

## COMPOSITION AND PHENOLOGY OF AN AVIAN COMMUNITY IN THE RIO GRANDE PLAIN OF TEXAS

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**ABSTRACT.**—In October–November 1988 and from middle February 1989 through July 1990 we used mist nets to examine the composition and seasonal occurrence of the avifauna in a dry thorn forest community of the north central portion of the Tamaulipan Biotic Province in Texas. Fifty-nine species and 1269 individuals were captured. Many species usually considered to reside permanently in the area were not present from November to March; species considered to be winter residents were caught only in low numbers. During the study, rainfall was 55% and 47% of the annual average. We suggest that the drought conditions were associated with reduction of food resources, forcing birds to abandon the area during the winter of 1989–1990 and to return to breed in low numbers in the spring of 1990. Lack of shrub foliage in spring 1990 may have caused a lower rate of capture for most species in that year because it resulted in the reduction of food resources and shelter. *Received 8 April 1993, accepted 5 Oct. 1993.*

This study provides information about the composition and phenology of an avian community inhabiting the arid thorn forest of the Tamaulipan Biotic Province of Texas. This province, located south of San Antonio between the Rio Grande and the Gulf Coast, is of particular biological interest because it is a region where Neotropical, Sonoran, and Austro-riparian species converge (Blair 1950). The dynamics of the region is driven by widely fluctuating rainfall, which causes marked changes in the vegetation (Lehman 1969:140, Norwine and Bingham 1985, Rappole et al. 1986) and indirectly the bird composition (Woodard 1975:47). The most important reference to the avifauna in the central portion of the Tamaulipan Biotic Province of Texas is by Oberholser (1974). However, seasonal distribution here and elsewhere in the region is poorly known for many common species (Rappole 1978, Pulich 1988).

Since the early 1900s, land owners, with the help of the U.S. government, have conducted programs for eradication of thorn forest in a large part of the province to increase forage production for livestock and to make land available for cultivation (Inglis et al. 1986). By 1959, 28% of the region had received some kind of shrub control (Davis and Spicer 1965:7). It is estimated that between 1940 and 1981 about 600,000 ha of thorn forest were treated annually (Welch 1982). These alterations of the vegetation probably have caused large changes in the composition, size, and distribution of the associated avifauna, especially in species depen-

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dent on dense scrub. Unfortunately, baseline data for assessing such changes are lacking. This is the first detailed study of the avifauna of the north central portion of the Tamaulipan Biotic Province. Our objective was to document the avian composition of a thornscrub community and to identify the extent to which the seasonal status of birds in the area corresponds with that reported by other authors.

#### METHODS AND STUDY AREA

We conducted the study on the 7285-ha T. J. Martin La Campana Ranch (28°02'N, 98°27'W) in McMullen and Duval counties, Texas. Temperatures recorded in Freer, Texas (35 km southwest of the study area) averaged 28°C in the summer and 13°C in the winter, with 125 days >32°C and 17 days <0°C (Natl. Fibers Inf. Cent. 1987). Precipitation data have been collected continuously on the ranch since 1959; rainfall is erratic, both seasonally and annually, and averages 70.5 cm, with peaks in May and September. During the study, rainfall was 55% and 47% of the annual average for 1988 and 1989, respectively, and 69% above the average from January to April 1990. The study area lies 450 m above sea level, and its topography is level to gently rolling. Soils are deep to shallow, and include the Hidalgo, Pettus, and Olmos series (Soil Conserve. Serv. 1985).

Vegetation of the region has been characterized as "Freer mixed brush" (Davis and Spicer 1965:16). In the study area, we sampled vegetation following the technique described by Wiens and Rotenberry (1981). Woody species included 18% blackbrush (*Acacia rigidula*), 15% guajillo (*Acacia berlandieri*), 9% Texas persimmon (*Diospyros texana*), 7% vine ephedra (*Ephedra antisyphilitica*), 6% Texas kidneywood (*Eysenhardtia texana*), 5% blue sage (*Salvia baellatafolia*), 5% Texas colubrina (*Colubrina texensis*), 4% guayacan (*Portiera angustifolia*), 4% granjeno (*Celtis pallida*), 4% mesquite (*Prosopis glandulosa*), 3% lotebrush (*Condalia obtusifolia*), 3% whitebrush (*Aloysia lycioides*), and 17% other species. Percent shrub coverage and shrub height averaged  $55.5 \pm 4.2\%$  ( $\pm$  SD) and  $1.2 \pm 0.6$  m ( $\pm$  SD), respectively. The ground between clumps of shrubs was mostly bare, with a few small cacti and other hardy xerophytes, except during the spring of 1991 when grasses and other herbaceous plants covered the ground.

