

- JOHNSGARD, P.A. 2002. North American owls: biology and natural history, 2nd Ed. Smithsonian Inst. Press, Washington, DC U.S.A.
- KELLY, E.G., E.D. FORSMAN, AND R.G. ANTHONY. 2003. Are Barred Owls displacing Spotted Owls? *Condor* 105:45–53.
- LEHMKUHL, J.F. AND M.G. RAPHAEL. 1993. Habitat pattern around northern Spotted Owl locations on the Olympic peninsula, Washington. *J. Wildl. Manage.* 57:302–315.
- MAYR, E. AND L.L. SHORT. 1970. Species taxa of North American birds: a contribution to comparative systematics. *Publ. Nuttall Ornithol. Club* 9.
- PEARSON, R.R. AND K.B. LIVEZEY. 2003. Distribution, numbers, and site characteristics of Spotted Owls and Barred Owls in the Cascade Mountains of Washington. *J. Raptor Res.* 37:265–275.
- TAYLOR, A.L. AND E.D. FORSMAN. 1976. Recent range extensions of the Barred Owl in western North America, including the first records for Oregon. *Condor* 78:560–561.
- U.S. FOREST SERVICE. 1988. Spotted Owl inventory and monitoring handbook. USDA For. Serv., Portland, OR U.S.A.
- ZAR, J.F. 1984. Biostatistical analysis. Prentice Hall, Englewood Cliffs, NJ U.S.A.

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## HISTORICAL AND CURRENT STATUS OF BREEDING AND WINTERING WESTERN BURROWING OWLS (*ATHENE CUNICULARIA HYPUGAEA*) IN TEXAS

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**KEY WORDS:** *Western Burrowing Owl*; *Athene cunicularia hypugaea*; *abundance*; *Breeding Bird Atlas*; *Breeding Bird Survey*; *Christmas Bird Count*; *population trend*; *Texas*.

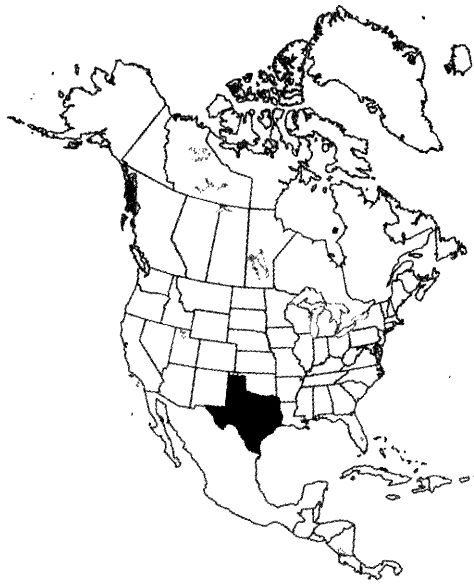
The western Burrowing Owl (*Athene cunicularia hypugaea*) is one of 18 New World Burrowing Owl subspecies, and one of only two in North America. Designated Endangered in Canada and Threatened in Mexico, the Burrowing Owl is a U.S. Fish and Wildlife Service (USFWS 2001) Bird of Conservation Concern in Regions 1 (Pacific), 2 (Southwest), and 6 (Mountain-Prairie). It is state-listed as Threatened in Colorado, Endangered in Iowa and Minnesota, and has been additionally listed in 16 other U.S. states (Arizona, California, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming) as a species of special concern (James and Espie 1997, Sheffield 1997, USFWS 2001). Population declines and range contractions have been noted at various locations throughout North America, prompting calls for more information about the species' historic and current population status that may be used to guide conservation efforts (Holroyd et al. 2001). Such assessments have been done for owl populations in sev-

eral U.S. states (e.g., Brown 2001, Korfanta et al. 2001, Martell et al. 2001, Murphy et al. 2001), Canada (Kirk and Hyslop 1998, Shyry et al. 2001), Mexico (Enriquez-Rocha et al. 1993), and North America as a whole (James and Ethier 1989), and they have documented declines in both breeding and wintering owl numbers.

