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POPULATION TRENDS OF THE LOGGERHEAD SHRIKE (*LANIUS LUDOVICIANUS*) IN ARKANSAS

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INTRODUCTION

The Loggerhead Shrike (*Lanius ludovicianus*) is an open-country bird that ranges from southern Canada to central Mexico and from the Atlantic to the Pacific. The National Audubon Society (1971) listed a group of bird species that were thought to be declining in numbers either regionally or throughout their ranges. The Loggerhead Shrike was included on this "Blue List" and has remained there to date. Arbib (1977) noted that the Loggerhead Shrike was possibly the most critically declining species on the Blue List and that it had declined slowly and steadily for many years dropping from common to uncommon over much of its range. Reasons for this decline are not known, but habitat alteration and egg-shell thinning due to pesticide residues have been suggested (Kridelbaugh 1981).

Population declines in Loggerhead Shrikes have been noted in Arkansas by Shepherd (1983), in Wisconsin by Erdman (1970), in Illinois by Graber et al. (1973), in Missouri by Kridelbaugh (1981), in the northeast U.S. by Milburn (1981), and in the southern Great Plains and southeast U.S. regions by Morrison (1981). Both Kridelbaugh (1981) and Milburn (1981) used Christmas Bird Count (CBC) data to determine winter population trends and Breeding Bird Survey (BBS) data for the breeding season. Morrison (1981) considered population trends of the species only in the winter, using CBC results; and he grouped information from individual counts and states into regions. Thus no studies have been conducted on population trends of breeding Loggerhead Shrikes in the south-central or southeast U.S. and information that is available on winter trends is lumped in broad regional categories. The purpose of this study was to look at population trends of the Loggerhead Shrike in Arkansas during the breeding and winter seasons.

METHODS

Data concerning numbers of Loggerhead Shrikes reported on Breeding Bird Surveys (BBS) in Arkansas 1967-83 were obtained from the U.S. Fish and Wildlife Service. Locations of BBS routes in the state were chosen randomly (D. James, pers. comm.). Each route is 40.3 kilometers (km) (25 mi) long and observers stop at 0.81 km (0.5 mi) intervals and count all birds seen and heard in a 0.4 km (0.25 mi) radius. Three minutes (min) are spent censusing birds at each stop. Surveys are conducted in June. Each survey begins 30 min before sunrise and must be completed before 1030 hrs. A detailed description of methods for conducting BBS routes can be found in Robbins and Van Velzen (1967, 1969).

Of 29 BBS routes in the state, 26 were chosen for study (Figure 1, Table 1) and three were eliminated because four, or more, years of data were missing. Mean values for number of shrikes per route were calculated for the state (26 routes) and for three physiographic regions of the state (Figure 1): the West Gulf Coastal Plain (8 routes), Delta (8 routes), and Interior Highlands (10 routes). These values were plotted against years also (Figure 2). Spearman's Rank Correlation (Siegel

Table 1. Summary of Breeding Bird Survey Results (1967-1983) for three physiographic regions in Arkansas and for the state as a whole. (N = number of years routes were run, X = mean number of shrikes reported per route over all years).

