J Raptor Res. 35(4):337–343

A PRELIMINARY ASSESSMENT OF BURROWING OWL POPULATION STATUS IN WYOMING

NICOLE M. KORFANTA[1]
School of Environment and Natural Resources, Box 3971, University of Wyoming, Laramie, WY 82071 U.S.A.

LOREN W. AYERS AND STANLEY H. ANDERSON
Wyoming Cooperative Fish and Wildlife Research Unit, Box 3166, University of Wyoming, Laramie, WY 82071 U.S.A.

DAVID B. MCDONALD
Department of Zoology and Physiology, Box 3166, University of Wyoming, Laramie, WY 82071 U.S.A.

ABSTRACT.—Currently, little is known about Burrowing Owl (*Athene cunicularia*) abundance in Wyoming. The Wyoming Game and Fish Department (WGFD) classifies the Burrowing Owl as a Species of Special Concern. We identified available data sources to assess Burrowing Owl distribution and population trends in Wyoming and conducted a population survey in eastern Wyoming. The WGFD's Wildlife Observation System (WOS), initiated in 1974, shows a decline in Burrowing Owl records, particularly during the 12-yr period 1986–97. However, trends in WOS records over time likely reflect changing interest in the database, rather than real population trends. Likewise, Breeding Bird Survey data since 1971 suggest a negative trend, but low numbers warrant caution in interpreting these data. Additional monitoring efforts are required to assess Burrowing Owl population trend more accurately within the state. To evaluate Burrowing Owl abundance at historical nesting locations, we surveyed 103 previously reported sites. A total of 18% of these historical sites was reoccupied in 1999. We also surveyed 85 plots selected at random from northern mixed- and short-grass prairie types to obtain an unbiased picture of Burrowing Owl distribution in eastern Wyoming. Only one owl was found on these random survey plots, emphasizing the importance of historical nesting sites to Wyoming Burrowing Owls.

KEY WORDS: *Burrowing Owl*; Athene cunicularia; *Wildlife Observation System*; *Breeding Bird Survey*; *population trend*; *site reoccupancy*; *Wyoming.*

Evaluación preliminar del estado de las poblaciones de Búho Cavador en Wyoming

RESUMEN.—Actualmente, se sabe poco sobre la abundancia del Búho Cavador (*Athene cunicularia*) in Wyoming. El Departamento de caza y pesca de Wyoming (WGFD) clasifica al Búho Cavador como una especie de especial interés. Nosotros identificamos fuentes de datos disponibles para evaluar las tendencias poblacionales y de distribución del Búho Cavador en Wyoming y condujimos un estudio de la población en el este de Wyoming. El Sistema de Observación de Vida Silvestre (WOS) del WGFD, iniciado en 1974, muestra una reducción en los registros de Búhos Cavadores, particularmente durante el periodo 1986–97. Sin embargo, las tendencias en los registros del WOS a lo largo del tiempo probablemente reflejan intereses cambiantes en la base de datos, mas que tendencias poblacionales reales. De igual modo, los datos del Estudio de Reproducción de Aves desde 1971 sugieren una tendencia negativa, pero sus bajos números requieren de cuidado al momento de interpretar esos datos. Se necesitan esfuerzos de monitoreo adicionales para evaluar mas exactamente la tendencia poblacional del Búho Cavador dentro del estado. Para valorar la abundancia del Búho Cavador en localidades de anidación históricas, estudiamos 103 sitios previamente reportados. Un total de 18% de estos sitios históricos fueron reocupados en 1999. Además estudiamos 85 parcelas seleccionados aleatoriamente de praderas norteñas del tipo de yerbas mixtas y de hierba corta para obtener una visión sin sesgos de la distribución del Búho Cavador en el oriente de Wyoming. Unicamente un búho fue encontrado sobre esas parcelas de estudio aleatorio, enfatizando la importancia de los sitios históricos de anidación para los Búhos Cavadores en Wyoming.