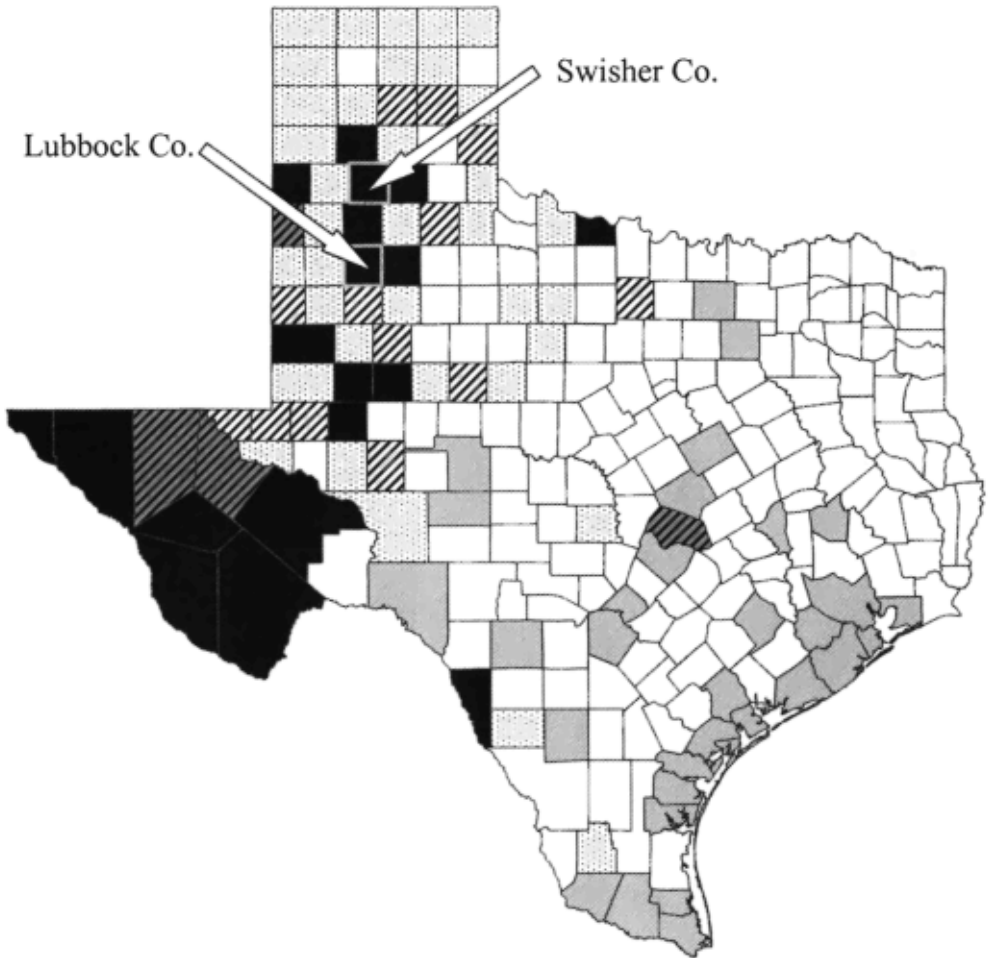
One state that has not had an assessment of its Burrowing Owl population, however, is Texas. Importantly, Texas consistently accounts for a substantial portion of the overall North American owl population in the Breeding Bird Survey, Christmas Bird Counts, and in a recent wildlife agency survey (James and Espie 1997). Indeed, the highest reported relative abundances of overwintering owls come from Texas (USGS 2003), and Texas also supports a sizeable population during the breeding season (James and Espie 1997).