Region	Route #	N	\bar{X}	S	Range	Spearman's rho
West Gulf Coastal Plain (8 routes)	01	17	2.47	3.10	0-10	-.5771*
	03	17	1.59	1.77	0-6	-.5420*
	04	17	2.59	1.94	0-8	-.4948*
	05	17	3.12	3.37	0-11	-.4977*
	06	16	2.06	1.95	0-7	-.4752*
	07	16	4.19	3.12	0-13	-.7492**
	12	16	2.31	2.18	0-7	-.5891*
	13	16	0.88	1.15	0-3	.1564
Regional Values		16.5	2.40	2.32	0-13	-.8061**
Delta (8 routes)	02	17	3.71	4.04	0-13	-.7114**
	08	15	0.47	1.06	0-3	.0256
	09	16	1.38	1.86	0-5	.3533
	10	17	0.53	1.12	0-4	-.0527
	16	14	1.29	1.68	0-5	.7088**
	17	17	2.12	1.80	0-6	.2843
	18	17	1.29	1.96	0-8	-.0671
	25	17	3.82	2.27	0-9	.0672
Regional Values		16.2	1.82	2.27	0-13	-.2868
Interior Highlands (10 routes)	11	14	2.21	2.04	0-8	-.2178
	14	17	1.76	2.14	0-7	-.5878**
	19	14	1.79	2.14	0-4	.1605
	20	17	0.41	0.62	0-2	-.4347*
	21	16	5.13	4.66	0-18	-.5598*
	22	17	1.35	1.37	0-4	.1803
	24	17	0.53	0.80	0-2	.1646
	27	14	1.00	0.96	0-2	.0191
	28	17	0.71	1.10	0-4	-.1937
	29	15	2.80	1.70	0-6	-.0000
Regional Values		15.8	1.77	1.66	0-18	-.5055*
Statewide (26 routes)		16.2	1.98	1.96	0-18	-.8387**

* Significant at .05 level

** Significant at .01 level

1956) was used to measure the association between numbers of shrikes reported on BBS routes and years.

Data concerning population trends of Loggerhead Shrikes in the winter were obtained from CBC results, 1950-81 (American Birds vols. 5-36). These surveys were conducted in 24-h periods during the latter half of December and early January. Permanent CBC boundaries were established by drawing a circle with a radius of 12.1 km (7.5 mi) around a central point, and observers count all birds seen or heard within those

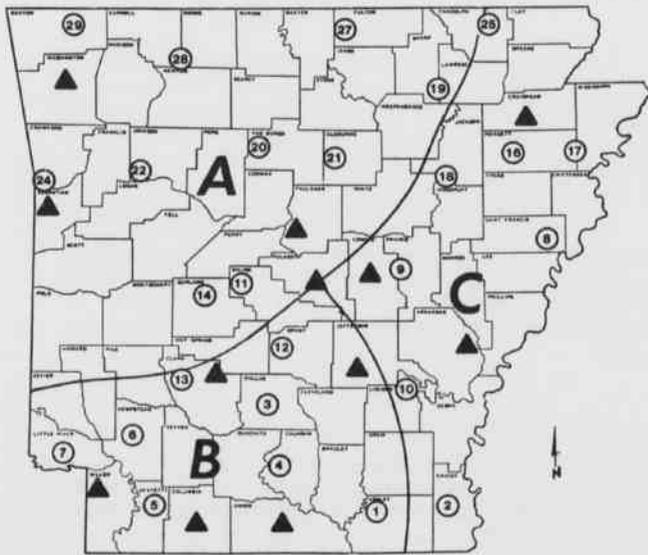
Population Trends of the Loggerhead Shrike (*Lanius ludovicianus*) in Arkansas

Figure 1. Locations of Breeding Bird Survey routes (circles), Christmas Bird Counts (triangles), and physiographic regions (A- Interior Highlands, B- West Gulf Coastal Plain, C- Delta) in Arkansas. Numbers in circles correspond to Breeding Bird Surveys listed in Table 1.

boundaries. Locations of CBC circles, survey dates, and number of observers per count are determined by local participants. CBC data used in this study will not be subjected to statistical analyses but will be used to demonstrate general trends in Loggerhead Shrike populations during the CBC period.

Twelve (12) Christmas Bird Counts were chosen for use in this study (Figure 1). These counts have been conducted with consistency and have 14 or more years of data. The following is a list of CBC's included in this study and the number of years each was conducted: Arkadelphia, Clark Co. (14); Conway, Faulkner Co. (14); El Dorado, Union Co. (29); Fayetteville, Washington Co. (20); Fort Smith, Sebastian Co. (29); Jonesboro, Craighead Co. (15); Little Rock, Pulaski Co. (28); Lonoke, Lonoke Co. (31); Magnolia, Columbia Co. (17); Pine Bluff, Jefferson Co. (17); Texarkana, Miller Co. (32); White River National Wildlife Refuge, Arkansas Co. (27).

