FINAL REPORT

WILDLIFE MONITORING STUDIES
SEAWEST WINDPOWER PROJECT, CARBON COUNTY, WYOMING
1995-1999

August 9, 2000

Prepared for:

SeaWest Energy Corporation
San Diego, California

&

Bureau of Land Management
Rawlins District Office
Rawlins, Wyoming

Prepared by:

Gregory D. Johnson, David P. Young, Jr., Wallace P. Erickson,
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Western **E**co**S**ystems **T**echnology, Inc.
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EXECUTIVE SUMMARY

This report presents results of the first four years of data collection for wildlife risk assessment and monitoring studies associated with the SeaWest windpower plant in Carbon County, Wyoming. Monitoring includes data collection on the Wind Resource Area (WRA) and an offsite reference area located near Morton Pass (MPR) approximately 16 km northeast of Bosler Junction. The WRA is divided into two study areas: Foote Creek Rim (FCR) located north and west of Arlington, and Simpson Ridge (SR) located south of Hanna. The first development unit was completed on FCR in January 1999, when 69 turbines became fully operational.

Raptor and other large bird (RLB) surveys were conducted yearlong to estimate spatial and temporal use of FCR, SR, and MPR. Use was measured by recording the amount of time all raptors and other large birds (waterfowl, shorebirds, waterbirds, corvids, and grouse) were observed within 0.8 km of each observation point during 40-minute periods. Over the first four years of the study, 40 species were documented during observations of 3,192 groups comprised of 4,760 birds while conducting RLB point count surveys on FCR. RLB groups with highest use of FCR, depending on season, were eagles, buteos, waterfowl, and corvids. Forty-six species were documented during observations of 1,486 groups comprised of 3,389 bird sightings while conducting RLB surveys on Simpson Ridge. RLB groups with the highest use of SR, depending on season, were eagles, waterfowl, buteos, and corvids. Twenty-nine species were documented during observations of 1,555 groups comprised of 2,001 bird sightings while conducting RLB surveys on MPR. RLB groups with highest use of MPR, depending on season, were buteos, eagles, waterfowl and large falcons.

A before-after/control-impact (BACI) analysis of RLB use data on FCR included data collected during the construction period and data collected following construction of the turbines. During the construction period, observed use of FCR by buteos was significantly higher than expected in the summer, whereas observed use by eagles in the summer and fall was significantly lower than expected. Significant changes in both buteo and eagle use of FCR during the construction period was attributed primarily to the number of proximate active nests, rather then to any construction-related effects. Observed use of large falcons was significantly higher than expected in the winter, whereas use of FCR by accipiters in the fall was significantly lower than expected. These changes were attributed to factors unrelated to the wind plant, including changes in migration routes, prey availability, or weather conditions.

In 1999, after the first development unit became operational and while other development units of Phase I were under construction, buteos continued to show higher than expected use of FCR in the summer, and use of FCR by accipiters and all raptors combined in the fall was lower than expected. Use of FCR by eagles and all other RLB groups in 1999 was similar to expected use. Reduced use of FCR in the fall was attributed primarily to changes in migration patterns, weather or other factors.

A total of 4437 observations was made of flying birds during RLB surveys on FCR and SR during the study. The Mitsubishi turbines comprising most of the turbines used by SeaWest have a rotor-swept height from 19 m to 62 m above ground. An estimated 31.9% of all flying birds were observed flying within the rotor-swept height of the turbine. For RLB groups with >40 observations

of flying birds, waterbirds had the highest proportion of flight heights within the rotor-swept height (42.8%), followed by eagles (42.4%), large falcons (36.6%), and buteos (35.9%).

An index to relative exposure to turbines based on mean use, proportion of observations recorded as flying, and proportion of flight heights recorded within the rotor-swept height of turbines was calculated for all species observed during RLB surveys. Based on this exposure index, RLB species with the highest exposure to turbines on FCR relative to other species are golden eagle, red-tailed hawk, common raven, ferruginous hawk, and prairie falcon; those species with the highest turbine exposure index on SR are golden eagle, common raven, ferruginous hawk, and red-tailed hawk.

Examination of spatial use data collected on FCR indicated that raptors appear to use the rim edge (+ 50 m) significantly more than other portions of the study area. Raptors observed near the rim edge also had a greater tendency to fly within the turbine rotor-swept height than when observed on other portions of the study area. These data suggest that placing turbines >50 m away from the rim edge is likely to reduce risk to raptors on FCR.

Over the four-year study, 92 species were documented during breeding season passerine/small bird (PSB) surveys on FCR, SR and MPR. During PSB surveys, 7,249 groups of birds comprised of 11,674 individuals were recorded. The five species with highest use of FCR were horned lark (2.08/plot/survey), vesper sparrow (0.93), Brewer's sparrow (0.45), cliff swallow (0.41), and Brewer's blackbird (0.39). The five species with highest use of SR were vesper sparrow (1.31/plot/survey), Brewer's sparrow (1.17), horned lark (1.01), sage thrasher (0.44), and cliff swallow (0.27). On MPR, the five species with highest use were horned lark (3.57/plot/survey), vesper sparrow (1.27), Brewer's sparrow (0.77), western meadowlark (0.44), and cliff swallow (0.33).

Based on the BACI analysis of PSB survey data collected in the summer, groups with significantly lower than expected use of FCR during the construction period included raptors, larks, and finches. Following construction, only finches had lower than expected use of FCR. Raptor use data collected during RLB surveys in the summer of 1998 was much more extensive than raptor data collected during PSB surveys, and the RLB data did not indicate reduced use of FCR by raptors. Horned larks may have avoided the area during construction, but use by this species was similar to expected after construction. Reduced use by finches in both 1998 and 1999 was attributed primarily to population shifts unrelated to windpower development.

All species of birds were recorded while conducting PSB surveys. Over the 4-year study, 5,441 birds were observed flying during PSB surveys on FCR and SR. Most (91.4%) of these observations were of birds flying below the rotor-swept height, 7.3% were within the rotor-swept height (19 m to 62 m) and 1.2% were flying above the rotor swept height of the turbines. Based on the PSB survey data, raptors had the highest proportion of flight heights within the rotor-swept height (45.0%), followed by blackbirds (15.2%), shorebirds (10.3%), swallows (8.8%), and thrushes (7.8%). An index to relative exposure to turbines was calculated for all species observed during PSB surveys using the same formula described above. Based on this index, species observed during PSB surveys with the highest turbine exposure index on FCR, in order, are pine siskin, American

goldfinch, cliff swallow, violet-green swallow, and horned lark. Even though raptors had a greater percentage of flight heights within the rotor-swept height than other groups recorded during PSB surveys, their abundance was much lower than that of passerines, which is why the turbine exposure index for raptors was relatively low. On SR, species with the highest turbine exposure index are cliff swallow, violet-green swallow, horned lark, Brewer's blackbird, and Brewer's sparrow.

Aerial and ground surveys for raptor nests were conducted within an area defined by a 16-km buffer surrounding the outermost edge of each study area. Mean number of active raptor nests for all species was 134 per year in the FCR and SR study areas combined. On the reference area and its associated buffer, an average of 44 active raptor nests were located per year. Nesting surveys focused on three species of primary interest, golden eagle, bald eagle, and ferruginous hawk. Within the FCR study area and associated buffer, number of young fledged per active nest checked over the four-year period averaged 1.7 for bald eagle, 1.2 for ferruginous hawk, and 1.0 for golden eagle. On the SR study area, number of young fledged per active nest checked averaged 1.3 for bald eagle, 1.1 for ferruginous hawk, and 0.9 for golden eagle. On MPR, number of young fledged per active nest checked averaged 1.8 for ferruginous hawk and 0.7 for golden eagle. One bald eagle nest produced one young in 1999 at MPR. Construction and operation of the turbines did not appear to affect density of active raptor nests or reproductive success of the three focal species in the FCR survey area.

Fixed-wing aerial surveys were conducted to obtain data on distribution and habitat use by big game in the WRA during the winter and fawning period in from the 1995/96 winter to the 1997/98 winter. The maximum estimate of pronghorn numbers ranged from 10,796 during the 1995/96 winter to 16,396 during the 1997/98 winter. Results of spatial analyses indicated that highest use of the survey area by pronghorn during all seasons was generally in the eastern portion of the survey area north of FCR; areas in the vicinity of FCR and SR received comparably lower use. Data collected during this study confirm pronghorn distribution data collected by the Wyoming Game and Fish Department.

From 1995 to 1998, big game pellet density was estimated on FCR and SR in the spring and fall to determine seasonal use within areas of turbine development. Density of all big game pellet groups on FCR during the winter period ranged from 115/ha in 1997/1998 to 486/ha in 1994/95. During the summer period, pellet group density was 178/ha in 1995 and 104/ha in 1997. In the SR area, winter pellet group density ranged from 225/ha in 1994/95 to 317/ha in 1997/98. During the summer period, pellet group density was 393/ha in 1995 and 275/ha in 1997. Starting in 1997, all pronghorn observed within 800 m of RLB survey points were recorded while conducting avian surveys. Data collected in 1997 and 1998 indicate no significant change in pronghorn abundance within 800 m of FCR. Mean number observed per survey for all six points combined was 1.07 in 1997, 1.59 in 1998 and 1.14 in 1999.

Mountain plover surveys were conducted to estimate use and reproductive effort of mountain plovers on FCR and MPR; no plovers have been observed on SR. The total estimated breeding population size for the 12-km^2 mesa on FCR was approximately 60 individuals in 1995, 41 in 1997, 32 in 1998 and 18 in 1999. Prior to initiation of construction activities, plovers used the entire rim, but observations were more concentrated on the northern end of the rim. During and following

construction, use of the southern portion of the rim was much lower than in previous years. On MPR, the total estimated breeding population size was approximately 8 in 1995, 30 in 1997, 13 in 1998, and 7 in 1999. Two mountain plover nests were located on FCR in 1995, eight were located in 1997, six were found in 1998, and four were found in 1999. Nest success on FCR ranged from 0 chicks per nest in 1999 to 2.5 chicks per nest in 1995. Poor nest success in 1999 was attributed to nest predation. Reduced population estimates in 1998 and 1999 and avoidance of the southern portion of the rim may be related to behavioral avoidance of construction and operation activities, turbine noise, or reduced habitat effectiveness caused by the presence of roads, turbine pads and other ground disturbance activities. Although population estimates on FCR were lower in 1998 and 1999 than in previous years, data collected on MPR indicate that plover use of the general region may have been lower in 1998 and 1999 than in previous years. Other regional data collected on mountain plovers (e.g., Pawnee National Grassland, Colorado data) also indicate a recent regionwide decrease in mountain plover abundance.

Aerial and ground sage grouse lek surveys were initiated to monitor trends in sage grouse use and distribution within each study area before, during, and after construction of wind turbines. Habitat use and distribution of sage grouse in close proximity to turbine development areas were estimated by recording sage grouse pellets within big game pellet plots. Twenty-two known historic lek sites were visited during the aerial survey and ground visits. The maximum number of males counted on six leks monitored during all four study years on SR increased from 116 in 1995 to 166 in 1999. Mean sage grouse pellet density on the FCR study area during the winter period ranged from 0/ha in 1997/98 to 69/ha during the 1994/95 winter period. During the summer period, sage grouse pellet density on FCR was 11/ha in 1995 and 4/ha in 1997. On the SR study area, mean sage grouse pellet density during winter ranged from 85/ha in 1997/98 to 131/ha during the 1994/95 winter period. During the summer period, pellet density was 143/ha in 1995 and 32/ha in 1997.

An index to rabbit and small mammal relative abundance within the range of raptors potentially affected by the project was calculated to assist interpretation of raptor relative use and nesting parameter data. Lagomorph abundance along six 32-km routes in all three study areas was similar in 1995 (34) and 1997 (38), but increased to 94 in 1998 and to 142 in 1999. An average of 214 plots along the lagomorph survey routes were searched per year for presence/absence of active ground squirrel burrows. Mean percent of plots containing active ground squirrel burrows in the FCR study area was fairly similar among years, ranging from 65.2% to 77.5%. On SR, these percentages ranged from 63.6% to 74.5%. The percent of MPR plots containing active ground squirrel burrows ranged from 72.5% to 82.1%. On FCR, mean density of ground squirrel burrows in plots established for big game/sage grouse pellet surveys was 47.2/ha in 1995 and 38.7/ha in 1997. On the SR study area, ground squirrel burrow density averaged 24.0/ha in 1995 and 29.0/ha in 1997. On the FCR study area, mean density of active prairie dog burrows on the two towns surveyed increased from 27.5/ha in 1995 to 45.1/ha in 1999. Mean density of active prairie dog burrows within the six towns surveyed in the SR study area ranged from 20.4/ha in 1998 to 30.2/ha in 1997. Density of active prairie dog burrows on the one MPR prairie dog town surveyed increased substantially from 22.9/ha in 1995 to 156.4/ha in 1998, then declined to 102.4/ha in 1999.

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INTRODUCTION

In 1994, Kenetech Windpower, Inc. (Kenetech) proposed to construct a 500-megawatt (MW) windpower development in Carbon County, Wyoming. Kenetech applied for a right-of-way (ROW) permit from the Rawlins District Office of the Bureau of Land Management (BLM) to construct and access facilities of the wind plant on federal land. While preparing the Environmental Impact Statement (EIS) for the proposed windpower project, TRC Mariah Associates Inc. (Mariah) initiated studies to obtain baseline data on avian resources in the study area. Results of those studies are presented in the EIS (BLM 1995a, 1995b) and in Thomas *et al*. (1997). As part of the ROW permit conditions, Kenetech agreed to continue study of potential effects of the proposed project on wildlife resources. Wildlife risk assessment and monitoring studies were initiated by Western EcoSystems Technology, Inc. (WEST) in March 1995. These studies were terminated in March 1996 just prior to the declaration of Chapter 11 bankruptcy by Kenetech. In late 1996, SeaWest Energy Corporation (SeaWest) acquired the rights to the Carbon County windpower project and wildlife monitoring studies were reinitiated in mid February 1997.

The first development unit, Foote Creek Rim I (FCR I), consists of a 41.4 MW wind plant comprised of 69 600-KW Mitsubishi turbines that was completed on Foote Creek Rim by SeaWest in January 1999. FCR II, a 1.8 MW wind plant consisting of three Mitsubishi 600-KW turbines, was completed in August 1999. FCR III, consisting of 33 NEG Micon NM 750 KW turbines capable of generating 24.75 MW, was also completed in August 1999. The wind plant currently consists of 105 turbines capable of generating 67.95 MW of electricity and related facilities (Figure 1), including meteorological towers, transmission lines, communications systems, transformers, substations, roads, and operations and maintenance facilities.

The scope and methods for conducting the wildlife risk assessment and monitoring studies were defined through consultation with the U.S. Fish and Wildlife Service (USFWS), Wyoming Game and Fish Department (WGFD), and BLM. Objectives of this study were to obtain quantifiable data on wildlife use, species composition, reproductive success, and distribution in areas with windpower developments or proposed for windpower development and in a comparable reference area. Pre-construction data collected in 1995 and 1997 and subsequent during and post-construction data collected in 1998 and 1999 were used to evaluate potential effects on wildlife of windpower development and operation.

The primary goals of the monitoring studies are to evaluate impacts to wildlife from each phase of development and the cumulative impact to wildlife from all windpower development in the Wind Resource Area (WRA) (BLM 1995b). The secondary goal of monitoring is to obtain information that can be used to reduce impacts to wildlife from subsequent developments. This monitoring study uses a before/after and control/impact (BACI) design (Green 1979) to assess effects. This monitoring study also provides data compatible with studies of numerous other windpower projects in operation or under development. Finally, this monitoring study assesses risk based on a weight of evidence approach.

This report presents wildlife monitoring data for four years of study and includes monitoring data collected up to the end of the most recent fall period (31 October 1999). Results of fatality searches conducted in 1999 have been presented in a separate report (Johnson *et al*. 2000). Due to the technical nature of this study, this report may be difficult to interpret by the general public and questions should be directed to the BLM.

STUDY AREAS

The WRA is divided into two study areas: Foote Creek Rim (FCR) located north and west of Arlington, and Simpson Ridge (SR) located south of Hanna (Figure 1). The two areas combined are approximately 24,550 ha in size and include 6,874 ha of federal land, 2,455 ha of state land, and 15,221 ha of private land (BLM 1995a). Data were collected on the existing wind plant (FCR), an area proposed for future development (SR) and an off-site reference area. Detailed descriptions of FCR and SR can be found in the EIS prepared for the project (BLM 1995a).

The off-site reference area, referred to as the Morton Pass Reference (MPR), is located approximately 10 miles northeast of the Bosler Junction on Wyoming Highway 34 and approximately one mile west of Morton Pass (Figure 1). This area includes the north-south ridge line adjacent to North Sybille Creek and the "Flat Top" plateau. Habitat, topography and wildlife species composition at the MPR area are similar to FCR and SR.

METHODS

Experimental Design

The BACI design combines collection of data before and after wind plant development with collection of data on control areas. An attempt was made to find an off-site control area as similar as possible, both physically and biologically, to the existing or proposed wind plant sites. Perfect control areas for the wind plant do not exist; therefore, control areas are termed reference areas. Three areas were initially studied, FCR, SR, and the off-site reference area, MPR. By sampling both reference and impact areas before and after windpower development, both temporal and spatial controls are used, optimizing impact assessment capabilities (Green 1979). Analyses under the BACI design can be used for comparing FCR, as well as future developments, to the reference areas both before and after development. Data collected on SR will be used as reference data for the FCR development prior to development of SR. There will always be one permanent off-site reference area not proposed for development to compare to the development areas.

Information to guide placement of wind turbines throughout the entire WRA will be obtained from analysis of the existing habitat and topographic data related to wildlife distribution and use. Habitats or other topographic variables positively or negatively related to wildlife use will be identified.
The monitoring protocol used for this study (WEST 1995) is a product of interaction among scientists, industry representatives, and agency professionals concerned with potential effects of

windpower development on wildlife in Wyoming. Monitoring activities combine relatively intensive surveys of species of primary interest (mountain plovers, raptors in general and golden eagle, bald eagle and ferruginous hawk in particular) with relatively less intensive surveys of species of secondary interest (e.g., non-raptor avian species, big game, sage grouse). In addition, several resources are considered only in so far as they may affect analysis of data on species of primary interest. For example, an index to relative abundance of rabbits (lagomorphs), prairie dogs, and ground squirrels within the range of raptors potentially affected by the project will be used to assist in interpretation of possible fluctuations in raptor numbers and reproductive success.

Analysis Philosophy

Implementation of the monitoring plan does not provide estimates of actual population sizes or other population parameters. Obtaining estimates of population size would require capture and marking of individual birds or other species of interest followed by telemetry or recapture studies. Although true population parameters are not estimated, this monitoring plan does provide indices that are indirectly related to actual population parameters.

Data collected under the BACI design are intended to be used to monitor trends in indices to population parameters over time (i.e., before, during and after wind plant construction) on wind plant and reference study areas. The data are not intended to compare the magnitude of indices among study areas. Data collected on FCR, SR, and MPR provide statistical inferences to indices of population parameters on those sites only; inferences to other areas cannot be made with these data. Under the BACI design, the actual parameter value or relative difference in parameter values among study areas are not used in the effects analysis, only trends in parameters over time are modeled to evaluate effects.

The relative low density of species of interest (e.g., raptors) or their broad distribution (e.g., big game) makes detection of statistically significant impacts difficult. Therefore, the design and analysis use a "weight of evidence" approach to determine effects of the project on species of interest. Estimates of direct mortality can be made in a given year through carcass searches, but tests of other parameters (e.g., raptor reproductive success) for any given year may have relatively little power to detect an effect of windpower on population levels of species of interest. However, the trend of effects (if any) will be modeled and examined to determine if effects are of a magnitude warranting additional, more detailed study. The weight of evidence approach assists in detection of biological significance when statistical significance is marginal.

This monitoring plan is a dynamic process that uses an accumulation of data collected over time to detect effects, if any, and to direct further study. Depending on the wildlife resource of interest, potential effects of windpower development may include effects on populations, changes in use of the area occupied by the turbines, and effects such as mortality (e.g., death due to collision with windfarm facilities). For example, a decline in avian use after construction of turbines without a similar decline on the reference area(s) may be interpreted as evidence of an effect of windpower development. A decline in use of both the reference area and wind plant, combined with locating

few or no avian fatalities within the wind plant, may be interpreted as a population response unrelated to the wind plant. If evidence suggests negative impacts are occurring to wildlife populations, additional, more detailed studies of population dynamics may be necessary to determine significance of impacts (e.g., mark/recapture studies and/or more comprehensive nesting studies to measure effect of mortality on population dynamics).

Raptor and Other Large Bird (RLB) Studies

Results of previous studies conducted at other wind plants (e.g., Howell and DiDonato 1991, Howell *et al*. 1991, Howell and Noone 1992, Orloff and Flannery 1992) suggest that raptors are one of the primary avian groups potentially affected by windpower development. Prior to conducting studies associated with the wind plant development, little information on raptor populations in the study area was available. Raptor and other large bird (RLB) surveys for the monitoring program were designed to assess both use of the study areas and population parameters for monitoring long-term effects on raptors and other large birds.

RLB Use Surveys

Use by raptors and other large birds is considered an index to density of species using the study areas. Although raptors are the primary species of interest, other large birds including waterfowl, shorebirds, waterbirds (e.g., herons, cormorants, pelicans), corvids (crows, ravens, magpies), goatsuckers (common nighthawk), and grouse were recorded during RLB surveys. The objective of the RLB use surveys is to estimate spatial and temporal use of FCR, SR, and MPR. Use was measured by counting all large birds observed within sample plots. We assumed that use is influenced by biological and physical characteristics of the site and/or the home range of the individual. Each bird detected during counts was located in relation to existing or measured information regarding the physical and biological characteristics of the site.

RLB stations (observation circles) surveyed by WEST on FCR were the same stations surveyed by Mariah in 1994 (Thomas *et al*. 1997) (Figure 3). The FCR study area has six stations (A-F) located along the long axis of the rim, three on the east edge (stations A, B, D), and three on the west edge (stations C, E, F). Methods for establishing location of stations are described in Thomas *et al*. (1997). RLB survey stations on FCR were located so that no overlap in the viewing area occurred between stations, but the circles were placed close enough together to ensure relatively complete coverage of the area of windpower development.

Because potential locations for siting wind plants in the SR study area had yet to be determined when the monitoring study was initiated in 1995, a sampling regime different from that used on FCR was used to allow sampling of the entire area. In 1995, 12 RLB survey stations were located and permanently marked in the SR study area using a systematic sampling procedure with a random starting point for the first station (Figure 4). All points were mapped on 7.5' USGS topographic maps. Once in the field, each station was established by locating the mapped point and, when necessary to increase visibility, moving the point to the nearest location that provided at least 270° (¾ of the observation circle) of visibility out to 0.8 km. The number of points surveyed on SR was

reduced from 12 to 6 starting September 1, 1998 (Figure 4); the remaining six are those located in areas determined by SeaWest to have the best potential for windpower development.

Six stations were established and permanently marked on MPR using a systematic sampling procedure (Figure 5). The sampling scheme used to establish RLB survey stations on MPR was similar to that used on FCR because the MPR area consists of two relatively small topographic features in close proximity to one another, rather than a large, topographically diverse area such as SR.

Each RLB observation station is a 0.8-km (0.5-mile) radius circle surrounding an observation point. Landmarks and other prominent topographic features were used to identify the boundary of each station. All raptors and other large birds observed during the survey were recorded, but data collected on birds observed beyond the 0.8-km radius were analyzed separately.

WEST conducted RLB surveys from 15 March 1995 to 13 March 1996 and from 15 February 1997 to 31 October 1999. Observations were made once every two weeks during the winter period (1 November - 14 February) and once a week during the remainder of the year. Observation times were rotated to cover all daylight hours. Each station was visited twice each sampling day, once during the morning (0600-1200) and once during the afternoon (1200-1800). Efforts were made to ensure each station was surveyed approximately the same number of times during each period of the day each season.

Data collected during each point visit consisted of instantaneous counts as well as continuous counts during a 40-minute interval. Instantaneous counts were taken at the beginning of the 40-minute interval and every ten minutes thereafter. All raptors and other large birds observed were recorded on data sheets at the time of observation. A unique observation number was assigned to each sighting to identify the location of first observation on the map. The date, plot number, observation period begin and end times, species, sex and age were recorded. Weather information (temperature, wind speed and direction, cloud cover, precipitation) was also recorded each visit. RLB observations made while traveling between points also were recorded, but data were analyzed separately.

Location of first sighting and direction of travel were mapped in the field. Broad categories of behavior (i.e., courtship, foraging, aggressive interaction) and flight patterns (i.e, perched, soaring, flapping, gliding) were recorded. The behavior and flight pattern when first observed were noted with a number 1 and each additional behavior or pattern observed was noted with an X. For example, if a raptor was first sighted while perched, then left its perch and flew out of the survey area, a 1 was written in the box next to perching, and an X was marked next to flapping. In 1995, estimates of flight height were made using classes of 1-7 m, 8-55 m, 55-100 m and >100 m; these classes corresponded to the height below, within, above and substantially above the space occupied by turbine blades of the Kenetech turbine originally proposed for use on FCR. Starting in February 1997, all flight heights were estimated to the nearest meter when the bird was first observed so that flight heights could be grouped after data collection to correspond to flight heights within the rotor-

swept height of any turbine type. In addition, during the time that each bird(s) remained in the survey plot, each altitude category the bird(s) occupied while flying was recorded and the order for each height category occupied was identified. The habitat traversed by the raptor was identified in a similar fashion. Any comments or unusual observations were also recorded.

Species lists were generated by study area and grouped by season. Seasons were defined as spring migration (15 February to 15 April), summer breeding season (16 April to 31 August), fall migration (1 September to 31 October), and winter (1 November to 14 February). The number of raptors and other large birds seen during each point count survey was standardized to a unit area and unit time surveyed. For example, if four raptors were seen during a 40-minute interval at a station with a viewing area of 2.01 km^2, these data were standardized to 4/2.01 = 2 raptors/km2 during a 40-minute survey. For instantaneous counts, the number of raptors and other large birds observed was standardized by area searched and the number of instantaneous counts taken during the point count. For example, if five instantaneous counts were taken during a 40-minute observation period, and two raptors were present during the second instantaneous count and one was present during the third instantaneous count, data were standardized to ((2+1)/5)/2.01 km^2 = 0.3 raptors/km^2 per instantaneous count.

As an illustration of the use of data for risk assessment, a relative index to exposure of individual birds to turbine collisions was calculated for all species observed in the FCR and SR study areas by season. The exposure index (E) was calculated using the following formula:

$$E = U \bullet P_f \bullet P_t$$

where U = mean use of species i, P_f = proportion of all observations of species i where activity was recorded as flying in both FCR and SR, and P_t = proportion of all flight height observations of species i within the rotor-swept height of the turbines at both FCR and SR. P_f was used as an index to the approximate percentage of time species i spends flying during the daylight period.

Information potentially useful to guide future placement of wind turbines was obtained by plotting locations of birds by species on FCR and SR. Locations of birds when first observed during surveys on FCR were classified relative to the rim edge. FCR is a table-top mesa with abruptly sloping edges. The rim edge is a distinct feature on FCR and was defined as the top of the slope. For each observation, locations were placed into one of three strata: (1) within 50 m of the rim edge, (2) >50 m off of the rim (away from mesa), and (3) over the mesa but >50 m away from the rim edge. The mean number of locations per km2 within each of the above three strata was calculated for each survey point. Overall estimates for locations per km^2 and associated variance within each strata were calculated by averaging estimates obtained for the six survey points. Mean number of birds per km^2 flying in the turbine rotor-swept height when first detected was calculated for each point.

Construction of FCR I was initiated with mobilization and road construction in August 1997. Approximately 25% of the turbines in FCR I were operational by November 1, 1998, and the

entire FCR I facility was fully operational by the end of January 1999. Construction of FCR II and FCR III was completed by August 2000.

A before/after-control/impact (BACI) analysis was used to test for significant changes in avian use at the FCR study area relative to reference areas using the following formula:

$$\frac{(FCR_{post} \ / \ FCR_{pre})}{(REF_{post} \ / \ REF_{pre})}$$

where FCR_{post} = the during or post-construction use estimate (#/survey) for avian group *i* on FCR, FCR_{pre} = the pre-construction use estimate for avian group *i* on FCR, REF_{post} = the mean during or post-construction use estimate for group *i* on SR and MPR, and REF_{pre} = the mean pre-construction use estimate for avian group *i* on SR and MPR. If avian use of FCR in relation to use of reference areas remains the same both prior to and during or following construction, then the number derived from this equation should equal 1.0. For example, if mean use of buteos in fall was 2.0/survey on FCR and 3.0/survey on reference areas prior to construction, and mean use of buteos was 2.3/survey on FCR and 3.7/survey on reference areas following construction. The above equation would yield:

$$\frac{(2.3 \ / \ 2.0)}{(3.7 \ / \ 3.0)} \ ' \ 0.93$$

A 90% bootstrap confidence interval (Manly 1991) was placed around the number calculated using the above equation. If the upper end of the 90% confidence interval (CI) was <1.0, then during or post-construction use was significantly lower than expected use. Conversely, if the lower end of the 90% CI was >1.0, then observed during or post-construction use was significantly greater than expected use. If 1.0 was included within the 90% CI, then actual during or post-construction use was not significantly different from expected use. The BACI analysis was conducted for all avian groups observed during RLB surveys. Data collected in the spring, summer and fall of 1998 are available to assess potential during construction effects. Data collected in the 1998/99 winter period as well as in the spring, summer and fall of 1999 are available for assessing both post-construction (operational) effects of FCR I as well as continued construction effects of FCR II and FCR III.

Raptor Nest Surveys

We assumed that the number and distribution of active nests within the area potentially affected by wind turbines over time represents an index to the status of the raptor breeding population. Objectives of the raptor nest surveys were to estimate numbers and distribution of nesting raptors which may be influenced by the project and to evaluate potential effects of the wind plant on nesting success. While all raptor species are of interest, nesting surveys focused on the three species of primary interest to the WGFD, golden eagle, bald eagle, and ferruginous hawk (Bob Oakleaf, Rich Guenzel and Steve Tessmann, WGFD, pers. commun.).

Because golden eagles are known to forage at least 16 km (10 miles) from a nest, we assumed that the zone of influence extends approximately 16 km from the wind plant. The raptor nest survey area

included each study area and a 16-km buffer surrounding the boundary of each study area (Figure 6). Total area surveyed was approximately 966 km^2 on the FCR survey area and 1,901 km^2 on the SR survey area. The FCR and SR raptor nest survey areas overlapped by approximately 14.5 km in the region between these sites (Figure 6).

The raptor nest survey area for the MPR area was located so that no part overlapped the FCR or SR survey areas. Because approximately 40% of the area defined by a 16-km radius circle centered around the MPR area was within the Laramie Range mountains, where habitat is quite different from that of FCR and SR, the center of the nest survey area for the reference area was shifted to the west of the MPR area proper (Figure 7). The surveyed area was approximately 1,386 km^2 in size and was centered on a location approximately 13 km west of the MPR area to ensure an area similar in size and habitat to the FCR and SR areas was surveyed.

Study areas were surveyed for all raptor nests by helicopter in the spring (April-May). Surveys generally covered the entire area but were concentrated in likely raptor nesting habitat (e.g., rock outcrops, cottonwood riparian zones). Active nests were characterized by presence of an incubating adult, eggs or young in the nest, or territory defense by adults. Helicopter surveys were followed by ground surveys from April through July to confirm species and status of active nests. In 1995, ground surveys were conducted in areas that may have provided suitable nesting locations for peregrine falcons, as this species often remains undetected during aerial surveys and there was some evidence that this species may use portions of the study area (Thomas *et al*. 1997). Regardless of species, all raptor nests were located with a Geographic Positioning System (GPS) and mapped on a USGS 7.5' topographic map. Data on habitat, nest status, and adult activity were recorded to the extent possible from the air. Nest data were recorded on BLM Nest History and Raptor Inventory data sheets.

When possible, active bald eagle, golden eagle, and ferruginous hawk nests detected during the helicopter survey were visited once from the ground to verify location, species, and occupancy. Not all nests of the focal species were checked due to time constraints resulting from weather-related aerial survey delays in 1995, problems accessing all sites (e.g., high water near rivers), and refusal by landowners to allow access. Nests of other raptor species readily accessible within the study areas also were checked to determine status. For all nests of focal species visited from the ground, the approximate stage (e.g., nest construction, incubation, downy chicks) of the nest was determined during the first visit to establish a date for a potential second visit. Additional ground visits were made to nests of focal species to determine number of young fledged. For all raptor species, the number of occupied nests within each study area was used to estimate relative use of nesting species potentially affected by wind turbines. For productivity estimates, total number of young fledged per active nest checked was calculated.

Passerine and Other Small Bird (PSB) Surveys

Passerine mortality has been documented at other wind plants in the U.S. (e.g., Erickson *et al*. 2000, Johnson *et al*. 1999, McCrary *et al*. 1986). Objectives of conducting point count passerine and other

small bird (PSB) surveys were to estimate relative use, species composition and spatial use of FCR, SR and MPR during the breeding season. Although passerines and other small birds were of primary interest, all avian species observed during PSB surveys were recorded. Intensity of the surveys was sufficient to obtain statistically adequate use data on common species, but provided only incidental data on uncommon and rare species. Impacts to uncommon or rare PSB species will be based primarily on evidence of direct mortality, rather than estimated changes in use.

PSB surveys were conducted three times during the breeding season (15 May to 31 July) at each station. Grids consisting of eight transects containing five point count stations per transect were established on each study area. Transects were perpendicular to the long axis of the FCR and MPR study areas (Figures 8 & 9), and were located on a grid at the SR area (Figure 10). Point count stations established along transects were 400 m apart at the FCR and MPR study areas and 500 m apart at SR; stations were further apart at SR due to the larger size of this study area.

A variable circular plot method (Reynolds *et al*. 1980) was used for conducting PSB surveys. Surveys were conducted between ½ hour before and four hours after sunrise. At each point, observers recorded all birds detected by sight and sound for an 8-minute period. An eight minute census interval was chosen because this interval is long enough to count most birds within a plot but short enough to minimize the probability of recording individuals more than once (Reynolds *et al*. 1980). Data recorded for each observation included species, number, estimated distance to the bird(s), activity, flight direction, and flight height.

Species lists were generated by study period and study area. The number of birds seen during each point count survey was standardized to a unit area and unit time surveyed. An index to relative risk of exposure to turbines was calculated for all bird species observed in the FCR and SR study areas using the same formula used for raptors and other large birds, with the exception that mean use was adjusted for visibility bias (Buckland *et al*. 1993) using the program DISTANCE (Laake *et al*. 1993). Pooling of data across some species that exhibited similar detectability was required when low numbers precluded estimating visibility bias for individual species. A BACI analysis to test for significant changes in avian use at the FCR study area relative to reference areas was also conducted for avian groups observed during PSB surveys.

Big Game Studies

Prior to initiation of the monitoring studies, it was suggested that the windpower development may cause gross changes in distribution and possibly influence use and movement of big game near areas where turbines are constructed. Primary objectives of the big game studies were to describe temporal and spatial distribution, use and habitat selection of big game in and around FCR and SR before and after construction of turbines, and to determine if turbines have a displacement effect.

Big Game Aerial Surveys

From 1995 to 1998, aerial surveys were conducted to obtain data on distribution and habitat use by big game during the winter and parturition (fawning) period. Surveys were conducted using fixed-

wing aircraft (Maule N91AR) because pronghorn is the species of primary interest, and fixed-wing aircraft are recommended for surveying this species. The objective of the big game aerial survey was to identify pronghorn winter concentration areas and parturition areas for the purpose of determining gross changes in distribution potentially caused by construction of the wind plant. Mule deer and elk observed during the surveys also were recorded.

A single survey was conducted each year during the parturition period (mid to late June) to estimate number and distribution of pronghorn within the study area. Surveys were conducted once every two weeks during winter (November through April). Aerial surveys were conducted within WGFD pronghorn Hunt Area 46 and the eastern portion of pronghorn Hunt Area 48. Twenty-three north-south oriented line transects, located systematically with a random starting point, were flown (Figure 11). Transects were located 3.2 km apart except in a 13-km-wide band that encompassed FCR, where transects were placed 1.6 km apart to concentrate effort in the vicinity of the FCR study area.

The WGFD Pronghorn Survey Protocol (WGFD 1982), as modified by the WGFD for current use (i.e., Johnson and Lindzey 1990, Guenzel 1997), was followed, including use of automated data entry/Geographical Positioning System (GPS) equipment. The GPS unit was used to locate starting and stopping points of each transect. Once "on-line", the airplane maintained a constant altitude and air speed. A laptop computer interfaced to the GPS was used to record continuous (every 10 seconds) latitudes and longitudes. When a group of animals was detected, latitude and longitude of the airplane were captured when a line drawn from the airplane to the group was perpendicular to the transect. The observer relayed the species, distance zone, and number of animals in the group to the recorder (pilot). Observers concentrated their efforts within a 200-m band on either side of the transect that included four distance bands labeled A, B, C, and D, with widths of 25, 25, 50, and 100 m, respectively at an altitude of 91 m above ground level. The first distance zone began 50 m on either side of the aircraft because the fuselage blocks the view in a band approximately 100 m wide directly beneath the aircraft. Observations beyond the 200-m zone were recorded but flagged to indicate they were outside the boundary.

Perpendicular distance from the center of the group or individual animal sighted to the flight line of the aircraft was measured. To aid in estimating perpendicular distance to groups of animals, wing-mounted templates were calibrated so that big game groups viewed through the templates could be placed into the discrete distance zones. Airspeed was constant over the entire survey area. Relative density corrected for visibility bias (Buckland *et al*. 1993) was estimated for pronghorn each survey date using the program DISTANCE (Laake *et al*. 1993). The Akaike's Information Criterion (Akaike 1973) was used to choose a best model of the probability of detection of an antelope group as a function of distance from observer. Group size bias also was estimated and included in the density calculations. Due to differences in transect density, data collected on that portion of the study area with transects spaced 1.6 km apart were analyzed separately from data collected on that portion of the study area where transects were spaced 3.2 km apart.

Pronghorn count data were grouped by month into 400 m by 800 m quadrats and units were expressed as number of pronghorn/km^2. Spatial statistical analyses were used to produce maps of

pronghorn density (number/km^2). The spatial analyses allow prediction of pronghorn density throughout the entire study area based on groups observed during systematic transect surveys. The mapping technique known as kriging (Isaaks and Srivastava 1989) was used to construct mapped values.

Big Game Pellet Surveys

From 1995 to 1998, big game pellet density was estimated to determine seasonal use within areas of turbine development. Pellet counts were conducted in the FCR and SR study areas. A grid consisting of 24 transects each with ten 2-meter radius circular plots was established on each study area. Plots were established 250 m apart along the 24 transects. At the FCR study area, the 24 transects were established equidistant apart perpendicular to the long axis of the study area with a random start for the first transect (Figure 12). At the SR study area, transects were established on a grid with a random placement for the first transect and equal distance between each subsequent transect (Figure 13).

Transects were established when the first survey was conducted in the spring of 1995. Transects were located using topographic maps and geographic landmarks. Plots on each transect were located by pacing between points while using a compass to maintain an east-west bearing. Distance between transects on FCR was established by pacing. Once a plot was located it was marked with a short piece of painted rebar. During subsequent surveys, pacing and a compass were again used to relocate points.

During the initial spring surveys, age of each pellet group was estimated based on appearance. Only those pellet groups estimated to be less than six months old were recorded. All pellets were then removed from within each plot to ensure only recent pellets would be recorded during subsequent fall surveys. Only pellet groups with over half of the pellet group by horizontal surface within the plot were counted. For those pellet-groups that were half in and half out, every other one was counted (Neff 1968).

Pellet groups were identified to species (antelope, deer, elk, sage grouse, domestic sheep, horse, or cow) based on size, appearance, and habitat type. Presence of other scat (e.g., lagomorph, coyote) also was recorded. Density of pellet groups was summarized by species and study area for each of the two sampling periods.

Pronghorn Observations During RLB Surveys

Beginning 15 February 1997, the size and location of all pronghorn groups observed within the 0.8 km radius of RLB survey points on FCR and SR were recorded while conducting RLB surveys. Each group observed was plotted on a map of the study area. The objective of this portion of the study was to obtain additional data on pronghorn use of those portions of the study area in close proximity to the wind development area.

Mountain Plover Surveys

When the monitoring study was initiated in 1995, mountain plover was on the USFWS list of candidate species for listing as threatened or endangered. In February 1999, the USFWS proposed to list mountain plover as a threatened species under the Endangered Species Act. Currently, the USFWS is collecting additional information and public comment concerning the proposal. A final decision on the proposed listing has not been made. Monitoring activities for mountain plovers were designed to provide data suitable for use in the consultation process should listing occur. Objectives of mountain plover studies were to estimate use, distribution, and reproductive effort of mountain plovers on FCR, SR and MPR. Methods used to measure these parameters were selected to provide data compatible with other mountain plover monitoring studies currently underway (e.g., U.S. Geological Survey, Biological Resources Division efforts in northeastern Colorado).

Transect Surveys

Mountain plovers show a strong affinity for nesting in areas with flat or slightly-sloping terrain and very short vegetation (Graul 1976, Parrish 1988, Knopf 1996). Topographic maps were used to define sites within each study area where suitable mountain plover habitat might exist. Field visits were made to visually assess potentially suitable habitat for key features such as slope, topography, and vegetation height; areas with suitable habitat were delineated on topographic maps.

Transects were established on suitable breeding habitat. East-west transects were placed 300 m apart, with length depending on size of the area being surveyed (e.g., from rim edge to rim edge on FCR). The majority of FCR (28 transects, Figure 14) and that portion of MPR called "Flat Top" (13 transects, Figure 15) were surveyed for mountain plovers. No mountain plovers have been observed and suitable breeding habitat for this species was not found in the SR study area. Each transect was surveyed six times during the breeding season (late April through early August). Observers slowly walked transects, stopping frequently to scan suitable habitat with binoculars and listen for calls. Data collected for every plover observation included age (adult vs. young of the year), distance from transect, association with other mountain plovers, and behavior. Beginning in 1997, all mountain plover observations were plotted on study area maps.

Mountain plover counts were summarized by transect and visit for each study area. The proportion and amount of suitable mountain plover habitat within each study area was estimated. Mountain plover density was calculated by adjusting observed counts for visibility bias using the program DISTANCE. A map of mountain plover densities was developed for each study area.

Nest Surveys

In the Pawnee National Grassland of Colorado, 75% of mountain plover nests are initiated between 25 April and 14 May (Graul 1975). Nest initiation is probably slightly later in Wyoming (Parrish 1988). Suitable habitat was monitored on a frequent basis beginning in early April to determine mountain plover arrival dates on FCR and MPR. Nest searches and monitoring occurred periodically from May through early July. Nest searching on the Pawnee national grassland involves driving a motorized vehicle along parallel transects in suitable habitat until a plover is flushed from a nest. The observer then retreats approximately 50 m and observes the plover until it returns to the nest and reveals the nest location (Fritz Knopf, USGS-BRD, pers. commun.). This technique was

not acceptable for this study because landowners expressed concern over vegetation impacts associated with off-road vehicle travel on the top of FCR and MPR. Therefore, we searched for nests by driving established 2-track roads with a pickup or ATV, or by walking areas not accessible by vehicle, and watching for flushed birds or birds exhibiting territory defense behavior. When a bird or pair of birds was located, the observer moved away from the potential nesting area and watched the bird or birds for movement back to a nest. If a nest was located, it was marked by placing small piles of rocks or dry cow manure approximately 3 to 4 m on either side of the nest, and the location was recorded on a topographic map. Each nest was monitored until the young had hatched and left the nest, the nest was abandoned, or the nest was destroyed by predators. Constraints on searching techniques imposed by landowners resulted in relatively small sample sizes. Therefore, data analysis was limited to describing status and outcome of each nest found.

Sage Grouse Studies

The primary objective of this portion of the study is to assess potential effects of wind plants and associated facilities on breeding populations of sage grouse within the study areas. Sage grouse lek surveys were initiated to monitor trends in sage grouse use and distribution within each study area prior to, during, and after construction of wind turbines. We also assessed the effects of turbines on sage grouse use in areas where turbines were proposed by counting sage grouse pellets within big game pellet plots on the FCR study area. Additional information on sage grouse abundance and distribution was acquired by recording sage grouse observed while conducting other study activities.

Lek Counts

Previous studies indicate that up to 80% of sage grouse nest within 3.2 km of the lek. Based on these studies, we assumed potential impacts to sage grouse would be limited to birds within 3.2 km of the wind plant study area. Background information on sage grouse leks in the study areas was obtained from the WGFD. Two known historic leks were within a 3.2-km buffer of FCR and 20 historic leks were within a 3.2-km buffer of SR. Locations of known leks within each study area and a 3.2-km buffer zone around each study area (Figure 6) were recorded on 1:100,000 scale maps. Aerial surveys were conducted in April to determine status of known leks and to search for additional leks. To supplement aerial surveys, known lek locations not located during aerial surveys were visited from the ground.

Sage grouse on leks, especially the cryptic hens, cannot accurately be counted from the air. Therefore, each lek was visited from the ground three times during the month of April by foot or vehicle. During each visit, the number of grouse on the lek were counted using binoculars and/or a spotting scope. Repeated counts were made of all individuals on the lek or in the immediate vicinity of the lek for 30 minutes, and the maximum number of grouse by sex was recorded.

Sage Grouse Use Surveys and Additional Baseline Data

Sage grouse use was primarily estimated using pellet transect data. During big game pellet transect surveys, sage grouse pellets or caecal droppings within the 2-m radius plots were recorded. An index to relative density of sage grouse in the wind development area was calculated using density

of sage grouse pellets. Incidental observations of sage grouse were recorded while conducting other study activities to provide additional information on sage grouse distribution.

Raptor Prey Availability Studies

An index to relative abundance of rabbits (lagomorphs), ground squirrels and prairie dogs was developed to assist interpretation of relative use and nesting parameter data for raptors. Indices derived prior to construction provide an index to abundance for comparison in future years. Objectives of prey availability studies were to determine an index to raptor prey availability within a 16-km buffer of each of the three study areas (FCR, SR, MPR), and to relate this index to differences in raptor use, breeding pair density, nest occupancy and nest success between study sites and years. The index should be sensitive enough to document major changes in abundance (eruptions and crashes), but minor changes in population density may not be detectable.

Lagomorphs

Trend counts as described by the WGFD (1982) were used to estimate lagomorph abundance. Thirty-two km transects along roads (2 near FCR, 3 near SR, and 2 near the MPR area) were sampled once in late August each year. Transects were distributed to provide adequate coverage of all habitat types in each study area (Figures 16 & 17). Transects were driven at approximately 32 km/hr beginning one-half hour after sunset. All lagomorphs observed in the headlights of the vehicle were counted, identified, and the km point at which they were observed recorded. Only one transect per observer was driven each night so that each transect was surveyed during peak activity hours for lagomorphs (i.e., the first hour after dark). Data were summarized and standardized as the total number of lagomorphs (by species) observed per km of road surveyed on each of the six routes.

Ground Squirrels

An index to relative abundance of ground squirrels within a 16-km buffer of FCR, SR and MPR was determined by conducting roadside ground squirrel burrow surveys. Ground squirrels were surveyed in late August and early September along the same roads used for lagomorph surveys. A systematic sample of points located every 0.8 km along the roads was selected. At each point, the observer randomly selected the left or right side of the road and searched a 625 m^2 (25 m × 25 m) plot for presence of active ground squirrel burrows. Observers searched the entire plot or until an active burrow was found. Active burrows were defined by direct observation of ground squirrels, presence of fresh scat near the burrow, or other evidence of recent use within ½ m of the burrow entrance. Indices to ground squirrel abundance also were developed by recording the number of ground squirrel burrows within plots used for big game pellet counts.

For plots located along lagomorph transect routes, data were expressed as the percent of plots containing at least one active ground squirrel burrow. Ground squirrel burrow data collected during big game pellet group transect surveys were expressed as mean number of burrows per ha.

Prairie Dogs

All known prairie dog towns within a 16-km buffer of FCR, SR, and MPR were mapped based on WGFD prairie dog distribution maps and any additional prairie dog towns discovered during other

monitoring study activities. Two prairie dog towns on the FCR area, six on the SR area (Figure 16), and one on the MPR area (Figure 17) were selected and surveyed in August and September. To ensure sample effort was approximately proportional to prairie dog town size, three transects orientated north-south and equidistant apart were located in each town. Transects were 3 m wide. Observers counted the number of active burrows within each transect. Active burrows were defined by presence of fresh scat within ½ meter of the burrow entrance, fresh digging, or visual observation of a prairie dog at a burrow. Burrows on the boundary of the transect were counted if more than half of the burrow entrance was located within the transect (Biggins *et al*. 1992). Data were expressed as density of active prairie dog burrows on each town surveyed.

Quality Assurance (QA)/Quality Control (QC)

QA/QC measures were implemented at all stages of the study, including field data collection, data entry, data analysis and report preparation. Observers were trained in the methods used and tested on their ability to identify avian species, to estimate size of large flocks, and to estimate distance to and flight heights of birds. At the end of each survey day, observers were responsible for inspecting their data forms for completeness, accuracy, and legibility. The study team leader periodically reviewed data forms to insure completeness and legibility, and any problems detected were corrected. Any changes made to data forms were initialed by the person making the change. Data were entered into electronic files by qualified technicians. The final data files were compared to raw data forms and any errors detected were corrected. Any irregular codes or unclear or ambiguous data detected were discussed with the observer and study team leader. All changes made to the raw data were documented for future reference. After the data had been keyed and verified, the study team leader checked a 10% sample of data forms against the final computer file. Any problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

RESULTS AND DISCUSSION

Avian Use and Species Composition

A total of 139 species of birds was documented on FCR, SR, and MPR during general wildlife observations and while conducting raptor and passerine surveys during the 4-year study. Scientific names of birds observed during the study are provided in Appendix A.

RLB Surveys

Foote Creek Rim

Over the four-year study, 40 species were documented during RLB surveys on FCR. During the surveys, 3,192 groups of birds comprised of 4,760 individuals were recorded (Appendix B). The number of birds observed by species used to obtain use and composition estimates are presented in Appendix C. The greatest number of RLB species was observed in summer (37) followed by fall (22), spring (21), and winter (7) (Table 1). Mean number of species observed per survey per plot

was used as an index to RLB richness. RLB richness was highest in the summer (1.37 species/survey) followed by fall (1.27), spring (0.85) and winter (0.35) (Table 1).

Without presence of marked birds, actual abundance or population sizes cannot be determined. For example, we do not know if observations of four golden eagles during the day on FCR represent four observations of the same eagle or observations of four different eagles. Therefore, all data on number of observations are presented as avian use. Use is a better indicator than abundance to assess potential effects of windpower development because it allows us to determine where high use areas are located, regardless of the number of individuals using those areas. In addition, the probability of turbine collisions is related more to amount of use of an area than to actual population size; turbines placed in low-use areas where populations across the study area are relatively high may result in less mortality than turbines placed in high-use areas where actual population sizes may be much lower.

RLB use of FCR was highest in the fall (2.42/survey), followed by summer (2.39/survey), spring (1.51/survey) and winter (0.51/survey) (Table 1). Based on mean number observed per survey, the three RLB avian groups (see Appendix D for list of species in each group) with highest use of FCR during the spring period were eagles (0.62/survey), corvids (0.33), and buteos (0.23) (Table 2). RLB species with highest use of FCR in the spring were golden eagle (0.61/survey), American crow (0.17), red-tailed hawk (0.14), common raven (0.10) and ferruginous hawk (0.06) (Table 3). Based on frequency of occurrence (percentage of surveys that each species was recorded, regardless of the total number of individuals observed), the most frequently observed RLB species on FCR in spring were golden eagle (37.2% of surveys), red-tailed hawk (10.8%), common raven (6.9%), ferruginous hawk (5.0%), and prairie falcon (4.6%) (Table 4).

In summer, buteos had the highest use of any RLB group on FCR (0.63/survey), followed by eagles (0.48) and waterfowl (0.42) (Table 2). RLB species with the highest use were red-tailed hawk (0.49/survey), golden eagle (0.48), unidentified ducks (0.18), American kestrel (0.18), and Canada goose (0.11) (Table 3). Many of the ducks observed during surveys were unidentified as they were on ponds located on the periphery of the 800-m radius circle. RLB species most frequently observed during summer surveys were red-tailed hawk (30.0% of surveys), golden eagle (29.3%), American kestrel (15.1%), prairie falcon (6.4%), and northern harrier (5.6%) (Table 4).

During fall surveys, buteos (0.76/survey), eagles (0.72), and corvids (0.43) were the three RLB groups with highest use of the FCR study area (Table 2). Golden eagle was the RLB species with the greatest use (0.70/survey), followed by red-tailed hawk (0.55), American crow (0.24), common raven (0.16), and American kestrel (0.13) (Table 3). The most frequently observed species in fall were golden eagle (36.3% of surveys), red-tailed hawk (19.3%), American kestrel (9.4%), ferruginous hawk (8.5%), and northern harrier (8.3%) (Table 4).

In the winter period, RLB groups with the highest use of FCR were eagles (0.34/survey), corvids (0.09) and buteos (0.06). The five RLB species with the highest use in winter were golden eagle (0.34/survey), common raven (0.08), rough-legged hawk (0.05), black-billed magpie (0.01) and

ferruginous hawk (0.01) (Table 3). The most frequently observed species were golden eagle (22.0% of surveys), followed by common raven (5.4%), rough-legged hawk (3.6%), black-billed magpie (1.2%), and prairie falcon (1.0%) (Table 4).

Simpson Ridge

RLB data presented in this report for Simpson Ridge include only data collected since 1995 on those points located in areas considered to have the best potential for wind power development (Points M, N, P, R, U, V) (Figure 4). Most data collected on the other points not currently being surveyed have previously been presented (see Johnson *et al*. 1998).

Forty-six species were documented while conducting RLB surveys on Simpson Ridge over the 4-year study. Sightings were made of 1,486 avian groups comprised of 3,389 birds (Appendix B). The greatest number of RLB species was observed in summer (41) followed by fall (23), spring (21) and winter (6) (Table 1). RLB richness was highest in the summer (1.14 species/survey) followed by fall (0.61), spring (0.53) and winter (0.18). Use by all species observed during RLB surveys was highest in the summer (3.53/survey), followed by fall (1.67), spring (1.04) and winter (0.30).

The three RLB groups with highest use of SR during spring were eagles (0.27/survey), waterfowl (0.25), and corvids (0.25) (Table 2). The five RLB species with greatest use of SR in the spring were golden eagle (0.26/survey), unidentified duck (0.15), American crow (0.14), ferruginous hawk (0.14) and common raven (0.08) (Table 3). Based on frequency of occurrence, the most commonly occurring species on SR in spring were golden eagle (15.9% of surveys), ferruginous hawk (8.8%), common raven (6.2%), and American kestrel (3.0%) (Table 4).

In summer, waterfowl had the highest use of any RLB group (2.22/survey), followed by buteos (0.25) and shorebirds (0.24) (Table 2). RLB species with the highest use of SR in summer were unidentified ducks (0.49/survey), mallard (0.48), American wigeon (0.18), eared grebe (0.18), and golden eagle (0.11). Species most frequently observed during summer surveys were golden eagle (11.3% of surveys), American kestrel (10.4%), northern harrier (9.6%), mallard (7.2%), and Ferruginous hawk (6.7%) (Table 4).

During fall surveys, waterfowl (1.10/survey), eagles (0.17), and buteos (0.09) were the three RLB groups with highest use of the SR study area (Table 2). RLB species with the highest use were unidentified duck (0.49/survey), Canada goose (0.48), golden eagle (0.16), northern harrier (0.09), and green-winged teal (0.06) (Table 3). The most frequently observed species in fall were golden eagle (13.6% of surveys), northern harrier (8.1%), American kestrel (5.3%), unidentified duck (5.0%), and red-tailed hawk (4.7%) (Table 4).

In the winter period, eagles (0.22/survey), corvids (0.06) and buteos (0.01) were the RLB groups with highest use of SR. RLB species with the highest use in winter were golden eagle (0.20/survey), common raven (0.04), bald eagle (0.02), black-billed magpie (0.01) and rough-legged hawk (0.01) (Table 3). Species most frequently observed during winter surveys were golden eagle (15.2% of

surveys), common raven (3.0%), bald eagle (1.9%), rough-legged hawk (1.2%) and black-billed magpie (0.9%) (Table 4).

Morton Pass Reference

Over the 4-year study, 29 species were documented during observations of 1,555 groups comprised of 2,001 birds while conducting RLB surveys on MPR (Appendix B). The greatest number of RLB species was observed in summer (26) followed by fall (16), spring (14) and winter (4) (Table 1). RLB richness was highest in the summer (0.72 species/survey) followed by fall (0.51), spring (0.47) and winter (0.16). For all RLB species combined, use was highest in the summer (0.95/survey), followed by spring (0.74), fall (0.68) and winter (0.24) (Table 1).

Groups with highest use of MPR in spring were eagles (0.29/survey), buteos (0.20), and waterfowl (0.08) (Table 2). Species with the highest spring use of MPR were golden eagle (0.28/survey), ferruginous hawk (0.12), unidentified duck (0.08), American kestrel (0.07), and red-tailed hawk (0.04) (Table 3). Those species observed most frequently included golden eagle (19.5% of surveys), ferruginous hawk (7.0%), American kestrel (5.5%), red-tailed hawk (3.4%), and prairie falcon (3.2%) (Table 4).

In summer, buteos had the highest use of any RLB group (0.30/survey), followed by eagles (0.17) and large falcons (0.12) (Table 2). Species with highest use were ferruginous hawk (0.19/survey), golden eagle (0.17), prairie falcon (0.12), American kestrel (0.08), and Swainson's hawk (0.05). Species most frequently observed during summer surveys were golden eagle (12.9% of surveys), ferruginous hawk (12.8%), prairie falcon (10.6%), American kestrel (6.7%), and red-tailed hawk (4.0%) (Table 4).

During fall surveys, eagles (0.25/survey), large falcons (0.12) and buteos (0.10) were the three RLB groups with highest use of MPR (Table 2). Species with highest use were golden eagle (0.24/survey), prairie falcon (0.12), northern harrier (0.08), common raven (0.06), and red-tailed hawk (0.04) (Table 3). The most frequently observed species in fall were golden eagle (16.2% of surveys), prairie falcon (10.6%), northern harrier (6.0%), red-tailed hawk (3.4%), and ferruginous hawk (3.1%) (Table 4).

Only four species (golden eagle, rough-legged hawk, common raven, Canada goose) were observed during RLB surveys in winter. Golden eagles were observed on 13.6% of surveys and their mean use was 0.21/survey. Rough-legged hawks were observed on 1.7% of surveys and mean use was 0.02/survey. Common ravens and Canada geese were observed only once during winter surveys (Tables 3 & 4).

The above data provide standardized information on species composition and relative use in each study area, but provide little information on length of time birds use each area. Information on length of time birds spend in each area was obtained by making instantaneous counts every 10 minutes during RLB surveys. Species that spend more time within the plot will have relatively higher use based on instantaneous count data than species that may be more frequently observed,

but spend less time in the plot. Based on these data, avian groups that spent the greatest amount of time on FCR were waterfowl, eagles, and buteos (Table 5). Species spending the most amount of time on FCR varied with season. In spring, golden eagle (0.06/instantaneous count), red-tailed hawk (0.04), mallard (0.02) and great blue heron (0.02) spent the most amount of time (Appendix E). In summer, unidentified duck (0.13/instantaneous count), red-tailed hawk (0.10), mallard (0.05) and golden eagle (0.05) spent the greatest amount of time on FCR. Species spending the most amount of time in fall were golden eagle (0.08/instantaneous count), red-tailed hawk (0.07) and common raven (0.02). Over the winter, most use of FCR was by golden eagle (0.03/instantaneous count), rough-legged hawk (0.002) and ferruginous hawk (0.002) (Appendix E).

Avian groups spending the most amount of time on SR were waterfowl, corvids and eagles (Table 5). Species that spent the most time on SR in spring were unidentified duck (0.06/instantaneous count), golden eagle (0.04), mallard (0.01) and ferruginous hawk (0.01) (Appendix E). All species spending the greatest amount of time on SR during summer and fall were waterfowl. In summer, these were unidentified duck (0.54/instantaneous count), mallard (0.19) and American wigeon (0.09). During fall, highest use of SR was recorded for unidentified duck (0.21/instantaneous count), Canada goose (0.10) and green-winged teal (0.03). Over the winter period, SR received greatest use by golden eagle (0.02/instantaneous count), common raven (0.004) and bald eagle (0.003) (Appendix E).

PSB Surveys

Over the four-year study, 92 species were documented during breeding season passerine/small bird (PSB) surveys on FCR, SR and MPR. During PSB surveys, 7,249 groups of birds comprised of 11,674 individuals were recorded (Appendix F). The number of birds observed by species used to obtain use and composition estimates are presented in Appendix C. The greatest number of species was observed on FCR (75) followed by SR (54) and MPR (38) (Table 1). Avian richness (# species/survey) was highest on MPR (3.04), followed by FCR (2.96) and SR (2.89) (Table 1).

Based on mean number observed per survey, the three avian groups with highest use of FCR were larks (2.08/survey), sparrows (1.94), and swallows (0.54); these groups comprised 31.9%, 29.9% and 8.3% of all birds seen, respectively (Table 6). The five species with highest use of FCR were horned lark (2.08/survey), vesper sparrow (0.93), Brewer's sparrow (0.45), cliff swallow (0.41) and Brewer's blackbird (0.39) (Table 7). Based on frequency of occurrence, the most commonly occurring species on FCR were horned lark (51.3% of surveys), vesper sparrow (47.9%), Brewer's sparrow (22.3%), green-tailed towhee (15.8%) and Brewer's blackbird (14.6%) (Table 7).

The three avian groups with highest use of SR were sparrows (2.90/survey), larks (1.02), and thrushes (0.52), which comprised 52.6%, 18.4% and 9.4% of all birds observed (Table 6). Species with highest use of SR were vesper sparrow (1.31/survey), Brewer's sparrow (1.17), horned lark (1.01), sage thrasher (0.44) and cliff swallow (0.27) (Table 7), while species most frequently observed were vesper sparrow (64.6% of surveys), Brewer's sparrow (54.8%), horned lark (42.1%), sage thrasher (33.3%), and green-tailed towhee (11.5%) (Table 7).

On MPR, the three bird groups with highest use were larks (3.84/survey), sparrows (2.57), and swallows (0.40); these groups comprised 51.1%, 34.2% and 5.3% of all birds observed, respectively (Table 6). Species with highest use were horned lark (3.57/survey), vesper sparrow (1.27), Brewer's sparrow (0.77), western meadowlark (0.44), and cliff swallow (0.33) (Table 7). The most frequently occurring species on MPR were horned lark (77.5% of surveys), vesper sparrow (64.2%), Brewer's sparrow (41.9%), western meadowlark (28.8%), and McCown's longspur (14.4%) (Table 7).

Differences in mean relative use and frequency of occurrence among species in both the RLB and PSB survey data primarily reflect differences in flocking behavior among species. Many of the species observed during RLB surveys with high use were observed on very few surveys, but tended to occur in large flocks when they were observed, especially waterbirds and waterfowl (Appendix G). For example, Canada geese, mallards, and Franklin's gulls were species with some of the highest use data in some seasons and study areas, yet their frequency of occurrence was relatively low. Flock sizes of up to 56 Canada geese, 25 mallards, and 30 Franklin's gulls were observed. Other species, such as raptors, were observed much more frequently than waterbirds and waterfowl, but these birds were often observed as lone individuals or very small groups, making their relative use lower than some species of waterbirds and waterfowl (Appendix G).

During and Post-construction Changes in Avian Use of FCR

Data collected prior to initiation of wind plant construction activities on FCR indicate that SR appears to provide a suitable reference for FCR, and MPR appears to provide an adequate off-site reference (Johnson *et al*. 1998). Although differences in avian richness and use were detected among study areas for some seasons, overall avian use and richness are fairly similar among the three study areas and appear adequate for comparing trends. Based on data collected to date, RLB groups that appear most suitable for comparing trends among study areas, depending on season, include buteos, eagles, falcons, all raptors combined, waterfowl, and corvids. PSB groups most appropriate for use in monitoring trends among study areas appear to be larks, sparrows, swallows, thrushes and blackbirds.

RLB Data - Construction Effects

The BACI analysis of RLB data indicated that for all seasons observed use of the FCR study area during construction was not significantly different from expected use by waterbirds, waterfowl, shorebirds, small falcons, other raptors (northern harrier, turkey vulture, osprey), all raptors combined, or corvids (Figure 18). Observed use of FCR by buteos was similar to expected use in the spring and fall seasons, but was higher than expected during the summer, possibly due to an increased number of nests and increased nest success in 1998. There were not enough data on winter use of FCR by buteos to allow for meaningful comparisons. Observed use of FCR by eagles was similar to expected use in the spring and winter periods of 1998, but was lower than expected in the summer and fall of 1998 (Figure 18). Conversely, the drop in eagle use of FCR in 1998 may be related more to a reduction in the number of proximate active nests than to any wind plant-related effect. A golden eagle nest located approximately 0.5 miles from the rim produced young in both

1995 and 1997. This nest was not active in 1998, which could at least partially explain reduced use of FCR by eagles in the summer and fall of 1998. It is unlikely construction of the windplant affected status of this nest in 1998, as it was active again in 1999 after FCR I became operational and while construction of FCR II and FCR III was taking place.

Observed use by large falcons on FCR was similar to expected use during the spring, summer, and fall, but was significantly higher than expected in the winter. The higher than expected use was due to a substantial increase in use of FCR by prairie falcons in the winter of 1998; winter use of SR by this species declined between 1995 and 1998 and no prairie falcons were observed on MPR in the winter period. Use of FCR by accipiters was similar to expected use in the spring, summer and winter. Accipiter use of FCR was significantly lower than expected in the fall of 1998. Accipiter use declined on FCR from 1997 to 1998, whereas accipiter use of both SR and MPR increased from 1997 to 1998 (Figure 18). Both the significantly higher use of FCR by large falcons in the winter and significantly lower use of FCR by accipiters in the fall are likely related more to prey availability, weather conditions, or other factors such as snow cover then to wind plant construction effects. There was no significant change in avian richness (# species/survey) during construction of the wind plant (Figure 19).

