# PROJECT PRAIRIE BIRDS: A CITIZEN SCIENCE PROJECT FOR WINTERING GRASSLAND BIRDS

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ABSTRACT.—Coastal prairies are the primary winter destination for two dozen species of migratory grassland birds and losses of this habitat have proven detrimental to their populations. As a result, some of Partners in Flight's (PIF) highest priority birds are grassland species. To examine grassland bird use of coastal prairies, Project Prairie Birds survey methodology was designed and field work was initiated in 1998. Avian surveys were conducted at 34 sites, each with multiple transects for a minimum of two years by all-volunteer, three-person crews identifying all species flushed from vegetation. Seasonal vegetation surveys measured five variables using five one square-meter sample areas. We also measured vertical thickness using a density board. We selected nine sites (26.5%) with three or more years of survey data for analysis. Thirty-nine species were detected of which 36% have PIF combined species assessment scores of 10 or above. In addition, 24% of the individuals were Le Conte's Sparrows which are a PIF Tier II priority species. A multiple regression between abundance and vegetative data for these two species showed a weak but significant correlation between Sedge Wren and the 0.5 m vertical thickness parameter ($R^2 = 0.1544$, $p < 0.0001$) but no significant relationship for Le Conte's Sparrow. This is likely due to high variances in the data as over-wintering location choice for these species is a function of climatic variability.

Losses of coastal prairie have proven to be detrimental to many bird species, and some of Partners in Flight's (PIF) highest priority birds are grassland species including Le Conte's Sparrow (*Ammodramus leconteii*), Grasshopper Sparrow (*A. savannarum*), and Henslow's sparrow (*A. henslowii*). As a result, grassland birds are a key research priority for the conservation of migrant landbirds. The general decline of grassland birds in the United States can be attributed to intensification of agriculture, reforestation, and increased urbanization (O'Connor et al. 1999). In recent decades, researchers have been able to gauge the extent of these population declines by using data collected from Breeding Bird Surveys (Askins 1999). Approximately 20 species of prairie-dependent birds require contiguous, naturally-disturbed grasslands during their breeding season. As our once-vast grasslands continue to be fragmented and isolated into smaller "islands," the dynamics of bird populations have changed, and in many cases, suffered. We know that habitat loss affects avian populations and although this information is critical to land managers and policymakers (Donovan et al. 2002), few studies document these effects. Species such as the House Wren (*Troglodytes aedon*), for example, may be more tolerant of fragmented habitat caused by ever-expanding urban development and agrarian sprawl. Henslow's Sparrow, one of the highest priority grassland birds in the PIF Continental Plan, (Rich et al. 2004) once bred in the tallgrass prairies of the Upper Texas Coast. However, with the loss of 99% of its habitat (Grace 1998), no Henslow's Sparrow breeding population has been observed in Texas since 1982 (Arnold and Garza 1998).

The majority of research directed at determining causes of grassland bird population declines has been conducted on the breeding grounds (Vickery and Herkert 2001). Winter habitat use studies may provide additional information in our understanding of grassland bird population declines as well as provide opportunities to involve landowners and birders in population monitoring. While interest in this group of birds has greatly increased, especially on breeding grounds, few studies address winter distribution, densities, impacts of management practices, or habitat requirements (Askins 1993, Donovan et al. 2002, Vickery et al. 1999).

Coastal prairies, the most endangered ecosystem in Texas (TPWD 2005), are the primary winter destination for two dozen species of migratory grassland birds including large numbers of sparrows, pipits, and wrens. In winter, these birds use a mosaic of remnant native prairie, agricultural fields, improved pastures, marshes, and hedge rows. In response to the need for new information, the Gulf Coast Bird Observatory (GCBO), in

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conjunction with project partners, Texas Parks and Wildlife Department (TPWD), Texas Partners in Flight, and Raven Environmental Services, Inc. developed and initiated Project Prairie Birds (PPB) in the winter of 1998. Designed as a 5-year, citizen-science project, we hoped to collect bird and vegetative data to map distribution and identify specific habitat requirements of over-wintering avian grassland species in Texas coastal prairies and surrounding areas. In addition to identifying the area-distribution of winter grassland birds, we hoped to find associations between our vegetative samplings and avian censuses that may identify habitat preferences for target species. Historically, land management for songbirds has seldom been addressed, but because of the growing interest in bird-related tourism and sustainable economic development for landowners, this program could be a gateway for melding land management and conservation ideals for the benefit of bird populations.