[Traducción de Victor Vanegas y César Márquez]

[1] E-mail address: korfanta@uwyo.edu

Wyoming is centrally located within the breeding range of the Burrowing Owl (*Athene cunicularia*), a species thought to be declining across much of its range in North America (James and Espie 1997). Burrowing Owls are reported to be widely distributed throughout the state in close association with black-tailed (*Cynomys ludovicianus*), and white-tailed (*C. leucurus*) prairie dog towns. Although several factors, including prairie dog eradication and habitat loss, may negatively affect the Wyoming Burrowing Owl population, little is known about population trends within the state.

Burrowing Owls are currently listed by the Wyoming Game and Fish Department (WGFD) as a Species of Special Concern, Category 4 (R. Oakleaf, A. Cerovski, R. Luce publ. comm.). This classification indicates that the species is widely distributed and suspected to be stable with no significant ongoing habitat loss. Although interest and concern for the species is growing, little work has been conducted on Burrowing Owls in Wyoming.

In light of documented declines in other portions of its range (James and Espie 1997), we evaluated available information to assess population trends and to establish baseline information for future monitoring of Burrowing Owls in Wyoming. We examined three sources of information: the Wyoming Game and Fish Department's (WGFD) Wildlife Observation System (WOS), Breeding Bird Survey data (BBS), and field data from a 1999 occupancy survey of historical and randomly-selected sites in eastern Wyoming. Each of these sources present different opportunities and limitations, and must be interpreted with discretion.

Our objective for the 1999 field survey was to establish baseline distribution and abundance data for Wyoming Burrowing Owls. We surveyed 103 historical breeding sites to determine reoccupancy of the sites. These results provide a useful baseline for future monitoring in Wyoming and allow comparisons to other states with data collection systems similar to the WOS. As such records may not represent the true distribution of Burrowing Owls in Wyoming accurately, we also surveyed 85 random sites in potential Burrowing Owl habitat to obtain an unbiased picture of distribution.

Available data were largely inadequate to address our objectives completely. Nonetheless, we believe it is important that current data be evaluated to provide a preliminary assessment of Burrowing Owl population status in Wyoming and to identify biases, information gaps, and areas for improvement in future monitoring. Therefore, we present the available data from three sources, along with cautious interpretation of trends.

METHODS

WOS Analysis. The WOS is a database comprising wildlife sightings within the state, reported voluntarily by state and federal biologists, researchers, Audubon Society members, and interested members of the general public. The WOS database is extensive, containing 713 records of Burrowing Owl sightings between 1974, when the WOS began, and 1997. We analyzed all records of adult and unknown-aged Burrowing Owl sightings made between 1 March–31 August, to exclude records of migratory birds from other populations. We sorted records by date and tallied total numbers of reports for each year. Change in numbers of records may correlate with population trend; therefore, the number of observations per year were graphed and examined for trend. Attention to Burrowing Owls increased in the late-1970s and early-1980s with the initiation of a non-game program within the WGFD (R. Oakleaf pers. comm.) and a University of Wyoming graduate research study on Burrowing Owls (Thompson 1984). Because of this probable reporting bias, we excluded early records of the WOS and performed a least-squares regression on the sightings made in the 12-yr period, 1986–97. To assess the validity of trends in the WOS records, we also examined WOS records for raptor species with suspected stable or increasing populations. We expected *a priori* that American Kestrel (*Falco sparverius*) and Red-tailed Hawk (*Buteo jamaicensis*) WOS records would remain stable with time, while WOS records for the Bald Eagle (*Haliaeetus leucocephalus*) would show an increasing trend. All regression analyses were one-tailed tests of the null hypothesis that no positive trend was present in WOS records for a species over time ($\alpha = 0.05$).

BBS Data. Wyoming BBS data are collected by annual, standardized surveys of selected roadside routes. Each observer records all bird species heard or seen within a 0.4-km radius from sample points during a 3-min period along selected survey routes. In most areas of the state, the June BBS survey coincides with the emergence of nestling owls and the presence of conspicuous adult Burrowing Owls in the vicinity of burrows.

We used the North American BBS web pages to obtain trend estimates for Wyoming populations of Burrowing Owl (Sauer et al. 1997), American Kestrel, and Red-tailed Hawk (Sauer et al. 1999). For Bald Eagles, we obtained a trend estimate for the entire Western BBS region because of an extremely small sample size when Wyoming was considered alone ($N = 3$). Estimates were calculated using route-regression trend estimation (Geissler and Sauer 1990). For Burrowing Owls, we examined two time periods: 1971–96 (the full BBS dataset) and 1986–96 (corresponding to the truncated WOS dataset). For all other raptors, we examined the time period 1980–98. We chose an $\alpha = 0.05$ to evaluate significance of trend estimates.