This oversight in the knowledge base was recently recognized, and an explicit call for research on the abundance of western Burrowing Owls in Texas was made (Wellicome and Holroyd 2001). In-depth studies on the coastal population are underway involving the USFWS, Canadian Wildlife Service, and Texas Parks & Wildlife ([http://www.cerc.usgs.gov/frs\\_webs/gulf\\_coast/owls.htm](http://www.cerc.usgs.gov/frs_webs/gulf_coast/owls.htm)). Given that declines in owl populations in the adjacent states of New Mexico and Oklahoma have been documented (Arrowood et al. 2001, Sheffield and Howery 2001) and that the owl has reportedly suffered from

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-  Breeding
-  Hypothetical Breeding
-  Winter
-  Year-round
-  No Owls Recorded



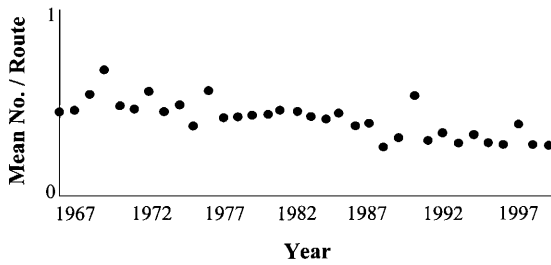


Figure 2. Plot of the mean number of western Burrowing Owls per Breeding Bird Survey route for the state of Texas, by year (1966–99).

range contractions in parts of North America (Wellcome and Holroyd 2001), information about the status of the western Burrowing Owl in Texas would fill a crucial gap in our knowledge. Therefore, in this paper I provide an assessment of western Burrowing Owl abundance in Texas for both the breeding and winter seasons, using historic records (back to 1960) up to current information (2001), and note whether any changes in owl abundance have occurred over that time. In so doing, I provide a current distribution map for the counties of Texas for both breeding and wintering periods. My analysis illustrates that gaps still exist in our knowledge of the western Burrowing Owl.

METHODS

A variety of techniques has been used to assess the status of the western Burrowing Owl, including questionnaires (e.g., Arrowood et al. 2001, Brown 2001), call-playback studies (Shyry et al. 2001), examinations of museum collection records (Enriquez-Rocha et al. 1993), resurveying areas where owls were historically recorded (e.g., Murphy et al. 2001, Korfanta et al. 2001), and summaries of long-term population survey data. I used data from the USFWS’s annual Breeding Bird Survey (BBS; 1966–99) and from the Texas Breeding Bird Atlas, which represents a compilation of records from 1987–92 (Benson and Arnold 2001) to document owl abundance during the breeding season. I used data from the National Audubon Society’s annual Christmas Bird Count (CBC; 1960–2001) to obtain information about owl abundance during the winter. Although the CBC has been conducted since 1900 in Texas, surveys were intermittent until 1909, and few surveys were conducted in the western por-

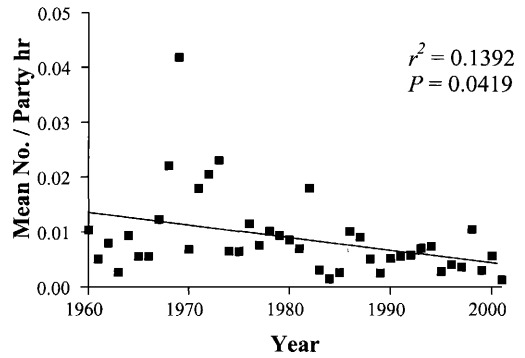


Figure 3. Plot of the mean number of western Burrowing Owls per party-hour per Christmas Bird Count circle for the state of Texas, by year (1960–2001). The slope of the regression line is significantly different than 0 ( $r^2 = 0.1392$ ,  $P = 0.0419$ ).

tion of the state until the 1930s, making consistent information about Burrowing Owls unavailable until 1936. Because survey protocols and circle sizes were not standardized until the late 1950s, however, data prior to 1960 are excluded from analysis. Other researchers have similarly used either BBS (Arrowood et al. 2001) or both BBS and CBC (Kirk and Hyslop 1998, Sheffield and Howery 2001) data to document historic and current western Burrowing Owl population trends.

The BBS data represented the mean number of owls recorded per route for each year; the CBC data represented the mean number of owls recorded per plot circle for each year. Only those routes and circles that reported the presence of western Burrowing Owls were included in analyses (i.e., data were not averaged over all routes/circles in the state). CBC data were also standardized by party-hour each year. Mean abundance data were plotted by year, and linear regression analysis was used to detect any significant trends in owl abundance over time.