One of the challenges of monitoring grassland birds is actually detecting these secretive and often elusive species. In the winter, identification is particularly difficult because birds are cryptically colored, do not sing identifiable songs, and often respond to disturbances by hiding in the grass or running along the ground beneath the herbaceous cover. Therefore, traditional sampling techniques, such as point counts or area search-method may not detect these birds. In order to increase their detection rate, we needed to create a survey methodology specifically designed to census birds that skulk in the grass and forb layer and go undetected. Thus, we designed the PPB methodology, which involves thrashing the grass with bamboo poles while surveying a transect to flush skulking birds.

## METHODS

Surveys were conducted each winter beginning in December 1998 and ending in February 2003 at 34 volunteer selected sites on the Upper Texas Coast and included federal, state, and private lands. Transects at each study site were monumented at the beginning of each field season (Fig. 1). A detailed description of the tools

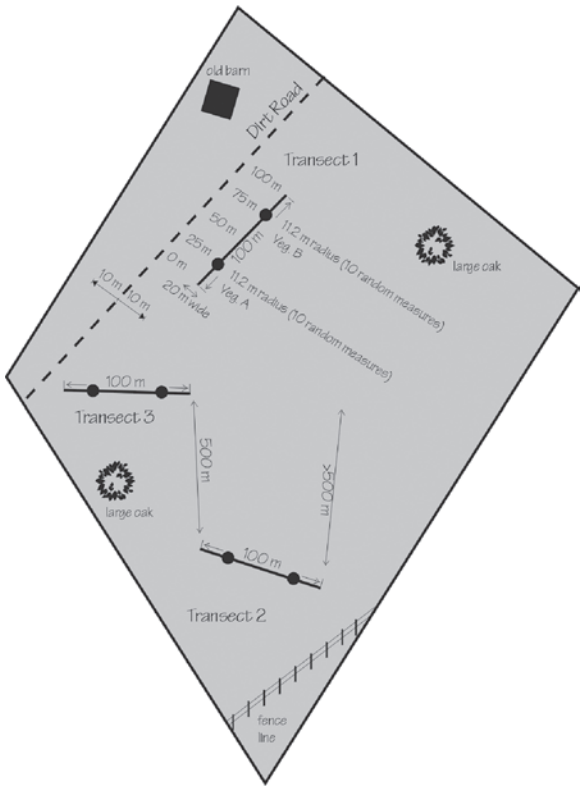


Figure 1. A sample field map showing that transects were 100 meters long, 20 meters wide, and separated by at least 200 meters to avoid flushing birds from transect-to-transect. Figure courtesy of Shackelford et al. 2001.

used and methods can be found at http://www.tpwd.state.tx.us/huntwild/wild/birding/project_prairie_birds/ (Shackelford et al. 2001).

Each winter, volunteers conducted three avian surveys and one vegetative survey on each transect. Avian surveys were conducted between half an hour after sunrise and 1500 h if wind speeds were less than five on the Beaufort Scale, and skies were clear to overcast (no drizzle or rain). Avian surveys were performed from December through February with a minimum of two weeks time lapsed between surveys. Survey crews consisted of two pole operators beating the vegetation with bamboo or cane poles in order to flush skulking birds (Fig. 2) and a third person, the caller, who walked between the pole operators, monitoring for birds as they flushed in front of the survey line. The crew walked in a straight survey line and completed each transect within 90–120 seconds. Members of the survey crew identified and recorded the number of birds flushed and monitored birds until they landed to prevent double-counting. Unidentified birds were sometimes relocated after completing the transect to identify the flushed individuals.