RLB Data - Post-construction Effects

After FCR I became operational, observed use of FCR in all seasons was similar to expected use for eagles, large falcons, small falcons, and other raptors (northern harrier, turkey vulture, osprey). Eagle use in the summer and fall of 1999 was similar to expected use likely because a nearby nest not used in 1998 was again active in 1999, producing one young. Observed use of FCR by buteos in the summer of 1999 continued to remain higher than expected; observed use of FCR by buteos was similar to expected during the other three seasons. Observed use of FCR by accipiters was significantly lower than expected for the fall season, despite the fact that fall use of FCR by accipiters increased from 1998 to 1999. Most accipiters observed in fall are migrants, and decreased use in the fall may have been related to changes in migration patterns, prey availability, weather conditions, or other factors. No accipiter fatalities were documented at FCR in 1999 (Johnson *et al*. 2000), and use of FCR by accipiters in the summer of 1999 was much higher than in previous years, suggesting that accipiters are not avoiding the wind plant.

Use of FCR in the fall by eagles, large falcons, small falcons, and accipiters increased from 1998 to 1999, but use of FCR in the fall by buteos and other raptors (northern harrier, turkey vulture, osprey) decreased. For all raptors combined, observed use in the fall was significantly lower than expected. Buteos comprise nearly 40% of all raptor use of FCR in the fall, and a fairly large (albeit not significant) decrease in buteo use of FCR in the fall was largely responsible for the significantly lower than expected use by all raptors combined. Many raptors observed in fall are migrants, and decreased use in the fall by all raptors combined may also have been related to changes in migration patterns, prey availability, or weather conditions. As was the case with accipiters, no buteo fatalities were documented at FCR in 1999 (Johnson *et al*. 2000), and use of FCR by buteos in the summer of 1999 was much higher than in previous years, again suggesting that buteos were not avoiding the wind plant. Due to reduced use by raptors in the fall, raptor richness (# species/survey) also was

significantly lower than expected in the fall, but not during any of the other three seasons (Figure 19).

Observed use of the FCR study area was similar to expected use in the spring, fall, and winter for waterbirds, waterfowl, and shorebirds. During the summer of 1999, however, observed use of FCR by all three of these groups was significantly lower than expected use (Figure 18). Use of FCR by these groups did not decline substantially from previous years; the significantly lower use relative to reference areas can be explained primarily by a substantial increase in use of SR by these groups during the summer of 1999. Above- average precipitation in the spring of 1999 likely resulted in a substantial increase in available habitat on SR, which has many small stock ponds and depressions that fill with water. These types of habitats are not as prevalent on or near FCR or MPR, which may explain why use of these two areas by waterbirds, waterfowl, and shorebirds did not show similar increases. Use of FCR by corvids was significantly lower than expected in the fall, but not during the rest of the year. Compared to previous years, corvid use in 1999 was lower in the summer and fall, but higher in the spring and winter. No corvid fatalities have been found during carcass searches, and higher use of FCR in the spring and winter suggest that construction and operation of the turbines are not displacing corvids. Lower use observed in the summer and fall may be due to food availability or other factors.

PSB Data - Construction Effects

Based on the BACI analysis of PSB survey data, groups with significantly lower than expected use of FCR during the construction period (1998) included raptors, larks, and finches (Figure 20). For all other groups (i.e., waterbirds, waterfowl, shorebirds, gamebirds, corvids, blackbirds, warblers, swallows, flycatchers, sparrows, thrushes, wrens, and woodpeckers), there were no significant changes in avian use during wind plant construction on FCR, as observed use by all groups was similar to expected use. There was also no significant change in avian richness (# species/survey) during construction (Figure 21). Raptor data collected during RLB surveys is much more extensive, and did not indicate reduced use of FCR in the summer of 1998.

PSB Data - Post-construction Effects

Data collected in 1999 were used to assess potential wind plant operation effects (FCR I) as well as construction-related impacts of FCR II and FCR III. Following construction, only finches continued to show significantly lower than expected use of FCR. Use of FCR by all other groups, including raptors, was not significantly different from expected during the operational phase of the wind plant in 1999. Avian richness also was similar to expected during the 1999 breeding season (Figure 21). Lower than expected use of FCR by larks in 1998 may indicate that horned larks avoided FCR during construction. If these birds were displaced by construction, the displacement was short-lived, as use of FCR by larks following construction in 1999 was similar to expected use. Most observations of finches on FCR are of pine siskins and American goldfinches within aspen habitats on the east side of the rim; these birds are rarely observed on the rim itself and are therefore less susceptible to wind plant-related mortality or disturbance. Finch abundance was much higher on FCR than on the two reference areas throughout the study. Abundance of finches on FCR was highest in 1995, and has steadily declined since, whereas abundance of finches on the two reference

areas (SR and MPR) has remained stable but very low throughout the study. No finch fatalities were located in 1999. Finch populations are known to be highly irregular from year to year and the decline seen on FCR is likely related to food availability, weather or other factors unrelated to windpower development.

Flight Heights

RLB Data

Data are available where flight heights were recorded to the nearest meter for 4,433 flying birds observed during RLB surveys on FCR and SR. Most (44.4%) observations were of birds flying <19 m, or below the rotor-swept height of the turbine. A total of 31.9% of birds was flying 19 m to 62 m, which is within the rotor-swept height, and the remaining 23.7% were flying >62 m, or above the rotor-swept height of the turbine (Table 8). For RLB groups with > 40 observations of flying birds, waterbirds had the highest proportion of flight heights within the rotor-swept height (42.8%), followed by eagles (42.4%), large falcons (36.6%), buteos (35.9%) and accipiters (26.8) (Table 8). For RLB species with > 20 observations of flying birds, the five with the greatest proportion of observations within the rotor-swept height were Swainson's hawk (48.6%), rough-legged hawk (46.2%), golden eagle (43.0%), mallard (42.9%), and turkey vulture (40.8%) (Appendix H).

PSB Data

All avian species were recorded during PSB surveys. A total of 5,441 flying birds were observed during PSB surveys on all three study areas from 1995 to 1999. Most (91.4%) of these observations were of birds flying below the rotor-swept height of turbines, 7.3% were of birds flying 19 m to 62 m high, which is within the rotor-swept height of the SeaWest turbines, and 1.2% were flying above the rotor-swept height (>62 m) (Table 8). For avian groups with > 20 observations of flying birds, raptors had the highest proportion of flight heights within the rotor-swept height (45.0%), followed by blackbirds (15.2%), shorebirds (10.3%), swallows (8.8%), and thrushes (7.8%) (Table 8). For species recorded flying at least 15 times during the study, the five with the greatest proportion of observations within the rotor-swept height were golden eagle (57.1%), red-tailed hawk (40.0%), American kestrel (27.8%), Brewer's blackbird (9.2) and cliff swallow (7.8%) (Appendix I). Common species (i.e., > 20 group observations) that were never observed flying within the rotor-swept height included broad-tailed hummingbird, sage thrasher, green-tailed towhee, McCown's longspur, and vesper sparrow. Other common species rarely observed flying within the rotor-swept height were Brewer's sparrow (1.2%), western meadowlark (3.2%), horned lark (3.6%), and brown-headed cowbird (4.2%) (Appendix I).

Turbine Exposure Indices

RLB Data

Indices to probability of turbine exposure based on mean use, proportion of observations recorded as flying, and proportion of flight heights recorded within the rotor-swept height of

turbines were calculated for all species observed during RLB surveys (Appendix J). Based on this index, RLB species with the relatively highest exposure on FCR during spring, in order, are golden eagle, red-tailed hawk, common raven, ferruginous hawk, and prairie falcon (Table 9). During summer, RLB species with the highest exposure index on FCR are golden eagle, red-tailed hawk, Franklin's gull, American kestrel, and Swainson's hawk. In fall, golden eagles remain the RLB species with the highest exposure index, followed by red-tailed hawk, common raven, ferruginous hawk, and prairie falcon. In winter, golden eagle, common raven, rough-legged hawk, ferruginous hawk, and prairie falcon had the highest relative turbine exposure indices (Table 9).

Based on this index, the five RLB species with highest relative turbine exposure index in the SR study area in spring, in order, are golden eagle, ferruginous hawk, common raven, unidentified buteo, and American crow. During summer, the five RLB species with the highest exposure index are golden eagle, mallard, Swainson's hawk, ferruginous hawk, and red-tailed hawk. In fall, of all RLB species recorded, golden eagle still had the highest relative risk of turbine exposure, followed by red-tailed hawk, northern harrier, American kestrel, and common raven. Golden eagles had the highest exposure index during winter, followed by common raven, rough-legged hawk, bald eagle, and prairie falcon (Table 9).

PSB Data

Indices to risk of turbine exposure were calculated for all species observed during PSB surveys using the same formula as was used for RLB data (Appendix K). Based on this analysis, species with the highest exposure index on FCR, in order, are pine siskin, American goldfinch, cliff swallow, violet-green swallow and horned lark (Table 10). On SR, species with the highest exposure index are cliff swallow, violet-green swallow, horned lark, Brewer's blackbird and Brewer's sparrow (Table 10). Even though raptors had a greater percentage of flight heights within the rotor-swept height than other groups recorded during PSB surveys, their abundance was much lower than that of passerines, which is why the turbine exposure index for raptors was relatively low using PSB survey data. Several species had relatively high exposure indices even though they had relatively low percentages of flight heights within the rotor-swept height. The higher exposure index was primarily a function of their relatively greater abundance (e.g., Brewer's blackbird, Brewer's sparrow and horned lark), or because they spent a significant percentage of their time flying (i.e., swallows).

This analysis may provide insight into what species might be the most likely to collide with turbines. Species with high relative exposure indices may not be at high risk of turbine collision; they are just at more risk than species with lower exposure indices based on our exposure index formula. 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. This index also only considers risk of turbine exposure based on use, proportion of observations recorded as flying, and flight height of each species. It does not take into consideration varying ability among species to detect and avoid turbines, habitat selection, behavior, and other factors that may influence probability of turbine exposure; therefore, actual exposure 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 collided with turbines more often, and turkey vultures and common ravens collided with turbines 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 (Richard Anderson, pers. commun.). In addition, proportions of birds observed flying within the rotor-swept height of turbines are based on number of individual birds observed, not flocks; therefore, one or two random chance observations of large flocks flying within the rotor-swept height greatly increases the proportion of observations indicating higher risk for that species. Over time, as better identification of characteristics or circumstances associated with avian risk are made, a more accurate determination of avian risk can be made.

There was some correlation between the species of turbine fatalities (see Johnson et al. 2000) and the exposure index we developed. The species with the greatest number of fatalities was horned lark, with 14 found dead. The horned lark turbine exposure index was #5 out of 75 species observed during PSB surveys on FCR. Other passerines fatalities with relatively high turbine exposure indices included cliff swallow, with one fatality and an exposure index of #3 of 75, Brewer's sparrow, with three fatalities and an exposure index of #10 of 75, and western meadowlark, with one fatality and a turbine exposure index of #15 of 75. Two American kestrel fatalities were found during the first study year, one in the spring and one in the fall. The turbine exposure index for this species was #9 of 21 species observed during RLB surveys in the spring, and #7 of 22 species observed flying in the RSH in the fall. The only other raptor fatality was a northern harrier found in the spring. The turbine exposure index for this species was #15 of 21 species.

Based on dates that the other 20 species of fatalities were collected, a majority of them were likely migrating through the project area. These birds likely collided with the turbine at night, as based on data collected for observations of these species during the daylight period, our exposure index was either 0 or near 0, primarily because these species were rarely observed on FCR, were rarely observed flying, or tended to fly at heights above or below the rotor-swept height of turbines.

Spatial Use of FCR and SR

RLB Data

Based on data collected since 1995, overall use of FCR by raptors observed during RLB surveys is fairly similar at all six survey points, ranging from approximately 1.0 to 1.5 raptors per survey (Figure 22). Eagle use of FCR was concentrated on the western side throughout the entire length of the rim during all four study years. Buteo use appeared to be related primarily to presence of

nests. Red-tailed hawk nests are present west of the rim near points C and E, and buteo use of these points was highest on the western side of the rim. Another red-tailed hawk nest occurs east of the rim at point B, and use at this point is highest on the eastern side of the rim. Falcons appeared to concentrate use on the west side of the rim at its northern end; use of the central and southern portions of the rim was more evenly distributed from west to east (Appendix L). Data collected by Mariah in 1994 indicated significantly greater use of the western side of the rim by raptors (Thomas *et al*. 1997).

Examination of spatial use also indicated that raptors use the rim edge significantly more than other portions of the study area. For each raptor observation on FCR, locations were placed into one of three strata: (1) within 50 m of the rim edge, (2) >50 m off of the rim, and (3) on the mesa but >50 m away from the rim edge (Figure 23). Total area encompassed within each of the three strata varied among the six survey points due to orientation of the rim at each point (Table 11). Using data collected by WEST since 1995, use of the rim edge was consistently higher than areas away from the rim edge for eagles, falcons, and all raptors combined at all six survey points (Figure 24). Higher use of the rim edge by buteos occurred at five of the six survey points (Table 11). WEST analyzed raptor use data collected by Mariah in 1994 (Thomas *et al*. 1997), and these data also show that use was higher on the rim edge than away from the rim edge at all six survey points for all raptors combined; however, for some raptor groups and survey points, use was higher either >50 m away from the rim or higher on the mesa but >50 m from the rim edge.

A far greater proportion of birds observed on the rim edge were flying at heights within the rotor-swept height (19 m-62 m) than were birds flying away from the rim edge. This tendency to fly within the rotor-swept height on the rim edge was consistently observed for golden eagles, falcons, and all raptors combined at all six survey points on FCR throughout the entire study (Table 12). Buteos tended to fly within the rotor-swept height along the rim edge at five of the six survey points.

Based on estimated use (#/km^2) and associated variance, those portions of FCR >50 m from the rim edge receive significantly less use by all raptor groups than those portions of FCR within 50 m of the rim edge. In addition, birds observed on the mesa but >50 m from the rim edge also tend to fly at heights not within the turbine rotor-swept height (Figure 25). Consistently greater use of the rim edge by all raptor groups combined with a tendency by raptors to fly within the rotor-swept height along the rim edge suggests that placing turbines >50 m away from the rim edge may reduce risk to raptors on FCR.

For all raptor species observed during RLB surveys on SR, highest use occurred on the southern end of Wilson Ridge, located in the southwest portion of the study area and on the north end of Simpson Ridge itself (Figure 26). The two points with the highest use were on north-south oriented ridges with steep slopes on one or both sides. Points with the lowest use were generally those on flat to slightly sloping topography.

PSB Data

Plots of relative use by passerines on FCR generally indicate that the east side of the rim receives highest use, likely due to presence of aspen habitat on that side. Four of the five points with the highest use all were located in aspen habitat on the east side of the rim. Lowest use was generally observed on top of the mesa itself and on the west side of the rim (Figure 28). On SR, passerine use was more uniform among points than use on FCR. Use was highest at points associated with presence of stockponds, draws, and dense, mature stands of big sagebrush; lowest use occurred on windswept ridgetops (Figure 28).

Raptor Nest Surveys

Total number of active raptor nests located on FCR and SR and the associated 16-km buffer areas around each study area ranged from 122 in 1995 to 146 in 1997 (mean = 134/year). The number of active nests located in the area of overlap between these two study areas has averaged 30/year. The FCR raptor nest study area contained 56 active nests in 1995, 83 active nests in 1997, and 70 active nests in both 1998 and 1999. The SR study area contained 87 active nests in 1995, 96 active nests in 1997, 97 active nests in 1998, and 93 active nests in 1999 (Figure 29). The MPR reference area and its associated 16-km buffer contained 40 active nests in 1995, 37 active nests in 1997, 49 active nests in 1998 and 48 active nests in 1999 (Figure 29). The total number of active raptor nests on all three study areas has remained fairly stable over the last three years. Mean density of active raptor nests over the 4-year study was highest on the FCR study area (0.07/km$^{2)}$, followed by SR (0.05/km^2) and MPR (0.03/km^2).

Based on four years of active nest data for the entire WRA (SR and FCR), active red-tailed hawk nests were most common (mean = 58/year), followed by golden eagle (30), ferruginous hawk (19), prairie falcon (11), Swainson's hawk (6), great-horned owl (6), and bald eagle (3). On MPR, ferruginous hawk nests were most common (15/year), followed by Swainson's hawk (10), golden eagle (8), red-tailed hawk (6), and great-horned owl and prairie falcon (2.5 each) (Figure 29). In 1999, a new active bald eagle nest was found at MPR.

Within the FCR study area and associated buffer, percent of active raptor nests checked that were later abandoned or predated ranged from 10.5% in 1995 to 51.5% in 1997. The minimum percentage of active nests that fledged young ranged from 36.4% in 1997 to 81.6% in 1995 (Table 13). For the three focal species, mean number of bald eagle young fledged per active nest checked ranged from none in 1997 (n=1 nest) to 2.0 in 1995, 1998 and 1999 (n=1-2 nests). Mean number of ferruginous hawks fledged per active nest checked ranged from none in 1997 (n=5 nests) to 2.25 in 1995 (n=2 nests). For golden eagle, the estimated number of young fledged per active nest checked ranged from 0.63 in 1997 (n=15 nests) to 1.38 in 1999 (n=14 nests). There appeared to be no effect of construction or operation of the FCR wind plant on raptor nest density (Figure 29) or reproductive success of the focal species in the FCR study area (Figure 30).

On the SR study area and associated buffer, percent of active raptor nests checked that were later abandoned or predated ranged from 27.0% in 1997 to 42.9% in 1995. Most unsuccessful nests were ferruginous hawk nests located on the ground along ridge tops. The minimum percentage of nests

estimated to have fledged young ranged from 44.1% in 1997 to 60.7% in 1999. The number of bald eagle young fledged per active nest checked ranged from 0.5 in 1997 (n=2 nests) to 1.67 in 1999 (n=3 nests). Ferruginous hawks fledged from 0.41 young/nest in 1997 (n=17 nests) to 1.86 young/nest in 1998 (n=14 nests). The number of golden eagle young fledged per active nest checked has ranged from 0.61 in 1998 (n=18 nests) to 1/10 in 1999 (n=24 nests) (Figure 30).

On MPR, number of ferruginous hawk young fledged per active nest checked ranged from 1.59 in 1997 (n=11 nests) to 2.18 in 1999 (n=11 nests). Mean number of golden eagle young fledged per active nest checked ranged from 0.56 in 1999 (n=8 nests) to 1.00 in 1995 (n=2 nests). No bald eagle nests were located in the MPR study area until 1999, when one nest fledged one young. Percent of active raptor nests checked that were abandoned or predated within the MPR study area ranged from 13.3% in 1995 to 34.5% in 1998 (Table 13). The minimum percentage of active nests that fledged young ranged from 56.9% in 1998 to 80.0% in 1995.

Big Game Studies

Big Game Aerial Surveys

During the winter period, maximum estimates of pronghorn numbers on the survey area ranged from 10,796 during the 1995/1996 winter to 16,396 during the 1997/1998 winter (Table 14). Mean detection probability averaged across all survey dates each year was 0.74 in 1995, 0.62 in 1997, and 0.55 in 1998. A group size bias was detected for three of the 11 survey dates in 1995 and two of the seven survey dates in 1998; no group size biases were detected in 1997. Average group size was lowest from April through June; the largest groups occurred from December through February (Table 14). Mean group size in the vicinity of FCR ranged from 1.6 on 24 June 1995 to 40.8 on 6 January 1998. Group sizes throughout the remainder of the study area ranged from 1.6 on 15 June 1997 to 41.2 on 26 January 1998 (Table 14).

Based on all survey years, maximum numbers of pronghorn generally occur in the study area in late winter; comparatively lower numbers occur in late spring (March through June). Pronghorn density on the survey area was estimated to range from 1.2/km^2 on 13 April 1997 to 14.7/km^2 on 26 January 1998 (Table 15).

Results of spatial statistical analyses indicated that highest use of the survey area by pronghorn during all seasons was generally in the eastern portion of the survey area north of FCR (Figure 31); however some variability between years was noted (Appendix M). The area adjacent to and including FCR received comparably little use by pronghorn throughout the year, especially in winter. Highest use of the FCR area occurred from March through June (Figure 31). The area around SR also received less use than other portions of the survey area. Lowest use of SR occurred during late winter (January-February); relatively higher use was observed in the spring and early summer, and highest use occurred in early winter (November-December) (Figure 32).

Survey data collected since 1995 indicate that there are no pronghorn winter concentrations or concentrations in June during the fawning period in close proximity to either FCR or SR. These

results are consistent with seasonal distribution maps maintained for pronghorns by the Wyoming Game and Fish Department; therefore, it does not appear that development of the wind plant on FCR will have a significant impact on wintering pronghorn. Additionally, FCR does not appear to be an important parturition area for pronghorn. Based on information collected to date, it does not appear that continuation of the aerial surveys would provide new information useful to assess impacts to big game. The Technical Advisory Committee (TAC) formed to guide research for the wind development project met in July 1998 to discuss research results to date and concluded that big game aerial surveys were no longer necessary; therefore, aerial surveys were discontinued following the June 1998 survey.

Big Game Pellet Surveys

Density of all big game pellet groups on FCR during the winter period ranged from 115/ha in 1997/1998 to 486/ha in 1994/95 (Table 16). During the summer period, pellet group density was 178/ha in 1995 and 104/ha in 1997. For all three winter periods combined, pronghorn comprised 63%, mule deer comprised 28% and elk comprised 9% of all pellet groups. During the two summer periods on FCR, pronghorn comprised 80%, mule deer comprised 13%, and elk comprised 7% of the pellet groups.

In the SR area, winter pellet group density varied from 224/ha in 1994/95 to 317/ha in 1997/98. During the summer period, pellet group density was 393/ha in 1995 and 275/ha in 1997 (Table 16). For all years combined, pronghorn, mule deer and elk comprised 80%, 20%, and <0.5% of big game pellet groups, respectively on SR during winter. During the summer period, pronghorn comprised 81% and mule deer comprised the remaining 19% of all pellet groups.

Big game pellet data were intended for use in the BACI impact assessment. One objective was to evaluate the potential for small scale displacement effects of the wind plant on pronghorn. However, it is likely that the amount of use detected using pellet surveys does not provide a substantial improvement over simple observations of pronghorn during diurnal RLB surveys. Observations of pronghorn and other big game during RLB surveys was initiated in February 1997, and analysis of these data (see below) appear sufficient to characterize big game use and distribution near the wind plant. Therefore, following direction of the TAC committee, big game pellet surveys were discontinued following the spring 1998 sampling period.

Big Game Observations During RLB Surveys

On FCR, mean number of pronghorn observed per RLB survey in 1997 ranged from 0.53 at point D to 2.46 at point F. In 1998, mean number of pronghorn observed per RLB survey ranged from 0.18 at point C to 5.94 at point F. Data collected in 1997 and 1998 indicate no significant change in pronghorn abundance within 800 m of FCR. Mean number observed per survey for all six points combined was 1.07 in 1997, 1.59 in 1998 and 1.14 in 1999 (Table 17). There was no significant ($p>0.10$) difference in pronghorn abundance between years.

Mountain Plover Surveys

Transect Surveys

The maximum number of adult mountain plovers detected during individual surveys on FCR has steadily decreased from 36 in 1995 to 11 in 1999 (Table 18). Based on survey data, it appears that most plovers arrive on FCR by late April. In 1995, the majority of the plover population had left by mid-July. From 1997 through 1999, however, the plover population appeared to remain relatively stable from late April through late July. Maximum mountain plover density on FCR adjusted for visibility bias (mean 4-year detection probability = 0.606) was 4.91/km^2 in 1995, 3.41/km^2 in 1997, 2.59/km^2 in 1998 and 1.50/km^2 in 1999 (Table 18). Assuming these density estimates represent the maximum breeding population on FCR, total estimated breeding population size for the 12-km^2 mesa on FCR was approximately 60 individuals in 1995, 41 in 1997, 32 in 1998 and 18 in 1999. The estimated breeding population in 1994 was 51 individuals (Thomas *et al*. 1997).

During 1995 and 1997, prior to construction activities, most mountain plovers were concentrated on the north end of Foote Creek Rim; however, plovers were detected throughout the entire length of the rim (Figure 32). Where plovers did occur, they tended to be uniformly distributed across the rim from east to west (Figure 33). This general pattern continued in 1998, with the exception that no use was documented in the southern 1/3 of the rim, where most construction activities occurred (Figure 33). In 1999, following construction of FCR I and during construction of FCR II and FCR III, plovers were primarily restricted to the northern 1/3 of the rim, and no plovers were detected along the entire southern half of the rim (Figure 32).

Reduced use of the southern portion of Foote Creek Rim by mountain plovers may be related to behavioral avoidance of operating turbines and/or construction and maintenance activities, reduced habitat effectiveness caused by the presence of roads, turbine pads and other ground disturbance activities, or a combination of the above. Bird displacement effects related to wind plants have received substantial attention in Europe. One study of a Dutch wind plant found that shorebirds, including lapwing (*Vanellus vanellus*), curlew (*Numenius arquata*), and golden plover (*Pluvialis apricaria*), were the most sensitive of all avian groups, and avoided the area up to 250 - 500 m from the wind plant (Winkelman 1990). Similarly, of several species present near a large Danish turbine, golden plovers and lapwings showed the most significant displacement (up to 800 m) from the turbine (Pederson and Poulsen 1991). In another Danish study, wintering golden plovers were found to nearly completely abandon a staging area around a wind plant comprised of small turbines (Peterson and Nohr 1989). Reduced use by other avian groups near windfarms, including waterfowl and passerines, have also been recorded in Europe (Peterson and Nohr 1989, Pederson and Poulsen 1991, Vauk 1990, Winkelman 1989, Winkelman 1990, Winkelman 1992). For other avian groups or species or at other wind plants, however, no displacement effects were observed (Karlsson 1983, Winkelman 1989, Winkelman 1990).

Wind plant-related displacement effects have received less attention in the U.S. At a large wind plant on Buffalo Ridge, Minnesota, use by 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 no differences in avian use as a function of distance from

turbine, however, suggesting that the area of reduced use did not extend to the distances that non-turbine plots were from turbines (range = 400 - 3750 m) (Johnson *et al*. 1999). Lower avian use where turbines were present 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. Although displacement of birds by wind plants is not desirable, especially where important habitats may be limited, if other suitable habitats are available, one potential benefit of avian avoidance of wind farms would be reduced potential for collision mortality (Crockford 1992).

On MPR, the maximum number of plovers counted during any survey ranged from five in 1995 (July 7) to 18 in 1997 (May 16). Maximum mountain plover density on MPR adjusted for visibility bias was 2.0/km^2 in 1995, 7.36/km^2 in 1997, 3.27/km^2 in 1998 and 1.63/km^2 in 1999 (Table 19). Assuming maximum density estimates represent the breeding population on MPR, then the total estimated breeding population size for the MPR area was approximately eight in 1995, 30 in 1997, 13 in 1998 and seven in 1999.

Although population estimates on FCR were lower in 1998 and 1999 than in previous years, data collected on MPR indicate that plover use may have been lower in 1998 and 1999 in the general region. Other regional data collected on mountain plovers (e.g., Pawnee National Grassland, Colorado data) also indicate a recent regionwide decrease in mountain plover abundance (Fritz Knopf, USGS-BRD, pers. commun.). SeaWest is currently implementing a mountain plover mitigation plan to minimize wind plant-related impacts to this species (Garret 1998).

Nest Surveys

Percent nest success for mountain plovers was estimated to be 100% in 1995 (n= 2 nests), 87.5% in 1997 (n=8 nests), and 66.7% in 1998 (n=6 nests). Number of young fledged per nest was estimated to be 2.5 in 1995, 2.4 in 1997 and 1.7 in 1998 (Table 20). Two of the nests found in 1998 were located approximately 200 m of from a turbine, and both nests were successful. None of the four plover nests found in 1999 produced any young, as all four were predated.

Nest success was based on presence or absence of eggshell fragments in the nest. Lack of large eggshell fragments in or near a nest usually indicates the nest was successful because adults remove eggshell fragments soon after the chicks hatch, possibly to reduce visibility of the nest and risk of predation. Presence of very small eggshell fragments resulting from pipping chicks remain in the nest and are another indicator that the nest was successful (Fritz Knopf, USGS-BRD, pers. commun.).

Two mountain plover nests were located on MPR in 1995, one was located in 1997, and none were located in 1998 or 1999. Both nests located in 1995 were successful and produced a total of three young; the one nest found in 1997 also was successful and produced two young (Table 20).

Sage Grouse Studies

Lek Surveys

Twenty-two historic lek sites were visited during the aerial survey and ground visits each year of the study. The number of active leks monitored ranged from seven in 1995 to nine in 1997 and 1998. All active leks were in the SR study area (Figure 34); no active leks were located in the FCR study area. Maximum counts for all seven leks monitored in 1995 totaled 133 males (mean = 19.0/lek) and 17 females (mean = 2.4/lek). In 1997, maximum counts for the nine leks monitored totaled 122 males (mean = 13.6/lek) and 59 females (mean = 6.6/lek) (Table 21). In 1998, maximum counts for the nine leks combined were 154 males (17.1/lek) and 88 females (9.8/lek). Three leks previously monitored were not monitored in 1999, as size of the sage grouse study area at Simpson Ridge was reduced to more accurately reflect those leks most likely affected by wind plant construction. Maximum counts for these six leks totaled 166 males (27.7/lek) and 23 females (3.8/lek). For the six leks monitored all four study years, total number of males decreased from 116 in 1995 to 96 in 1997, then increased to 118 in 1998 and to 166 in 1999. The number of males is considered a better indicator of population trends because male lek attendance is much more consistent and stable than that of females. The largest lek was located approximately 3.2 km south-southeast of Carbon and had a maximum count of 38 males in 1995 and 1997, 39 males in 1998 and 52 males in 1999 (Figure 35).

Sage Grouse Use Surveys and Additional Baseline Data

Mean sage grouse pellet density on the FCR study area during the winter period ranged from 0/ha in 1997/1998 to 69/ha during the 1994/95 winter period. During the summer period, sage grouse pellet density on FCR was 11/ha in 1995 and 4/ha in 1997 (Table 16). On the SR study area, mean sage grouse pellet density during winter ranged from 85/ha in 1997/1998 to 131/ha in 1994/95. During the summer period, pellet density was 143/ha in 1995 and 32/ha in 1997 (Table 16). Pellet surveys were discontinued following the spring 1998 sampling period. Several sage grouse were observed while conducting other study activities on the SR study area. Highest concentrations of sage grouse were observed approximately 1.5 to 3.2 km southeast and 5 km west-southwest of the historic town of Carbon (Figure 35).

Raptor Prey Availability Studies

Lagomorphs

For all routes combined, the total number of cottontails observed increased from 13 in 1995 and 12 in 1997 to 44 in 1998 and to 53 in 1999. White-tailed jackrabbit abundance followed similar trends, as the total number observed increased from 21 in 1995 and 26 in 1997 to 50 in 1998 and to 89 in 1999 (Table 22). For all years and routes, white-tailed jackrabbits comprised 60.4% of all rabbits observed and cottontails comprised 39.6%. Mean abundance of all lagomorphs was highest on the MPR area in 1995 (0.31/km) and 1999 (1.31/km) and was highest on the FCR area in both 1997 (0.24/km) and 1998 (0.70/km) (Figure 36). For all years combined, highest mean lagomorph abundance occurred on the Wheatland Reservoir #3 route within the MPR study area (0.73/km), and lowest abundance occurred on the Highway 30 route within the SR study area (0.22/km) (Table 22).

Ground Squirrels

An average of 214 plots were searched per year along the six 32-km-long routes in all three study areas. Mean percent of plots containing active ground squirrel burrows in the FCR study area ranged from 65.2% in 1998 to 77.5% in 1995 (Figure 36). On SR, mean percent of plots containing active burrows ranged from 63.6% in 1997 to 74.5% in 1998. The percent of MPR plots containing active ground squirrel burrows ranged from 72.5% in 1999 to 82.1% in 1995 (Table 23). These data indicate very similar ground squirrel abundance from 1995 to 1999. On FCR, mean density of ground squirrel burrows in plots established for big game/sage grouse pellet surveys was 47.2/ha following the summer of 1995 and 38.7/ha following the summer of 1997. On the SR study area, ground squirrel burrow density averaged 24.0/ha at the end of the 1995 summer and 29.0/ha at the end of the 1997 summer. These data also indicate relatively stable ground squirrel populations throughout the study.

Prairie Dogs

On the FCR study area, density of active prairie dog burrows on the two towns surveyed increased from 27.5/ha in 1995 to 45.1/ha in 1999 (Table 24). Mean density of active prairie dog burrows within the six towns surveyed in the SR study area increased from 24.3/ha in 1995 to 30.2/ha in 1997. In 1998 and 1999, the Coal Mines prairie dog town could not be accessed because the mine closed the access road. Density of active prairie dog burrows on the remaining five towns was 20.4/ha in 1998 and 26.7/ha in 1999. Density of active prairie dog burrows on the one MPR prairie dog town surveyed increased substantially from 22.9/ha in 1995 to 156.4/ha in 1998, then declined to 102.4/ha in 1999 (Figure 36).

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Table 1. Avian relative use and richness by season on Foote Creek Rim (FCR), Simpson Ridge (SR) and Morton Pass Reference (MPR) areas, 1995-1999.

RLB Survey Data

Season	Study Area		
	FCR	SR	MPR
Spring			
No. Species	22	17	9
Mean No./Survey[a]	1.51	1.04	0.74
Mean No. Species/Survey	0.85	0.53	0.47
Summer			
No. Species	34	41	24
Mean No./Survey	2.39	3.53	0.95
Mean No. Species/Survey	1.37	1.14	0.72
Fall			
No. Species	20	20	15
Mean No./Survey	2.42	1.67	0.68
Mean No. Species/Survey	1.27	0.61	0.51
Winter			
No. Species	7	6	4
Mean No./Survey	0.51	0.30	0.24
Mean No. Species/Survey	0.35	0.18	0.16

[a] Each RLB survey was defined as the number of birds observed per observation point per 40- minute period.

PSB Survey Data

Season	Study Area		
	FCR	SR	MPR
Breeding Season			
No. Species	75	54	38
Mean No./Survey[a]	6.51	5.51	7.52
Mean No. Species/Survey	2.96	2.89	3.04

[a] Each PSB survey was defined as the number of birds observed per observation point per 8-minute period.

Table 2. Mean relative use, percent composition, and percent frequency of occurrence of avian groups observed during RLB surveys, 1995-1999[a].

Foote Creek Rim

	Mean Use				% Composition				% Freq. Of Occurrence			
Group	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win
Waterbirds	0.075	0.144	0.003	0	5.0	6.0	0.1	0	1.8	2.4	0.3	0
Shorebirds	0	0.041	0	0	0	1.7	0	0	0	3.0	0	0
Waterfowl	0.123	0.419	0.050	0	8.1	17.6	2.1	0	2.7	11.0	1.9	0
Accipiters	0.002	0.014	0.098	0	0.2	0.6	4.1	0	0.2	1.4	6.3	0
Buteos	0.230	0.633	0.760	0.057	15.2	26.6	31.4	11.3	16.2	36.6	27.8	4.4
Eagles	0.619	0.478	0.721	0.340	41.0	20.0	29.8	67.3	37.5	29.4	37.0	22.4
Large falcons	0.054	0.074	0.089	0.010	3.6	3.1	3.7	2.1	4.9	6.5	7.9	1.0
Small falcons	0.048	0.180	0.131	0	3.2	7.6	5.4	0	3.8	15.3	9.6	0
Other raptors	0.021	0.120	0.110	0	1.4	5.0	4.6	0	1.8	8.5	8.8	0
Unidentified raptors	0.003	0.006	0.015	0.004	0.2	0.2	0.6	0.7	0.3	0.5	1.5	0.3
All raptors	0.976	1.505	1.925	0.411	64.8	63.1	79.6	81.3	51.9	66.9	68.2	25.5
Grouse	0	0.004	0.003	0	0	0.2	0.1	0	0	0.1	0.3	0
Corvids	0.325	0.253	0.433	0.094	21.5	10.6	17.9	18.6	10.3	11.7	11.9	6.6
Common nighthawks	0	0.007	0.002	0	0	0.3	0.1	0	0	0.2	0.2	0
Other large birds	0	0	0.003	0	0	0	0.1	0	0	0	0.3	0
TOTAL	1.507	2.385	2.417	0.505	100.0	100.0	100.0	100.0	--	--	--	--

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Table 2 (Continued). Mean relative use, percent composition, and percent frequency of occurrence of avian groups observed during RLB surveys, 1995-1999[a].

Simpson Ridge

	Mean Use				% Composition				% Freq. Of Occurrence			
Group	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win
Waterbirds	0.007	0.190	0.008	0	0.7	5.4	0.5	0	0.3	5.2	0.8	0
Shorebirds	0	0.243	0.009	0	0	6.9	0.6	0	0	6.3	0.9	0
Waterfowl	0.253	2.222	1.102	0	24.2	63.0	66.0	0	4.8	17.7	8.1	0
Accipiters	0.005	0.003	0.021	0	0.4	0.1	1.2	0	0.4	0.3	1.6	0
Buteos	0.174	0.246	0.094	0.012	16.7	7.0	5.6	3.9	10.4	16.2	7.8	1.2
Eagles	0.273	0.151	0.173	0.224	26.1	4.3	10.4	75.6	15.9	11.4	14.0	16.1
Large falcons	0.010	0.053	0.009	0.005	1.0	1.5	0.6	1.5	1.0	5.0	0.9	0.5
Small falcons	0.030	0.130	0.057	0	2.9	3.7	3.4	0	3.0	10.4	5.7	0
Other raptors	0.028	0.168	0.085	0	2.7	4.8	5.1	0	2.8	11.1	8.1	0
Unidentified raptors	0	0.004	0.022	0	0	0.1	1.3	0	0	0.4	2.2	0
All raptors	0.519	0.755	0.460	0.241	49.7	21.4	27.6	81.0	26.5	42.6	31.4	16.9
Grouse	0.014	0.015	0.010	0	1.4	0.4	0.6	0	1.0	0.5	1.0	0
Corvids	0.251	0.077	0.056	0.056	24.1	2.2	3.4	19.0	8.0	4.7	4.6	3.9
Common nighthawks	0	0.012	0.009	0	0	0.3	0.5	0	0	0.4	0.9	0
Other large birds	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1.043	3.528	1.669	0.297	100.0	100.0	100.0	100.0	--	--	--	--

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Table 2 (Continued). Mean relative use, percent composition, and percent frequency of occurrence of avian groups observed during RLB surveys, 1995-1999[a].

Morton Pass Reference

	Mean Use				% Composition				% Freq. Of Occurrence			
Group	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win	Spr	Sum	Fall	Win
Waterbirds	0.009	0.056	0.012	0	1.3	5.9	1.7	0	0.2	3.1	0.2	0
Shorebirds	0.002	0.040	0	0	0.3	4.2	0	0	0.2	2.6	0	0
Waterfowl	0.080	0.038	0.013	0.005	10.9	4.0	1.9	1.9	0.5	1.9	0.5	0.5
Accipiters	0	0.006	0.003	0	0	0.7	0.4	0	0	0.6	0.3	0
Buteos	0.198	0.302	0.101	0.017	26.7	31.7	14.7	7.2	12.9	19.8	8.5	1.7
Eagles	0.291	0.169	0.248	0.211	39.2	17.8	36.2	88.9	19.7	12.9	16.9	13.6
Large falcons	0.039	0.123	0.122	0	5.3	12.9	17.8	0	3.4	10.8	10.6	0
Small falcons	0.074	0.080	0.029	0	10.0	8.4	4.2	0	5.8	6.7	2.9	0
Other raptors	0.012	0.062	0.078	0	1.6	6.5	11.4	0	1.2	5.9	6.3	0
Unidentified raptors	0.002	0.002	0.005	0	0.3	0.2	0.8	0	0.2	0.2	0.3	0
All raptors	0.617	0.744	0.585	0.228	83.3	78.1	85.5	96.1	34.5	42.4	35.9	15.3
Grouse	0.019	0.003	0	0	2.5	0.3	0	0	0.5	0.3	0	0
Corvids	0.014	0.028	0.069	0.005	1.8	2.9	10.1	1.9	1.1	1.6	3.1	0.5
Common nighthawks	0	0.043	0.006	0	0	4.5	0.8	0	0	2.9	0.6	0
Other large birds	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0.741	0.953	0.684	0.237	100.0	100.0	100.0	100.0	--	--	--	--

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Table 3. Five species with highest use (based on mean number per survey) observed during RLB surveys on FCR, SR and MPR, 1995-1999.

	Foote Creek Rim		Simpson Ridge		Morton Pass Reference	
Season	Species	#/survey	Species	#/survey	Species	#/survey
Spring	Golden eagle	0.606	Golden eagle	0.263	Golden eagle	0.283
	American crow	0.165	Unidentified duck	0.149	Ferruginous hawk	0.122
	Red-tailed hawk	0.143	American crow	0.142	Unidentified duck	0.078
	Common raven	0.104	Ferruginous hawk	0.138	American kestrel	0.072
	Ferruginous hawk	0.058	Common raven	0.082	Red-tailed hawk	0.040
Summer	Red-tailed hawk	0.487	Unidentified duck	1.200	Ferruginous hawk	0.194
	Golden eagle	0.476	Mallard	0.359	Golden eagle	0.168
	Unidentified duck	0.184	American wigeon	0.227	Prairie falcon	0.121
	American kestrel	0.175	Eared Grebe	0.150	American kestrel	0.080
	Canada goose	0.105	Golden eagle	0.150	Swainson's hawk	0.051
Fall	Golden eagle	0.699	Unidentified duck	0.491	Golden eagle	0.240
	Red-tailed hawk	0.548	Canada goose	0.475	Prairie falcon	0.122
	American crow	0.238	Golden eagle	0.163	Northern harrier	0.076
	Common raven	0.164	Northern harrier	0.085	Common raven	0.061
	American kestrel	0.126	Green-winged teal	0.063	Red-tailed hawk	0.039
Winter	Golden eagle	0.336	Golden eagle	0.201	Golden eagle	0.211
	Common raven	0.082	Common raven	0.043	Rough-legged hawk	0.017
	Rough-legged hawk	0.045	Bald eagle	0.023	Common raven	0.005
	Black-billed magpie	0.012	Black-billed magpie	0.014	Canada goose	0.005
	Ferruginous hawk	0.012	Rough-legged hawk	0.012		

Table 4. Five most commonly occurring bird species (based on percent frequency of occurrence) observed during RLB surveys on FCR, SR and MPR, 1995-1999.

	Foote Creek Rim		Simpson Ridge		Morton Pass Reference	
Season	Species	% Freq.	Species	% Freq.	Species	% Freq.
Spring	Golden eagle	37.2	Golden eagle	15.9	Golden eagle	19.5
	Red-tailed hawk	10.8	Ferruginous hawk	8.8	Ferruginous hawk	7.0
	Common raven	6.9	Common raven	6.2	American kestrel	5.5
	Ferruginous hawk	5.0	American kestrel	3.0	Red-tailed hawk	3.4
	Prairie falcon	4.6	Unidentified buteo	2.5	Prairie falcon	3.2
Summer	Red-tailed hawk	30.0	Golden eagle	11.3	Golden eagle	12.9
	Golden eagle	29.3	American kestrel	10.4	Ferruginous hawk	12.8
	American kestrel	15.1	Northern harrier	9.6	Prairie falcon	10.6
	Prairie falcon	6.4	Mallard	7.2	American kestrel	6.7
	Northern harrier	5.6	Ferruginous hawk	6.7	Red-tailed hawk	4.0
Fall	Golden eagle	36.3	Golden eagle	13.6	Golden eagle	16.2
	Red-tailed hawk	19.3	Northern harrier	8.1	Prairie falcon	10.6
	American kestrel	9.4	American kestrel	5.3	Northern harrier	6.0
	Ferruginous hawk	8.5	Unidentified duck	5.0	Red-tailed hawk	3.4
	Northern harrier	8.3	Red-tailed hawk	4.7	Ferruginous hawk	3.1
Winter	Golden eagle	22.0	Golden eagle	15.2	Golden eagle	13.6
	Common raven	5.4	Common raven	3.0	Rough-legged hawk	1.7
	Rough-legged hawk	3.6	Bald eagle	1.9	Common raven	0.5
	Black-billed magpie	1.2	Rough-legged hawk	1.2	Canada goose	0.5
	Prairie falcon	1.0	Black-billed magpie	0.9		

Table 5. Mean number of birds observed per instantaneous count for avian groups recorded during RLB surveys on FCR and SR, 1995-1999.

Foote Creek Rim

	Mean Use			
Group	Spr	Sum	Fall	Win
Accipiters	0	<0.0005	0.009	0
Buteos	0.042	0.113	0.091	0.004
Eagles	0.059	0.046	0.075	0.029
Large falcons	0.002	0.007	0.006	0.002
Small falcons	0.003	0.010	0.008	0
Other raptors	0.001	0.007	0.008	0
Unidentified raptors	0	<0.0005	<0.0005	0
Corvids	0.013	0.026	0.020	0.002
Grouse	0	0.004	<0.0005	0
Waterbirds	0.023	0.013	0	0
Shorebirds	0	0.003	0	0
Waterfowl	0.061	0.207	0.025	0
Common nighthawks	0	0.001	0	0
TOTAL	0.203	0.438	0.243	0.036

Simpson Ridge

	Mean Use			
Group	Spr	Sum	Fall	Win
Accipiters	0.001	0	0.001	0
Buteos	0.014	0.023	0.006	0.001
Eagles	0.045	0.019	0.014	0.023
Large falcons	0	0.005	0.001	0
Small falcons	0.001	0.008	0.005	0
Other raptors	0.003	0.026	0.008	0
Unidentified raptors	0	<0.0005	0	0
Corvids	0.015	0.013	0.002	0.006
Grouse	0	0.003	0	0
Waterbirds	0	0.054	0.007	0
Shorebirds	0	0.101	0.001	0
Waterfowl	0.091	0.882	0.329	0
Common nighthawks	0	<0.0005	0	0
TOTAL	0.1691	1.1337	0.3728	0.0299

Table 6. Mean relative use, percent composition, and percent frequency of occurrence of avian groups observed during breeding season PSB surveys, 1995-1999.

	Mean Use[a]			% Composition[b]			% Freq. Occurrence[c]		
Group	FCR	SR	MPR	FCR	SR	MPR	FCR	SR	MPR
Waterbirds	0.015	0.008	0.006	0.22	0.15	0.08	1.04	0.42	0.63
Waterfowl	0.065	0.158	0	0.99	2.87	0	0.63	2.29	0
Shorebirds	0.090	0.042	0.104	1.38	0.76	1.39	6.46	2.71	7.08
Raptors	0.083	0.048	0.031	1.28	0.87	0.42	6.46	3.54	2.92
Gamebirds	0.027	0.040	0.002	0.42	0.72	0.03	1.46	2.08	0.21
Corvids	0.042	0.033	0.004	0.64	0.60	0.06	3.33	2.71	0.42
Blackbirds	0.521	0.244	0.242	8.01	4.43	3.21	18.33	11.46	9.38
Warblers	0.117	0	0	1.79	0	0	6.67	0	0
Swallows	0.540	0.321	0.396	8.30	5.82	5.26	21.25	10.00	15.42
Finches	0.285	0.004	0.002	4.39	0.08	0.03	8.33	0.21	0.21
Flycatchers	0.069	0.033	0.006	1.06	0.60	0.08	5.21	1.46	0.63
Sparrows	1.944	2.896	2.573	29.88	52.57	34.22	67.92	86.04	77.29
Larks	2.077	1.015	3.840	31.93	18.42	51.06	54.58	42.08	78.54
Thrushes	0.292	0.517	0.179	4.48	9.38	2.38	16.25	36.04	13.75
Wrens	0.115	0.100	0.094	1.76	1.82	1.25	6.04	7.71	6.46
Woodpeckers	0.065	0.004	0	0.99	0.08	0	5.00	0.42	0
Other	0.160	0.046	0.040	2.47	0.83	0.53	10.63	3.54	2.08
TOTAL	6.512	5.508	7.519	100.0	100.0	100.0	--	--	--

[a]Mean use = Mean number observed/8-minute count.
[b]Percent Composition = percent of all observations comprised of species *i*.
[c]Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Table 7. Ten species with highest use (based on mean number observed per survey) and highest percent frequency of occurrence observed during breeding season PSB surveys on FCR, SR, and MPR, 1995-1999.

Mean Use

Foote Creek Rim		Simpson Ridge		Morton Pass Reference	
Species	#/survey	Species	#/survey	Species	#/survey
Horned Lark	2.08	Vesper Sparrow	1.31	Horned Lark	3.57
Vesper Sparrow	0.93	Brewer's Sparrow	1.17	Vesper Sparrow	1.27
Brewer's Sparrow	0.45	Horned Lark	1.01	Brewer's Sparrow	0.77
Cliff Swallow	0.41	Sage Thrasher	0.44	Western Meadowlark	0.44
Brewer's Blackbird	0.39	Cliff Swallow	0.27	Cliff Swallow	0.33
Green-tailed Towhee	0.25	Brewer's Blackbird	0.18	McCown's Longspur	0.27
Pine Siskin	0.16	Green-tailed Towhee	0.16	Brewers Blackbird	0.22
American Robin	0.15	Western Meadowlark	0.12	Sage Thrasher	0.14
American Goldfinch	0.11	Unidentified Sparrow	0.11	Rock Wren	0.09
Chipping Sparrow	0.11	Rock Wren	0.10	Killdeer	0.06

Percent Frequency of Occurrence

Foote Creek Rim		Simpson Ridge		Morton Pass Reference	
Species	% freq.	Species	% Freq.	Species	% Freq.
Horned Lark	51.3	Vesper Sparrow	64.6	Horned Lark	77.5
Vesper Sparrow	47.9	Brewer's Sparrow	54.8	Vesper Sparrow	64.2
Brewer's Sparrow	22.3	Horned Lark	42.1	Brewer's Sparrow	41.9
Green-tailed Towhee	15.8	Sage Thrasher	33.3	Western Meadowlark	28.8
Brewer's Blackbird	14.6	Green-tailed Towhee	11.5	McCown's Longspur	14.4
Cliff Swallow	13.1	Western Meadowlark	9.0	Sage Thrasher	11.0
American Robin	10.0	Brewer's Blackbird	8.8	Cliff Swallow	11.0
Broad-tailed Hummingbird	7.7	Rock Wren	7.7	Brewer's Blackbird	8.5
Western Meadowlark	6.9	Cliff Swallow	6.3	Rock Wren	6.5
American Goldfinch	6.5	Unidentified Sparrow	5.6	Killdeer	3.8

Table 8. Flight heights of avian groups observed during surveys on FCR and SR study areas, 1995-1999.

RLB Survey Data

Group	# individs.	# flocks	% of obs. Flying	Flight height categories % of observations 1-18 m	19-62 m[a]	>62 m
Waterbirds	176	43	68.8	13.3	42.8	43.9
Shorebirds	72	40	39.1	72.9	8.5	18.6
Waterfowl	559	83	26.3	17.1	9.5	73.3
Accipiters	62	58	91.2	62.5	26.8	10.7
Buteos	1047	865	86.9	44.4	35.9	19.7
Eagles	1163	1084	92.8	25.4	42.4	32.2
Large falcons	154	149	95.7	45.1	36.6	18.3
Small falcons	291	282	85.1	73.1	20.8	6.1
Other raptors	239	218	91.6	59.0	21.9	19.1
Unidentified raptors	18	18	100.0	64.7	29.4	5.9
Grouse	7	3	38.9	100.0	0.0	0.0
Corvids	631	301	75.8	66.3	17.0	16.7
Common nighthawks	13	8	92.9	47.4	52.6	0.0
Other large birds	1	1	100.0	0.0	100.0	0.0
TOTAL	4433	3153	65.8	44.4	31.9	23.7

[A] 19-62 m = rotor-swept height of SeaWest turbines

Table 8 (Continued). Flight heights of avian groups observed during surveys on FCR and SR study areas, 1995-1999.

PSB Survey Data

			Fight height categories % of observations		
Group	# individs.	# flocks	1-18 m	19-62 m[a]	>62 m
Waterbirds	36	15	66.7	30.0	3.3
Waterfowl	103	12	48.3	0.0	51.7
Shorebirds	69	26	89.7	10.3	0.0
Raptors	223	107	51.4	45.0	3.6
Gamebirds	24	12	100.0	0.0	0.0
Corvids	66	17	72.7	22.7	4.5
Blackbirds	458	121	83.2	15.2	1.6
Warblers	11	8	100.0	0.0	0.0
Swallows	720	186	90.7	8.8	0.5
Finches	111	13	81.0	19.0	0.0
Flycatchers	16	9	100.0	0.0	0.0
Sparrows	951	373	98.3	1.7	0.0
Larks	2386	722	96.4	3.4	0.2
Thrushes	147	42	87.5	7.8	4.7
Wrens	16	6	100.0	0.0	0.0
Woodpeckers	8	2	100.0	0.0	0.0
Other	96	33	100.0	0.0	0.0
Total	5441	1704	91.4	7.3	1.2

[a] 19-62 m = rotor-swept height of SeaWest turbines

Table 9. Five species with highest turbine exposure index from RLB survey data based on mean use, proportion of observations recorded as flying, and proportion of flight heights recorded within rotor-swept height of turbines, 1995-1999.

	Foote Creek Rim		Simpson Ridge	
Season	Species	Exposure Index[a]	Species	Exposure Index
Spring	Golden eagle	0.2416	Golden eagle	0.1048
	Red-tailed hawk	0.0402	Ferruginous hawk	0.0471
	Common raven	0.0253	Common raven	0.0200
	Ferruginous hawk	0.0198	Unidentified buteo	0.0084
	Prairie falcon	0.0183	American crow	0.0061
Summer	Golden eagle	0.1897	Golden eagle	0.0598
	Red-tailed hawk	0.1370	Mallard	0.0456
	Franklin's gull	0.0396	Swainson's hawk	0.0356
	American kestrel	0.0315	Ferruginous hawk	0.0290
	Swainson's hawk	0.0273	Red-tailed hawk	0.0239
Fall	Golden eagle	0.2786	Golden eagle	0.0650
	Red-tailed hawk	0.1541	Red-tailed hawk	0.0177
	Common raven	0.0399	Northern harrier	0.0097
	Ferruginous hawk	0.0372	American kestrel	0.0095
	Prairie falcon	0.0295	Common raven	0.0093
Winter	Golden eagle	0.1339	Golden eagle	0.0801
	Common raven	0.0200	Common raven	0.0105
	Rough-legged hawk	0.0200	Rough-legged hawk	0.0053
	Ferruginous hawk	0.0041	Bald eagle	0.0050
	Prairie falcon	0.0035	Prairie falcon	0.0018

[a] Exposure index calculated by multiplying mean use (#/survey) times proportion of all observations where species *i* was observed flying times proportion of all flying observations where species *i* was observed within the rotor-swept height of turbines.

Table 10. Ten species with highest turbine exposure index from PSB survey data based on mean use adjusted for visibility bias, proportion of observations recorded as flying, and proportion of flight heights recorded within rotor-swept height of turbines, 1995-1999.

Foote Creek Rim		Simpson Ridge	
Species	Exposure Index[a]	Species	Exposure Index[a]
Pine Siskin	0.542	Cliff Swallow	0.189
American Goldfinch	0.324	Violet-green Swallow	0.176
Cliff Swallow	0.289	Horned Lark	0.074
Violet-green Swallow	0.250	Brewer's Blackbird	0.043
Horned Lark	0.152	Brewer's Sparrow	0.021
Brewer's Blackbird	0.095	Pine Siskin	0.014
American Robin	0.031	Western Meadowlark	0.007
Tree Swallow	0.016	Mountain Bluebird	0.006
Mountain Bluebird	0.012	American Kestrel	0.005
Brewer's Sparrow	0.008	American Robin	0.005

[a] Exposure index calculated by multiplying mean use (#/survey) adjusted for visibility bias times proportion of all observations where species *i* was observed flying times proportion of all flying observations where species *i* was observed within the rotor-swept height of turbines.

Table 11. Estimates of the number of raptor locations/km^2 on FCR by point for three strata (off rim, on rim edge, on rim) using survey data from 1995 to 1999.

		Area	Eagles		Buteos		Falcons		All Raptors	
Point[a]	Strata	km^2	#	#/km^2	#	#/km^2	#	#/km^2	#	#/km^2
	off rim	1.70	48	0.09	57	0.11	20	0.04	135	0.25
A	rim edge	0.18	52	0.92	49	0.87	28	0.50	145	2.57
	on rim	0.13	2	0.05	5	0.12	2	0.05	20	0.49
	off rim	1.08	18	0.05	170	0.50	11	0.03	212	0.63
B	rim edge	0.31	41	0.42	37	0.38	20	0.21	111	1.14
	on rim	0.63	6	0.03	3	0.02	10	0.05	29	0.15
	off rim	1.26	101	0.26	129	0.33	25	0.06	278	0.70
C	rim edge	0.28	78	0.89	65	0.74	21	0.24	174	1.99
	on rim	0.48	15	0.10	7	0.05	13	0.09	33	0.22
	off rim	1.39	45	0.10	99	0.23	29	0.07	213	0.49
D	rim edge	0.34	68	0.64	58	0.55	28	0.26	165	1.55
	on rim	0.29	14	0.15	8	0.09	9	0.10	29	0.32
	off rim	0.93	100	0.34	51	0.18	33	0.11	194	0.67
E	rim edge	0.17	41	0.77	20	0.38	22	0.41	91	1.71
	on rim	0.91	13	0.05	15	0.05	18	0.06	51	0.18
	off rim	1.12	123	0.35	37	0.11	24	0.07	197	0.56
F	rim edge	0.34	108	1.01	30	0.28	24	0.23	176	1.65
	on rim	0.55	15	0.09	9	0.05	21	0.12	49	0.28

[a] Points A-F correspond to the six raptor survey points placed on Foote Creek Rim

Table 12. Estimates of the number of raptor locations/km^2 within the flight height zone of 19 m - 62 m by point for three strata (off rim, on rim edge, on rim) using raptor survey data collected from 1995 to 1999.

		Area	Eagles		Buteos		Falcons		All Raptors	
Point[a]	Strata	km^2	#	#/km^2	#	#/km^2	#	#/km^2	#	#/km^2
	off rim	1.70	30	0.06	36	0.07	5	0.01	77	0.14
A	rim edge	0.18	32	0.57	14	0.25	5	0.09	51	0.91
	on rim	0.13	1	0.02	0	0.00	0	0.00	3	0.07
	off rim	1.08	6	0.02	70	0.21	4	0.01	91	0.27
B	rim edge	0.31	27	0.28	11	0.11	1	0.01	45	0.46
	on rim	0.63	3	0.02	1	0.01	1	0.01	7	0.04
	off rim	1.26	60	0.15	84	0.21	13	0.03	162	0.41
C	rim edge	0.28	39	0.45	33	0.38	10	0.11	86	0.98
	on rim	0.48	4	0.03	5	0.03	4	0.03	13	0.09
	off rim	1.39	19	0.04	58	0.13	6	0.01	93	0.21
D	rim edge	0.34	43	0.40	23	0.22	4	0.04	70	0.66
	on rim	0.29	6	0.07	4	0.04	0	0.00	10	0.11
	off rim	0.93	44	0.15	42	0.14	11	0.04	100	0.34
E	rim edge	0.17	18	0.34	10	0.19	9	0.17	38	0.71
	on rim	0.91	7	0.02	4	0.01	5	0.02	15	0.05
	off rim	1.12	58	0.17	24	0.07	9	0.03	94	0.27
F	rim edge	0.34	56	0.53	12	0.11	10	0.09	80	0.75
	on rim	0.55	5	0.03	5	0.03	4	0.02	14	0.08

[a] Points A-F correspond to the six raptor survey points placed on Foote Creek Rim

Table 13. Fate of active raptor nests monitored in the Foote Creek Rim, Simpson Ridge and Reference Area, 1995-1999.

Foote Creek Rim

Species	Number of Nests Monitored	Nests Abandoned/ Predated	Nests Producing Young[a]	Nests Fledging Young	Calculated Young Fledged/Active Nest Checked[b]
			1995		
Bald Eagle	1	0	0	1	2.00
Ferruginous Hawk	2	0	1	1	2.25
Golden Eagle	8	2	0	6	0.88
Prairie Falcon	1	0	0	1	2.00
Red-tailed Hawk	7	0	2	5	1.57
			1997		
Bald Eagle	1	1	0	0	0.00
Ferruginous Hawk	5	5	0	0	0.00
Golden Eagle	15	7	1	7	0.63
Prairie Falcon	4	1	2	1	1.25
Red-tailed Hawk	8	3	5	unk.	0.50
			1998		
Bald Eagle	2	0	0	2	2.00
Ferruginous Hawk	3	1	0	2	1.67
Golden Eagle	12	4	0	8	1.00
Prairie Falcon	4	0	2	2	1.88
Red-tailed Hawk	4	2	2	0	0.75
			1999		
Bald Eagle	2	0	0	2	2.00
Ferruginous Hawk	6	2	1	4	1.50
Golden Eagle	14	1	0	13	1.38
Prairie Falcon	4	2	1	1	1.13
Red-tailed Hawk	15	7	5	3	0.60

[a] These nests produced downy young but it was not determined if the young fledged.

[b] To calculate number of young fledged per active nest, we assumed that ½ of downy young whose fate was not determined eventually fledged.

Table 13 (Continued). Fate of active raptor nests monitored in the Foote Creek Rim, Simpson Ridge and Reference Area, 1995-1999.

Simpson Ridge					
	1995				
Species	Number of Nests Monitored	Nests Abandoned/ Predated	Nests Producing Young[a]	Nests Fledging Young	Calculated Young Fledged/Active Nest Checked[b]
Bald Eagle	2	0	0	2	1.50
Ferruginous Hawk	14	8	0	6	1.07
Golden Eagle	8	4	0	4	0.63
Prairie Falcon	2	0	0	2	1.50
Red-tailed Hawk	2	0	1	1	2.25
	1997				
Bald Eagle	2	1	0	1	0.50
Ferruginous Hawk	17	13	1	3	0.41
Golden Eagle	22	7	1	14	0.89
Prairie Falcon	6	1	3	2	1.50
Red-tailed Hawk	12	5	7	unk.	0.38
	1998				
Bald Eagle	3	1	0	2	1.34
Ferruginous Hawk	14	5	0	9	1.86
Golden Eagle	18	9	0	9	0.61
Prairie Falcon	6	1	4	1	1.08
Red-tailed Hawk	8	3	4	1	0.75
	1999				
Bald Eagle	3	0	0	3	1.67
Ferruginous Hawk	14	6	0	8	1.36
Golden Eagle	24	6	1	17	1.10
Prairie Falcon	4	1	1	2	1.88
Red-tailed Hawk	10	5	5	0	0.50
Swainson's Hawk	1	0	1	0	1.50

[a] These nests produced downy young but it was not determined if the young fledged.

[b] To calculate number of young fledged per active nest, we assumed that ½ of downy young whose fate was not determined eventually fledged.

Table 13 (Continued). Fate of active raptor nests monitored in the Foote Creek Rim, Simpson Ridge and Reference Area, 1995-1999.

Morton Pass Reference

Species	Number of Nests Monitored	Nests Abandoned/ Predated	Nests Producing Young[a]	Nests Fledging Young	Calculated Young Fledged/Active Nest Checked[b]
			1995		
Ferruginous Hawk	11	2	1	8	2.05
Golden Eagle	2	0	0	2	1.00
Prairie Falcon	1	0	0	1	1.00
Red-tailed Hawk	1	0	1	0	1.00
			1997		
Ferruginous Hawk	11	3[c]	1	7	1.59
Golden Eagle	6	2[d]	0	4	0.83
Prairie Falcon	1	0	1	0	0.50
Red-tailed Hawk	1	0	1	unk.	0.50
			1998		
Ferruginous Hawk	15	6	1	8	1.63
Golden Eagle	8	2	1	5	0.81
Prairie Falcon	3	0	2	1	2.00
Red-tailed Hawk	3	2	1	0	0.33
			1999		
Ferruginous Hawk	11	2	1	8	2.18
Golden Eagle	8	4	1	3	0.56
Prairie Falcon	4	0	4	0	4.00
Red-tailed Hawk	0	na	na	na	na
Bald Eagle	1	0	0	1	1.00

[a] These nests produced downy young but it was not determined if the young fledged.
[b] To calculate number of young fledged per active nest, we assumed that ½ of downy young whose fate was not determined eventually fledged.
[c] One nest fell out of tree
[d] One nest fell off of cliff.

Table 14. Estimates of the number of pronghorn and 95% confidence intervals for the big game aerial survey study area.

1995/96

	Average Group Size			95 % Confidence Intervals		
Date	Strata 1[a]	Strata 2[b]	# Pronghorn	Lower Limit	Upper Limit	
1/25/95	17.5	20.2	1582	649	3852	
2/08/95	9.4	11.3	5063	2610	9821	
2/23/95	12.7	14.8	6141	3658	10311	
3/30/95	6.5	7.4	3581	2133	6012	
4/07/95	4.8	4.8	4478	2802	7155	
5/16/95	2.9	3.2	5382	3664	7905	
6/24/95	1.6	1.8	2072	1390	3089	
11/20/957.7	10.5	4617	2751	7749		
12/5/95	19.9	25.5	4706	2761	8023	
12/18/9514.5	17.7	10,796	6503	17,923		
2/29/96	21.7	34.8	4943	2161	11,308	

1997/98

	Average Group Size		95 % Confidence Intervals	
Date	Strata 1[a]	Strata 2[b] # Pronghorn	Lower Limit	Upper Limit
02/16/9715.7	20.5	4572	1647	12,692
03/11/9717.9	18	5123	3120	8413
03/18/9711.7	10.4	7319	4762	11,248
04/13/978.5	27	1306	208	8198
04/26/974.2	4.3	8359	5715	12,226
06/15/971.7	1.6	3241	2471	4249
11/11/9710.4	10.9	5688	3920	8253
11/30/9723.3	17.8	8450	4738	15,073
12/13/9729.4	33.9	6585	4074	10,643
01/06/9840.8	42	12,696	5904	27,303
01/26/9831.9	41.2	16,396	5422	49,579
03/05/9828.05	13	2184	700	6818
03/14/9810.46	18.36	14,736	6299	34,474
04/03/989.42	5.94	4771	3007	7569
04/27/982.91	5.08	7434	5233	10,560
06/20/982.5	3.98	7602	4260	13,565

[a] transects 1 mile apart

[b] transects 2 miles apart

Table 15. Pronghorn density estimates and 95% confidence intervals for the big game aerial survey study area.