Oil well operations, road construction, and cattle installations were scattered throughout the ranch. The ranch was grazed continuously and cattle ranged freely. Stocking rates varied but averaged 12.5 ha/animal unit.

As a part of an ongoing program at the ranch to improve habitat for white-tailed deer (*Odocoileus virginianus*) and Northern Bobwhites (*Colinus virginianus*) and to investigate the numerical response in bird captures to mechanical clearing of thornscrub strips, three 30–125 ha plots were roller-chopped and three 16–41 ha plots were disced on strips 55–61 m wide alternating with adjacent 244-m wide untreated strips. Roller-chopped and disced strips comprised 20–29% of each section, respectively. Four sites, 1–3 km apart, were selected to sample birds: Sites 1 and 2 each consisted of a disced strip and an adjacent untreated scrub. Sites 3 and 4 consisted of a roller-chopped strip and adjacent untreated scrub. Woody species composition on the treated strips was similar to that in the adjacent untreated scrub, but shrub cover was reduced by 89–98% and remained low and short (20–50 cm) during the 1.5 years of the study (Bozzo et al. 1992).

Forty mist nets (4 shelves, 12 × 2.6 m, 36-mm mesh) were placed in sets of 10 on the four study sites. At each site, nets were deployed at 50-m intervals: five along a line in the center of the treated strips and five 50 m from the border in the adjacent scrub. Net locations were the same throughout the study.

We mist-netted birds in October–November 1988 from middle February 1989 through July 1990, yielding a total of 22,323 net-h. Numbers of net-h by season were 3948 (1989) and 4399 (1990) during the spring (Mar.–May); 5142 (1989) and 520 (1990) in the summer (Jun.–Aug.); 684 (1988) and 4207 (1989) in the fall (Sept.–Nov.); and 3493 in the winter of 1989–1990 (Dec.–Feb.).

We sampled birds for two consecutive days in two-week cycles: week 1, sites 1 and 2; week 2, sites 3 and 4; consequently, for each capture site the birds were not subjected to netting for 13 days after the two-day sampling period. We maintained this schedule to minimize net shyness. We netted from dawn to dusk, except in summer, when we closed the nets during the hottest hours of the day.

Each bird captured was banded with a U.S.F.W.S. aluminum band and examined to determine sex and age (when possible). Date, time, site, and net of capture were also recorded.

## RESULTS

We captured 1269 individuals of 59 species during the study (common and scientific names are provided in Figs. and Appendix 1). Seven species made up 68% of total captures. They were, in order of decreasing abundances, Pyrrhuloxia, Common Ground-Dove, Northern Mockingbird, Painted Bunting, Cassin's Sparrow, Black-throated Sparrow, and White-crowned Sparrow. Ten additional species comprised 20% of the captures. Arranged in decreasing abundance these were Curve-billed Thrasher, Olive Sparrow, Northern Oriole, Northern Cardinal, White-eyed Vireo, Long-billed Thrasher, Scissor-tailed Flycatcher, Lark Sparrow, Cactus Wren, and Brown-headed Cowbird. The remaining 47 species accounted for only 12% of the sample.

In showing data on seasonal occurrence, the species are divided into (1) permanent residents—present throughout the year, (2) summer residents—present and breeding only in the summer months, (3) winter residents—present through the winter months, and (4) transients—present only during migration.

*Permanent residents.*—This group was represented by 950 individuals from 17 species considered to be present throughout the year in the Coastal Bend (Rappole and Blacklock 1985), lower Rio Grande Valley (Griscom and Crosby 1925, 1926; Oberholser 1974), and the remainder of the Tamaulipan Biotic Province of Texas (Oberholser 1974). The bulk of captures occurred from early March to early November (Fig. 1). For all of these species, the combined rate of capture (birds/net-h) remained fairly constant during the spring (0.05), summer (0.06), and fall (0.03), but declined sharply during the winter (0.007). The Verdin, Cactus Wren, Northern Cardinal, Cassin's Sparrow, Lark Sparrow, Brown-headed Cowbird, and Bronzed Cowbird were not caught at all during the winter.