Vegetation was measured once per year, after all avian surveys had been completed to minimize disturbance of birds occupying the study areas. This end-of-season survey gave a good representation of the actual vegetative structure used by birds. Cover data were collected from five randomly selected one square-meter sample areas per transect (Fig. 3). Percent composition of the following cover was determined: grass (standing alive or dead; includes sedges, rushes and reeds), forbs (broad-leaved herbaceous plants), woody shrubs, leaf litter (flattened, dead vegetation) and bare ground (soil). The number of fire ant mounds and gopher mounds within each sample square were also counted. The percent of the area in the sample square covered by water (not standing rainwater) and average water depth were also recorded.

Robel et al.'s (1970) density board technique was used to determine vertical thickness. In wooded or savannah-like situations, basal area of trees was measured using a 1-factor metric prism at each of the five sample squares. The total number of woody shrubs, the total number of trees, and the total number of snags (standing, dead trees) in the 20 $\times$ 100 m transect area were also recorded. In addition, participants recorded grazing, burning, and mowing histories if available as well as size of grassland.

All data were recorded on specially designed field data sheets and then entered in Microsoft Excel. Simple summary statistics for each site were compiled and the Shannon Diversity index was used to demonstrate variation in species diversity between sites and within sites by transects. A multiple regression between abundance and vegetation data was conducted for nine sites with three or more years of survey data.

Figure 2. Avian surveys were conducted by a survey crew of three that walked a transect attempting to flush and identify skulking grassland birds. Figure courtesy of Shackelford et al. 2001.

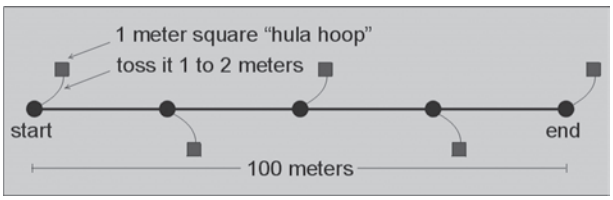


Figure 3. Participants collected cover composition and vertical thickness vegetation parameters by walking along the center of the transect and randomly tossing a 1 meter$^2$ hoop every 25 meters. Figure courtesy of Shackelford et al. 2001.

## RESULTS

A total of 1,666 avian surveys was conducted on 34 sites. Over 200 volunteers participated with a minimum of 4,000 volunteer hours dedicated to PPB. Thirty-nine species of birds were detected with a total of 4,761 individuals including high priority species such as Attwater's Greater Prairie-Chicken (*Tympanuchus cupido attwateri*), Henslow's, Nelson's Sharp-tailed (*A. nelsoni*), Seaside (*A. maritimus*), Le Conte's, and Grasshopper sparrows, Sprague's Pipit (*Anthus spragueii*), Sedge Wren (*Cistothorus platensis*), Northern Bobwhite (*Colinus virginianus*), and Short-eared Owl (*Asio flammeus*).

In the nine sites selected, each had three or more years of data and had the highest number of transects (253) for in depth analysis. For the most part, these sites (Fig. 4) were located along the Upper Texas Coast where we had a concentration of volunteers and near the headquarters of the Gulf Coast Bird Observatory whose staff coordinated and participated in many of the PPB surveys.

We calculated a diversity measure using the Shannon Diversity Index (H) to determine how diversity was impacted by different management practices and to give some indication of habitat quality for a given species. We also used the evenness measure to determine how individuals were distributed among the different species. Because the number of transects varied from site to site and from year to year, the number of transects used to calculate H varied from as few as two to as many as 19 (Table 1). These data show values of H varying from 0.23 to 1.19 where values closest to 0 represent transects that contained equal numbers of individuals of each species, and values of 1 or greater are transects that had one or more species that dominated the diversity (e.g., 90% species A, and 10% a mixture of Species B, C, and D).

