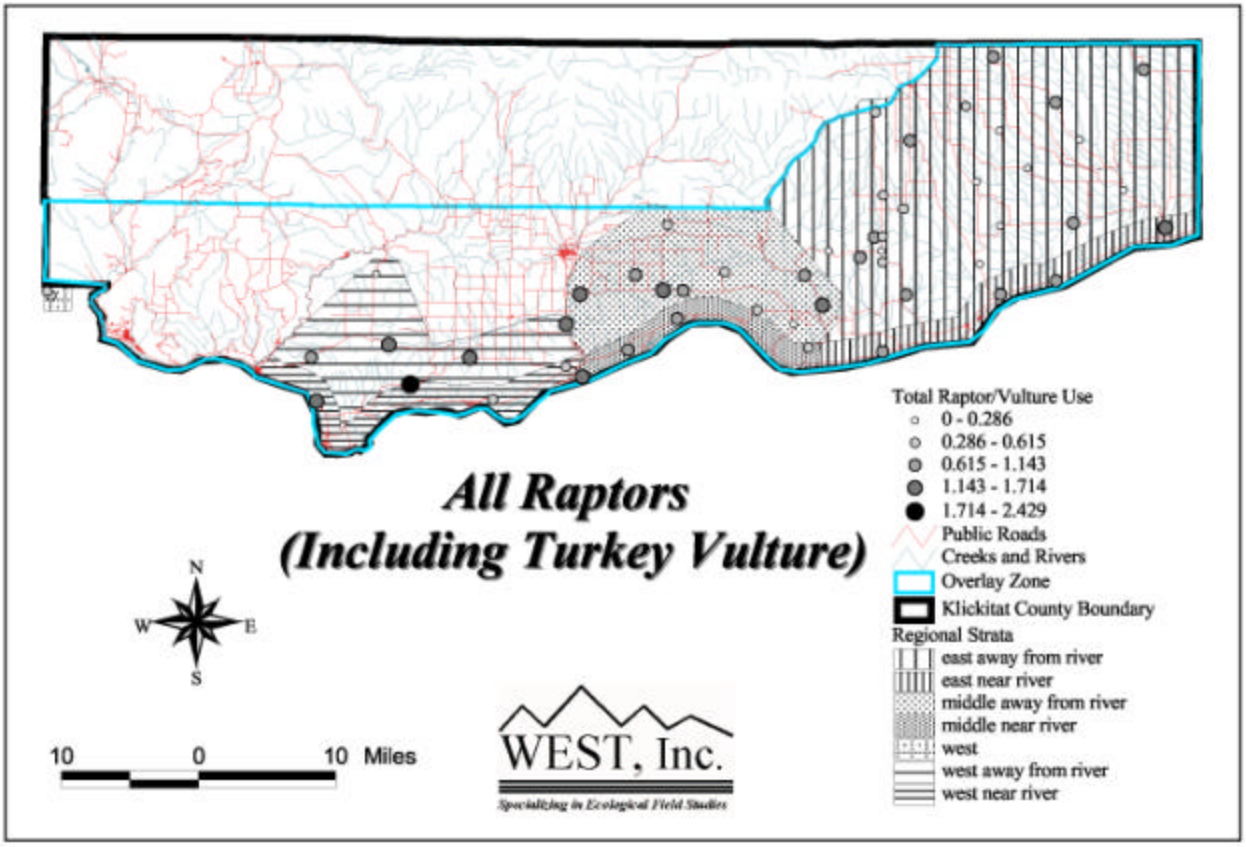


Figure 4. Avian use (# / 20-minute survey) by station from mid-April thru mid-July, 2002.

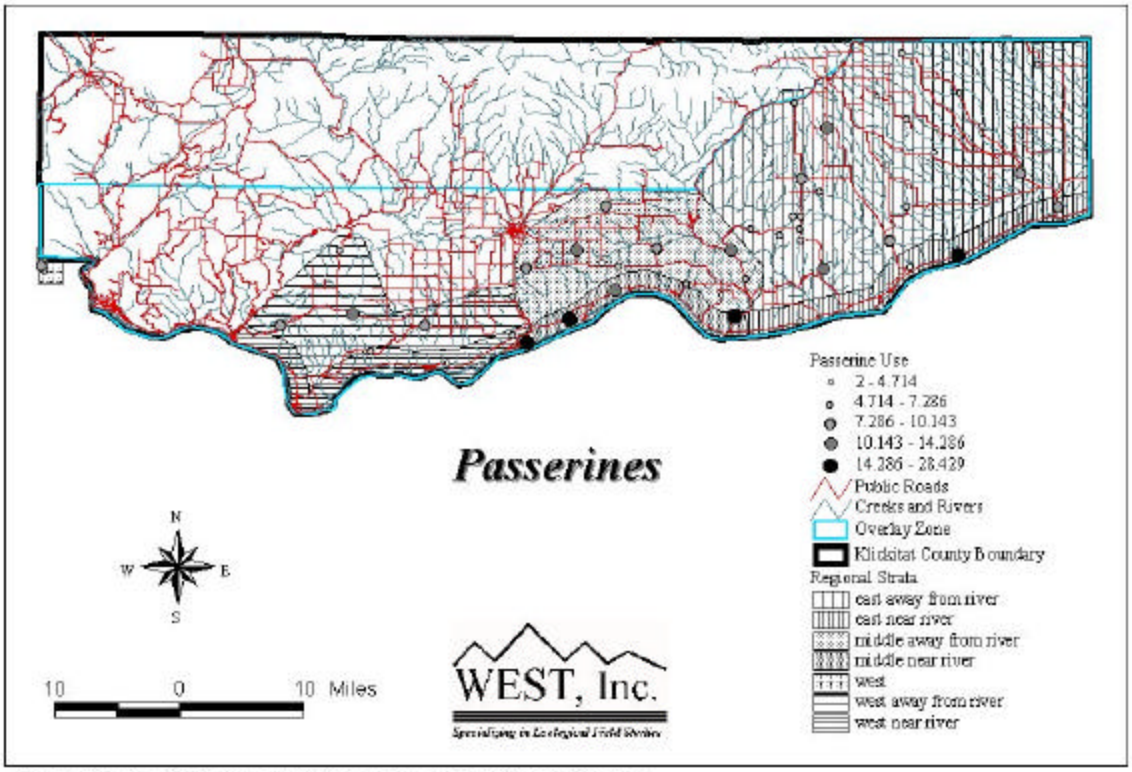


Figure 4. Avian use (#/ 20-minute survey) by station from mid-April thru mid-July, 2002.