Considering only AHY-birds ( $N = 604$ ), the sample was composed of 329 males, 212 females, and 63 birds of unknown sex. Segregation of

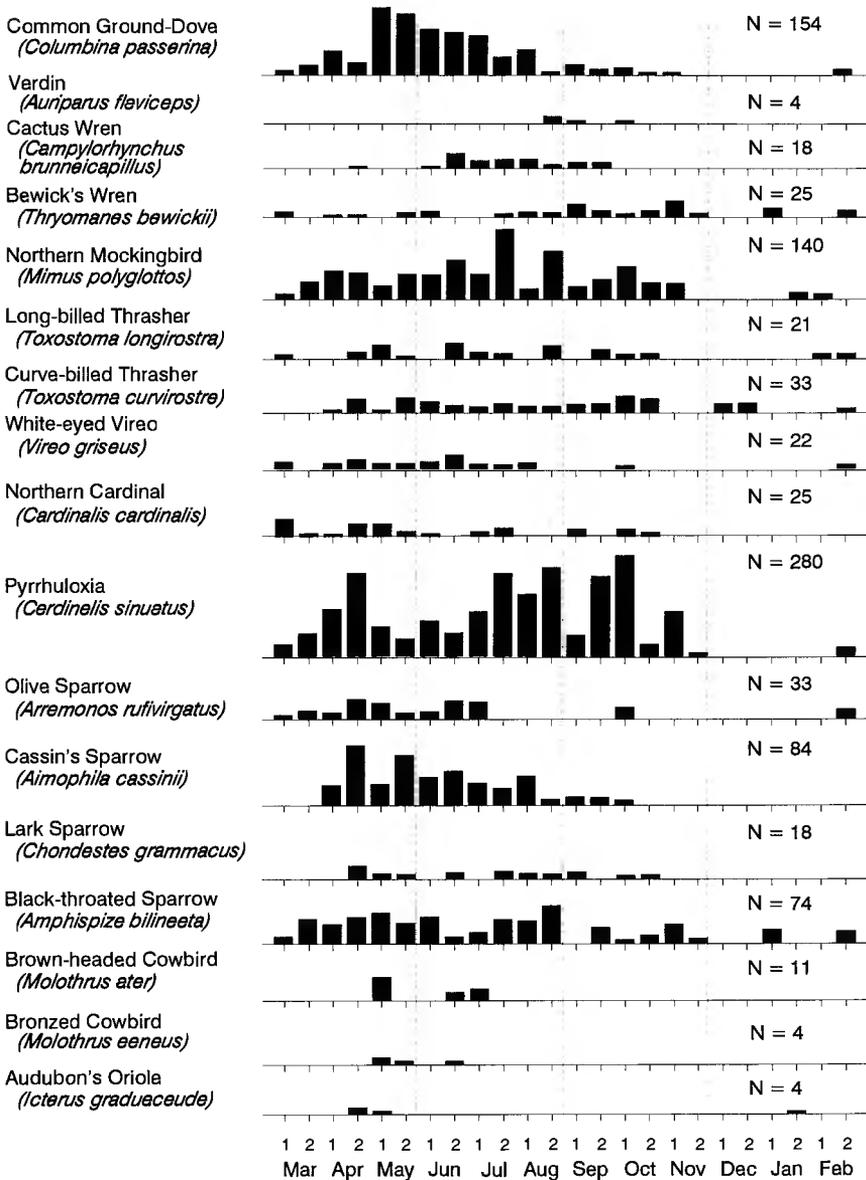


FIG. 1. Distribution of species considered permanent residents (Oberholser 1974); bars represent proportional occurrence at two week intervals.

TABLE 1  
MONTHLY PERCENTAGE DISTRIBUTION OF AGE AND SEX CLASS FOR BIRDS CLASSED AS  
"PERMANENT" AND "SUMMER" RESIDENTS, LA CAMPANA RANCH, McMULLEN AND DUVAL  
COUNTIES, TEXAS, 1988-1990 (SEE TEXT FOR EXPLANATION)

Month	Permanent residents								Summer residents							
	Sex <sup>2</sup> (%)				Age (%)				Sex <sup>2</sup> (%)				Age (%)			
	N	M	F	U	N	AHY	HY	U	N	M	F	U	N	AHY	HY	U
Jan	4	25	0	75	5	100	0	0	—	—	—	—	—	—	—	—
Feb	17	35	12	53	17	100	0	0	—	—	—	—	—	—	—	—
Mar	52	43	29	28	52	100	0	0	—	—	—	—	—	—	—	—
Apr	171	57	32	12	171	100	0	0	12	75	0	25	12	100	0	0
May	172	62	37	1	186	92	7	1	62	60	28	12	64	97	2	1
Jun	109	56	40	4	145	75	23	2	21	41	50	9	27	79	21	0
Jul	50	46	48	6	125	40	60	0	25	20	44	36	42	60	40	0
Aug	15	20	33	47	90	17	74	9	3	67	0	33	15	20	80	0
Sep	2	100	0	0	40	5	70	25	2	50	0	50	6	33	17	50
Oct	8	50	38	12	90	9	57	34	1	100	0	0	3	33	0	67
Nov	4	75	0	25	29	14	24	62	—	—	—	—	—	—	—	—