With the exception of UH Coastal Center (UHCC), which clearly shows a near even distribution of species, all other sites showed a highly uneven distribution of species. The implication is that sites with values closest to zero are those that have the most homogenous habitat, and higher values may represent more habitat diversity. Nearly 36% of individual birds encountered on PPB surveys had Partners in Flight combined species assessment scores above 10 meaning these are species whose populations are showing the greatest declines (Table 2).

In addition, almost 32% of birds recorded from the surveys were either Le Conte's Sparrows ($n = 830$) or Sedge Wrens ($n = 709$). Le Conte's Sparrow is a PIF priority species for Gulf Coastal Prairie (the project's target habitat), during winter (Vermillion et al. 2008). Almost all sites detected Le Conte's Sparrow, and all but one site (Indiangrass Preserve) detected Sedge Wren. A plot of abundance of these two species over the first five years of surveys shows an obvious fluctuation of individual numbers among years (Fig. 5). This likely is a function of climatic variability (e.g., rainfall, temperature extremes), but the PPB protocol did not collect those data. In future studies of grassland birds, collection of weather data could prove a valuable addition to explain population fluctuations between or among years.

We used regression analysis to analyze the relationship between vegetative cover composition and abundance, diversity, and species richness of birds detected on surveys as well as occurrence of Le Conte's Sparrows and Sedge Wrens. The only significant result was a positive, but weak correlation between the occurrence of Sedge Wren and 0.5 m vertical thickness ($R^2 = 0.1544$, $p < 0.0001$).

## DISCUSSION

The site profiles included in this analysis show some correlations that are obvious even without statistical analysis. Not surprisingly, larger sites with more transects recorded higher numbers of individual birds than small sites. Likewise sites with four or five years of participation recorded more individual birds than sites with two or three years. Factors that contributed to species diversity were only partially addressed by the methodology of PPB but some correlations between species diversity and habitat are clear from the anecdotal site descriptions. Few sites were restricted to a single microhabitat, and most contained varying amounts of pure prairie plus prairie grading into one or more non-prairie vegetative communities (freshwater marsh, salt marsh, and areas with shrubs and small trees). In these habitat gradations, or ecotones, non-prairie species co-occurred with typical prairie species raising the overall species diversity of those sites (Table 2).

Some of the species rated most at risk by PIF (Table 2) were recorded in low to very low numbers including Nelson's Sharp-tailed Sparrow, Henslow's Sparrow, Yellow Rail (*Coturnicops noveboracensis*), and Greater Prairie-Chicken. The prairie-chicken risk score is somewhat deceptive because it is a composite score for all populations of Greater Prairie-Chicken, not the critically endangered Attwater's race which, if considered separately, should qualify for the maximum PIF value of 20. Only one site recorded this species and only

**Table 1.** Annual summaries for the nine sites used in this analysis showing the total number of individuals and number of species encountered per winter as well as an average of the Shannon Diversity Index calculated per transect during each survey year at each site.