Since numbers of observers, parties, and miles driven within boundaries of CBC's vary, numbers of shrikes reported on each count were normalized by using the following formulas: (1) number of shrikes / number of parties and (2) number of shrikes / number of miles driven X 100. This provides us with an estimate of the number of shrikes per census party and the number of shrikes per 161 km (100 mi) driven. Our assumptions are (1) as the number of census parties increases, numbers of shrikes observed will increase up to a point where more parties do not provide better coverage of shrike habitat, and (2) as the number of miles driven increases, numbers of shrikes will increase up to a point where additional driving does not provide better coverage of shrike habitat. Mean values (all 12 CBC's) for number of shrikes per count, parties per count, miles driven per count, shrikes per party, and shrikes per 100 miles driven were calculated for all CBC's conducted in each year. These values were plotted against years, 1950-81 (Figures 3,4).

RESULTS

BREEDING SEASON

Numbers of Loggerhead Shrikes in Arkansas appear to have declined significantly ($P \leq .01$; Table 1, Figure 2A) during the period 1967-83. Mean values decreased from 3.92 shrikes per BBS route in

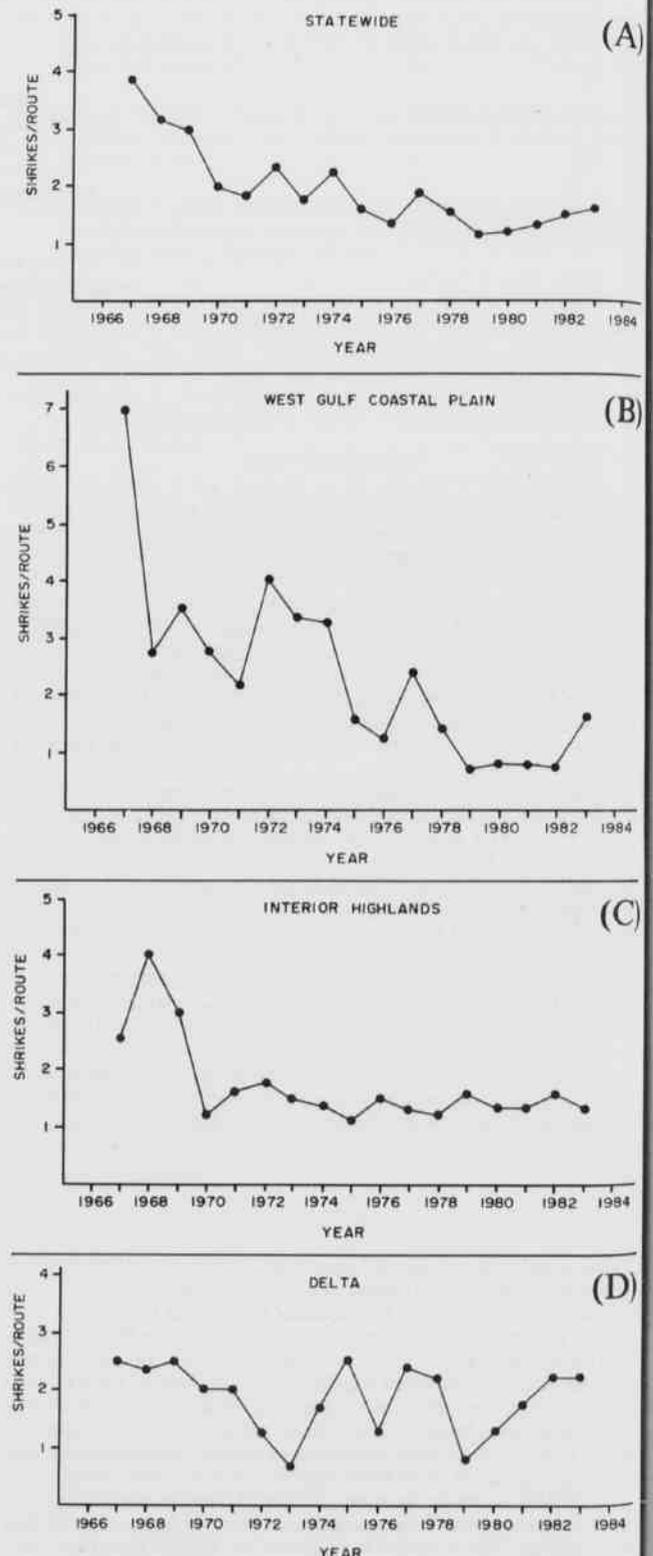


Figure 2. Mean numbers of Loggerhead Shrikes reported on Breeding Bird Survey routes in Arkansas, 1967-1983. (A) Statewide, (B) West Gulf Coastal Plain, (C) Interior Highlands, (D) Delta

Fred L. Burnside and William M. Shepherd

1967 to 1.66 shrikes per route in 1983. Results suggest that numbers of shrikes seen along routes in both the West Gulf Coastal Plain and Interior Highland regions have declined significantly ($P \leq .01$ and $P \leq .05$ respectively; Figure 2B,C) while routes in the Delta have not shown this trend (Figure 2D). Mean values of shrikes per route in the West Gulf Coastal Plain decreased from 7.0 in 1967 to 1.57 in 1983 and mean values of shrikes per route in the Interior Highlands decreased from 4.0 in 1968 to 1.33 in 1983. A relatively steady decline in shrikes was noted across years in the West Gulf Coastal Plain (Figure 2B) while numbers per route in the Interior Highlands decreased rapidly during 1967-70 (Figure 2C) and then leveled off for the remainder of the study