Because BBS data were also reported to the WOS, these two data sources were not strictly independent. However, BBS sightings constitute only a minor portion

of the total WOS records. Because the WOS is probably not greatly affected by BBS data, these two data sources were considered separately.

Reoccupancy Survey. In 1999, we surveyed for Burrowing Owls in random and historical (identified from WOS records) sites east of 108° longitude. We restricted the survey to eastern Wyoming for logistical reasons and because this area contains the largest contiguous tracts of northern mixed- and short-grass prairie.

Historical sites ($N = 103$) were chosen at random from a pool of WOS records with ≥2 Burrowing Owls per sighting; historical records with multiple Burrowing Owl sightings were more likely to represent historical breeding locations as opposed to sightings of individual birds. Because some Burrowing Owl populations show high site-fidelity (Haug et al. 1993), WOS records of all ages (i.e., number of years since an original sighting) were considered. Historical sites comprised a broad array of habitat types and qualities, ranging from isolated and undisturbed to urban or cultivated lands.

We also surveyed a total of 85 random sites in eastern Wyoming. We systematically selected 55 survey sites from a pool of state sections (Section 36 in each Township, 2.6 km^2) with a dominant vegetation type of northern mixed- or short-grass prairie. Because these vegetation types represent the most likely Burrowing Owl habitat, we refer to these as "high-probability" random sites. We also selected 30 "low-probability" sites at random from a pool of state sections with dominant vegetation types of sagebrush, irrigated croplands, or desert shrub. We selected state sections (public land) to facilitate property access. In each state section, we surveyed the southeastern quarter-section (64.75 ha) using four point counts, which were then pooled to yield a total Burrowing Owl count for the quarter-section. Individual Burrowing Owls were counted only once, and only adults contributed to the count. When the selected quarter-section was not accessible, we randomly selected one of the four adjacent state sections and sampled the southeastern quarter-section.

Surveys were conducted 15 May–1 August 1999. Sites were surveyed between sunrise and 1100 H and between 1700 H and sunset (Haug and Didiuk 1993), and only when wind speeds were <20 km/hr, with no precipitation. Each quarter-section was surveyed from all four sides unless access to one side was not possible, in which case we surveyed an additional point on an adjacent quarter-section. When hills, vegetation, or other features impaired visibility, we walked or drove into the quarter-section until visibility improved.

At each station, we conducted a 12-min search using a 15× spotting scope and 10× binoculars. The search period was divided into three parts: a 5-min observation period, during which we looked and listened for owls, a 2-min Burrowing Owl call playback and search period, and another 5-min listening and search period. The use of recorded calls greatly increases the ability to detect both male and female Burrowing Owls (Haug and Didiuk 1993). We used a megaphone and a tape player to transmit a male territorial call and a "chuck-and-chatter" call. Adult owls were sexed based on coloration and behavioral differences (Martin 1973).

RESULTS

WOS Analysis. A map of all WOS record locations (Fig. 1) showed that Burrowing Owl sightings were distributed broadly throughout Wyoming, with highest concentrations occurring in the southern half of the state. Two trends were evident from the curvilinear shape of the WOS data over time (Fig. 2): numbers of records generally increased between 1974–80 to a maximum of 56 in 1981, and record numbers decreased between 1981–97. There was a significant, negative linear relationship ($P = 0.002$, $r^2 = 0.64$) between numbers of Burrowing Owl sightings and year for the 1986–97 subset of the WOS data (Fig. 2). The regressions of WOS American Kestrel ($P < 0.001$, $r^2 = 0.71$) and Red-tailed Hawk ($P < 0.001$, $r^2 = 0.83$) sightings vs. year were also negative and highly significant (Fig. 3). Bald Eagle records also decreased over time ($P = 0.002$, $r^2 = 0.63$; Fig. 3).