| Site | Season | Number of individuals | Number of species | Average diversity (H) of transects |
|---|---|---|---|---|
| Anahuac NWR | | | | |
| | 1998–1999 | 54 | 9 | 0.7557 |
| | 2001–2002 | 113 | 11 | 0.6673 |
| | 2002–2003 | 76 | 12 | 0.6909 |
| Armand Bayou | | | | |
| | 1998–1999 | 18 | 3 | 0.5992 |
| | 2001–2002 | 28 | 3 | 1.0365 |
| | 2002–2003 | 28 | 6 | 1.1910 |
| Attwater Prairie Chicken NWR | | | | |
| | 1998–1999 | 140 | 10 | 0.7679 |
| | 1999–2000 | 133 | 5 | 0.6014 |
| | 2000–2001 | 236 | 9 | 0.7325 |
| | 2001–2002 | 220 | 7 | 0.6318 |
| | 2002–2003 | 108 | 7 | 1.0058 |
| Brazoria NWR | | | | |
| | 1999–2000 | 116 | 6 | 0.8832 |
| | 2000–2001 | 31 | 4 | 0.5530 |
| | 2001–2002 | 92 | 5 | 0.4294 |
| Brazos Bend SP | | | | |
| | 1999–2000 | 26 | 7 | 0.8747 |
| | 2000–2001 | 54 | 8 | 0.5533 |
| | 2001–2002 | 33 | 6 | 0.3112 |
| | 2002–2003 | 5 | 4 | 0.4192 |
| Indiangrass Preserve | | | | |
| | 2000–2001 | 11 | 2 | 0.8739 |
| | 2001–2002 | 40 | 3 | 0.6072 |
| | 2002–2003 | 5 | 1 | 0.8390 |
| San Bernard NWR | | | | |
| | 2000–2001 | 23 | 6 | 0.3850 |
| | 2001–2002 | 10 | 3 | 0.7805 |
| | 2002–2003 | 26 | 3 | 0.7100 |
| TX City PP | | | | |
| | 1998–1999 | 83 | 9 | 0.6648 |
| | 1999–2000 | 56 | 8 | 0.6222 |
| | 2002–2003 | 13 | 5 | 0.3466 |
| UHCC | | | | |
| | 1998–1999 | 59 | 5 | 0.3612 |
| | 1999–2000 | 43 | 8 | 0.2842 |
| | 2000–2001 | 28 | 4 | 0.2398 |
| | 2002–2003 | 44 | 7 | 0.2398 |

two individuals were found. In the case of Nelson's Sharp-tailed Sparrow, the low overall numbers (two sites, two individuals) reflect the tidal salt marsh habitat preference of this species along with its furtive nature within that habitat. In addition, this study focused on sites that were mostly upland prairie, not those properties with extensive salt marsh. Henslow's Sparrow was found somewhat more widely (six sites, 11 individuals). This species is known to favor pine savanna for wintering habitat, and indeed the one site in the project that contains significant amounts of this habitat accounted for four of six individuals. Yellow Rails were found at only one site, but are notoriously hard to detect. This species is highly likely to occur at coastal and near coastal sites but the search methodology probably was not adequate to detect them in representative numbers.

**Table 2.** Avian species found on all PPB transects and their preferred habitats along with the Partners in Flight combined scores (higher scores are more threatened). PIF Combined Score is a continental score which reflects population size, breeding status, wintering status, and threats across the entire range of landbird species. Dashes indicate that no score is available for the species.