period. Seven BBS routes in the West Gulf Coastal Plain showed significant downward trends in shrike numbers ($P \leq .05$, $N=8$) while only one in the Delta ($P \leq .01$, $N=8$) and three in the Interior Highlands region ($P \leq .05$, $N=10$) showed similar trends. Route 16 in the Delta region was the only BBS route that showed a significant increase in shrike numbers ($P \leq .01$).

WINTER

Mean numbers of shrikes observed on CBC's in Arkansas 1950-81 can be seen in Figure 3A. A sharp increase in numbers of shrikes per count is seen for the period 1950-66. Numbers of shrikes declined during 1966-81. Mean numbers of parties per count and miles driven per count (Figure 3B,C) increased from 1950-64 and leveled off during the next 17 years. A marked increase in observers in the field and the greater use of vehicles for transportation on counts may account for some of the increase in shrike numbers reported during the period 1950-64. Numbers of shrikes per count (Figure 3A) dropped during 1966-81 despite relative stability in numbers of parties and miles driven per count during that period.

Mean values for numbers of shrikes per party and shrikes per 100 miles driven on CBC's were plotted against years (Figure 4A,B). Results suggest that numbers of shrikes wintering in Arkansas have declined during 1950-81. However, the methodology associated with CBC's does not provide data as accurate as that derived from BBS surveys and these results should be viewed cautiously. Of the 12 individual CBC's analyzed, only Fayetteville and White River National Wildlife Refuge showed marked decreases in shrikes over time. Population levels in each of the other 10 counts were either stable or their trends could not be detected.

DISCUSSION

A significant decline in shrike numbers during the breeding season has occurred between 1967-83. Results indicate that this statewide decline was most highly influenced by data collected along BBS routes located in the West Gulf Coastal Plain region where seven of eight routes showed significant declines in shrike numbers. The Interior Highlands region also showed a significant decline. Only three of 10 routes declined significantly in this region and declines were only seen during the period 1967-70. Shrike numbers reported during the remaining 13 years were relatively stable.