<sup>2</sup> Considering only AHY-birds.

monthly captures by sex indicates that males were more often caught than females except for July and August, when the relationship was reversed (Table 1). Small samples from September to January and proportionally large captures of birds of unknown sex in February, March, and August may bias this presumed relationship. The difference in numbers of males captured versus number of females, however, was substantial for the Common Ground-Dove (73M, 49F, 5U), Curve-billed Thrasher (15M, 3F, 3U), Olive Sparrow (21M, 2F, 4U), Cassin's Sparrow (36M, 15F, 7U), and Black-throated Sparrow (23M, 8F, 13U). Nearly even sex ratios occurred in the Northern Mockingbird (34M, 36F, 11U) and Pyrrhuloxia (73M, 63F, 6U).

Our sample included 316 birds in breeding condition (i.e., birds with cloacal protuberance and/or incubation patch) representing all of the permanent resident species except the Verdin. Individuals in breeding condition were present from early March to early August, with the peak occurring from late April to early July (Figs. 2 and 3). We were unable to determine breeding status for the Common Ground-Dove, Brown-headed Cowbird, and Bronzed Cowbird.

Capture of HY-birds started in early May. After late July more HY-birds than AHY-birds were captured, with a peak in HY captures from July to August (Table 1). Occurrence and number of HY-birds captured varied among species.

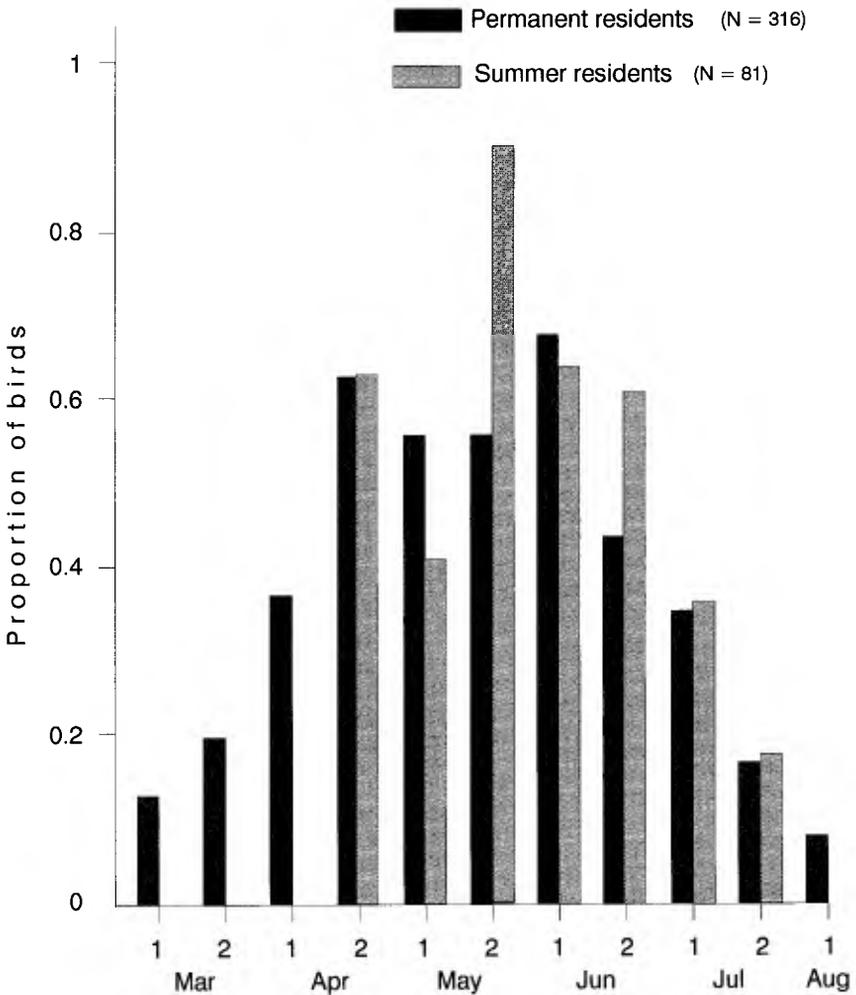


FIG. 2. Biweekly proportion of birds in breeding condition for permanent and summer resident species.

