SURVEYS OF NIGHT BIRDS ALONG THE RIO GRANDE IN WEBB COUNTY, TEXAS

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ABSTRACT

This project sought to determine species richness and relative abundances of all nocturnal birds at representative wooded riparian (river and stock pond) habitats of the Galvan Ranch, Webb County, Texas. We conducted elicited and non-elicited call count surveys (including 91 ten-minute point counts) at monthly intervals from February-June, 1998. Monthly surveys were conducted over one night, from sunset to moonset, between half and full moon phases, and were completed by 0200 hr. Four owl and five nightjar species were detected on the ranch. No ferruginous pygmy-owls were found during this project, although suitable habitat seemed available. Nightjars, as a group, were five times more abundant than owls (mean number of nightjars per point count was 2.6; mean number of owls per point count was 0.5). Mean number per point count of great horned owl (*Bubo virginianus*), eastern screech owl (*Otus asio*), elf owl (*Micrathene whitneyi*), barn owl (*Tyto alba*), common poorwill (*Phalaenoptilus nuttallii*), lesser nighthawk (*Chordeiles acutipennis*), common pauraque (*Nyctidromus albicollis*), common nighthawk (*Chordeiles minor*), and whip-poor-will (*Caprimulgus vociferus*) was 0.25, 0.17, 0.15, 0.03, 1.22, 1.14, 0.57, 0.07, and 0.01 respectively. The river survey sites supported more species (θ = 2.2) than did upland pond sites (θ = 1.5), however, only one species (common pauraque) showed a preference for the river sites (X^2 = 6.38, d.f. = 1, P = 0.012).

INTRODUCTION

Southern Texas is well known for its great variety of birds, including many tropical species (i.e., those breeding primarily in Mexico and Central America) which reach their northern limits of distribution in southern Texas. Historically, efforts to preserve and study the avifauna in southern Texas have been restricted to federal wildlife areas and state lands in the lower Rio Grande Valley, a region extending from the Gulf of Mexico inland to the International Falcon Reservoir (Fig. 1). Even prior to the establishment of refuges, early scientific expeditions in southern Texas focused on the lower Rio Grande Valley and the coast (Merrill 1878; Sennett 1878; Pearson 1921). Upriver of the International Falcon Reservoir, nearly all lands remain in private ownership. Consequently, the distributions, abundances, and basic ecology of bird species occurring in the region of the Rio Grande Valley between International Falcon Reservoir and Del Rio (a distance of approximately 350 km) remained virtually unstudied until 1997.

In 1997, breeding bird surveys conducted by Woodin et al. (1998) on the Galvan Ranch (located along the Rio Grande northwest of Laredo) represented possibly the first scientific survey of breeding and migrating birds within this region of Texas. Of the 143 bird species documented during the 1997 surveys, 28 species were tropical. Several of the tropical species had been thought to exist in the U.S. only in the lower Rio Grande Valley. To complete the species checklist for this ranch, the U.S. Fish and Wildlife Service funded additional surveys of nocturnal birds on the Galvan Ranch in 1998.

Of special interest to the U.S. Fish and Wildlife Service were the distribution and abundance of ferruginous pygmy-owls (*Glaucidium brasilianum*) in Texas. Historically, the ferruginous pygmy-owl was widespread and considered a fairly common resident in the riparian woodlands and dense brushland of the lower Rio Grande Valley of Texas. Extensive brush clearing between 1920 and 1945 may have caused the decline of this species (Oberholser 1974). Prior to 1989, only a few known pygmy-owls remained along the Rio Grande in Starr and Hidalgo Counties. In 1989, the ferruginous pygmy-owl was found in the coastal oak woodlands of Kenedy and Brooks Counties in greater numbers than had been thought to occur there (Wauer et al. 1993). In Arizona, however, where the only other population of ferruginous pygmy-owls in the United States exists, the bird is very scarce. Between the years 1990 and 1995, annual surveys conducted by the U.S. Fish and Wildlife Service, the U.S. National Park Service, and the Arizona Fish and Game Department resulted in $\leq$ 3 individuals per year. In 1996, a total of 16 pygmy-owls were detected (U. S. Department of the Interior 1997). This species was considered in 1993 for federal protection under the Endangered Species Act. However, because of the difference in status between the Texas and Arizona populations, the U. S. Fish and Wildlife Service in 1997 listed only the Arizona population of the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) as endangered.