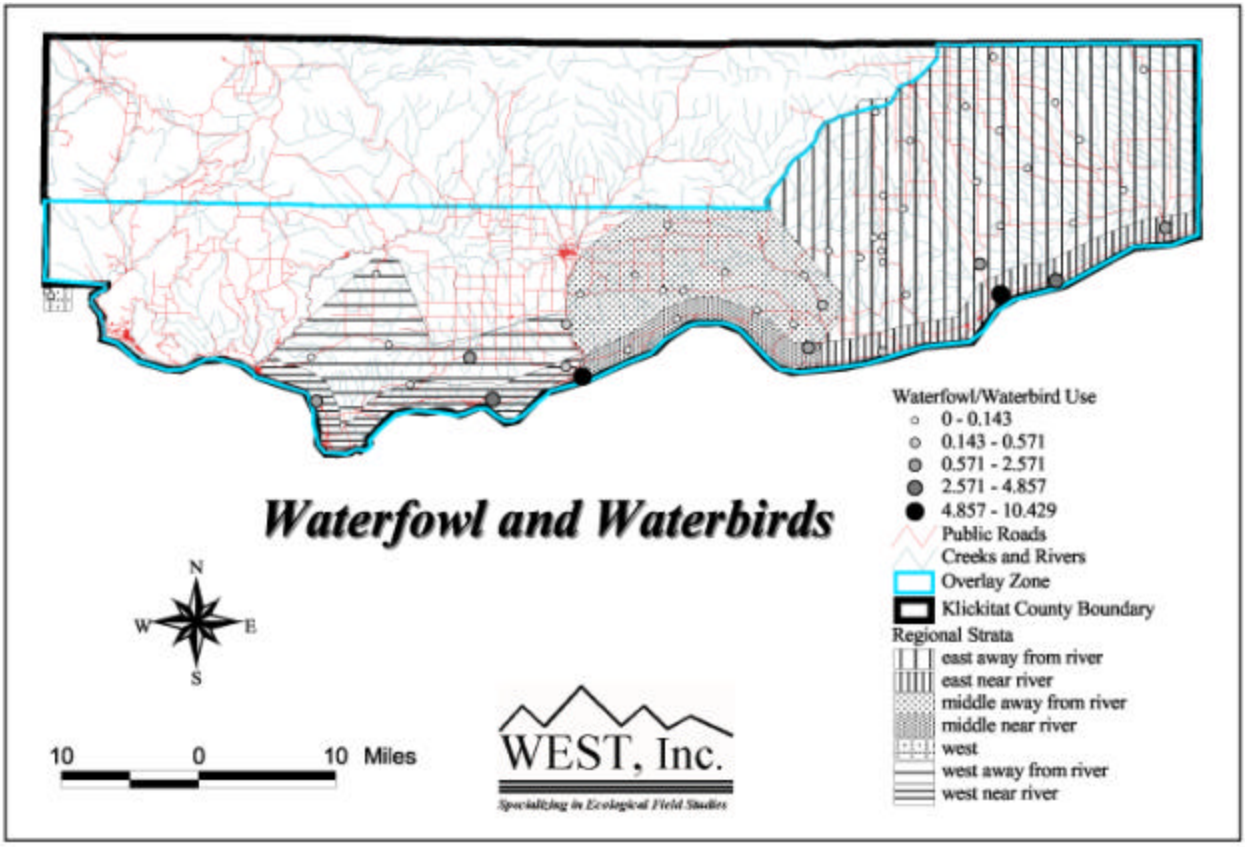


Figure 4. Avian use (# / 20-minute survey) by station from mid-April thru mid-July, 2002.

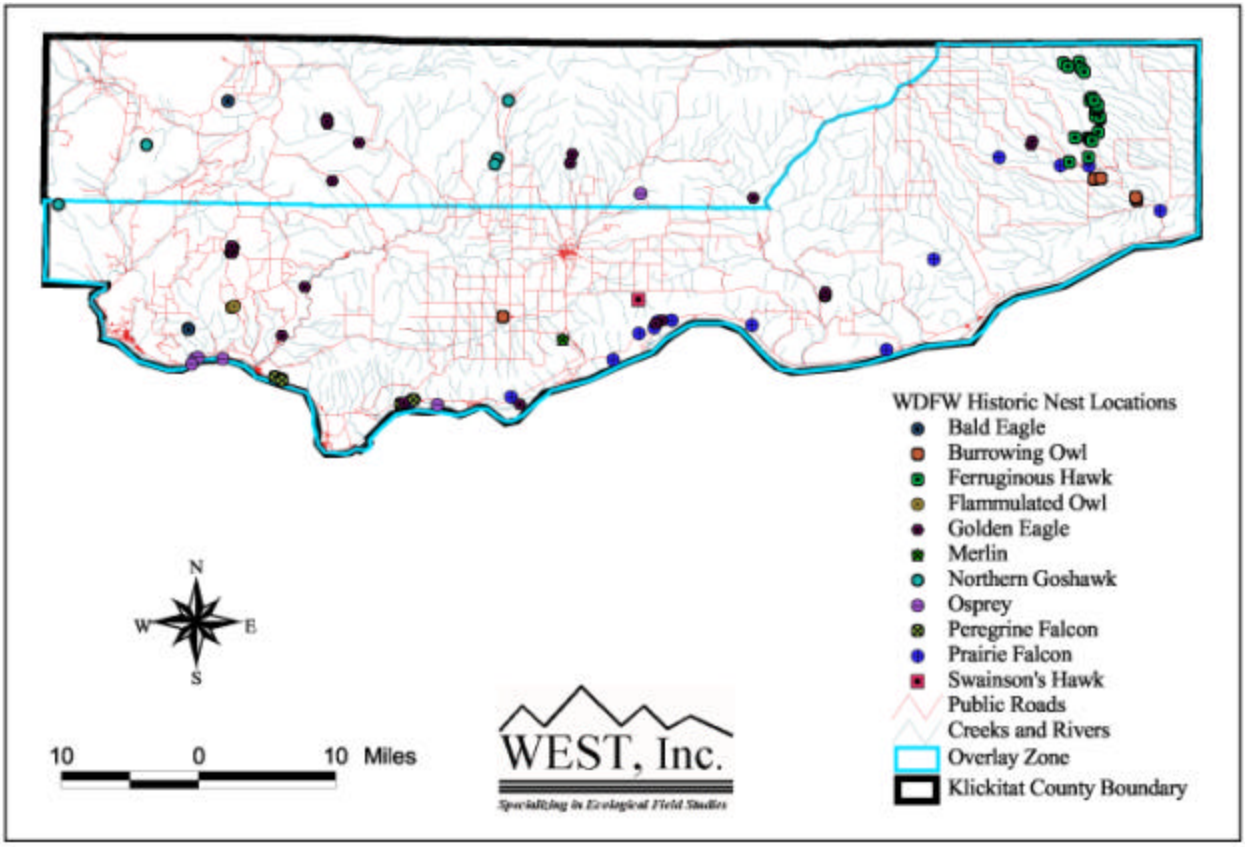


Figure 5. Historic raptor nest locations from the Washington Department of Fish and Wildlife Priority Habitat Species Database.

