GENERAL NOTES

Population growth in the Cattle Egret.—The spread of the Cattle Egret (*Bubulcus ibis*) into North America is one of the most dramatic and best-documented ornithological events of this century (Crosby 1972, Browder 1973, Fogarty and Hetrick 1973). In the past 20 years the species has expanded its range into many states and to southern Canada; in winter, birds are found in the coastal plain across the southern United States, especially along the Gulf Coast and in Florida.

If the number of Cattle Egrets wintering in the United States represents a roughly constant fraction of the total breeding population (see Browder 1973), then Audubon Society Christmas count data should provide an index to population growth for this species while it has been expanding in an essentially unlimited environment. In this study we have analyzed Christmas count data for the winters of 1956–57 through 1971–72, as part of an ongoing effort to use Christmas counts for revealing large-scale patterns of avian ecology and biogeography. Techniques of computerized data storage, retrieval, and analysis have been described elsewhere (Bock and Lepthien 1974).

Fig. 1 shows the average number of birds counted per party-hour of effort, for those counts occurring within the range of the Cattle Egret as it appeared in the 1971–72 count. Results indicate a dramatic (at least 2000-fold) increase during the 16-year period. This increase has not been continuous. Christmas count data indicate sharp declines in 1962, 1963, and 1968. Symbols in Fig. 1 show the occurrence of unusual cold waves between 1956 and 1971 in Florida and/or Louisiana, major Cattle Egret wintering areas. These data are taken from the monthly weather summaries published by the U.S. Department of Commerce (1956–72). It is probable that severe weather in 1962, 1963, and 1968 caused the observed population declines (Fig. 1). The cold weather of 1957–58 probably did not affect Cattle Egrets because they were present then only in small numbers and could concentrate far to the south. The very brief cold period in Florida in January 1971 seems not to have had an effect (Fig. 1), but weather records indicate that this month actually averaged warmer than usual as a whole.

Browder (1973) has suggested that most Cattle Egrets migrate south of the United States to winter. It is possible that the declines of 1962, 1963, and 1968 were in fact increased emigration in response to severe weather. However, Fig. 1 shows that populations did not return to previous levels until 1966 following the 1962 and 1963 declines, and until 1970 following the 1968 decline. If massive emigrations did occur, many of the birds must never have returned. We would conclude that an unusually severe winter period in the southeastern United States causes extensive Cattle Egret mortality, or at least weakens the birds so that they fail to breed the following nesting season. It is interesting that Gray Heron (*Ardea cinerea*) populations in Great Britain declined following hard winters between 1928 and 1950 (Lack 1951).

In spite of evident density independent declines caused by weather conditions, the increase in Cattle Egrets between 1956 and 1971 conforms generally to the exponential growth pattern expected in a species expanding into an unlimited environment (e.g. Slobodkin 1964). The dashed line in Fig. 1 is an exponential growth curve with the best fit to our data. The "instantaneous rate of natural increase" (r) for this curve is 0.21 (coefficient of determination = 0.69). This would be the realized rate of increase from 1956 through 1971. A curve fitted to