Loggerhead Shrikes require open areas with short and/or patchy grasses for foraging and scattered trees or hedgerows for nest substrates near suitable foraging areas (Miller 1931, Bent 1950). Grazing by farm animals and some agricultural practices, such as harvesting hay from fields, help maintain suitable habitat for Loggerhead Shrikes by keeping grasses short (Kridelbaugh 1981). Tall, dense grasses seem to preclude use of these areas by shrikes. Historically, most of the southeast U.S. was unsuitable for use by shrikes because it was densely forested. Patchy habitat occurred along the Gulf and Atlantic coasts and in isolated prairie regions in the southeast, and these areas were likely used by Loggerhead Shrikes (Palmer 1898, Milburn 1981). Shrike habitat was created as forest land was cleared for homesites and agricultural purposes (Butler 1898, Palmer 1898, Mousley 1918).

If shrikes have shown an affinity for farmland in the past, which we think they have, then a decline in numbers of farms, farm acreage,

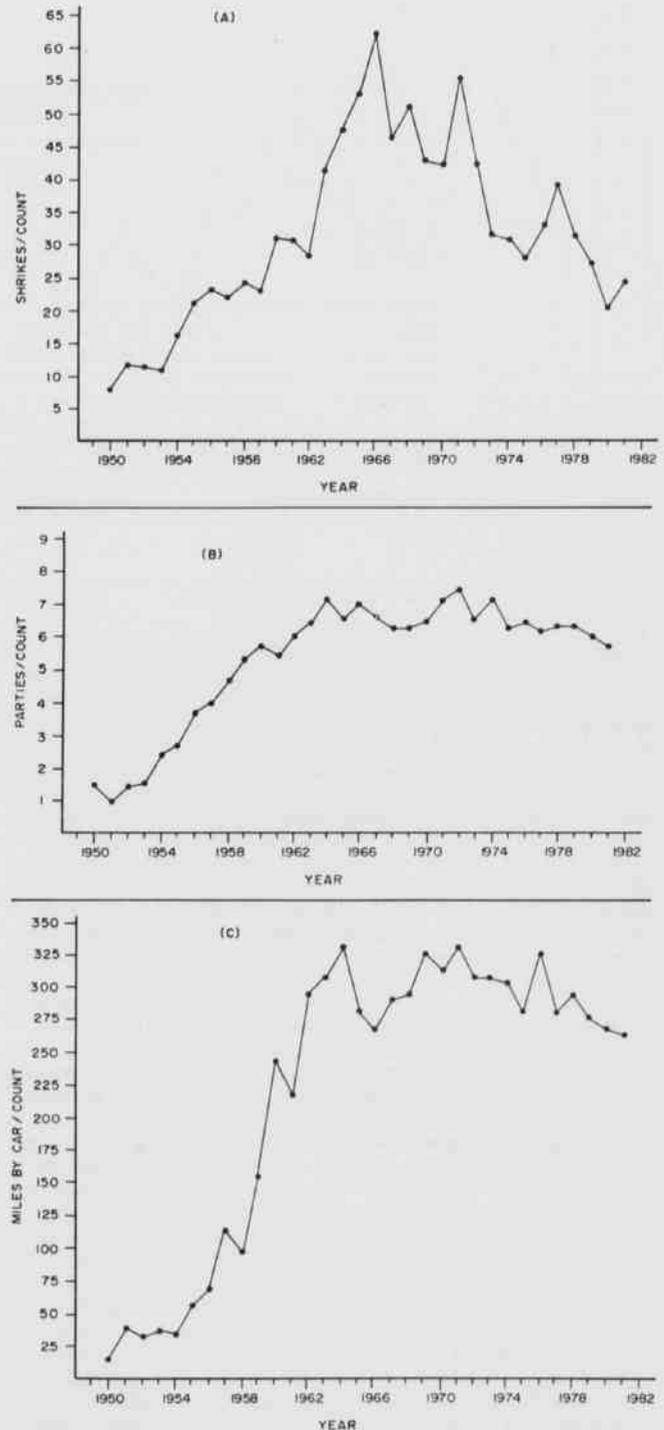


Figure 3. Mean numbers of shrikes (A), parties (B), and miles driven (C) on Christmas Bird Counts in Arkansas, 1950-1981.