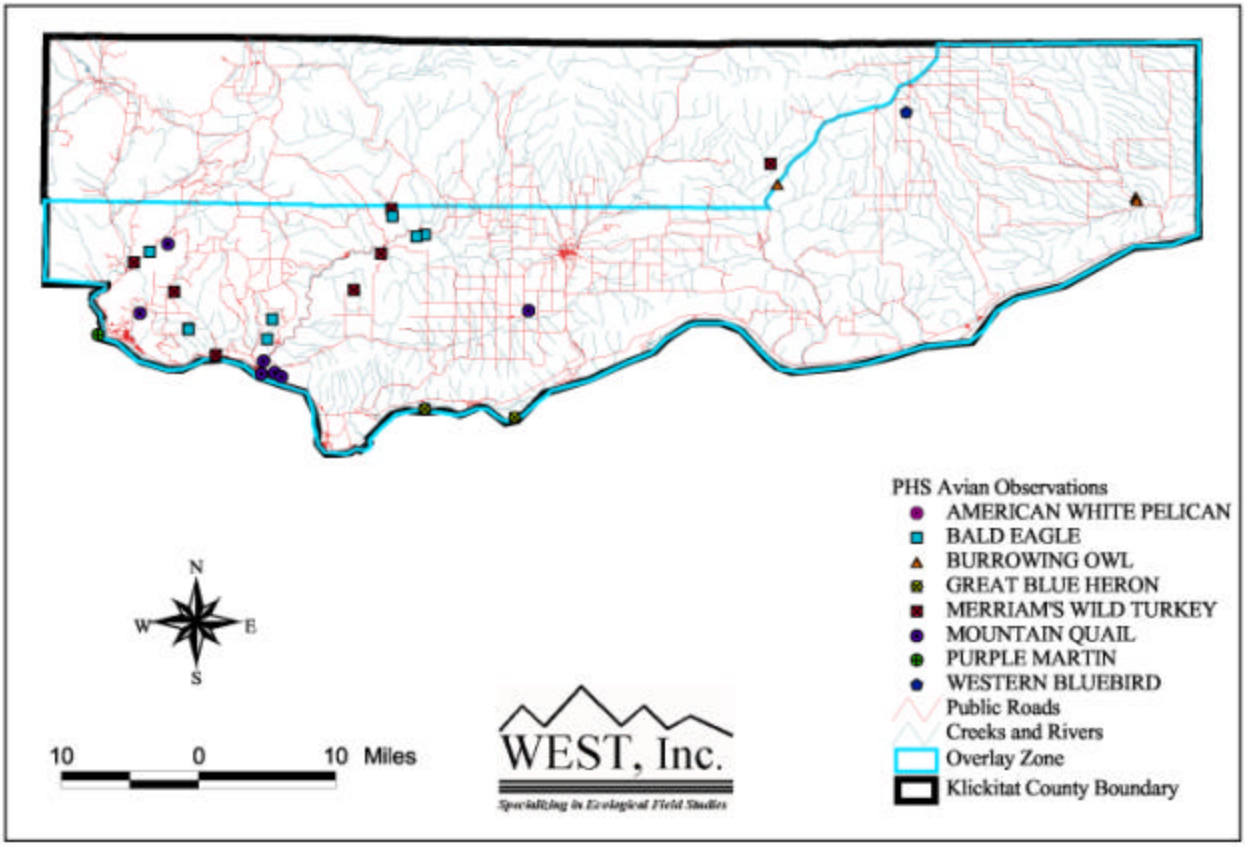


Figure 6. Locations of sensitive species contained within the WPHS database.

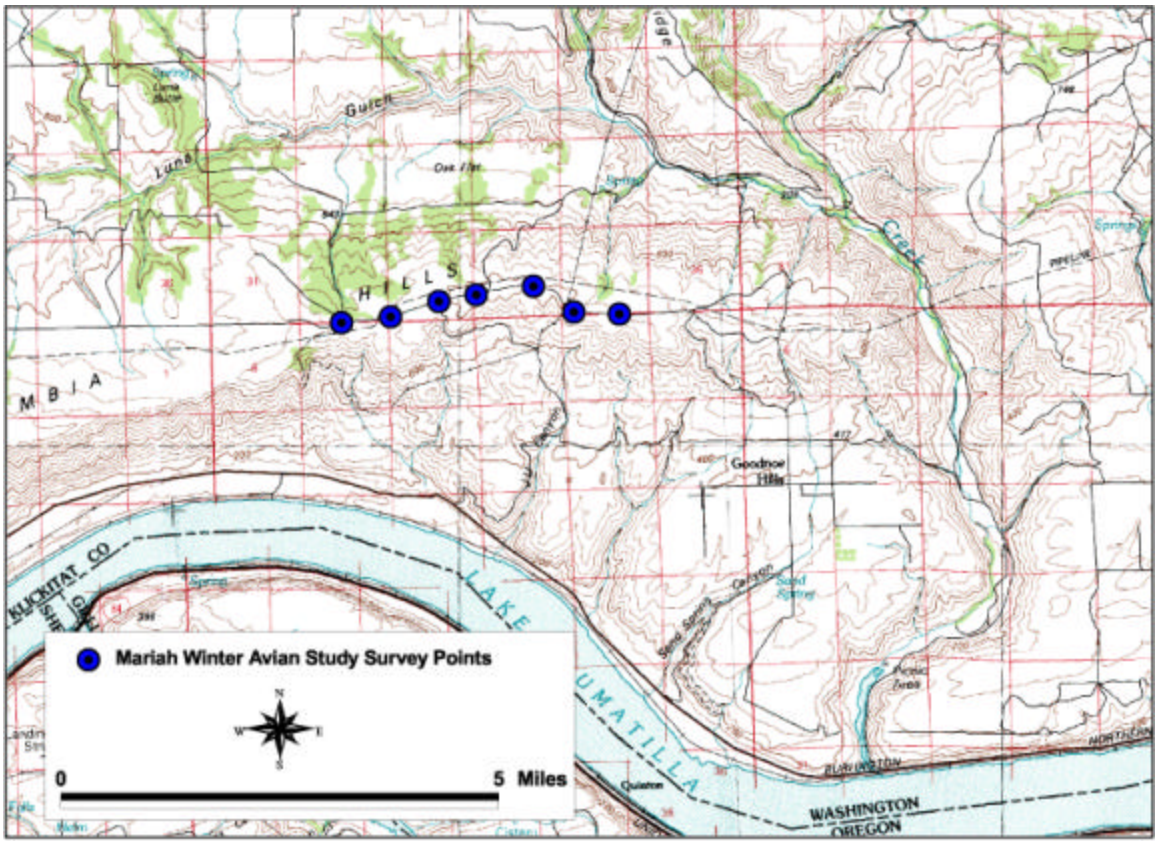


Figure 7. Mariah Project Area.