Also of interest to the U.S. Fish and Wildlife Service was the possible occurrence on the Galvan Ranch of the elf owl (*Micrathene whitneyi*), a southwestern species which has a breeding range extending into much of Mexico. In the United States, the elf owl breeds in desert habitats of Arizona and New Mexico. In Texas, it breeds in the Trans Pecos region and, to a lesser degree, in extreme southern Texas (Hidalgo, Starr, and Zapata Counties) (Benson and Arnold 2000). The breeding distribution of elf owls between the Trans Pecos region and the lower Rio Grande Valley is poorly known (Oberholser 1974, Rappole and Blacklock 1994). Though not as rare or as restricted in range as the ferruginous pygmy-owl, elf owls on the Galvan Ranch represent a new record for Webb County, and contribute much to the knowledge of the distribution of this species in Texas.

Because of the uncertain status and/or distributions of the ferruginous pygmy-owl and elf owl in Texas, the present study was important in determining if other populations existed along the Rio Grande in Webb County. We considered the ferruginous pygmy-owl and elf owl as “target” species for this project.

The objectives of this present study were to:

1) Determine if ferruginous pygmy-owls, elf owls, and other rare and/or tropical species were present on the Galvan Ranch.
2) Attempt to document reproductive effort/success of ferruginous pygmy-owls and elf owls, if these species were detected during the study.
3) Determine relative abundance of breeding and migrating owl and nightjar species.
4) Determine bird species associations for pond and river habitats.

DESCRIPTION OF STUDY AREA

The 28,000 ha Galvan Ranch (27° 53' N, 99° 54' W), approximately 60 km upriver of Laredo, in Webb County, Texas (Fig. 1), occurs within the ecological region known as the Tamaulipan Biotic Province (Blair 1950). In the Tamaulipan Biotic Province of southern Texas, geography and climate interact, resulting in the overlap of ranges of temperate and tropical birds. Because of the high daily mean temperatures of a subtropical climate, mild winters, and the unique diversity of vegetation (including western desert, northern, and tropical plants), many tropical bird species occurring widely in Mexico and Central America reach their northern limits of distribution in southern Texas (Oberholser 1974).

The Laredo/Webb County area of Texas, while considered a part of the Rio Grande Valley, is nevertheless sharply distinct in several aspects from the lower reaches of the valley. Annual rainfall at Laredo averages less than in the lower Rio Grande Valley. Mean annual precipitation between the years 1900-1983 for the Eagle Pass/Cotulla region was about 20.5 inches (52.1 cm), while for the same period Brownsville received a mean annual rainfall of about 26.5 inches (67.3 cm) (Norwine and Bingham 1986). Because of this, bird and plant species typical of western deserts are more prevalent in Webb County than in the lower Rio Grande Valley. Cattle grazing is the dominant land use along the Rio Grande northwest of Laredo. As a result, this part of Texas, where nearly all lands are in privately owned ranches, contains large expanses of native brushland. Across the border in the adjacent Mexican states of Tamaulipas, Nuevo Leon, and Coahuila, most of the land also remains in native brush. In contrast, most of the native Tamaulipan brushland in the lower Rio Grande Valley in both the U.S. and Mexico has been lost to agriculture (cotton, sorghum, and citrus) and residential/commercial developments (Jahrsdoerfer and Leslie 1988).

The Galvan Ranch is divided into two units. The Main Unit includes the area between Highway (Hwy) 83 and Farm to Market (FM) 1472, and the River Pasture Unit includes land between FM 1472 and the Rio Grande (Fig. 2). The Galvan Ranch includes uplands of Tamaulipan thorn scrub, dominated by honey mesquite (*Prosopis glandulosa*), blackbrush (*Acacia rigidula*), whitebrush (*Aloysia gratissima*), cenizo (*Leucophyllum frutescens*), creosotebush (*Larrea tridentata*), guajillo (*Acacia berlandieri*), lotebush (*Ziziphus obtusifolia*), and prickly pear (*Opuntia engelmannii*). Approximately 5.7 km of the Galvan Ranch border the Rio Grande, where the narrow riparian corridor is mostly giant reed (*Arundo donax*) with smaller patches of common reed (*Phragmites australis*). The reed habitat is bordered by grasses and scattered forbs; the predominant grass is buffelgrass (*Pennisetum ciliar*e).