BBS Data. The BBS trend analysis for Burrowing Owls in Wyoming during the time period 1971–96 showed a significant trend of −37.42% ($P = 0.012$). This trend estimate was based on data from nine surveyed routes, the maximum number of routes for which a trend estimate could be obtained with Wyoming BBS data. The trend estimate for the 1986–96 time period was −33.37% ($P = 0.182$, $N = 5$ routes).

For Bald Eagles, the Western BBS region showed a trend of +3.8% ($P = 0.05$, $N = 65$ routes). The trends for Red-tailed Hawk and American Kestrel BBS sightings in Wyoming were +3.7% ($P = 0.05$, $N = 75$) and +2.5% ($P = 0.23$, $N = 81$), respectively.

Reoccupancy Survey. Burrowing Owl sightings were distributed throughout eastern Wyoming, with higher concentrations occurring around Buffalo, Torrington, and Rawlins (Fig. 1). Of 188 sites surveyed, a total of 37 owls were seen at 16 sites. Thirty-six of the detected owls were located on WOS historical sites ($N = 103$), one Burrowing Owl was found on a random high-probability site ($N = 55$), and none was detected on random low-probability sites ($N = 30$). Of the 103 historical sites that were revisited, 17.5% were reoccupied in 1999.

A total of 43% of occupied sites ($N = 16$) and 10% of unoccupied sites ($N = 168$) were also currently occupied by black- or white-tailed prairie dogs. A logistic regression showed the presence of Burrowing Owls was a positive function of the pres-

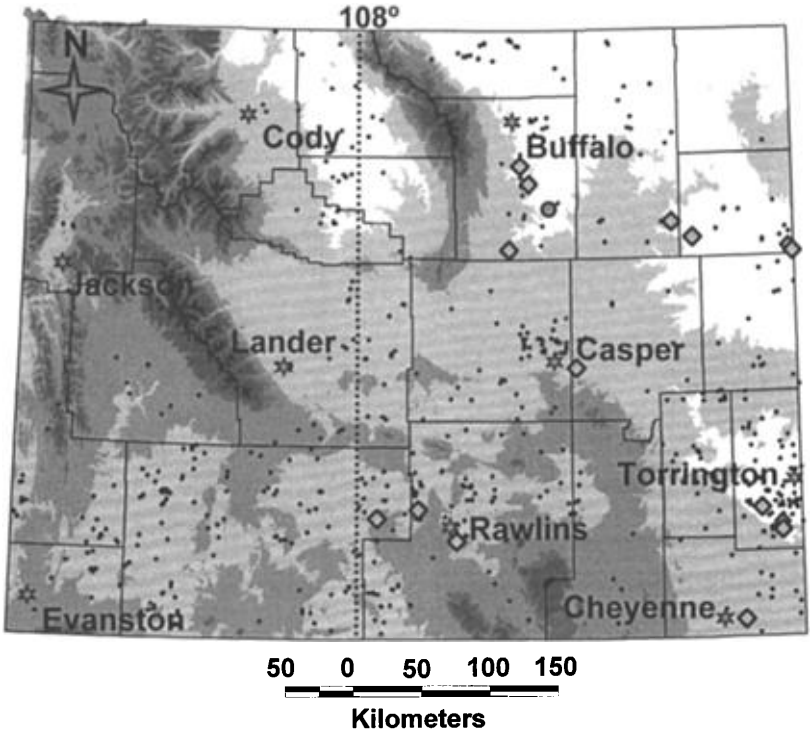

Figure 1. Wildlife Observation System (WOS) historical records and 1999 reoccupancy survey sites with Burrowing Owls (BUOW).

ence of prairie dogs ($B = 1.92$, df = 1, $P = 0.001$). Burrowing Owls not found in association with active prairie dog colonies generally nested in inactive prairie dog towns or burrows excavated by badgers (*Taxidea taxus*), Wyoming ground squirrels (*Spermophilus elegans elegans*), thirteen-lined ground squirrels (*S. tridecemlineatus*), or red foxes (*Vulpes vulpes*). A total of 19% of the occupied sites, and 23% of unoccupied sites were currently or recently (within the previous year) grazed by cattle, sheep, or buffalo (*Bison bison*). There was no significant difference between these values ($P = 0.679$).