1995/96

	Average Group Size			95 % Confidence Intervals	
Date	Strata 1[a]	Strata 2[b]	Density (#/km^2)	Lower Limit	Upper Limit
1/25/95	17.5	20.2	1.4	0.6	3.5
2/08/95	9.4	11.3	4.5	2.3	8.8
2/23/95	12.7	14.8	5.5	3.3	9.3
3/30/95	6.5	7.4	3.2	1.9	5.4
4/07/95	4.8	4.8	4.0	2.5	6.4
5/16/95	2.9	3.2	4.8	3.3	7.1
6/24/95	1.6	1.8	1.9	1.3	2.8
11/20/957.7	10.5	4.1	2.5	7.0	
12/5/95	19.9	25.5	4.2	2.5	7.2
12/18/9514.5	17.7	9.7	5.8	16.1	
2/29/96	21.7	34.8	4.4	1.9	10.2

1997/98

	Average Group Size			95 % Confidence Intervals	
Date	Strata 1[a]	Strata 2[b]	Density (#/km^2)	Lower Limit	Upper Limit
02/16/9715.7	20.5	4.1	1.5	11.4	
03/11/9717.9	18.0	4.6	2.8	7.6	
03/18/9711.7	10.4	6.6	4.3	10.1	
04/13/978.5	27.0	1.2	0.2	7.4	
04/26/974.2	4.3	7.5	5.1	11.0	
06/15/971.7	1.6	2.9	2.2	3.8	
11/11/9710.4	10.9	5.1	3.5	7.4	
11/30/9723.3	17.8	7.6	4.3	13.5	
12/13/9729.4	33.9	5.9	3.7	9.6	
01/06/9840.8	42.0	11.4	5.3	24.5	
01/26/9831.9	41.2	14.7	4.9	44.5	
03/05/9828.1	13	2.1	0.7	6.3	
03/14/9810.5	18.4	13.2	5.7	31.0	
04/03/989.4	5.9	4.3	2.7	6.8	
04/27/982.9	5.1	6.7	4.7	9.5	
06/20/982.5	4.0	6.8	3.8	12.2	

Table 16. Big game and sage grouse pellet group densities (#/ha) for the winters of 1994-1995, 1996-1997 and 1997-1998, and for summers of 1995 and 1997.

	Winter94-95		Summer95		Winter 96-97		Summer 97		Winter 97-98	
Species	FCR	SR	FCR	SR	FCR	SR	FCR	SR	FCR	SR
Pronghorn	264	161	144	310	187	241	82	232	88	268
Deer	181	60	30	82	48	56	7	42	11	49
Elk	42	3	4	0	18	0	15	0	15	0
Total Big Game	486	225	178	393	253	296	104	275	115	317
Sage Grouse	69	131	11	143	66	118	4	32	0	85
Total Number of Plots	229	237	215	223	217	215	214	226	208	226

Table 17. Mean number of pronghorn observed per 40-minute survey within 800 m of RLB survey points on FCR

Station	Year		
	1997	1998	1999
A	0.73	1.34	0.77
B	0.61	0.64	0.49
C	1.00	0.18	0.36
D	0.53	0.35	0.74
E	1.08	1.13	0.77
F	2.46	5.94	3.70
Mean	1.07	1.59	1.14
SE	0.29	0.89	0.47

Table 18. Counts of mountain plovers by transect and visit on Foote Creek Rim.

		1995							
Transect	Approx. Transect Length (m)	May 15&18	May 29	June 13&14	June 26&27	July 12	Aug 4	Total	Plovers/ km^2/survey
1	200	0	0	0	0	0	0	0	0.00
2	300	0	0	0	0	0	0	0	0.00
3	400	0	0	0	0	0	0	0	0.00
4	450	0	0	1	0	0	0	1	1.42
5	475	0	0	0	0	0	0	0	0.00
6	600	1	0	0	0	0	0	1	1.06
7	700	0	0	2	0	0	0	2	1.82
8	575	0	0	3	0	0	0	3	3.32
9	450	0	0	0	0	0	0	0	0.00
10	500	0	1	0	0	0	0	1	1.27
11	500	3	0	0	0	0	0	3	3.82
12	500	0	0	2	0	0	0	2	2.55
13	350	0	0	0	0	0	0	0	0.00
14	250	0	0	2	0	0	0	2	5.10
15	200	0	0	2	0	0	0	2	6.37
16	400	0	0	1	0	0	0	1	1.59
17	400	0	0	1	0	0	0	1	1.59
18	350	0	0	0	0	0	0	0	0.00
19	900	6	0	0	1	0	0	7	4.95
20	1050	1	0	3	1	0	0	5	3.03
21	1250	3	0	2	1	0	0	6	3.06
22	1000	0	0	3	4	0	0	7	4.46
23	1000	3	5	0	4	1	0	13	8.28
24	1100	6	4	5	0	0	0	15	8.69
25	700	2	0	3	0	0	0	5	4.55
26	900	4	0	1	4	0	0	9	6.37
27	500	0	0	2	0	0	0	2	2.55
28	650	0	0	3	1	0	1	5	4.90
Total	16,650	29	10	36	16	1	1	93	
Adjusted total		48.0	16.6	59.6	26.5	1.7	1.7		
Adjusted density (#/km^2)		3.95	1.36	4.91	2.18	0.14	0.14		

Table 18 (Continued). Counts of mountain plovers by transect and visit on Foote Creek Rim.

		1997							
Transect	Approx. Transect Length (m)	Apr 28	May 15	June 02	June 25	July 14	July 31	Total	Plovers/ km^2/survey
1	200		0	0	0	0	0	0	0.00
2	300		0	2	0	0	0	2	3.54
3	400		0	1	0	0	0	1	1.33
4	450		0	0	0	0	0	0	0.00
5	475		0	0	0	0	0	0	0.00
6	600		0	0	0	0	0	0	0.00
7	700		0	0	0	0	0	0	0.00
8	575		0	0	0	0	0	0	0.00
9	450		0	0	0	0	0	0	0.00
10	500		0	0	0	0	0	0	0.00
11	500		0	0	0	0	0	0	0.00
12	500		0	0	0	0	0	0	0.00
13	350		0	0	0	0	0	0	0.00
14	250		0	0	0	1	0	0	1	2.12
15	200		0	0	0	1	0	0	1	2.65
16	400		0	1	0	0	0	0	1	1.33
17	400		1	0	2	4	0	1	8	10.62
18	350		2	0	1	1	0	0	4	6.07
19	900		5	1	1	0	1	2	10	5.90
20	1050		3	2	0	0	0	0	5	2.53
21	1250		1	4	0	0	0	0	5	2.12
22	1000		0	2	0	0	0	4	6	3.18
23	1000		1	0	1	4	4	1	11	5.84
24	1100		4	8	4	0	1	0	17	8.20
25	700		0	1	1	1	1	0	4	3.03
26	900		3	1	0	1	0	0	5	2.95
27	500		0	0	0	0	11	17	28	29.72
28	650		0	0	0	5	6	0	11	8.98
Total	16,650		20	23	10	18	24	25	120	
Adjusted Total			33.1	38.1	16.6	29.8	39.7	41.4		
Adjusted Density (#/km^2)			2.73	3.14	1.36	2.45	3.27	3.41		

Table 18 (Continued). Counts of mountain plovers by transect and visit on Foote Creek Rim.

1998									
Transect	Approx. Transect Length (m)	Apr 19	May 7	May 27	June 9	July 1	July 23	Total	Plovers/ km^2/survey
1	200		0	0	0	0	0	0	0.00
2	300		0	0	0	0	0	0	0.00
3	400		0	0	0	0	0	0	0.00
4	450		0	0	0	0	0	0	0.00
5	475		0	0	0	0	0	0	0.00
6	600		0	0	0	0	0	0	0.00
7	700		0	0	0	0	0	0	0.00
8	575		0	0	0	0	0	0	0.00
9	450		0	0	0	0	0	0	0.00
10	500		0	0	0	0	0	0	0.00
11	500		0	1	0	0	0	1	1.06
12	500		0	0	0	0	0	0	0.00
13	350		0	0	1	0	0	1	1.52
14	250		0	0	0	0	0	0	0.00
15	200		0	1	1	0	0	2	5.31
16	400		0	1	1	0	0	2	2.65
17	400		0	2	0	0	0	2	2.65
18	350		2	0	2	2	0	6	9.10
19	900		0	1	1	1	0	3	1.77
20	1050		0	0	2	2	0	4	2.02
21	1250		0	3	1	0	0	4	1.70
22	1000		2	2	3	0	0	7	3.72
23	1000		3	3	1	6	0	13	6.90
24	1100		0	0	1	4	6	11	5.31
25	700		0	0	1	2	0	10	13	9.86
26	900		0	0	1	0	0	0	1	0.59
27	500		9	1	1	1	4	0	16	16.99
28	650		3	1	2	1	5	0	12	9.80
Total	16,650		19	16	19	19	15	10	98	
Adjusted Total			31.5	26.5	31.5	31.5	24.8	16.6		
Adjusted Density (#/km^2)			2.59	2.18	2.59	2.59	2.05	1.36		

Table 18 (Continued). Counts of mountain plovers by transect and visit on Foote Creek Rim.

		1999							
Transect	Approx. Transect Length (m)	Apr. 28	May 17	June 14	June 29	July 14	July 28	Total	Plovers/ km^2/survey
1	200	0	0	0	0	0	0	0	0.00
2	300	0	0	0	0	0	0	0	0.00
3	400	0	0	0	0	0	0	0	0.00
4	450	0	0	0	0	0	0	0	0.00
5	475	0	0	0	0	0	0	0	0.00
6	600	0	0	0	0	0	0	0	0.00
7	700	0	0	0	0	0	0	0	0.00
8	575	0	0	0	0	0	0	0	0.00
9	450	0	0	0	0	0	0	0	0.00
10	500	0	0	0	0	0	0	0	0.00
11	500	0	0	0	0	0	0	0	0.00
12	500	0	0	0	0	0	0	0	0.00
13	350	0	0	0	0	0	0	0	0.00
14	250	0	0	0	0	0	0	0	0.00
15	200	0	0	0	0	0	0	0	0.00
16	400	0	0	0	0	0	0	0	0.00
17	400	0	2	0	0	0	0	0	2.65
18	350	0	0	0	0	0	0	0	0.00
19	900	0	0	0	0	0	0	0	0.00
20	1050	0	0	0	0	0	0	0	0.00
21	1250	0	0	0	3	3	0	3	2.55
22	1000	0	0	1	0	0	0	2	0.53
23	1000	0	0	0	3	0	0	0	1.59
24	1100	3	0	5	1	0	0	8	4.34
25	700	1	1	1	0	6	2	11	8.34
26	900	0	0	0	0	0	0	0	0.00
27	500	0	0	0	0	1	0	1	1.06
28	650	3	0	0	1	1	1	6	4.90
Total	16,650	7	3	7	8	11	3	39	
Adjusted Total		11.6	5.0	11.6	13.2	18.2	5.0		
Adjusted Density (#/km^2)		0.95	0.41	0.95	1.09	1.50	0.41		

Table 19. Counts of mountain plovers by transect and visit on Morton Pass Reference area.

1995

Transect	Approx. Transect Length (m)	June 12	June 28	July 7	July 13	July 25	Total	Plovers/ km^2/survey	
1	1000		0	0	0	0	0	0	0.00
2	1200		0	0	0	0	1	1	0.56
3	1200		0	0	0	0	0	0	0.00
4	1000		1	0	0	0	0	1	0.67
5	900		0	0	1	0	0	1	0.74
6	750		0	0	0	0	0	0	0.00
7	700		0	0	0	0	0	0	0.00
8	800		0	0	0	0	0	0	0.00
9	1050		0	0	2	0	0	2	1.27
10	1100		1	0	0	0	1	2	1.21
11	700		0	1	0	0	0	1	0.95
12	800		0	0	0	0	1	1	0.83
13	775		0	0	0	0	0	0	0.00
14	1100		1	1	2	0	1	5	3.03
Total	13,075		3	2	5	0	4	14	
Adjusted total			5.0	3.3	8.3	0.0	6.6		
Adjusted density (#/km^2)			1.2	0.8	2.0	0.0	1.6		

1997

Transect	Approx. Transect Length (m)	April 30	May 16	June 4	June 24	July 7	July 25	Total	Plovers/ km^2/survey	
1	1000		0	0	0	0	0	0	0	0.00
2	1200		0	0	0	0	0	0	0	0.00
3	1200		0	1	0	0	0	0	1	0.46
4	1000		0	1	0	0	0	0	1	0.56
5	900		0	0	0	0	0	0	0	0.00
6	750		1	0	0	0	0	0	1	0.74
7	700		0	0	0	0	0	0	0	0.00
8	800		0	8	0	0	1	0	9	6.25
9	1050		0	5	0	0	0	0	5	2.65
10	1100		0	1	0	2	0	0	3	1.52
11	700		0	1	0	0	1	0	2	1.59
12	800		0	0	1	0	0	0	1	0.69
13	775		2	0	0	0	0	0	2	1.43
14	1100		0	1	1	0	0	0	2	1.01
Total	13,075		3	18	2	2	2	0	27	
Adjusted Total			5.0	29.8	3.3	3.3	3.3	0		
Adjusted Density (#/km^2)			1.23	7.36	0.82	0.82	0.82	0		

Table 19 (Continued). Counts of mountain plovers by transect and visit on Morton Pass Reference area.

1998

Transect	Approx. Transect Length (m)	Apr 21	May 13	May 29	June 12	June 29	July 20	Total	Plovers/ km^2/survey
1	1000	0	0	0	0	0	0	0	0.00
2	1200	0	0	0	0	0	0	0	0.00
3	1200	0	0	0	0	0	0	0	0.00
4	1000	0	0	0	0	0	0	0	0.00
5	900	0	0	0	0	0	0	0	0.00
6	750	0	0	0	0	0	0	0	0.00
7	700	1	0	0	0	0	0	1	0.76
8	800	1	0	0	0	0	0	1	0.66
9	1050	2	0	0	0	0	0	2	1.01
10	1100	1	2	0	0	1	0	4	1.93
11	700	0	1	0	0	0	0	1	0.76
12	800	1	0	0	0	0	0	1	0.66
13	775	0	0	0	0	0	1	1	0.68
14	1100	2	2	0	0	0	0	4	1.93
Total	13,075	8	5	0	0	1	1	15	
Adjusted Total		13.25	8.28	0.00	0.00	1.66	1.66		
Adjusted Density (#/km^2)		3.27	2.04	0.00	0.00	0.41	0.41		

1999

Transect	Approx. Transect Length(m)	May 3	May 18	June 17	June 24	July 15	July 27	Total	Plovers/ km^2/survey
1	1000	0	0	0	0	0	0	0	0.00
2	1200	0	0	0	0	0	0	0	0.00
3	1200	0	0	0	0	0	0	0	0.00
4	1000	0	0	0	0	0	0	0	0.00
5	900	0	0	0	0	0	0	0	0.00
6	750	0	0	0	0	0	0	0	0.00
7	700	0	0	0	0	0	0	0	0.00
8	800	0	2	0	0	0	0	2	1.33
9	1050	0	0	0	0	0	0	0	0.00
10	1100	1	0	0	0	0	1	2	0.97
11	700	3	0	0	1	0	0	4	3.03
12	800	0	0	0	0	0	0	0	0.00
13	775	0	0	0	0	0	0	0	0.00
14	1100	0	0	0	0	0	0	0	0.00
Total	13,075	4	2	0	1	0	1	8	
Adjusted Total		6.61	3.31	0.00	1.66	0.00	1.66		
Adjusted Density (#/km^2)		1.63	0.82	0.00	0.41	0.00	0.41		

Table 20. Mountain plover nest success on FCR and reference areas.

1995

Nest Number[a]	Date found	Location	No. of eggs	Nest outcome[b]
A1	6/1/95	FCR	3	3 chicks hatched
A2	6/1/95	FCR	3	2 chicks hatched
R1	6/2/95	MPR	3	2 chicks hatched
R2	6/5/95	MPR	3	1 chick hatched

1997

Nest Number	Date found	Location	No. of eggs	Nest outcome
A1	6/5/97	FCR	3	3 chicks hatched
A2	6/6/97	FCR	3	2 chicks hatched
A3	6/6/97	FCR	3	3 chicks hatched
A4	6/6/97	FCR	3	3 chicks hatched
A5	6/6/97	FCR	3	3 chicks hatched
A6	6/6/97	FCR	2	2 chicks hatched
A7	6/6/97	FCR	3	3 chicks hatched
A8	6/25/97	FCR	3	Unknown
R1	6/25/97	MPR	3	2 chicks hatched

1998

Nest Number	Date found	Location	No. of eggs	Nest outcome
A1	5/27/98	FCR	2	1 chick hatched
A2	5/27/98	FCR	3	3 chicks hatched
A3	5/26/98	FCR	3	3 chicks hatched
A4	5/27/98	FCR	3	0 chicks hatched
A5	5/27/98	FCR	3	0 chicks hatched
A6	5/29/98	FCR	3	3 chicks hatched

1999

Nest Number	Date found	Location	No. of eggs	Nest outcome
A1	6/7/99	FCR	3	0 chicks hatched
A2	6/7/99	FCR	3	0 chicks hatched
A3	6/8/99	FCR	3	0 chicks hatched
A4	6/15/99	FCR	3	0 chicks hatched

[a] A = assessment area (FCR), R = reference area

[b] It was assumed chicks hatched when no eggs were present in the nest and egg shell fragments from pipping were located in the nest. It was assumed no chicks hatched when no pip shell fragments were found in nest.

Table 21. Maximum counts of sage grouse on leks.

	Males				Females				Unclassified			
Lek Number[a]	1995	1997	1998	1999	1995	1997	1998	1999	1995	1997	1998	1999
1	na	12[b]	22	na	0	3[b]	5	na	9[c]	0	0	na
2	38	38	39	52	3	7	22	9	0	0	0	2
3	20	8	9	12	2	8	11	2	0	1	0	1
4	14	12	11	na	5	5	6	na	0	0	0	na
5	20	20	28	36	1	15	18	7	0	3	0	2
6	28	15	23	14	5	8	10	0	0	3	0	18 [d]
7	10	9	13	20	1	8	16	5	0	1	0	0
8	3	2	3	na	0	1	0	na	0	0	0	na
9	na	6[c]	6	32	na	4[e]	0	0	na	0	0	30
Total	133	122	154	166	17	59	88	23	9	8	0	53
Total for selected leks [f]	116	96	118	166	12	50	77	23	0	8	0	53

[a]All leks were located on the Simpson Ridge Study area.
[b]Information provided by Wyoming Game and Fish Department.
[c]9 birds were observed flying during aerial survey; a lek was never located in this vicinity in 1995.
[d] 18 birds observed flying from lek approximately ½ mile away.
[e] new lek in 1997, information provided by Arch of Wyoming.
[f] Includes only leks 2, 3, 5, 6, 7 and 9; leks 1, 4, and 8 were not surveyed during 1999.

Table 22. Number of white-tailed jackrabbits (WTJR) and cottontail rabbits (CORA) observed while driving 32-km long transects.

1995

Route Identification	Number of WTJR	Number of CORA	Number of WTJR/km	Number of CORA/km	Total number of lagomorphs/km
	Foote Creek Rim				
Foote Creek Rim	1	0	0.03	0	0.03
County Road 3[a]	2	1	0.06	0.03	0.09
Mean			0.045	0.015	0.06
	Simpson Ridge				
Simpson Ridge	3	2	0.09	0.06	0.16
Highway 30	2	3	0.06	0.09	0.16
County Road 3[a]	2	1	0.06	0.03	0.09
Mean			0.07	0.06	0.13
	Morton Pass Reference				
Wheatland Reservoir	2	7	0.06	0.22	0.28
Fetterman Road	11	0	0.34	0	0.34
Mean			0.20	0.11	0.31

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.

Table 22 (Continued). Number of white-tailed jackrabbits (WTJR) and cottontail rabbits (CORA) observed while driving 32-km long transects.

1997

Route Identification	Number of WTJR	Number of CORA	Number of WTJR/km	Number of CORA/km	Total number of lagomorphs/km
	Foote Creek Rim				
Foote Creek Rim	9	1	0.28	0.03	0.31
County Road 3[a]	5	0	0.16	0	0.16
Mean			0.22	0.015	0.24
	Simpson Ridge				
Simpson Ridge	0	8	0	0.25	0.25
Highway 30	0	3	0	0.09	0.09
County Road 3[a]	5	0	0.16	0	0.16
Mean			0.05	0.11	0.17
	Morton Pass Reference				
Wheatland Reservoir 3[b]	5	0	0.16	0	0.16
Fetterman Road	7	0	0.22	0	0.22
Mean			0.19	0	0.19

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.
[b] Route altered in 1997 because landowner denied access.

Table 22 (Continued). Number of white-tailed jackrabbits (WTJR) and cottontail rabbits (CORA) observed while driving 32-km long transects.

1998

Route Identification	Number of WTJR	Number of CORA	Number of WTJR/km	Number of CORA/km	Total number of lagomorphs/km
	Foote Creek Rim				
Foote Creek Rim	25	1	0.78	0.03	0.81
County Road 3[a]	9	10	0.28	0.31	0.59
Mean			0.53	0.17	0.7
	Simpson Ridge				
Simpson Ridge	8	22	0.25	0.69	0.94
Highway 30	3	3	0.09	0.09	0.19
County Road 3[a]	9	10	0.28	0.31	0.59
Mean			0.21	0.36	0.57
	Morton Pass Reference[b]				
Fetterman Road	5	8	0.16	0.25	0.41

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.
[b] The Wheatland Reservoir #3 route could not be run because land changed hands and access was not allowed.

Table 22 (Continued). Number of white-tailed jackrabbits (WTJR) and cottontail rabbits (CORA) observed while driving 32-km long transects.

1999

Route Identification	Number of WTJR	Number of CORA	Number of WTJR/km	Number of CORA/km	Total number of lagomorphs/km
	Foote Creek Rim				
Foote Creek Rim	31	8	0.97	0.25	1.22
County Road 3[a]	5	16	0.17	0.5	0.67
Mean			0.57	0.38	0.95
	Simpson Ridge				
Simpson Ridge	14	13	0.44	0.41	0.85
Highway 30	9	5	0.28	0.16	0.44
County Road 3[a]	5	16	0.28	0.31	0.59
Mean			0.33	0.29	0.63
	Morton Pass Reference				
Wheatland Reservoir 3[b]	9	5	1.13	0.63	1.76
Fetterman Road	21	6	0.66	0.19	0.85
Mean			0.90	0.41	1.31

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.
[b] Only 1/4 of transect (8 km) completed due to inaccessible private land.

Table 23. Number and percent of plots searched that contained active or inactive ground squirrel burrows.

1995

Route Identification	Number of Plots Searched	Number of Plots with Active Burrows	Number of Plots with Inactive Burrows	Percent of Plots with Active Burrows	Percent of Plots with Inactive Burrows
	Foote Creek Rim				
Foote Creek Rim	40	32	8	80.0	20.0
County Road 3[a]	36	27	9	75.0	25.0
Mean				77.5	22.5
	Simpson Ridge				
Simpson Ridge	40	25	15	62.5	37.5
Highway 30	26	19	7	73.1	26.9
County Road 3[a]	36	27	9	75.0	25.0
Mean				70.2	29.8
	Morton Pass Reference				
Wheatland Reservoir 3	32	30	2	93.8	6.2
Fetterman Road	37	26	11	70.3	29.7
Mean				82.1	35.9

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.

Table 23 (Continued). Number and percent of plots searched that contained active or inactive ground squirrel burrows.

1997

Route Identification	Number of Plots Searched	Number of Plots with Active Burrows	Number of Plots with Inactive Burrows	Percent of Plots with Active Burrows	Percent of Plots with Inactive Burrows
	Foote Creek Rim				
Foote Creek Rim	39	29	10	74.4	25.6
County Road 3[a]	39	30	9	76.9	23.1
Mean				75.6	24.4
	Simpson Ridge				
Simpson Ridge	40	28	12	70.0	30.0
Highway 30	32	14	18	43.8	56.2
County Road 3[a]	39	30	9	76.9	23.1
Mean				63.6	36.4
	Morton Pass Reference				
Wheatland Reservoir 3[b]	40	30	10	75.0	25.0
Fetterman Road	40	33	7	82.5	17.5
Mean				78.8	21.2

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.
[b] Route altered in 1997 because landowner denied access.

Table 23 (Continued). Number and percent of plots searched that contained active or inactive ground squirrel burrows.

1998

Route Identification	Number of Plots Searched	Number of Plots with Active Burrows	Number of Plots with Inactive Burrows	Percent of Plots with Active Burrows	Percent of Plots with Inactive Burrows
	Foote Creek Rim				
Foote Creek Rim	38	21	17	55.3	44.7
County Road 3[a]	40	30	10	75.0	25.0
Mean				65.2	34.8
	Simpson Ridge				
Simpson Ridge	41	34	7	82.9	17.1
Highway 30	32	21	11	65.6	34.4
County Road 3[a]	40	30	10	75.0	25.0
Mean				74.5	25.5
	Morton Pass Reference				
Wheatland Reservoir 3[b]	21	15	6	71.4	28.6
Fetterman Road	41	33	8	80.5	19.5
Mean				76.0	24.0

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.
[b] Only one half of transect completed due to inaccessible private land.

Table 23 (Continued). Number and percent of plots searched that contained active or inactive ground squirrel burrows.

1999

Route Identification	Number of Plots Searched	Number of Plots with Active Burrows	Number of Plots with Inactive Burrows	Percent of Plots with Active Burrows	Percent of Plots with Inactive Burrows
	Foote Creek Rim				
Foote Creek Rim	35	22	13	63	37
County Road 3[a]	39	26	13	68	32
Mean				65.5	34.5
	Simpson Ridge				
Simpson Ridge	42	26	16	62	38
Highway 30	34	21	13	62	38
County Road 3[a]	39	26	13	68	32
Mean				64	36
	Morton Pass Reference				
Wheatland Reservoir 3[b]	11	6	5	55	45
Fetterman Road	40	36	4	90	10
Mean				72.5	27.5

[a] The County Road 3 route is located between the Simpson Ridge and Foote Creek Rim study areas.
[b] Only 1/4 of transect (8 km) completed due to inaccessible private land.

Table 24. Number and density of active and inactive prairie dog burrows.

1995

Prairie Dog Town Identification	Number of Active Burrows	Number of Inactive Burrows	Total Length of Transects (m)	Active Burrows per ha	Inactive Burrows per ha
	Foote Creek Rim				
Horne Flats[a]	57	105	9225	20.60	37.94
Foote Creek Rim	88	30	8385	34.98	11.93
Mean			8805	27.45	25.55
	Simpson Ridge				
Horne Flats[a]	57	105	9225	20.60	37.94
Coal Mines	20	22	1700	39.22	43.14
Raptor Point X	10	15	1135	29.37	44.05
Fiddlers Green Reservoir	24	18	1500	53.33	40.00
Elk Mountain	42	45	4123	33.96	36.38
Medicine Bow	0	44	3300	0	44.44
Mean			3497	24.31	39.56
	Morton Pass Reference				
Fetterman Road	21	54	3055	22.91	58.92

[a] The Horne Flats prairie dog town is located between the Simpson Ridge and Foote Creek Rim study areas.

Table 24 (Continued). Number and density of active and inactive prairie dog burrows.

1997

Prairie Dog Town Identification	Number of Active Burrows	Number of Inactive Burrows	Total Length of Transects (m)	Active Burrows per ha	Inactive Burrows per ha
	Foote Creek Rim				
Horne Flats[a]	100	56	8580	38.85	21.76
Foote Creek Rim	39	35	8257	15.74	14.13
Mean			8419	27.52	18.02
	Simpson Ridge				
Horne Flats[a]	100	56	8580	38.85	21.76
Coal Mines	24	18	1500	53.33	40.00
Raptor Point X	0	12	1200	0	33.33
Fiddlers Green Reservoir	0	12	1790	0	22.35
Elk Mountain	53	27	3865	45.71	23.28
Medicine Bow	0	32	2605	0	40.95
Mean			3257	30.19	26.78
	Morton Pass Reference				
Fetterman Road	74	26	3004	82.11	28.85

[a] The Horne Flats prairie dog town is located between the Simpson Ridge and Foote Creek Rim study areas.

Table 24 (Continued). Number and density of active and inactive prairie dog burrows.

1998

Prairie Dog Town Identification	Number of Active Burrows	Number of Inactive Burrows	Total Length of Transects (m)	Active Burrows per ha	Inactive Burrows per ha
	Foote Creek Rim				
Horne Flats[a]	145	30	8555	56.42	11.67
Foote Creek Rim	35	47	8025	14.52	19.5
Mean				35.47	15.59
	Simpson Ridge				
Horne Flats[a]	145	30	8555	56.42	11.67
Coal Mines[b]					
Raptor Point X	0	7	1500	0	15.56
Fiddlers Green Reservoir	0	7	1875	0	12.50
Elk Mountain	46	25	3375	45.54	24.75
Medicine Bow	0	-[c]	2605	0	-[c]
Mean				20.39	16.12
	Morton Pass Reference				
Fetterman Road	147	45	3135	156.38	47.87

[a] The Horne Flats prairie dog town is located between the Simpson Ridge and Foote Creek Rim study areas.
[b] Coal mines prairie dog town could not be accessed due to mining operations.
[c] No prairie dogs were observed during the survey, and the number of inactive burrows was not determined.

Table 24 (Continued). Number and density of active and inactive prairie dog burrows.

1999

Prairie Dog Town Identification	Number of Active Burrows	Number of Inactive Burrows	Total Length of Transects (m)	Active Burrows per ha	Inactive Burrows per ha
	Foote Creek Rim				
Horne Flats[a]	150	65	8800	56.82	24.62
Foote Creek Rim	81	114	8050	33.47	47.11
Mean				45.12	35.87
	Simpson Ridge				
Horne Flats[a]	150	65	8800	56.82	24.62
Coal Mines	1	13	1450	2.27	29.55
Raptor Point X	1	1	1650	2	2
Fiddlers Green Reservoir	5	6	1800	9.26	11.11
Elk Mountain	71	19	3650	64.55	17.27
Medicine Bow*					
Mean				26.98	16.91
	Morton Pass Reference				
Fetterman Road	87	34	2845	102.35	40

[a] The Horne Flats prairie dog town is located between the Simpson Ridge and Foote Creek Rim study areas.
* This town was dropped from the protocol due to a change in land ownership and a lack of prairie dogs.

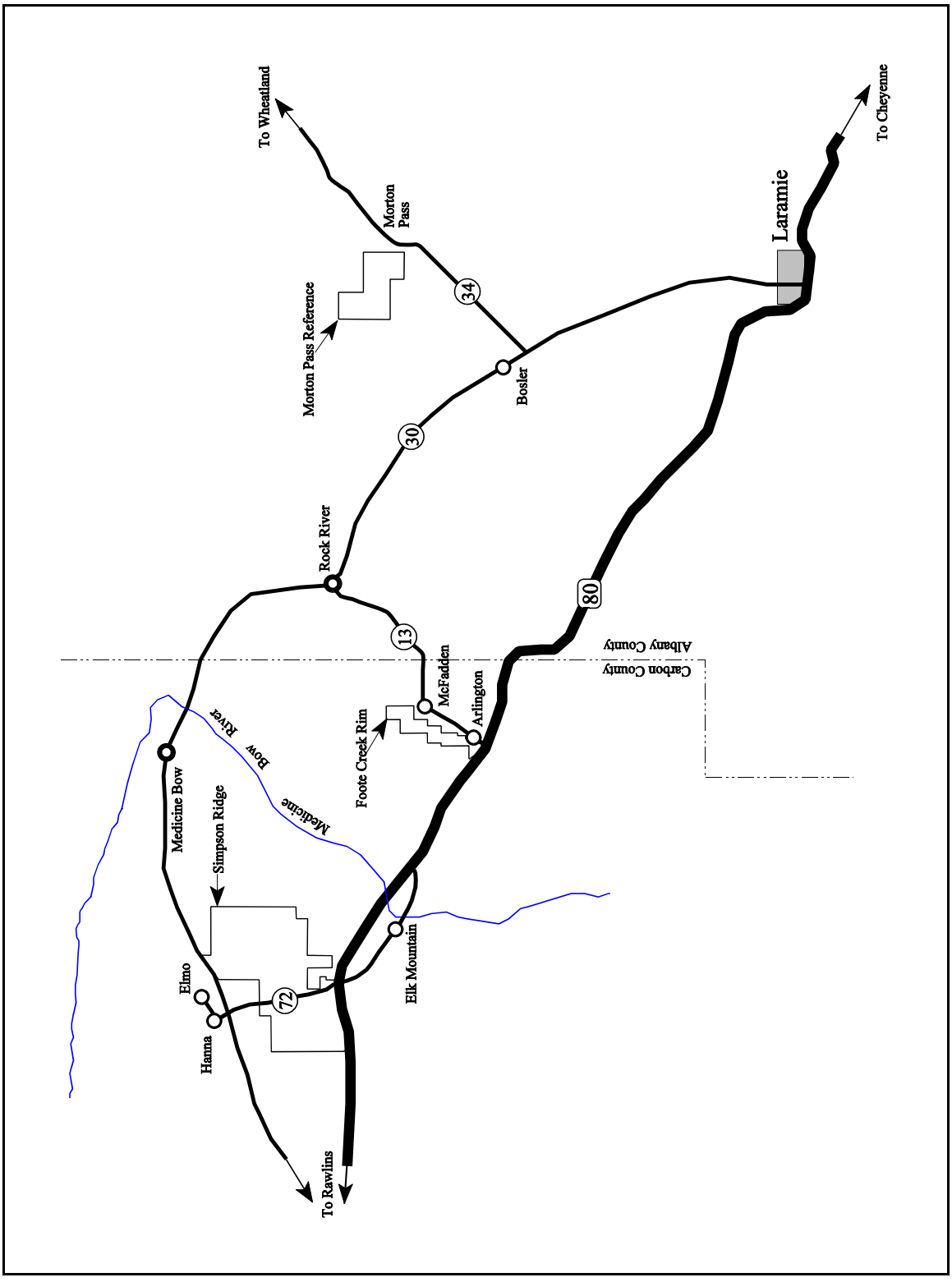


Figure 1. Location of Foote Creek Rim, Simpson Ridge, and Morton Pass Reference study areas.

Figure 2. Approximate locations of windplant features on Foote Creek Rim.

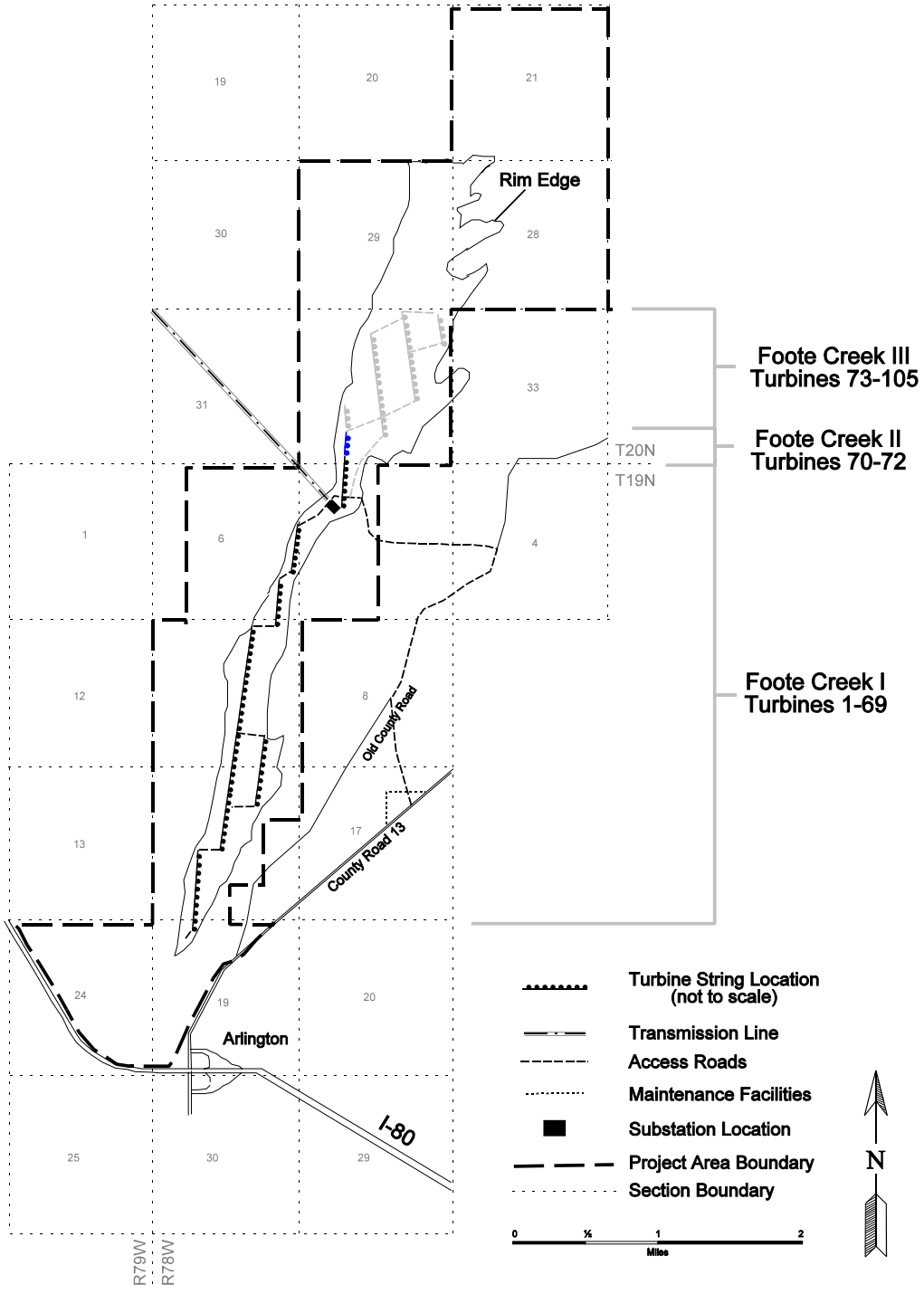
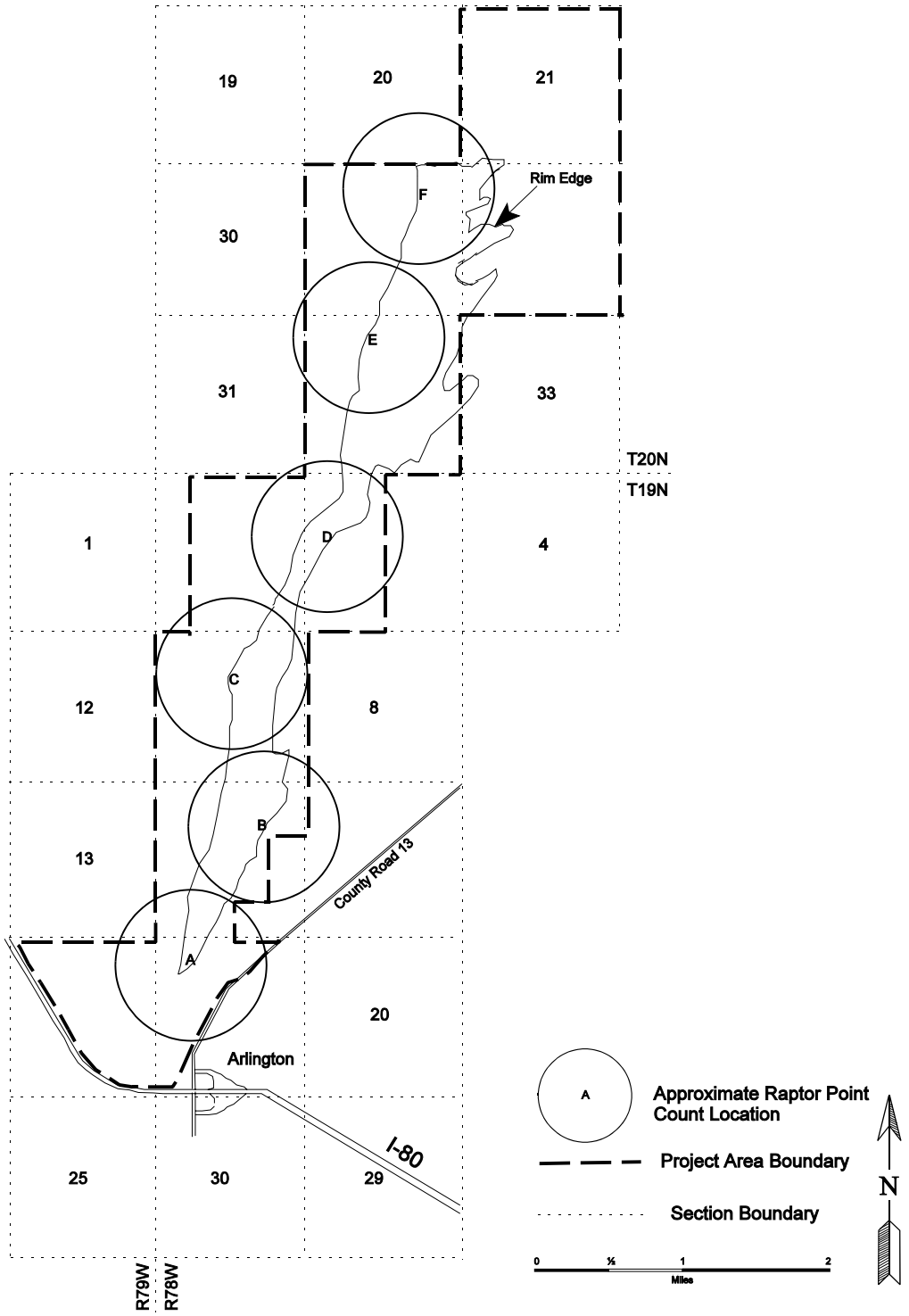


Figure 3. Location of RLB observation plots on Foote Creek Rim.



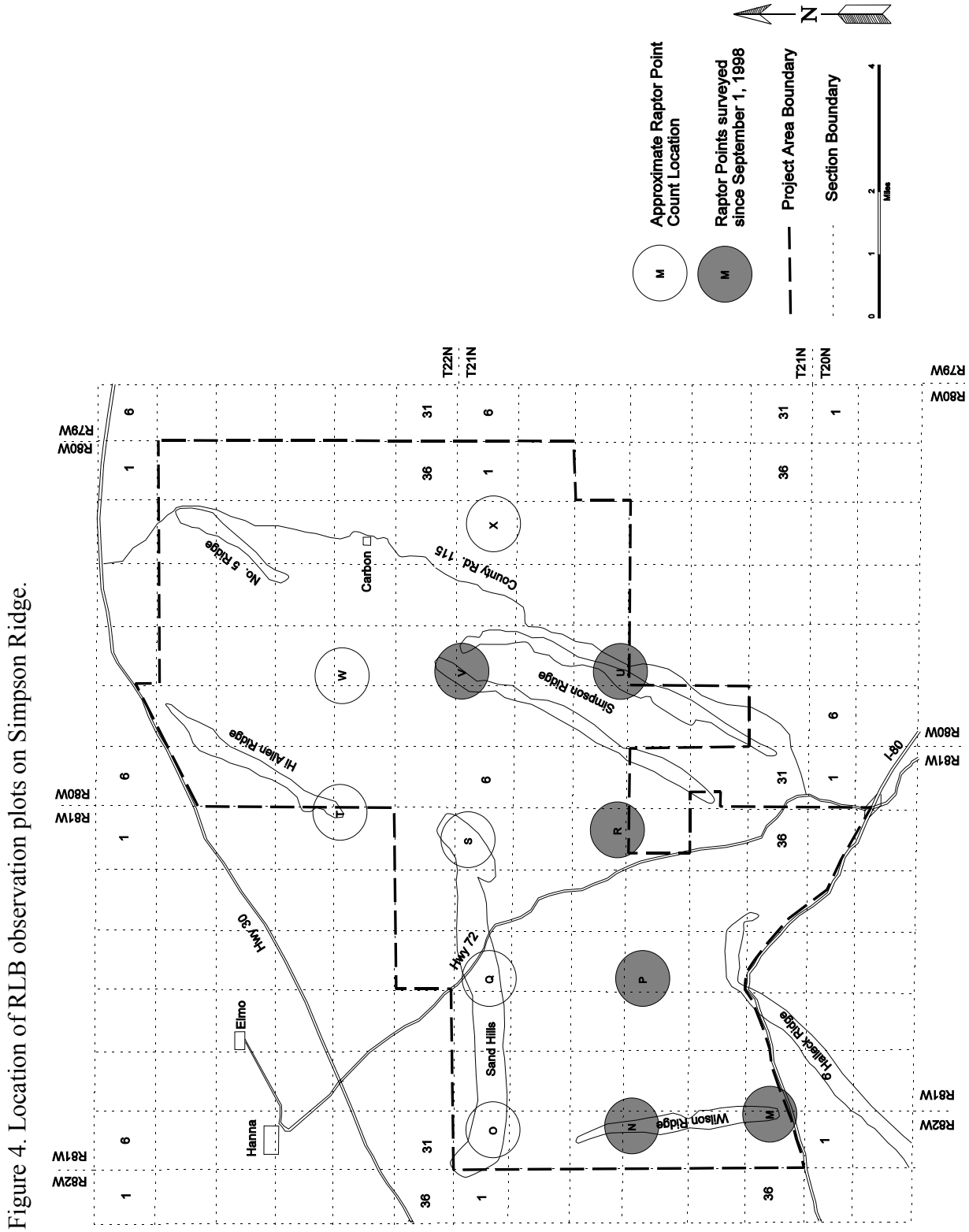
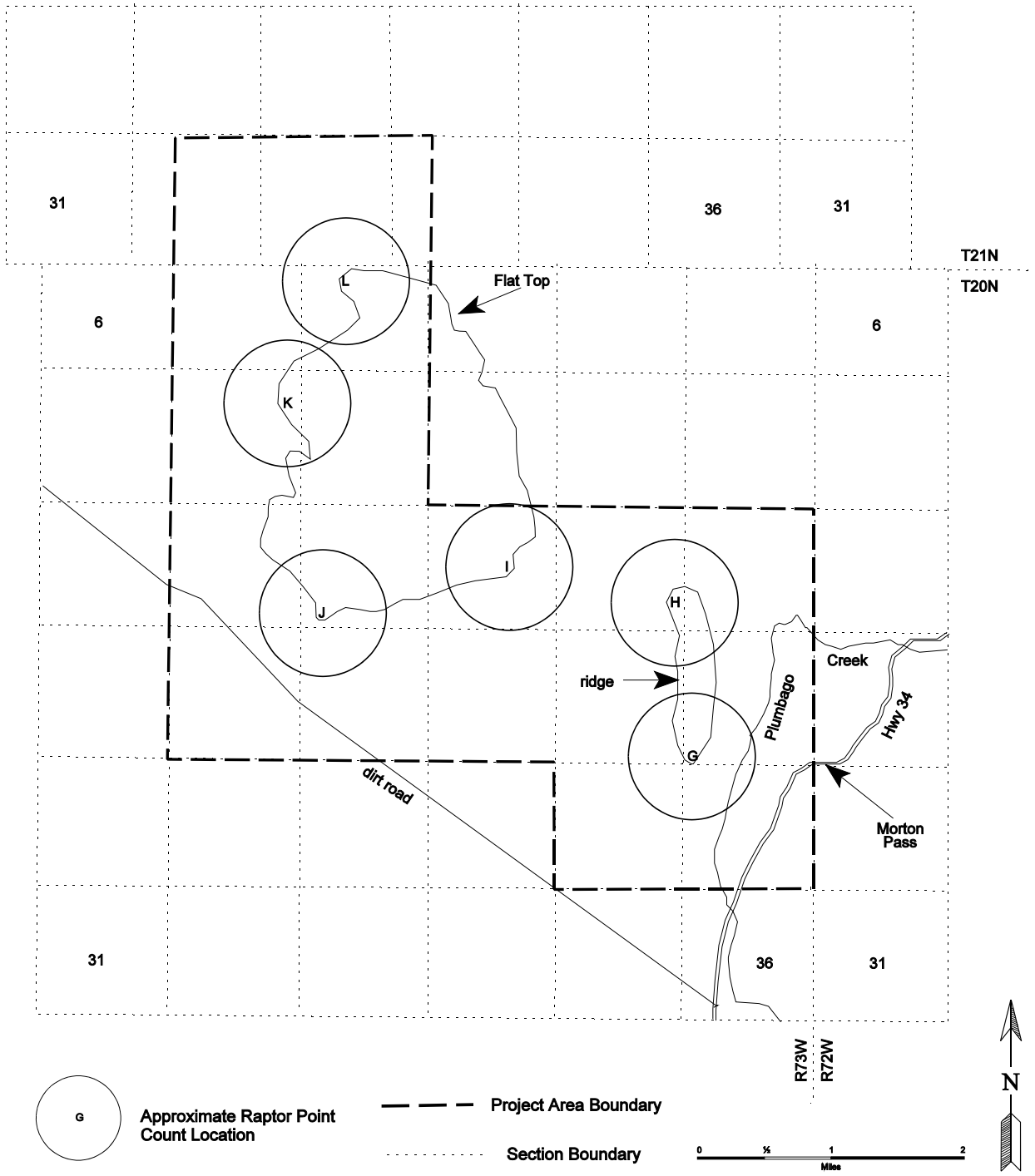


Figure 4. Location of RLB observation plots on Simpson Ridge.

Figure 5. Location of RLB observation plots on the Morton Pass Reference area.



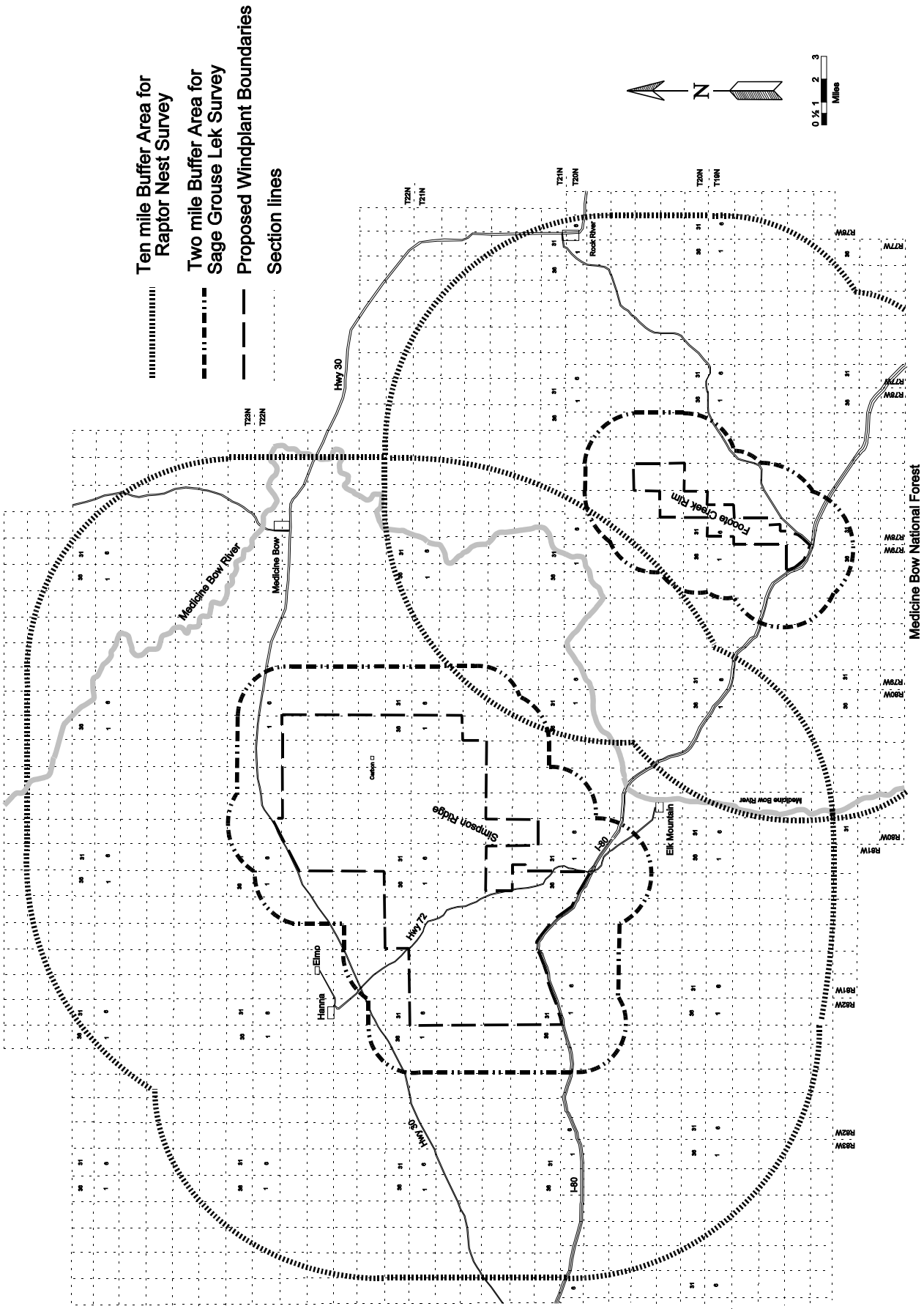


Figure 6. Location of raptor nest and sage grouse lek survey areas for Foote Creek Rim and Simpson Ridge.

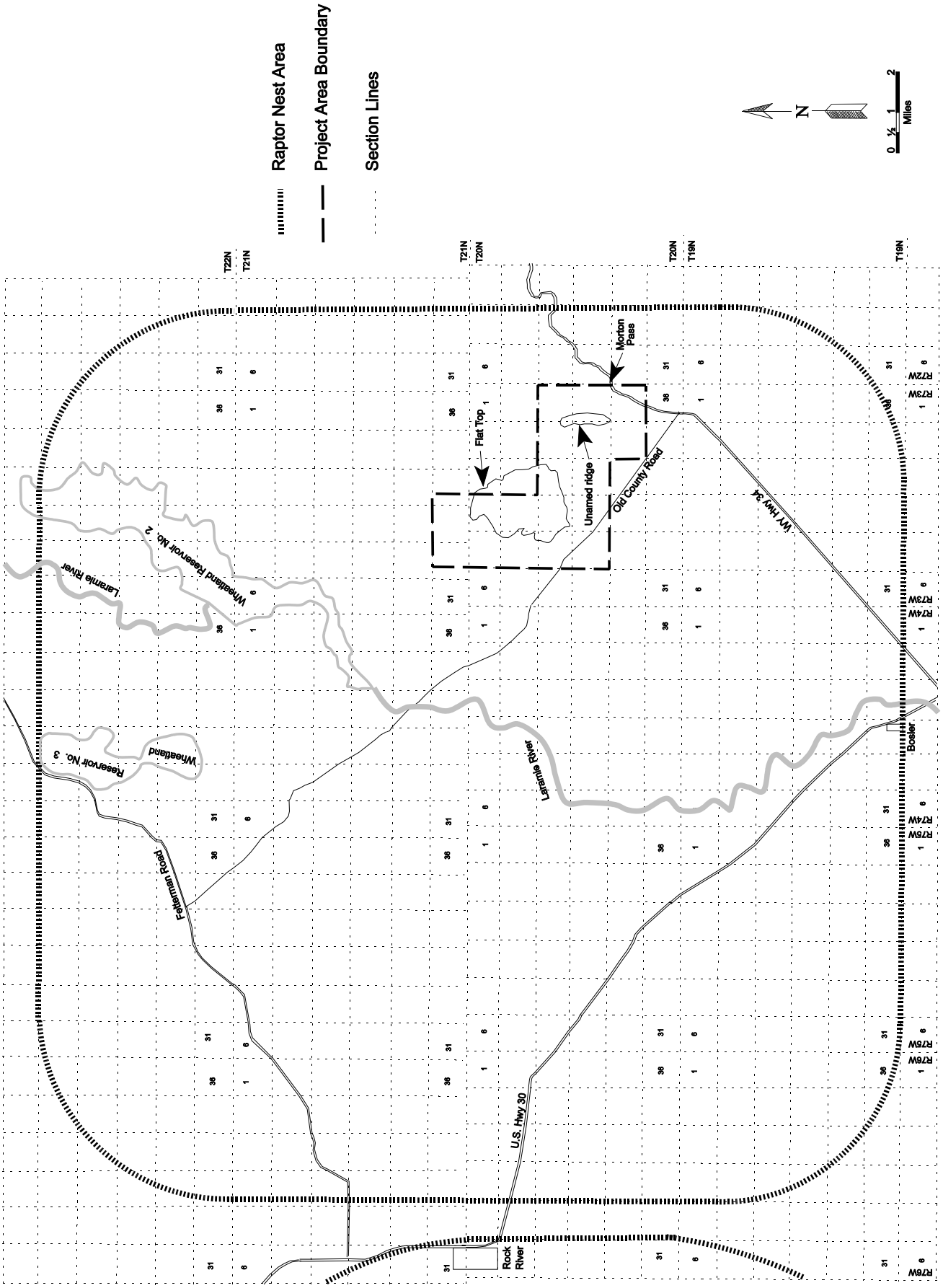


Figure 7. Location of raptor nest survey area for the Morton Pass Reference area.

Figure 8. Approximate locations of PSB transects on Foote Creek Rim.

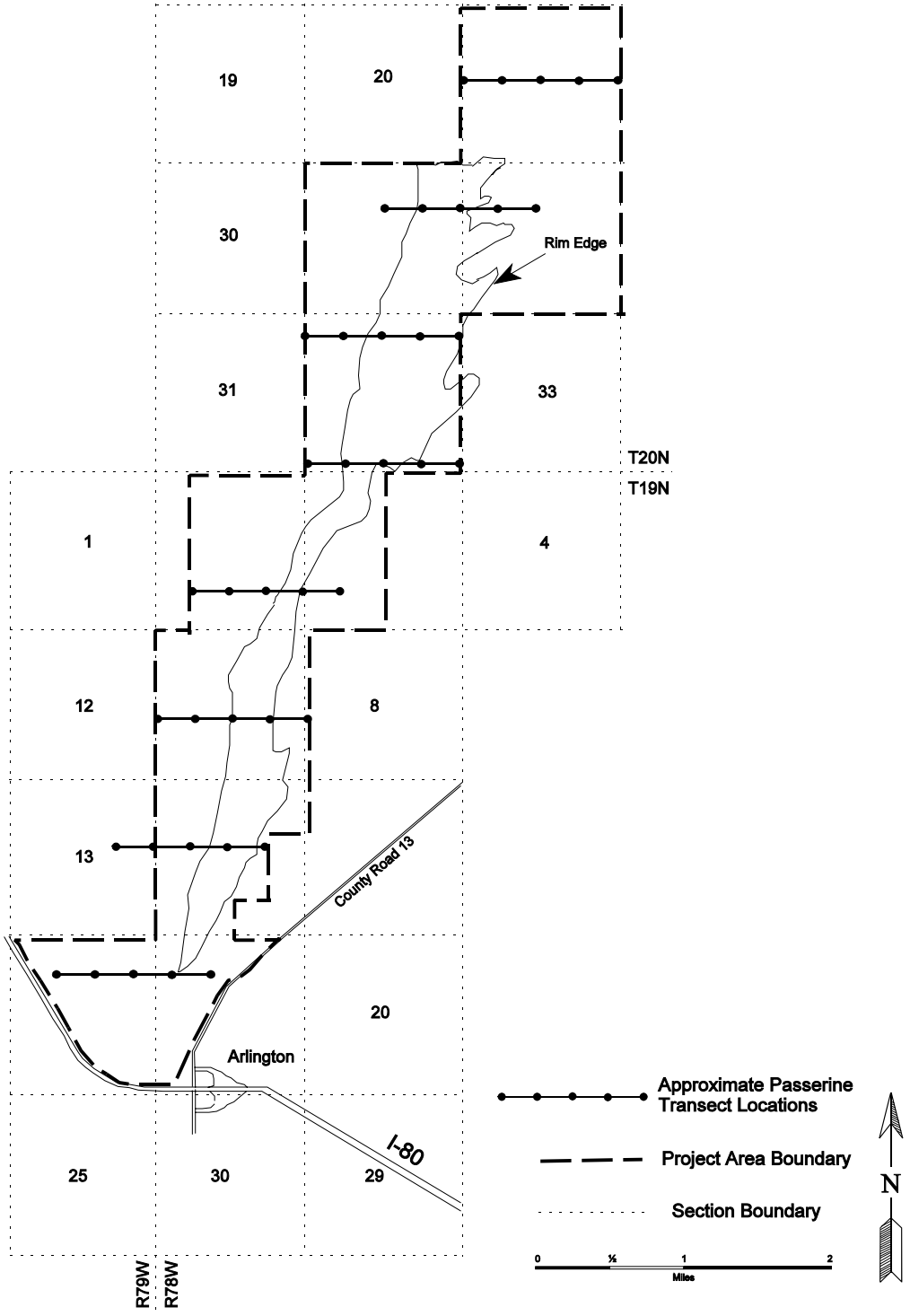
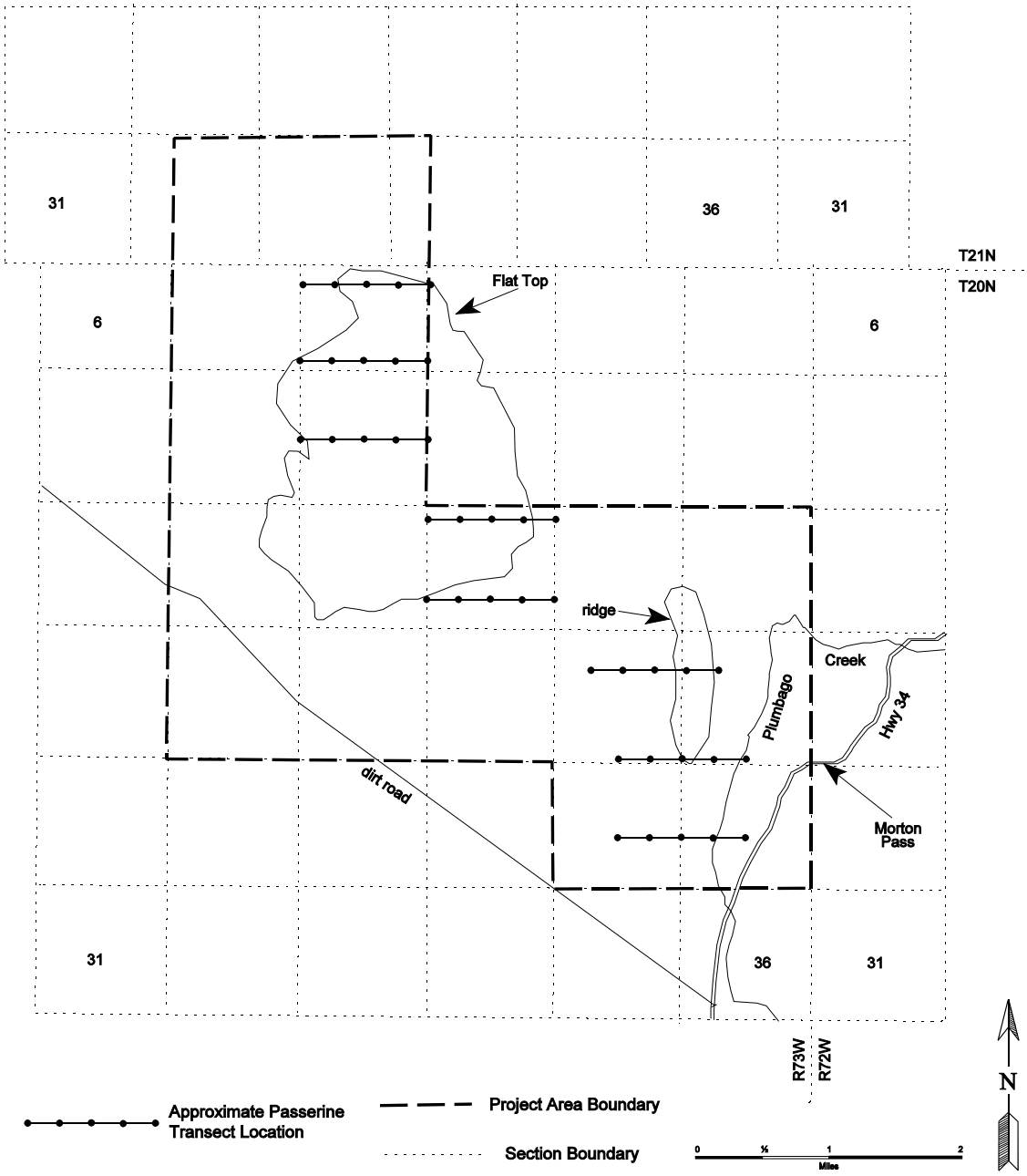


Figure 9. Approximate locations of PSB transects on Morton Pass Reference area.



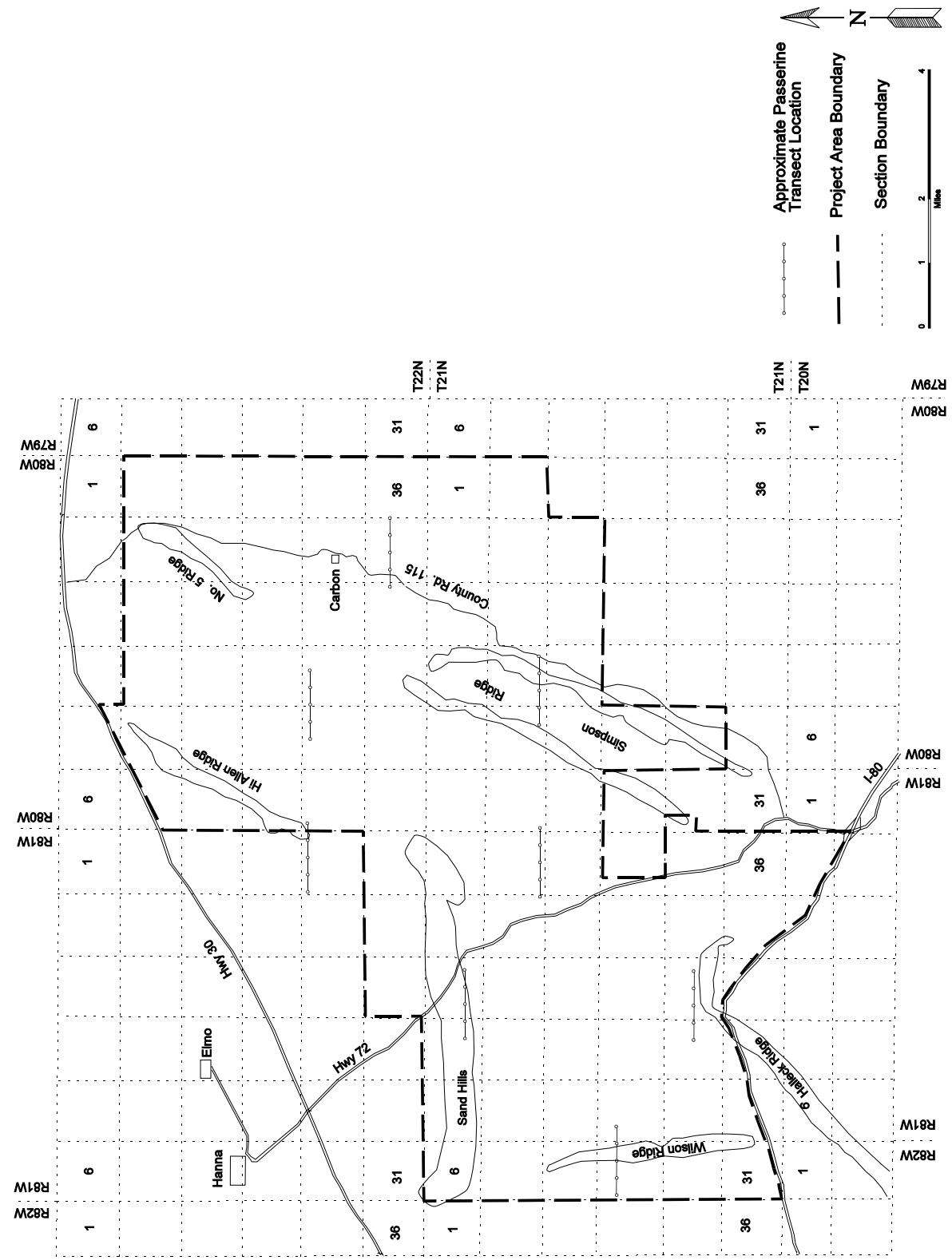


Figure 10. Approximate locations of PSB transects on Simpson Ridge.