*Summer residents.*—This group was represented by 169 individuals of 10 species considered to be present and breeding only in the summer months in Coastal Bend (Rappole and Blacklock 1985), lower Rio Grande Valley (Griscom and Crosby 1925, 1926; Oberholser 1974), and remainder of the Tamaulipan Biotic Province of Texas (Oberholser 1974). Most individuals of these species arrived by late April and departed by late August (Fig. 4). For all species combined, capture rates (birds/net-h) re-

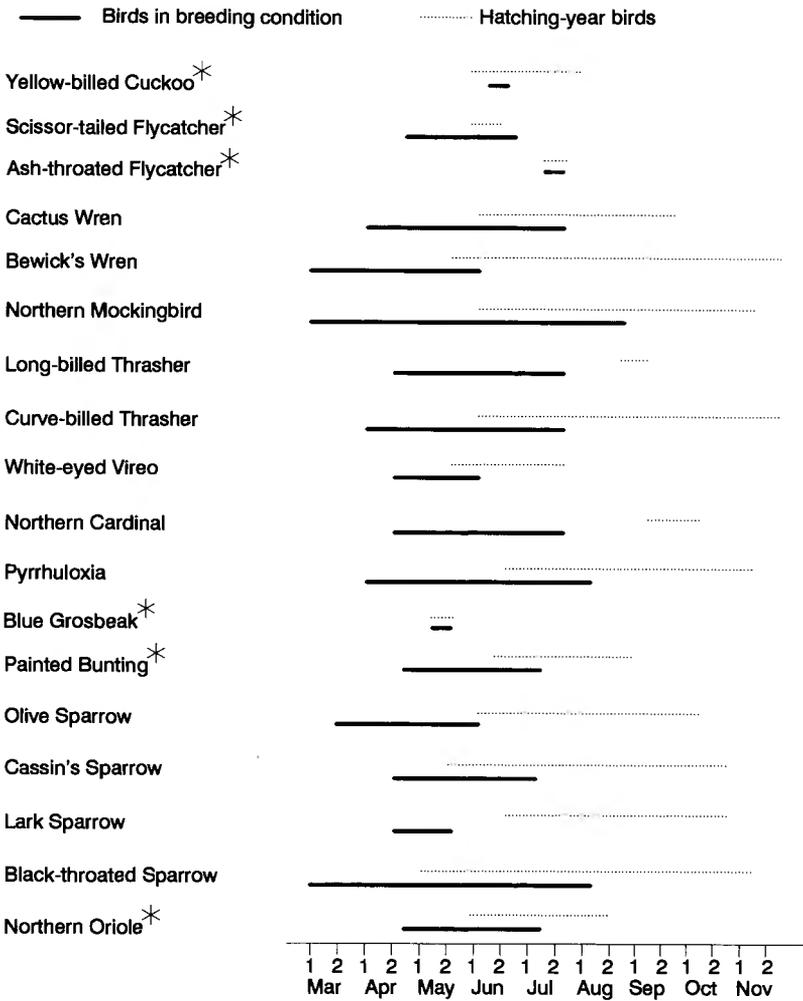


FIG. 3. Presence of individual species and hatching-year birds of permanent and summer (\*) resident species.

mained fairly constant during the spring (0.010) and summer (0.015) and declined in the fall (0.002). Considering only AHY-birds (N = 126), the sample was composed of 64 males, 38 females, and 24 birds of unknown sex. Segregation of monthly captures by sex and age is presented in Table 1. Twelve birds of these species were recaptured, but only one individual was recaptured between years, a Painted Bunting (28 Apr. 1989 and 11 Apr. 1990). Our sample included 81 birds in breeding status. The Brown-

crested Flycatcher and Bell's Vireo are supposed to be "summer residents" in this region, but they occurred in low numbers, and none was captured in breeding condition. Summer residents in breeding condition were present from late April to late July, with a peak in late May (Figs. 2 and 3).

*Winter residents.*—This group was represented by 91 individuals of 13 species considered to be present only during the winter months in the Coastal Bend (Rappole and Blacklock 1985), lower Rio Grande Valley (Griscom and Crosby 1925, 1926; Oberholser 1974), and remainder of the Tamaulipan Biotic Province of Texas (Oberholser 1974). However, our data indicate that rather than winter residents, these birds were probably transients. Although these species were present from early September to early May, only seven individuals of five species were caught from December to February (Fig. 5). The sample was dominated by AHY-birds and un-sexed birds.