Open stands of mature trees, mostly honey mesquite, black willow (*Salix nigra*), and sugar hackberry (*Celtis laevigata*) are present on the upland edge of the riparian corridor. Espada Creek, a deep canyon with flowing water, enters the Rio Grande at the southwestern boundary of the ranch. Dominant vegetation within the canyon is

mature mixed woods, including Mexican ash (*Fraxinus berlandieriana*), sugar hackberry, honey mesquite, and granjeno (*Celtis pallida*).

The Galvan Ranch habitats along the upper reaches of the river include woods; deep canyons and arroyos (including Espada Creek); steep, rocky bluffs in some places; and adjacent uplands of Tamaulipan thorn scrub. In contrast, the lower portion of the river features less topographical relief, more expanses of giant cane, and is bordered by upland mesquite savannah.

Widely distributed throughout the Galvan Ranch are 73 stock ponds. Dominant woody species at the stock ponds are honey mesquite, huisache (*Acacia minuta*), and retama (*Parkinsonia aculeata*). At many ponds, 1-3 mature black willows tower above the rest of the canopy. In the northeastern half of the ranch, the landscape is dominated by honey mesquite.

METHODS

Six stations along the Rio Grande and 13 stations at stock ponds throughout the ranch were chosen for sampling. All stations were at least 1.0 km apart. Stations were located within 100 meters of dense woody vegetation containing one or more trees with a dbh (diameter at breast height) $\geq$ 30.5 cm (12 in). This requirement was based on habitat associations found for ferruginous pygmy-owls in Texas (Mays 1996; Proudfoot 1996). These stations were sampled for breeding or migrating owls and nightjars using unlimited distance (Blondel et al. 1981) point counts at approximately one month intervals, from February - June inclusive, 1998. The dates for monthly surveys were February 4-5, March 11-12, April 8-9, May 7-8, and June 4-5, 1998. Surveys were begun immediately following sunset, and no surveys were conducted in fog, high wind (> 16 km/hr) or in rainfall heavier than a mist (Robbins 1981). All surveys were conducted when the moon was waxing between half and full phases. All point counts were completed over one night before the moon set (generally before 0200 h). Each survey team routinely reversed the order in which stations were sampled so that stations were not always visited at the same relative time after sunset. A total of 91 point counts were conducted during the five-month sampling period.

Point counts lasted for 10 min and were preceded by one minute of silence. We chose 10-minute point counts (instead of 5 minutes) because of the possibility of encountering rare or tropical species (Karr 1981). During the 10-minute listening period, any non-elicited, spontaneous calls were noted. Any owls or nightjars seen during the point count period were also noted. We estimated numbers of individuals for each species detected during a point count. We did not attempt to record distances or directions of bird calls; therefore, the abundance estimates in this report should not be used as absolute measurements of densities.

After each point count, a three-minute, prerecorded call of either the elf owl or of the ferruginous pygmy-owl was broadcast to elicit responses from target species. We used a Johnny Stewart Wildlife Caller at a level of approximately 95 decibels (measured at a distance of 1 m). We listened for responses an additional three minutes after broadcasting the calls. Any responses heard during the broadcast, or within the three minutes following the broadcast, were noted separately from non-elicited calls heard during the point count. Prerecorded calls of the elf owl and pygmy-owl were alternated between sampling stations so that all stations received at least two broadcast calls of each of the target species during the study.

In an attempt to monitor reproductive success of elf owls, we used a miniaturized CCD camera (Computar model EM 200-L37, Chugai Boyeki Corp., Commack, N.Y.) attached to a 10-m telescoping aluminum pole to peer into nest cavities.

We calculated overall relative abundances of owl and nightjar species present on the Galvan Ranch by averaging the means of point count results from each of the 19 sites. Relative abundance estimates for the elf owl, lesser nighthawk (*Chordeiles acutipennis*)

and common nighthawk (*Chordeiles minor*) were calculated over the three-month sampling period of April-June, because these species are migratory and were present on the Galvan Ranch only during that period. To examine bird and habitat associations, we used t-tests to compare total species richness, owl species richness, and nightjar species richness between river and pond habitats.

We examined habitat preferences (river vs pond) for great horned owl (*Bubo virginianus*), eastern screech-owl (*Otus asio*), elf owl, lesser nighthawk, common poorwill (*Phalaenoptilus nuttalli*), and common pauraque by determining presence and absence for each species at each of the 19 sites. We used a series of 2 x 2 chi-square tests to test for significant differences among the frequency data.