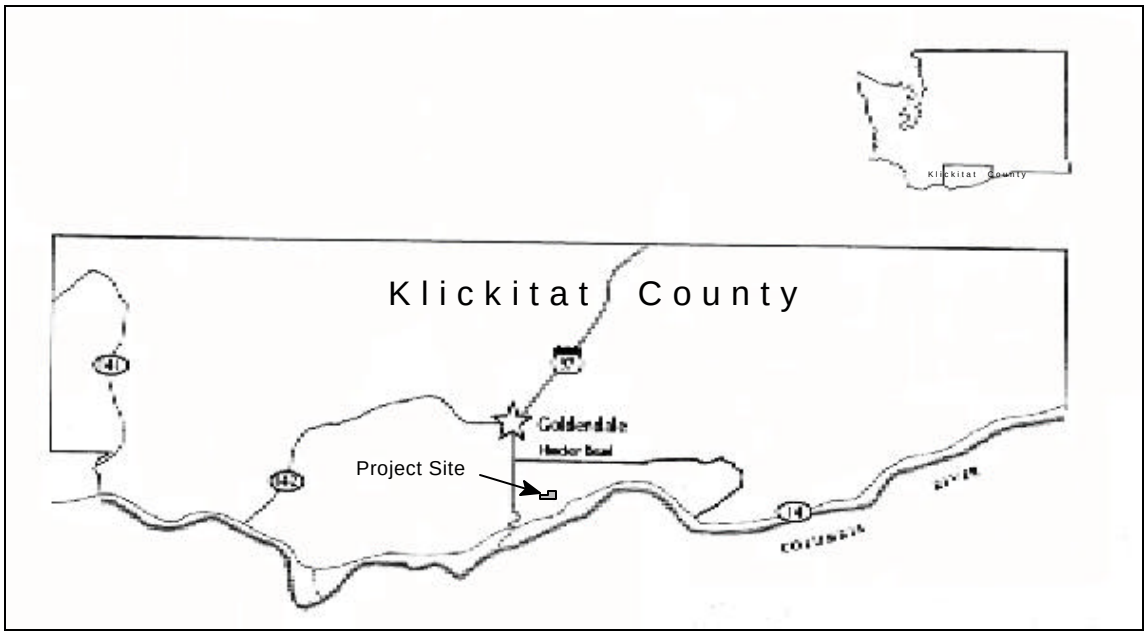


Figure 8. Location of the proposed CARES wind plant site surveyed in 1998 (Information from Erickson *et al.* 1999).

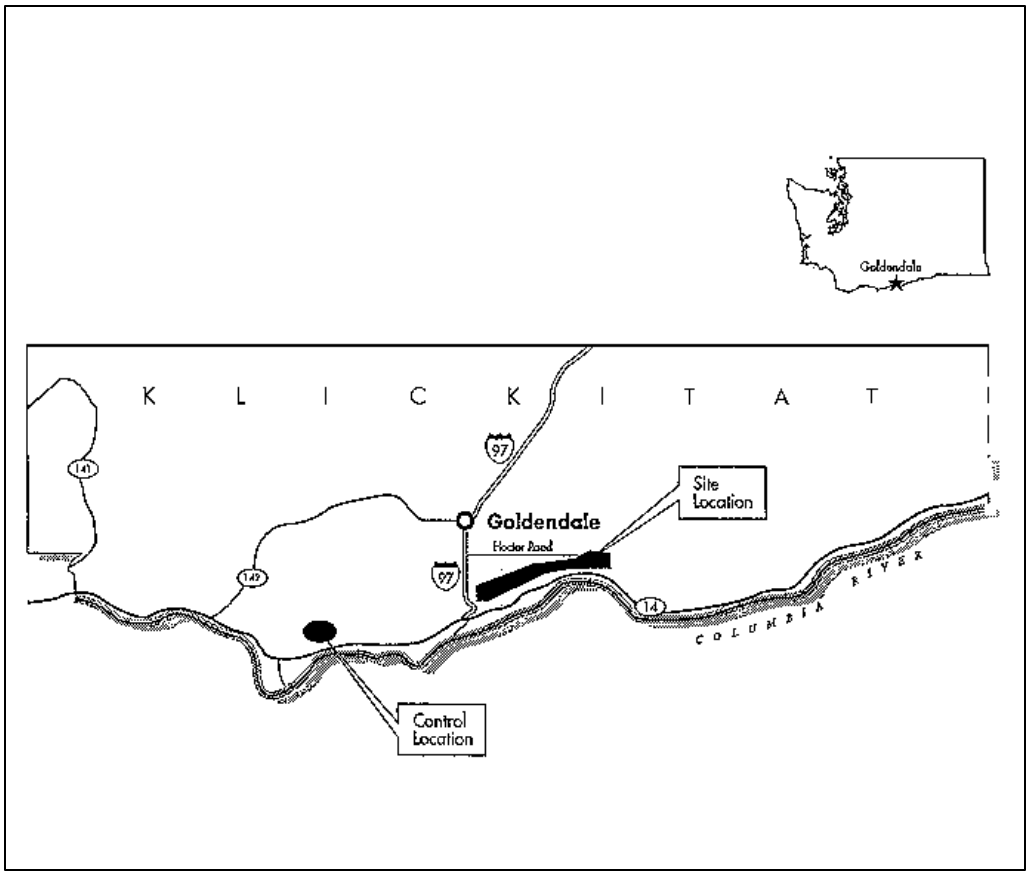
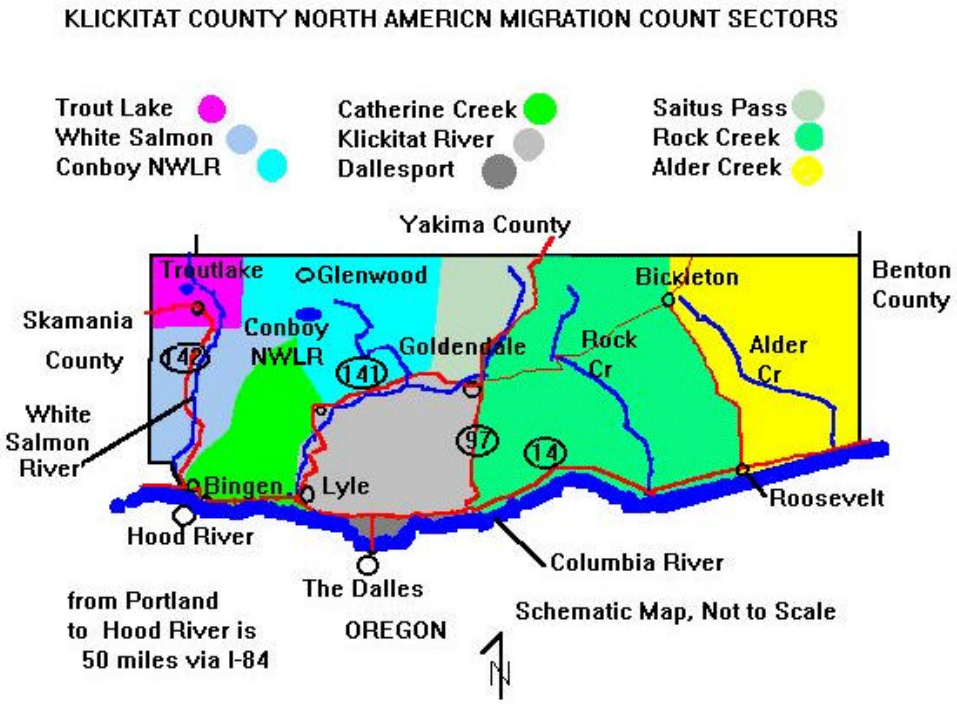
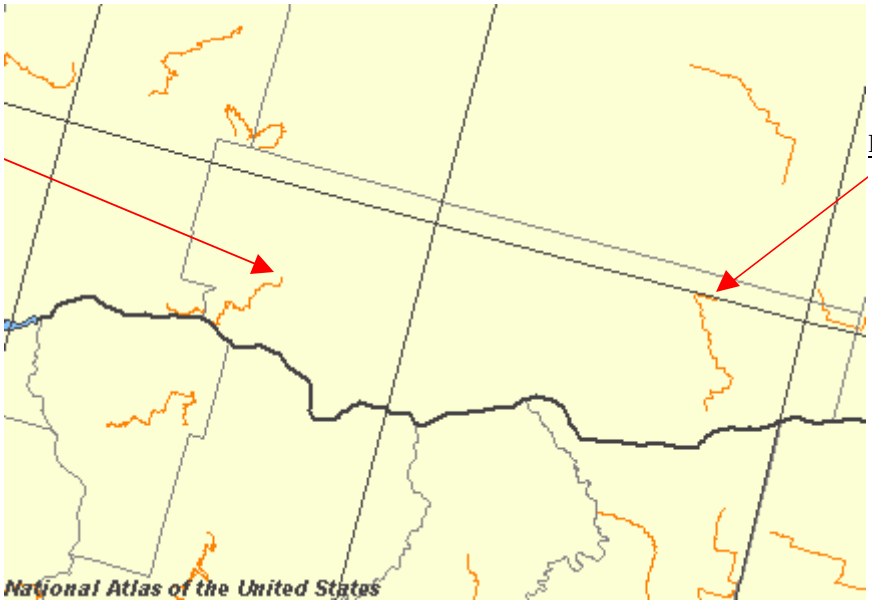