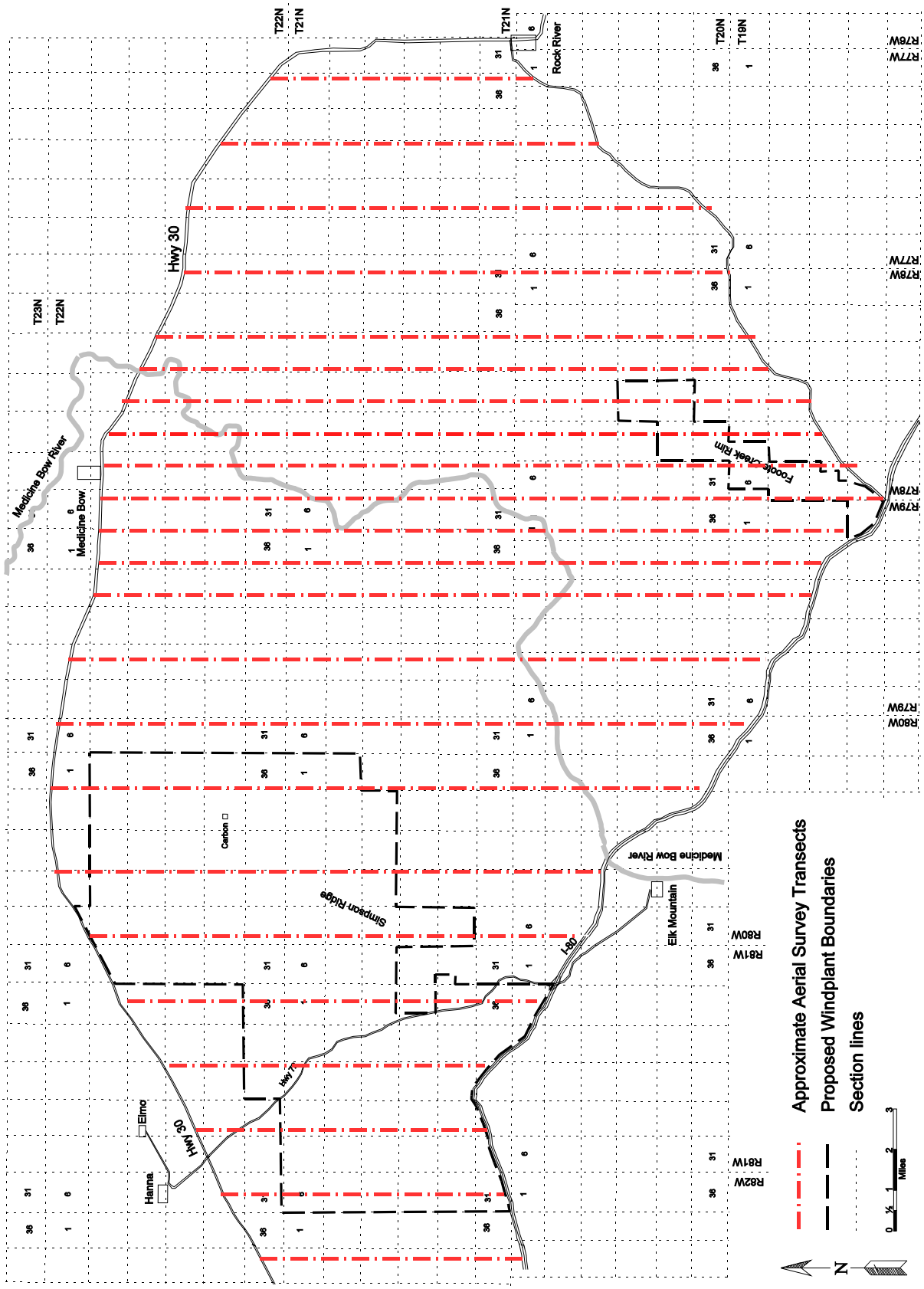
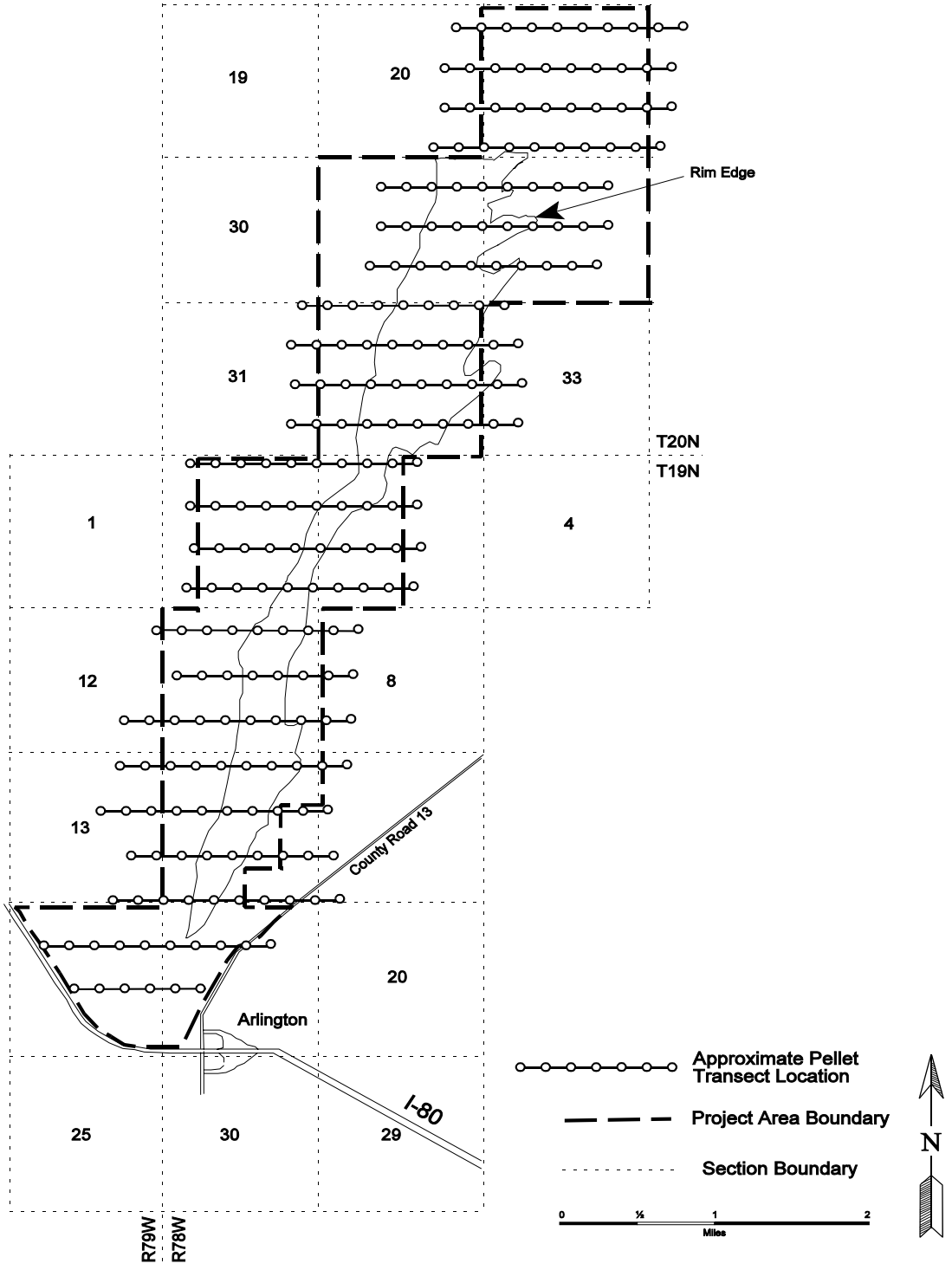


Figure 11. Approximate locations of pronghorn aerial survey transects in WGFD Hunt Areas 46 and 48.

Figure 12. Approximate locations of big game/sage grouse pellet transects on Foote Creek Rim.



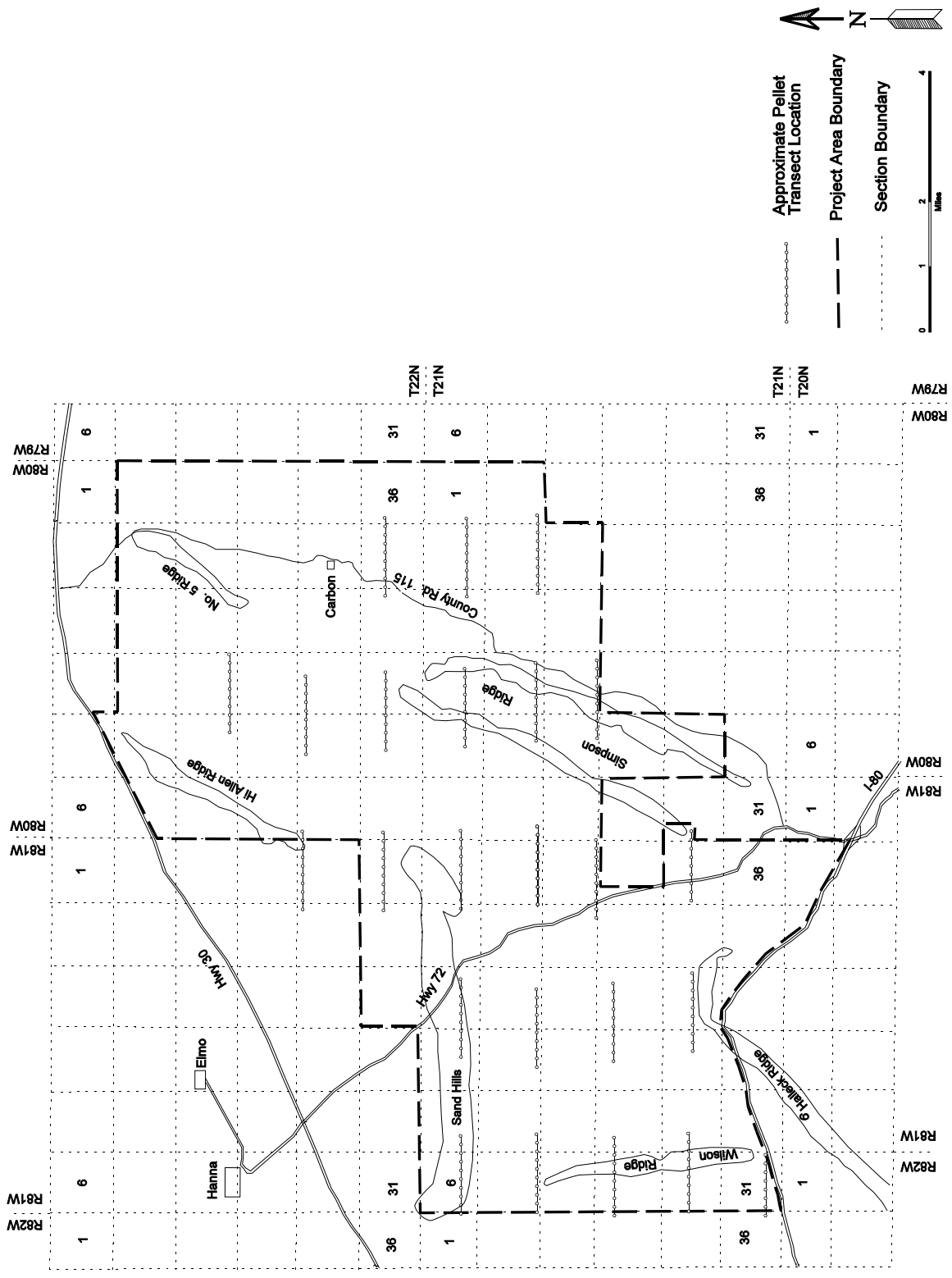


Figure 13. Approximate locations of big game/sage grouse pellet survey transects on Simpson Ridge.

Figure 14. Approximate locations of mountain plover survey transects on Foote Creek Rim.

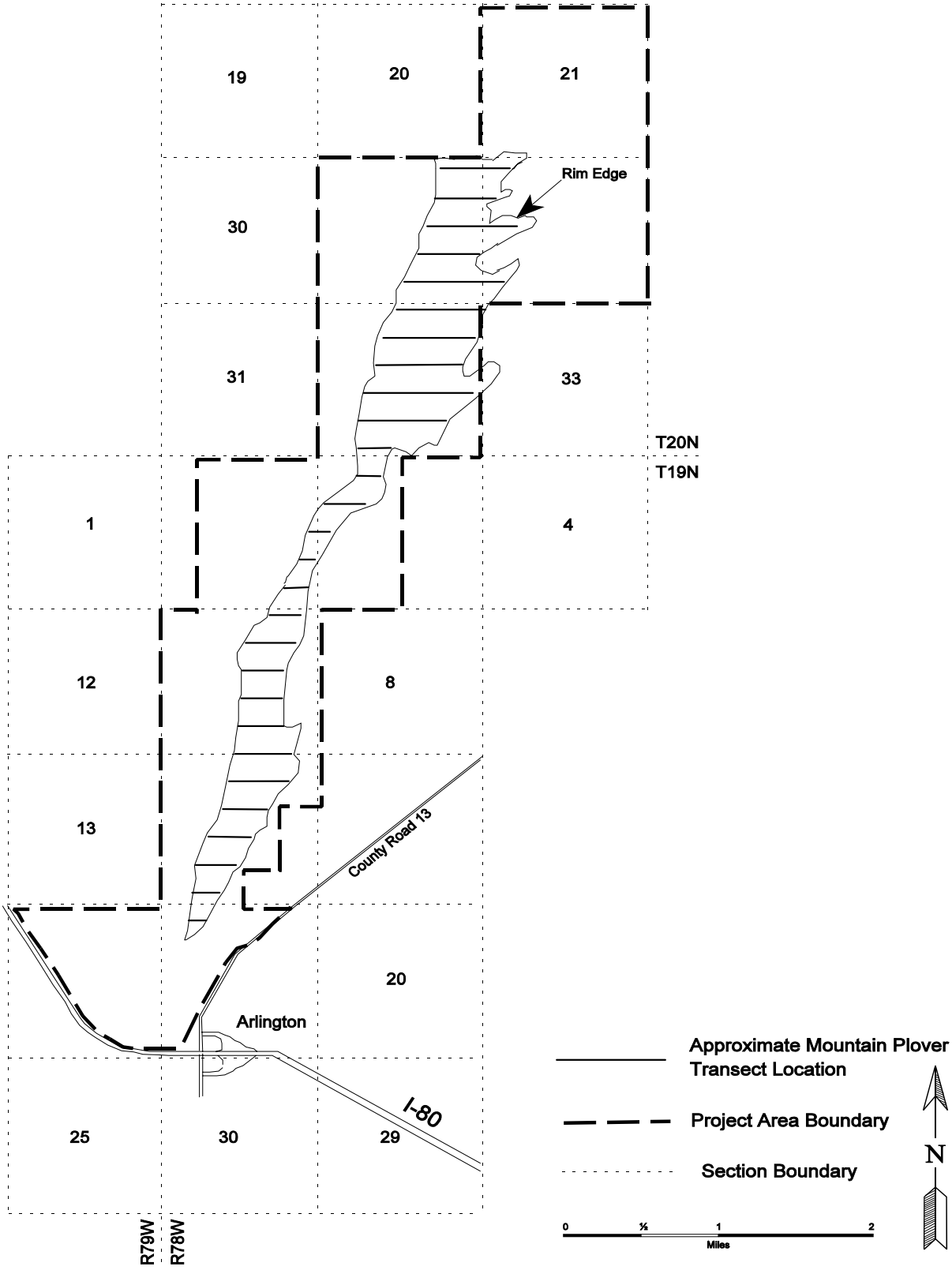
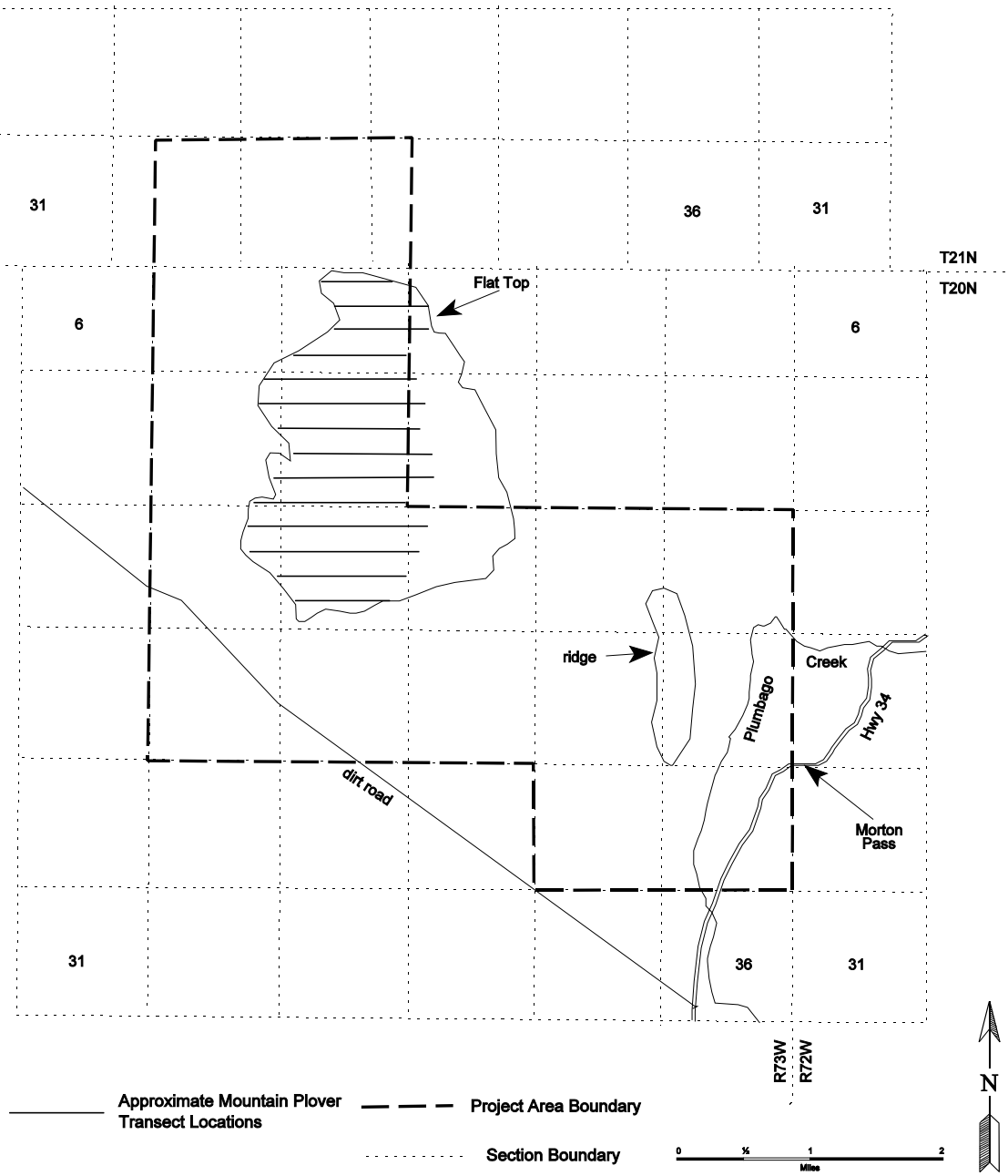


Figure 15. Approximate locations of mountain plover survey transects on Morton Pass Reference area.



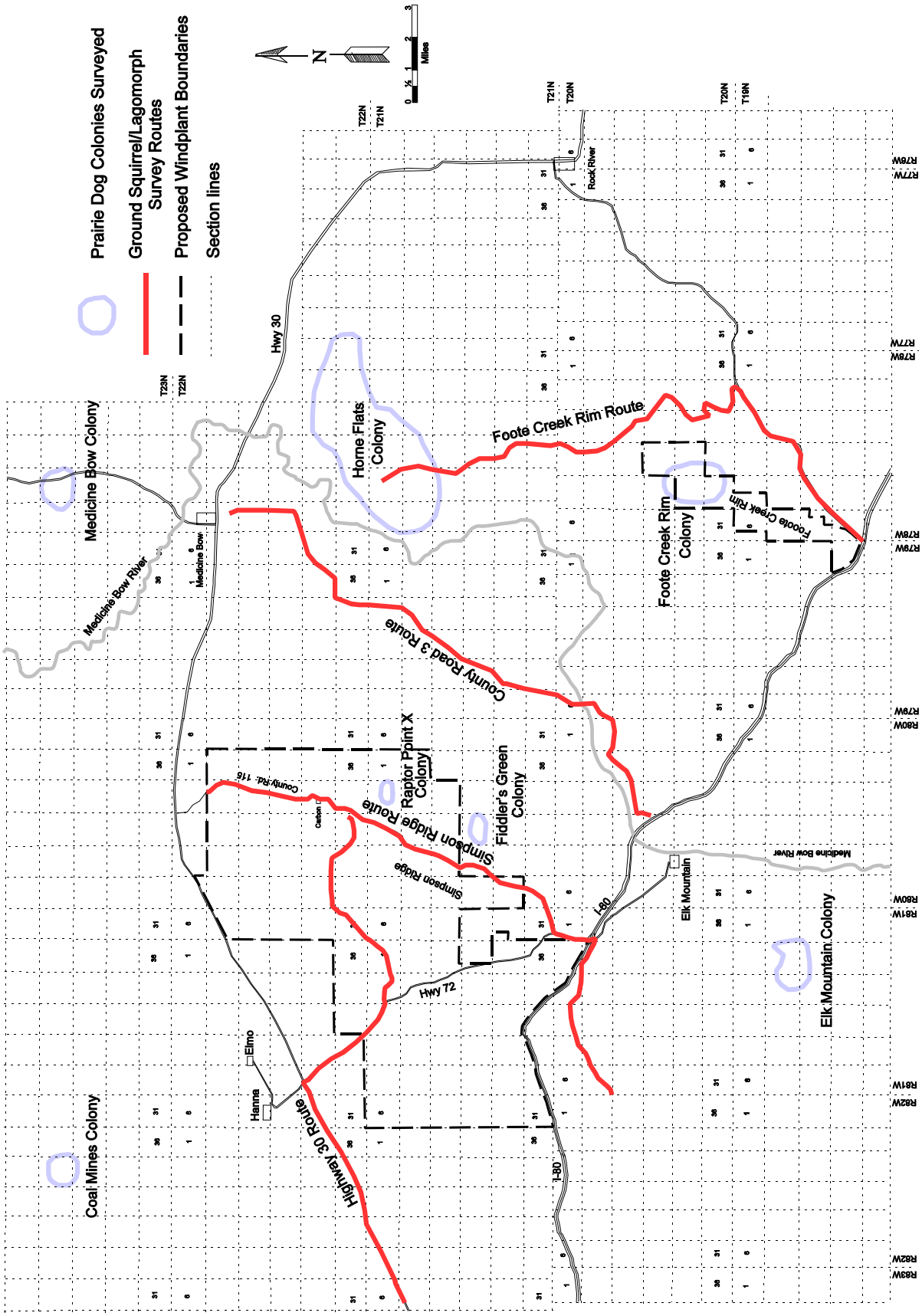


Figure 16. Location of lagomorph and ground squirrel transects and prairie dog towns surveyed in the wind resource area.

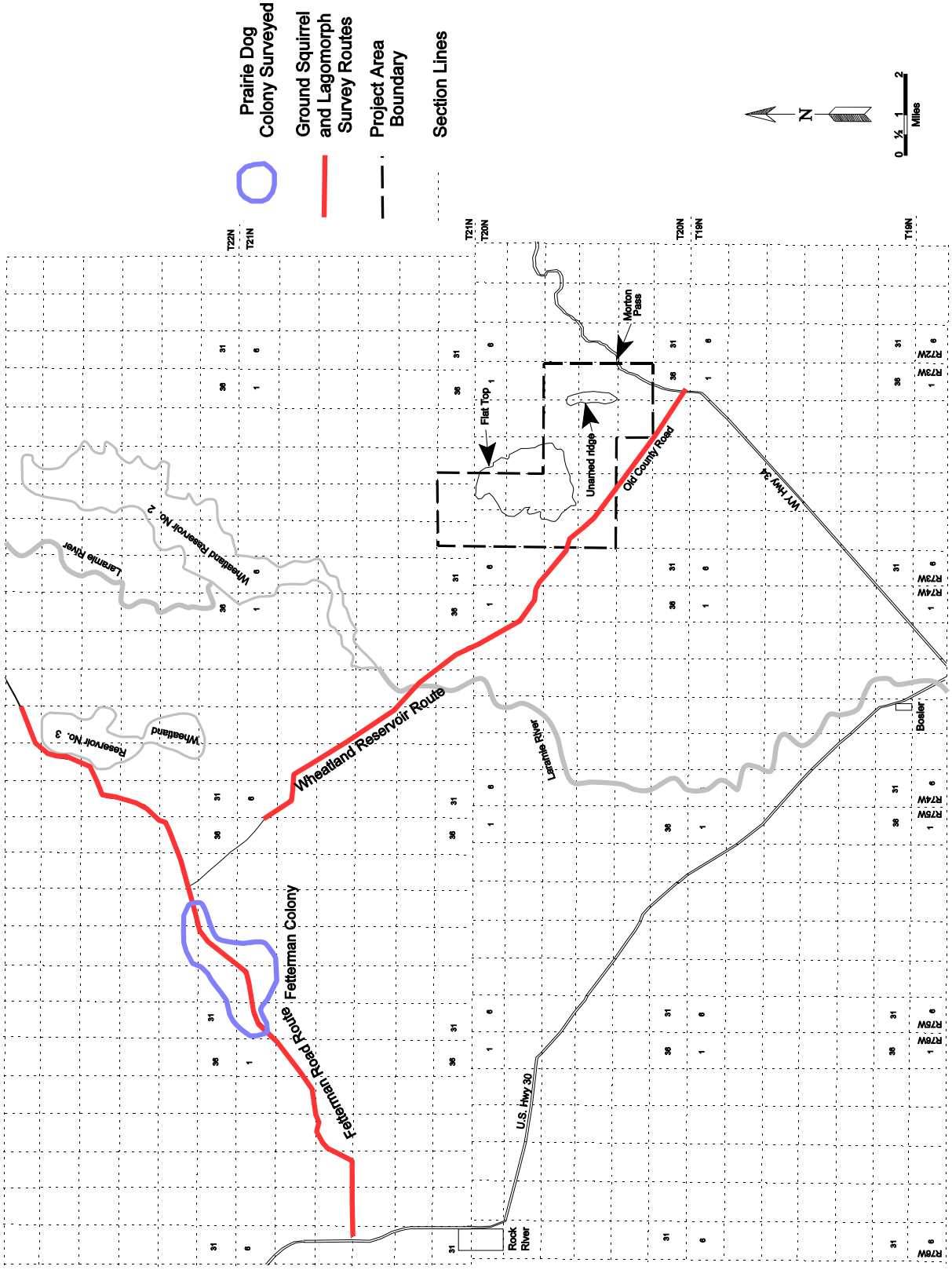
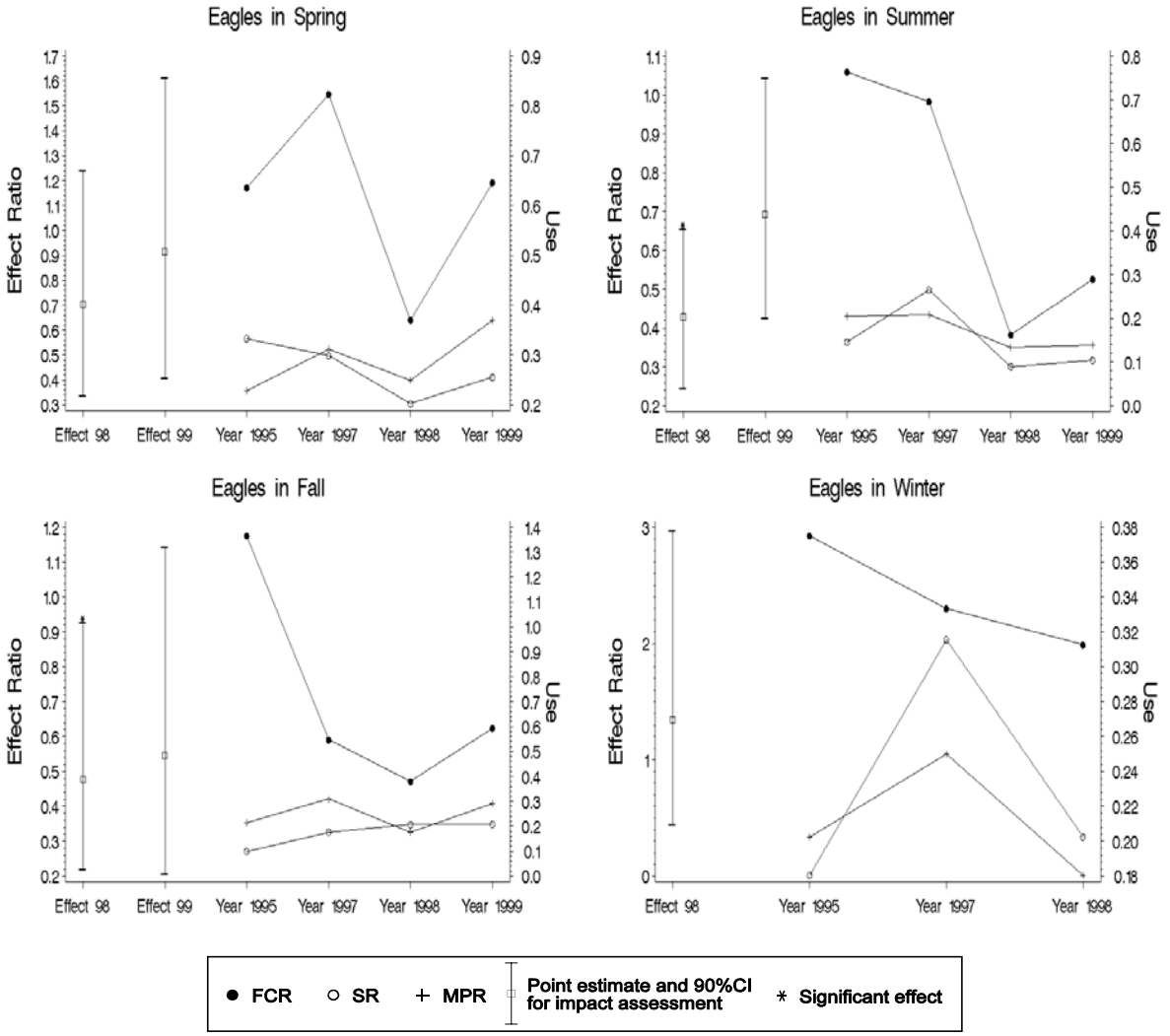


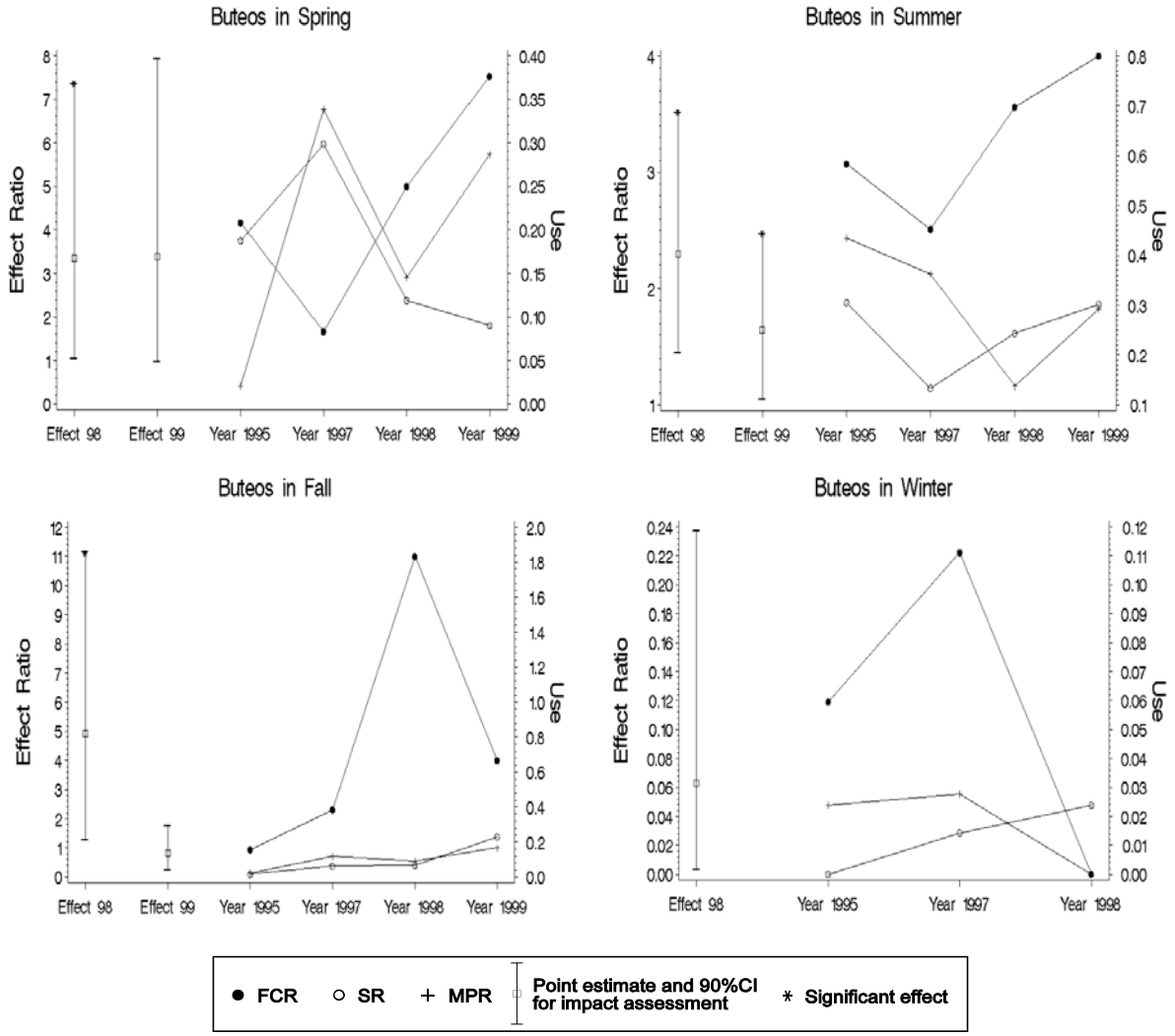
Figure 17. Location of lagomorph and ground squirrel transects and prairie dog town surveyed at Morton Pass Reference area.

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



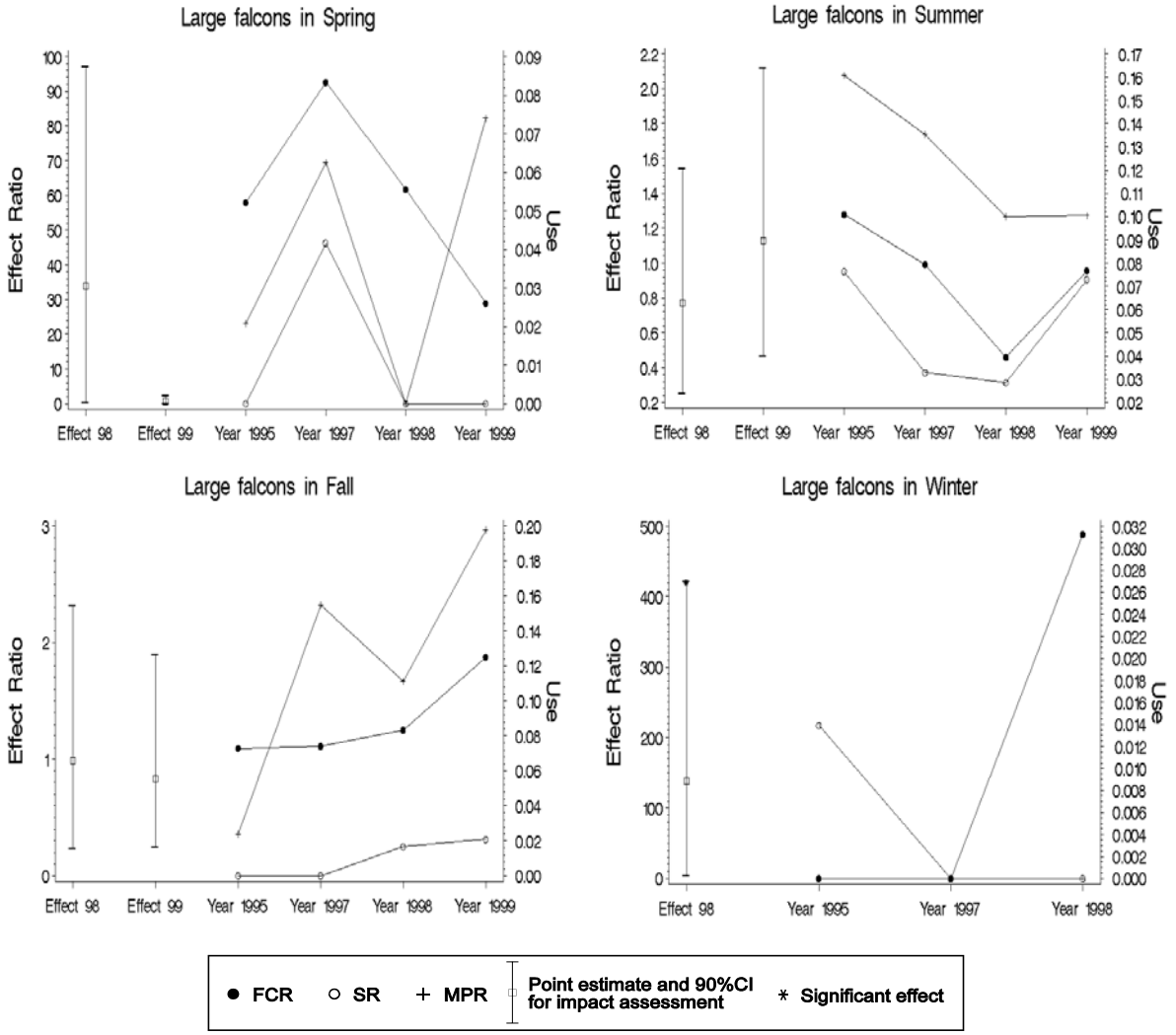
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/ turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



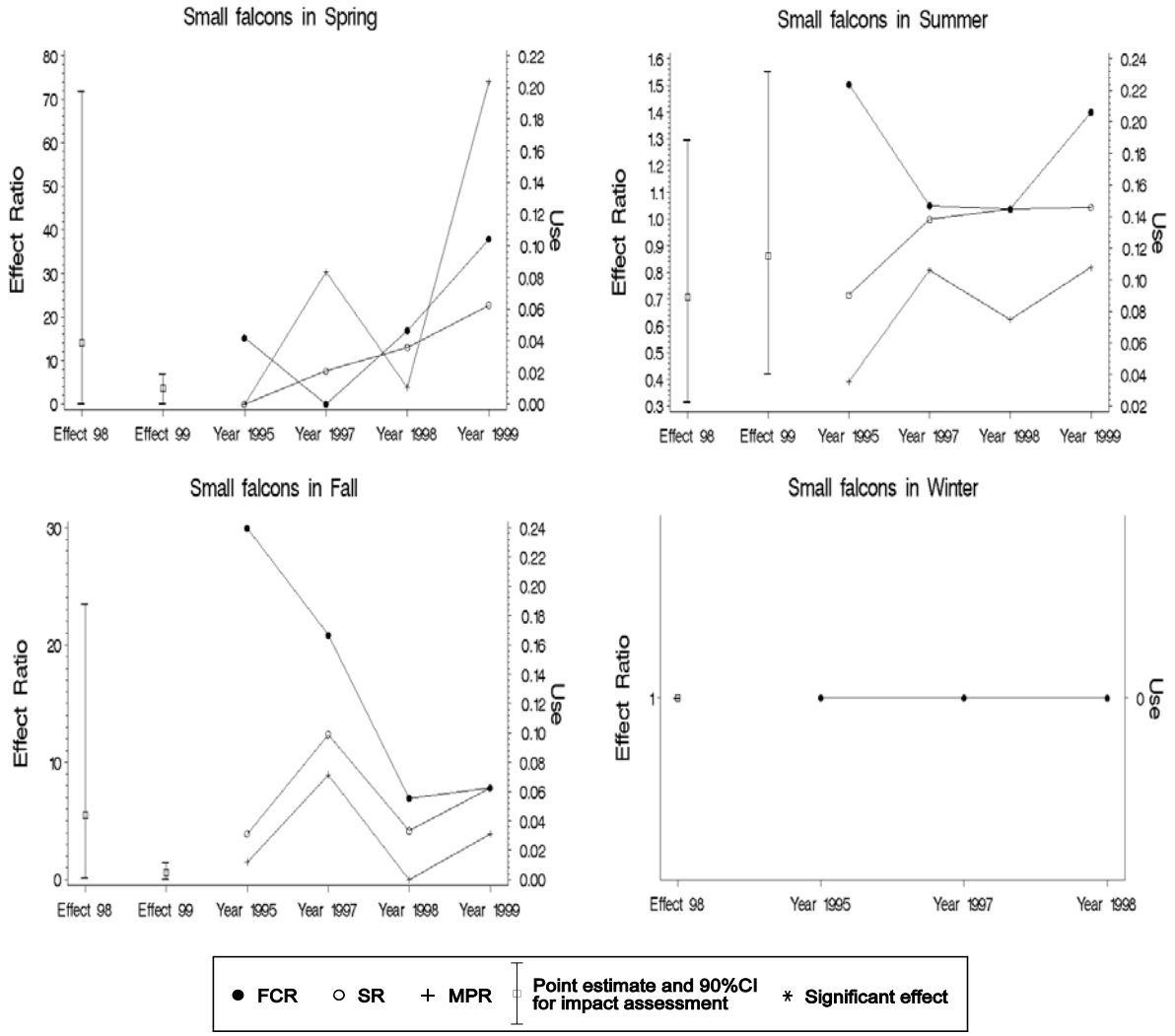
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/ turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



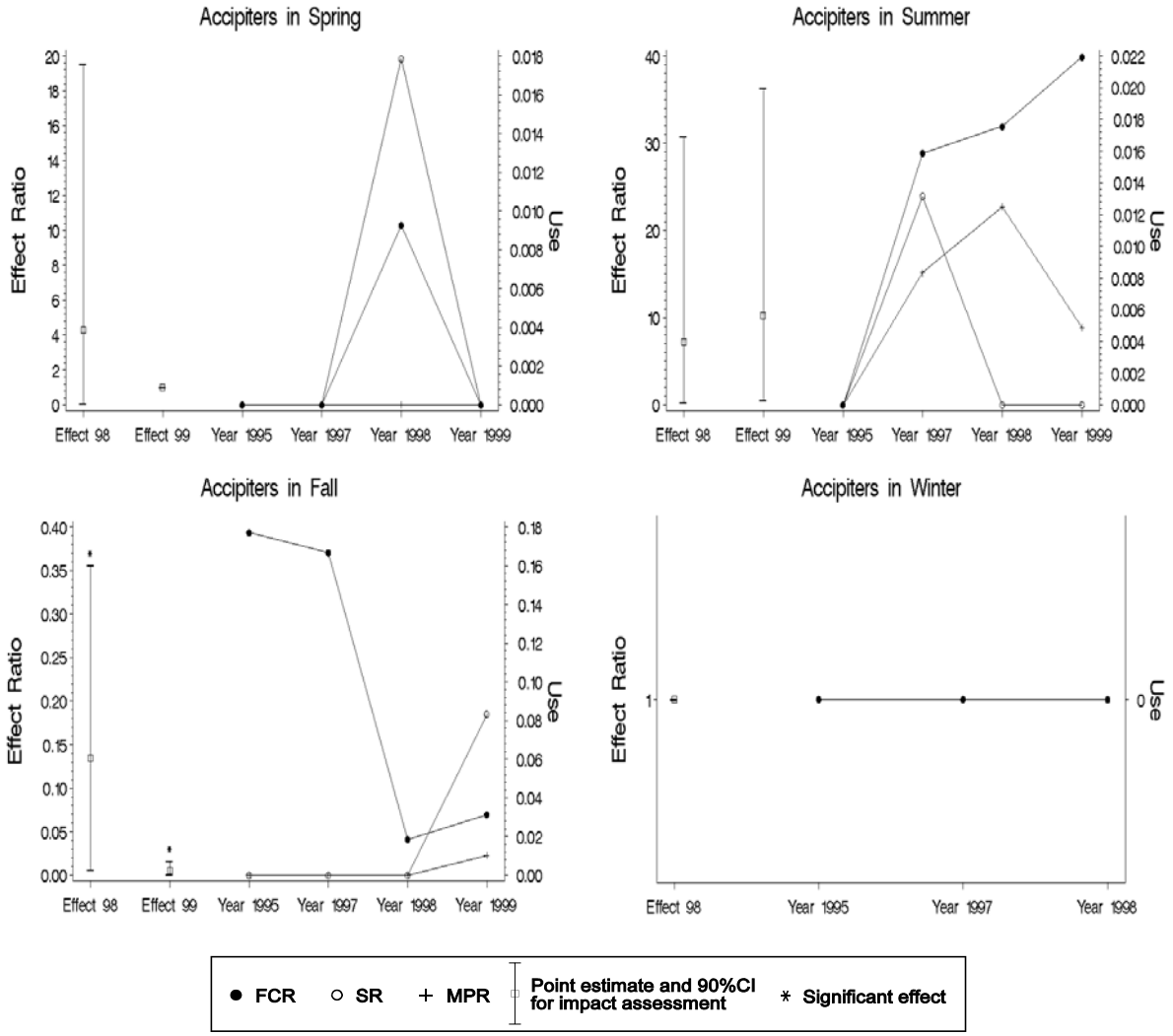
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



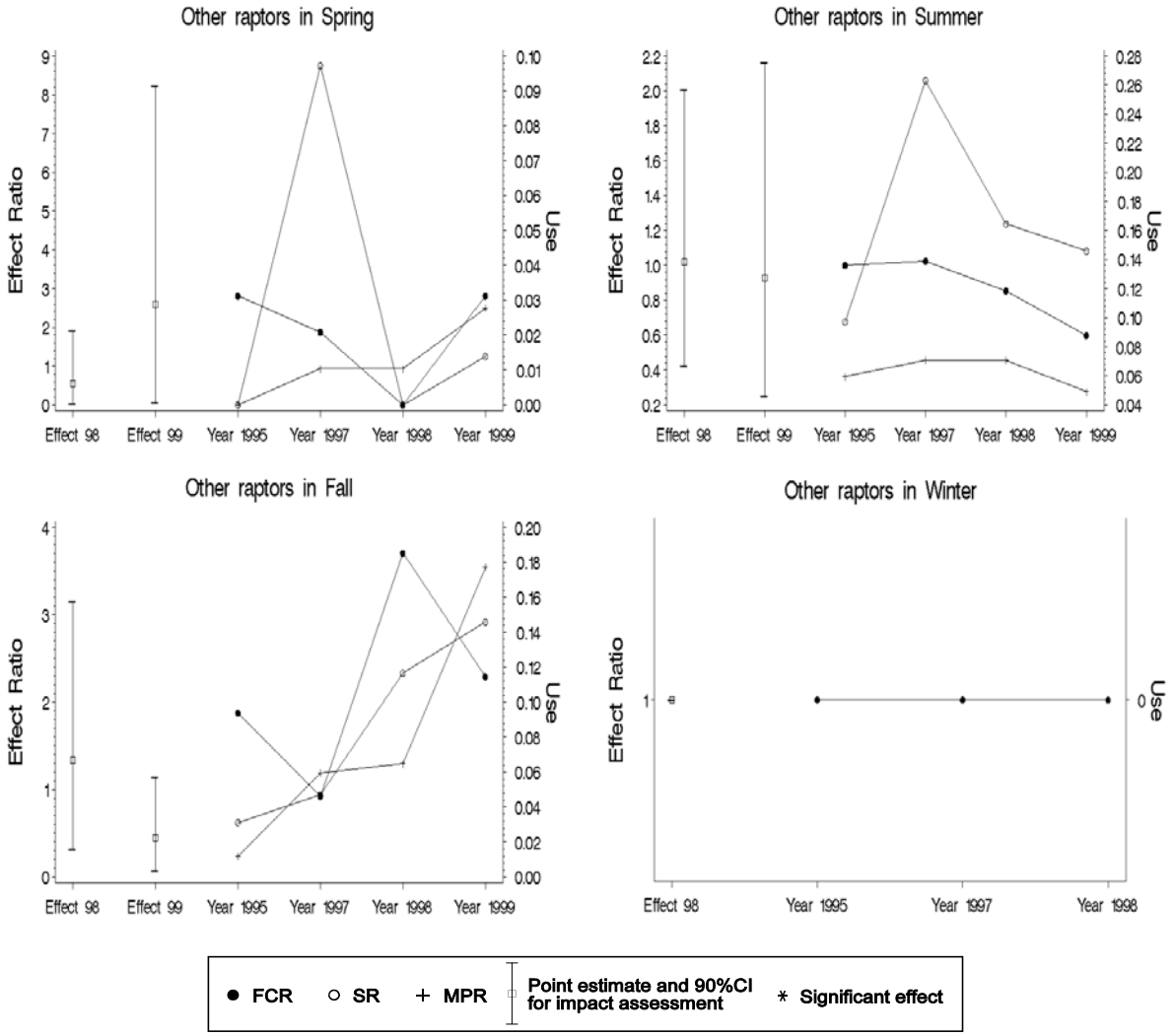
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR



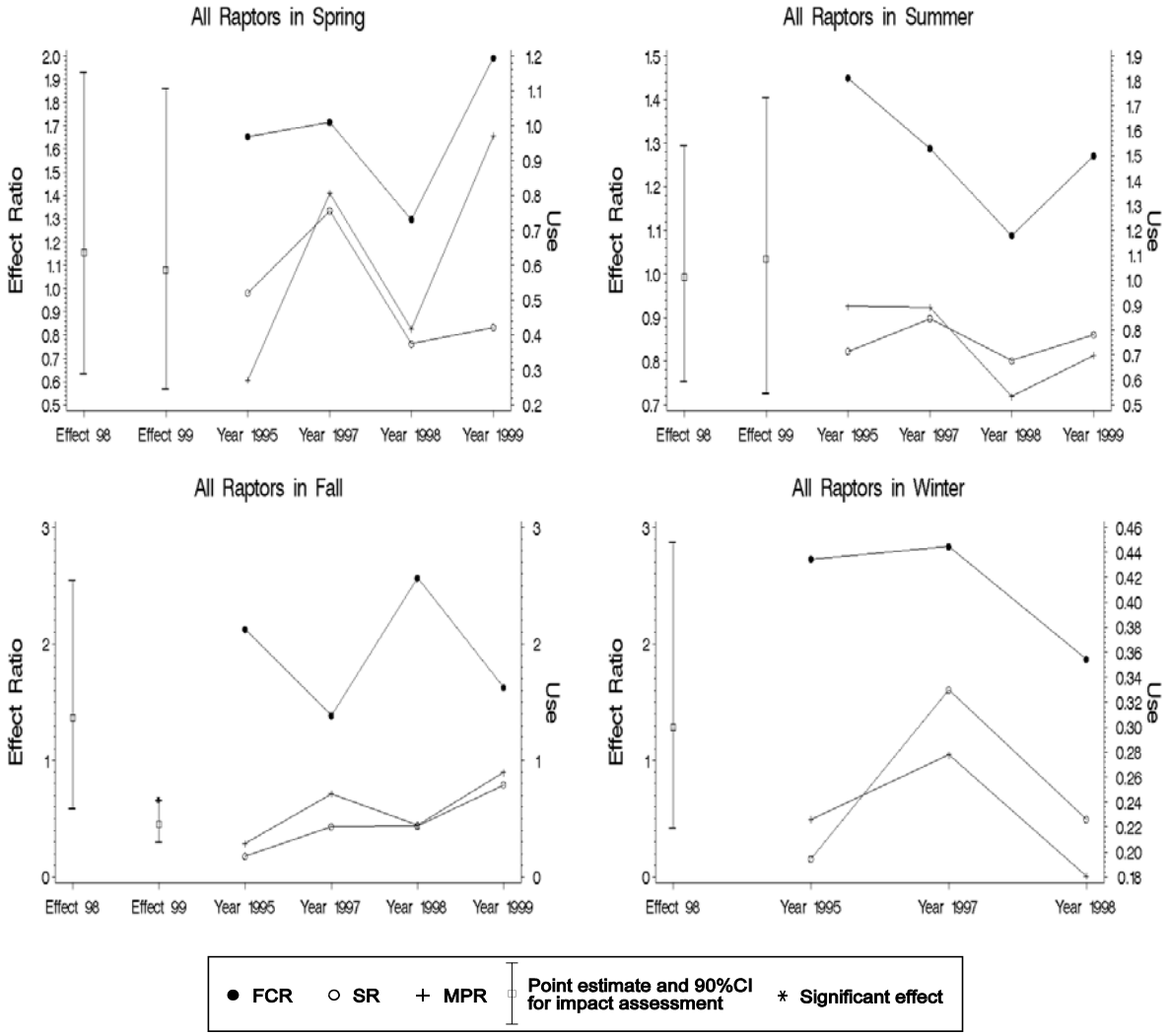
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



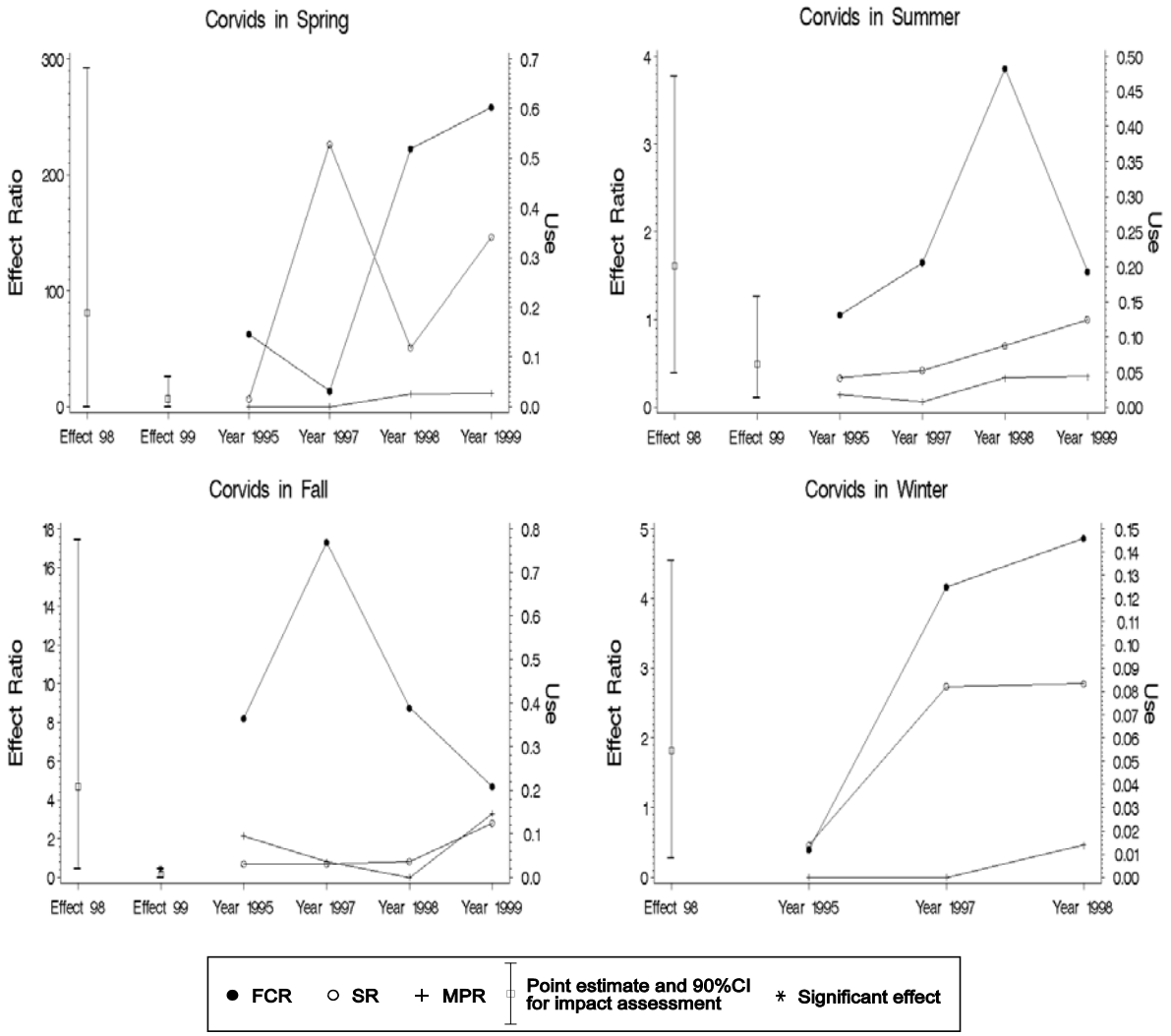
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



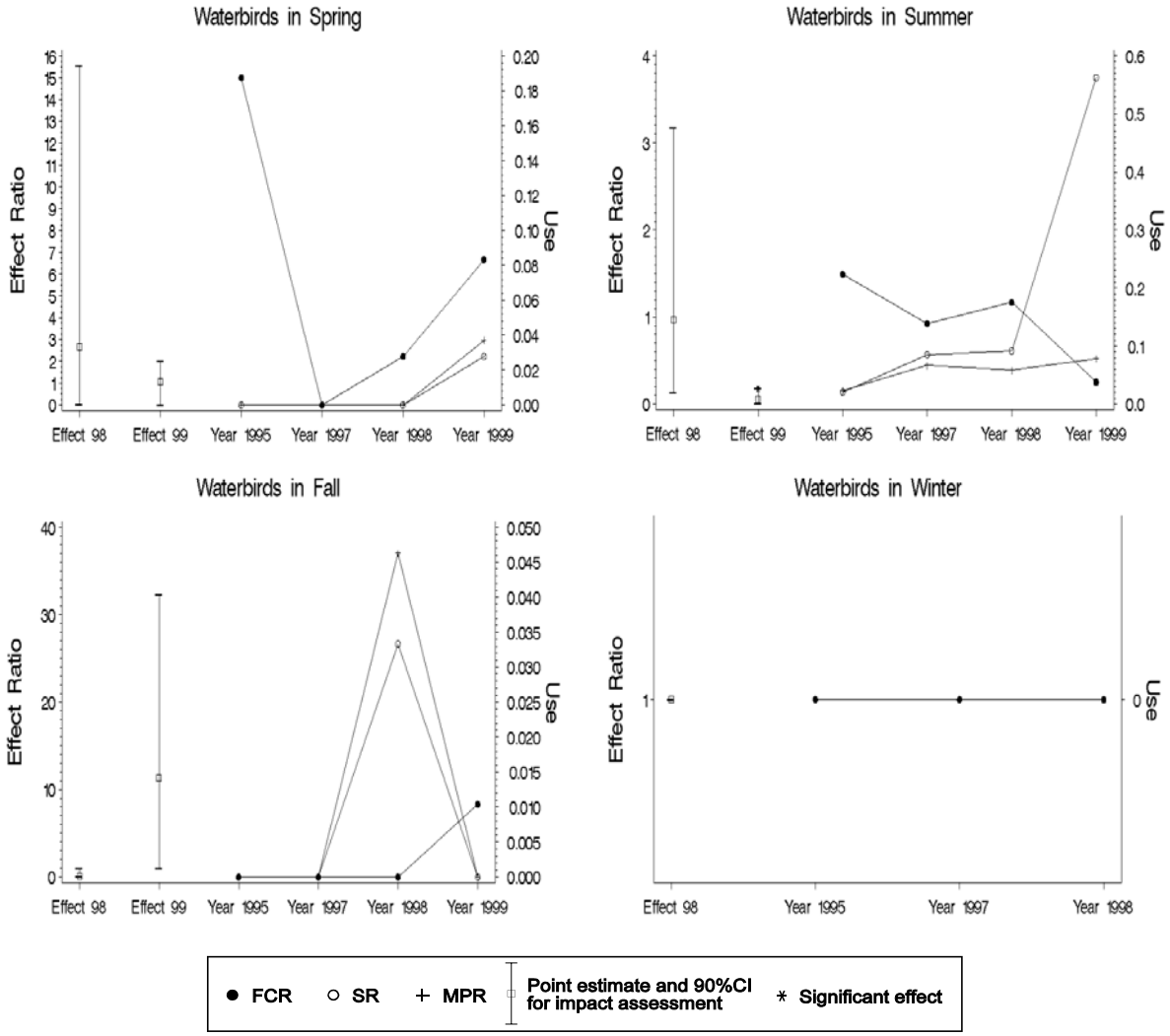
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



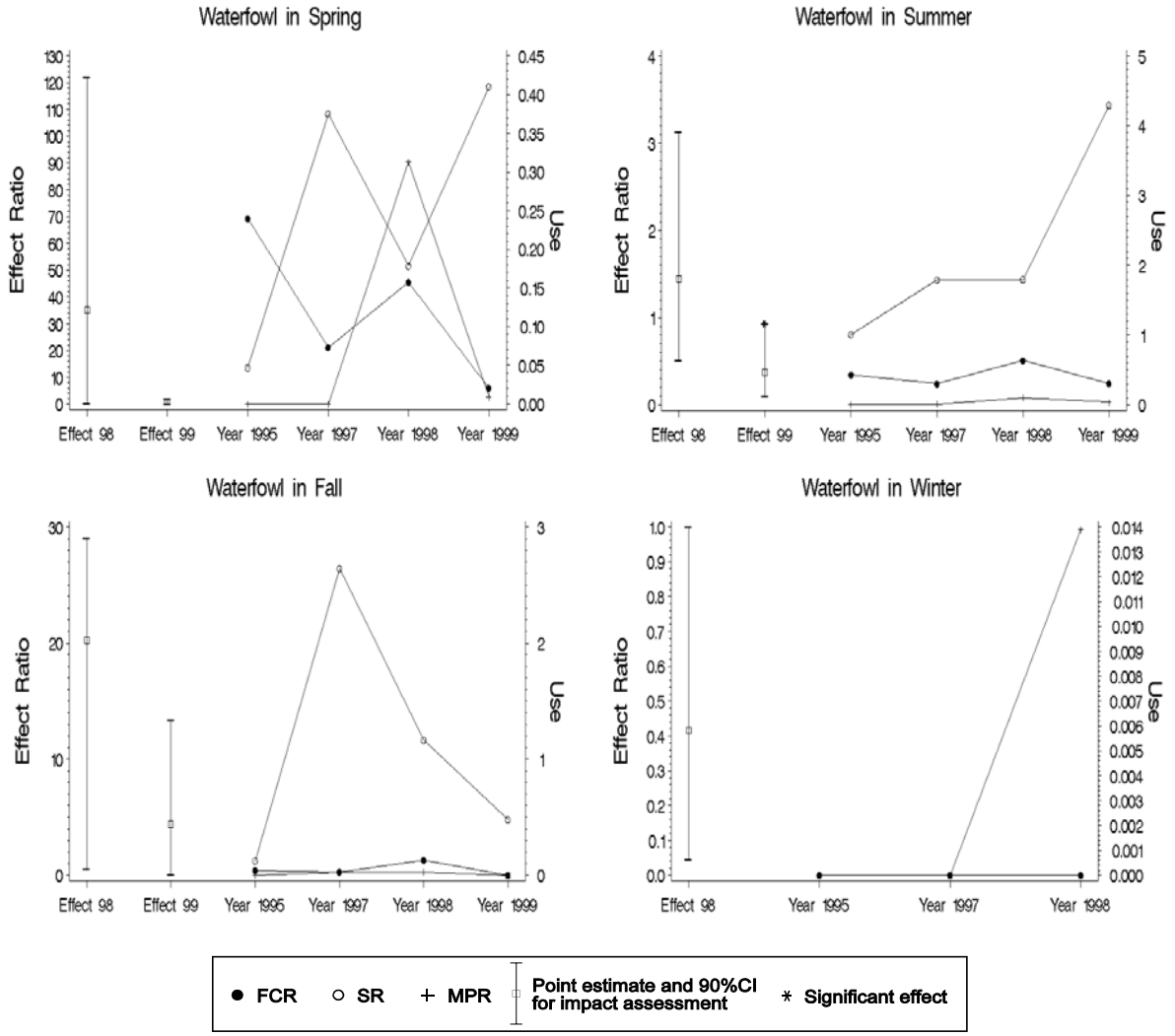
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



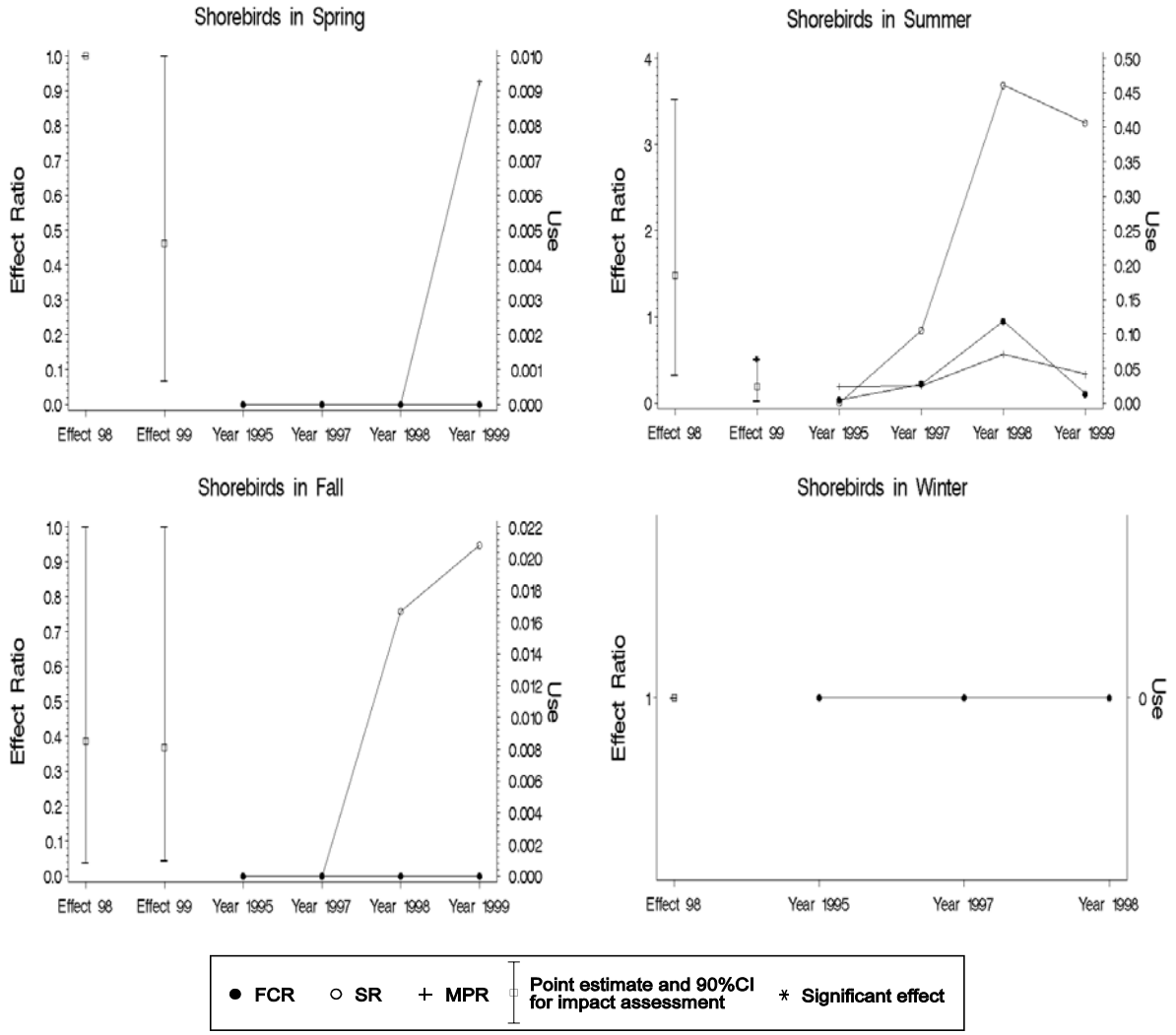
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



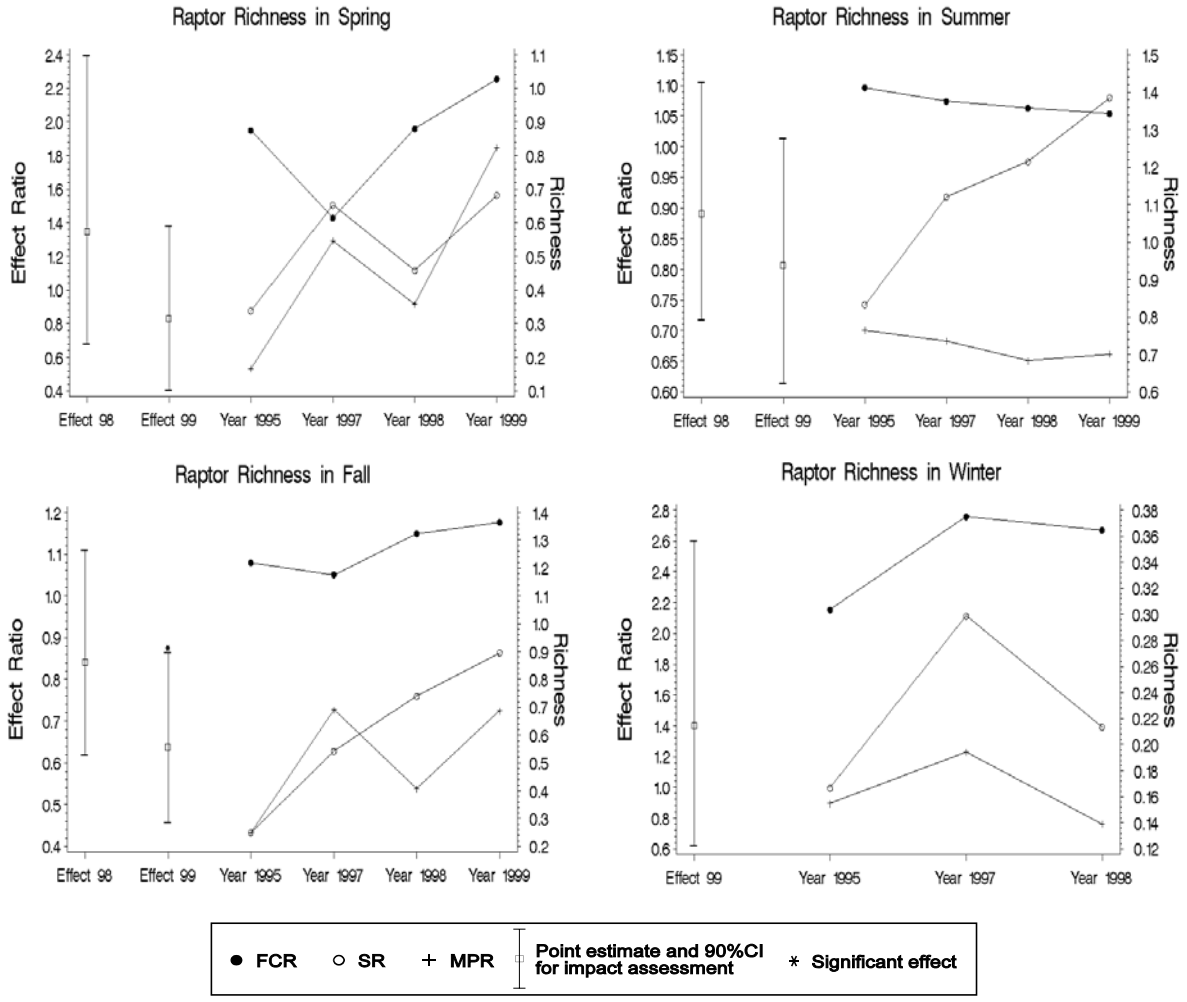
[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 18. Avian relative use (number observed/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR, and MPR.



