We are grateful for the assistance of many people at Monteverde, and to F. Gary Stiles for a critical review of an earlier version of this paper. Tramer was supported by grant DEB 76-10787 from the National Science Foundation and a sabbatical leave from the University of Toledo.—ELLIOT J. TRAMER AND THOMAS R. KEMP, *Dept. Biology, Univ. Toledo, Toledo, Ohio 43606.* *Accepted 10 Dec. 1981.*

Wilson Bull., 94(3), 1982, pp. 354–355

Decline of the Roadrunner in Missouri.—A gradual northeastward range expansion of the Roadrunner (*Geococcyx californianus*) has been documented over the past 50 years. In the late 19th century Goss (History of the Birds of Kansas, Geo. W. Crane and Co., Topeka, Kansas, 1891) described the Roadrunner's range as being "northern Mexico, north to southern Colorado and California, east into Texas and southwest Kansas." Expansion of this range into eastern Kansas and Oklahoma was first reported in the 1930's (Colvin, Auk 52:88, 1935). Sutton (*in* Bent, U.S. Natl. Mus. Bull. 176, 1940) cited the Roadrunner's range as extending east to south-central Kansas and central Oklahoma. Subsequent extension in Arkansas was reported by Baerg (Condor 52:165, 1950) and James (Arkansas Acad. Sci. Proc. 14:8–13, 1960). First documentation of Roadrunners in Missouri was by Brown (Condor 65:242–243, 1963) who reported 12 sightings in the southwestern part of the state dating back to 1956. Probasco (5th Midwest Prairie Conference Proc., Iowa St. Univ., Ames, Iowa, 1976) provided further documentation of the bird in Missouri. This northeast expansion coincided with range extensions northward in California (Kimsey, Condor 55:215, 1953) and Utah (Hayward et al., Great Basin Naturalist Memoirs, Birds of Utah, No. 1, Brigham Young Univ. Press, Provo, Utah, 1976) and eastward into Louisiana (Lowery, Louisiana Birds, Louisiana State Univ. Press, Baton Rouge, Louisiana, 1955).

To further document the range expansion of the Roadrunner in Missouri, a survey by Jim Rathert within the Missouri Department of Conservation provided information on many sightings of Roadrunners in southern Missouri. All sightings were made or substantiated by Conservation Agents familiar with the avifauna of the area. Based on these results and extensive personal communication with bird watchers, Breeding Bird Census participants and Audubon Christmas Count personnel, we determined that the Roadrunner's range continued to expand both north and east in Missouri until 1976. By this time Roadrunners had been sighted throughout 36 counties in southern Missouri, extending north to the Missouri River (Fig. 1) but centered in the glade areas of the southwestern part of the state.

Beginning with the severe winter of 1976–77, the Missouri population of Roadrunners began a decline which continued through 1978–79, probably due to three successive severe winters. The 1978 distribution was much reduced from previous years (Fig. 1). The Audubon Christmas Bird Count data for Oklahoma also showed a decline from 26 Roadrunners sighted in 1976 to 17 in 1977 and one in 1978, despite an increase in the number of observers (Am. Birds, Vols. 31–33, 1977–1979).

Decline of the Missouri Roadrunner population may have been caused by starvation indirectly brought about by severe winter weather. Although Roadrunners are highly opportunistic feeders and eat a variety of small vertebrates, they rely on invertebrates, chiefly insects, during the nonbreeding season (Bryant, Univ. Calif. Publ. Zool. 17:21–50, 1916; Sutton, Bull. Oklahoma Ornithol. Soc. 5:30, 1972).

Climatic data for the region were studied to investigate the possible role of severe winter weather in preventing Missouri Roadrunners from obtaining food. During the period of active range expansion in Missouri, winter weather was characterized by snow cover that was

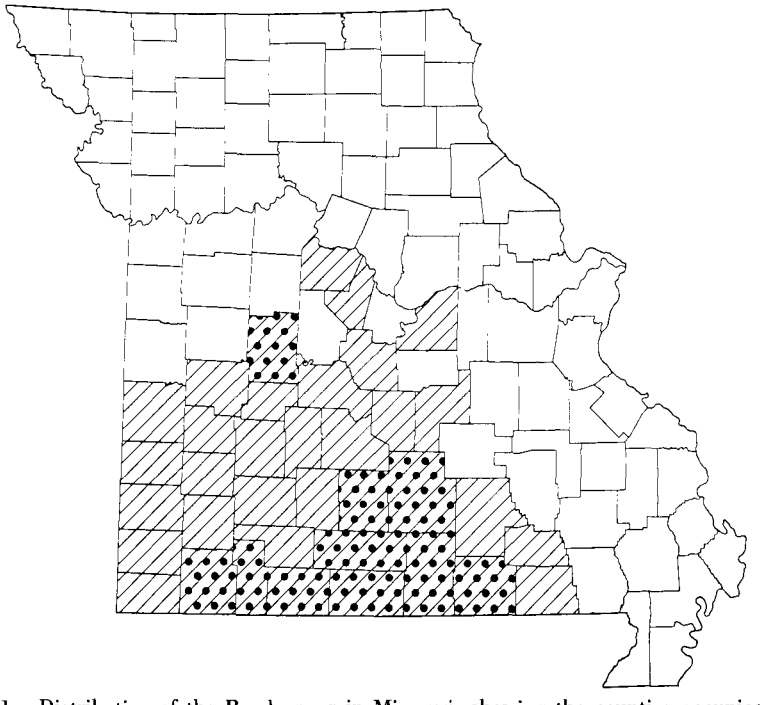

FIG. 1. Distribution of the Roadrunner in Missouri, showing the counties occupied in 1976 (diagonal lines) and 1978 (dotted areas).

generally light and short in duration. The mean daily snow cover was 1.4 cm in January (the severest month) and the mean number of snow days was 7.9. Beginning with the winter of 1976–77 and continuing in 1977–78 and 1978–79, snow cover was heavy and persistent. The mean daily snow cover was 18.0 cm, 11.2 cm and 11.6 cm in January of the 3 years, respectively, and the number of snow days were 29, 22 and 31, respectively. It may be that these periods of prolonged snow cover prevented the birds from obtaining prey, especially insects and reptiles, resulting in starvation. On 23 January 1979, a Roadrunner in weakened condition was found in Pulaski County, Missouri; it subsequently died. Postmortem examination showed that the gastrointestinal tract was empty and the bird's weight was 202 g, less than half that of healthy Roadrunners in December in Oklahoma (Geluso, Bull. Oklahoma Ornithol. Soc. 2:5–6, 1969). Snow cover at the time of capture was heavy and had been continuous for 25 days.

The observations reported herein suggest that the Missouri Roadrunner population declined between 1976 and 1979 during a period of unusually severe winters.

Acknowledgments.—This study was funded in part by the USDA Forest Service, Cooperative Research Agreement 13-666. We thank Keith E. Evans and George E. Probasco of the Forest Service for their valuable assistance.—DOUGLAS J. NORRIS AND WILLIAM H. ELDER, *Missouri Cooperative Wildlife Research Unit, School of Forestry, Fisheries and Wildlife, Univ. Missouri, 112 Stephens Hall, Columbia, Missouri 65211.* *Accepted 5 Jan. 1982.*