DISCUSSION

We examined three data sources, including BBS, WOS, and 1999 reoccupancy survey data, to evaluate the quality of available data and to determine trend in Burrowing Owl relative abundance in Wyoming. None of these data sources alone was sufficient to define Burrowing Owl population status. Our analyses indicated that existing data sources were inadequate to evaluate trends in the Wyoming Burrowing Owl population.

The WOS documents a large number of Burrowing Owl sightings over a relatively long time period; however, it is limited by two major reporting biases. First, search effort is not consistent among years, making the number of records in the database contingent on interest in the species and interest in the database. Because the WOS does not include information on search effort, population trends are inextricable from changing interest in a species. This was demonstrated by declines in American Kestrel, Red-tailed Hawk, and Bald Eagle records during 1986–97. BBS data for a similar time period suggest that populations of all three of these species are stable or increasing in Wyoming. WOS declines are likely accounted for by decreased reporting of sightings to the database by researchers and birders rather than by declines in actual abundance of the species. Thus, although Burrowing Owl WOS records have declined signif-

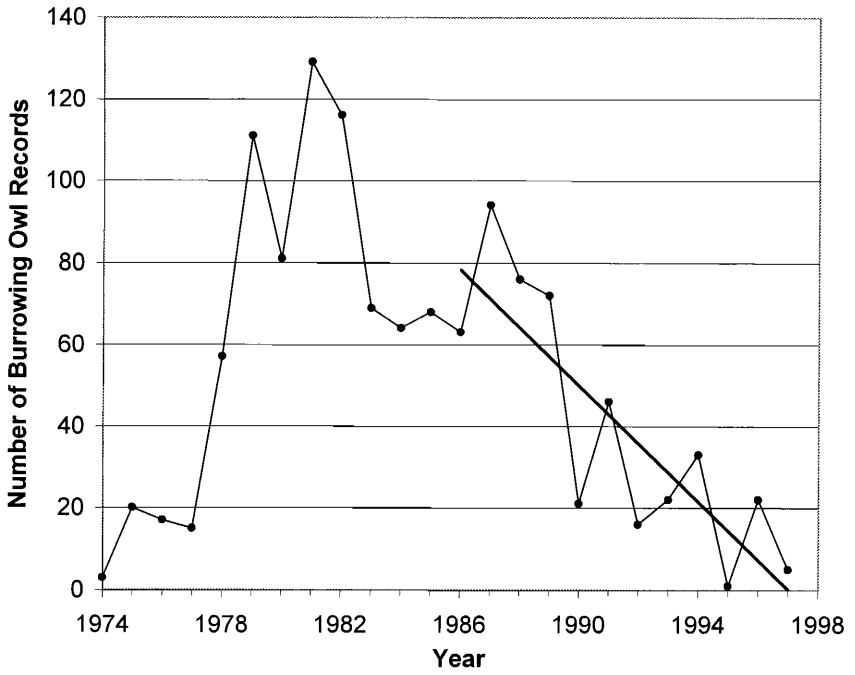

Figure 2. Numbers of Burrowing Owl records per year in the Wyoming Game and Fish Department's Wildlife Observation System (WOS). The significant decline in Burrowing Owl records during the period 1986–97 may represent either declining Burrowing Owl abundance or decreasing interest in the WOS database.