[1]A significant decline in use during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 19. Avian diversity (number of species/40-minutes/plot) and construction/turbine effect estimates with 90% confidence intervals[1] based on RLB data for FCR, SR,and MPR.



[12]A significant decline in diversity during construction/post construction period on FCR relative to the reference areas is indicated when the upper limit of effect CI is less than 1.0

Figure 20. Relative avian use and construction/turbine effect estimates with 90% confidence intervals based on PSB survey data.

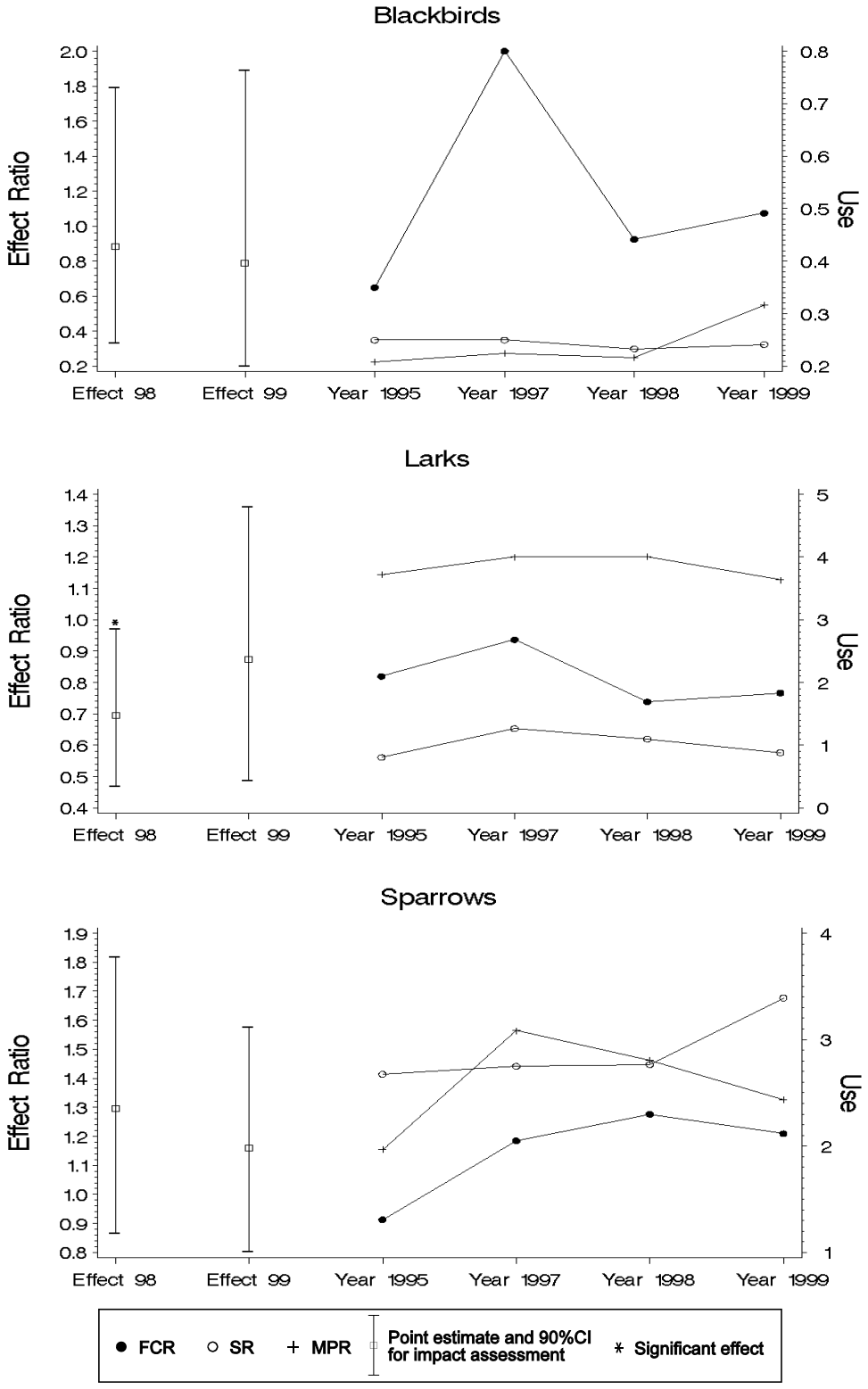


Figure 20 (continued). Relative avian use and construction/turbine effect estimates with 90% confidence intervals based on PSB survey data.

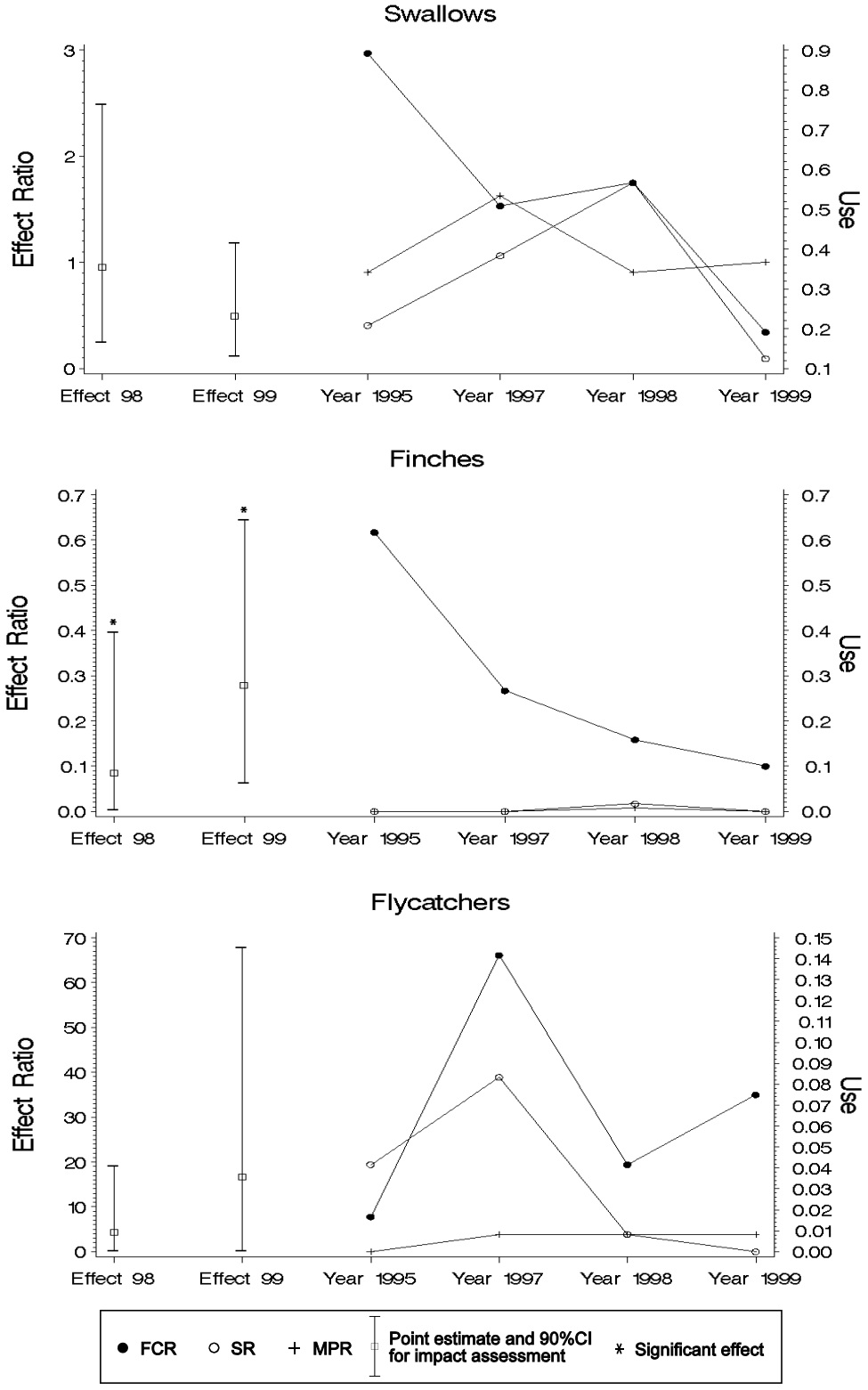


Figure 20 (continued). Relative avian use and construction/turbine effect estimates with 90% confidence intervals based on PSB survey data.

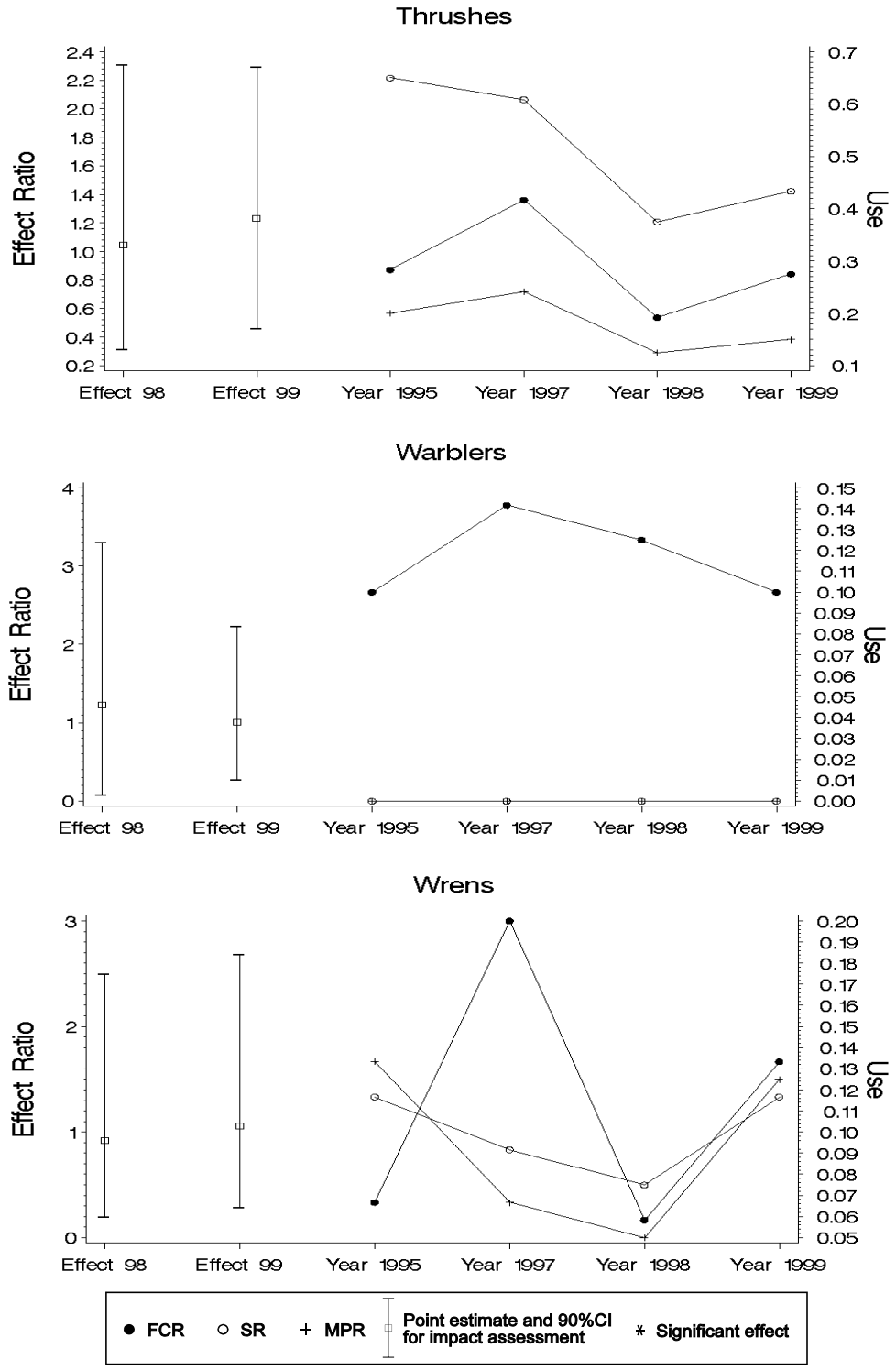


Figure 20 (continued). Relative avian use and construction/turbine effect estimates with 90% confidence intervals based on PSB survey data.

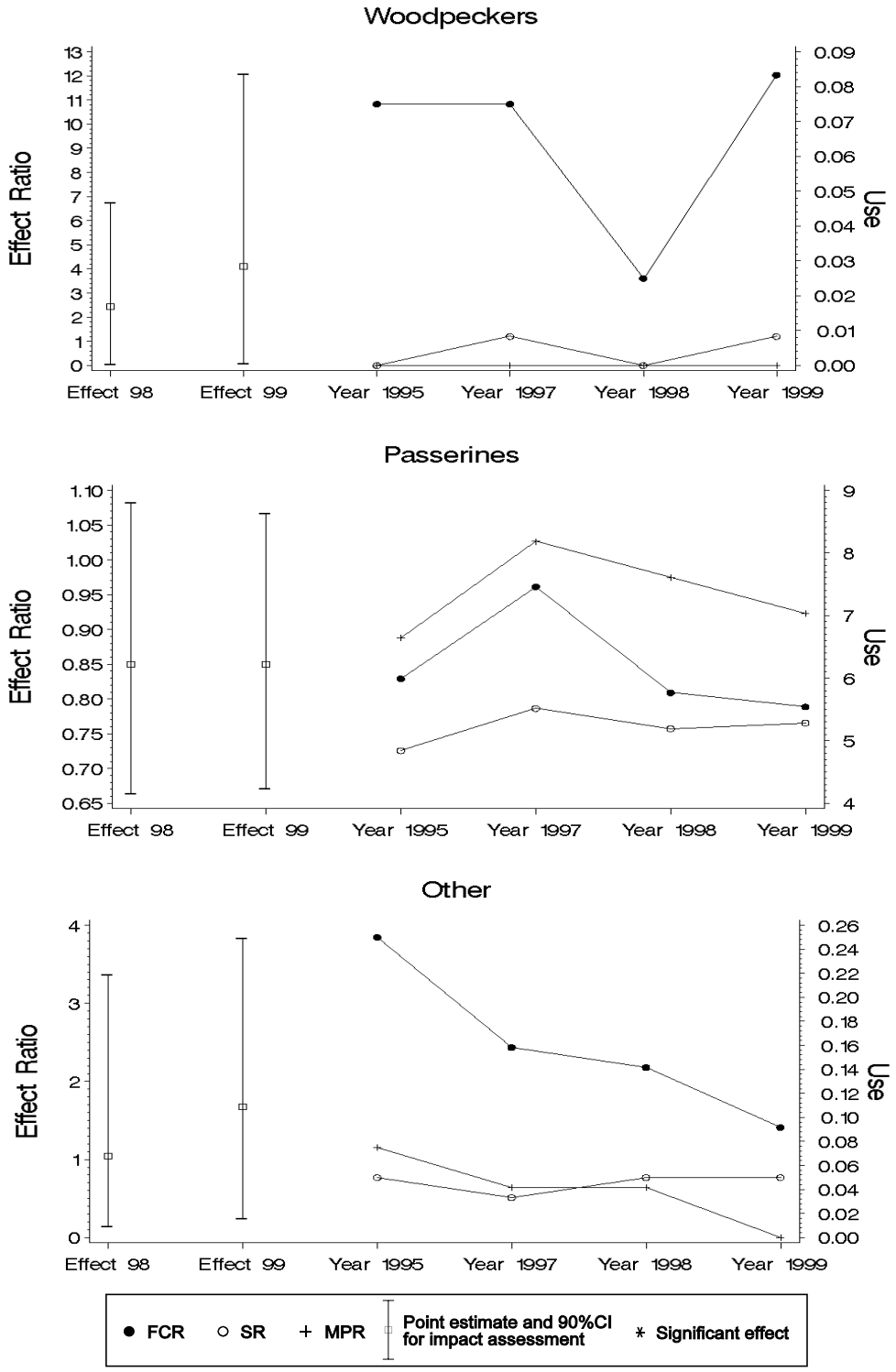


Figure 20 (continued). Relative avian use and construction/turbine effect estimates with 90% confidence intervals based on PSB survey data.

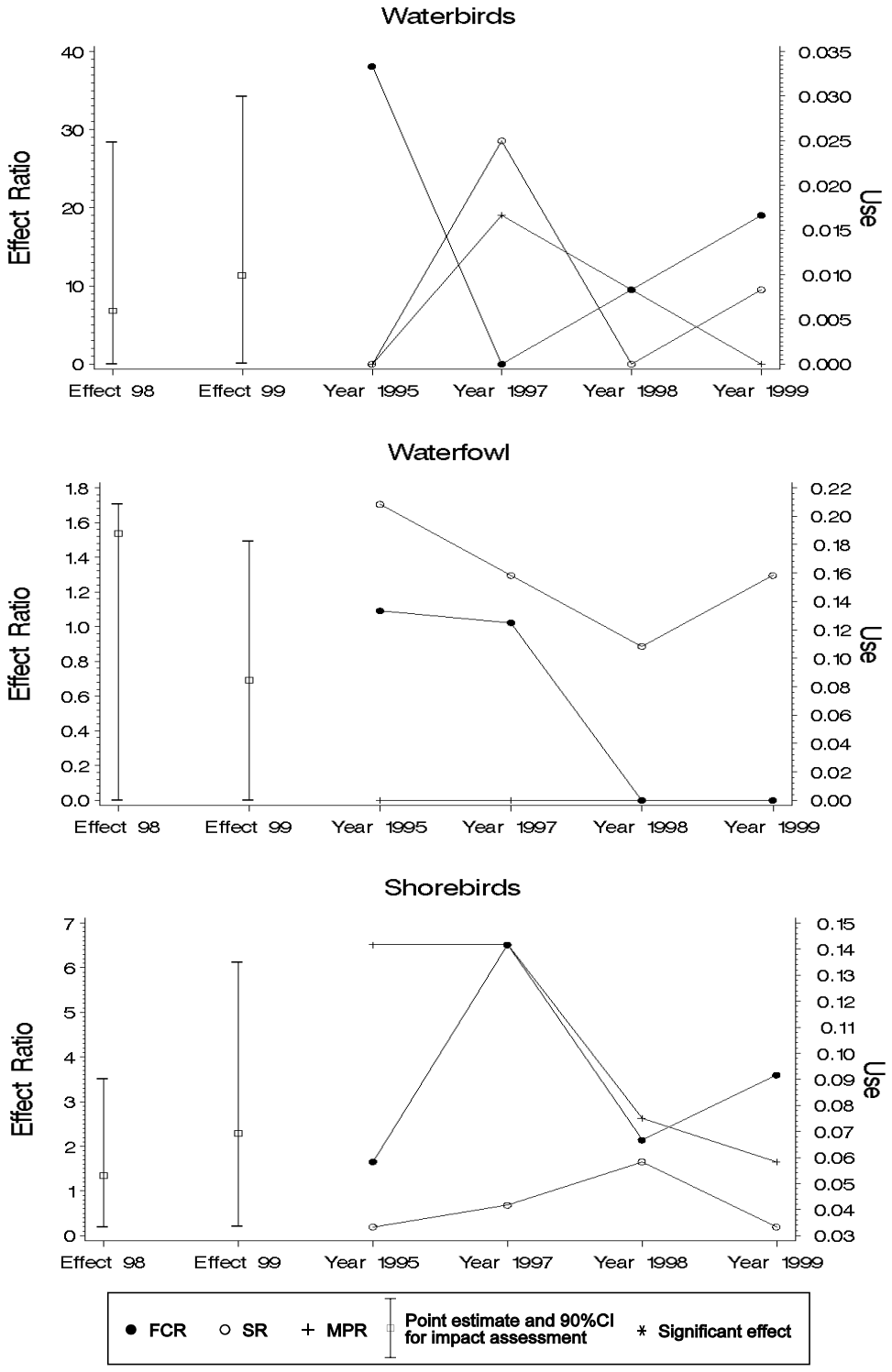


Figure 20 (continued). Relative avian use and construction/turbine effect estimates with 90% confidence intervals based on PSB survey data.

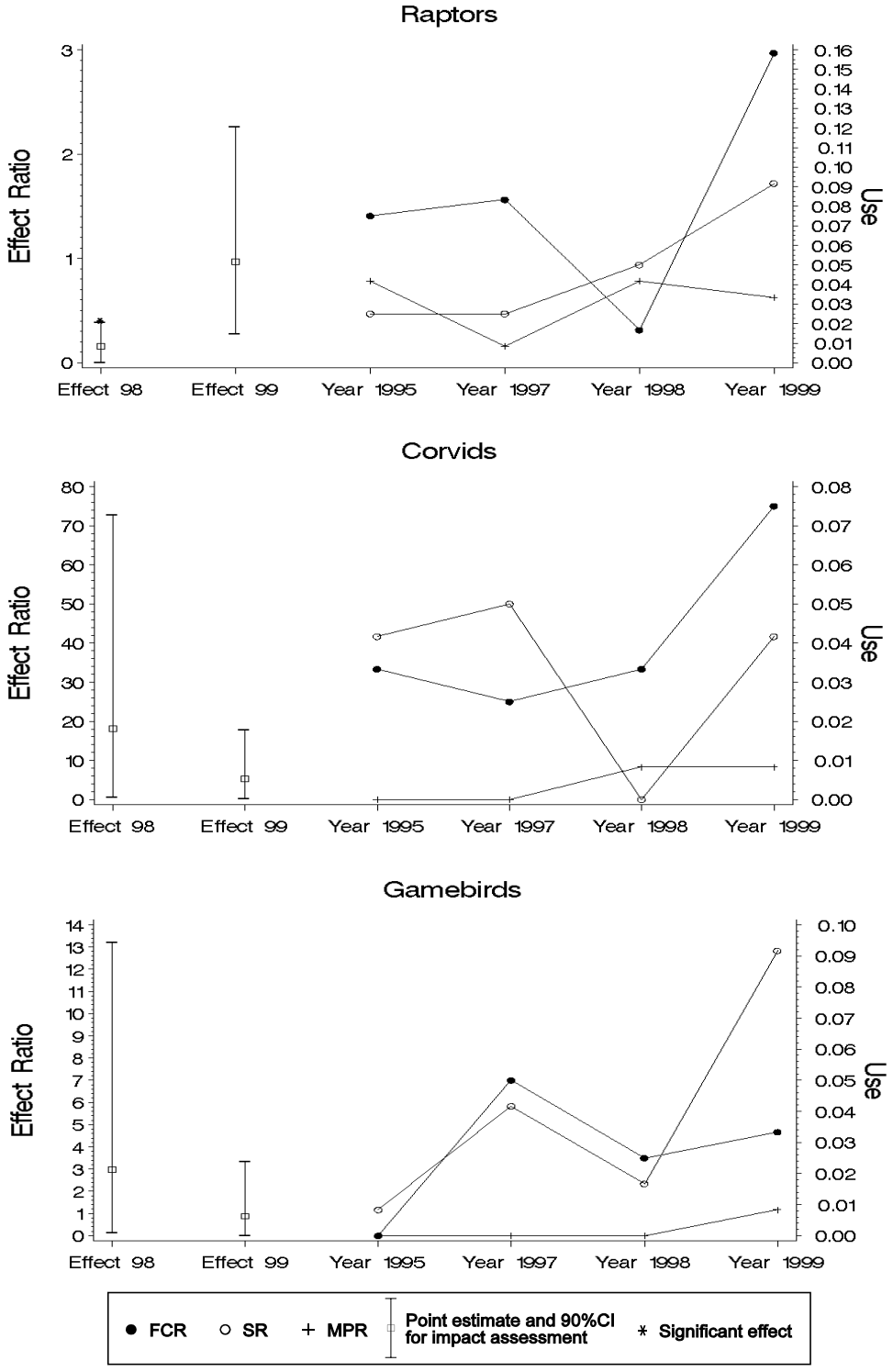


Figure 21. Relative avian diversity and construction/turbine effect estimates with 90% confidence intervals based on PSB survey data.

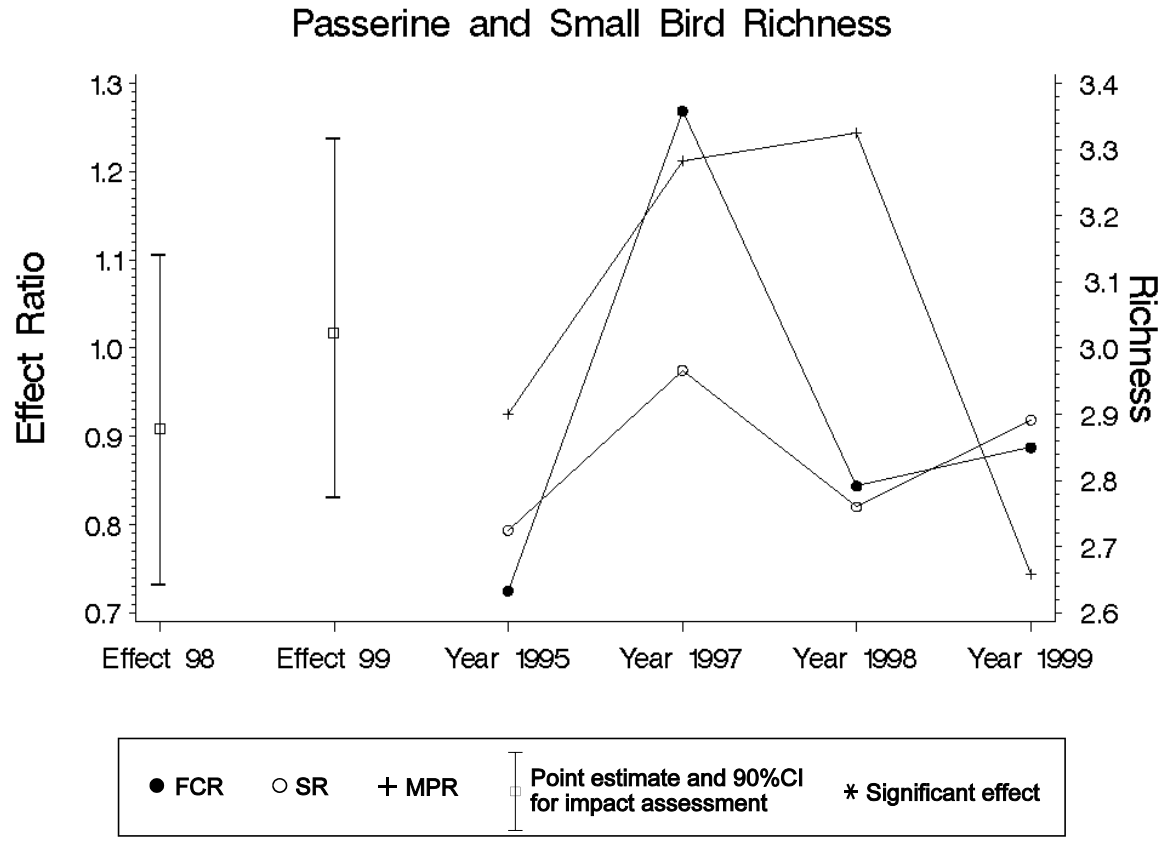


Figure 22. Spatial use of Foote Creek Rim by raptors observed during RLB survyes.

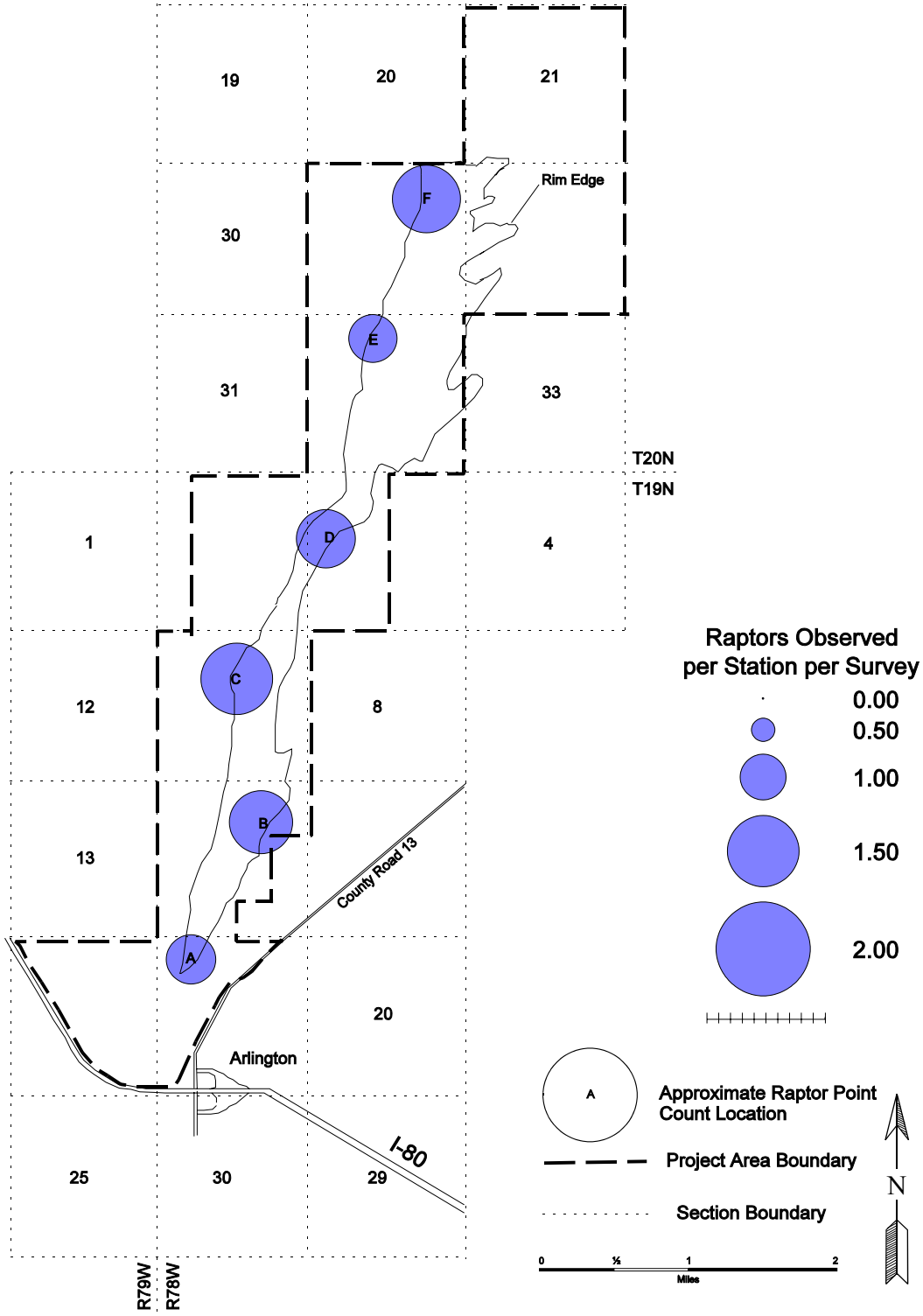


Figure 23. Location of Foote Creek Rim RLB observations circles and associated strata used to characterize spatial use of Foote Creek Rim by raptors in relation to the rim edge.

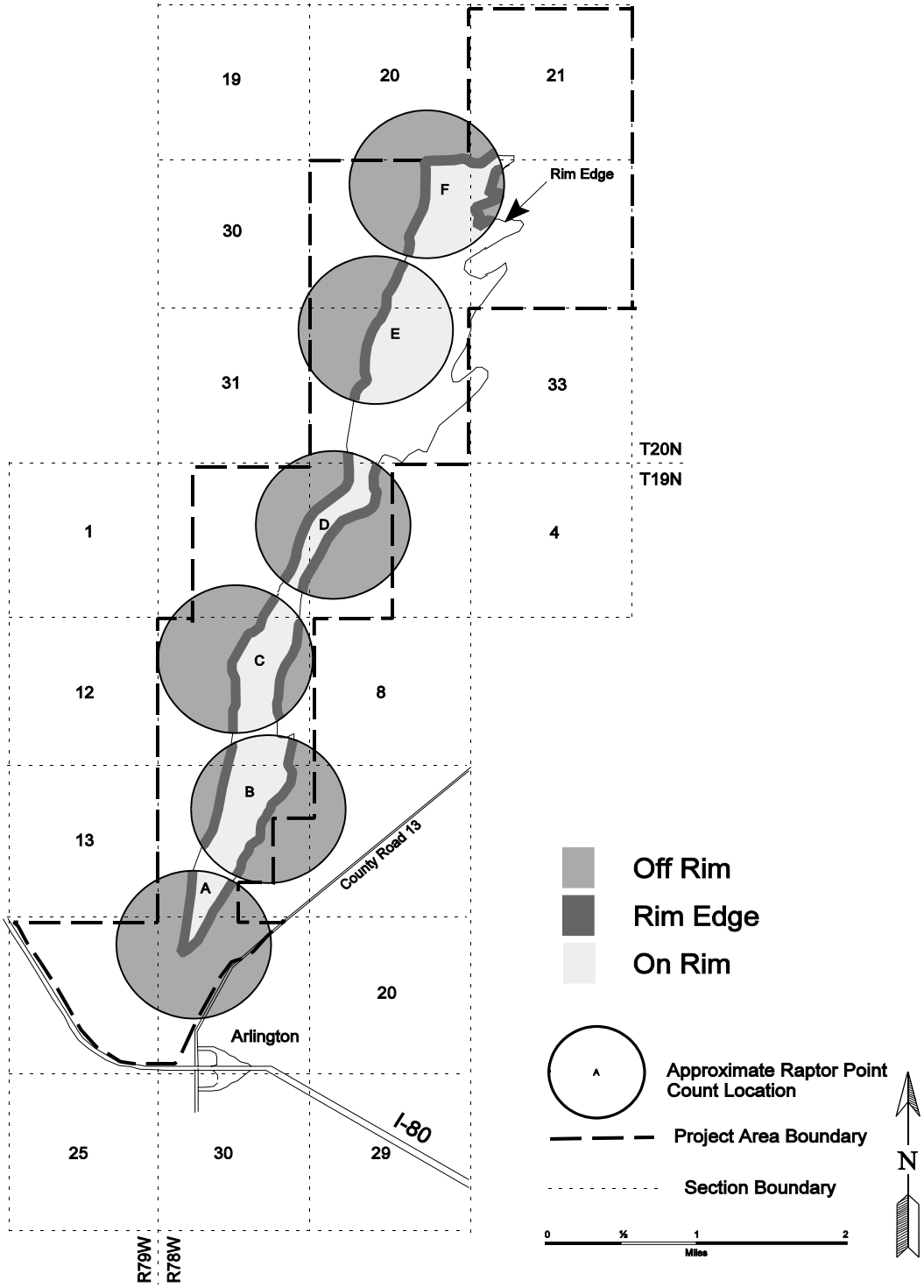
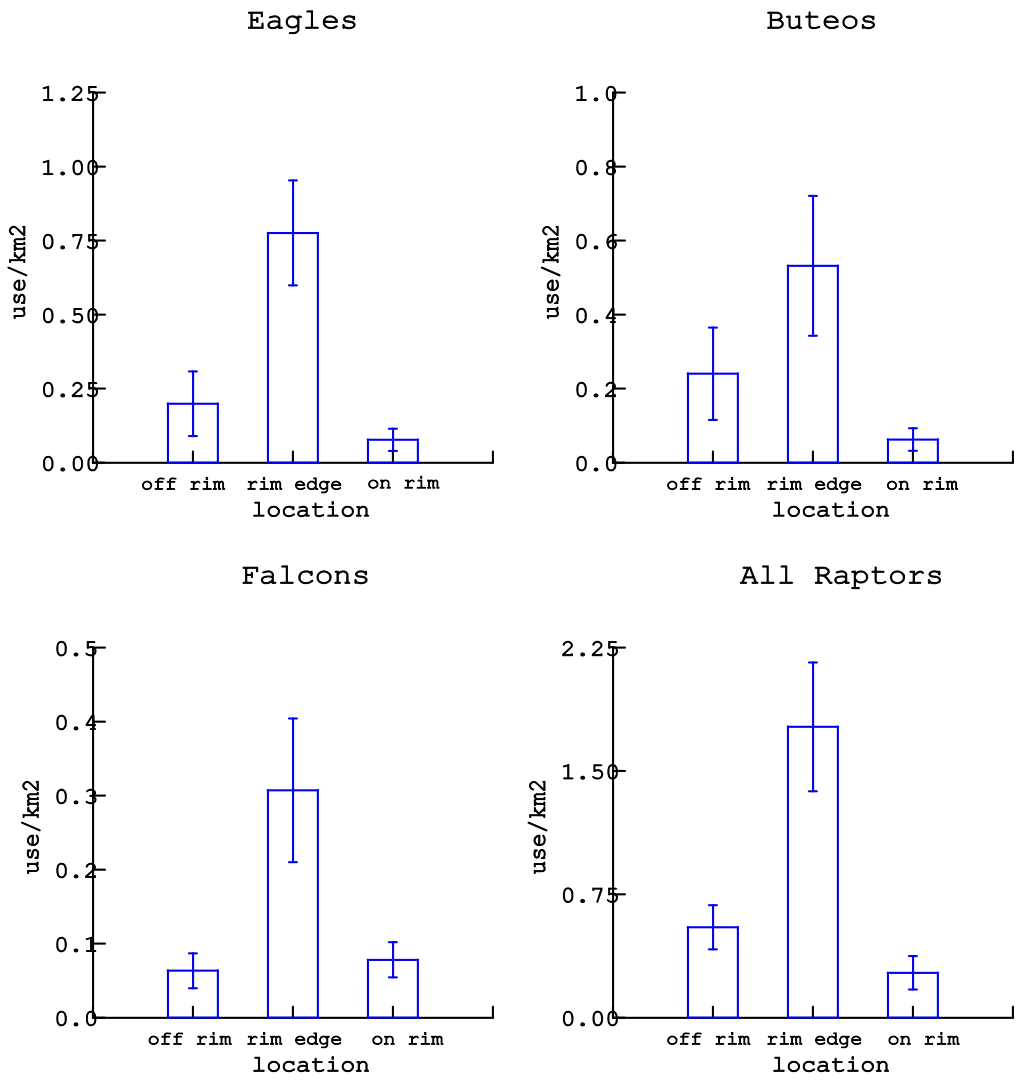
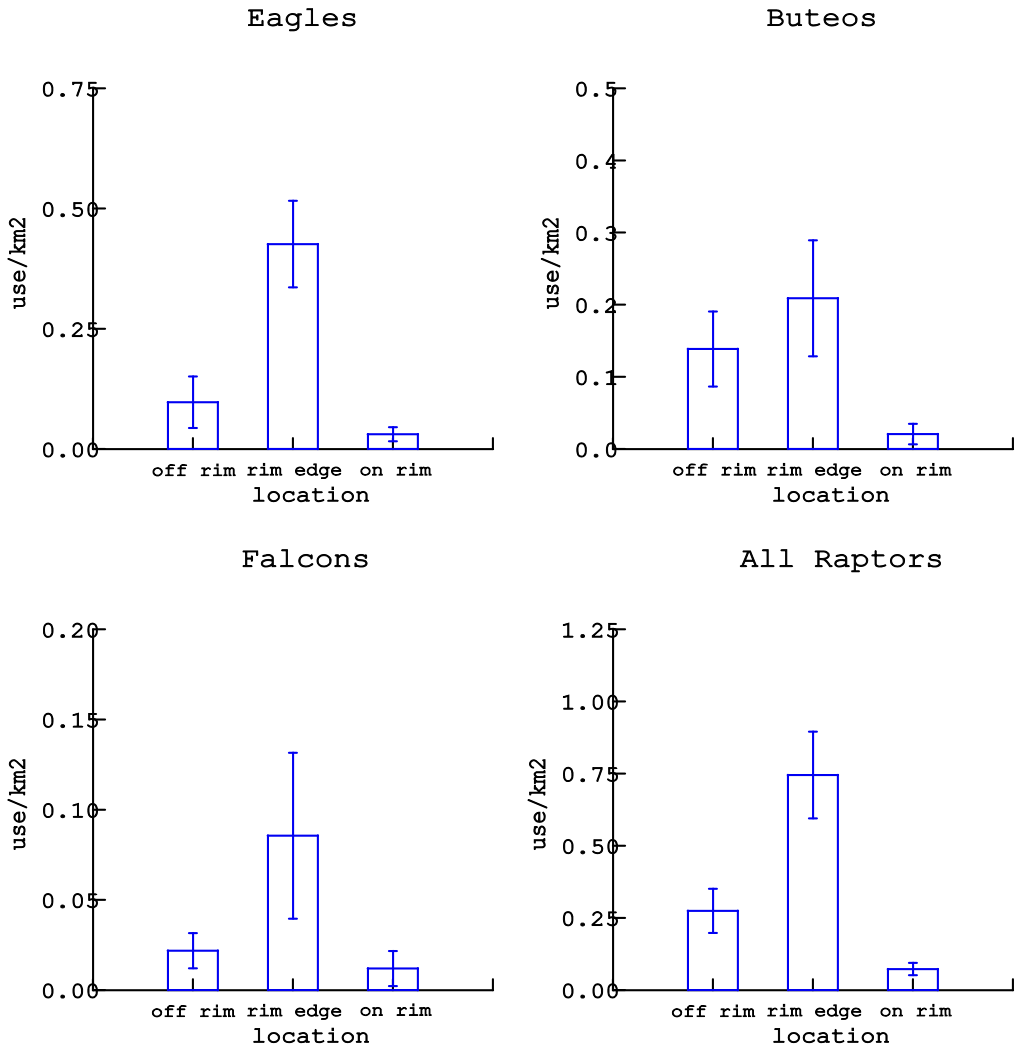


Figure 24. Spatial use of Foote Creek Rim by raptors in relation to the rim edge[1].



[1] Rim edge is defined as the area within 50 m of the edge of the rim; off rim is defined as those areas > 50 m away from the rim edge; and on rim is defined as those areas on top of (over) Foote Creek Rim but > 50 m away from the rim edge. Lines associated with each bar depict ± 2 standard errors.

Figure 25. Observations per square kilometer of raptors flying within the turbine rotor swept area (RSA) as a function of location on Foote Creek Rim.



[1] Rim edge is defined as the area within 50 m of the edge of the rim; off rim is defined as those areas > 50 m away from the rim edge; and on rim is defined as those areas on top of (over) Foote Creek Rim but > 50 m away from the rim edge. Lines associated with each bar depict ± 2 standard errors.

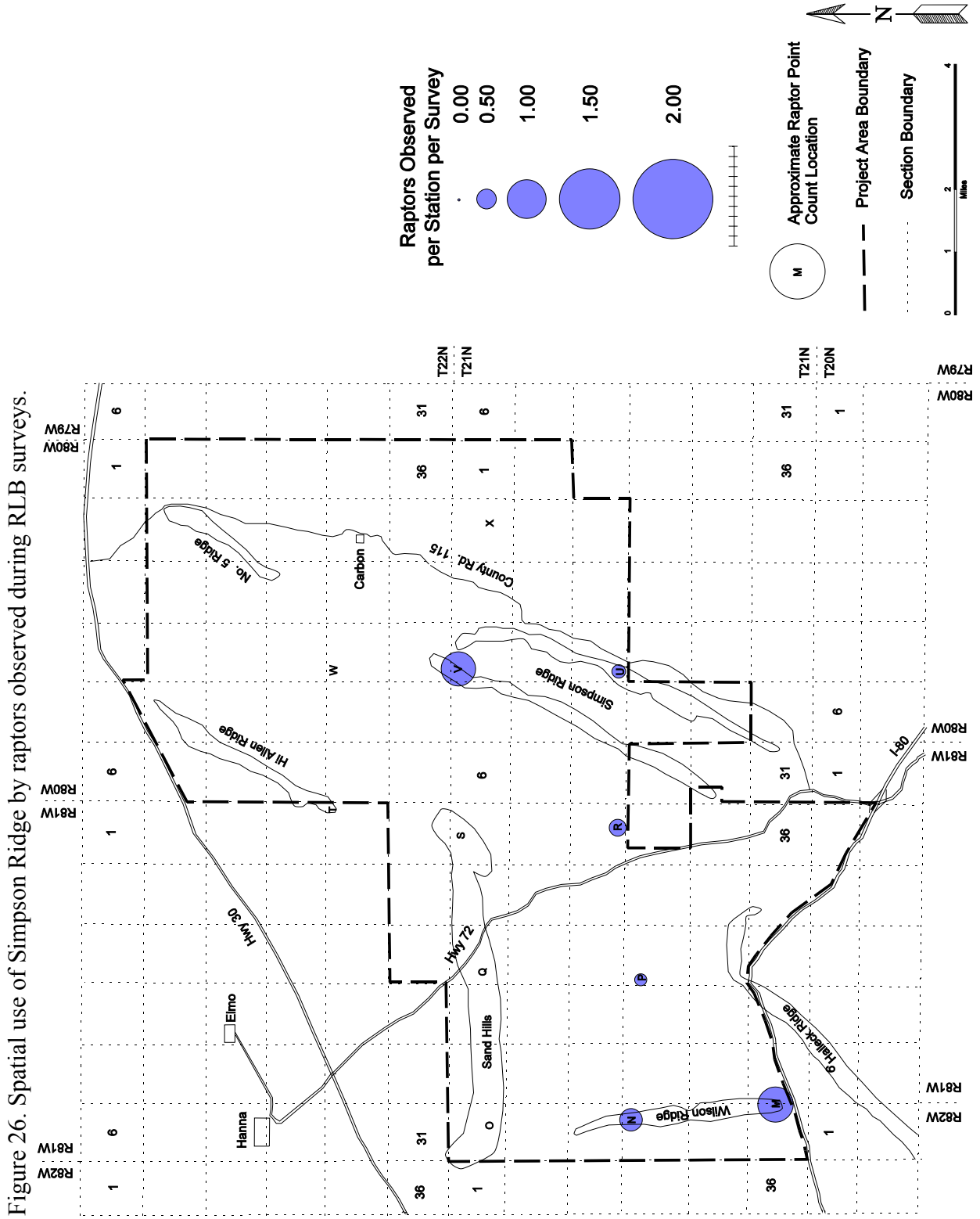
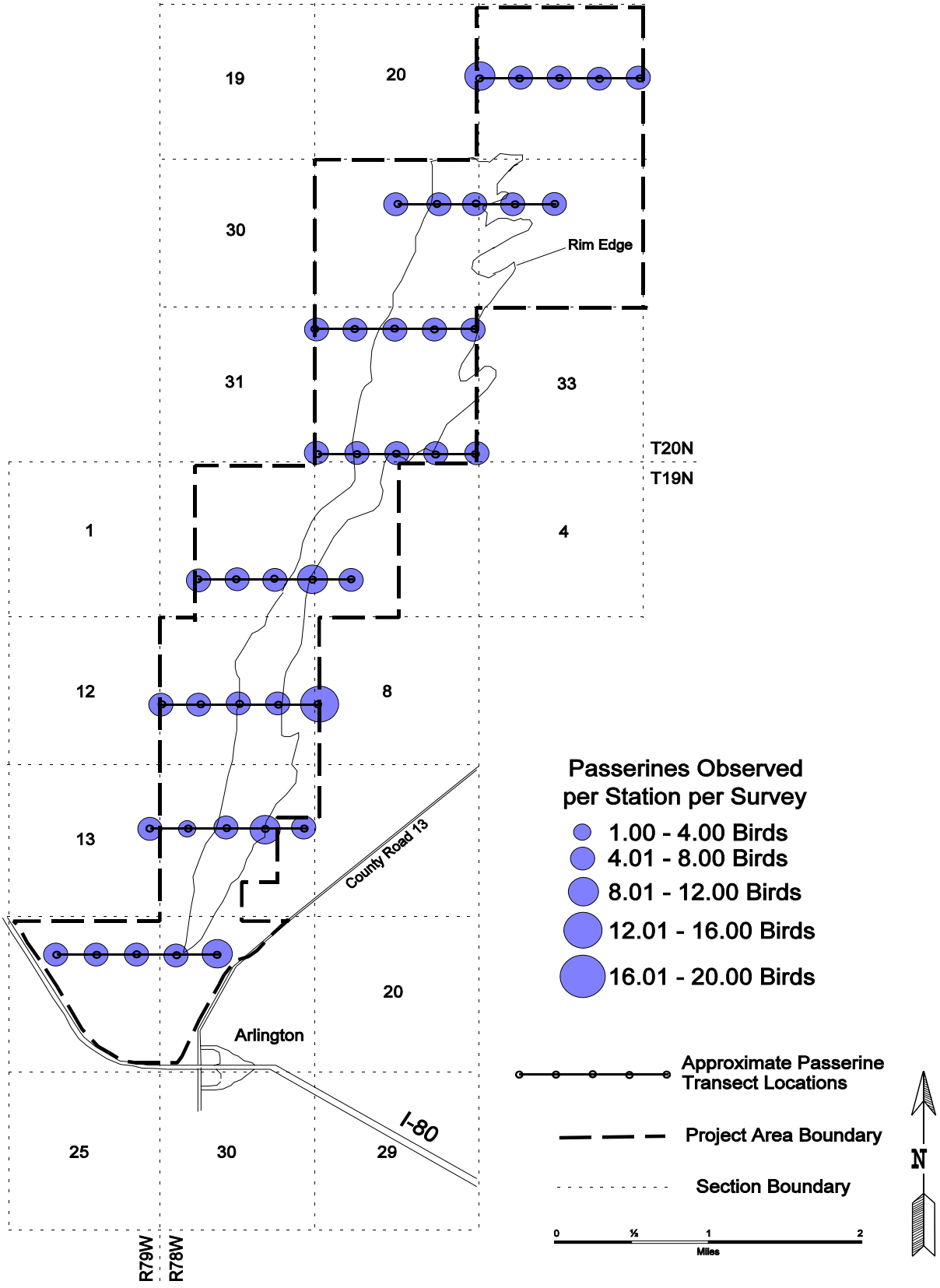


Figure 26. Spatial use of Simpson Ridge by raptors observed during RLB surveys.

Figure 27. Spatial use of Foote Creek Rim by passerines observed during PSB surveys.



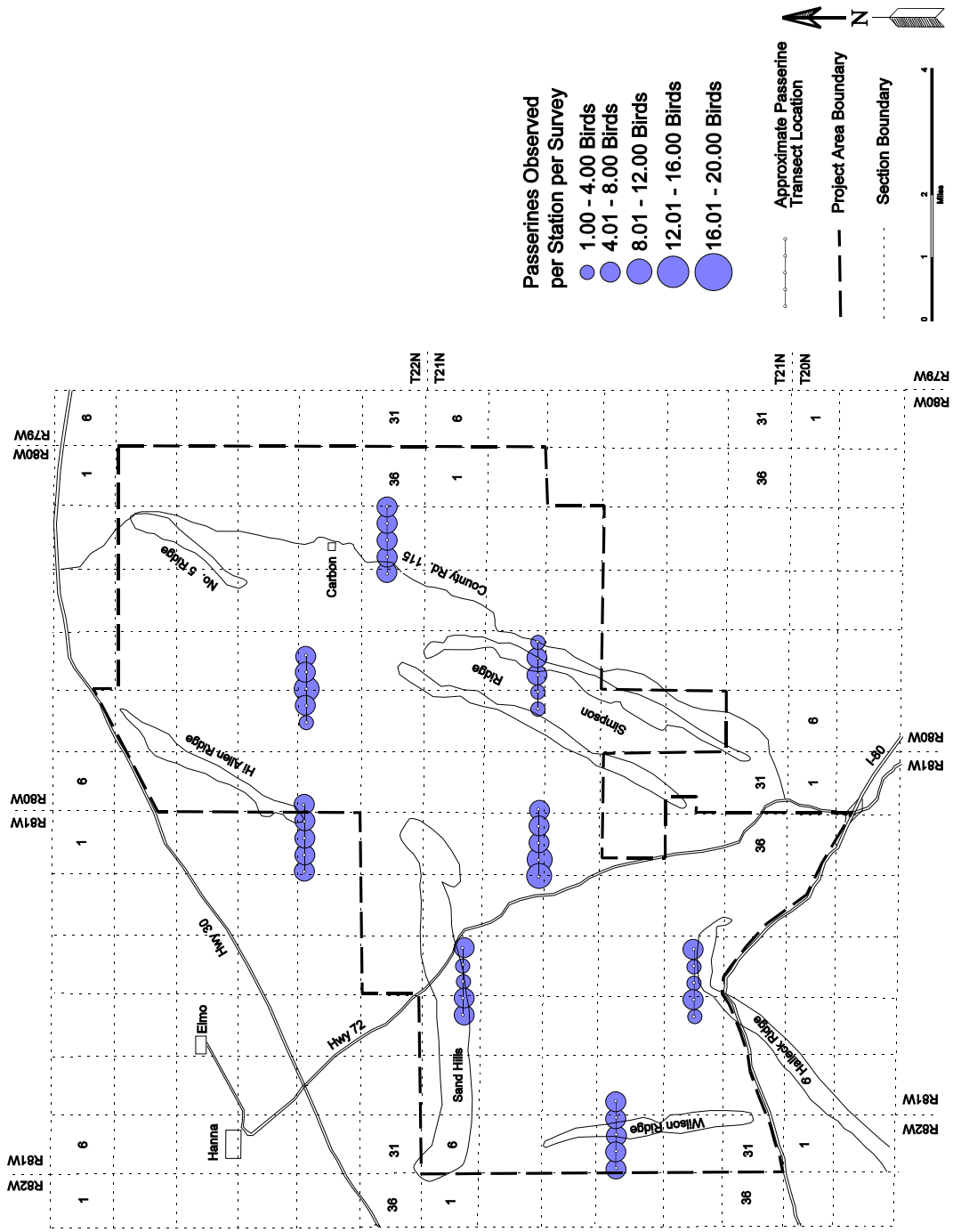


Figure 28. Spatial use of Simpson Ridge by passerines observed during PSB surveys.

Figure 29. Number of raptor nests by year and study area.

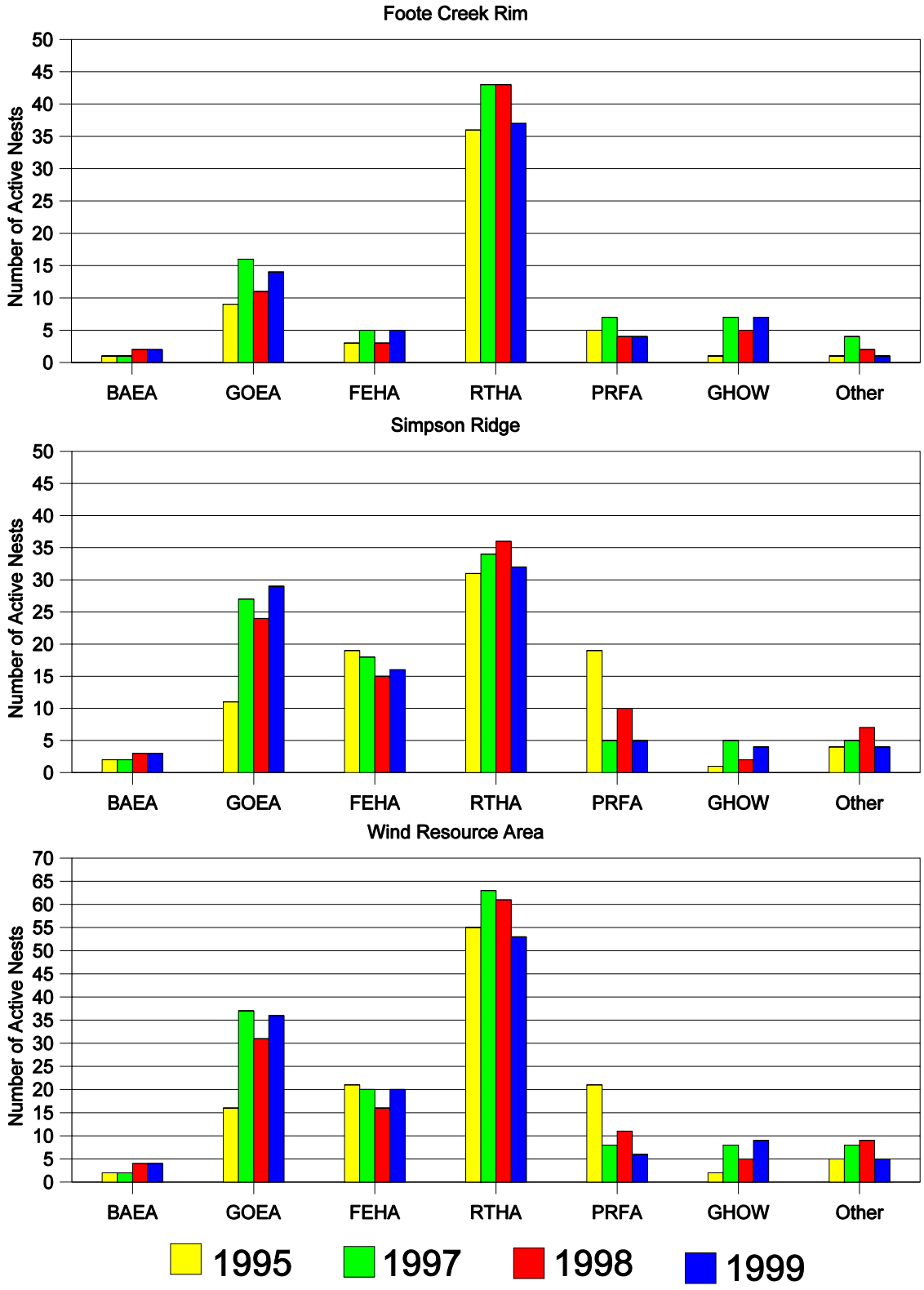


Figure 29 (continued). Number of raptor nests by year and study area.