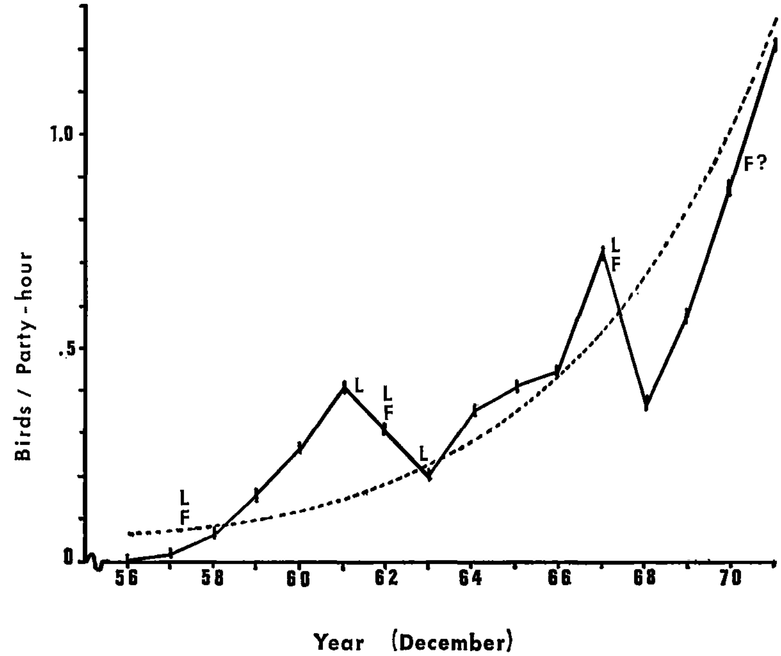

Fig. 1. Christmas count abundance of Cattle Egrets in the United States, 1956–71. Solid line = actual data; broken line = best fit exponential regression line ($N_t = 0.02\ e^{0.21t}$; coefficient of determination = 0.69). F = severe cold weather in Florida; L = severe cold weather in Louisiana.

the data from 1956 to 1961 has an r value of 0.84 (coefficient of determination = 0.92); this is a very high growth rate for any natural population of vertebrates, and may approximate the intrinsic rate of natural increase (r_{max}) for this species. For unknown reasons, population growth slowed between 1964 and 1966 (Fig. 1). A curve fitted to abundance estimates from 1968 to 1971 has an r value of 0.41 (coefficient of determination = 0.99), suggesting that the population subsequently resumed an exponential growth pattern but that the rate of increase had declined. This may be a sign that the North American Cattle Egret population is approaching carrying capacity, at least on its winter range.

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Food fluctuations and multiple clutches in the Mountain Plover.—Based on research conducted on the Pawnee National Grassland, Weld County, Colorado from 1969–72, I described the Mountain Plover's (*Charadrius montanus*) social system and discussed its adaptive significance (Graul 1973, Living Bird 12: 69). Data collected in the same place from 9 to 17 May 1974 provide support for two of my earlier predictions: (1) extreme fluctuations in food (insects) occur on the shortgrass prairie on a yearly, seasonal, and spatial basis; and (2) female Mountain Plovers respond to high food levels by producing multiple clutches; a female will produce a clutch to be incubated by her mate and another that she will attend herself. The new data are needed, as only two cases of females producing multiple clutches in this fashion were documented previously and the extreme fluctuation in food prediction was based on indirect evidence.

Following a wet 1973 season (J. Stoddard pers. comm.) the prairie in early May was strikingly different from any period during 1969–72. Many shallow basins that had been dry contained water and *Carex* sp. grew luxuriously in places that had been covered predominantly by blue grama grass (*Bouteloua gracilis*) and/or buffalo grass (*Buchloe dactyloides*). Mountain Plovers eat a variety of insects, including grasshoppers, and in conjunction with the wet condition short-horned grasshoppers (*Acrididae*) were abundant locally; my car flushed hundreds in pastures where previously I had flushed only occasional individuals. The wet condition was only temporary and was followed by drought in late May (M. Howe pers. comm.). Thus the preceding observations support the food fluctuation prediction.

Six adults at separate nests were individually marked with color bands and dye. Based on a total of 18 checks during the daytime and 14 at night each of these birds was tending its nest alone. On the last check at each nest the sex of the incubating bird was confirmed by laparotomy (5 cases) or through collection (1 case) and all were males.

Three females with brood patches were collected and their ovaries were examined. One was being courted by a male who was tending a nest containing a complete clutch (3 eggs). Ovary examination showed clearly that this female had completed one clutch. Follicles were present that could develop into eggs, but a new clutch would not have been laid for at least a few more days. The other females were being courted by males having brood patches, but it was not determined whether the males were tending nests. Both females had ovaries indicating they were in the process of laying a clutch and had laid a separate clutch several days earlier.