and/or changes in land use on farms could account for declines in shrike populations. There were approximately 221,991 farms in Arkansas in 1925 and they averaged 28.5 ha (70.4 acres) in size (Agricultural Census, U.S.D.A. 1925, 1935, 1945, 1950, 1954, 1959, 1964, 1969, 1974, 1978, 1982). By 1982, only 50,525 farms were reported but average farm

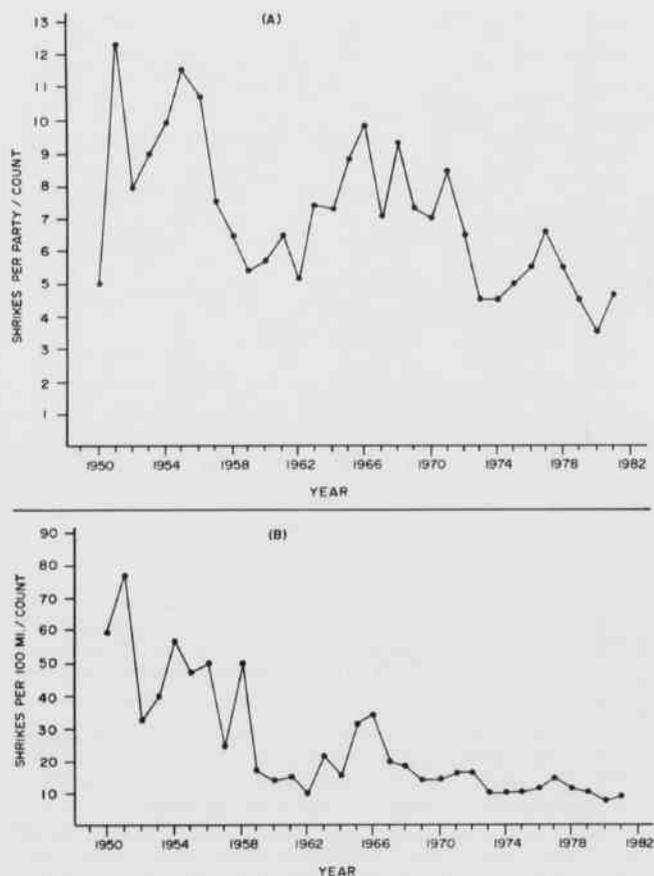
Population Trends of the Loggerhead Shrike (*Lanius ludovicianus*) in Arkansas

Figure 4. Mean numbers of shrikes per party (A) and shrikes per 100 miles driven (B) on Christmas Bird Counts in Arkansas, 1950-1981.

size increased to 117.8 ha (291 acres). Farmers have been using their land much more intensively in recent years than in the past due to economic pressures and modern farming methods. It appears that social and economic conditions are selecting for large intensively managed farms and against small subsistence farms. Scattered trees in agricultural fields, which might be used by shrikes as nest sites, are susceptible to lightning and wind damage and many are cut to provide space for crops. Hedgerows also have been cleared in many areas of the state and these, and scattered trees, are seldom replaced on modern farms. These factors could account in part for the declines noted in this study.

A value for the percent farmland for each county having a BBS route within its boundaries was obtained from the Agricultural Census. Six counties within the West Gulf Coastal Plain showed an average decrease in farmland from 42% in 1925 to 23% in 1982. Eight counties in the Interior Highlands region showed an average decrease in farmland from 54% in 1925 to 35% in 1982. Seven counties in the Delta showed an increase in farmland from 44% to 79% in the same time period. The decrease in farmland in the Coastal Plain and Interior Highlands regions could partially account for declines in shrike numbers, especially during the breeding season. Although farmland is abundant in the Delta and percent farmland has increased since 1925, monocultures of row-crops dominate this region and perch sites, nest sites, and foraging areas appear limited.

Studies need to be conducted to determine if, and to what extent, alteration of shrike habitat is responsible for the apparent decline in numbers in the southeast U.S. With a better understanding of the life history and habitat requirements of the Loggerhead Shrike, we may be able to avert listing this species as "endangered".

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