*Transients.*—This group was represented by 59 individuals of 19 species considered to occur only during migration in the Coastal Bend (Rappole and Blacklock 1985), lower Rio Grande Valley (Griscom and Crosby 1925, 1926; Oberholser 1974), and remainder of the Tamaulipan Biotic Province of Texas (Oberholser 1974) (Appendix I). They were present in the area from late March to late May in spring and from early September to late October in fall. Peaks in numbers of species and individuals caught occurred in early May and early October. Spring and fall samples were composed of 15 and 11 species, respectively.

#### DISCUSSION

Categorization of the status of bird species in this area is uncertain. "Permanent residents" are defined as those species that reside in the same area throughout the year (Pulich 1988). However, species listed as permanent residents in our study area (Oberholser 1974) were not present in the winter of 1989–1990. Even though we saw a few individuals of some of these species, it was evident that the majority were gone by late October and did not return until late April. Clearly, many species that are considered to be resident and nonmigratory show seasonal movements. The assumed seasonal status for most of these species in the central portions of the Tamaulipan Biotic Province of Texas is an extrapolation from what we know of populations in the Coastal Bend and Lower Rio Grande Valley. But our data indicate that this information may not apply for some species that inhabit the drier and climatically more extreme central area of this province.

Where these species go during the winter is uncertain, but there is some evidence that inland populations move toward the coast. The Long-billed



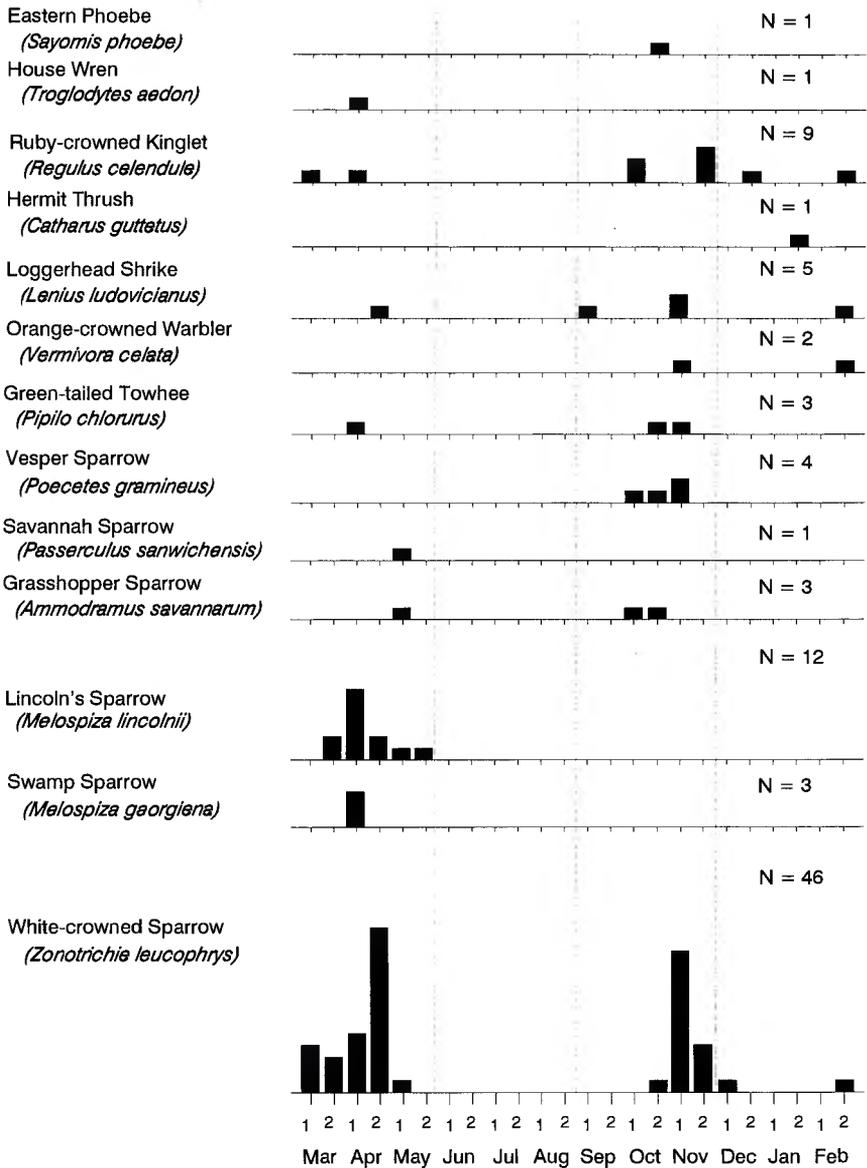


FIG. 5. Distribution of species considered "winter residents" (Oberholser 1974); bars represent proportional occurrence at two week intervals.