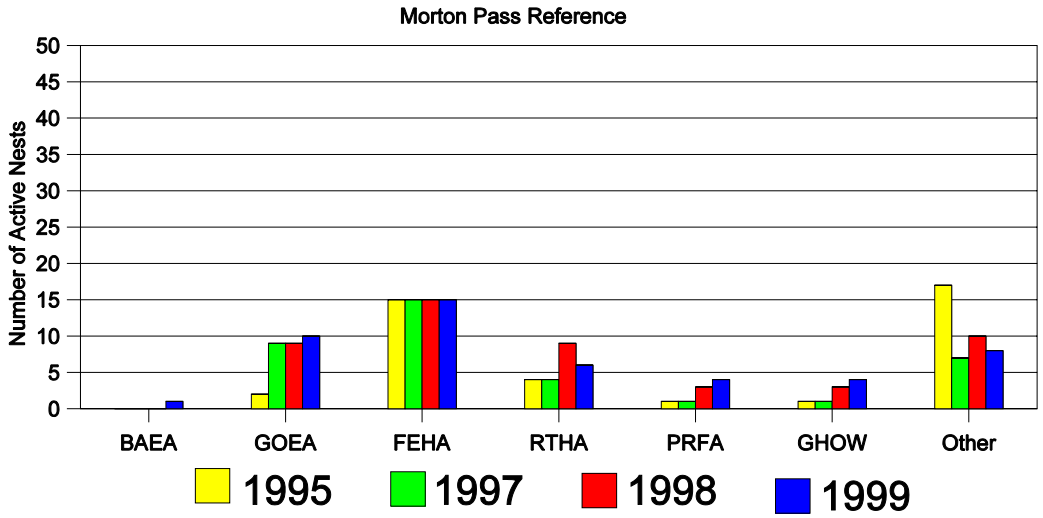
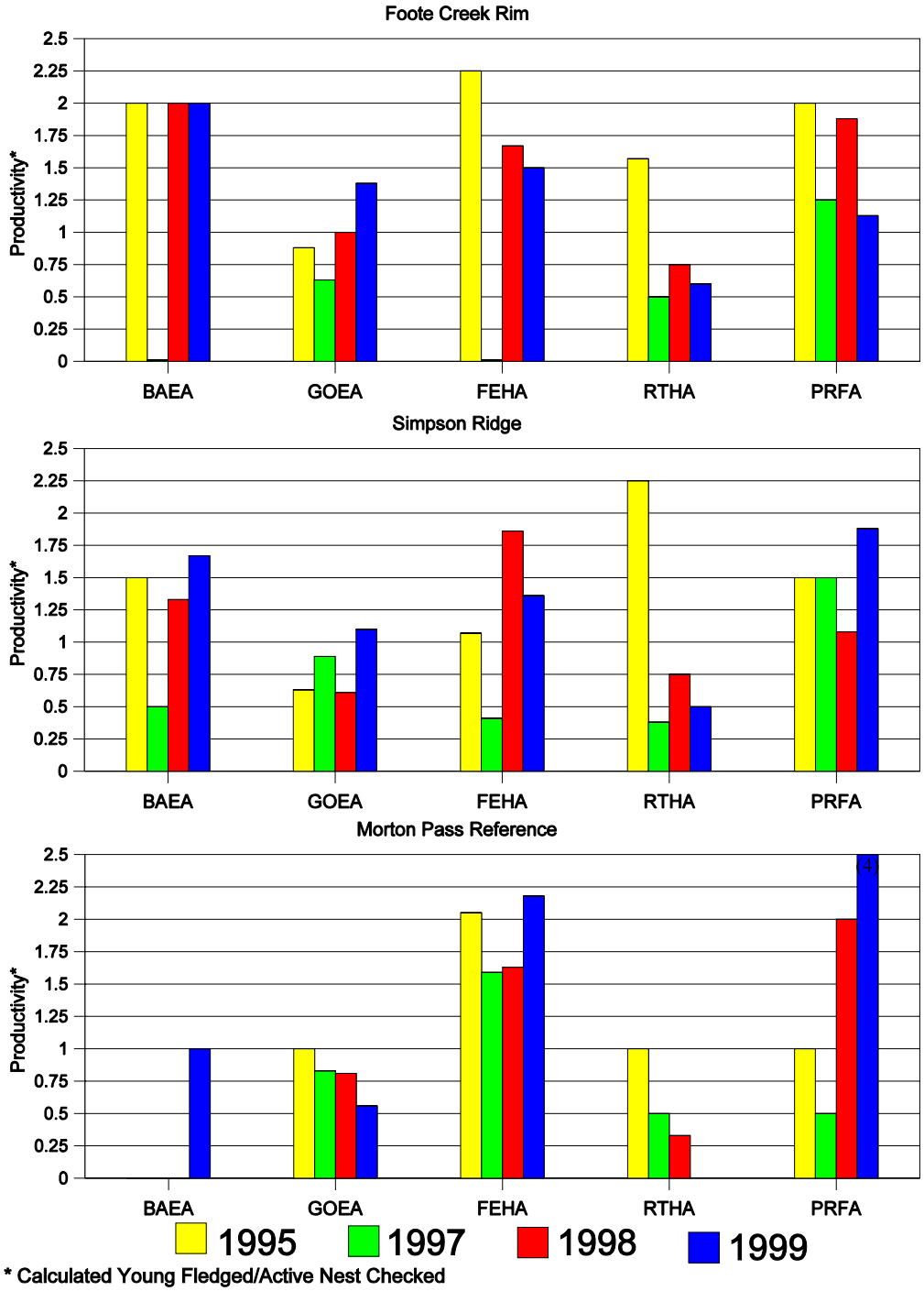


Figure 30. Calculated number of young fledged per active nest checked.



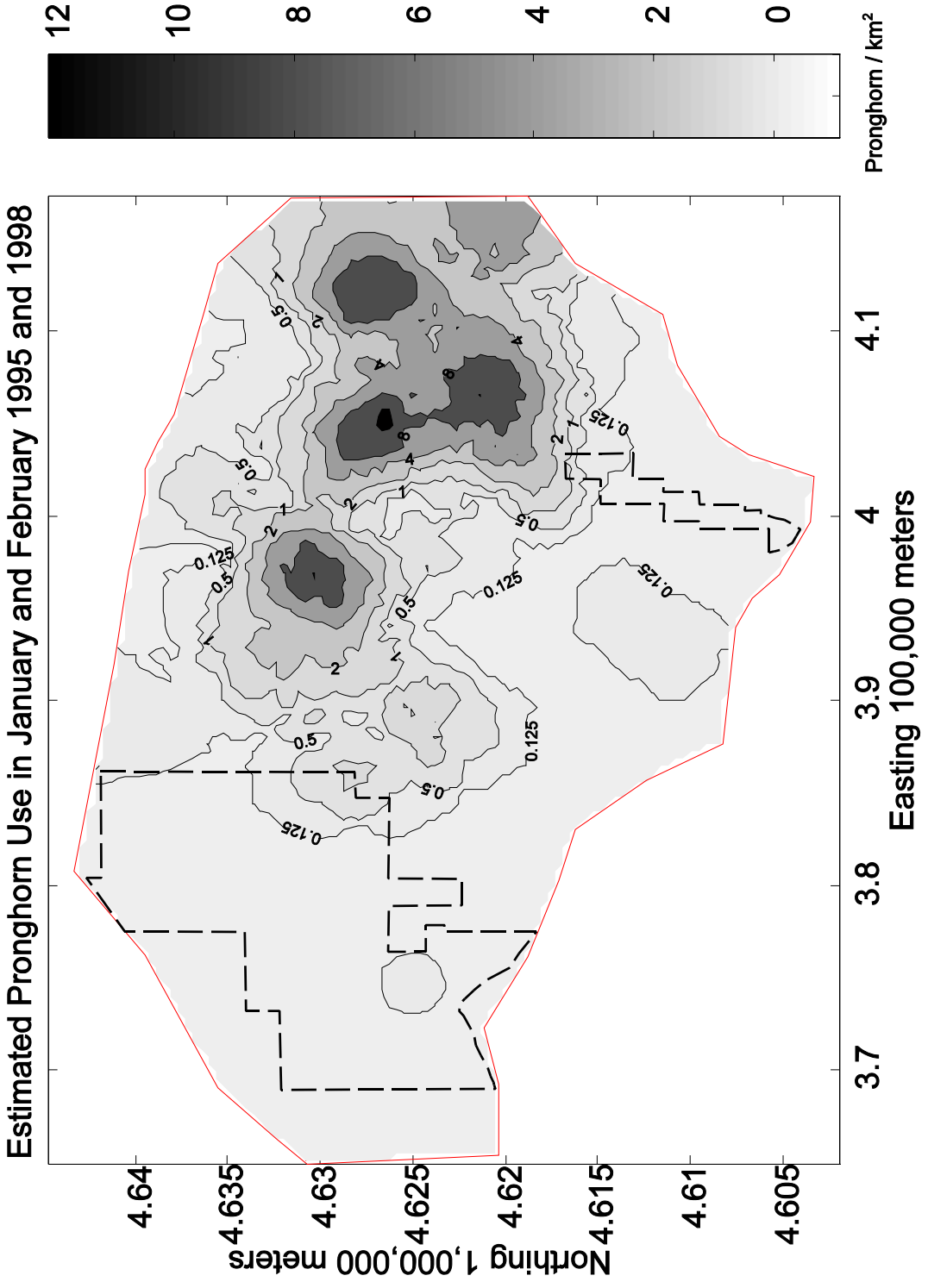


Figure 31. Estimated pronghorn use by season in the Simpson Ridge/Foote Creek Rim survey area.

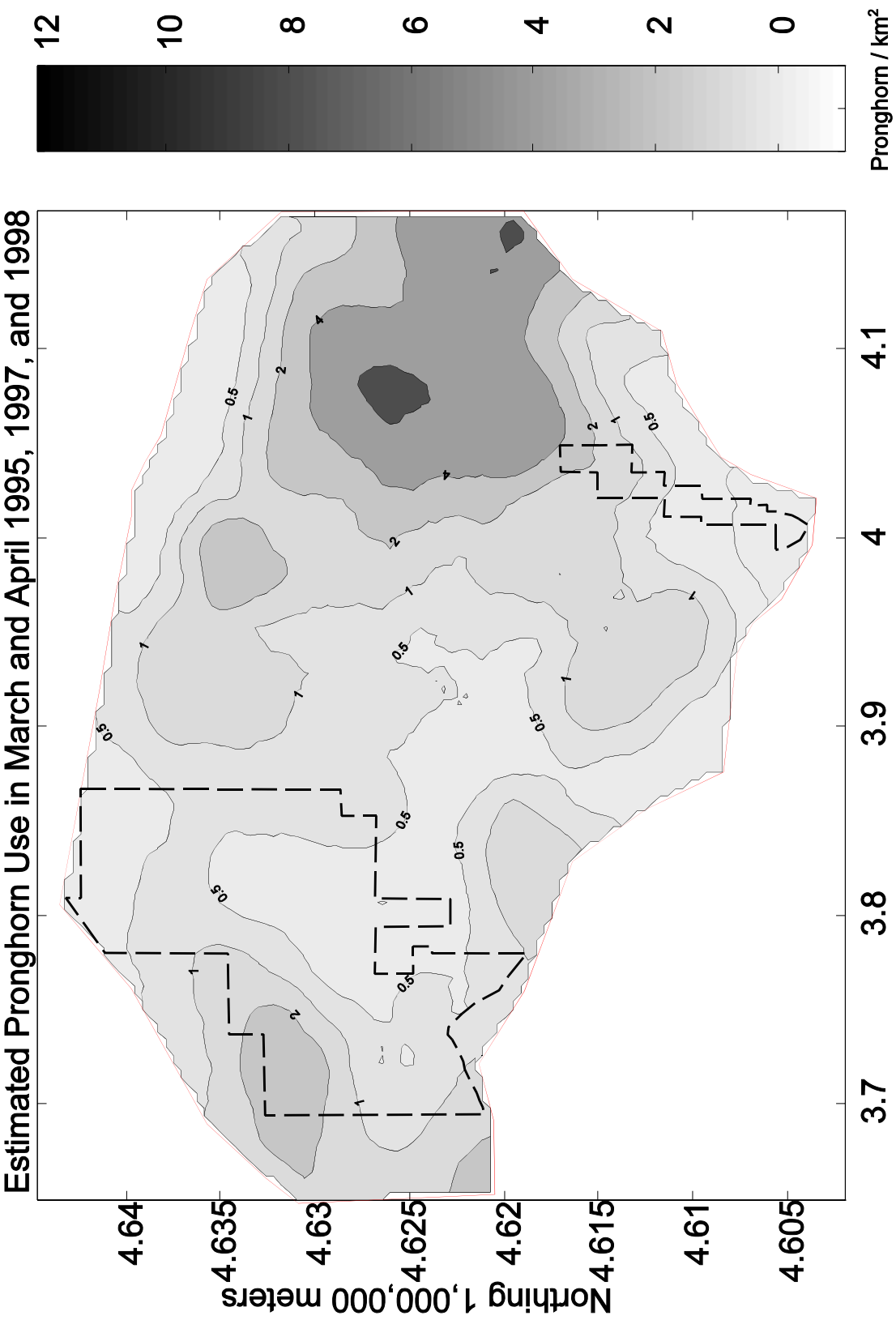


Figure 31 (continued). Estimated pronghorn use by season in the Simpson Ridge/Foote Creek Rim survey area.

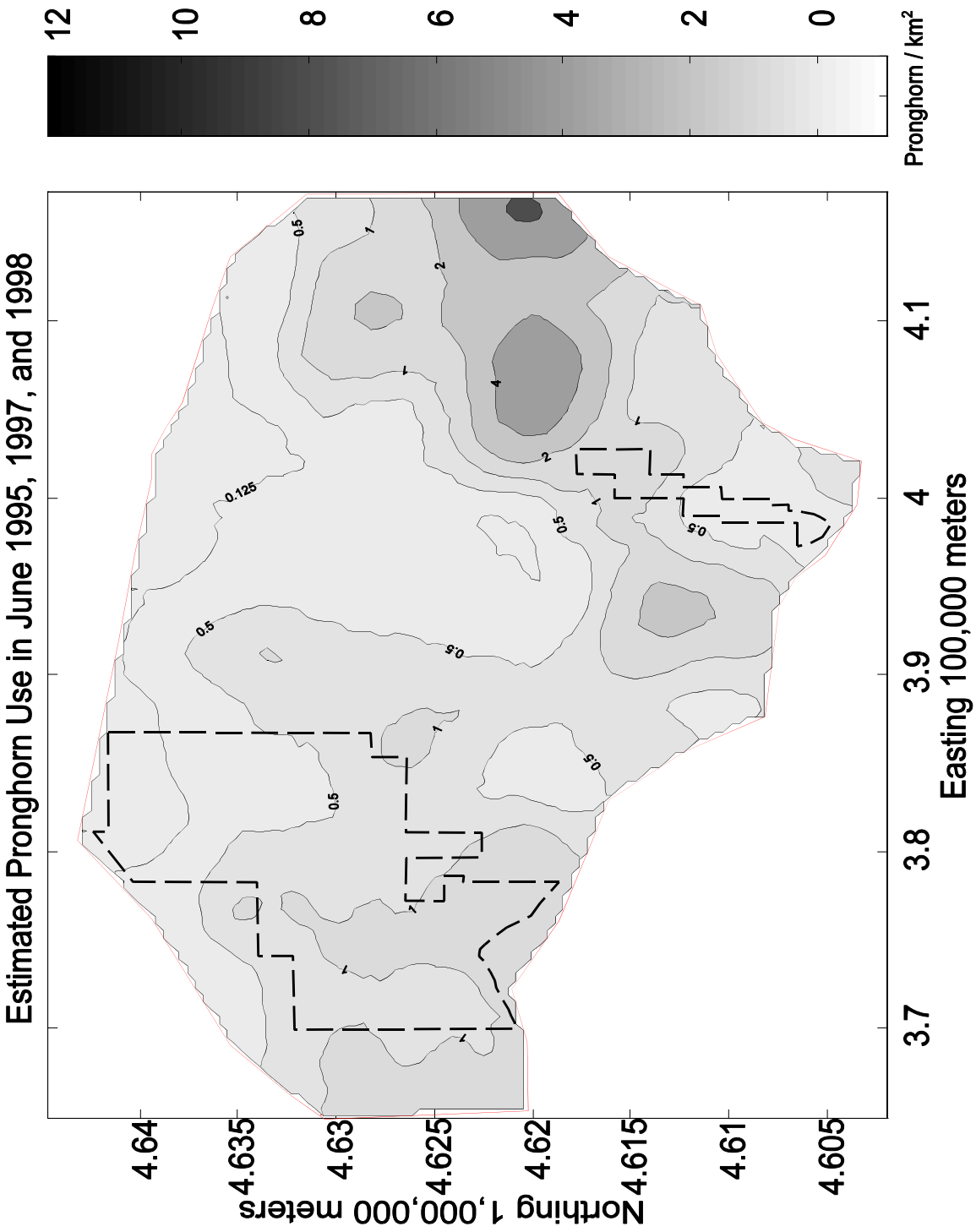


Figure 31 (continued). Estimated pronghorn use by season in the Simpson Ridge/Foote Creek Rim survey area.

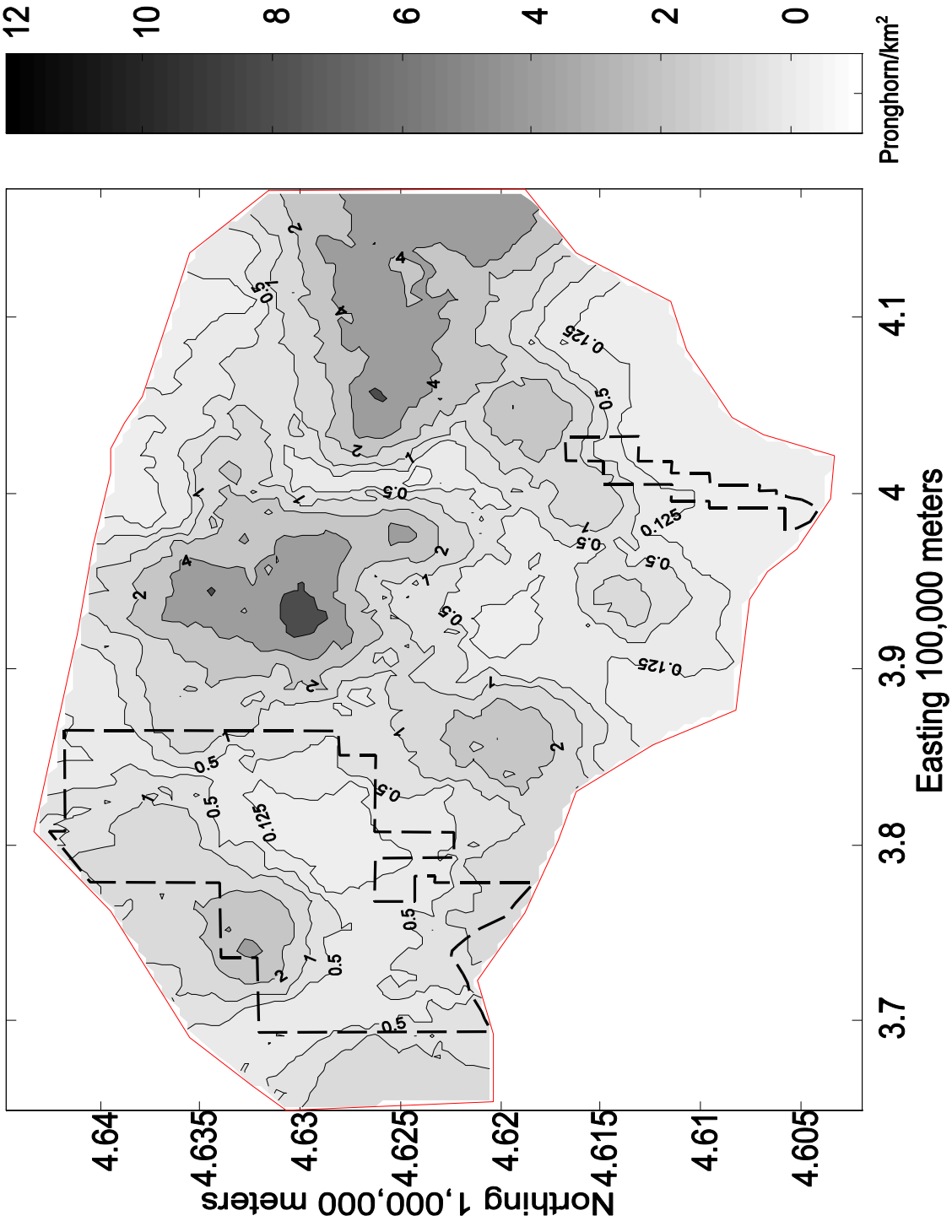


Figure 31 (continued). Estimated pronghorn use by season in the Simpson Ridge/Foote Creek Rim survey area.

Figure 32. Spatial use of Foote Creek Rim by mountain plovers.

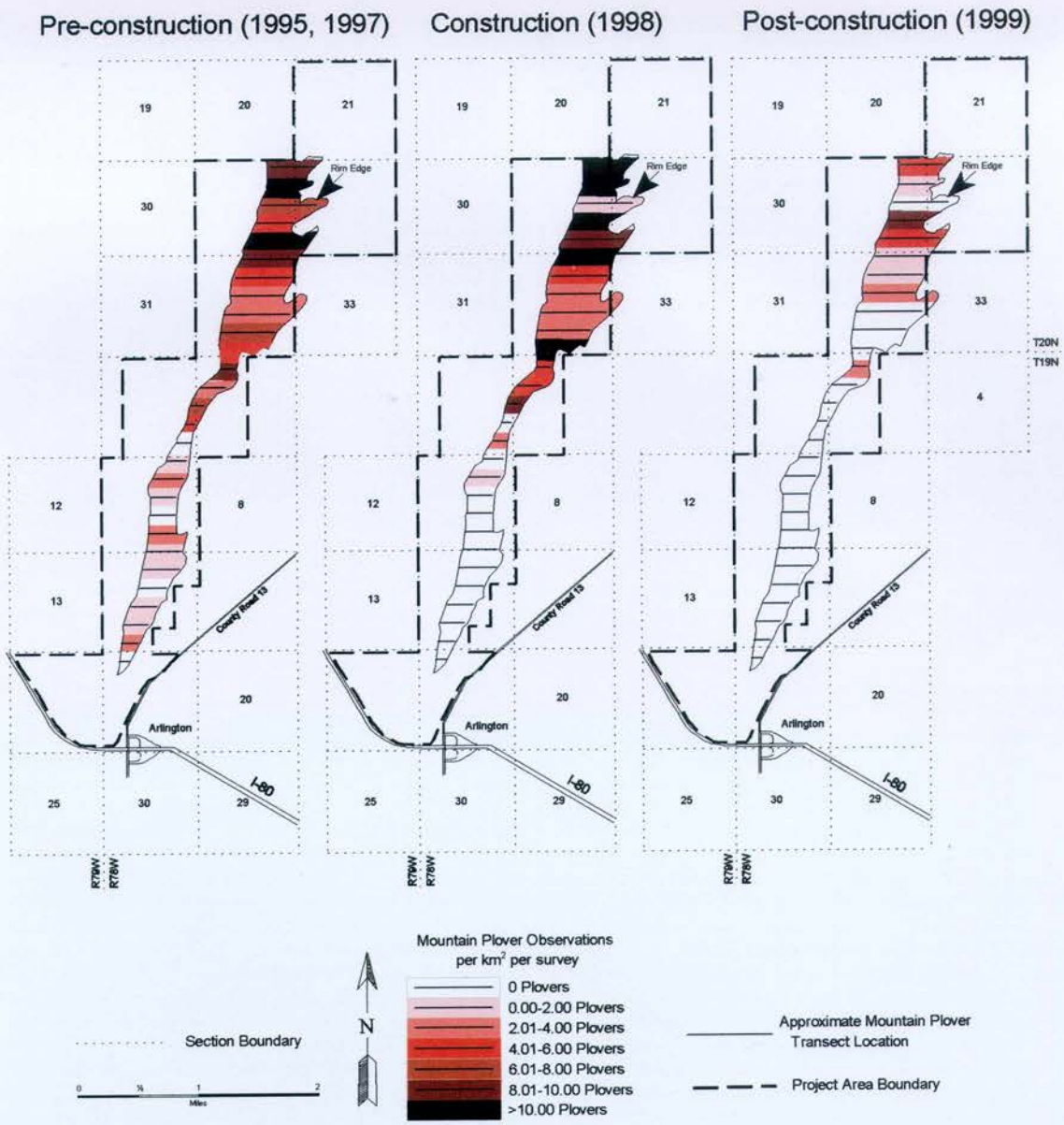
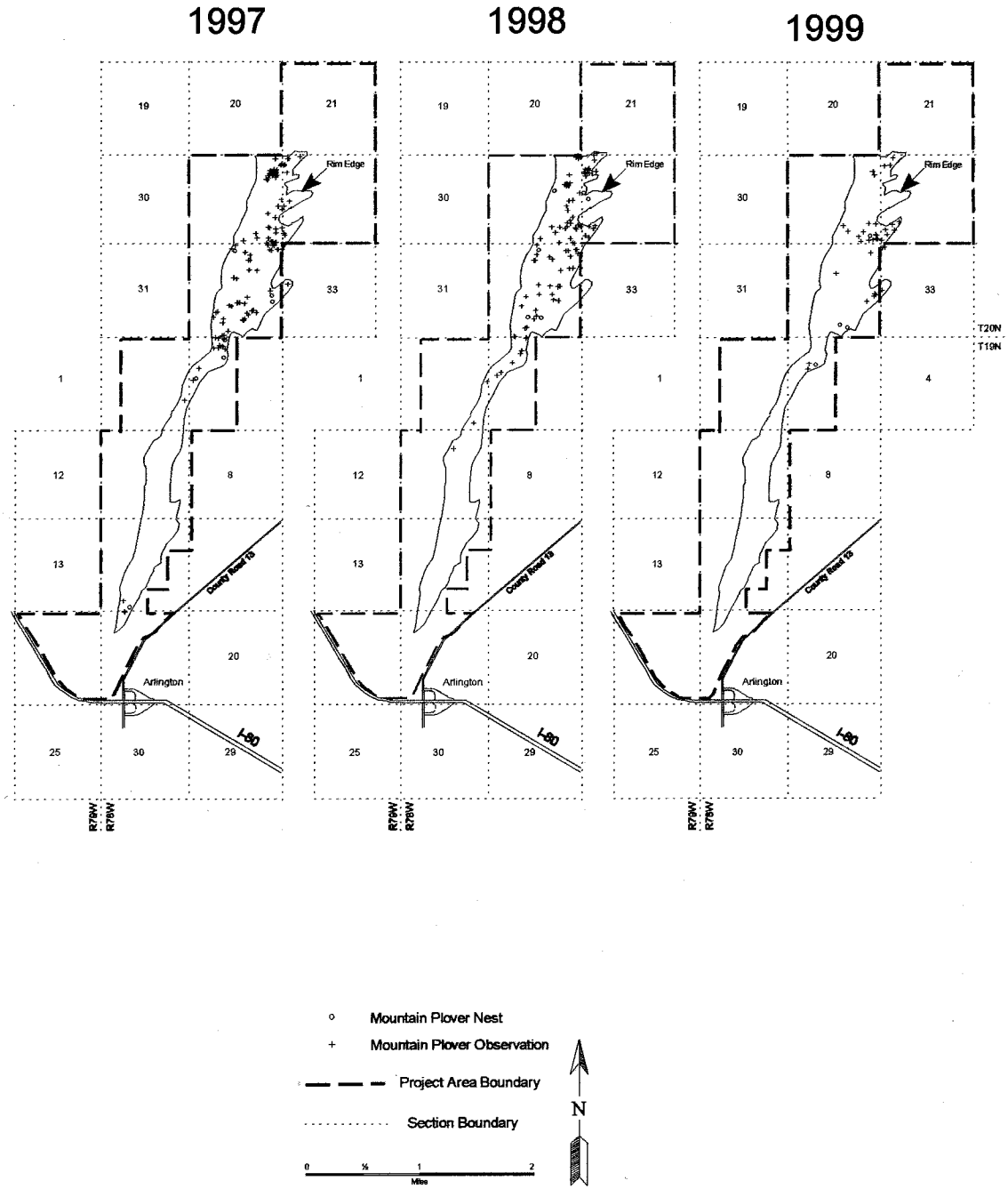


Figure 33. Individual mountain plover observations on Foote Creek Rim.



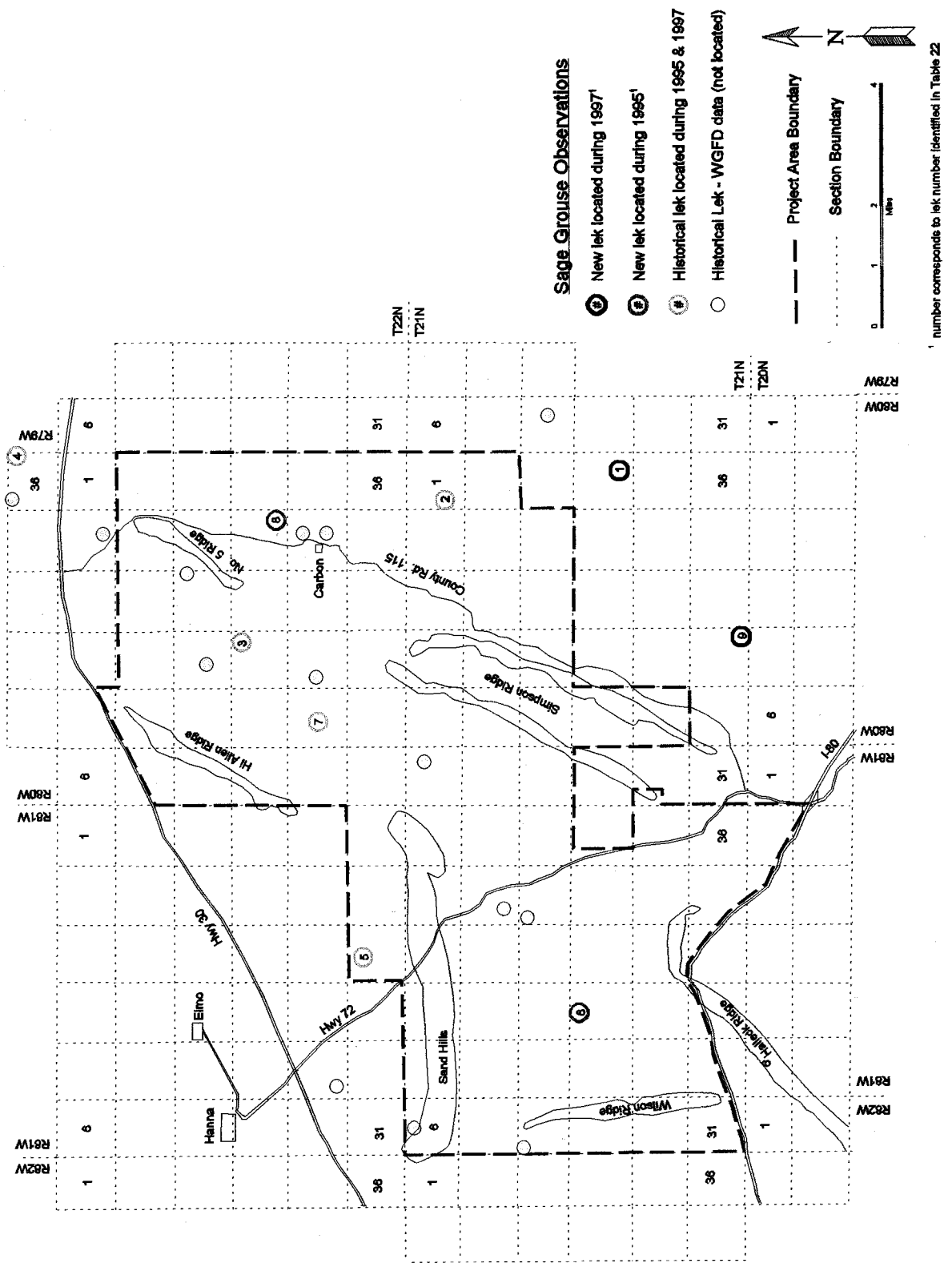


Figure 34. Distribution of sage grouse leks on Simpson Ridge.

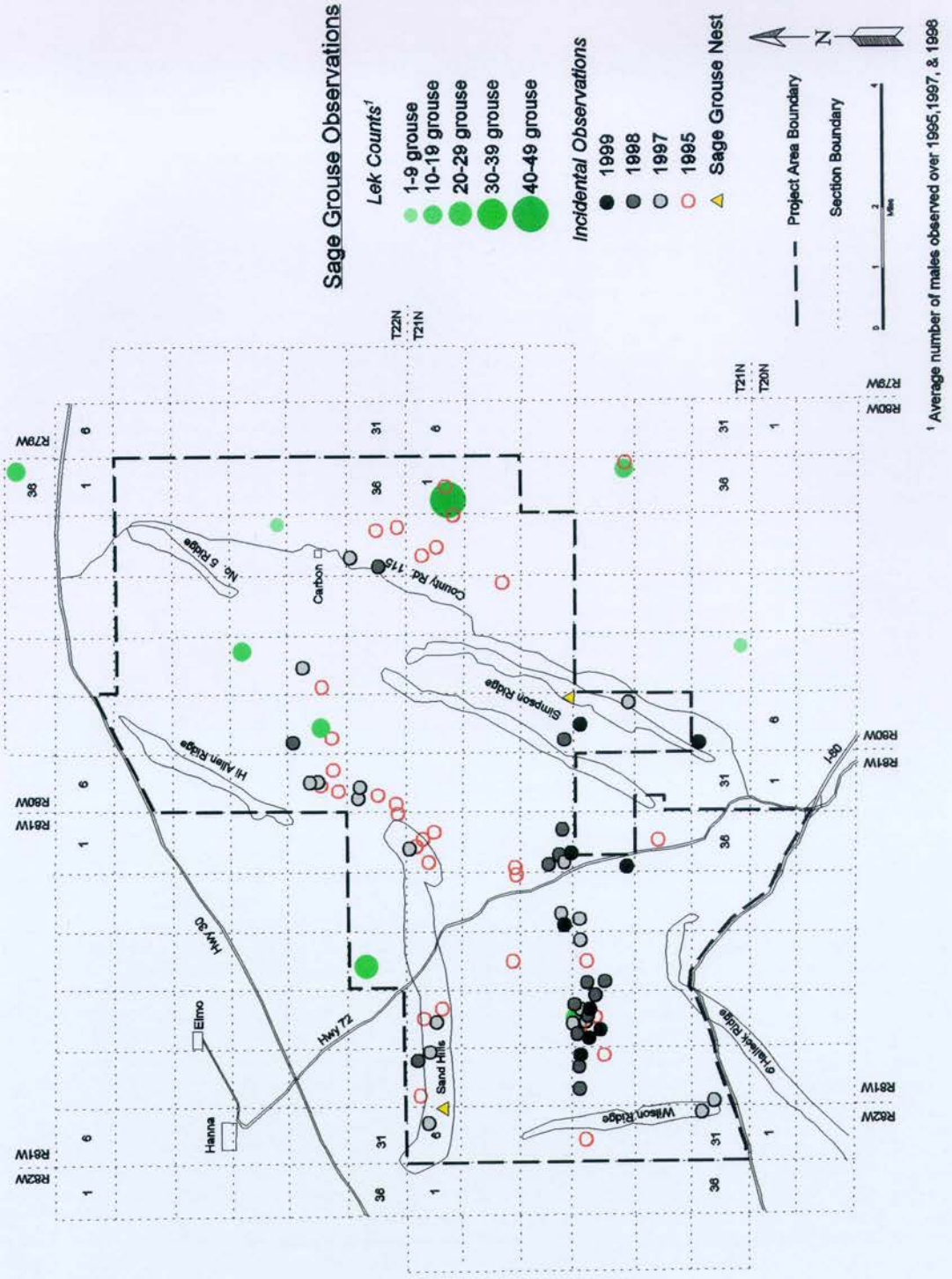
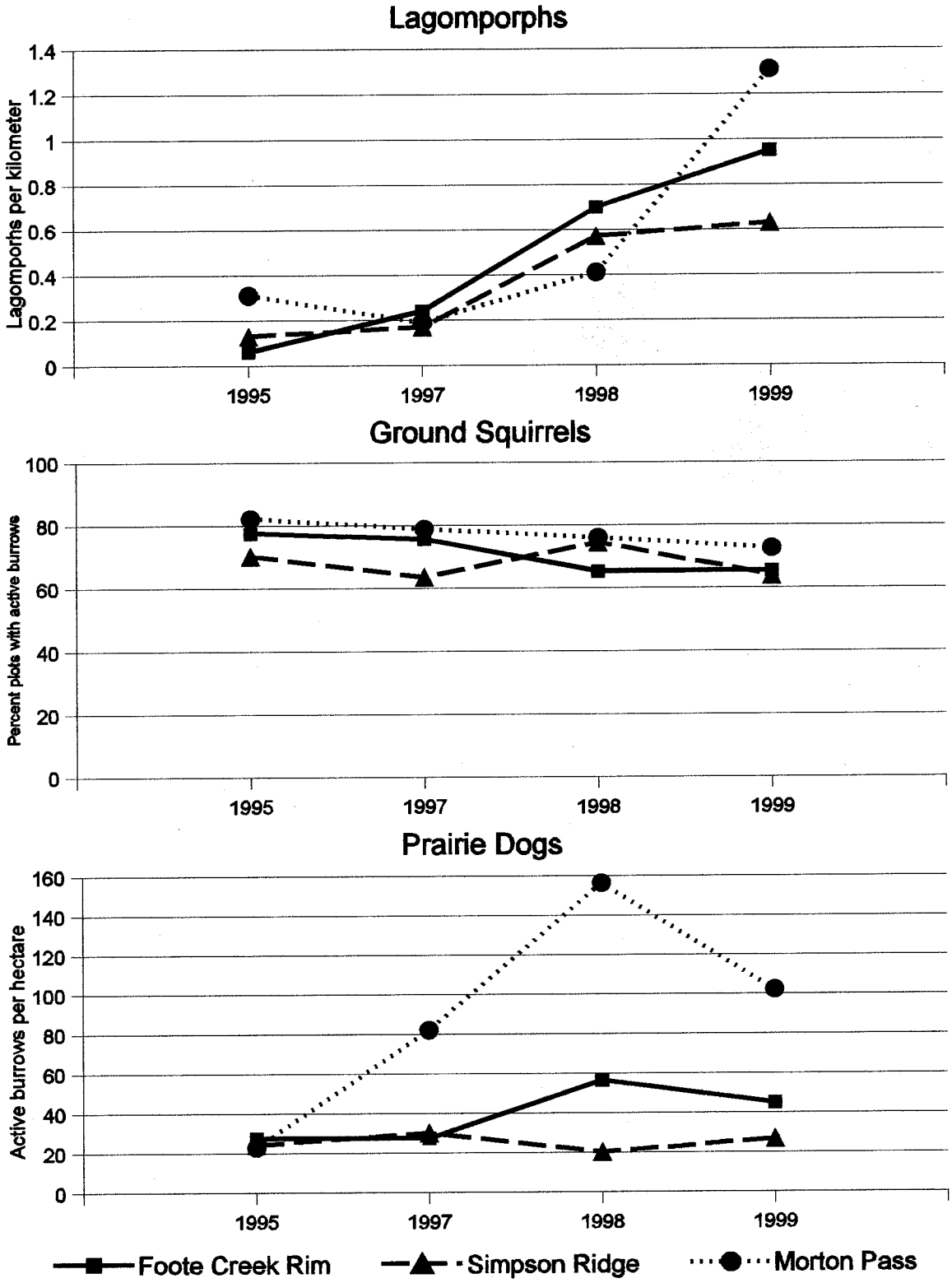


Figure 35. Spatial use of Simpson Ridge by sage grouse.

Figure 36. Prey availability by year and study area.



Appendix A. List of birds recorded during avian surveys and general wildlife observations on Foote Creek Rim, Simpson Ridge, and the Morton Pass Reference Area, 1995-1999.

Common Name	Scientific Name
Pied-billed Grebe	*Podilymbus podiceps*
Eared Grebe	*Podiceps nigricollis*
Western Grebe	*Aechmophorus occidentalis*
American White Pelican	*Pelicanus erythrorhynchos*
Double-crested Cormorant	*Phalacrocorax auritus*
Great Blue Heron	*Ardea herodias*
Turkey Vulture	*Cathartes aura*
Snow Goose	*Chen caurelescens*
Canada Goose	*Branta canadensis*
Gadwall	*Anas strepera*
American Wigeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya vallisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Lesser Scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
Common Merganser	*Mergus merganser*
Ruddy Duck	*Oxyura jamaicensis*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperi*
Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
Rough-legged Hawk	*Buteo lagopus*
Golden Eagle	*Aquila chrysaetos*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Prairie Falcon	*Falco mexicanus*
Sage Grouse	*Centrocercus urophasianus*
Blue Grouse	*Dendragopus obscurus*
Chukar	*Alectoris chukar*
Gray Partridge	*Perdix perdix*
Sandhill Crane	*Grus canadensis*
American Coot	*Fulica americana*

Appendix A (Continued). List of birds recorded during avian surveys on Foote Creek Rim, Simpson Ridge, and the Morton Pass Reference Area, 1995-1999.

Common Name	Scientific Name
Killdeer	*Charadrius vociferus*
Mountain Plover	*Charadrius montanus*
American Avocet	*Recurvirostra americana*
Marbled Godwit	*Limosa fedoa*
Long-billed Curlew	*Numenius americanus*
Common Snipe	*Gallinago gallinago*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Franklin's Gull	*Larus pipixcan*
California Gull	*Larus californicus*
Ring-billed Gull	*Larus delawarensis*
Caspian Tern	*Sterna caspia*
Mourning Dove	*Zenaida macroura*
Great Horned Owl	*Bubo virginianus*
Long-eared Owl	*Asio otus*
Burrowing Owl	*Athene cunicularia*
Common Nighthawk	*Chordeiles minor*
Common Poorwill	*Phalaenoptilus nuttallii*
White-throated Swift	*Aeronautes saxatalis*
Broad-tailed Hummingbird	*Selasphorus platycercus*
Rufous Hummingbird	*Selasphorus rufus*
Belted Kingfisher	*Ceryle alcyon*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-naped Sapsucker	*Sphyrapicus nuchalis*
Northern Flicker	*Colaptes auratus*
Olive-sided Flycatcher	*Contopus borealis*
Western Wood Pewee	*Contopus sordidulus*
Dusky Flycatcher	*Empidonax oberholseri*
Cordilleran Flycatcher	*Empidonax occidentalis*
Say's Phoebe	*Sayornis saya*
Western Kingbird	*Tyrannus verticalis*
Eastern Kingbird	*Tyrannus tyrannus*
Loggerhead Shrike	*Lanius ludovicianus*
Warbling Vireo	*Vireo gilvus*
Pinyon Jay	*Gymnorhinus cyanocephalus*
Blue Jay	*Cyanocitta cristata*
Clark's Nutcracker	*Nucifraga columbiana*
Black-billed Magpie	*Pica pica*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*

Appendix A (Continued). List of birds recorded during avian surveys on Foote Creek Rim, Simpson Ridge, and the Morton Pass Reference Area, 1995-1999.

Common Name	Scientific Name
Cliff Swallow	*Hirundo pyrrhonota*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee	*Poecile atricapillus*
Brown Creeper	*Certhia americana*
Rock Wren	*Salpinctes obsoletus*
House Wren	*Troglodytes aedon*
Ruby-crowned Kinglet	*Regulus calendula*
Mountain Bluebird	*Siala curricoides*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Gray Catbird	*Dumetella carolinensis*
Northern Mockingbird	*Mimus polyglottos*
Sage Thrasher	*Oreoscoptes montanus*
Brown Thrasher	*Toxostoma rufum*
American Pipit	*Anthus spinoletta*
European Starling	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*
Orange-crowned Warbler	*Vermivora celata*
Townsend's Warbler	*Dendroica townsendii*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
McGillivray's Warbler	*Oporornis tolmei*
Wilson's Warbler	*Wilsonia pusilla*
Green-tailed Towhee	*Pipilo chlorurus*
Chipping Sparrow	*Spizella passerina*
Brewer's Sparrow	*Spizella breweri*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Lark Bunting	*Calamospiza melanocorys*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
Baird's Sparrow	*Ammodramus bairdii*
White-crowned Sparrow	*Zonotrichia leucophrys*
Dark-eyed Junco	*Junco hyemalis*
McCown's Longspur	*Calcarius mccownii*
Snow Bunting	*Plectrophenax nivalis*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Lazuli Bunting	*Passerina amoena*
Red-winged Blackbird	*Agelaius phoeniceus*
Western Meadowlark	*Sturnella neglecta*
Brewer's Blackbird	*Euphagus cyanocephalus*

Appendix A (Continued). List of birds recorded during avian surveys on Foote Creek Rim, Simpson Ridge, and the Morton Pass Reference Area, 1995-1999.

Common Name	Scientific Name
Western Tanager	*Piranga ludoviciana*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Gray-crowned Rosy Finch	*Leucosticte arctoa*
Pine Siskin	*Carduelis pinus*
American Goldfinch	*Carduelis tristis*
Evening Grosbeak	*Coccothraustes vespertinus*

Appendix B. Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

Foote Creek Rim

	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
American white pelican	0	0.029	0	0	0	1.2	0	0	0	0.9	0	0
Double-crested cormorant	0.010	0	0	0	0.7	0	0	0	0.3	0	0	0
Great blue heron	0.023	0.002	0	0	1.6	0.1	0	0	0.3	0.2	0	0
Canada goose	0.018	0.105	0.005	0	1.2	4.4	0.2	0	0.8	2.2	0.2	0
Mallard	0.055	0.094	0.008	0	3.6	3.9	0.3	0	1.7	4.6	0.5	0
Gadwall	0	0.005	0	0	0	0.2	0	0	0	0.3	0	0
American wigeon	0	0.015	0	0	0	0.6	0	0	0	0.8	0	0
Green-winged teal	0	0.002	0	0	0	0.1	0	0	0	0.1	0	0
Northern shoveler	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
Blue-winged teal	0	0	0.003	0	0	0	0.1	0	0	0	0.3	0
Cinnamon teal	0	0.002	0	0	0	0.1	0	0	0	0.1	0	0
Lesser scaup	0	0.007	0	0	0	0.3	0	0	0	0.3	0	0
Common merganser	0.013	0.003	0	0	0.9	0.1	0	0	0.3	0.2	0	0
Sandhill Crane	0.009	0.012	0	0	0.6	0.5	0	0	0.5	0.8	0	0
Turkey vulture	0	0.057	0.019	0	0	2.4	0.8	0	0	3.0	1.0	0
Unidentified duck	0.037	0.184	0.035	0	2.4	7.7	1.4	0	0.5	4.8	1.4	0
Osprey	0	0.004	0	0	0	0.2	0	0	0	0.4	0	0
Sharp-shinned hawk	0	0.006	0.064	0	0	0.3	2.7	0	0	0.6	4.3	0
Cooper's hawk	0.002	0.005	0.027	0	0.2	0.2	1.1	0	0.2	0.5	2.3	0
Unidentified accipiter	0	0.002	0.007	0	0	0.1	0.3	0	0	0.2	0.7	0
Red-tailed hawk	0.143	0.487	0.548	0	9.5	20.4	22.7	0	10.8	30.0	19.3	0
Swainson's hawk	0	0.058	0.015	0	0	2.4	0.6	0	0	4.7	1.3	0
Rough-legged hawk	0.017	0.003	0.010	0.045	1.1	0.1	0.4	8.9	1.6	0.3	1.0	3.6
Ferruginous hawk	0.058	0.046	0.109	0.012	3.8	1.9	4.5	2.4	5.0	3.8	8.5	0.8

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix B (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

Foote Creek Rim

	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Northern harrier	0.021	0.059	0.091	0	1.4	2.5	3.8	0	1.8	5.6	8.3	0
Unidentified buteo	0.012	0.040	0.078	0	0.8	1.7	3.2	0	1.0	3.2	6.7	0
Golden eagle	0.606	0.476	0.699	0.336	40.2	19.9	28.9	66.5	37.2	29.3	36.3	22.0
Bald eagle	0.010	0.001	0.020	0.004	0.7	<0.05	0.8	0.8	1.0	0.1	1.7	0.4
Unidentified eagle	0.003	0.001	0.003	0	0.2	<0.05	0.1	0	0.3	0.1	0.3	0
Prairie falcon	0.052	0.073	0.084	0.010	3.4	3.1	3.5	2.1	4.6	6.4	7.7	1.0
Unidentified large falcon	0.003	0	0.005	0	0.2	0	0.2	0	0.3	0	0.5	0
Merlin	0.005	0.003	0.005	0	0.3	0.1	0.2	0	0.5	0.3	0.5	0
Unidentified falcon	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
American kestrel	0.038	0.175	0.126	0	2.5	7.3	5.2	0	3.0	15.1	9.4	0
Blue Grouse	0	0.004	0	0	0	0.2	0	0	0	0.1	0	0
Unidentified raptor	0.003	0.006	0.015	0.004	0.2	0.2	0.6	0.7	0.3	0.5	1.5	0.3
Unidentified small falcon	0.005	0.002	0	0	0.3	0.1	0	0	0.5	0.2	0	0
Chukar	0	0	0.003	0	0	0	0.1	0	0	0	0.3	0
Killdeer	0	0.002	0	0	0	0.1	0	0	0	0.2	0	0
Unidentified Sandpiper	0	0.003	0	0	0	0.1	0	0	0	0.1	0	0
Unidentified Shorebird	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
Wilson's phalarope	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
Common snipe	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
California gull	0.021	0.016	0	0	1.4	0.7	0	0	0.5	0.8	0	0
Franklin's gull	0.020	0.097	0	0	1.3	4.0	0	0	0.8	0.6	0	0
Unidentified Gull	0	0	0.003	0	0	0	0.1	0	0	0	0.3	0
Common nighthawk	0	0.007	0.002	0	0	0.3	0.1	0	0	0.2	0.2	0
Common raven	0.104	0.097	0.164	0.082	6.9	4.1	6.8	16.3	6.9	5.6	8.0	5.4

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix B (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

Foote Creek Rim

	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
American crow	0.165	0.067	0.238	0	10.9	2.8	9.9	0	1.0	1.7	2.1	0
Black-billed magpie	0.056	0.089	0.030	0.012	3.7	3.7	1.2	2.4	3.2	5.1	2.4	1.2
Mountain plover	0	0.032	0	0	0	1.4	0	0	0	2.4	0	0
Unidentified Large Bird	0	0	0.003	0	0	0	0.1	0	0	0	0.3	0
TOTAL	1.51	2.39	2.42	0.51	100.0	100.0	100.0	100.0	--	--	--	--

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix B (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

Simpson Ridge

	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
American white pelican	0	0.002	0	0	0	<0.05	0	0	0	0.2	0	0
Eared Grebe	0	0.150	0	0	0	4.2	0	0	0	3.6	0	0
Great blue heron	0	0.003	0	0	0	0.1	0	0	0	0.3	0	0
Unidentified Grebe	0	0.008	0	0	0	0.2	0	0	0	0.3	0	0
Canada goose	0.010	0.050	0.475	0	1.0	1.4	28.5	0	1.0	0.8	1.2	0
Pied-billed Grebe	0	0	0.008	0	0	0	0.5	0	0	0	0.8	0
Unidentified Tern	0	0.014	0.013	0	0	0.4	0.8	0	0	0.4	0.9	0
Mallard	0.027	0.359	0.013	0	2.6	10.2	0.8	0	1.4	7.2	0.9	0
Redhead	0.005	0.002	0	0	0.5	<0.05	0	0	0.5	0.2	0	0
Gadwall	0	0.115	0.016	0	0	3.3	0.9	0	0	3.6	0.4	0
American wigeon	0	0.227	0.034	0	0	6.4	2.0	0	0	6.5	1.4	0
Northern pintail	0	0.056	0	0	0	1.6	0	0	0	2.4	0	0
Green-winged teal	0.036	0.063	0.063	0	3.4	1.8	3.8	0	0.4	2.4	1.3	0
Northern shoveler	0	0.019	0	0	0	0.5	0	0	0	0.9	0	0
Blue-winged teal	0	0.033	0	0	0	0.9	0	0	0	0.9	0	0
Ring-necked duck	0	0.012	0	0	0	0.3	0	0	0	0.5	0	0
Cinnamon teal	0	0.004	0.010	0	0	0.1	0.6	0	0	0.2	0.5	0
Canvasback	0.005	0	0	0	0.5	0	0	0	0.5	0	0	0
Lesser scaup	0.009	0.051	0	0	0.9	1.4	0	0	0.9	1.9	0	0
Bufflehead	0.010	0.031	0	0	1.0	0.9	0	0	0.5	1.0	0	0
Common merganser	0	0.002	0	0	0	<0.05	0	0	0	0.2	0	0
Turkey vulture	0.010	0.012	0	0	1.0	0.3	0	0	1.0	0.8	0	0
Unidentified duck	0.149	1.200	0.491	0	14.3	34.0	29.4	0	1.9	6.7	5.0	0
Osprey	0	0.007	0	0	0	0.2	0	0	0	0.7	0	0

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix B (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

Simpson Ridge

	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Sharp-shinned hawk	0	0.003	0.021	0	0	0.1	1.2	0	0	0.3	1.6	0
Cooper's hawk	0.005	0	0	0	0.4	0	0	0	0.4	0	0	0
Red-tailed hawk	0.011	0.085	0.063	0	1.0	2.4	3.7	0	1.1	6.0	4.7	0
Swainson's hawk	0	0.075	0.012	0	0	2.1	0.7	0	0	5.2	1.2	0
Rough-legged hawk	0	0	0	0.012	0	0	0	3.9	0	0	0	1.2
Ferruginous hawk	0.138	0.085	0.014	0	13.2	2.4	0.8	0	8.8	6.7	1.4	0
Northern harrier	0.017	0.149	0.085	0	1.7	4.2	5.1	0	1.7	9.6	8.1	0
Unidentified buteo	0.025	0.002	0.005	0	2.4	0.1	0.3	0	2.5	0.2	0.5	0
Golden eagle	0.263	0.150	0.163	0.201	25.2	4.2	9.8	67.7	15.9	11.3	13.6	15.2
Bald eagle	0.009	0.002	0.009	0.023	0.9	<0.05	0.6	7.9	0.9	0.2	0.9	1.9
Peregrine falcon	0	0.002	0	0	0	<0.05	0	0	0	0.2	0	0
Prairie falcon	0.010	0.049	0.009	0.005	1.0	1.4	0.6	1.5	1.0	4.7	0.9	0.5
Unidentified large falcon	0	0.002	0	0	0	<0.05	0	0	0	0.2	0	0
American kestrel	0.030	0.130	0.053	0	2.9	3.7	3.2	0	3.0	10.4	5.3	0
Unidentified raptor	0	0.004	0.022	0	0	0.1	1.3	0	0	0.4	2.2	0
Unidentified small falcon	0	0	0.004	0	0	0	0.2	0	0	0	0.4	0
Sage grouse	0.014	0.010	0.010	0	1.4	0.3	0.6	0	1.0	0.3	1.0	0
Red-necked phalarope	0	0.005	0	0	0	0.1	0	0	0	0.2	0	0
Killdeer	0	0.055	0	0	0	1.6	0	0	0	2.8	0	0
Marbled Godwit	0	0	0.005	0	0	0	0.3	0	0	0	0.5	0
Unidentified Sandpiper	0	0.033	0.004	0	0	0.9	0.3	0	0	0.3	0.4	0
Wilson's phalarope	0	0.096	0	0	0	2.7	0	0	0	3.0	0	0
American Avocet	0	0.059	0	0	0	1.7	0	0	0	2.9	0	0

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix B (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

Simpson Ridge

	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
California gull	0	0.011	0	0	0	0.3	0	0	0	1.1	0	0
Franklin's gull	0	0.016	0	0	0	0.5	0	0	0	0.2	0	0
Unidentified Gull	0.007	0	0	0	0.7	0	0	0	0.3	0	0	0
Common nighthawk	0	0.012	0.009	0	0	0.3	0.5	0	0	0.4	0.9	0
Common raven	0.082	0.057	0.038	0.043	7.9	1.6	2.3	14.4	6.2	3.0	2.7	3.0
American crow	0.142	0.003	0.004	0	13.6	0.1	0.2	0	0.7	0.3	0.4	0
Black-billed magpie	0.027	0.017	0.014	0.014	2.5	0.5	0.9	4.5	1.5	1.3	1.4	0.9
TOTAL	1.04	3.53	1.67	0.30	100.0	100.0	100.0	100.0	--	--	--	--

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix B (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

	Morton Pass Reference											
	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
American white pelican	0	0.034	0.012	0	0	<0.05	<0.05	0	0	1.0	0.2	0
Double-crested cormorant	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
Great blue heron	0.009	0	0	0	<0.05	0	0	0	0.2	0	0	0
Canada goose	0	0.006	0.006	0.005	0	<0.05	<0.05	<0.05	0	0.1	0.3	0.5
Mallard	0.002	0.009	0	0	<0.05	<0.05	0	0	0.2	0.4	0	0
American wigeon	0	0.002	0	0	0	<0.05	0	0	0	0.1	0	0
Northern pintail	0	0.006	0	0	0	<0.05	0	0	0	0.3	0	0
Turkey vulture	0	0.023	0.002	0	0	<0.05	<0.05	0	0	2.2	0.2	0
Unidentified duck	0.078	0.016	0.007	0	0.1	<0.05	<0.05	0	0.3	1.0	0.2	0
Sharp-shinned hawk	0	0.004	0.003	0	0	<0.05	<0.05	0	0	0.4	0.3	0
Unidentified Large Accipiter	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
Unidentified accipiter	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
Red-tailed hawk	0.040	0.044	0.039	0	0.1	<0.05	0.1	0	3.4	4.0	3.4	0
Swainson's hawk	0	0.051	0.018	0	0	0.1	<0.05	0	0	4.0	1.5	0
Rough-legged hawk	0.025	0	0.006	0.017	<0.05	0	<0.05	0.1	2.4	0	0.6	1.7
Ferruginous hawk	0.122	0.194	0.031	0	0.2	0.2	<0.05	0	7.0	12.8	3.1	0
Northern harrier	0.012	0.039	0.076	0	<0.05	<0.05	0.1	0	1.2	3.7	6.0	0
Unidentified buteo	0.012	0.014	0.008	0	<0.05	<0.05	<0.05	0	1.2	1.4	0.8	0
Golden eagle	0.283	0.168	0.240	0.211	0.4	0.2	0.4	0.9	19.5	12.9	16.2	13.6
Bald eagle	0.007	0.001	0.008	0	<0.05	<0.05	<0.05	0	0.7	0.1	0.8	0
Peregrine falcon	0.002	0.002	0	0	<0.05	<0.05	0	0	0.2	0.2	0	0
Prairie falcon	0.037	0.121	0.122	0	<0.05	0.1	0.2	0	3.2	10.6	10.6	0
American kestrel	0.072	0.080	0.029	0	0.1	0.1	<0.05	0	5.5	6.7	2.9	0
Unidentified raptor	0.002	0.002	0.005	0	<0.05	<0.05	<0.05	0	0.2	0.2	0.3	0

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix B (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during RLB surveys, 1995-1999[a].

Morton Pass Reference

	Mean Use				% Composition				% Freq. of Occurrence			
Species	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Unidentified small falcon	0.002	0	0	0	<0.05	0	0	0	0.2	0	0	0
Sage grouse	0.019	0.003	0	0	<0.05	<0.05	0	0	0.5	0.3	0	0
Killdeer	0	0.012	0	0	0	<0.05	0	0	0	0.7	0	0
Wilson's phalarope	0	0.003	0	0	0	<0.05	0	0	0	0.1	0	0
American Avocet	0	0.003	0	0	0	<0.05	0	0	0	0.1	0	0
Common snipe	0	0.001	0	0	0	<0.05	0	0	0	0.1	0	0
California gull	0	0.021	0	0	0	<0.05	0	0	0	2.0	0	0
Common nighthawk	0	0.043	0.006	0	0	<0.05	<0.05	0	0	2.9	0.6	0
Common raven	0.014	0.028	0.061	0.005	<0.05	<0.05	0.1	<0.05	1.1	1.6	2.5	0.5
Black-billed magpie	0	0	0.003	0	0	0	<0.05	0	0	0	0.3	0
Mountain plover	0.002	0.022	0	0	<0.05	<0.05	0	0	0.2	1.8	0	0
TOTAL	0.74	0.95	0.68	0.24	100.0	100.0	100.0	100.0	--	--	--	--

[a] Mean use = Mean number observed/40-minute count; Percent Composition = percent of all observations comprised of species *i*, Frequency of Occurrence = percent of all surveys where species *i* was recorded.

Appendix C. Total number of bird observations during surveys, 1995-1999.

RLB Survey Data

Species	1995-96	1997-8	1998-99	1999	TOTAL
American white pelican	24	64	30	23	141
Double-crested cormorant	4	1	2	0	7
Unidentified Grebe	0	0	0	3	3
Eared Grebe	0	0	12	50	62
Pied-billed Grebe	0	0	2	0	2
Great blue heron	10	2	0	5	17
Unidentified Tern	0	7	3	1	11
Canada goose	133	109	191	19	452
Snow Goose	0	40	0	0	40
Mallard	115	83	101	49	348
Redhead	0	0	1	1	2
Gadwall	6	15	24	25	70
American wigeon	15	73	45	18	151
Northern pintail	11	13	10	4	38
Northern shoveler	0	4	0	7	11
Green-winged teal	14	17	21	6	58
Ring-necked duck	0	6	1	0	7
Blue-winged teal	1	4	0	10	15
Cinnamon teal	2	0	4	0	6
Canvasback	0	0	0	1	1
Lesser scaup	22	10	3	4	39
Bufflehead	5	15	4	2	26
Common merganser	34	2	0	1	37
Unidentified duck	29	514	638	587	1768
Sandhill Crane	13	2	15	3	33
Turkey vulture	11	30	33	17	91
Osprey	0	1	3	3	7
Sharp-shinned hawk	13	18	4	9	44
Unidentified Large Accipiter	0	0	1	0	1
Unidentified accipiter	0	6	3	2	11
Cooper’s hawk	4	12	3	4	23
Red-tailed hawk	170	156	356	253	935
Swainson’s hawk	38	46	60	56	200
Rough-legged hawk	8	19	6	10	43
Ferruginous hawk	153	156	80	123	512
Unidentified buteo	9	44	55	50	158
Northern harrier	66	72	72	67	277
Golden eagle	668	633	424	386	2111
Bald eagle	1	15	15	12	43
Unidentified eagle	2	2	0	2	6
Peregrine falcon	0	3	0	1	4

Appendix C. Total number of bird observations during surveys, 1995-1999.

RLB Survey Data

Species	1995-96	1997-8	1998-99	1999	TOTAL
Prairie falcon	77	109	72	88	346
Unidentified large falcon	1	3	0	2	6
Unidentified falcon	0	0	1	1	2
Merlin	1	3	1	2	7
American kestrel	102	128	94	125	449
Unidentified small falcon	1	2	4	3	10
Unidentified raptor	8	4	7	31	50
Blue Grouse	4	0	0	0	4
Sage grouse	14	8	8	12	42
Chukar	0	0	0	1	1
Killdeer	4	8	27	4	43
Long-billed Curlew	0	0	2	0	2
Marbled Godwit	0	0	0	1	1
Unidentified Sandpiper	0	0	14	0	14
Unidentified Shorebird	0	0	0	1	1
Wilson's phalarope	0	3	26	27	56
Red-necked phalarope	0	0	3	0	3
American Avocet	0	10	12	12	34
Common snipe	1	1	0	0	2
California gull	11	10	19	15	55
Unidentified Gull	0	0	0	4	4
Franklin's gull	47	31	35	5	118
Common nighthawk	10	19	21	7	57
Common raven	41	66	172	159	438
American crow	74	164	81	48	367
Black-billed magpie	39	47	75	10	171
Mountain plover	0	9	35	8	52
Unidentified Large Bird	0	0	1	1	2
TOTAL	2016	2819	2932	2383	10,150

Appendix C (Continued). Total number of bird observations during surveys, 1995-1999.

PSB Survey Data

Species	1995	1997	1998	1999	Total
American White Pelican	0	8	6	0	14
Great Blue Heron	0	0	0	1	1
Canada Goose	32	19	7	0	58
Mallard	8	12	6	0	26
American Coot	0	0	0	1	1
Gadwall	0	22	13	14	49
American Wigeon	9	10	22	20	61
Northern Pintail	0	0	0	2	2
Green-winged Teal	2	3	4	0	9
Blue-winged Teal	1	0	0	14	15
Cinnamon Teal	1	0	0	3	4
Northern Shoveler	0	1	0	3	4
Lesser Scaup	0	2	0	4	6
Redhead	1	3	0	4	8
Canvasback	0	1	0	0	1
Unidentified Dabbler	16	0	0	18	34
Ruddy Duck	0	0	4	4	8
Unidentified Duck	15	7	0	18	40
Eared Grebe	0	0	18	22	40
Sharp-shinned Hawk	0	0	0	1	1
Red-tailed Hawk	20	7	22	20	69
Swainson's Hawk	2	10	5	1	18
Ferruginous Hawk	14	10	5	9	38
Unidentified Buteo	0	2	0	0	2
Northern Harrier	6	0	3	8	17
Golden Eagle	16	20	12	10	58
Bald Eagle	0	0	1	0	1
Prairie Falcon	5	4	3	2	14
Unidentified Large Falcon	0	1	0	0	1
American Kestrel	7	4	11	17	39
Unidentified Raptor	0	0	0	1	1
Sage Grouse	2	0	3	15	20
Sandhill Crane	2	3	14	1	20
Killdeer	16	32	18	30	96
Common Snipe	1	0	8	0	9
Mountain Plover	24	29	19	16	88
Long-billed Curlew	0	2	0	0	2
American Avocet	2	4	2	0	8
Wilson's Phalarope	0	4	6	2	12
Unidentified Shorebird	0	5	0	0	5
California Gull	2	2	5	2	11
Caspian Tern	0	1	0	0	1
Mourning Dove	6	12	5	7	30

Appendix C (Continued). Total number of bird observations during surveys, 1995-1999.

	PSB Survey Data				
Species	1995	1997	1998	1999	Total
Common Nighthawk	8	11	3	1	23
Northern Flicker	13	13	1	20	47
Red-naped Sapsucker	0	1	3	0	4
Broad-tailed Hummingbird	21	19	13	13	66
Rufous Hummingbird	3	0	0	0	3
Unidentified Hummingbird	0	1	0	1	2
Eastern Kingbird	0	2	1	0	3
Western Kingbird	0	2	0	1	3
Say's Phoebe	5	12	3	0	20
Olive-sided Flycatcher	1	0	0	0	1
Cordilleran Flycatcher	0	0	4	0	4
Western Wood Pewee	2	10	0	2	14
Dusky Flycatcher	0	1	0	0	1
Unidentified Flycatcher	0	3	4	8	15
Horned Lark	851	989	843	859	3542
Tree Swallow	2	4	16	5	27
Barn Swallow	6	1	6	11	24
Cliff Swallow	186	171	152	74	583
N. Rough-winged Swallow	0	3	0	0	3
Unidentified Swallow	1	9	17	9	36
Violet-green Swallow	20	9	4	1	34
Common Raven	3	0	14	18	35
American Crow	1	1	2	0	4
Black-billed Magpie	23	19	15	13	70
Clark's Nutcracker	1	2	0	0	3
Blue Jay	0	0	0	1	1
House Wren	8	24	6	13	51
Rock Wren	50	27	24	44	145
Sage Thrasher	147	140	90	117	494
Swainson's Thrush	0	1	1	1	3
Gray Catbird	1	1	0	0	2
American Robin	23	41	27	29	120
Mountain Bluebird	20	34	17	19	90
Loggerhead Shrike	0	0	0	2	2
Brown Thrasher	0	0	2	0	2
Hermit Thrush	0	0	0	1	1
European Starling	1	1	6	2	10
Warbling Vireo	1	3	4	1	9
Ruby-crowned Kinglet	0	0	0	1	1
Unidentified Vireo	0	1	0	0	1
Orange-crowned Warbler	1	2	0	0	3
Yellow Warbler	5	10	4	7	26
Yellow-rumped Warbler	2	1	8	3	14

Appendix C (Continued). Total number of bird observations during surveys, 1995-1999.