RESULTS

Four owl and five nightjar species were found on the Galvan Ranch (Fig. 3). We did not locate ferruginous pygmy-owls at any of the study site locations on the Galvan Ranch, although we did find elf owls. We first detected elf owls on the Galvan Ranch on April 8, 1998. On this date, a total of 13 individual elf owls were heard or seen on the ranch. Eight of these 13 were detected along the upper portion of the river, the area featuring deep canyons (including Espada Creek), which empty into the Rio Grande. The other five elf owls were detected at the opposite end of the ranch, in the northern section of the main unit. This area is primarily mesquite thorn scrub with relatively large areas of dense brush. Eight of the 13 elf owls heard were detected during point counts (i.e., via unsolicited calls). Four other individuals responded to broadcasted, pre-recorded elf owl calls, and one elf owl was observed in a woodpecker hole in an old telephone pole.

During May, no elf owls were detected. However, in June, we detected three elf owls. Two of these were vocalizations heard in the same area of the river where this species was heard during April. The other elf owl was seen in the same telephone pole cavity (in the northern section of the main unit of the ranch) which had been occupied by an elf owl in April. Throughout the project, no elf owls were detected within the large area between the riparian sites and the northern thorn scrub sites.

We attempted to find elf owl nests and nestlings in cavities of large dead trees in the flood plain of the Rio Grande during mid-June, but we were unsuccessful in gaining visual access to the inside of the cavities. The cavities used by elf owls were too small to allow passage of even a miniaturized camera. Most cavities were approximately 5 cm in diameter.

We believe, though we cannot confirm, that a sixth nightjar species was present on the Galvan Ranch. On two occasions, we heard what we believe to have been tawny-collared nightjars (*Caprimulgus salvini*). On April 9, two tawny-collared nightjars may have been heard during a point count being conducted near a stock pond located in low Tamaulipan thorn scrub habitat in the ranch's main unit (Fig. 2), approximately 14 km northeast of the Rio Grande. On June 4, one tawny-collared nightjar may have been heard near a stock pond in the mesquite thorn scrub of the ranch's main unit (Fig. 2), approximately 30 km northeast of the Rio Grande. A different team reported each detection. In the June report, the call was heard initially for a duration of about 10-15 seconds at a considerable distance ($\geq$ 200 m). About two minutes later, the call was repeated for a duration of about 5 seconds. We attempted to elicit a response by broadcasting a conspecific recording, however, no calls were heard after the initial vocalizations.

The following year, two special trips were made by field crews to search for tawny-collared nightjars on the Galvan Ranch. On May 6 and July 19, 1999, stops were made throughout the main unit during the evening and night hours to broadcast

recorded tawny-collared nightjar calls in an attempt to elicit responses. No tawny-collared nightjars were detected on either trip.

The two most abundant species of night birds were common poorwill (θ = 1.22 birds/point count) and lesser nighthawk (θ = 1.14 birds/point count). Nightjars, as a group, were five times more abundant (θ = 2.6 nightjars/point count) than owls (θ = 0.5 owls/point count)(Fig. 3). Elf owls were detected at a mean abundance of 0.15 birds per point count.

River sites had a greater number of night bird species than did ponds (Table 1). Owl species richness did not differ between river and pond habitats (t = -0.31, d.f. = 17, P = 0.76). Nightjar species richness, however, was higher (t = -3.72, d.f. = 17, P = 0.002) in river habitats. River sites had a mean of 1.8 nightjar species/point count, and pond sites had a mean of 1.1 nightjar species/point count.

A preference for river habitats was found for the common pauraque (X^2 = 6.38, *d.f.* = 1, P = 0.012). None of the other eight species of night birds showed differences between pond and river habitats (P > 0.05).