| Species | PIF combined score (out of 20) | Habitat preference |
|---|---|---|
| Henslow's Sparrow (*Ammodramus henslowii*) | 18 | Pine Savanna |
| Attwater's Greater Prairie Chicken (*Tympanuchus cupido attwateri*) | 17 | Upland Coastal Prairie |
| Sprague's Pipit (*Anthus spragueii*) | 16 | Upland Coastal Prairie |
| Seaside Sparrow (*Ammodramus maritimus*) | 15 | Prairie-Salt Marsh Ecotone |
| Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*) | 14 | Prairie-Salt Marsh Ecotone |
| Burrowing Owl (*Athene cunicularia*) | 13 | Upland Coastal Prairie |
| Le Conte's Sparrow (*Ammodramus leconteii*) | 13 | Upland Coastal Prairie |
| Short-eared Owl (*Asio flammeus*) | 13 | Upland Coastal Prairie |
| Grasshopper Sparrow (*Ammodramus savannarum*) | 12 | Upland Coastal Prairie |
| Field Sparrow (*Spizella pusilla*) | 12 | Prairie-Shrub Ecotone |
| Loggerhead Shrike (*Lanius ludovicianus*) | 12 | Prairie-Shrub Ecotone |
| Northern Bobwhite (*Colinus virginianus*) | 12 | Upland Coastal Prairie |
| Eastern Meadowlark (*Sturnella magna*) | 11 | Upland Coastal Prairie |
| Vesper Sparrow (*Pooecetes gramineus*) | 11 | Prairie-Shrub Ecotone |
| Northern Harrier (*Circus cyaneus*) | 11 | Generalist |
| Sedge Wren (*Cistothorus platensis*) | 9 | Upland Coastal Prairie |
| Barn Owl (*Tyto alba*) | 9 | Prairie-Shrub Ecotone |
| Orange-crowned Warbler (*Vermivora celata*) | 9 | Prairie-Shrub Ecotone |
| Savannah Sparrow *(Passerculus sandwichensis*) | 9 | Generalist |
| Song Sparrow (*Melospiza melodia*) | 8 | Prairie-Shrub Ecotone |
| White-tailed Kite (*Elanus leucurus*) | 8 | Prairie-Shrub Ecotone |
| Palm Warbler (*Dendroica palmarum*) | 8 | Prairie-Shrub Ecotone |
| Common Yellowthroat (*Geothlypis trichas*) | 8 | Prairie-Fresh Water Marsh Ecotone |
| Marsh Wren (*Cistothorus palustris*) | 8 | Prairie-Fresh Water Marsh Ecotone |
| Red-winged Blackbird (*Agelaius phoeniceus*) | 8 | Prairie-Fresh Water Marsh Ecotone |
| Common Grackle (*Quiscalus quiscula*) | 8 | Generalist |
| Eastern Phoebe (*Sayornis phoebe*) | 8 | Generalist |
| Northern Mockingbird (*Mimus polyglottos*) | 8 | Generalist |
| Lincoln's Sparrow (*Melospiza lincolnii*) | 7 | Prairie-Shrub Ecotone |
| Swamp Sparrow (*Melospiza georgiana*) | 7 | Prairie-Fresh Water Marsh Ecotone |
| House Wren (*Troglodytes aedon*) | 6 | Generalist |
| Yellow-rumped Warbler (*Dendroica coronata*) | 6 | Generalist |
| American Robin (*Turdus migratorius*) | 5 | Generalist |
| Mourning Dove (*Zenaida macroura*) | 5 | Generalist |
| American Bittern (*Botaurus lentiginosus*) | – | Prairie-Fresh Water Marsh Ecotone |
| Wilson's Snipe (*Gallinago delicata*) | – | Prairie-Fresh Water Marsh Ecotone |
| Virginia Rail (*Rallus limicola*) | – | Prairie-Fresh Water Marsh Ecotone |
| Yellow Rail (*Coturnicops noveboracensis*) | – | Prairie-Fresh Water Marsh Ecotone |
| Killdeer (*Charadrius vociferus*) | – | Generalist |

PIF at risk species recorded in higher numbers included Seaside Sparrow, Sprague's Pipit, Le Conte's Sparrow, and Sedge Wren. Seaside Sparrow (four sites, 19 individuals) prefers salt marsh (Post and Greenlaw 1994) and Sprague's Pipits (three sites, eight individuals) prefer disturbed areas with short grass (Robbins and Dale 1999). The majority of sites included in this study were tall-grass prairie except where mowing, overgrazing, or burning occurred, thus there was little optimum habitat for either of these species among the study sites.

In contrast, both Sedge Wren (19 sites, 709 individuals) and Le Conte's Sparrow (24 sites, 830 individuals) were among the most numerous species recorded. Preferred habitat of Le Conte's Sparrows includes moist