	PSB Survey Data				
Species	1995	1997	1998	1999	Total
MacGillivray's Warbler	3	2	0	3	8
Unidentified Warbler	0	0	0	1	1
Black-headed Grosbeak	1	0	0	0	1
Western Meadowlark	140	146	124	120	530
Red-winged Blackbird	2	11	20	10	43
Brewer's Blackbird	125	177	100	91	493
Common Grackle	4	2	0	0	6
Brown-headed Cowbird	3	10	17	24	54
Unidentified Blackbird	1	0	4	23	28
American Goldfinch	19	24	10	6	59
Pine Siskin	57	9	11	4	81
Evening Grosbeak	0	0	1	0	1
Green-tailed Towhee	30	59	75	72	236
McCown's Longspur	39	44	39	27	149
Savannah Sparrow	4	8	0	2	14
Song Sparrow	0	1	3	17	21
Lincoln's Sparrow	0	2	0	0	2
White-crowned Sparrow	0	6	1	1	8
Baird's Sparrow	0	0	0	2	2
Lark Sparrow	0	3	0	0	3
Vesper Sparrow	512	417	423	572	1924
Brewer's Sparrow	173	397	361	350	1281
Chipping Sparrow	4	0	49	0	53
Dark-eyed Junco	0	2	0	0	2
Unidentified Sparrow	0	14	64	51	129
Lark Bunting	13	4	13	7	37
Cedar Waxwing	0	0	4	0	4
Black-capped Chickadee	0	0	1	1	2
Unidentified Bird	14	4	0	0	18
TOTAL	2760	3151	2832	2931	11,674

Appendix D. Species of birds grouped for analysis.

PSB Survey Data

Waterbirds
Eared Grebe
Sandhill Crane
American White Pelican
Great Blue Heron
California Gull
Caspian Tern

Waterfowl
Canada Goose
Mallard
Gadwall
American Wigeon
Northern Shoveler
Blue-winged Teal
Cinnamon Teal
Northern Pintail
Green-winged Teal
Unidentified Dabbler
Canvasback
Redhead
Lesser Scaup
Ruddy Duck
Unidentified Duck
American Coot

Game Birds
Sage Grouse
Mourning Dove

Corvids
Black-billed Magpie
American Crow
Common Raven
Clark's Nutcracker
Blue Jay

Shorebirds
American Avocet
Long-billed Curlew
Wilson's Phalarope
Common Snipe
Killdeer
Mountain Plover
Unidentified Shorebird

Raptors
Golden Eagle
Bald Eagle
Northern Harrier
Prairie Falcon
Unidentified Large Falcon
Sharp-shinned Hawk
American Kestrel
Ferruginous Hawk
Red-tailed Hawk
Swainson's Hawk
Unidentified Buteo
Unidentified Raptor

Woodpeckers
Northern Flicker
Red-naped Sapsucker

Flycatchers
Say's Phoebe
Olive-sided Flycatcher
Western Kingbird
Eastern Kingbird
Western Wood Pewee
Cordilleran Flycatcher
Dusky Flycatcher
Empidonax Flycatcher

Appendix D (Continued). Species of birds grouped for analysis.

PSB Survey Data

Swallows
Common Nighthawk
Northern Rough-winged Swallow
Violet-green Swallow
Tree Swallow
Cliff Swallow
Barn Swallow
Unidentified Swallow

Blackbirds
Common Grackle
European Starling
Brown-headed Cowbird
Brewer's Blackbird
Red-winged Blackbird
Unidentified Blackbird

Sparrows
Green-tailed Towhee
Song Sparrow
Savannah Sparrow
White-crowned Sparrow
Lincoln's Sparrow
Baird's Sparrow
Lark Sparrow
Vesper Sparrow
Brewer's Sparrow
Chipping Sparrow
Dark-eyed Junco
Unidentified Sparrow
Western Meadowlark
Lark Bunting

Larks
Horned Lark
McCown's Longspur

Thrushes/thrushlike
Sage Thrasher
Brown Thrasher
Gray Catbird
American Robin
Swainson's Thrush
Hermit Thrush
Mountain Bluebird

Wrens
House Wren
Rock Wren

Warblers & Vireos
Warbling Vireo
Unidentified Vireo
Yellow Warbler
MacGillivray's Warbler
Yellow-rumped Warbler
Orange-crowned Warbler
Unidentified Warbler

Finches
American Goldfinch
Pine Siskin
Black-headed Grosbeak
Evening Grosbeak

Other
Broad-tailed Hummingbird
Rufous Hummingbird
Unidentified Hummingbird
Cedar Waxwing
Black-capped Chickadee
Loggerhead Shrike
Ruby-crowned Kinglet
Unidentified Bird

Appendix D (Continued). Species of birds grouped for analysis.

RLB Survey Data

Raptors

Eagles
- Bald Eagle
- Golden Eagle
- Unidentified Eagle

Buteos
- Ferruginous Hawk
- Rough-legged Hawk
- Red-tailed Hawk
- Swainson's Hawk
- Unidentified Buteo

Large Falcons
- Prairie Falcon
- Peregrine Falcon
- Unidentified Large Falcon

Small Falcons
- American Kestrel
- Merlin
- Unidentified Small Falcon

Accipiters
- Cooper's Hawk
- Sharp-shinned Hawk
- Unidentified Accipiter

Other Raptors
- Northern Harrier
- Turkey Vulture
- Osprey
- Unidentified Raptor

Waterfowl
- Canada Goose
- Snow Goose
- Mallard
- Northern Pintail
- American Wigeon
- Gadwall
- Northern Shoveler
- Blue-winged Teal
- Cinnamon Teal
- Green-winged Teal
- Lesser Scaup
- Canvasback
- Redhead
- Ring-necked Duck
- Bufflehead
- Common Merganser
- Unidentified Duck

Shorebirds
- Common Snipe
- Killdeer
- Wilson's Phalarope
- Red-necked Phalarope
- American Avocet
- Marbled Godwit
- Mountain Plover
- Unidentified Sandpiper
- Unidentified Shorebird

Gamebirds
- Blue Grouse
- Sage Grouse
- Chukar

Waterbirds
- American White Pelican
- Double-crested Cormorant
- California Gull
- Franklin's Gull
- Unidentified Gull
- Unidentified Tern
- Great Blue Heron
- Sandhill Crane
- Pied-billed Grebe
- Eared Grebe
- Unidentified Grebe

Goatsuckers
- Common Nighthawk

Corvids
- American Crow
- Common Raven
- Black-billed Magpie

Appendix E. Mean number of birds observed per instantaneous count for all species recorded during RLB surveys on FCR and SR, 1995-1999.

Foote Creek Rim

Species	Spring	Summer	Fall	Winter
American white pelican	0	0.003	0	0
Great blue heron	0.023	0.001	0	0
Canada goose	0.016	0.029	0	0
Mallard	0.023	0.048	0.008	0
Gadwall	0	0.003	0	0
American wigeon	0	0.003	0	0
Northern shoveler	0	0.001	0	0
Blue-winged teal	0	0	0.003	0
Cinnamon teal	0	0.002	0	0
Lesser scaup	0	0.001	0	0
Common merganser	0.003	0	0	0
Sandhill Crane	0.001	0.004	0	0
Turkey vulture	0	0.004	0.002	0
Unidentified duck	0.019	0.125	0.014	0
Osprey	0	<0.0005	0	0
Sharp-shinned hawk	0	<0.0005	0.005	0
Cooper's hawk	0	<0.0005	0.004	0
Unidentified accipiter	0	0	0.001	0
Red-tailed hawk	0.035	0.103	0.073	0
Swainson's hawk	0	0.004	0	0
Rough-legged hawk	0.001	<0.0005	0.001	0.002
Ferruginous hawk	0.004	0.004	0.007	0.002
Northern harrier	0.001	0.004	0.006	0
Unidentified buteo	0.001	0.004	0.007	0
Golden eagle	0.059	0.046	0.076	0.030
Bald eagle	0.001	<0.0005	0.001	0
Prairie falcon	0.002	0.006	0.006	0.001
Unidentified large falcon	0.001	0	0	0
Unidentified falcon	0	<0.0005	0	0
American kestrel	0.002	0.010	0.009	0
Blue Grouse	0	0.004	0	0
Unidentified raptor	0	<0.0005	0.001	0
Unidentified small falcon	0.001	0	0	0
Chukar	0	0	0.001	0
California gull	0	<0.0005	0	0
Franklin's gull	0	0.009	0	0
Common nighthawk	0	0.001	0	0
Common raven	0.006	0.009	0.016	0.001
American crow	0.003	0.002	0	0
Black-billed magpie	0.003	0.015	0.004	0.001
Mountain plover	0	0.003	0	0

Appendix E (Continued). Mean number of birds observed per instantaneous count for all species recorded during RLB surveys on FCR and SR, 1995-1999.

	Simpson Ridge			
Species	Spring	Summer	Fall	Winter
Eared Grebe	0	0.071	0	0
Great blue heron	0	<0.0005	0	0
Unidentified Grebe	0	0.008	0	0
Canada goose	0.002	0.005	0.095	0
Pied-billed Grebe	0	0	0.008	0
Unidentified Tern	0	0	0.013	0
Mallard	0.012	0.190	0.013	0
Redhead	0.005	0.002	0	0
Gadwall	0	0.041	0	0
American wigeon	0	0.085	0.013	0
Northern pintail	0	0.019	0	0
Green-winged teal	0	0.044	0.025	0
Northern shoveler	0	0.015	0	0
Blue-winged teal	0	0.016	0	0
Ring-necked duck	0	<0.0005	0	0
Cinnamon teal	0	0.004	0.010	0
Canvasback	0.005	0	0	0
Lesser scaup	0.006	0.037	0	0
Bufflehead	0.010	0.007	0	0
Common merganser	0	<0.0005	0	0
Turkey vulture	0.002	<0.0005	0	0
Unidentified duck	0.061	0.538	0.210	0
Osprey	0	0.001	0	0
Sharp-shinned hawk	0	0	0.001	0
Cooper's hawk	0.001	0	0	0
Red-tailed hawk	0.001	0.010	0.004	0
Swainson's hawk	0	0.009	0.002	0
Rough-legged hawk	0	0	0	0.001
Ferruginous hawk	0.013	0.006	0.002	0
Northern harrier	0.001	0.022	0.012	0
Unidentified buteo	0	0	0.001	0
Golden eagle	0.042	0.019	0.014	0.021
Bald eagle	0	0	0	0.003
Peregrine falcon	0	<0.0005	0	0
Prairie falcon	0	0.006	0.001	0
American kestrel	0.001	0.009	0.005	0
Unidentified raptor	0	<0.0005	0	0
Killdeer	0	0.017	0	0
Marbled Godwit	0	0	0.001	0

Appendix E (Continued). Mean number of birds observed per instantaneous count for all species recorded during RLB surveys on FCR and SR, 1995-1999.

	Simpson Ridge			
Species	Spring	Summer	Fall	Winter
Unidentified Sandpiper	0	0.007	0	0
Wilson's phalarope	0	0.070	0	0
Red-necked Phalarope	0	0.002	0	0
American Avocet	0	0.029	0	0
California gull	0	0.001	0	0
Common nighthawk	0	0.001	0	0
Common raven	0.007	0.008	0.002	0.004
American crow	0.010	<0.0005	0	0
Black-billed magpie	0	0.004	0	0.002

Appendix F. Mean relative use, percent composition, and percent frequency of occurrence of birds observed during PSB surveys, 1995-1999[a]

	Mean Use			% Composition			% Freq. Occurrence		
Species	FCR	SR	MPR	FCR	SR	MPR	FCR	SR	MPR
American White Pelican	0	0.006	0.002	0	0.11	0.03	0	0.21	0.21
Great Blue Heron	<0.005	0	0	0.03	0	0	0.21	0	0
Canada Goose	0.054	0.040	0	0.83	0.72	0	0.42	0.21	0
Mallard	0.010	0.013	0	0.16	0.23	0	0.21	0.83	0
Gadwall	0	0.029	0	0	0.53	0	0	0.42	0
American Wigeon	0	0.031	0	0	0.57	0	0	1.46	0
Green-winged Teal	0	0.006	0	0	0.11	0	0	0.63	0
Cinnamon Teal	0	<0.005	0	0	0.04	0	0	0.21	0
Lesser Scaup	0	<0.005	0	0	0.08	0	0	0.21	0
Redhead	0	0.006	0	0	0.11	0	0	0.21	0
Canvasback	0	<0.005	0	0	0.04	0	0	0.21	0
Unidentified Duck	0	0.025	0	0	0.45	0	0	0.21	0
Turkey Vulture	<0.005	0	0	0.06	0	0	0.21	0	0
Sharp-shinned Hawk	<0.005	0	0	0.03	0	0	0.21	0	0
Red-tailed Hawk	0.023	<0.005	0	0.35	0.04	0	1.88	0.21	0
Swainson's Hawk	<0.005	<0.005	0	0.06	0.08	0	0.42	0.42	0
Ferruginous Hawk	<0.005	0.008	0.015	0.03	0.15	0.19	0.21	0.63	1.46
Northern Harrier	0.013	<0.005	0	0.19	0.08	0	1.25	0.42	0
Golden Eagle	0.013	<0.005	<0.005	0.19	0.08	0.06	0.83	0.42	0.42
Prairie Falcon	0.006	<0.005	<0.005	0.10	0.08	0.03	0.63	0.42	0.21
American Kestrel	0.017	0.021	0.010	0.26	0.38	0.14	1.67	1.67	0.83
Sage Grouse	0	0.021	<0.005	0	0.38	0.03	0	0.63	0.21
Sandhill Crane	<0.005	0	0	0.06	0	0	0.21	0	0
Killdeer	0.013	0.033	0.063	0.19	0.60	0.83	1.25	2.29	3.75
Common Snipe	0.006	0	0	0.10	0	0	0.63	0	0
Mountain Plover	0.058	0	0.038	0.90	0	0.50	3.96	0	3.13
Long-billed Curlew	0	0	<0.005	0	0	0.06	0	0	0.21
Wilson's Phalarope	<0.005	0.008	0	0.03	0.15	0	0.21	0.42	0
Unidentified Shorebird	0.010	0	0	0.16	0	0	0.42	0	0
California Gull	0.008	<0.005	<0.005	0.13	0.04	0.06	0.63	0.21	0.42
Mourning Dove	0.027	0.019	0	0.42	0.34	0	1.46	1.46	0
Common Nighthawk	0.010	<0.005	0.015	0.16	0.04	0.19	1.04	0.21	1.46
Northern Flicker	0.056	<0.005	0	0.86	0.08	0	4.58	0.42	0
Red-naped Sapsucker	0.013	0	0	0.19	0	0	0.83	0	0
Unidentified Woodpecker	<0.005	0	0	0.03	0	0	0.21	0	0
Broad-tailed Hummingbird	0.102	0.017	<0.005	1.57	0.30	0.03	7.71	1.67	0.21
Rufous Hummingbird	<0.005	<0.005	0	0.03	0.08	0	0.21	0.21	0
Unidentified Hummingbird	<0.005	0	0	0.06	0	0	0.42	0	0

[a] Mean use = Mean number observed/8-minute count; Percent Composition = percent of all observations comprised of species *i*; Frequency of occurrence = percent of all surveys where species *i* was recorded.

Appendix F (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during PSB surveys, 1995-1999[a]

	Mean Use			% Composition			% Freq. Occurrence		
Species	FCR	SR	MPR	FCR	SR	MPR	FCR	SR	MPR
Eastern Kingbird	<0.005	0	0	0.06	0	0	0.21	0	0
Western Kingbird	<0.005	<0.005	<0.005	0.03	0.04	0.03	0.21	0.21	0.21
Say's Phoebe	0	0.031	<0.005	0	0.57	0.06	0	1.25	0.42
Olive-sided Flycatcher	<0.005	0	0	0.03	0	0	0.21	0	0
Cordilleran Flycatcher	<0.005	0	0	0.03	0	0	0.21	0	0
Western Wood Pewee	0.027	0	0	0.42	0	0	1.67	0	0
Dusky Flycatcher	<0.005	0	0	0.03	0	0	0.21	0	0
Unidentified Flycatcher	0.029	0	0	0.45	0	0	2.50	0	0
Horned Lark	2.077	1.015	3.569	31.90	18.42	47.46	51.25	42.08	77.50
Tree Swallow	0.042	<0.005	0	0.64	0.04	0	1.67	0.21	0
Barn Swallow	0.015	<0.005	0.027	0.22	0.08	0.36	1.25	0.42	2.08
Cliff Swallow	0.410	0.269	0.329	6.30	4.88	4.38	13.13	6.25	11.04
N. Rough-winged Swallow	0	0	0.006	0	0	0.08	0	0	0.42
Bank Swallow	<0.005	0	<0.005	0.06	0	0.03	0.21	0	0.21
Unidentified Swallow	0.023	0.019	0.015	0.35	0.34	0.19	1.88	1.25	1.04
Violet-green Swallow	0.035	0.025	<0.005	0.54	0.45	0.03	2.92	1.67	0.21
Common Raven	0.008	<0.005	<0.005	0.13	0.04	0.06	0.63	0.21	0.42
Black-billed Magpie	0.031	0.029	0	0.48	0.53	0	2.50	2.29	0
Clark's Nutcracker	0	<0.005	0	0	0.04	0	0	0.21	0
Blue Jay	<0.005	0	0	0.03	0	0	0.21	0	0
House Wren	0.100	0	0	1.54	0	0	4.79	0	0
Rock Wren	0.015	0.100	0.094	0.22	1.82	1.25	1.04	7.71	6.46
Sage Thrasher	0.035	0.442	0.142	0.54	8.02	1.88	2.92	33.33	11.04
Swainson's Thrush	0.006	0	0	0.10	0	0	0.63	0	0
Gray Catbird	<0.005	0	0	0.06	0	0	0.42	0	0
American Robin	0.148	0.023	0.019	2.27	0.42	0.25	10.00	1.67	1.67
Mountain Bluebird	0.096	0.048	0.019	1.47	0.87	0.25	4.79	2.29	1.46
Brown Thrasher	0	<0.005	0	0	0.08	0	0	0.42	0
Loggerhead Shrike	0	<0.005	0	0	0.08	0	0	0.42	0
Hermit Thrush	<0.005	0	0	0.03	0	0	0.21	0	0
European Starling	0.019	0	0	0.29	0	0	0.83	0	0
Warbling Vireo	0.017	0	0	0.26	0	0	1.25	0	0
Unidentified Vireo	<0.005	0	0	0.03	0	0	0.21	0	0
Ruby-crowned Kinglet	<0.005	0	0	0.03	0	0	0.21	0	0
Orange-crowned Warbler	0.006	0	0	0.10	0	0	0.63	0	0
Yellow Warbler	0.044	0	0	0.67	0	0	3.54	0	0
Yellow-rumped Warbler	0.029	0	0	0.45	0	0	1.04	0	0
MacGillivray's Warbler	0.017	0	0	0.26	0	0	1.25	0	0

[a] Mean use = Mean number observed/8-minute count; Percent Composition = percent of all observations comprised of species *i*; Frequency of occurrence = percent of all surveys where species *i* was recorded.

Appendix F (Continued). Mean relative use, percent composition, and percent frequency of occurrence of birds observed during PSB surveys, 1995-1999[a]

	Mean Use			% Composition			% Freq. Occurrence		
Species	FCR	SR	MPR	FCR	SR	MPR	FCR	SR	MPR
Unidentified Warbler	<0.005	0	0	0.03	0	0	0.21	0	0
Western Meadowlark	0.075	0.123	0.442	1.15	2.23	5.87	6.88	8.96	28.75
Red-winged Blackbird	0.008	0.038	<0.005	0.13	0.68	0.06	0.63	1.67	0.42
Brewer's Blackbird	0.385	0.175	0.217	5.92	3.18	2.88	14.58	8.75	8.54
Common Grackle	0.013	0	0	0.19	0	0	0.63	0	0
Brown-headed Cowbird	0.052	0.027	0.019	0.80	0.49	0.25	3.13	2.08	1.25
Unidentified Blackbird	0.044	<0.005	<0.005	0.67	0.08	0.03	0.42	0.42	0.21
American Goldfinch	0.115	0	<0.005	1.76	0	0.03	6.46	0	0.21
Pine Siskin	0.165	<0.005	0	2.53	0.08	0	2.50	0.21	0
Evening Grosbeak	<0.005	0	0	0.03	0	0	0.21	0	0
Green-tailed Towhee	0.248	0.160	0.027	3.81	2.91	0.36	15.83	11.46	2.08
Unidentified Finch	<0.005	0	0	0.06	0	0	0.21	0	0
McCown's Longspur	0	0	0.271	0	0	3.60	0	0	14.38
Savannah Sparrow	0.013	<0.005	0.015	0.19	0.04	0.19	0.63	0.21	1.04
Song Sparrow	0.015	0.017	<0.005	0.22	0.30	0.06	1.25	1.67	0.42
Lincoln's Sparrow	<0.005	0	0	0.06	0	0	0.42	0	0
White-crowned Sparrow	0.017	0	0	0.26	0	0	1.25	0	0
Lark Sparrow	0	0	<0.005	0	0	0.03	0	0	0.21
Baird's Sparrow	<0.005	0	0	0.06	0	0	0.21	0	0
Vesper Sparrow	0.927	1.308	1.271	14.24	23.75	16.90	47.92	64.58	64.17
Brewer's Sparrow	0.448	1.173	0.771	6.88	21.29	10.25	22.29	54.79	41.88
Chipping Sparrow	0.106	<0.005	0	1.63	0.08	0	1.46	0.42	0
Dark-eyed Junco	<0.005	0	0	0.06	0	0	0.42	0	0
Unidentified Sparrow	0.083	0.108	0.042	1.28	1.97	0.55	6.04	5.63	3.54
Lark Bunting	0.010	0.019	0.033	0.16	0.34	0.44	1.04	1.25	1.46
Cedar Waxwing	0.008	0	0	0.13	0	0	0.21	0	0
Black-capped Chickadee	<0.005	0	0	0.06	0	0	0.42	0	0
Unidentified Bird	0.027	<0.005	<0.005	0.42	0.04	0.06	1.25	0.21	0.42
TOTAL	6.512	5.509	7.520	100.0	100.0	100.0	--	--	--

[a] Mean use = Mean number observed/8-minute count; Percent Composition = percent of all observations comprised of species *i*; Frequency of occurrence = percent of all surveys where species *i* was recorded.

Appendix G. Flock size characteristics of birds observed during surveys on FCR, SR, and MPR, 1995-1999.

RLB Survey Data

		Flock Size		
Species	N	Mean	Min	Max
American white pelican	23	2.91	1	8
Double-crested cormorant	2	2.5	1	4
Unidentified Grebe	1	3	3	3
Eared Grebe	16	3.88	1	11
Pied-billed Grebe	2	1	1	1
Great blue heron	6	2.83	1	9
Unidentified Tern	4	2.75	1	7
Canada goose	37	5.68	1	56
Mallard	108	3.07	1	25
Redhead	2	1	1	1
Gadwall	24	2.71	1	15
American wigeon	50	3.02	1	17
Northern pintail	17	2.24	1	9
Northern shoveler	5	1.8	1	2
Green-winged teal	18	3.22	1	8
Ring-necked duck	3	2.33	1	4
Blue-winged teal	6	2.5	1	6
Cinnamon teal	3	2	2	2
Canvasback	1	1	1	1
Lesser scaup	15	2.47	1	5
Bufflehead	7	3	2	5
Common merganser	4	2.25	1	5
Unidentified duck	119	7.67	1	200
Sandhill Crane	9	1.56	1	2
Turkey vulture	65	1.26	1	6
Osprey	7	1	1	1
Sharp-shinned hawk	40	1.08	1	2
Unidentified Large Accipiter	1	1	1	1
Unidentified accipiter	6	1	1	1
Cooper’s hawk	19	1.05	1	2
Red-tailed hawk	681	1.25	1	100
Swainson’s hawk	130	1.11	1	3
Rough-legged hawk	38	1	1	1
Ferruginous hawk	380	1.05	1	2
Unidentified buteo	95	1.07	1	3
Northern harrier	237	1.02	1	2
Golden eagle	1434	1.08	1	4
Bald eagle	31	1.03	1	2
Unidentified eagle	3	1	1	1

Appendix G (Continued). Flock size characteristics of birds observed during surveys on FCR, SR, and MPR, 1995-1999.

RLB Survey Data

		Flock Size		
Species	N	Mean	Min	Max
Peregrine falcon	4	1	1	1
Prairie falcon	304	1.03	1	2
Unidentified large falcon	4	1	1	1
Unidentified falcon	1	1	1	1
Merlin	7	1	1	1
American kestrel	395	1.02	1	2
Unidentified small falcon	6	1	1	1
Unidentified raptor	22	1.05	1	2
Blue Grouse	1	4	4	4
Sage grouse	10	1.9	1	7
Chukar	1	1	1	1
Killdeer	26	1.65	1	4
Marbled Godwit	1	1	1	1
Unidentified Sandpiper	3	4.67	1	10
Unidentified Shorebird	1	1	1	1
Wilson's phalarope	17	2.76	1	6
Red-necked phalarope	2	1.5	1	2
American Avocet	17	1.88	1	4
Common snipe	2	1	1	1
California gull	33	1.45	1	5
Unidentified Gull	2	1.5	1	2
Franklin's gull	10	10.8	1	30
Common nighthawk	39	1.38	1	5
Common raven	220	1.47	1	12
American crow	36	7.58	1	40
Black-billed magpie	94	1.51	1	7
Mountain plover	42	1.24	1	2
Unidentified Large Bird	1	1	1	1

Appendix G (Continued). Flock size characteristics of birds observed during surveys on FCR, SR, and MPR, 1995-1999.

PSB Survey Data

		Flock Size		
Species	N	Mean	Min	Max
American White Pelican	2	2.0	1	3
Great Blue Heron	1	1.0	1	1
Canada Goose	3	15.0	11	19
Mallard	5	2.2	1	5
Gadwall	2	7.0	3	11
American Wigeon	7	2.1	1	6
Green-winged Teal	3	1.0	1	1
Cinnamon Teal	1	1.0	1	1
Lesser Scaup	1	2.0	2	2
Redhead	1	3.0	3	3
Canvasback	1	1.0	1	1
Unidentified Duck	1	12.0	12	12
Turkey Vulture	1	2.0	2	2
Sharp-shinned Hawk	1	1.0	1	1
Red-tailed Hawk	12	1.0	1	1
Swainson's Hawk	4	1.0	1	1
Ferruginous Hawk	11	1.1	1	2
Northern Harrier	8	1.0	1	1
Golden Eagle	10	1.0	1	1
Prairie Falcon	6	1.0	1	1
American Kestrel	21	1.1	1	2
Sage Grouse	4	2.8	1	8
Sandhill Crane	1	2.0	2	2
Killdeer	42	1.2	1	4
Common Snipe	3	1.0	1	1
Mountain Plover	40	1.2	1	3
Long-billed Curlew	1	2.0	2	2
Wilson's Phalarope	3	1.7	1	2
Unidentified Shorebird	3	1.7	1	2
California Gull	6	1.2	1	2
Mourning Dove	15	1.5	1	4
Common Nighthawk	13	1.0	1	1
Northern Flicker	29	1.0	1	1
Red-naped Sapsucker	3	1.0	1	1
Unidentified Woodpecker	1	1.0	1	1
Broad-tailed Hummingbird	58	1.0	1	1
Rufous Hummingbird	3	1.0	1	1
Unidentified Hummingbird	2	1.0	1	1
Eastern Kingbird	1	2.0	2	2

Appendix G (Continued). Flock size characteristics of birds observed during surveys on FCR, SR, and MPR, 1995-1999.

PSB Survey Data

		Flock Size		
Species	N	Mean	Min	Max
Western Kingbird	3	1.0	1	1
Say's Phoebe	8	2.1	1	7
Olive-sided Flycatcher	1	1.0	1	1
Cordilleran Flycatcher	1	1.0	1	1
Western Wood Pewee	12	1.1	1	2
Dusky Flycatcher	1	1.0	1	1
Unidentified Flycatcher	13	1.1	1	2
Horned Lark	2272	1.4	1	75
Tree Swallow	9	2.3	1	10
Barn Swallow	19	1.2	1	2
Cliff Swallow	240	2.0	1	30
N. Rough-winged Swallow	2	1.5	1	2
Bank Swallow	2	1.5	1	2
Unidentified Swallow	20	1.4	1	3
Violet-green Swallow	24	1.3	1	3
Common Raven	6	1.2	1	2
Black-billed Magpie	23	1.3	1	3
Clark's Nutcracker	1	1.0	1	1
Blue Jay	1	1.0	1	1
House Wren	41	1.2	1	2
Rock Wren	95	1.1	1	2
Sage Thrasher	280	1.1	1	3
Swainson's Thrush	3	1.0	1	1
Gray Catbird	2	1.0	1	1
American Robin	83	1.1	1	3
Mountain Bluebird	49	1.6	1	12
Brown Thrasher	2	1.0	1	1
Loggerhead Shrike	2	1.0	1	1
Hermit Thrush	1	1.0	1	1
European Starling	7	1.3	1	3
Warbling Vireo	6	1.3	1	3
Unidentified Vireo	1	1.0	1	1
Ruby-crowned Kinglet	1	1.0	1	1
Orange-crowned Warbler	3	1.0	1	1
Yellow Warbler	21	1.0	1	1
Yellow-rumped Warbler	10	1.4	1	3
MacGillivray's Warbler	8	1.0	1	1
Unidentified Warbler	1	1.0	1	1
Western Meadowlark	294	1.0	1	3

Appendix G (Continued). Flock size characteristics of birds observed during surveys on FCR, SR, and MPR, 1995-1999.

PSB Survey Data

		Flock Size		
Species	N	Mean	Min	Max
Red-winged Blackbird	15	1.6	1	4
Brewer's Blackbird	208	1.8	1	20
Common Grackle	4	1.5	1	2
Brown-headed Cowbird	32	1.5	1	4
Unidentified Blackbird	5	4.8	1	20
American Goldfinch	42	1.3	1	5
Pine Siskin	21	3.9	1	10
Evening Grosbeak	1	1.0	1	1
Green-tailed Towhee	196	1.1	1	3
Unidentified Finch	1	2.0	2	2
McCown's Longspur	114	1.1	1	3
Savannah Sparrow	13	1.1	1	2
Song Sparrow	17	1.0	1	1
Lincoln's Sparrow	2	1.0	1	1
White-crowned Sparrow	7	1.1	1	2
Lark Sparrow	1	1.0	1	1
Baird's Sparrow	1	2.0	2	2
Vesper Sparrow	1508	1.1	1	6
Brewer's Sparrow	1028	1.1	1	5
Chipping Sparrow	10	5.3	1	25
Dark-eyed Junco	2	1.0	1	1
Unidentified Sparrow	83	1.3	1	7
Lark Bunting	25	1.2	1	3
Cedar Waxwing	1	4.0	4	4
Black-capped Chickadee	2	1.0	1	1
Unidentified Bird	12	1.3	1	4

Appendix H. Fight heights of birds observed during RLB surveys on FCR and SR study areas, 1995-1999.

Species	# individs.	# flocks	proportion flying RSH	Flight Height 1-18 m	19-62 m	>62 m
American white pelican	29	10	96.7	15.4	41.0	43.6
Double-crested cormorant	4	1	100.0	nd	nd	nd
Unidentified Grebe	0	0	0.0	nd	nd	nd
Eared Grebe	0	0	0.0	nd	nd	nd
Pied-billed Grebe	0	0	0.0	nd	nd	nd
Great blue heron	3	3	20.0	0.0	50.0	50.0
Unidentified Tern	1	1	9.1	100.0	0.0	0.0
Canada goose	152	17	65.2	0.0	1.3	98.7
Mallard	111	35	29.6	57.1	42.9	0.0
Redhead	0	0	0.0	nd	nd	nd
Gadwall	4	2	6.2	nd	nd	nd
American wigeon	20	5	12.2	nd	nd	nd
Northern pintail	5	4	14.3	nd	nd	nd
Northern shoveler	0	0	0.0	nd	nd	nd
Green-winged teal	11	3	18.0	nd	nd	nd
Ring-necked duck	1	1	12.5	nd	nd	nd
Blue-winged teal	5	3	25.0	100.0	0.0	0.0
Cinnamon teal	2	1	33.3	nd	nd	nd
Canvasback	0	0	0.0	nd	nd	nd
Lesser scaup	9	2	24.3	nd	nd	nd
Bufflehead	0	0	0.0	nd	nd	nd
Common merganser	7	3	77.8	100.0	0.0	0.0
Unidentified duck	232	7	21.6	100.0	0.0	0.0
Sandhill Crane	11	6	78.6	0.0	66.7	33.3
Turkey vulture	59	42	100.0	8.5	40.8	50.7
Osprey	7	7	100.0	22.2	44.4	33.3
Sharp-shinned hawk	37	34	90.2	82.1	17.9	0.0
Unidentified accipiter	5	5	100.0	50.0	50.0	0.0
Cooper's hawk	20	19	90.9	40.9	31.8	27.3
Red-tailed hawk	684	529	83.2	49.6	33.8	16.6
Swainson's hawk	90	78	97.8	21.5	48.6	29.9
Rough-legged hawk	26	26	96.3	26.9	46.2	26.9
Ferruginous hawk	172	164	95.0	40.5	35.9	23.5
Unidentified buteo	75	68	90.4	35.1	37.2	27.7
Northern harrier	173	169	88.7	81.9	12.9	5.3
Golden eagle	1136	1058	92.7	25.4	43.0	31.6
Bald eagle	24	23	100.0	28.1	21.9	50.0

[a] Number of groups observed where flight height data were recorded
[b] 19-62 m zone considered within rotor-swept height of SeaWest turbines
[c] RSH = Rotor-swept Height of SeaWest turbines

Appendix H (Continued). Fight heights of birds observed during RLB surveys on FCR and SR study areas, 1995-1999.

			proportion	Flight Height		
Species	# individs.	# flocks	flying	1-18 m	19-62 m	>62 m
Unidentified eagle	3	3	100.0	0.0	100.0	0.0
Peregrine falcon	1	1	100.0	0.0	100.0	0.0
Prairie falcon	148	143	95.5	44.4	36.8	18.8
Unidentified large falcon	4	4	100.0	60.0	20.0	20.0
Unidentified falcon	1	1	100.0	100.0	0.0	0.0
Merlin	7	7	100.0	83.3	16.7	0.0
American kestrel	279	270	84.5	72.8	21.3	6.0
Unidentified small falcon	5	5	100.0	75.0	0.0	25.0
Unidentified raptor	18	18	100.0	64.7	29.4	5.9
Blue grouse	0	0	0.0	nd	nd	nd
Sage grouse	5	2	50.0	100.0	0.0	0.0
Chukar	0	0	0.0	nd	nd	nd
Killdeer	18	12	42.9	75.0	25.0	0.0
Marbled Godwit	1	1	50.0	100.0	0.0	0.0
Unidentified Sandpiper	14	3	100.0	58.3	0.0	41.7
Unidentified Shorebird	1	1	100.0	0.0	0.0	100.0
Wilson's phalarope	12	6	22.2	100.0	0.0	0.0
Red-necked phalarope	2	1	66.7	100.0	0.0	0.0
American Avocet	11	6	28.9	100.0	0.0	0.0
Common snipe	1	1	100.0	nd	nd	nd
California gull	29	16	100.0	34.6	50.0	15.4
Unidentified Gull	3	2	100.0	33.3	66.7	0.0
Franklin's gull	108	11	100.0	6.8	40.8	52.4
Common nighthawk	13	8	92.9	47.4	52.6	0.0
Common raven	255	175	88.2	61.8	27.6	10.7
American crow	253	30	71.1	60.5	6.0	33.5
Black-billed magpie	123	79	65.8	94.6	4.3	1.1
Mountain plover	14	10	43.8	85.7	14.3	0.0
Unidentified Large Bird	1	1	100.0	0.0	100.0	0.0

[a] Number of groups observed where flight height data were recorded
[b] 19-62 m zone considered within rotor-swept height of SeaWest turbines
[c] RSH = Rotor-swept Height of SeaWest turbines

Appendix I. Percentage of birds flying and percentage of flight heights below, within, and above the rotor-swept area of turbines for birds observed during PSB surveys, 1995-1999.

Species	# indivs.	# flocks	% of obs. flying	flight height categories % of observations		
				1-18 m	19-62 m[a]	>62 m
American White Pelican	12	6	66.7	30.0	60.0	10.0
Great Blue Heron	1	1	100.0	0.0	100.0	0.0
Canada Goose	69	2	89.6	6.3	0.0	93.8
Mallard	12	3	33.3	100.0	0.0	0.0
American Coot	0	0	0.0	0.0	0.0	0.0
Gadwall	7	3	14.3	0.0	0.0	0.0
American Wigeon	9	1	14.8	100.0	0.0	0.0
Northern Pintail	0	0	0.0	0.0	0.0	0.0
Green-winged Teal	5	2	55.6	100.0	0.0	0.0
Blue-winged Teal	0	0	0.0	0.0	0.0	0.0
Cinnamon Teal	0	0	0.0	0.0	0.0	0.0
Northern Shoveler	0	0	0.0	0.0	0.0	0.0
Lesser Scaup	0	0	0.0	0.0	0.0	0.0
Redhead	0	0	0.0	0.0	0.0	0.0
Canvasback	0	0	0.0	0.0	0.0	0.0
Unidentified Dabbler	0	0	0.0	0.0	0.0	0.0
Ruddy Duck	0	0	0.0	0.0	0.0	0.0
Unidentified Duck	1	1	2.5	100.0	0.0	0.0
Eared Grebe	0	0	0.0	0.0	0.0	0.0
Turkey Vulture	3	2	100.0	0.0	100.0	0.0
Sharp-shinned Hawk	0	0	0.0	0.0	0.0	0.0
Red-tailed Hawk	49	22	71.0	52.0	40.0	8.0
Swainson's Hawk	16	10	88.9	66.7	33.3	0.0
Ferruginous Hawk	29	12	76.3	41.7	58.3	0.0
Unidentified Buteo	2	1	100.0	0.0	100.0	0.0
Northern Harrier	17	6	100.0	83.3	16.7	0.0
Golden Eagle	57	27	98.3	39.3	57.1	3.6
Bald Eagle	1	1	100.0	100.0	0.0	0.0
Prairie Falcon	14	6	100.0	50.0	50.0	0.0
Unidentified Large Falcon	1	1	100.0	0.0	0.0	100.0
American Kestrel	33	18	84.6	72.2	27.8	0.0
Unidentified Raptor	1	1	100.0	0.0	0.0	0.0
Sage Grouse	1	1	5.0	100.0	0.0	0.0
Sandhill Crane	11	1	57.9	100.0	0.0	0.0
Killdeer	28	11	30.8	100.0	0.0	0.0
Common Snipe	2	2	22.2	0.0	100.0	0.0
Mountain Plover	22	5	25.6	80.0	20.0	0.0
Long-billed Curlew	2	1	100.0	100.0	0.0	0.0

[b] 19-62 m = rotor-swept area of SeaWest turbines

Appendix I (Continued). Percentage of birds flying and percentage of flight heights below, within, and above the rotor-swept area of turbines for birds observed during PSB surveys, 1995-1999.

Species	# indivs.	# flocks	% of obs. flying	flight height categories % of observations		
				1-18 m	19-62 m[a]	>62 m
American Avocet	5	2	62.5	100.0	0.0	0.0
Wilson's Phalarope	5	2	50.0	100.0	0.0	0.0
Unidentified Shorebird	5	3	100.0	0.0	0.0	0.0
California Gull	11	6	100.0	71.4	28.6	0.0
Caspian Tern	1	1	100.0	100.0	0.0	0.0
Mourning Dove	23	11	76.7	100.0	0.0	0.0
Common Nighthawk	18	3	78.3	66.7	33.3	0.0
Northern Flicker	8	2	20.0	100.0	0.0	0.0
Red-naped Sapsucker	0	0	0.0	0.0	0.0	0.0
Unidentified Woodpecker	0	0	0.0	0.0	0.0	0.0
Broad-tailed Hummingbird	53	17	91.4	100.0	0.0	0.0
Rufous Hummingbird	2	2	66.7	0.0	0.0	0.0
Unidentified Hummingbird	2	1	100.0	0.0	0.0	0.0
Eastern Kingbird	0	0	0.0	0.0	0.0	0.0
Western Kingbird	2	2	66.7	100.0	0.0	0.0
Say's Phoebe	8	2	40.0	100.0	0.0	0.0
Olive-sided Flycatcher	0	0	0.0	0.0	0.0	0.0
Cordilleran Flycatcher	0	0	0.0	0.0	0.0	0.0
Western Wood Pewee	3	2	21.4	100.0	0.0	0.0
Dusky Flycatcher	0	0	0.0	0.0	0.0	0.0
Unidentified Flycatcher	3	3	20.0	0.0	0.0	0.0
Horned Lark	2269	672	65.3	96.2	3.6	0.18
Tree Swallow	27	9	100.0	95.7	4.3	0.0
Barn Swallow	23	8	95.8	100.0	0.0	0.0
Cliff Swallow	577	140	99.5	92.2	7.8	0.0
N. Rough-winged Swallow	3	2	100.0	100.0	0.0	0.0
Bank Swallow	3	2	100.0	0.0	0.0	0.0
Unidentified Swallow	36	19	100.0	80.8	11.5	7.7
Violet-green Swallow	33	3	97.1	20.0	80.0	0.0
Common Raven	26	12	78.8	75.0	18.8	6.3
American Crow	2	1	50.0	0.0	100.0	0.0
Black-billed Magpie	37	3	52.9	80.0	20.0	0.0
Clark's Nutcracker	1	1	33.3	0.0	0.0	0.0
Blue Jay	0	0	0.0	0.0	0.0	0.0
House Wren	5	3	10.2	100.0	0.0	0.0
Rock Wren	11	3	7.7	100.0	0.0	0.0
Sage Thrasher	54	17	11.8	100.0	0.0	0.0
Swainson's Thrush	1	1	33.3	100.0	0.0	0.0

[b] 19-62 m = rotor-swept area of SeaWest turbines

Appendix I (Continued). Percentage of birds flying and percentage of flight heights below, within, and above the rotor-swept area of turbines for birds observed during PSB surveys, 1995-1999.

Species	# indivs.	# flocks	% of obs. flying	flight height categories % of observations		
				1-18 m	19-62 m[a]	>62 m
Gray Catbird	0	0	0.0	0.0	0.0	0.0
American Robin	53	14	45.7	87.5	12.5	0.0
Mountain Bluebird	39	10	43.3	73.7	10.5	15.8
Brown Thrasher	0	0	0.0	0.0	0.0	0.0
Loggerhead Shrike	0	0	0.0	0.0	0.0	0.0
Hermit Thrush	0	0	0.0	0.0	0.0	0.0
European Starling	9	4	90.0	100.0	0.0	0.0
Warbling Vireo	0	0	0.0	0.0	0.0	0.0
Unidentified Vireo	1	1	100.0	100.0	0.0	0.0
Ruby-crowned Kinglet	0	0	0.0	0.0	0.0	0.0
Orange-crowned Warbler	0	0	0.0	0.0	0.0	0.0
Yellow Warbler	2	2	8.0	0.0	0.0	0.0
Yellow-rumped Warbler	7	4	50.0	100.0	0.0	0.0
MacGillivray's Warbler	1	1	12.5	0.0	0.0	0.0
Black-headed Grosbeak	0	0	0.0	0.0	0.0	0.0
Unidentified Warbler	0	0	0.0	0.0	0.0	0.0
Western Meadowlark	52	26	10.8	96.8	3.2	0.0
Red-winged Blackbird	25	7	61.0	100.0	0.0	0.0
Brewer's Blackbird	356	88	72.2	88.5	9.2	2.3
Common Grackle	1	1	16.7	0.0	0.0	0.0
Brown-headed Cowbird	39	15	72.2	95.8	4.2	0.0
Unidentified Blackbird	28	6	100.0	20.0	80.0	0.0
American Goldfinch	45	8	76.3	88.9	11.1	0.0
Pine Siskin	64	4	79.0	75.0	25.0	0.0
Evening Grosbeak	0	0	0.0	0.0	0.0	0.0
Green-tailed Towhee	33	16	14.9	100.0	0.0	0.0
Unidentified Finch	2	1	100.0	0.0	0.0	0.0
McCown's Longspur	117	50	78.5	100.0	0.0	0.0
Savannah Sparrow	0	0	0.0	0.0	0.0	0.0
Song Sparrow	0	0	0.0	0.0	0.0	0.0
Lincoln's Sparrow	1	1	50.0	0.0	0.0	0.0
White-crowned Sparrow	1	1	12.5	0.0	0.0	0.0
Lark Sparrow	0	0	0.0	0.0	0.0	0.0
Baird's Sparrow	0	0	0.0	0.0	0.0	0.0
Vesper Sparrow	437	148	23.8	100.0	0.0	0.0
Brewer's Sparrow	313	140	25.7	98.8	1.2	0.0
Chipping Sparrow	45	5	84.9	100.0	0.0	0.0
Dark-eyed Junco	2	2	100.0	0.0	0.0	0.0
Unidentified Sparrow	67	34	52.3	88.6	11.4	0.0

[b] 19-62 m = rotor-swept area of SeaWest turbines

Appendix I (Continued). Percentage of birds flying and percentage of flight heights below, within, and above the rotor-swept area of turbines for birds observed during PSB surveys, 1995-1999.

Species	# indivs.	# flocks	% of obs. flying	flight height categories % of observations		
				1-18 m	19-62 m[a]	>62 m
Lark Bunting	23	4	62.2	100.0	0.0	0.0
Cedar Waxwing	4	1	100.0	100.0	0.0	0.0
Black-capped Chickadee	0	0	0.0	0.0	0.0	0.0
Unidentified Bird	12	8	70.6	0.0	0.0	0.0
TOTAL	5441	1704	xx	91.4	7.3	1.2

[b] 19-62 m = rotor-swept area of SeaWest turbines

Appendix J. Relative turbine exposure indices for birds observed during RLB surveys, 1995-1999.

Foote Creek Rim

Species	Exposure Index[a] Spring	Summer	Fall	Winter	Prop. Flying[b]	% Flying in RSH[b]
American white pelican	0	0.0115	0	0	96.7	41.0
Double-crested cormorant	0	0	0	0	100	0
Great blue heron	0.0023	0.0002	0	0	20.0	50.0
Canada goose	0.0002	0.0009	<0.0001	0	65.2	1.3
Mallard	0.0070	0.0119	0.0010	0	29.6	42.9
Gadwall	0	0	0	0	6.2	0
American wigeon	0	0	0	0	12.2	0
Northern shoveler	0	0	0	0	0	0
Green-winged teal	0	0	0	0	18.0	0
Blue-winged teal	0	0	0	0	25.0	0
Cinnamon teal	0	0	0	0	33.3	0
Lesser scaup	0	0	0	0	24.3	0
Common merganser	0	0	0	0	77.8	0
Unidentified duck	0	0	0	0	21.6	0
Sandhill Crane	0.0047	0.0063	0	0	78.6	66.7
Turkey vulture	0	0.0233	0.0078	0	100	40.8
Osprey	0	0.0018	0	0	100	44.4
Sharp-shinned hawk	0	0.0010	0.0103	0	90.2	17.9
Unidentified accipiter	0	0.0010	0.0035	0	100	50.0
Cooper's hawk	0.0006	0.0014	0.0078	0	90.9	31.8
Red-tailed hawk	0.0402	0.1370	0.1541	0	83.2	33.8
Swainson's hawk	0	0.0276	0.0071	0	97.8	48.6
Rough-legged hawk	0.0076	0.0013	0.0044	0.0200	96.3	46.2
Ferruginous hawk	0.0198	0.0157	0.0372	0.0041	95.0	35.9
Unidentified buteo	0.0040	0.0135	0.0262	0	90.4	37.2
Northern harrier	0.0024	0.0068	0.0104	0	88.7	12.9
Golden eagle	0.2416	0.1897	0.2786	0.1339	92.7	43.0
Bald eagle	0.0022	0.0002	0.0044	0.0009	100	21.9
Unidentified eagle	0.0030	0.0010	0.0030	0	100	100
Prairie falcon	0.0183	0.0257	0.0295	0.0035	95.5	36.8
Unidentified large falcon	0.0006	0	0.0010	0	100	20.0
Unidentified falcon	0	0	0	0	100	0
Merlin	0.0008	0.0005	0.0008	0	100	16.7
American kestrel	0.0068	0.0315	0.0227	0	84.5	21.3
Unidentified small falcon	0	0	0	0	100	0
Unidentified raptor	0.0009	0.0018	0.0044	0.0012	100	29.4
Blue Grouse	0	0	0	0	0	0
Chukar	0	0	0	0	0	0

[a] Exposure index calculated by multiplying mean use (#/survey) times proportion of all observations where species *i* was observed flying times proportion of all flying observations where species *i* was observed within the rotor-swept height of turbines.

[b] Percent flying and percent flying in the RSH was calculated using data from FCR and SR, combined

Appendix J (Continued). Relative turbine exposure indices for birds observed during RLB surveys, 1995-1999.

Foote Creek Rim

Species	Exposure Index[a] Spring	Summer	Fall	Winter	Prop. Flying[b]	% Flying in RSH[b]
Killdeer	0	0.0002	0	0	42.9	25.0
Unidentified Sandpiper	0	0	0	0	100	0
Unidentified Shorebird	0	0	0	0	100	0
Wilson's phalarope	0	0	0	0	22.2	0
Common snipe	0	0	0	0	100	0
California gull	0.0105	0.0080	0	0	100	50.0
Unidentified Gull	0	0	0.0020	0	100	66.7
Franklin's gull	0.0082	0.0396	0	0	100	40.8
Common nighthawk	0	0.0034	0.0010	0	92.9	52.6
Common raven	0.0253	0.0236	0.0399	0.0200	88.2	27.6
American crow	0.0070	0.0029	0.0102	0	71.1	6.0
Black-billed magpie	0.0016	0.0025	0.0008	0.0003	65.8	4.3
Mountain plover	0	0.0020	0	0	43.8	14.3
Unidentified Large Bird	0	0	0.0030	0	100	100

[a] Exposure index calculated by multiplying mean use (#/survey) times proportion of all observations where species i was observed flying times proportion of all flying observations where species i was observed within the rotor-swept height of turbines.

[b] Percent flying and percent flying in the RSH was calculated using data from FCR and SR, combined

Appendix J (Continued). Relative turbine exposure indices for birds observed during RLB surveys, 1995-1999.

Simpson Ridge

Species	Exposure Index[a] Spring	Summer	Fall	Winter	Prop. Flying[b]	% Flying in RSH[b]
American white pelican	0	0.0008	0	0	96.7	41.0
Unidentified Grebe	0	0	0	0	0	0
Eared Grebe	0	0	0	0	0	0
Pied-billed Grebe	0	0	0	0	0	0
Great blue heron	0	0.0003	0	0	20.0	50.0
Unidentified Tern	0	0	0	0	9.1	0
Canada goose	0.0001	0.0004	0.0040	0	65.2	1.3
Mallard	0.0034	0.0456	0.0017	0	29.6	42.9
Redhead	0	0	0	0	0	0
Gadwall	0	0	0	0	6.2	0
American wigeon	0	0	0	0	12.2	0
Northern pintail	0	0	0	0	14.3	0
Northern shoveler	0	0	0	0	0	0
Green-winged teal	0	0	0	0	18.0	0
Ring-necked duck	0	0	0	0	12.5	0
Blue-winged teal	0	0	0	0	25.0	0
Cinnamon teal	0	0	0	0	33.3	0
Canvasback	0	0	0	0	0	0
Lesser scaup	0	0	0	0	24.3	0
Bufflehead	0	0	0	0	0	0
Common merganser	0	0	0	0	77.8	0
Unidentified duck	0	0	0	0	21.6	0
Turkey vulture	0.0041	0.0049	0	0	100	40.8
Osprey	0	0.0031	0	0	100	44.4
Sharp-shinned hawk	0	0.0005	0.0034	0	90.2	17.9
Cooper’s hawk	0.0014	0	0	0	90.9	31.8
Red-tailed hawk	0.0031	0.0239	0.0177	0	83.2	33.8
Swainson’s hawk	0	0.0356	0.0057	0	97.8	48.6
Rough-legged hawk	0	0	0	0.0053	96.3	46.2
Ferruginous hawk	0.0471	0.0290	0.0048	0	95.0	35.9
Unidentified buteo	0.0084	0.0007	0.0017	0	90.4	37.2
Northern harrier	0.0019	0.0170	0.0097	0	88.7	12.9
Golden eagle	0.1048	0.0598	0.0650	0.0801	92.7	43.0
Bald eagle	0.0020	0.0004	0.0020	0.0050	100	21.9
Peregrine falcon	0	0.0020	0	0	100	100
Prairie falcon	0.0035	0.0172	0.0032	0.0018	95.5	36.8
Unidentified large falcon	0	0.0004	0	0	100	20.0
American kestrel	0.0054	0.0234	0.0095	0	84.5	21.3

a Exposure index calculated by multiplying mean use (#/survey) times proportion of all observations where species i was observed flying times proportion of all flying observations where species i was observed within the rotor-swept height of turbines.

b Percent flying and percent flying in the RSH was calculated using data from FCR and SR, combined

Appendix J (Continued). Relative turbine exposure indices for birds observed during RLB surveys, 1995-1999.

Simpson Ridge

Species	Exposure Index[a] Spring	Summer	Fall	Winter	Prop. Flying[b]	% Flying in RSH[b]
Unidentified small falcon	0	0	0	0	100	0
Unidentified raptor	0	0.0012	0.0065	0	100	29.4
Sage grouse	0	0	0	0	50.0	0
Red-necked phalarope	0	0	0	0	66.7	0
Killdeer	0	0.0059	0	0	42.9	25.0
Marbled Godwit	0	0	0	0	50.0	0
Unidentified Sandpiper	0	0	0	0	100	0
Wilson's phalarope	0	0	0	0	22.2	0
American Avocet	0	0	0	0	28.9	0
California gull	0	0.0055	0	0	100	50.0
Unidentified Gull	0.0047	0	0	0	100	66.7
Franklin's gull	0	0.0065	0	0	100	40.8
Common nighthawk	0	0.0059	0.0044	0	92.9	52.6
Common raven	0.0200	0.0139	0.0093	0.0105	88.2	27.6
American crow	0.0061	0.0001	0.0002	0	71.1	6.0
Black-billed magpie	0.0008	0.0005	0.0004	0.0004	65.8	4.3

a Exposure index calculated by multiplying mean use (#/survey) times proportion of all observations where species i was observed flying times proportion of all flying observations where species i was observed within the rotor-swept height of turbines.

b Percent flying and percent flying in the RSH was calculated using data from FCR and SR, combined

Appendix K. Relative turbine exposure indices for birds observed during PSB surveys, 1995-1999.

Species	Exposure Index FCR	Exposure Index SR	Mean Use FCR	Mean Use SR	Detection Probability	% fly	% in rotor swept height
Pine Siskin	0.542	0.014	0.165	0.004	0.06	79.0	25.0
American Goldfinch	0.324	0.000	0.115	0.000	0.03	76.3	11.1
Cliff Swallow	0.289	0.189	0.410	0.269	0.11	99.5	7.8
Violet-green Swallow	0.250	0.176	0.035	0.025	0.11	97.1	80.0
Horned Lark	0.152	0.074	2.077	1.015	0.32	65.3	3.6
Unidentified Blackbird	0.135	0.013	0.044	0.004	0.26	100.0	80.0
Brewer's Blackbird	0.095	0.043	0.385	0.175	0.27	72.2	9.2
American Robin	0.031	0.005	0.148	0.023	0.27	45.7	12.5
Unidentified Swallow	0.024	0.020	0.023	0.019	0.11	100.0	11.5
Unidentified Sparrow	0.017	0.021	0.083	0.108	0.3	52.3	11.4
Tree Swallow	0.016	0.001	0.042	0.002	0.11	100.0	4.3
Mountain Bluebird	0.012	0.006	0.096	0.048	0.37	43.3	10.5
Brewer's Sparrow	0.008	0.021	0.448	1.173	0.17	25.7	1.2
Golden Eagle	0.007	0.002	0.013	0.004	1	98.3	57.1
Red-tailed Hawk	0.007	0.001	0.023	0.002	1	71.0	40.0
Mountain Plover	0.006	0.000	0.058	0.000	0.47	25.6	20.0
Brown-headed Cowbird	0.006	0.003	0.052	0.027	0.26	72.2	4.2
Western Meadowlark	0.004	0.007	0.075	0.123	0.06	10.8	3.2
Turkey Vulture	0.004	0.000	0.004	0.000	1	100.0	100.0
American Kestrel	0.004	0.005	0.017	0.021	1	84.6	27.8
Black-billed Magpie	0.003	0.003	0.031	0.029	1	52.9	20.0
Prairie Falcon	0.003	0.002	0.006	0.004	1	100.0	50.0
Common Snipe	0.003	0.000	0.006	0.000	0.47	22.2	100.0
Common Nighthawk	0.003	0.001	0.010	0.002	1	78.3	33.3
California Gull	0.002	0.001	0.008	0.002	1	100.0	28.6
Great Blue Heron	0.002	0.000	0.002	0.000	1	100.0	100.0
Northern Harrier	0.002	0.001	0.013	0.004	1	100.0	16.7
Swainson's Hawk	0.001	0.001	0.004	0.004	1	88.9	33.3
Common Raven	0.001	0.000	0.008	0.002	1	78.8	18.8
Ferruginous Hawk	0.001	0.004	0.002	0.008	1	76.3	58.3
Vesper Sparrow	0.000	0.000	0.927	1.308	0.29	23.8	0.0
Green-tailed Towhee	0.000	0.000	0.248	0.160	0.16	14.9	0.0
Chipping Sparrow	0.000	0.000	0.106	0.004	0.3	84.9	0.0
Broad-tailed Hummingbird	0.000	0.000	0.102	0.017	0.07	91.4	0.0
House Wren	0.000	0.000	0.100	0.000	0.2	10.2	0.0
Northern Flicker	0.000	0.000	0.056	0.004	0.96	20.0	0.0
Canada Goose	0.000	0.000	0.054	0.040	1	89.6	0.0
Yellow Warbler	0.000	0.000	0.044	0.000	0.07	8.0	nd
Sage Thrasher	0.000	0.000	0.035	0.442	1	11.8	0.0
Unidentified Flycatcher	0.000	0.000	0.029	0.000	0.13	20.0	nd
Yellow-rumped Warbler	0.000	0.000	0.029	0.000	0.07	50.0	0.0
Mourning Dove	0.000	0.000	0.027	0.019	1	76.7	0.0

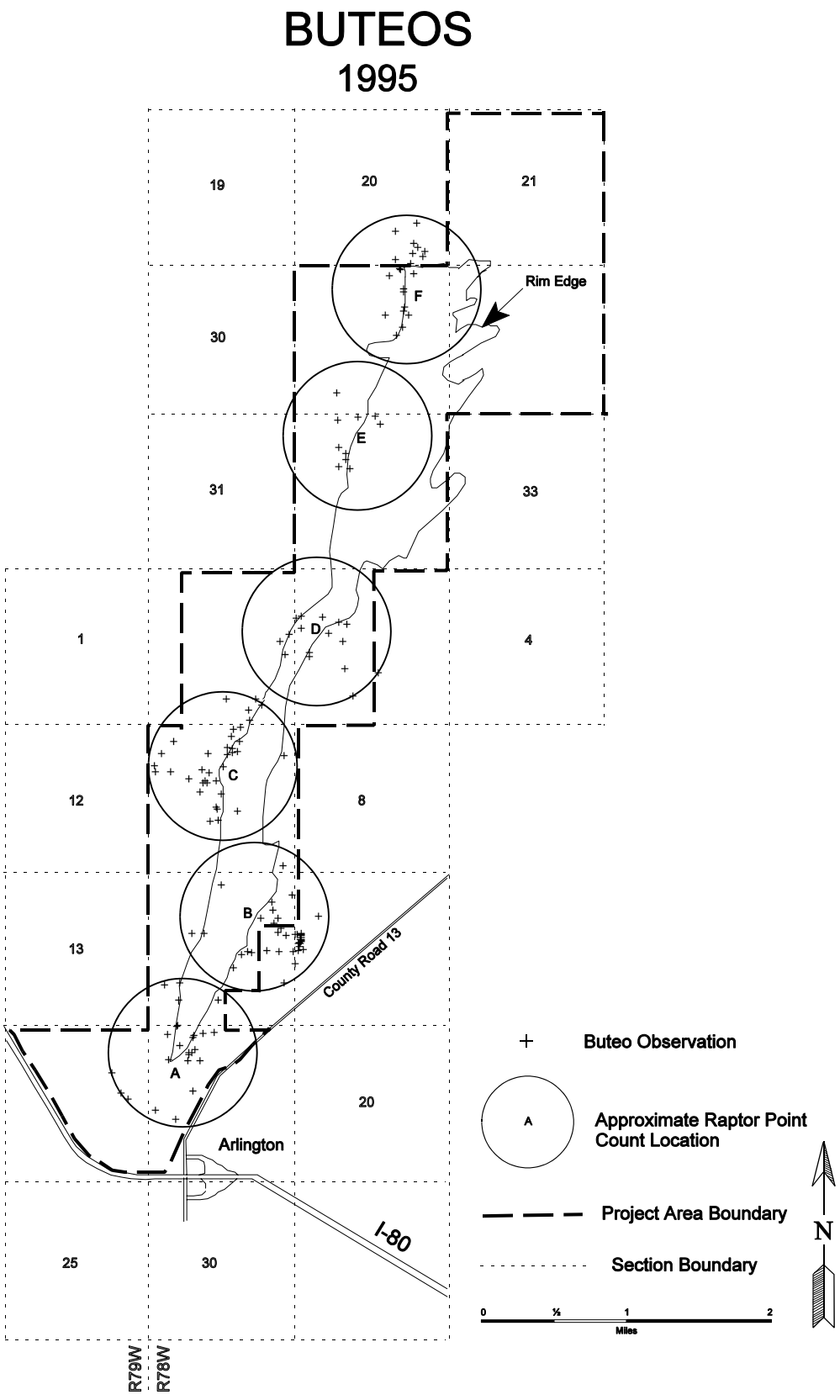
Appendix K (Continued). Relative turbine exposure indices for birds observed during PSB surveys, 1995-1999.

Species	Exposure Index FCR	Exposure Index SR	Mean Use FCR	Mean Use SR	Detection Probability	% fly	% in rotor swept height
Unidentified Bird	0.000	0.000	0.027	0.002	1	70.6	0.0
Western Wood Pewee	0.000	0.000	0.027	0.000	0.13	21.4	0.0
European Starling	0.000	0.000	0.019	0.000	0.26	90.0	0.0
MacGillivray's Warbler	0.000	0.000	0.017	0.000	0.07	12.5	0.0
Warbling Vireo	0.000	0.000	0.017	0.000	0.07	0.0	0.0
White-crowned Sparrow	0.000	0.000	0.017	0.000	0.3	12.5	0.0
Barn Swallow	0.000	0.000	0.015	0.004	0.11	95.8	0.0
Rock Wren	0.000	0.000	0.015	0.100	0.45	7.7	0.0
Song Sparrow	0.000	0.000	0.015	0.017	0.3	0.0	0.0
Common Grackle	0.000	0.000	0.013	0.000	0.26	16.7	0.0
Killdeer	0.000	0.000	0.013	0.033	0.47	30.8	0.0
Red-naped Sapsucker	0.000	0.000	0.013	0.000	0.96	0.0	0.0
Savannah Sparrow	0.000	0.000	0.013	0.002	0.3	0.0	0.0
Lark Bunting	0.000	0.000	0.010	0.019	0.3	62.2	0.0
Mallard	0.000	0.000	0.010	0.013	1	33.3	0.0
Unidentified Shorebird	0.000	0.000	0.010	0.000	0.47	100.0	0.0
Cedar Waxwing	0.000	0.000	0.008	0.000	0.3	100.0	0.0
Red-winged Blackbird	0.000	0.000	0.008	0.038	0.26	61.0	0.0
Orange-crowned Warbler	0.000	0.000	0.006	0.000	0.07	0.0	0.0
Swainson's Thrush	0.000	0.000	0.006	0.000	0.69	33.3	0.0
Baird's Sparrow	0.000	0.000	0.004	0.000	0.3	0.0	0.0
Bank Swallow	0.000	0.000	0.004	0.000	0.11	100.0	0.0
Black-capped Chickadee	0.000	0.000	0.004	0.000	0.3	0.0	0.0
Dark-eyed Junco	0.000	0.000	0.004	0.000	0.3	100.0	0.0
Eastern Kingbird	0.000	0.000	0.004	0.000	0.13	0.0	0.0
Gray Catbird	0.000	0.000	0.004	0.000	0.69	0.0	0.0
Lincoln's Sparrow	0.000	0.000	0.004	0.000	0.3	50.0	0.0
Sandhill Crane	0.000	0.000	0.004	0.000	1	57.9	0.0
Unidentified Finch	0.000	0.000	0.004	0.000	0.79	100.0	0.0
Unidentified Hummingbird	0.000	0.000	0.004	0.000	0.07	100.0	0.0
Blue Jay	0.000	0.000	0.002	0.000	0.69	0.0	0.0
Cordilleran Flycatcher	0.000	0.000	0.002	0.000	0.13	0.0	0.0
Dusky Flycatcher	0.000	0.000	0.002	0.000	0.13	0.0	0.0
Evening Grosbeak	0.000	0.000	0.002	0.000	0.3	0.0	0.0
Hermit Thrush	0.000	0.000	0.002	0.000	0.3	0.0	0.0
Olive-sided Flycatcher	0.000	0.000	0.002	0.000	0.13	0.0	0.0
Ruby-crowned Kinglet	0.000	0.000	0.002	0.000	0.3	0.0	0.0
Rufous Hummingbird	0.000	0.000	0.002	0.004	0.07	66.7	0.0
Sharp-shinned Hawk	0.000	0.000	0.002	0.000	1	0.0	0.0
Unidentified Vireo	0.000	0.000	0.002	0.000	0.07	100.0	0.0
Unidentified Warbler	0.000	0.000	0.002	0.000	0.07	0.0	0.0
Unidentified Woodpecker	0.000	0.000	0.002	0.000	1	0.0	0.0

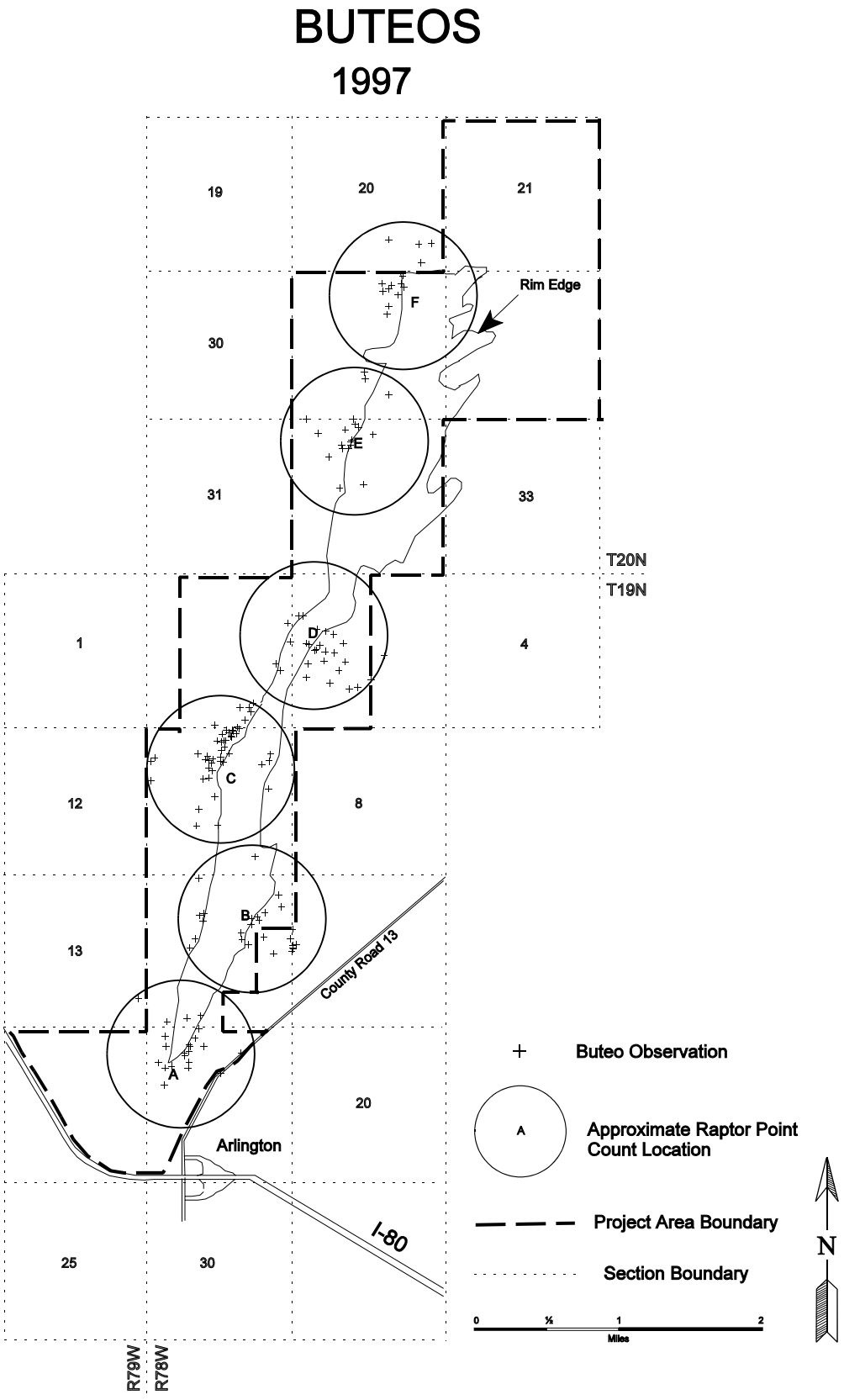
Appendix K (Continued). Relative turbine exposure indices for birds observed during PSB surveys, 1995-1999.