DISCUSSION

The nation's largest population of ferruginous pygmy-owls (Wauer et al. 1993) is located in Kenedy and Brooks Counties (Fig.1), about 200-250 km from the Galvan Ranch. There they use mixed habitats of primarily mature live oak (*Quercus virginiana*) and honey mesquite. Mesquite savanna habitat is also utilized (although to a lesser degree) in this area (Wauer et al. 1993; Proudfoot 1996). Historically, ferruginous pygmy-owls nested in mesquite thickets (Johnsgard 1988; Kaufman 1996), and small numbers of ferruginous pygmy-owls still occur in remnant mesquite thickets in parts of Starr County (Oberholser 1974; Mlodinow and O'Brien 1996), also about 200-250 km from the Galvan Ranch. No oak trees occur on the Galvan Ranch. However, Mays (1996) suggested that pygmy-owls in Brooks and Kenedy Counties select large dbh ($\geq$ 20.3 cm) trees, rather than for species of tree (i.e., oak). Honey mesquite dominates much of the landscape on the Galvan Ranch. We found many large, old-growth honey mesquite trees associated with stands of dense, native brush understory throughout the ranch, which should provide appropriate habitat for ferruginous pygmy-owls (Mays 1996; Proudfoot 1996).

Woodpecker holes for nest sites are another important resource for ferruginous pygmy-owls (Johnsgard 1988; Kaufman 1996). Breeding bird surveys on the Galvan Ranch in 1997 (Woodin et al. 1998) found both the golden-fronted woodpecker (*Melanerpes aurifrons*) and the ladder-backed woodpecker (*Picoides scalaris*) to be relatively abundant, along with cavities constructed by them in trees, fence posts, and telephone poles throughout the ranch.

Although habitat and nesting cavities for ferruginous pygmy-owls seem to be available on the Galvan Ranch, we believe that this owl species was not present during our surveys. We base this belief largely on the reliability of this species to respond to broadcasted conspecific calls (Proudfoot and Beasom 1996). However, if this owl species was present in extremely low numbers, it is possible that we did not detect it, given the small proportion (about 0.33%) of the Galvan Ranch (approximately 28,000 ha) that was surveyed.

Two species of night birds, common pauraque (a tropical species) and elf owl (a partially tropical species), were found on the Galvan Ranch. The presence of the elf owl on the Galvan Ranch may represent a range extension, as no prior elf owl records exist for Webb County. However, some sources have assumed its presence in this region of Texas (Texas Ornithological Society 1995, Henry and Gehlbach 1999), because of the known occurrence of this species in other nearby counties. In the recent past elf owls were thought to occur in Texas only in the Big Bend region and in the lower reaches of the Rio Grande Valley (Karalus and Eckert 1974). The numbers, distribution, and ecology of this species of owl are poorly known throughout North America, although some investigation has occurred in California (Cardiff 1980). Information about this species in Texas includes habitat selection and population density studies at Santa Ana National Wildlife Refuge in the lower Rio Grande Valley (Gamel 1997). A nest box

program in western Texas has met with good success (B. McKinney, pers. comm.).

Conditions may not have been optimum for breeding elf owls during the late spring/early summer of 1998 for two reasons. After early spring rains, no more rain fell until late August, and daytime temperatures reached record highs (approximately 43°C/110°F). Secondly, beginning in May, smoke from persistent wildfires in Mexico caused hazy atmospheric conditions to continue for many weeks. Some night birds are known to reduce activity and calling in response to low light conditions (Cooper 1981; Mills 1986; Morrell et al. 1991). This may explain the marked decrease in elf owl numbers (from 13 in April to three in June), which may be only a consequence of lowered calling. However, many of the birds detected in April may have dispersed to other areas to nest. It is likely that under better climatic conditions, numbers of breeding elf owls may be higher than those reported here.

It is not unreasonable to assume that the tawny-collared nightjar may have been present on the Galvan Ranch in 1998.
The range for this species includes the lowlands of Nuevo Leon and Tamaulipas (Peterson and Chalif 1973). The range map in Howell and Webb (1995) place the northern range of tawny-collared nightjars in Nuevo Leon less than 200 km from the Galvan Ranch. Furthermore, Cleere (1998) shows the northern range of the tawny-collared nightjar to extend to the Rio Grande in Coahuila (i.e., immediately across the river from the Galvan Ranch). Occasional visits to the Galvan Ranch by tawny-collared nightjars therefore seem plausible. The relative lack of birders or biologists to monitor nocturnal birds, and the similarity of the tawny-collared nightjars' song with that of the common poorwill, may partially explain the absence of U.S. records for this species. However, we were unable to record or otherwise verify the calls as those of tawny-collared nightjars, therefore we suggest that the 1998 reports be viewed cautiously.