Figure 9. Location of proposed Kenetech and CARES wind farm sites and control locations surveyed in 1993-1994 (Information from Jones and Stokes 1995).

Figure 10. North American Migration Count sectors for Klickitat County.



Route 25



Route 26

Figure 11. North American Breeding Bird Survey route numbers 25 (Snowden) and 26 (Bickleton) in Klickitat County.

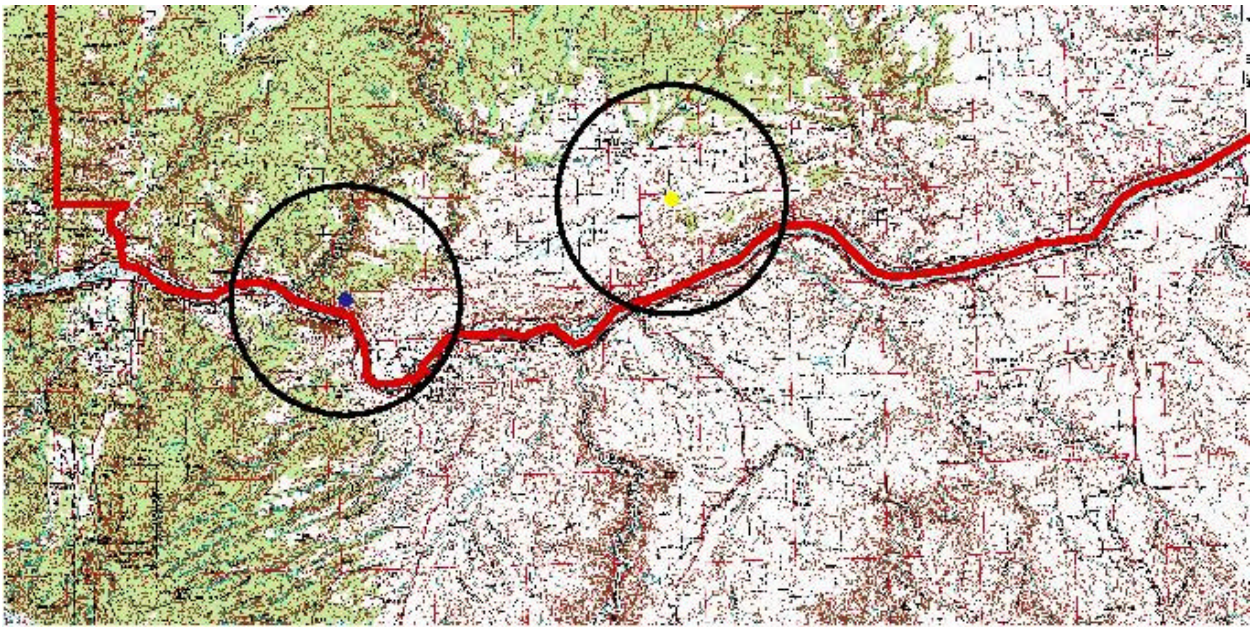


Figure 12. Locations of the Lyle and Columbia Hills-Klickitat Valley Christmas Bird Count Circles.

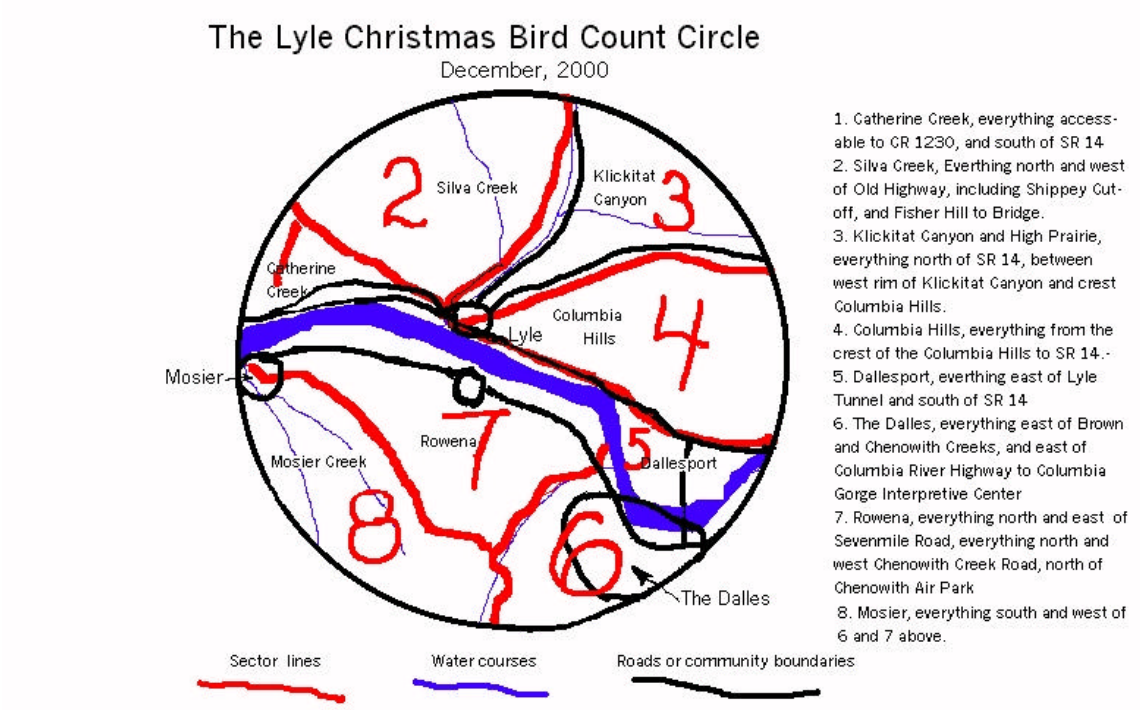


Figure 13. Sectors within the Lyle Christmas Bird Count Circle (Map from Hansen 2002).