Species	Exposure Index FCR	Exposure Index SR	Mean Use FCR	Mean Use SR	Detection Probability	% fly	% in rotor swept height
Western Kingbird	0.000	0.000	0.002	0.002	0.13	66.7	0.0
Wilson's Phalarope	0.000	0.000	0.002	0.008	0.47	50.0	0.0
American White Pelican	0.000	0.003	0.000	0.006	1	66.7	60.0
American Wigeon	0.000	0.000	0.000	0.031	1	14.8	0.0
Brown Thrasher	0.000	0.000	0.000	0.004	0.3	0.0	0.0
Canvasback	0.000	0.000	0.000	0.002	1	0.0	0.0
Cinnamon Teal	0.000	0.000	0.000	0.002	1	0.0	0.0
Clark's Nutcracker	0.000	0.000	0.000	0.002	1	33.3	0.0
Gadwall	0.000	0.000	0.000	0.029	1	14.3	0.0
Green-winged Teal	0.000	0.000	0.000	0.006	1	55.6	0.0
Lark Sparrow	0.000	0.000	0.000	0.000	0.3	0.0	0.0
Lesser Scaup	0.000	0.000	0.000	0.004	1	0.0	0.0
Loggerhead Shrike	0.000	0.000	0.000	0.004	0.3	0.0	0.0
Long-billed Curlew	0.000	0.000	0.000	0.000	0.47	100.0	0.0
McCown's Longspur	0.000	0.000	0.000	0.000	0.3	78.5	0.0
Northern rough-winged Swallow	0.000	0.000	0.000	0.000	0.11	100.0	0.0
Redhead	0.000	0.000	0.000	0.006	1	0.0	0.0
Sage Grouse	0.000	0.000	0.000	0.021	1	5.0	0.0
Say's Phoebe	0.000	0.000	0.000	0.031	0.13	40.0	0.0
Unidentified Duck	0.000	0.000	0.000	0.025	1	2.5	0.0

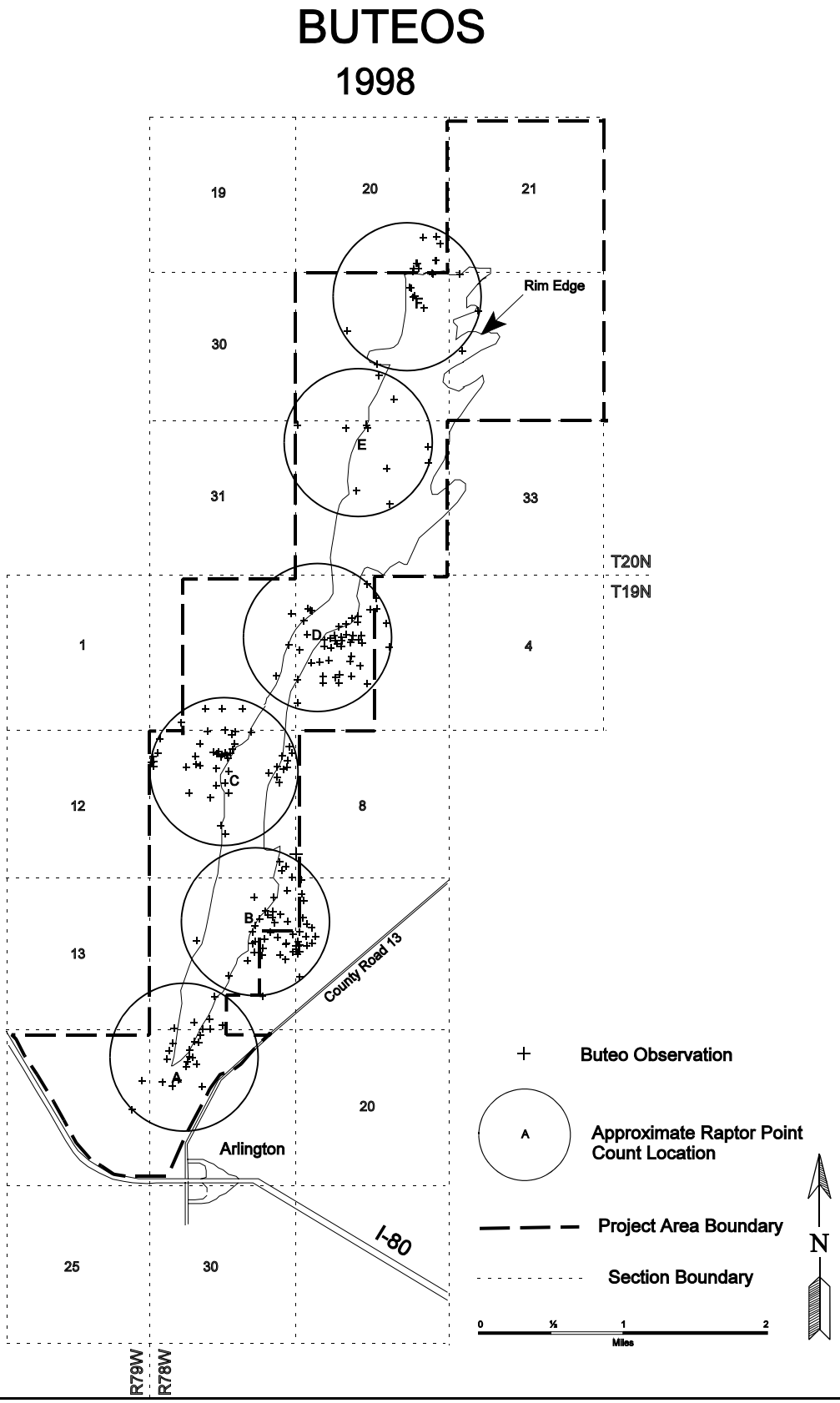
Appendix L. Individual raptor observations by plot on Foote Creek Rim.



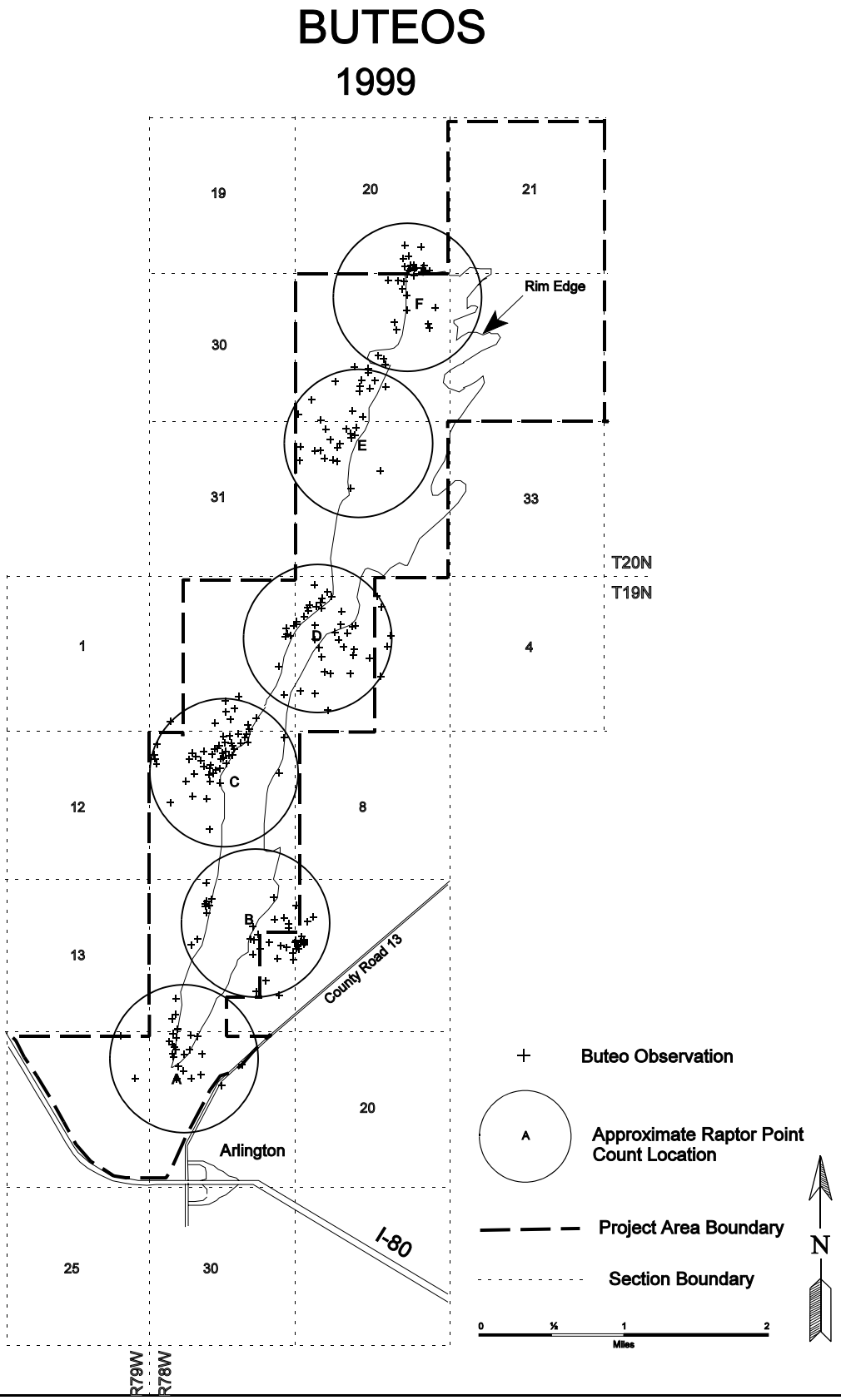
Appendix L. Individual raptor observations by plot on Foote Creek Rim.



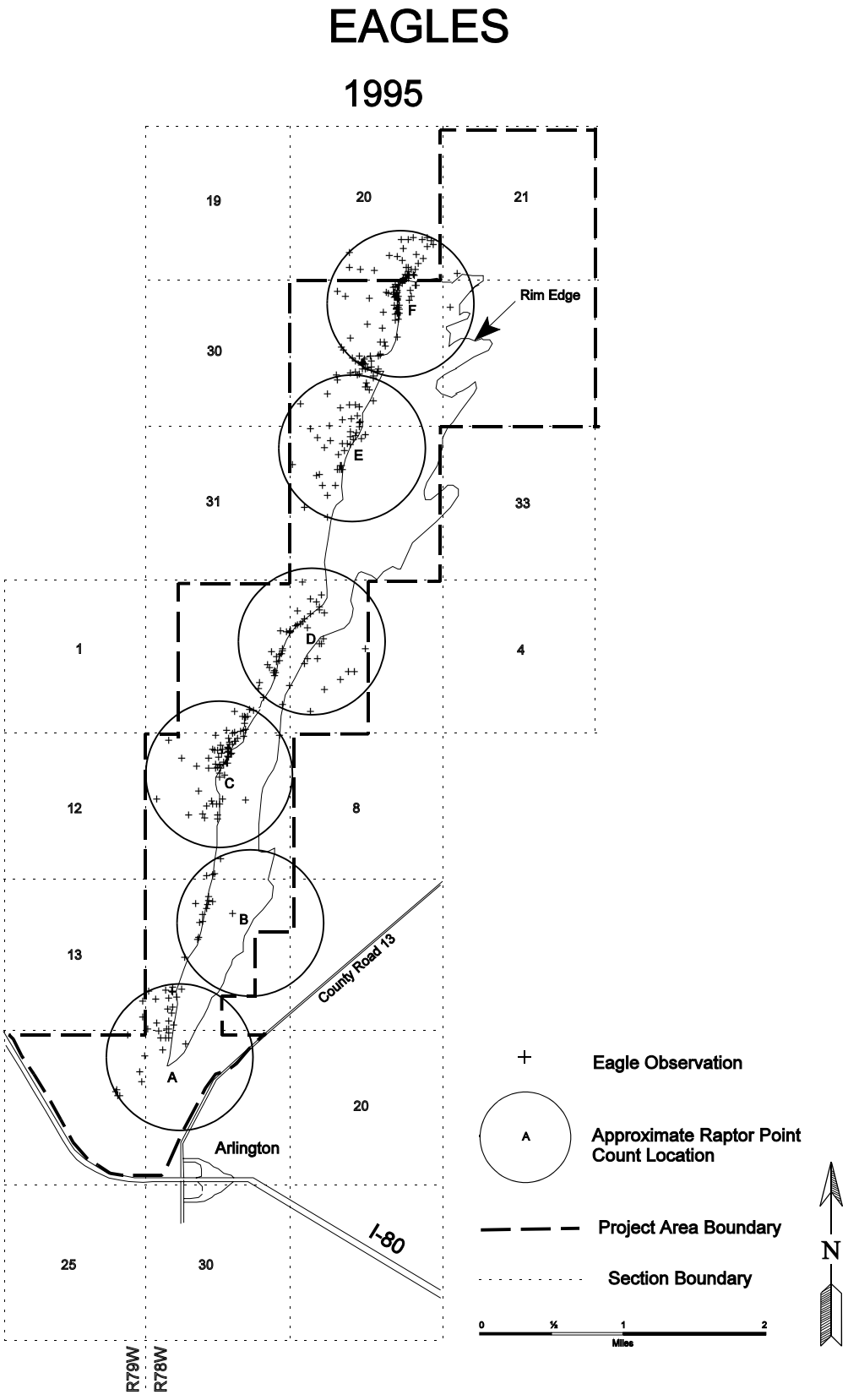
Appendix L. Individual raptor observations by plot on Foote Creek Rim.



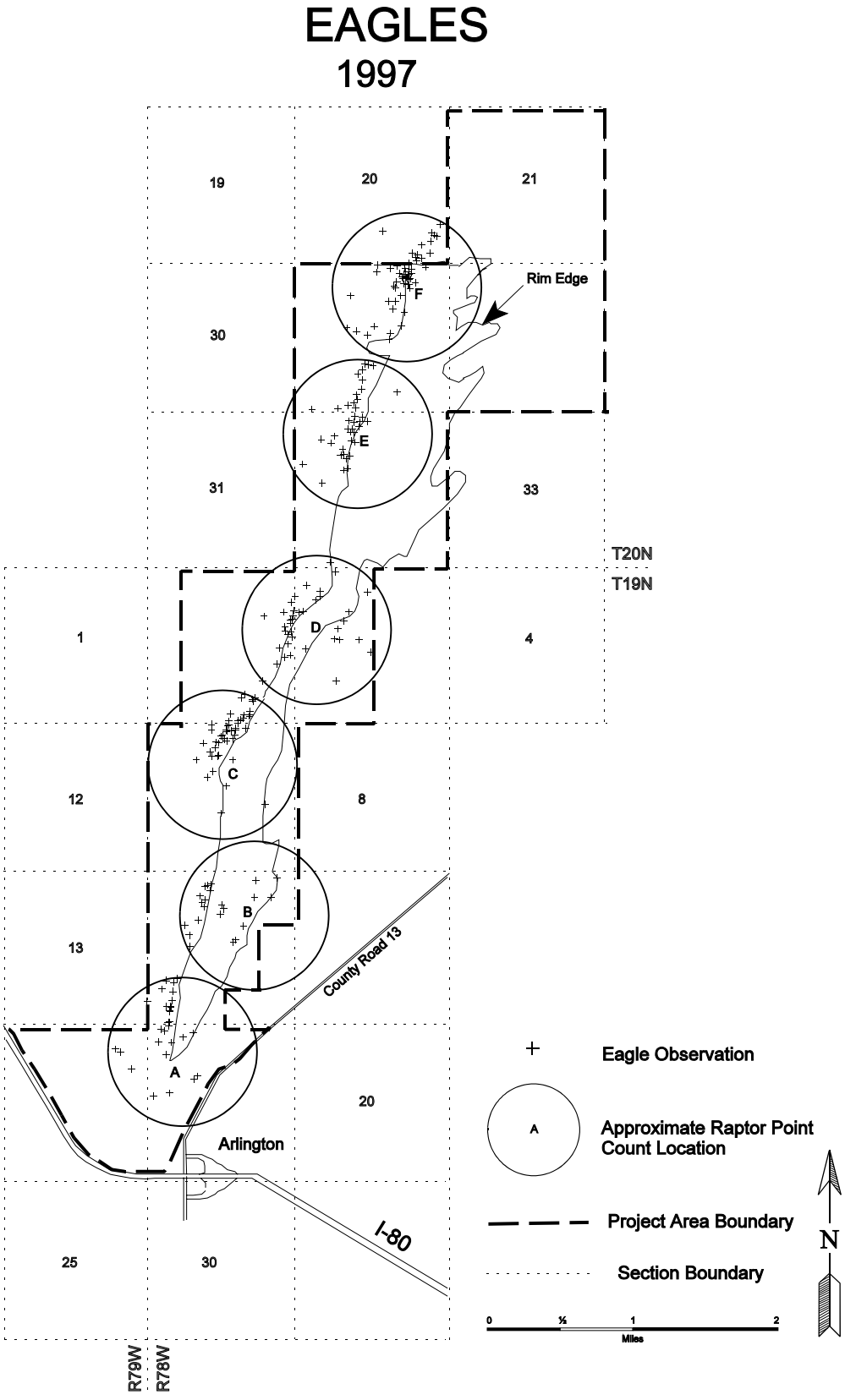
Appendix L. Individual raptor observations by plot on Foote Creek Rim.



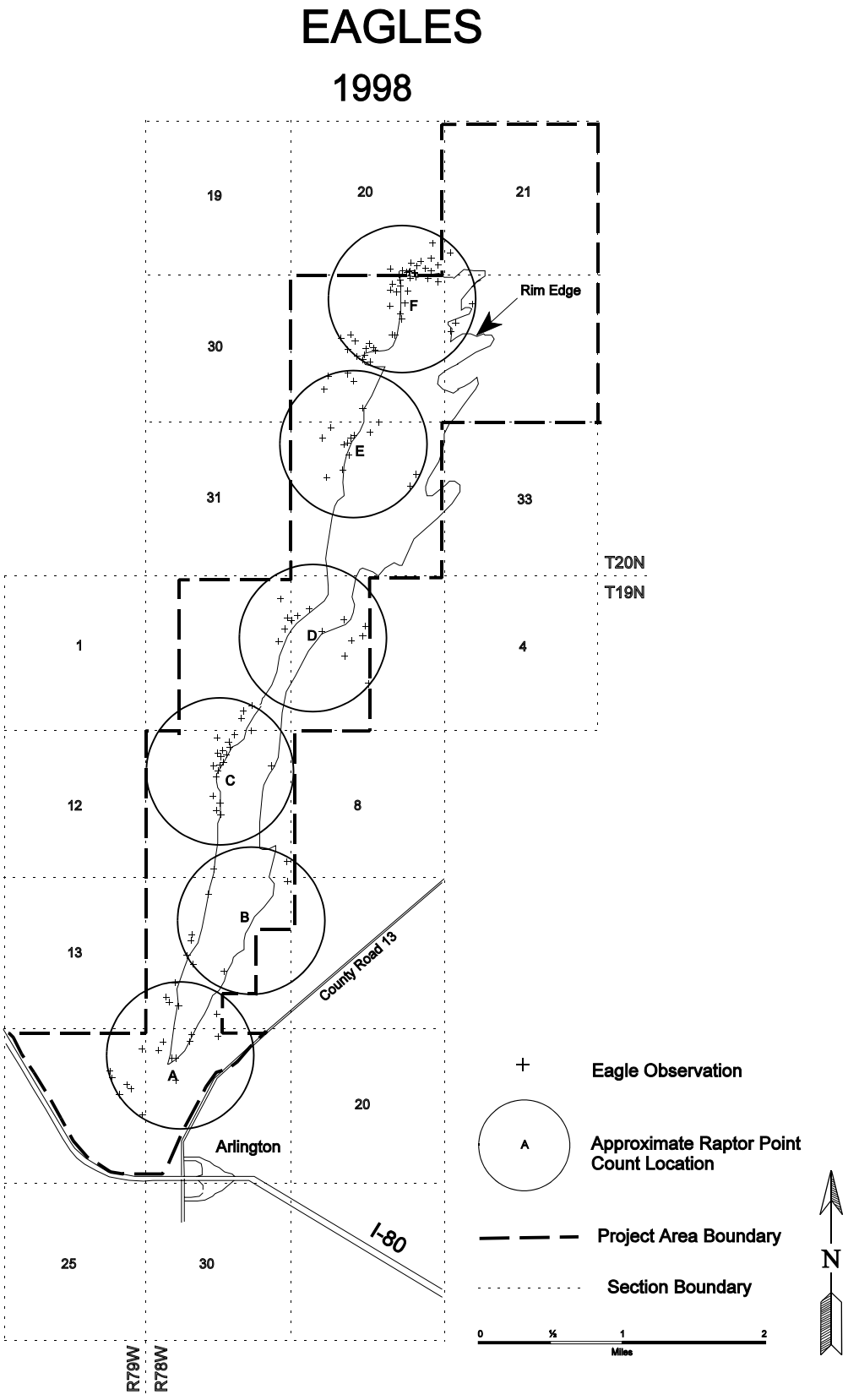
Appendix L. Individual raptor observations by plot on Foote Creek Rim.



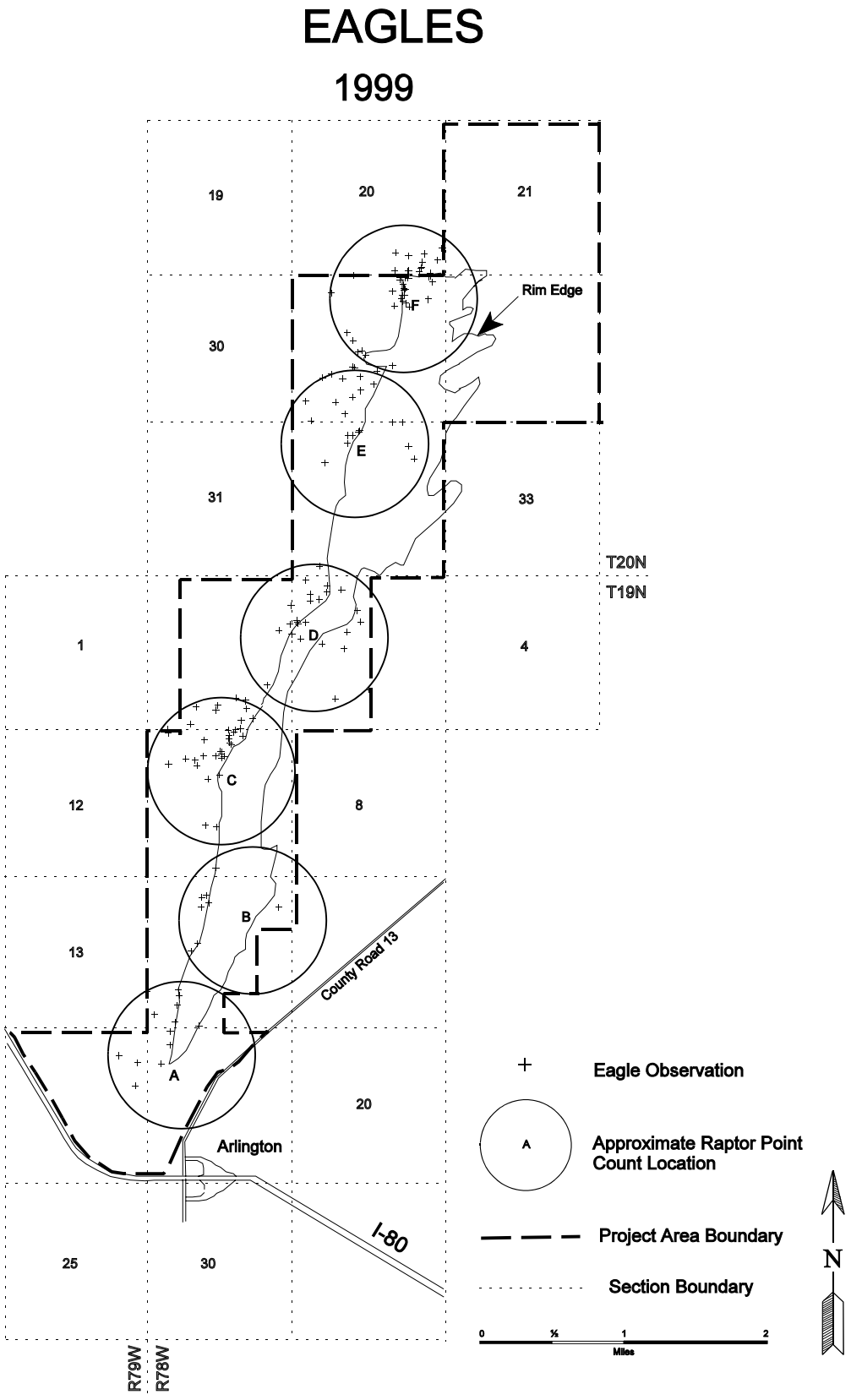
Appendix L. Individual raptor observations by plot on Foote Creek Rim.



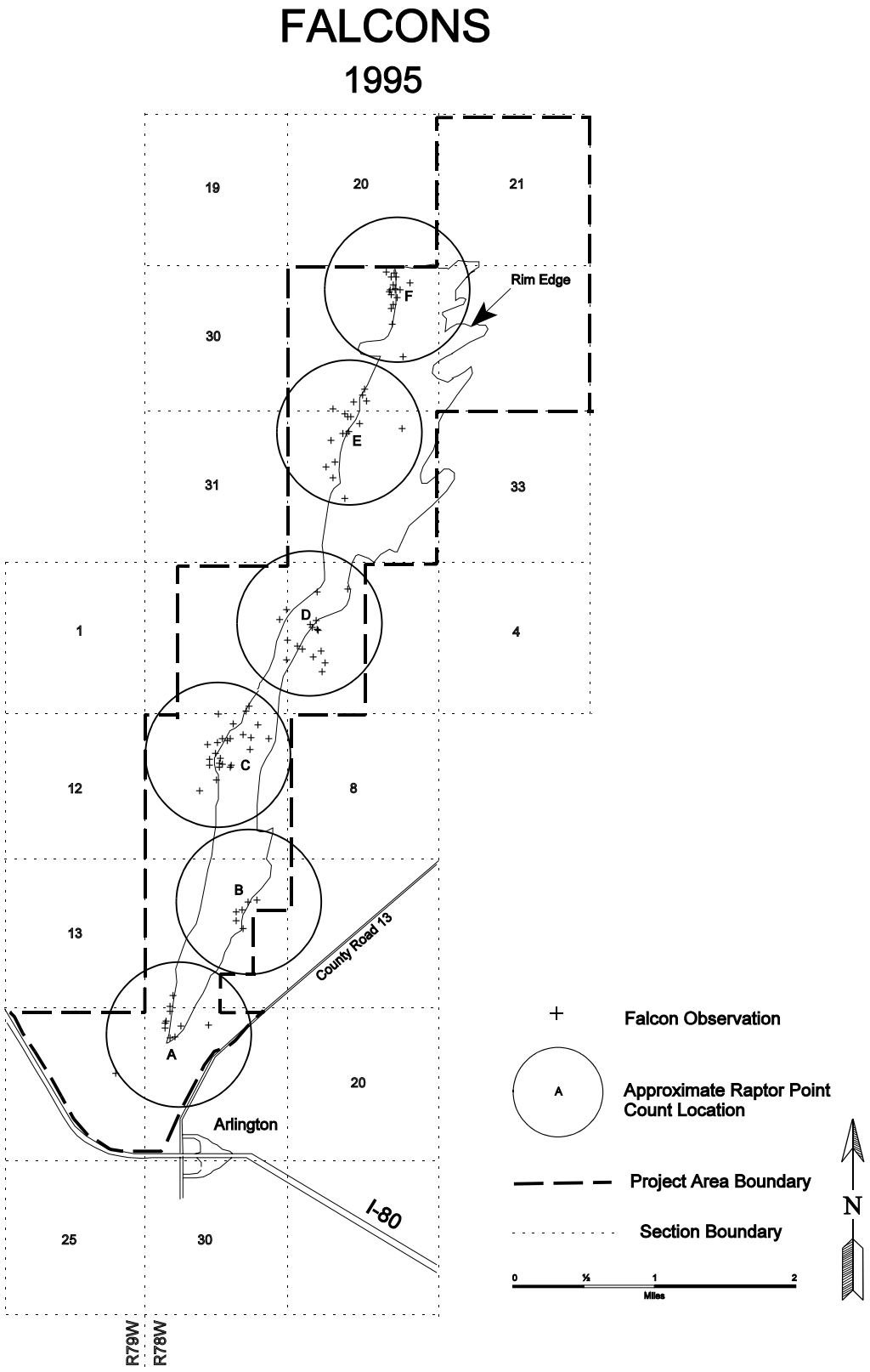
Appendix L. Individual raptor observations by plot on Foote Creek Rim.



Appendix L. Individual raptor observations by plot on Foote Creek Rim.



Appendix L. Individual raptor observations by plot on Foote Creek Rim.



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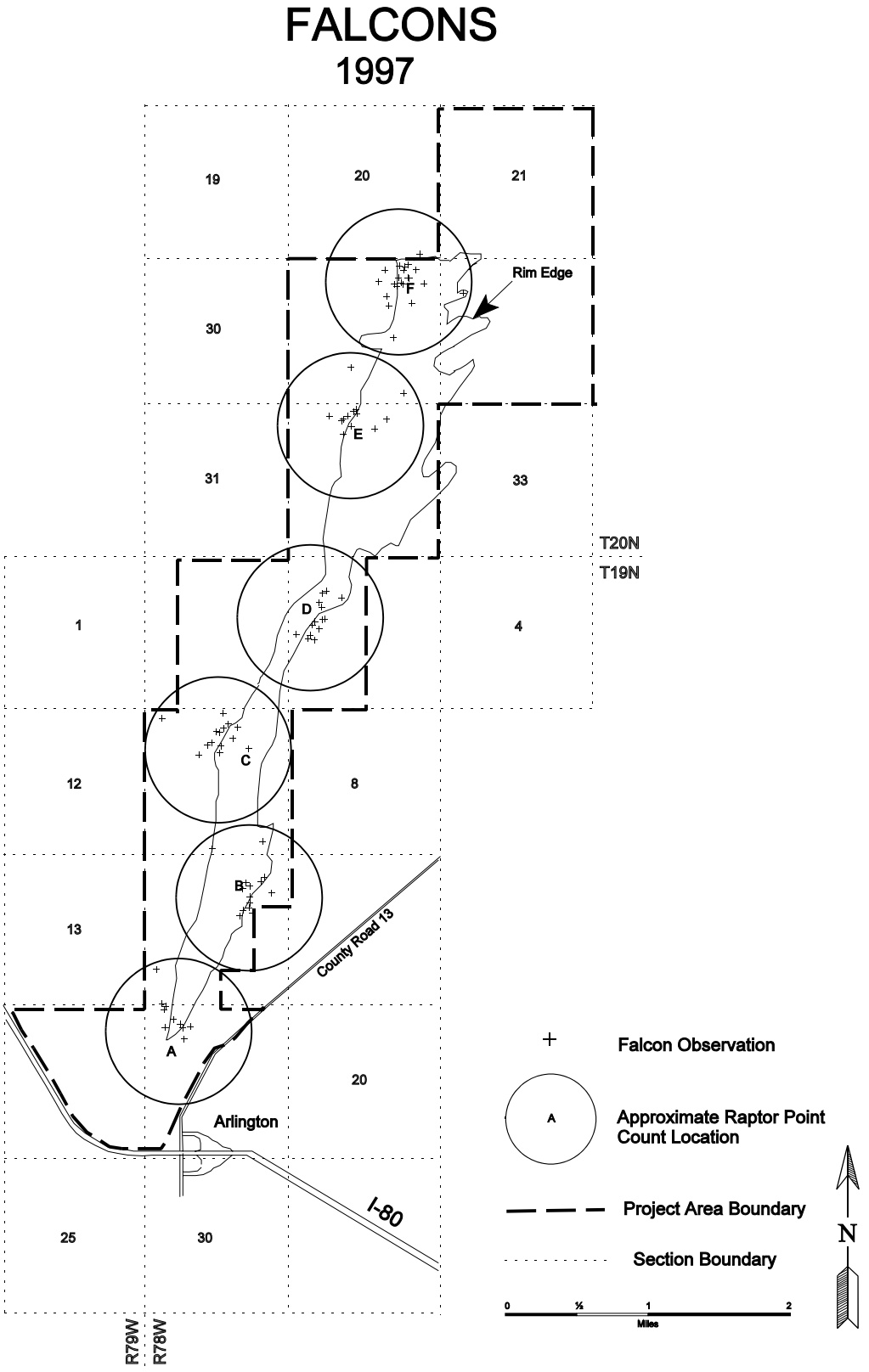
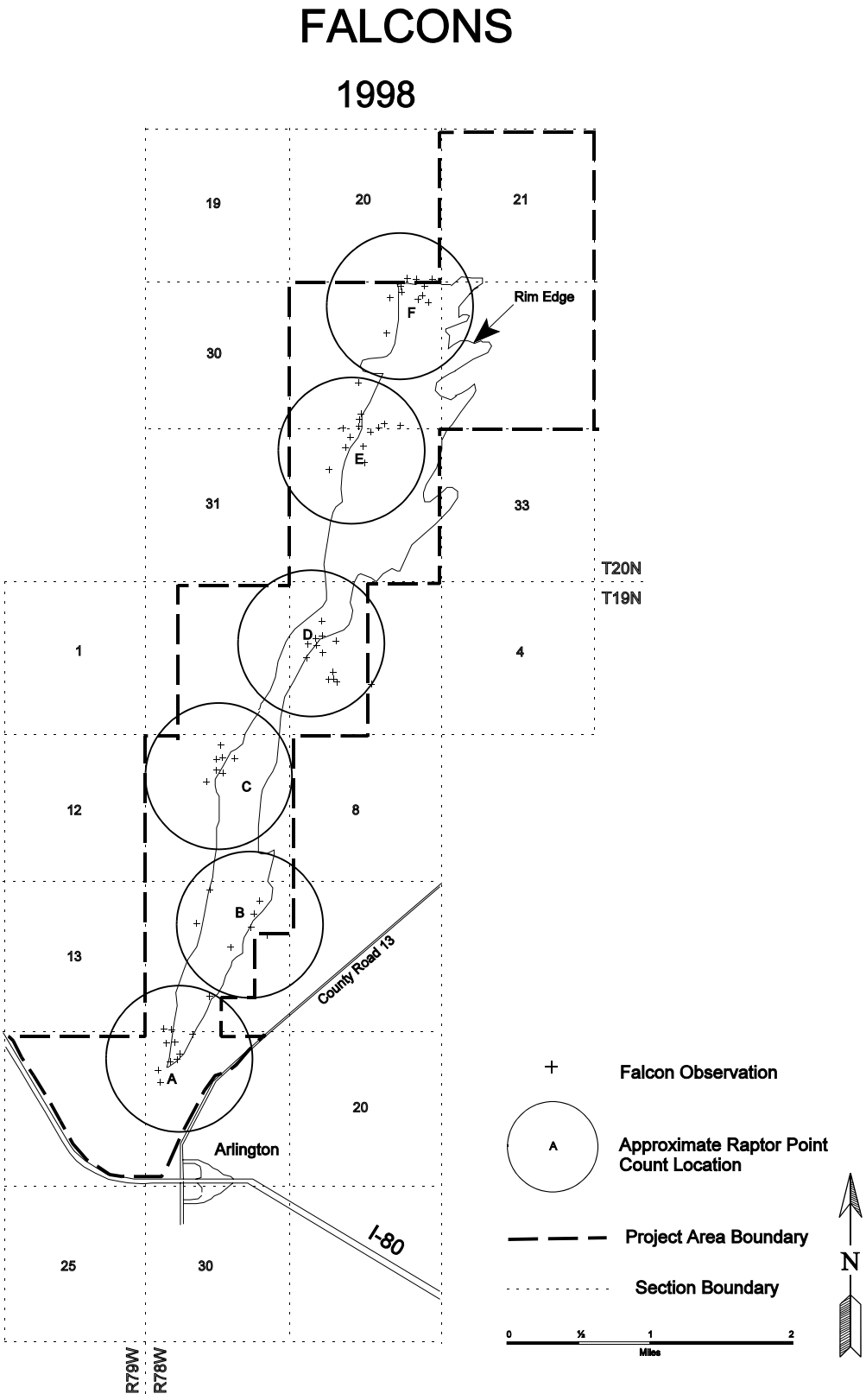
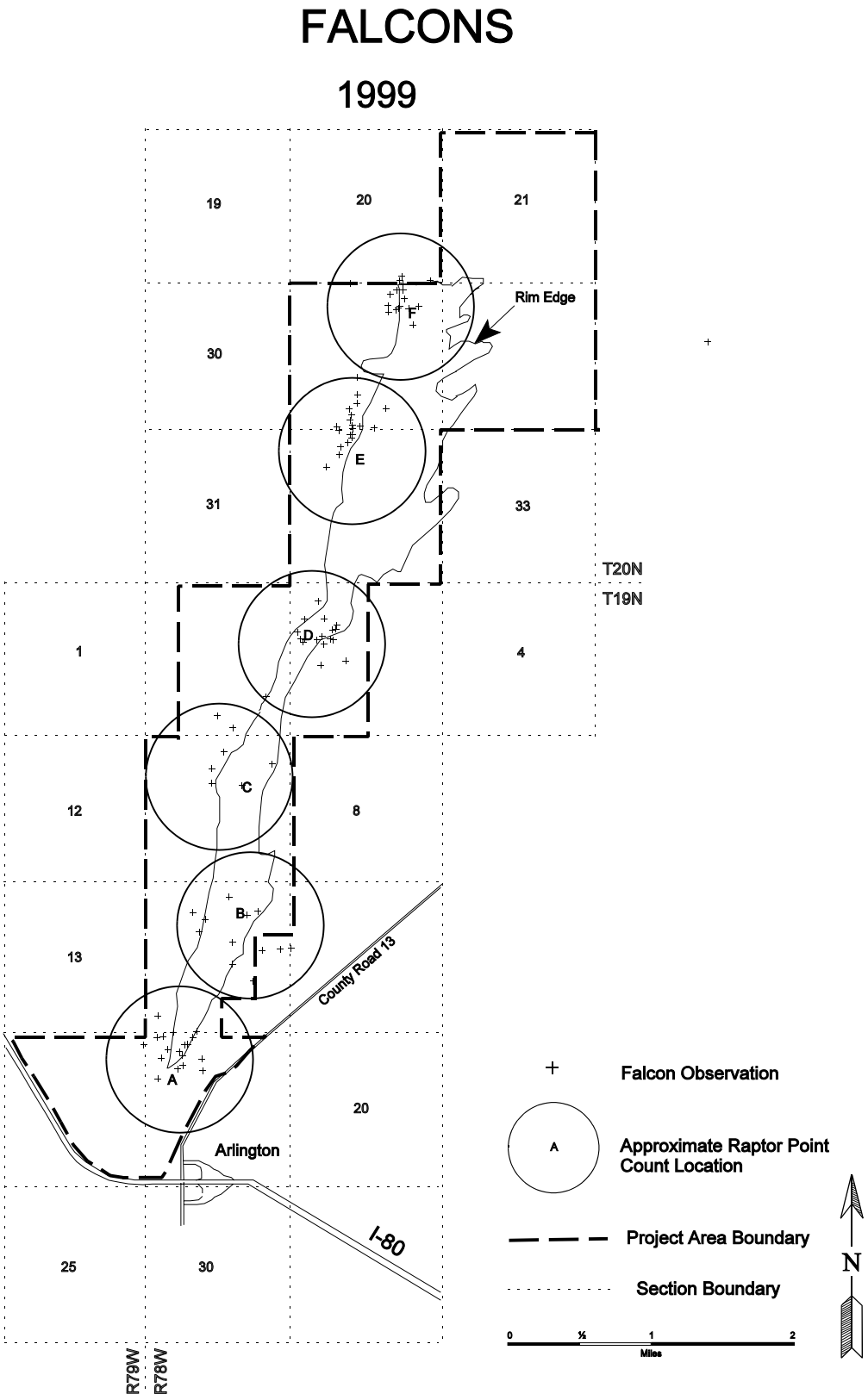


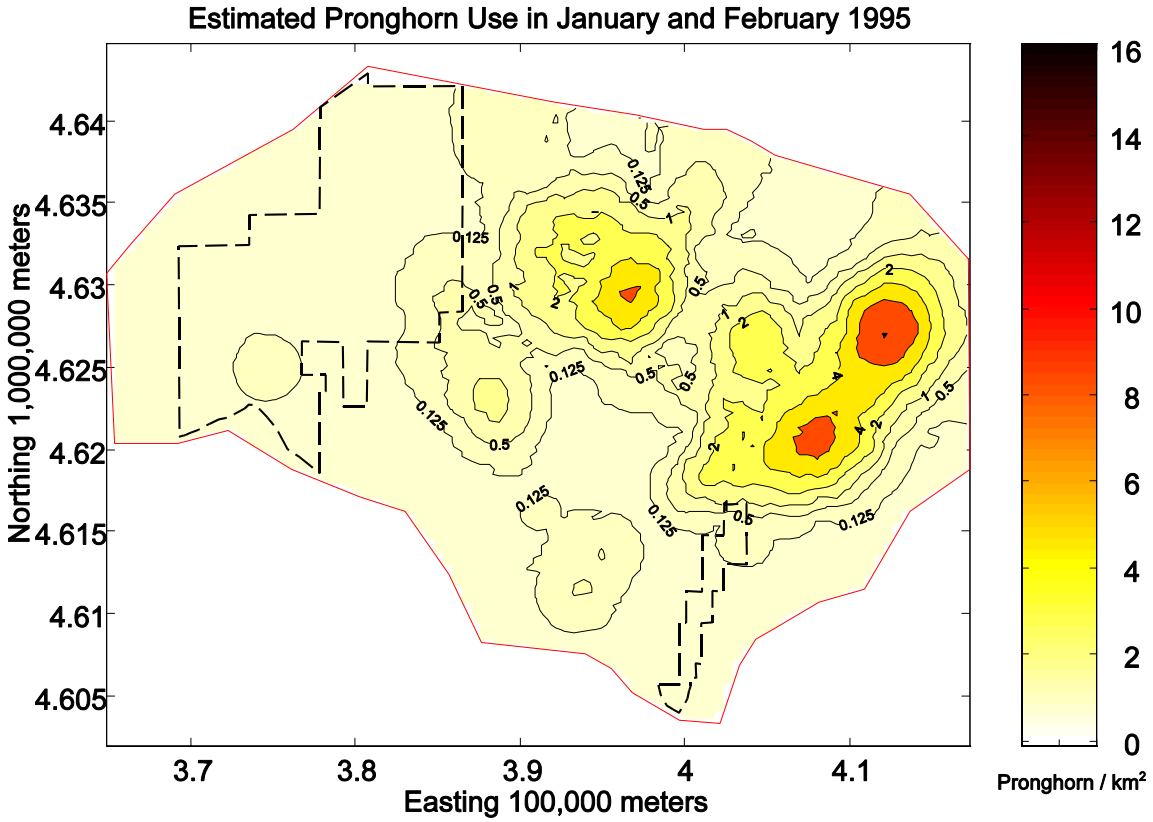
Appendix L. Individual raptor observations by plot on Foote Creek Rim.

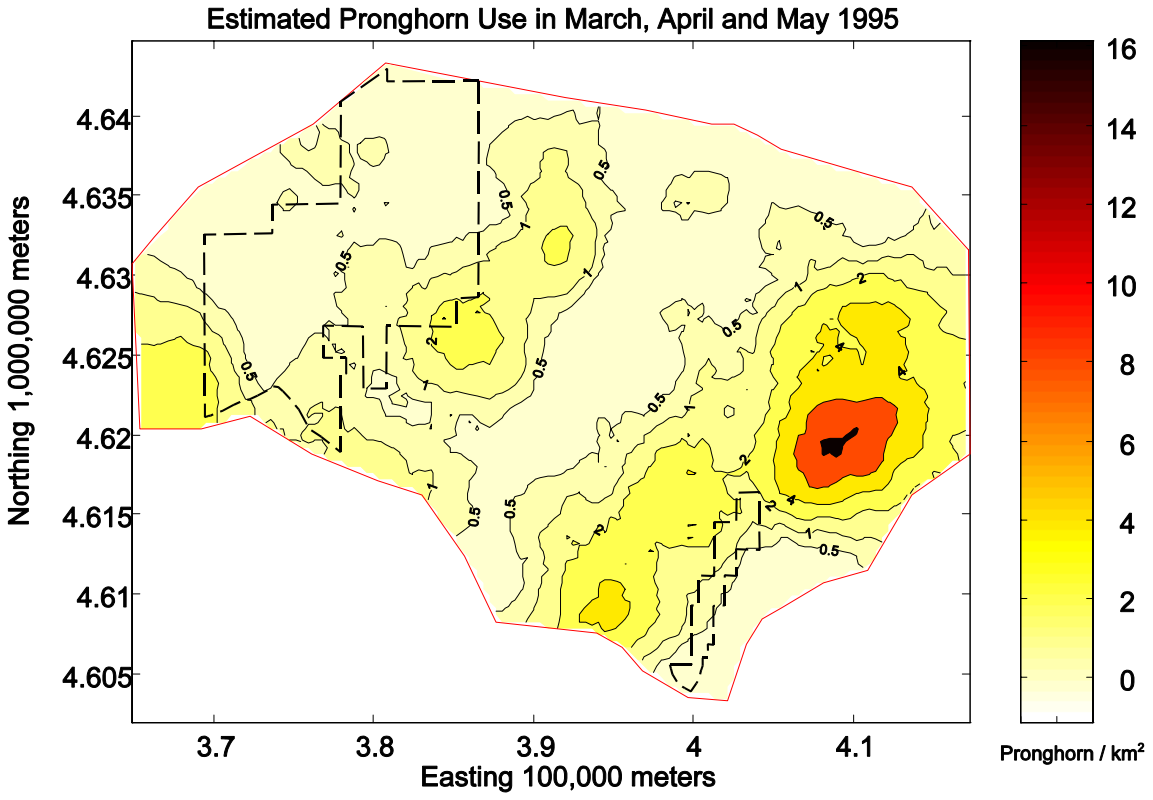


Appendix L. Individual raptor observations by plot on Foote Creek Rim.

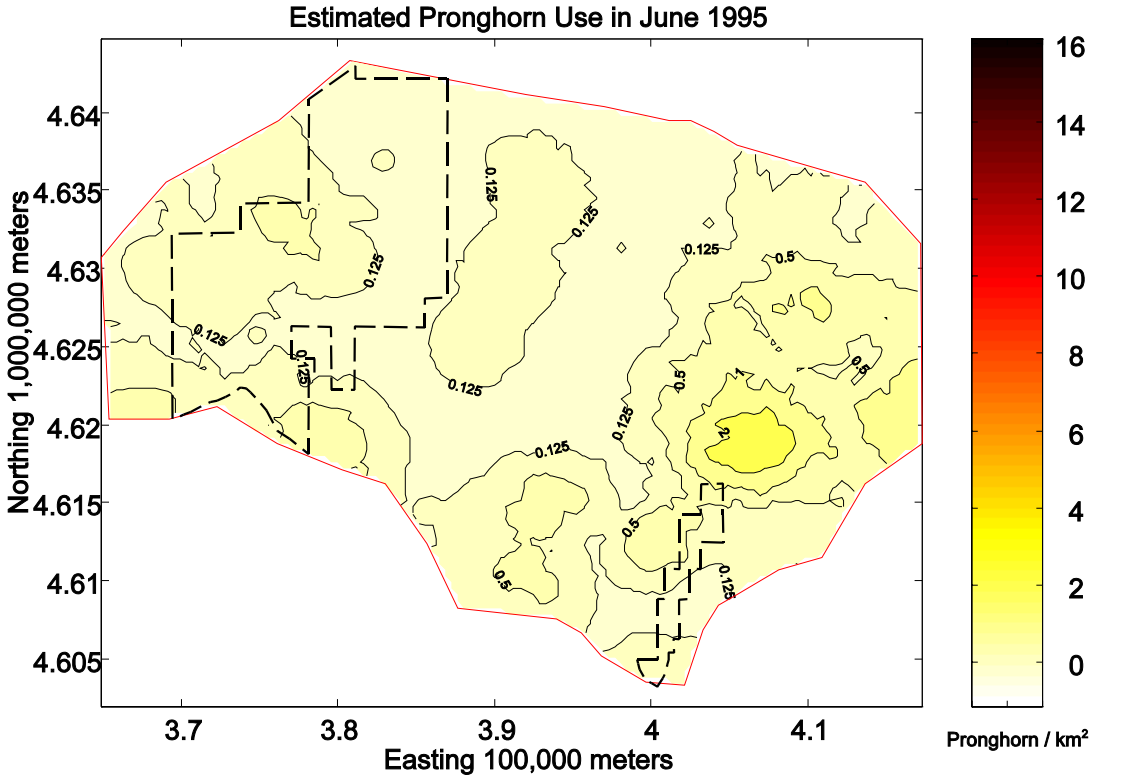


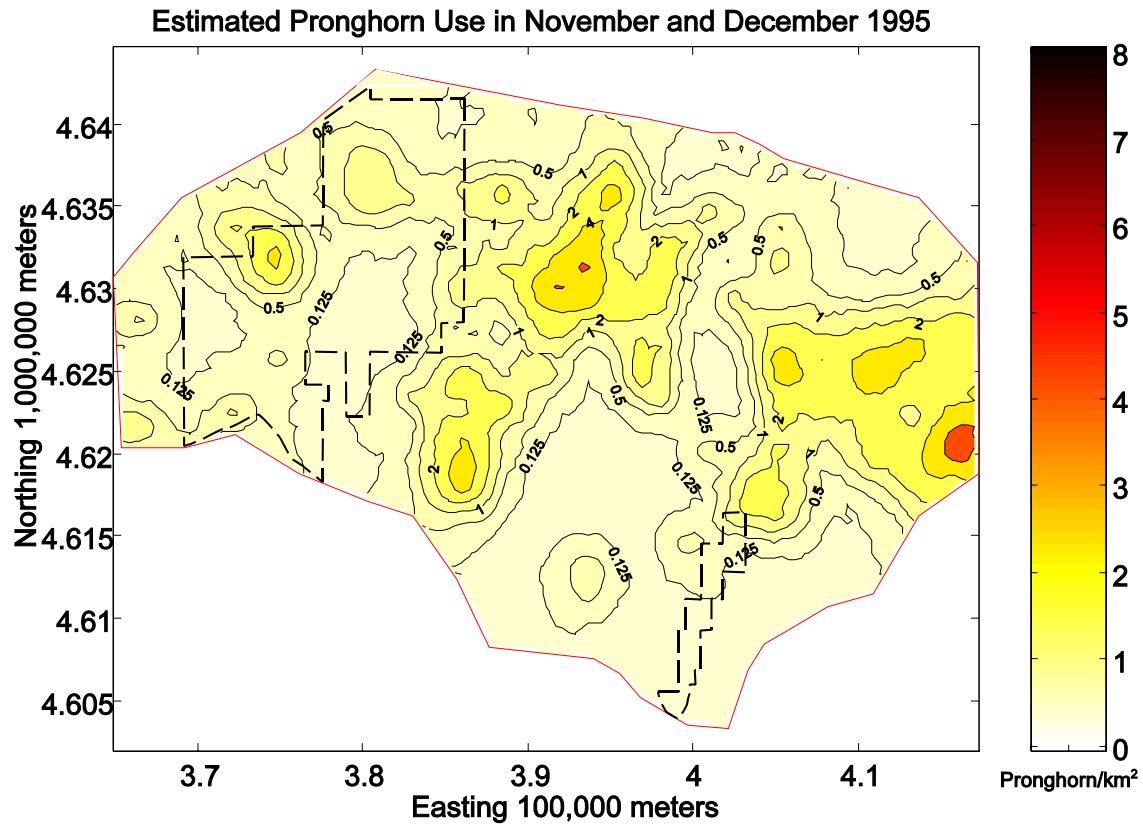
Appendix M. Estimated pronghorn use of the wind resource area by season and year.





Appendix M. Estimated pronghorn use of the wind resource area by season and year.





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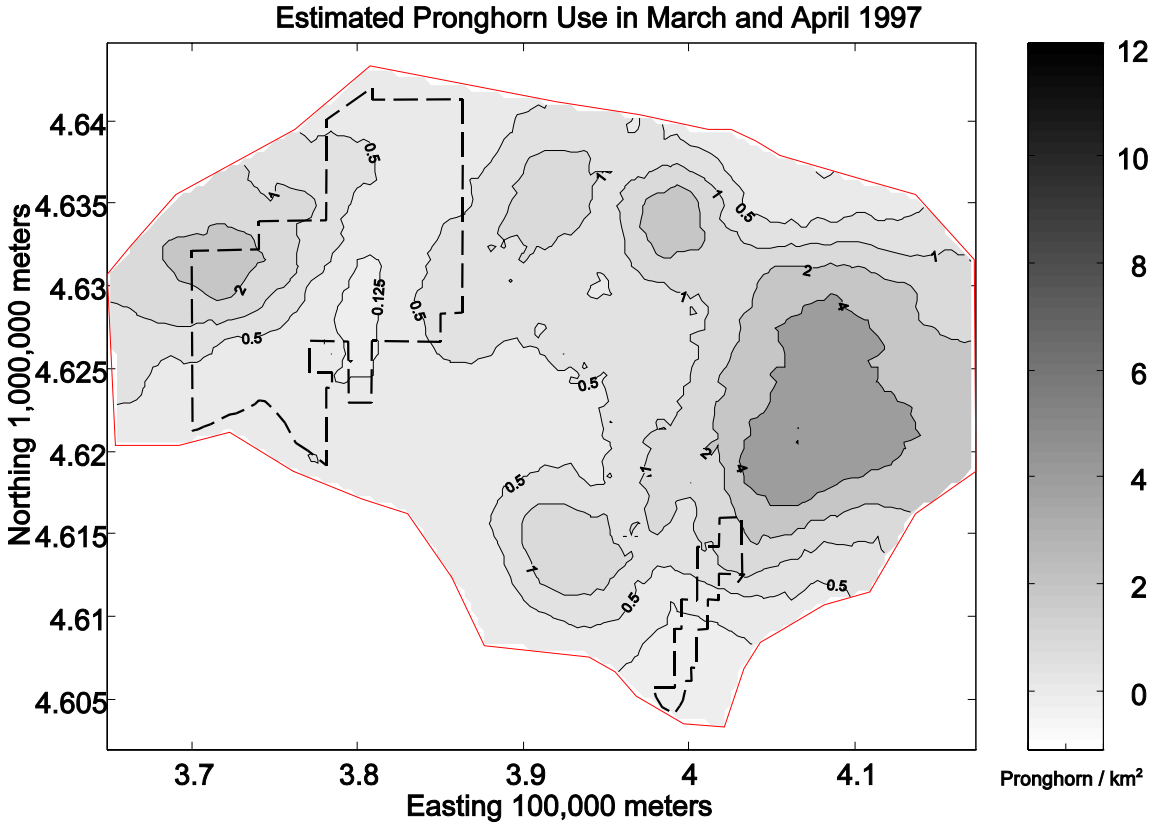

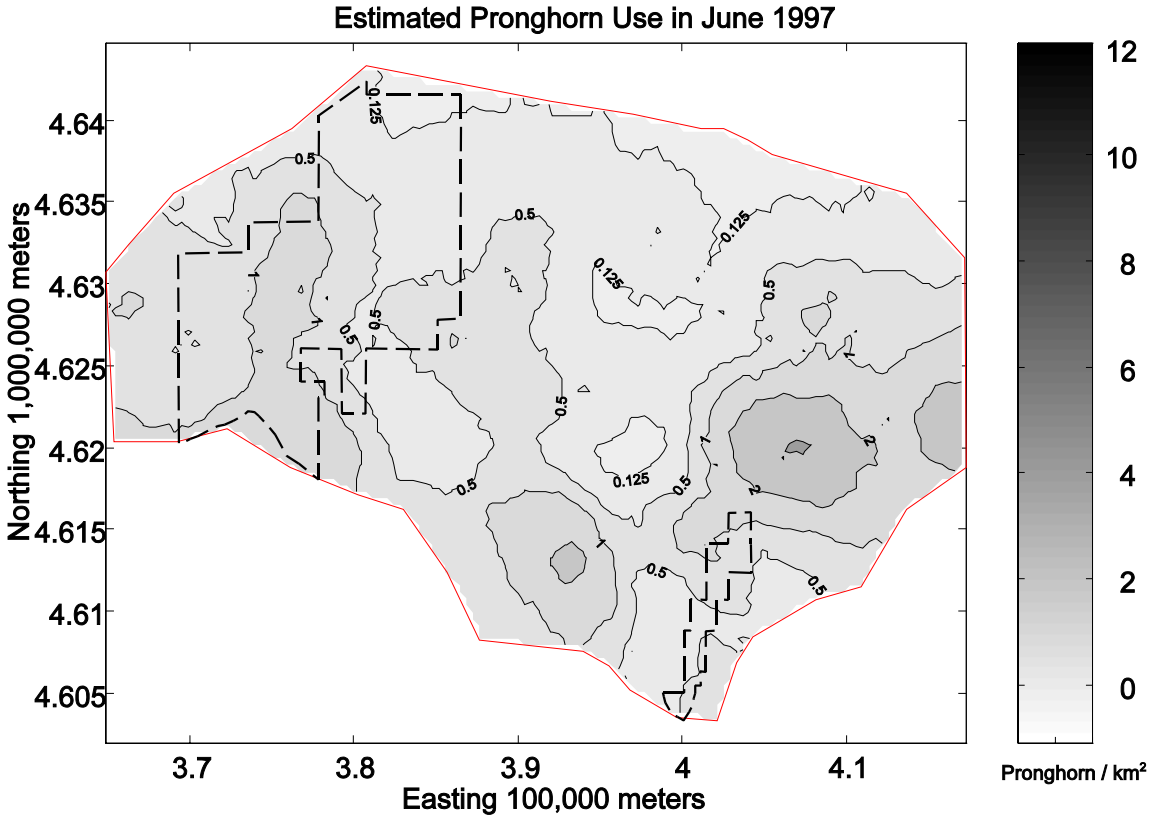

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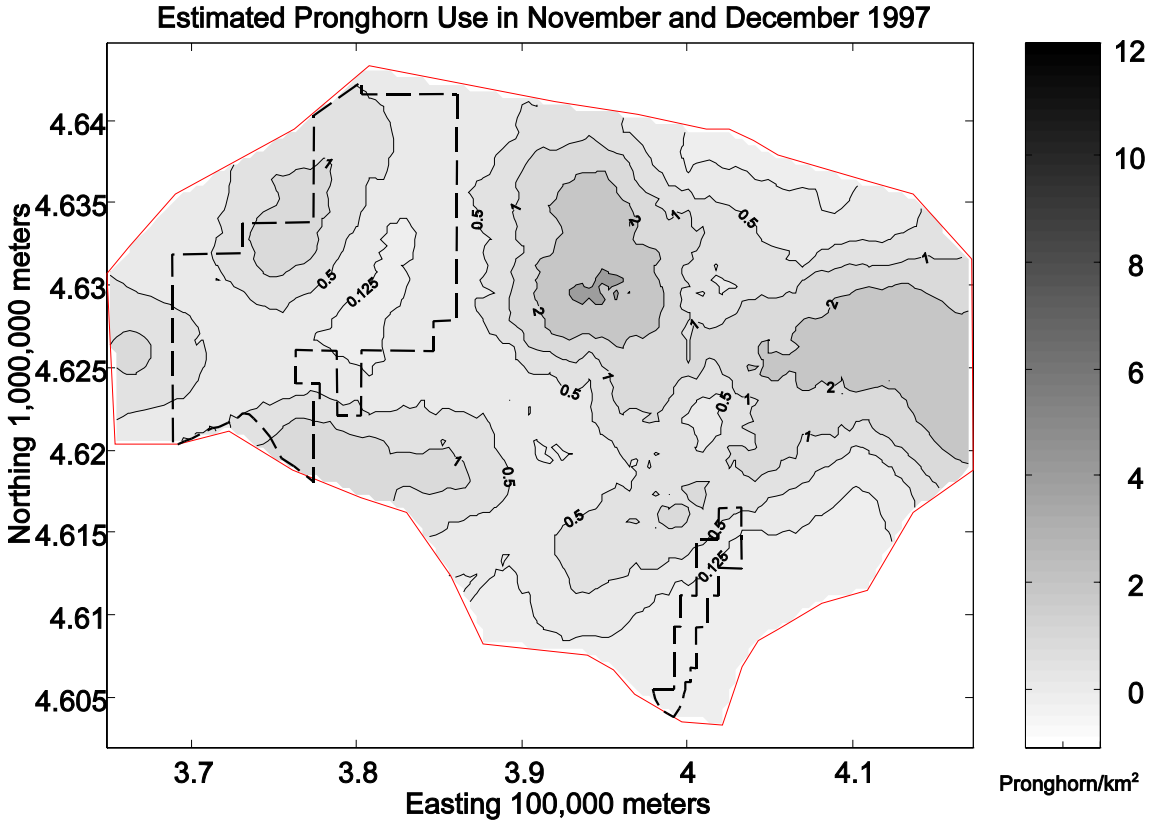

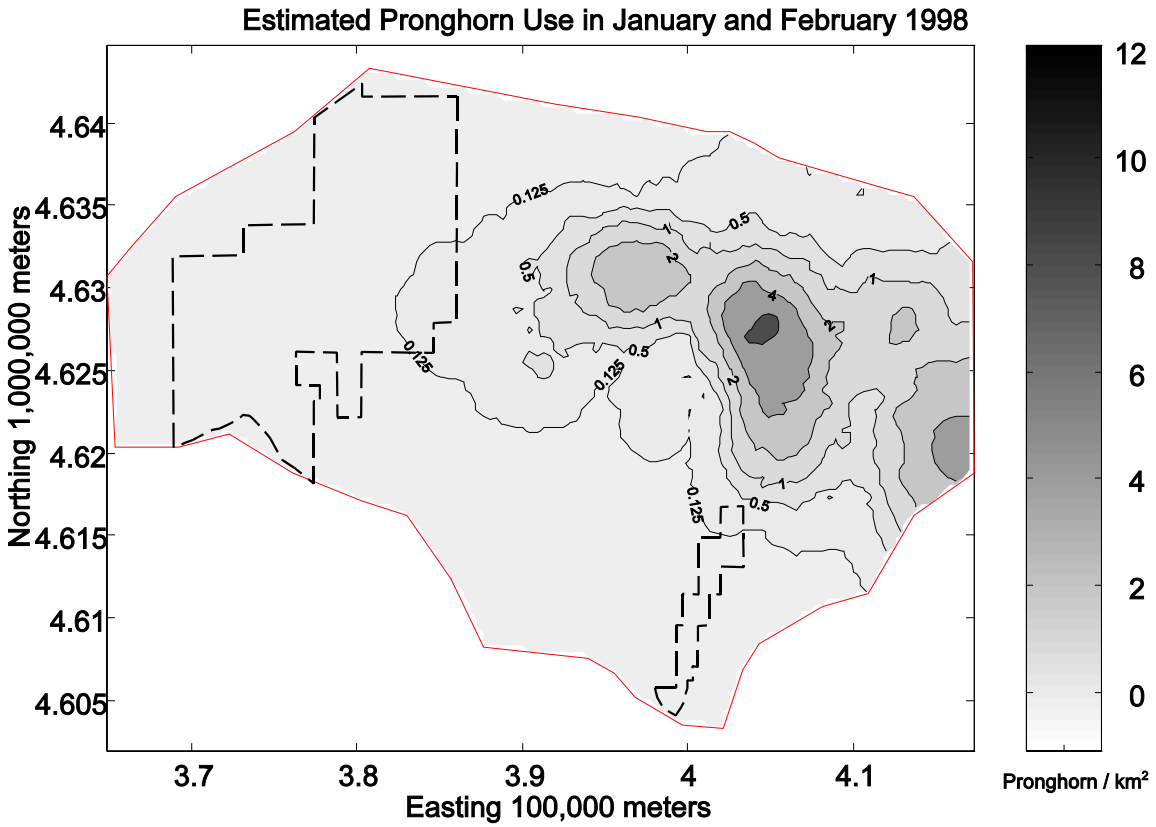

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