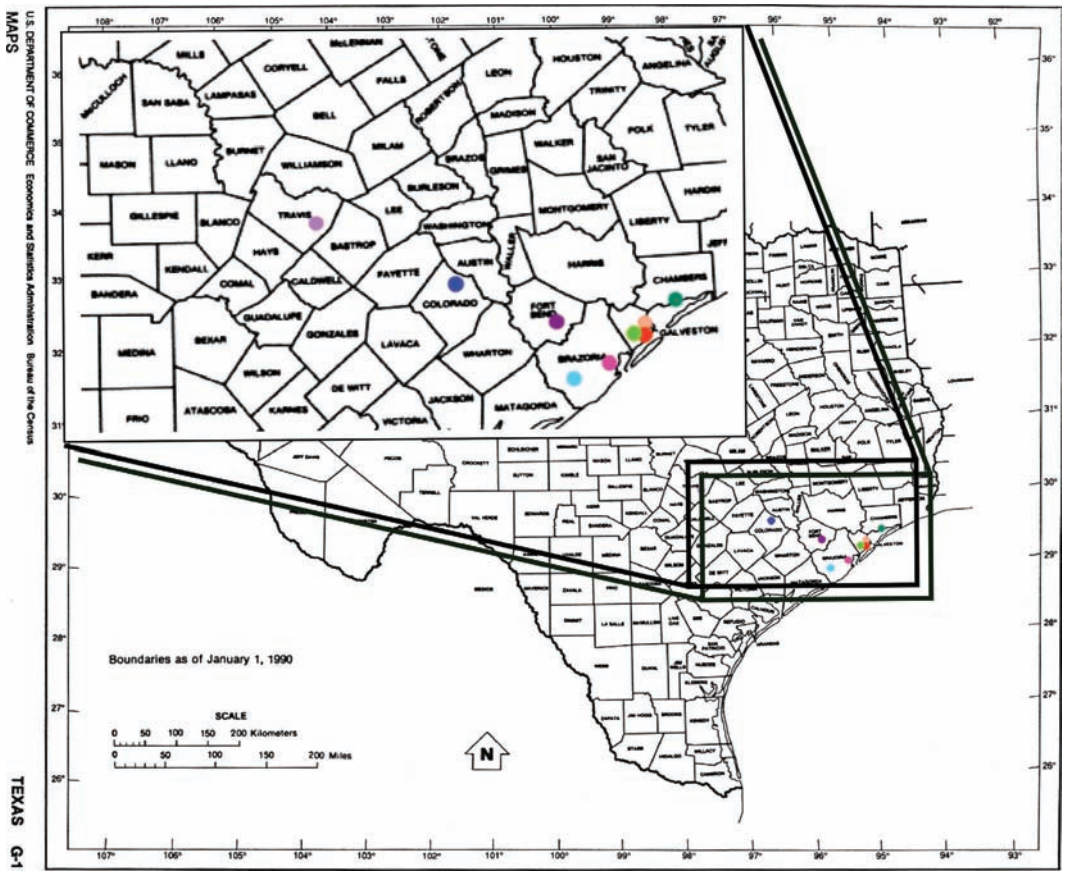


Figure 4. Sites included in this analysis included seven counties along the Upper Texas Coast. Figure courtesy of Shackelford et al. 2001.

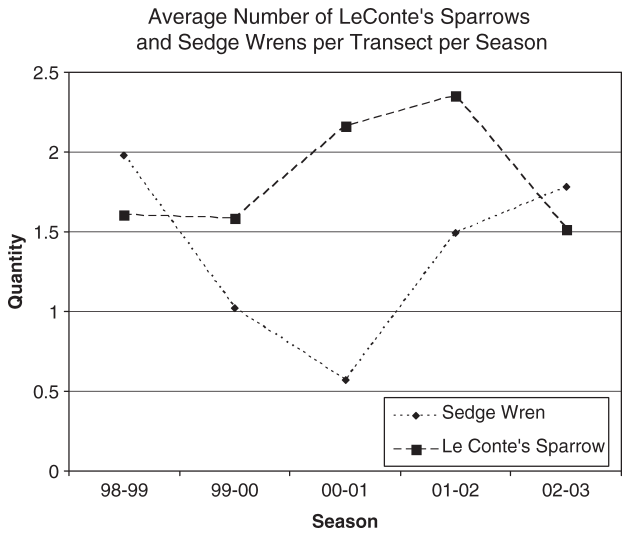


Figure 5. Le Conte's Sparrows and Sedge Wrens detected per season/transect showing fluctuation among years.

fields of broomsedge (Lowther 1996), but little information is available on preferred winter habitats of Sedge Wrens in Texas (Herkert et al. 2001). These data reveal of clear tendency for Sedge Wren to occur in or near coastal locations and much less at inland ones, while Le Conte's Sparrow showed no similar coastal bias.