Appendix A. Avian species observed while conducting fixed-point surveys (April 15, 2002 – July 12, 2002) on the Klickitat County Project Site. [a]

Species/Group	Spring		Summer		Grand Total	
	# obs.	# groups	# obs.	# groups	# obs.	# groups
Waterfowl\Waterbirds						
American coot	1	1	0	0	1	1
Canada goose	8	3	26	3	34	6
mallard	4	3	0	0	4	3
wood duck	3	2	0	0	3	2
California gull	37	8	0	0	37	8
Forster's tern	0	0	1	1	1	1
double-crested cormorant	0	0	1	1	1	1
great blue heron	3	2	0	0	3	2
ring-billed gull	64	16	37	11	101	27
unidentified gull	62	15	86	15	148	30
Subtotal	182	50	151	31	333	81
Shorebirds						
killdeer	8	8	5	5	13	13
long-billed curlew	5	4	1	1	6	5
spotted sandpiper	2	1	4	3	6	4
Subtotal	15	13	10	9	25	22
Corvids						
American crow	9	6	1	1	10	7
Stellar's jay	9	6	4	4	13	10
black-billed magpie	13	11	11	9	24	20
common raven	243	87	251	58	494	145
Subtotal	274	110	267	72	541	182
Upland Gamebirds						
California quail	23	17	11	8	34	25
chukar	9	2	1	1	10	3
gray partridge	1	1	0	0	1	1
ring-necked pheasant	9	9	7	7	16	16
Subtotal	42	29	19	16	61	45
Doves						
mourning dove	47	35	79	42	126	77
Raptors						
Accipiter						
sharp-shinned hawk	1	1	0	0	1	1
Cooper's hawk	1	1	1	1	2	2
Subtotal	2	2	1	1	3	3

Appendix A (*continued*). Avian species observed while conducting fixed-point surveys (April 15, 2002 – July 12, 2002) on the Klickitat County Project Site. [a]

Species/Group	Spring		Summer		Grand Total	
	# obs.	# groups	# obs.	# groups	# obs.	# groups
Buteos						
Swainson's hawk	1	1	3	3	4	4
ferruginous hawk	5	5	0	0	5	5
red-tailed hawk	72	61	59	55	131	116
rough-legged hawk	1	1	0	0	1	1
unidentified buteo	13	12	19	18	32	30
Subtotal	92	80	81	76	173	156
Eagles						
bald eagle	3	3	0	0	3	3
golden eagle	3	2	7	5	10	7
unidentified eagle	0	0	2	2	2	2
Subtotal	6	5	9	7	15	12
Falcons						
merlin	0	0	3	3	3	3
American kestrel	46	43	50	43	96	86
prairie falcon	4	4	3	3	7	7
unidentified falcon	3	3	0	0	3	3
Subtotal	53	50	56	49	109	99
Other Raptors						
northern harrier	14	11	12	12	26	23
osprey	4	4	3	3	7	7
turkey vulture	14	10	16	12	30	22
Subtotal	32	25	31	27	63	52
Raptor Subtotal	185	162	178	160	363	322
Passerines						
American goldfinch	98	12	79	20	177	32
American robin	21	18	28	21	49	39
Bewick's wren	4	4	2	2	6	6
Brewer's blackbird	114	27	40	12	154	39
Brewer's sparrow	3	3	1	1	4	4
Bullock's oriole	7	7	19	15	26	22
Cassin's finch	5	1	3	3	8	4
European starling	162	42	0	0	162	42
Hammond's flycatcher	0	0	2	2	2	2
Olive-sided Flycatcher	2	2	2	1	4	3
Say's phoebe	5	4	1	1	6	5
Townsend's solitaire	2	2	0	0	2	2

Appendix A (*continued*). Avian species observed while conducting fixed-point surveys (April 15, 2002 – July 12, 2002) on the Klickitat County Project Site. [a]

Species/Group	Spring		Summer		Grand Total	
	# obs.	# groups	# obs.	# groups	# obs.	# groups
Townsend's warbler	1	1	1	1	2	2
Vaux's swift	21	4	16	8	37	12
Veery	0	0	1	1	1	1
Wilson's warbler	3	3	6	6	9	9
ash-throated flycatcher	0	0	7	7	7	7
bank swallow	6	2	0	0	6	2
barn swallow	50	19	75	16	125	35
black-capped chickadee	5	5	1	1	6	6
black-headed grosbeak	0	0	1	1	1	1
brown-headed cowbird	2	2	6	6	8	8
canyon wren	0	0	2	2	2	2
chipping sparrow	15	8	19	10	34	18
cliff swallow	74	13	103	14	177	27
common yellowthroat	0	0	1	1	1	1
dark-eyed junco	31	12	8	5	39	17
eastern kingbird	0	0	1	1	1	1
golden-crowned kinglet	7	6	2	2	9	8
golden-crowned sparrow	0	0	2	1	2	1
grasshopper sparrow	3	2	4	4	7	6
horned lark	132	92	252	111	384	203
house finch	37	8	32	10	69	18
house sparrow	1	1	0	0	1	1
house wren	0	0	1	1	1	1
lark sparrow	1	1	14	13	15	14
lazuli bunting	0	0	7	7	7	7
lesser goldfinch	0	0	6	3	6	3
loggerhead shrike	1	1	0	0	1	1
mountain bluebird	70	36	44	30	114	66
northern rough-winged swallow	13	2	36	7	49	9
pine siskin	8	2	2	1	10	3
red-breasted nuthatch	1	1	1	1	2	2
red-winged blackbird	66	29	23	11	89	40
rock wren	18	16	20	20	38	36
ruby-crowned kinglet	1	1	0	0	1	1
savannah sparrow	5	4	3	3	8	7
solitary vireo	0	0	1	1	1	1
song sparrow	6	6	7	7	13	13
spotted towhee	13	13	8	7	21	20
tree swallow	6	2	1	1	7	3
unidentified bluebird	2	2	1	1	3	3
unidentified finch	0	0	22	1	22	1

Appendix A (*continued*). Avian species observed while conducting fixed-point surveys (April 15, 2002 – July 12, 2002) on the Klickitat County Project Site. [a]