Thrasher, Northern Cardinal, Pyrrhuloxia, and Brown-headed Cowbird are more numerous along the immediate coast during the winter (Rappole and Blacklock 1985); the Black-throated Sparrow has been reported only in December at the Aransas National Wildlife Refuge (USFWS 1980), which is on the coast, and from December to March for the central coast (Hagar and Packard 1952).

These movements may reflect responses to changes in climatic conditions (Terrill and Ohmart 1984, Petit 1989). Our data show that not only species considered to be permanent residents on the study area were mostly gone during the winter but also that species that were expected to be winter residents were captured in low numbers. Of 91 individuals of "winter resident" species only seven were caught from December to February; the remaining 84 individuals were apparently transients. Griscom (1920, in Bent 1968:991) reported that the Black-throated Sparrow disappeared from the vicinity of San Antonio with the first cold weather. In our study area temperatures in the winter of 1989–1990 ranged from 0°C to 15°C in January and early February; however, low temperatures, especially during the nights and mornings, occurred from late November to late February. Freezing temperatures occurred from 14 to 17 December and again on 23 and 24 December.

Availability of food may play a role in these movements (Graber and Graber 1979, Van Balen 1980). For our study area, 1988 and 1989 were dry years; rainfall recorded at the ranch was only 55% and 47% of the annual average, respectively. In the winter of 1989–1990, the scrub vegetation was so dry and reduced by the falling or withering of leaves that the supply of food at this time may have declined to a level that made the area unsuitable for insectivorous foliage gleaning species such as the Verdin and White-eyed Vireo which were not seen at all. Several granivorous species such as the Common Ground-Dove, Northern Cardinal, and Pyrrhuloxia which were not caught or seen on our study plots were, however, seen close to the main camp where there were seeds on the roads. Oberholser (1974:702) mentioned that the White-eyed Vireo winters in the region in areas where shrubs keep their leaves through the winter; Henshaw (in Bent 1948:230) reported that during the winter in California, the Cactus Wren moved for days or weeks to areas with denser cover.

Movements over much longer distances may occur as well. Rappole et al. (in press) recently summarized information on presence of regular migration movements into the Neotropics by species presumed to be permanent residents in the Tamaulipan Biotic Province. Most of these species were large, conspicuous daytime migrants in which actual migration flights could be observed on the Veracruz coast (e.g., Great Black Hawk

[*Buteogallus urubitinga*] and Short-tailed Hawk [*Buteo brachyurus*]). Detection of such movements may require extensive banding studies.

Comparison of captures between the springs of 1989 and 1990, which had similar netting efforts revealed important changes in both composition and abundance of bird species. More individuals were captured in 1989 than in 1990 ( $N_{1989} = 353$ ,  $N_{1990} = 132$ ;  $G$ -test of goodness of fit,  $G = 104.5$ ,  $df = 1$ ,  $P < 0.001$ ). At the species level, all species were caught in larger numbers in 1989 than 1990. The Brown-crested Flycatcher, Verdin, Cactus Wren, Long-billed Thrasher, Curve-billed Thrasher, White-eyed Vireo, Bell Vireo, and Olive Sparrow were captured in 1989 but not in 1990.

Lack of foliage in most shrubs in the spring of 1990 probably played a major role in the large decline in capture rates of breeding individuals from 1989 to 1990 ( $N_{1989} = 353$ ,  $N_{1990} = 132$ ;  $t$ -test for paired comparisons,  $T = 4.24$ ,  $P < 0.001$ ), because it resulted in the reduction of food resources and shelter. In 1989, shrubs had foliage at least until the end of the breeding season. A continuing shortage of rain and the occurrence of freezing temperatures in December left most shrubs without leaves. In the spring of 1990, as a result of the rainfall, a lush growth of forbs and grasses covered most of the ground; however, most shrubs, particularly blackbrush, were still essentially leafless by June. This lack of shrub foliage may have caused the low numbers of captures for those species that depend on shrubs for nesting (14 in our study area). Of the few species of shrubs that kept their leaves, guajillo was the most common; however, because of the windy environment of the study area, the extreme flexibility of its branches made it inappropriate for nest placement. Species such as the Cassin's and Black-throated Sparrows, that often nest on the ground, were captured in similar numbers in the springs of both years.