BBS route information, CBC records, and information from the Texas Breeding Bird Atlas were used to construct a distributional map for the western Burrowing Owl in Texas, by county (Fig. 1). Additional data for Swisher County (indicated on Fig. 1) came from Ross and Smith (1970).

RESULTS

An examination of the distributional county map (Fig. 1) shows that many gaps still exist in our knowledge of

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Figure 1. Distributional map for the western Burrowing Owl in Texas, by county. If at least one breeding or overwintering occurrence was recorded in a county, the county is shaded (stippled for breeding record only, gray for winter record only). If a county had both breeding and overwintering records, it is shaded black. Unshaded counties had no records of western Burrowing Owls. The “hypothetical breeding” (striped) category includes both “Possible” and “Probable” localities from the Texas Breeding Bird Atlas that were not confirmed otherwise by BBS data. Note that the hypothetical breeding category can co-occur with winter records (gray stripes). Lubbock and Swisher counties (mentioned in text) are indicated.

the spatial and temporal distribution of western Burrowing Owls in Texas. These gaps may be explained in part by a lack of Breeding Bird Survey routes and Christmas Bird Count circles in many parts of Texas. Because of this patchy distribution of survey sites, there are numerous counties where owls likely occur, but have never been recorded in certain seasons or at all; our knowledge about the distribution of the western Burrowing Owl would benefit greatly from a survey of these likely counties. In addition, the number of owls that winter in Texas may be underestimated if CBC surveys are conducted during inclement weather when the owls are most likely to be in their burrows and not in view (Butts 1973).

No significant changes were found in the mean number of western Burrowing Owls during the breeding season from 1966–99 ( $P = 0.2498$ ; Fig. 2). The slope was negative ( $-2.04$ ), suggesting a population decline, but this trend was not significantly different from zero over the past 34 yr. However, the mean number of owls recorded has been consistently low (Fig. 2).

A significant decline was detected in the mean number of overwintering owls from 1960–2001 ( $r^2 = 0.1392$ ,  $P = 0.0419$ ; Fig. 3); there have not been any large peaks in mean owls recorded since the early 1970s. Lubbock County has consistently reported the highest numbers of owls in winter (averaging 3–10 owls per circle), especially in recent years (recorded highest owl counts in 8 of the past 15 yr and always among the 10 highest counts in the state during the past 15 yr; USGS 2003).

#### DISCUSSION

There are limitations in using BBS and CBC data that pertain to differences in participant effort and skills (Sauer et al. 1994, Peterson 1995) and the lack of consensus about which statistical method for estimating population trends is the most appropriate (Thomas 1996), and caution has been urged when using trend data to recommend conservation actions (Dunn 2002). Despite these shortcomings, the value of such long-term data is acknowledged (James et al. 1996). The trends noted in the present study should therefore be placed in the larger context of similar evaluations that have been conducted for western Burrowing Owls in other U.S. states, Canadian provinces, and Mexican states (e.g., Enriquez-Rocha et al. 1993, Kirk and Hyslop 1998, Shyry et al. 2001, Vercauteren et al. 2001). This study thus complements previous work and fills a gap in our knowledge about the overall population trajectory of the western Burrowing Owl.

No significant changes were found in the mean number of western Burrowing Owls during the breeding season from 1966–99, although the trend was downward. An earlier, shorter-term analysis of BBS data revealed a similar suggestive, but statistically non-significant, decline (Sheffield 1997). Significant declines in the number of breeding owls over limited periods of time have been reported from the Panhandle and Trans-Pecos regions of Texas (Haug et al. 1993), however, suggesting that local-

ized populations may not conform to the overall state pattern. The statistically significant decline in overwintering owls (particularly since the 1970s) mirrors a pattern seen in California (Sheffield 1997).