Species/Group	Spring		Summer		Grand Total	
	# obs.	# groups	# obs.	# groups	# obs.	# groups
unidentified flycatcher	3	3	4	4	7	7
unidentified passerine	17	13	18	3	35	16
unidentified sparrow	8	5	2	2	10	7
unidentified swallow	33	11	30	10	63	21
unidentified warbler	22	2	0	0	22	2
vesper sparrow	14	12	6	6	20	18
violet-green swallow	46	4	38	7	84	11
western bluebird	20	12	5	5	25	17
western kingbird	40	26	50	34	90	60
western meadowlark	344	264	268	208	612	472
western tanager	12	10	8	8	20	18
western wood-pewee	1	1	14	14	15	15
white-crowned sparrow	142	25	19	8	161	33
willow flycatcher	0	0	1	1	1	1
yellow warbler	0	0	1	1	1	1
yellow-breasted chat	0	0	2	2	2	2
yellow-rumped warbler	70	26	14	12	84	38
Subtotal	1794	830	1394	726	3188	1556
Other – 3 identified						
Lewis' woodpecker	11	11	13	13	24	24
Rufous hummingbird	1	1	0	0	1	1
Belted kingfisher	3	2	0	0	3	2
common nighthawk	0	0	3	3	3	3
red-breasted sapsucker	1	1	0	0	1	1
red-shafted flicker	10	10	1	1	11	11
unidentified hummingbird	1	1	4	4	5	5
unidentified woodpecker	4	4	0	0	4	4
unidentified bird	1	1	0	0	1	1
Subtotal	32	31	21	21	53	52
Grand Total	2571	1260	2119	1077	4690	2337

[a] Includes observations recorded at distances greater than 800 m from the observer.

Appendix B. List of avian species observed during fixed-point surveys April 15, 2002 – July 12, 2002.

Species/Group	Scientific Name	Species/Group	Scientific Name	Species/Group	Scientific Name
sharp-shinned hawk	*Accipiter striatus*	golden-crowned sparrow	*Zonotrichia atricapilla*	double-crested cormorant	*Phalacrocorax auritus*
Cooper's hawk	*Accipiter cooperi*	chipping sparrow	*Spizella passerina*	mallard	*Anas platyrhynchos*
red-tailed hawk	*Buteo jamaicensis*	Brewer's sparrow	*Spizella breweri*	wood duck	*Aix sponsa*
Swainson's hawk	*Buteo swainsoni*	dark-eyed junco	*Junco hyemalis*	Canada goose	*Branta canadensis*
rough-legged hawk	*Buteo lagopus*	song sparrow	*Melospiza melodia*	great blue heron	*Ardea herodias*
ferruginous hawk	*Buteo regalis*	spotted towhee	*Pipilo maculatus*	American coot	*Fulica americana*
northern harrier	*Circus cyaneus*	black-headed grosbeak	*Pheucticus melanocephalus*	spotted sandpiper	*Actitis macularia*
golden eagle	*Aquila chrysaetos*	lazuli bunting	*Passerina amoena*	long-billed curlew	*Numenius americanus*
bald eagle	*Haliaeetus leucocephalus*	western tanager	*Piranga ludoviciana*	killdeer	*Charadrius vociferus*
prairie falcon	*Falco mexicanus*	cliff swallow	*Petrochelidon pyrrhonota*	black-billed magpie	*Pica pica*
Merlin	*Falco columbarius*	barn swallow	*Hirundo rustica*	Stellar's jay	*Cyanocitta stelleri/ Aphelocoma*
American kestrel	*Falco sparverius*	tree swallow	*Tachycineta bicolor*	common raven	*Corvus corax*
turkey vulture	*Cathartes aura*	violet-green swallow	*Tachycineta thalassina*	American crow	*Corvus brachyrhynchos*
osprey	*Pandion haliaetus*	bank swallow	*Riparia riparia*	chukar	*Alectoris chukar*
Vaux's swift	*Chaetura vauxi*	northern rough-winged swallow	*Stelgidopteryx serripennis*	California quail	*Callipepla californica*
eastern kingbird	*Tyrannus tyrannus*	loggerhead shrike	*Lanius ludovicianus*	gray partridge	*Perdix perdix*
western kingbird	*Tyrannus verticalis*	solitary vireo	*Vireo solitarius*	ring-necked pheasant	*Phasianus colchicus*
ash-throated flycatcher	*Myiarchus cinerascens*	yellow warbler	*Dendroica petechia*	mourning dove	*Zenaida macroura*
Say's phoebe	*Sayornis saya*	yellow-rumped warbler	*Dendroica coronata*	belted kingfisher	*Ceryle alcyon*
olive-sided flycatcher	*Contopus cooperi*	Townsend's warbler	*Dendroica townsendi*	red-breasted sapsucker	*Sphyrapicus ruber*
western wood-pewee	*Contopus virens*	common yellowthroat	*Geothlypis trichas*	Lewis' woodpecker	*Melanerpes lewis*
willow flycatcher	*Empidonax traillii*	yellow-breasted chat	*Icteria virens*	red-shafted flicker	*Colaptes auratus*
Hammond's flycatcher	*Empidonax hammondii*	Wilson's warbler	*Wilsonia pusilla*	common nighthawk	*Chordeiles minor*
horned lark	*Eremophila alpestris*	house sparrow	*Passer domesticus*	Rufous hummingbird	*Selasphorus rufus*
European starling	*Sturnus vulgaris*	canyon wren	*Campylorhynchus brunneicapillus*		

Appendix B (*continued*). List of avian species observed during fixed-point surveys April 15, 2002 – July 12, 2002.

Species/Group	Scientific Name	Species/Group	Scientific Name	Species/Group	Scientific Name
brown-headed cowbird	*Molothrus ater*	rock wren	*Salpinctes obsoletus*		
red-winged blackbird	*Agelaius phoeniceus*	Bewick's wren	*Thryomanes bewickii*	unidentified buteo	
western meadowlark	*Sturnella neglecta*	house wren	*Troglodytes aedon*	unidentified eagle	
Bullock's oriole	*Icterus bullockii*	red-breasted nuthatch	*Sitta canadensis*	unidentified falcon	
Brewer's blackbird	*Euphagus cyanocephalus*	black-capped chickadee	*Poecile atricapillus*	unidentified flycatcher	
Cassin's finch	*Carpodacus purpureus*	golden-crowned kinglet	*Regulus satrapa*	unidentified finch	
house finch	*Carpodacus mexicanus*	ruby-crowned kinglet	*Regulus calendula*	unidentified sparrow	
American goldfinch	*Carduelis tristis*	Townsend's solitaire	*Myadestes townsendi*	unidentified swallow	
lesser goldfinch	*Carduelis psaltria*	Veery	*Catharus fuscescens*	unidentified warbler	
pine siskin	*Carduelis pinus*	American robin	*Turdus migratorius*	unidentified bluebird	
vesper sparrow	*Pooecetes gramineus*	western bluebird	*Sialia mexicana*	unidentified passerine	
savannah sparrow	*Passerculus sandwichensis*	mountain bluebird	*Sialia currucoides*	unidentified gull	
grasshopper sparrow	*Ammodramus savannarum*	California gull	*Larus californicus*	unidentified woodpecker	
lark sparrow	*Chondestes grammacus*	ring-billed gull	*Larus delawarensis*	unidentified hummingbird	
white-crowned sparrow	*Zonotrichia leucophrys*	Forster's tern	*Sterna forsteri*	unidentified bird	

Appendix C. Habitat of blocks surveyed for raptor nests in Klickitat County study area.