We found our relative abundance data in Figure 3 difficult to interpret for the following reasons. Studies with comparable information on the full assemblage of night bird species are uncommon. Owl surveys frequently are directed at a single species undergoing decline and in immediate need of assistance; three examples of owl species which have generated intense conservation interest and many single-species surveys are the ferruginous pygmy owl, the northern spotted owl (*Strix occidentalis*), and the burrowing owl (*Athene cunicularia*). Results of comprehensive surveys of all owls are available for some areas (e.g., Shuford and Filton 1998; Francis and Bradstreet 1997; Swengel and Swengel 1997), but we were unable to locate published results of comprehensive surveys of owls in southern Texas or in other semiarid southwestern regions with which we could compare our results.

Few surveys of nightjar species are available. Those published were focused on one or two breeding species (e.g., Cooper 1981). Most areas within the U.S. support only two or three species of nightjars. We could not locate results of nightjar surveys to compare directly with our results, which include data for five nightjar species.

It is not surprising that species richness of Galvan Ranch night birds was higher at river sites than at pond sites. Species richness data of early-morning surveys in 1997 on the Galvan Ranch indicated that more species occurred along the Rio Grande, or at stock ponds $\leq$ 12 km away from the Rio Grande, than at stock ponds located > 12 km away from the river. The 1997 results also showed that more tropical species occurred along the river than at ponds (Woodin et al. 1998).

Our finding of a preference for the river habitat by common pauraques is significant because existing information for this species indicates woodlands and dense thickets as the primary habitat used, with only casual mention of riverine habitat usage (Cleere 1998, Kaufman 1996). In the lower Rio Grande Valley, common pauraques are widespread and, although habitat associations have not been quantified, are found in areas including dry thorn scrub (T. Brush, pers. comm.). On the Galvan Ranch, thick brush, tall trees, and other woody vegetation prevail around both stock ponds and the Rio Grande. The river habitat, however, features more dense grass and forbs than the stock pond habitats, probably because of past long-term overgrazing (until 1996) around the stock ponds. We suggest that, on the Galvan Ranch, the importance of the Rio Grande to common pauraques may be a consequence of past long-term overgrazing around the stock ponds.

Although nightjar abundance and diversity were positively related to the Rio Grande, neither owl abundance nor owl species richness was related to the river sites. The only possible exception to this was the elf owl, which appeared initially to be positively associated with the river. However, our data for this species failed to meet the assumption of equal variances, and, as a consequence, elf owl relative abundance was not statistically different between pond and river habitats. However, we feel that with a larger sample size (more elf owls), an association with the river may have been detectable. At Santa Ana National Wildlife Refuge (in the lower Rio Grande Valley), however, elf owls prefer semi-open Tamaulipan thorn scrub forest, while avoiding riparian woodlands, low Tamaulipan thorn scrub, and areas with either no understory or very dense understories (Gamel 1997). The riparian woodlands at Santa Ana National Wildlife Refuge are flood forests with only low herbaceous cover in the understory (Gamel 1997). In contrast, much of the Galvan Ranch riparian habitat consists of mid-height grass interspersed with shrubs, which probably provides better elf owl habitat.

SUGGESTIONS FOR FUTURE STUDIES

According to Swengel and Swengel (1997), many owls exhibit species-specific annual cycles of calling behavior. This phenomenon presents problems for researchers wishing to conduct auditory surveys over a single year. In order to estimate owl relative abundance and distribution in a given area, a minimum of four years of consecutive surveys is suggested (Swengel and Swengel 1997). The information in this study could be expanded into a multi-year project to give a more accurate night bird species list for the Galvan Ranch or other priority areas in southern Texas. This would also increase the chances for documenting rare or tropical species in this biologically diverse part of the U.S.

Despite their almost global distribution, nightjars remain a generally unstudied group of birds (Cleere 1998). Likewise, little is known about nightjar ecology in southern Texas. It is unknown if the habitat association we found for common pauraques is unique to the Webb County area of Texas, or if common pauraques in other areas of southern Texas are also associated with the Rio Grande (or other waterways). However, these results support our earlier findings that the Rio Grande is important to tropical bird distribution and conservation in the United States.

Much more information is needed to understand the ecology of all tropical birds in this western region of the Rio Grande Valley. Comparisons between the western valley region (i.e. Webb County) and the lower valley region (i.e., Cameron, Starr and Hidalgo Counties) also could be essential in identifying management needs in this fast growing region of the country. The relatively undeveloped areas in and around Webb County could serve possibly as control sites for newly acquired refuge tracts currently undergoing restoration in the lower valley.

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