Texas is fortunate to support both breeding and overwintering populations of the western Burrowing Owl as well as both resident and migratory populations (Ross and Smith 1970, Butts 1973). Indeed, Texas has been considered a "promising location for future studies" on the species (Wellicome and Holroyd 2001). Owl numbers are low, however, and thus merit concern. In addition, the number of wintering owls has declined over the past few decades. Because the western Burrowing Owl is a conservation priority by the USFWS as well as by various state and provincial agencies, information about the abundance and distribution of the owl is important for determining current and future management actions and goals. A continuation of monitoring studies such as BBS and CBC is clearly needed, along with much more research on the western Burrowing Owl in Texas and elsewhere (Wellicome and Holroyd 2001). An expansion of the coverage currently provided by the BBS and CBC would supplement our knowledge of how abundant the species is in portions of the state that are currently unsampled.

Because Texas represents the area of highest abundance of overwintering western Burrowing Owls in the US (USGS 2003), the decline in winter owl abundance possibly reflects reduced numbers observing owl populations elsewhere in North America. Banding studies would help resolve this issue by identifying whether owls that overwinter in Texas are from declining breeding populations from Canada. Identifying the cause(s) behind the decline in overwintering birds is necessary if this decline is to be halted and reversed, but potential causes of the decline will remain undetermined unless more in-depth studies are completed.

RESUMEN.—Una compilación de los datos sobre las poblaciones reproductivas y sobre invernantes del búho cavador oriental (*Athene cunicularia hypugaea*) del Estudio de Reproducción de Aves (1966–99), los Conteos Navegadores de Aves (1960–2001), y del Atlas de Reproducción de Aves de Texas (1987–92), revelaron que mientras la abundancia de búhos en la estación reproductiva permaneció relativamente baja pero constante en unas cuantas de las décadas pasadas, el número de búhos en el invierno ha decaído. Debido a que Texas representa el área con la más alta abundancia de búhos cavadores occidentales sobre invernantes, este declive posiblemente está reflejando el decrecimiento en las poblaciones reproductivas de búhos notada en otros sitios de Norteamérica. Un mapa de la distribución en Texas por condado, de los búhos durante su reproducción y durante la temporada invernal, fue compilado y reveló que aun existían algunos vacíos en nuestro conocimiento sobre donde están los búhos en Texas. Esta información prob-

ablemente será útil para guiar los planes de manejo invernal y para estimular mayor investigación sobre el búho cavador occidental en Texas y en cualquier otra parte de su rango.

[Traducción de César Márquez]