Plot Number	Description	Category	Survey (Full, Partial, None)
2	The entire plot is dominated by mature coniferous forest with a few clearcuts and a powerline. The area is not suitable for searching from the helicopter.	Conifer Forest	None
3 - 4	Dominated by coniferous and oak woodlands with a few scattered agricultural fields. The area has several houses which were avoided, making surveys difficult.	Conifer / Oak	Partial
5	The plot is located on the south side of the Columbia Hills. The area is dominated by open grassland with oak stands and scattered cottonwoods present in drainages. One powerline is present.	Grassland / Oak	Full
6	The plot is centered along the crest of the Columbia Hills. The north side of the Columbia Hills is dominated by open grassland with large patches of oak and some cottonwood riparian areas. The south side of the Columbia Hills is contains open grassland with a few cottonwood riparian areas.	Grassland / Oak Cottonwood Riparian Present	Full
7	The plot is located along the south side of the Columbia Hills and contains open grassland with a few cottonwood riparian areas.	Grassland / Oak Cottonwood Riparian Present	Full
8	The area is dominated by agricultural land with a few scattered trees. A few powerlines are present.	Agriculture	Full
9	The plot is located along the south side of the Columbia Hills. The area is dominated by open grassland with a few scattered trees. The plot contains some cliffs near the Columbia River.	Grassland Cliffs present	Full
10	The plot is centered on the crest of the Columbia Hills. The north side is dominated by agricultural lands with a few scattered trees and residences. The south side is dominated by open grassland with a few scattered cottonwoods and a powerline.	Agriculture / Grassland	Full
11	This plot was not surveyed due to high concentrations of houses, including the Maryhill Museum.	Residential	None
12	The area is dominated by agricultural land with a few cottonwood riparian areas. A few scattered cottonwoods are present within the agricultural fields. Housing densities are moderate and some riparian areas were not searched due to the presence of houses and horses.	Agriculture Cottonwood Riparian areas present	Partial
13	The plot is located along the Columbia River. A large powerplant and many powerlines are located within the plot, making searches difficult. The plot contains some cliffs along the Columbia River and a few cottonwoods which were searched.	Grassland / Industrial Cliffs present	Partial
14	The area is dominated by agricultural land with scattered cottonwoods and some residences.	Agriculture	Full

Appendix C (*continued*). Habitat of blocks surveyed for raptor nests in Klickitat County study area.

Plot Number	Description	Category	Survey (Full, Partial, None)
15	The plot is located along the Columbia Hills with grasslands interspersed with large stands of oak on the north side of the Columbia Hills, and open grassland on the south side of the Columbia Hills.	Grassland / Oak	Full
16	The area was not surveyed. The plot contains large stands of oak, but is located within a housing subdivision. One red-tailed hawk nest was found in the plot while scouting the area.	Residential	None
17	The plot is dominated by agricultural lands with large stands of oak located within areas of topography.	Agriculture / Oak	Full
18	The plot is located on the south side of the Columbia Hills and is dominated by open grassland. The area contains cliffs along the Columbia River, as well as stands of juniper and oak.	Grassland / Oak and Juniper Cliffs present	Full
19	The plot is located along the Columbia River and contains approximately one mile of Rock Creek Canyon. The canyon contains some cottonwood and rock outcrops. Outside the canyon, the area is dominated by grassland with some scattered juniper.	Grassland / Juniper Cottonwood Riparian and Cliffs Present	Full
20	Rock Creek canyon dominates the plot. The confluence of Rock and Squaw Creek's is located within the plot. A mature cottonwood riparian area is present along the creeks, while the canyon walls contain rock outcrops and cliffs. Some juniper and oak stand are present along drainages.	Canyon Cottonwood Riparian and Cliffs Present	Full
21	Rock Creek canyon dominates the plot. A mature cottonwood riparian area is present along the creeks, while the canyon walls contain rock outcrops and cliffs. Some juniper and oak stand are present along drainages.	Canyon Cottonwood Riparian and Cliffs Present	Full
22	The plot is located along the Columbia River. The area is dominated by open grassland. Rock outcrops and cliffs are present along the Columbia River. A few scattered cottonwood, juniper and one powerline are present.	Grassland Cottonwood Riparian Present	Full

Appendix C (*continued*). Habitat of blocks surveyed for raptor nests in Klickitat County study area.

Plot Number	Description	Category	Survey (Full, Partial, None)
24	Open lithisol grasslands dominate the area. A few stands of oak and scattered juniper are present.	Grassland / Oak and Juniper	Full
25	Open lithisol grasslands dominate the area. A few scattered juniper, a small cottonwood stand and a few rock outcrops are present.	Grassland / Juniper	Full
26	The area is dominated by agricultural land with a few scattered juniper, cottonwood, locust and a few rock outcrops.	Agriculture	Full
27	Agricultural land dominates the plot. A few scattered juniper and cottonwood are present. One mature coniferous stand is present along a stream in Wood Gulch.	Agriculture / Conifer	Full
28	The plot is dominated by agricultural land. Two stands of conifer and juniper are present along Wood Gulch and Big Horn Canyon.	Agriculture / Conifer	Full
29	Wood Gulch Canyon dominates the plot. A mature cottonwood riparian area, cliffs and rock outcrops are present along Wood Gulch. Scattered juniper are found on upper slopes.	Canyon Cottonwood Riparian and Cliffs Present	Full
30	The plot is located along the Columbia River and contains the east side of Wood Gulch Canyon. The plot contains several cliffs and rock outcrops.	Canyon Cliffs Present	Full
31 – 32	The area is dominated by open grassland. A few scattered residences and patches of oak and conifer are present.	Grassland / Oak	Full
33	The plot is dominated by CRP land. Scattered juniper are present, with junipers more numerous along Pine Creek.	CRP (Grassland?)/ Juniper	Full
34	The plot is dominated by CRP land. Scattered juniper are present, with junipers more numerous within Juniper Canyon.	CRP / Juniper	Full
35	Open sage-steppe dominate the area. Pine Creek and an associated mature cottonwood riparian area are present.	Grassland Cottonwood Riparian present	Full
36 – 37	Open sage-steppe dominate the area with juniper stands and few scattered ponderosa pine present within canyons and drainages.	Grassland / Juniper	Full

Appendix C (*continued*). Habitat of blocks surveyed for raptor nests in Klickitat County study area.

Plot Number	Description	Category	Survey (Full, Partial, None)
38 - 39	Open sage-steppe dominate the area with a few scattered juniper and cottonwood present within the drainages.	Grassland / Juniper	Full
40	The area is dominated by agricultural land and dissected by stands of juniper within canyons and drainages.	Agriculture / Juniper	Full
41 – 42	Open sage-steppe dominate the area. Canyons with rimrock and scattered juniper and cottonwood are present.	Grassland / Juniper	Full
43	The plot is dominated by agricultural land with a few scattered cottonwood and juniper.	Agriculture / Juniper	Full
44	Open grassland and Alder Creek Canyon dominate the plot. Some mature cottonwood are present along Alder Creek, and scattered juniper and rock outcrops are present.	Grassland Cottonwood Riparian and Cliffs present	Full