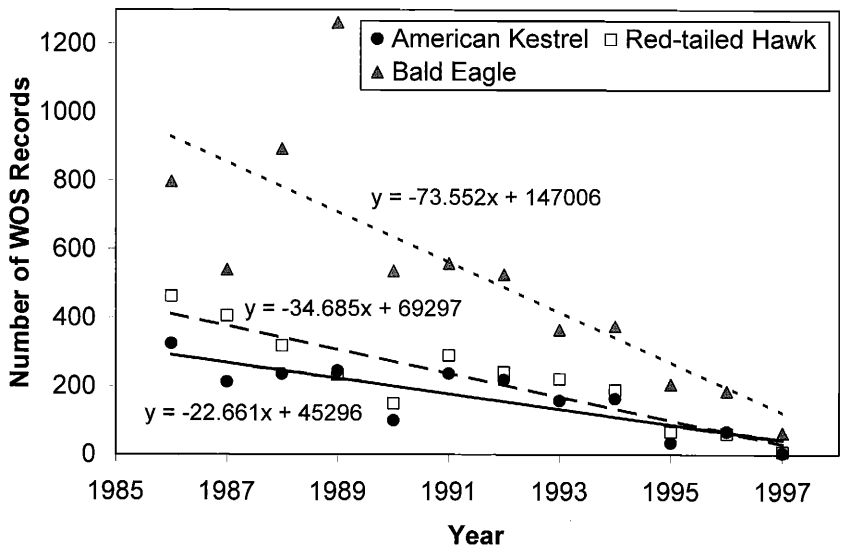

Figure 3. Trends in Wyoming Game and Fish Department's Wildlife Observation System (WOS) records over time for raptors identified by the Breeding Bird Survey as stable (American Kestrel and Red-tailed Hawk) or increasing (Bald Eagle).

icantly in recent years, it is impossible to know to what extent this decline reflects the actual population trend. In addition to this temporal bias, the WOS may also be spatially biased. Burrowing Owl colonies closer to urban areas or roads are probably better represented in the WOS than are more remote colonies, which are less likely to be detected by biologists and birders. This bias may affect the distribution information. For instance, clusters of Burrowing Owl records near towns may be either a function of easier human access or the preferred use of semi-urban landscapes by Burrowing Owls, a behavior that has been documented in other populations (Haug et al. 1993). Although the WOS may be valuable in identifying historical nesting locations, it may not afford a representative view of Burrowing Owl distribution in the state.

Although the BBS has the advantage of standardized sampling effort and is not subject to reporting biases characteristic of the WOS, these data must be carefully interpreted. In all time periods considered, few routes documented Burrowing Owls in Wyoming. A minimum of 14 routes are necessary for reliable trend estimates (J.R. Sauer publ. comm.); hence, the small sample size in Wyoming makes the accuracy of trend estimates questionable. In addition, the survey approach used in the BBS is best suited for common or high-density species. Burrowing Owls are often spatially clustered because of their association with prairie dog towns (Desmond et al. 1995), so a BBS route that intersects a prairie dog town may result in several Burrowing Owl sightings. If a given route does not pass near a town, it is unlikely that any Burrowing Owls will be sighted. Because of the specialized habitat and the low relative abundance of this species, variance among routes and among years is high, resulting in imprecise trend estimates. Despite this potential for imprecision, trend estimates were significantly negative for routes with Burrowing Owls.

Surveying historical nesting locations could be a valuable means of detecting trends in Burrowing Owl populations at historical nesting areas if it is repeated in the future. While reoccupancy seems quite low, we currently have no quantitative means to assess the significance of a 17.5% reoccupancy of historical sites. Survey of historical sites alone may artificially result in a low reoccupancy simply because of the slow movement of prairie dog towns and Burrowing Owl aggregations through time away from initial, historical nesting locations (Rich 1984). For this reason, and to assess Burrowing Owl distribution in an objective manner, we also surveyed random sites. We found only one Burrowing Owl on 85 random sites; thus, it appeared that vegetation type alone was an insufficient site-selection criterion. Future surveys could use vegetation parameters in conjunction with prairie dog town locations to identify potential Burrowing Owl habitat more precisely for survey. The paucity of Burrowing Owl detections on random survey sites also suggests that conservation of established nesting locations is important.

In areas where Burrowing Owls are sympatric with prairie dogs, the owls are thought to prefer nesting in active prairie dog towns because of improved predator detection (e.g., Haug et al. 1993, Desmond et al. 1995). However, our results show that fewer than half of the detected Burrowing Owl nests were associated with active prairie dog towns. Two possibilities exist to explain the lack of Burrowing Owl and prairie dog co-occurrence in eastern Wyoming: 1)association with prairie dogs may not confer advantages such as increased predator detection or, 2) although nonprairie dog habitat is suboptimal, site fidelity may keep the owls in areas of declining quality. Heavy reliance on mammals other than prairie dogs for burrow excavation has not been previously documented for Burrowing Owl populations co-occurring with prairie dogs, although this does occur elsewhere within the Burrowing Owl's range (Haug et al. 1993). Additional research is needed to confirm the prevalence of this nesting strategy and to determine its effect on population dynamics and persistence.