As a result of this study, we have demonstrated the large numbers of previously undocumented grassland birds that winter in coastal prairies, and that two species of concern for coastal prairie, Le Conte's Sparrow and Sedge Wren, are among the most abundant birds found in Texas coastal prairies in winter. We also determined that winter grassland bird studies are needed to determine habitat requirements for conservation purposes, and that the PPB protocol worked well for documenting the presence of grassland birds in coastal prairies.

We are satisfied that the protocol developed produced the desired outcome. Prior to the development of this grassland bird flushing technique, few attempts were made to monitor these secretive birds, especially on such a large scale. Peaking the interests and utilizing the energy of avocational birders, or citizen scientists, was a unique endeavor, and we fully recommend this technique for future bird monitoring activities. One of the most important objectives of this project was to raise awareness among the public and avocational birders about these little-known birds and their under-studied grassland communities. The numbers of volunteers who participated in this project attest to the interest generated, as well as the general public concern for grassland birds and prairie ecosystems. After interviews with participants, and after participating ourselves, we identified the primary problems associated with the protocol to be 1) the difficulty of identifying flushed birds to species, and 2) the physical effort required to traverse the rough terrain of most of the transects. Though there is little we can do to reduce the physical demands of the field work, it is possible to improve the training techniques for this unusual identification challenge. One option is to develop a video of prairie birds being flushed to allow practice identification sessions. Another is simply more time in the field with volunteers and trial sampling surveys prior to actually collecting data.

We have also considered the need to include additional vegetative sampling (plant species identification) to the current protocol, along with collection of climatological data, which may be archived elsewhere. Both of these inclusions would allow for a more in-depth comparison of species diversity and habitat selection. However, the collection of more variables would be an additional burden for the volunteers who had already committed a great deal of time to this project.

## ACKNOWLEDGMENTS

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# USE OF ARTIFICIAL BURROWS BY WESTERN BURROWING OWLS AND OTHER VERTEBRATES DURING WINTER IN SOUTHERN TEXAS

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ABSTRACT.—Burrows are an integral part of the natural history of the Western Burrowing Owl (*Athene cunicularia hypugaea*), however, mammal burrows are uncommon in southern Texas where the Burrowing Owl overwinters. Seventy-two artificial burrows of 2.4 m length were monitored regularly for Burrowing Owl and other vertebrate use over two non-breeding seasons (October through March, 2001 to 2003). Six types of burrows, differing in diameter (15, 20, or 25 cm) and number of openings (two or three), were monitored. Small-diameter (15 cm) burrows accounted for 79% of all Burrowing Owl use. Burrowing Owl use of artificial burrows was not related to number of openings ($p = 0.1$), but diameter of openings was significant ($p = 0.05$). Vertebrates used all six types of artificial burrows.

The Western Burrowing Owl, *Athene cunicularia hypugaea*, is native to the grasslands and deserts of the western half of North America, including Mexico, the United States, and southern Canada (Haug et al. 1993). These birds are mostly migratory, breeding in Canada and the western U.S., and spending their winters in the southwestern U.S. and Mexico. Although once common, the Western Burrowing Owl has declined throughout much of its range and is listed as endangered in Canada, threatened in Mexico, and as a National Bird of Conservation Concern by the U.S. Fish and Wildlife Service (Klute et al. 2003). The decline of the Western Burrowing Owl has been due predominately to the loss of habitat from agricultural development and from loss of natural burrows through burrowing mammal control activities (Haug et al. 1993).

Western Burrowing Owls make use of abandoned burrows originally excavated by small to medium-sized mammals, such as prairie dogs (*Cynomys* spp.), large ground squirrels (*Spermophilus* spp.), American badgers (*Taxidea taxus*), nine-banded armadillos (*Dasypus novemcinctus*), skunks (*Mephitis* spp.), and rabbits (*Sylvilagus* spp.). Nesting in burrows helps the owls thermoregulate by providing a place to stay warm during

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