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Killdeer breeding densities.—The Killdeer (*Charadrius vociferus*) is abundant throughout much of North America. There is, however, only limited information on Killdeer breeding densities. The present study was conducted between 12 April and 5 August, 1970 on approximately 113 ha of the St. Paul Campus, University of Minnesota, and the adjacent Minnesota State Fairgrounds.

The study area included 3 different habitat types: (1) open fields of mowed native grasses and weeds or untended dirt and coal (24 ha); (2) badly crumbled and unused asphalt areas of the fairgrounds (32 ha); and (3) agricultural fields (57 ha). Prior to 23 May, 75% of the agricultural field area was bare cultivated fields and 25% had plants higher than 15 cm growing in rows. After 23 May, the percentage of the agricultural fields with crops 15 cm or taller increased steadily, and by mid-July, virtually all the agricultural area had crops.

Killdeer sneak away from their nests if a human walks slowly into an area. Therefore, I searched for nests by running from concealment into an area and watching for Killdeer startled off their nests, and then by returning to concealment and watching Killdeer return to their nests. Between 20 April and 1 July I checked the entire study area for nests approximately once every 4 days. A bow-net nest trap and mist nets were used to capture adult Killdeer at their nests. Chicks were located by watching for their movements while I ran into an area or by scanning with binoculars. They were caught by hand before they could fly. Age of chicks was estimated by body size and the stage of rectrix development, relative to chicks of known age. Each bird captured was banded with a USFWS metal band and 1 or 2 colored plastic bands. During this study neither all the breeding Killdeer were banded nor were all the nests on the study area found. However, it is likely that most of the chicks hatched on the study area were caught because chick movements were easily detected.

Fourteen breeding pairs of Killdeer were observed. Both individuals of 8 pairs were banded, and 1 member in each of the other 6 pairs was banded. These 14 pairs initiated 26 nests and hatched 13 chicks, all of which were banded. An additional 17 chicks from unfound nests of unmarked pairs were banded.

The population of the study area was estimated by the Lincoln Index method (Davis, Manual for the Analysis of Rodent Populations, Edward Bros. Inc., Ann Arbor, 1956) to be 67 adult Killdeer, based on the total number of sightings of banded adults (48) and unbanded adults (99). Observations were made of the entire study area, every day between 11 June and 11 July 1970, in order to get a large sample. The last adult Killdeer was banded on 11 June, and pre-migratory flocking non-residents had not yet appeared by 11 July. (Post-breeding population estimates of 234, 241, and 170 adult Killdeer were made on 21 July, 29 July, and 5 August, respectively.)

To determine if the entire population was breeding, I based a second population estimate on the number of chicks captured from the known nests of the marked pairs and the number of chicks captured from unknown nests of unmarked pairs. The rationale for this method follows. The young from known nests were all captured within 100 m of their nests and the chicks of a brood remain together, with their parents, until after attaining flight capabilities. Therefore, other groups of chicks captured on the study area must have been separate broods from unknown nests on the study area. Because average brood size and the estimated age of the chicks at capture are similar for chicks from known nests and from unfound nests (1.9 chicks/brood, 10 days and 1.7 chicks/brood, 15 days respectively) it is reasonable to assume equal productivity by the marked

TABLE 1

ESTIMATED 1970 KILLDEER BREEDING DENSITIES PRIOR TO 23 MAY

Habitat (area)	Estimated Number of Nests Prior to 23 May	Density Pairs/100 Ha
Open Field (24 ha)	8	33.3
Asphalt areas (32 ha)	10	31.3
Bare cultivated fields (43 ha)	13	30.2
Planted fields (14 ha)	2	14.3

and unmarked pairs. Based on this assumption, a calculation of the breeding population can be made by equating the ratios of marked pairs (14) to their chicks (13) and unmarked pairs (unknown) to their chicks (17). This yields an estimate of 18 unmarked pairs, and a total breeding population of 32 pairs of Killdeer.

This second determination (64 individuals) is remarkably close to the first (67 individuals). This agreement suggests that most of the population of the study area was breeding, and suggests the marked pairs are representative of the entire population. Thus it is reasonable to assume the habitat distribution of the marked pairs was indicative of the entire breeding population. Estimating a breeding population of 33 pairs and knowing the habitat distribution of the 13 marked pairs which had first nests prior to 23 May, it is possible to calculate approximate first nest breeding densities of the entire breeding population for the different habitat types (Table 1).

The literature on Killdeer breeding densities is scattered and difficult to interpret. On 16 ha of grazed, rolling grassland, 2 and 3 pairs of Killdeer occurred during 2 successive years (Holliday, Aud. Field Notes 1:219, 1947; Holliday, Aud. Field Notes 2: 243–244, 1948). One pair of Killdeer bred on 11 ha of uncultivated prairie grassland during each of 3 years (Fairfield, Aud. Field Notes 16:431, 1962; Fairfield, et al., Aud. Field Notes 17:503–504, 1963; Fairfield, Aud. Field Notes 18:564, 1964). Speirs and Orenstin (Can. Field-Nat. 81:175–183, 1965) found Killdeer in 7 of 10 areas censused in Ontario County, Canada. The average density was 6.7 adult birds per 40 ha (range, 6 to 16 adult birds per 40 ha); presumably they were breeding birds for the censuses were taken in June. In this study I found breeding densities 2 to 5 times those of Holliday (op. cit.), Fairfield (op. cit.), and Speirs and Orenstin (op. cit.).

No single census method guarantees accuracy. The application of several techniques to the same population and comparison of the results allows critical evaluation of the accuracy of the estimates and if the results agree, increased confidence in their validity. In this study the census techniques are not completely independent. However, they do confirm that most of the population was breeding, and provide confidence in the accuracy of the population estimate.

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Brown Pelican restocking efforts in Louisiana.—The last natural nesting of the Brown Pelican (*Pelecanus occidentalis*) in Louisiana occurred in 1961 (Williams and Martin, Quart. J. Florida Acad. Sci. 31:130–140, 1969). Soon thereafter, it became evi-