Heavy growth of forbs and grasses made the habitat suitable for species primarily associated with weedy and grassy fields, such as Savannah, Grasshopper, Lincoln's, and Swamp sparrows, which were caught in the spring of 1990 but not in 1989. However, this situation may have contributed to the low capture rate of other species that need bare ground for feeding. Roth (1971) mentioned that the dense, tall herb cover probably caused the absence of the Common Ground-Dove, Northern Mockingbird, Long-billed Thrasher, Curve-billed Thrasher, and Northern Cardinal in some of his study sites.

In a rapidly fluctuating environment, e.g., the Tamaulipan Biotic Province of Texas, birds must be able to choose breeding and wintering sites according to local conditions. The idea of birds moving to other areas during the winter and changing location for breeding when the habitat is not suitable is possible but unproven.

We consider that birds inhabiting the central portion of this province are subjected to more extreme and variable climatic conditions than those inhabiting the Coastal Bend and Lower Rio Grande Valley. Periodic climatic extremes apparently constitute a primary force that determines the composition and abundance of the birds, as has been suggested for birds inhabiting grassland-shrubsteppe communities (Wiens 1974, Knopf et al. 1990, Zimmerman 1992). In wet years, when the rainfall is sufficient to bring the scrub and mesquite trees into complete green leaf and the winters are not harsh, the area may be populated by species that extend their breeding distribution, winter residence, or stopovers during migration. In dry years, however, the bird community is quite reduced. Roth (1979, p. 168) alluded to this pattern for Dickcissels (*Spiza americana*) which, "... nest in South Texas in wet years when the grass is lush but pass by in dry years without nesting." He added that this behavior may, "... represent past selection on a northern population to breed earlier or to raise an extra brood, or selection on a southern population to compensate for unpredictable weather and vegetation conditions by moving north when conditions become poor." We suggest that facultative movements of this nature may be the rule among birds using the central portion of the Tamaulipan Biotic Province of Texas.

#### ACKNOWLEDGMENTS

We are grateful to the Caesar Kleberg Wildlife Research Institute staff and director S. L. Beasom, for their support, and to Tom Martin, Jr. for use of his ranch. Thoughtful reviews by K. Winker and F. C. James provided useful criticism of this manuscript. We also thank E. Morton, W. McShea, C. R. Blem, B. L. Winteristz, and D. Conner for their helpful reviews of the manuscript. Funding for this study was provided by Enron Corporation and the Caesar Kleberg Foundation for Wildlife Conservation.

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## APPENDIX I

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TOTAL NUMBER OF INDIVIDUALS OF TRANSIENT SPECIES CAPTURED AT LA CAMPANA RANCH,  
MCMULLEN AND DUVAL COUNTIES, TEXAS, 1988–1990

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Yellow-bellied Flycatcher ( <i>Empidonax flaviventris</i> ),	3
Acadian Flycatcher ( <i>E. virescens</i> ),	2
Alder-Willow Flycatchers ( <i>E. traillii-alnorum</i> ),	8
Least Flycatcher ( <i>E. minimus</i> ),	1
Eastern Phoebe ( <i>Sayornis phoebe</i> ),	1
Great Crested Flycatcher ( <i>Myiarchus crinitus</i> ),	1
Blue-gray Gnatcatcher ( <i>Poliophtila caerulea</i> ),	16
Swainson's Thrush ( <i>Catharus ustulatus</i> ),	1
Solitary Vireo ( <i>Vireo solitarius</i> ),	1
Blue-winged Warbler ( <i>Vermivora pinus</i> ),	1
Nashville Warbler ( <i>V. ruficapilla</i> ),	5
Magnolia Warbler ( <i>Dendroica magnolia</i> ),	4
Black-throated Green Warbler ( <i>D. virens</i> ),	3
Bay-breasted Warbler ( <i>D. castanea</i> ),	1
American Redstart ( <i>Setophaga ruticilla</i> ),	1
Mourning Warbler ( <i>Oporornis philadelphia</i> ),	2
Wilson's Warbler ( <i>Wilsonia pusilla</i> ),	4
Yellow-breasted Chat ( <i>Icteria virens</i> ),	2
Indigo Bunting ( <i>Passerina cyanea</i> ),	2

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