Existing databases are incapable of detecting more than gross trends for the Wyoming Burrowing Owl population. Both the WOS and BBS indicated significant declines in Burrowing Owl abundance; however, reporting bias and sample sizes hindered inference from either source. The statewide reoccupancy study at historical sites must be repeated before we can assess its capacity for documenting population trend. Thus, we recommend that a regular standardized survey be implemented, which incorporates and expands upon our preliminary efforts.

In spite of its associated biases, the WOS provides a useful resource to identify broad-scale distribution patterns and historical nesting locations in the state. Given high site-fidelity of the species documented in other studies (Haug et al. 1993) and the results of our reoccupancy study, it appears

that management of these historical nesting sites would have the greatest conservation impact for Burrowing Owls in Wyoming.

ACKNOWLEDGEMENTS

Thanks to Brady Morris for his large contribution to the Burrowing Owl field surveys. Thanks also to Drs. Gregory Hayward, Troy Wellicome, and Geoffrey Holroyd, and two anonymous reviewers for providing suggestions that improved the manuscript significantly. Robert Oakleaf (WGFD) served as an excellent source of information on the WOS. Funding for this study was provided by The Wyoming Nature Conservancy, The Nature Conservancy's Wings of the Americas program, Wyoming Game and Fish Department, Biological Resource Division of the USGS, and the University of Wyoming College of Arts and Sciences. Thanks to Drs. Jerry Freilich and Charles Duncan of The Nature Conservancy for providing funding opportunities and other essential assistance. This project would not have been possible without the many Wyoming landowners who graciously allowed us access.

LITERATURE CITED

DESMOND, M.J., J.A. SAVIDGE, AND T.F. SEIBERT. 1995. Spatial patterns of Burrowing Owl (*Speotyto cunicularia*) nests within black-tailed prairie dog (*Cynomys ludovicianus*) towns. *Can. J. Zool.* 73:1375–1379.

GEISSLER, P.H. AND J.R. SAUER 1990. Topics in route-regression analysis. Pages 54–57 *in* J.R. Sauer and S. Droege [EDS.], Survey designs and statistical methods for the estimation of avian population trends. U.S. Fish and Wildl. Serv., Biol. Rep. 90, Washington, DC U.S.A.

HAUG, E.A. AND A.B. DIDIUK. 1993. Use of recorded calls to detect Burrowing Owls. *J. Field Ornithol.* 64:188–194.

———, B.A. MILLSAP, AND M.S. MARTELL. 1993. Burrowing Owl (*Speotyto cunicularia*). *In* A. Poole and F. Gill [EDS.], The birds of North America, No. 61. The Academy of Natural Sciences, Philadelphia, PA and American Ornithologists' Union, Washington, DC U.S.A.

JAMES, P.C. AND R.H.M. ESPIE. 1997. Current status of the Burrowing Owl in North America: an agency survey Pages 3–5 *in* J.L. Lincer and K. Steenhof, [EDS.], The Burrowing Owl, its biology and management including the proceedings of the first international Burrowing Owl symposium. J. Raptor Res. Report 9.

MARTIN, D.J. 1973. Selected aspects of Burrowing Owl ecology and behavior. *Condor* 75:446–456.

RICH, T. 1984. Monitoring Burrowing Owl populations· implications of burrow re-use. *Wildl. Soc. Bull.* 12:178–180.

SAUER, J.R., J.E. HINES, G. GOUGH, I. THOMAS, AND B G PETERJOHN. 1997. The North American breeding bird survey results and analysis. Version 96.4. USGS Patuxent Wildlife Research Center, Laurel, MD U.S.A. http //www.mbr.nbs.gov/bbs/bbs96.html.

SAUER, J.R., J.E. HINES, I. THOMAS, J. FALLON, AND G. GOUGH. 1999. The North American breeding bird survey, results and analysis 1966–1998. Version 98 1. USGS Patuxent Wildlife Research Center, Laurel, MD U.S.A. http://www.mbr.nbs.gov/bbs/bbs98.html.

THOMPSON, C. 1984. Selected aspects of Burrowing Owl ecology in central Wyoming. M.S. thesis, Univ. Wyoming, Laramie, WY U.S.A.