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#### LITERATURE CITED

- ARWOOD, P.C., C.A. FINLEY, AND B.C. THOMPSON. 2001. Analyses of Burrowing Owl populations in New Mexico. *J. Raptor Res.* 35:362–370.
- BENSON, K.L.P. AND K.A. ARNOLD. 2001. The Texas Breeding Bird Atlas. Texas A&M University System, College Station and Corpus Christi, TX U.S.A. 12 July 2001. <http://tbba.cbi.tamucc.edu>
- BROWN, N.L. 2001. The howdy owls of Arizona: a review of the status of *Athene cunicularia*. *J. Raptor Res.* 35:344–350.
- BUTTS, K.O. 1973. Life history and habitat requirements of Burrowing Owls in western Oklahoma. M.S. thesis, Oklahoma State University, Stillwater, OK U.S.A.
- DUNN, E.H. 2002. Using decline in bird populations to identify needs for conservation action. *Conserv. Biol.* 16:1632–1637.
- ENRIQUEZ-ROCHA, P., J.L. RANGEL-SALAZAR, AND D.W. HOLT. 1993. Presence and distribution of Mexican owls: a review. *J. Raptor Res.* 27:154–160.
- HAUG, E.A., B.A. MILLSAP, AND M.S. MARTELL. 1993. Burrowing Owl. In A. Poole and F. Gill [Eds.], *The birds of North America*, No. 61. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, DC U.S.A.
- HOLROYD, G.L., R. RODRÍGUEZ-ESTRELLA, AND S.R. SHEFFIELD. 2001. Conservation of the Burrowing Owl in western North America: issues, challenges, and recommendations. *J. Raptor Res.* 35:399–407.
- JAMES, F.C., C.E. MCCULLOUGH, AND D.A. WIEDENFELD. 1996. New approaches to the analysis of population trends in land birds. *Ecology* 77:13–27.
- JAMES, P.C. AND R.H.M. ESPIE. 1997. Current status of the Burrowing Owl in North America: an agency survey. *Raptor Res. Report* 9:3–5.
- AND T.J. ETHIER. 1989. Trends in the winter distribution and abundance of Burrowing Owls in North America. *Am. Birds* 43:1224–1225.
- KIRK, D.A. AND C. HYSLOP. 1998. Population status and recent trends in Canadian raptors: a review. *Biol. Conserv.* 83:91–118.
- KORFANTA, N.M., L.W. AYERS, S.H. ANDERSON, AND D.B. McDONALD. 2001. A preliminary assessment of Burrowing Owl population status in Wyoming. *J. Raptor Res.* 35:337–343.
- MARTELL, M.S., J. SCHLADWEILER, AND F. CUTHBERT. 2001. Status and attempted reintroduction of Burrowing Owls in Minnesota, U.S.A. *J. Raptor Res.* 35:331–336.
- MURPHY, R.K., K.W. HASSELBLAD, C.D. GRONDAHL, J.G. SIDDLE, R.E. MARTIN, AND D.W. FREED. 2001. Status of the Burrowing Owl in North Dakota. *J. Raptor Res.* 35:322–330.
- PETERSON, A.P. 1995. Erroneous party-hour data and a proposed method of correcting observer effort in Christmas Bird Counts. *J. Field Ornithol.* 66:385–390.
- ROSS, P.V. AND D.J. SMITH. 1970. Notes on the ecology of the Burrowing Owl, *Speotyto cunicularia*, in the Texas High Plains. *Texas J. Sci.* 21:479–480.
- SAUER, J.R., B.G. PETERJOHN, AND W.A. LINK. 1994. Observer differences in the North American breeding bird survey. *Auk* 111:50–62.
- SHEFFIELD, S.R. 1997. Current status, distribution, and conservation of the Burrowing Owl (*Speotyto cunicularia*) in midwestern and western North America. Pages 399–407 in J.R. Duncan, D.H. Johnson, and T.H. Nicholls [Eds.], *Biology and Conservation of Owls of the Northern Hemisphere: Second International Symposium, February 5–9, 1997, Winnipeg, Manitoba, Canada*. USDA For. Serv. Gen. Tech. Rep. NC-190.
- SHEFFIELD, S.R. AND M. HOWERY. 2001. Current status, distribution, and conservation of the Burrowing Owl in Oklahoma. *J. Raptor Res.* 35:351–356.
- SHYRY, D.T., T.I. WELLCOME, J.K. SCHMUTZ, G.L. ERICKSON, D.L. SCOBIE, R.F. RUSSELL, AND R.G. MARTIN. 2001. Burrowing Owl population-trend surveys in southern Alberta: 1991–2000. *J. Raptor Res.* 35:310–315.
- THOMAS, L. 1996. Monitoring long-term population change: why are there so many analysis methods? *Ecology* 77:49–58.
- U.S. FISH AND WILDLIFE SERVICE. 2001. Birds of Conservation Concern 2001. USFWS, Division of Migratory Bird Management, Arlington, VA U.S.A.
- U.S. GEOLOGICAL SURVEY (USGS). 2003. Patuxent Wildlife Research Center: <http://www.mbr-pwrc.usgs.gov/bbs/cbcra/h3780ra.html>
- VERCAUTEREN, T.L., S.W. GILLIHAN, AND S.W. HUTCHINGS. 2001. Distribution of Burrowing Owls on public and private lands in Colorado. *J. Raptor Res.* 35:357–361.
- WELLCOME, T.I. AND G.L. HOLROYD. 2001. The Second International Burrowing Owl Symposium: background and context. *J. Raptor Res.* 35:269–273.

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