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REGIONAL VARIATION IN THE FOOD OF NESTLING CATTLE EGRETS

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IN their spread into and across North America, Cattle Egrets (*Bubulcus ibis*) appear to be occupying a previously vacant niche. Most breeding colonies established in North America have been in preexisting heronries, but the Cattle Egrets do not compete with the indigenous species for food. At a heronry in north central Florida, the diet of Cattle Egret nestlings differed from the diets of the nestlings of three other heron species (Jenni 1969). At another locality in north central Florida, adults ate a diet that was noncompetitive with the diets of other species (Fogarty and Hetrick 1973). This paper compares the food of nestling Cattle Egrets at four different Florida localities.

I systematically collected boluses of undigested food regurgitated by Cattle Egret nestlings in response to my intrusion into their colonies during the late morning and early afternoon. The samples were preserved immediately in 10% formalin. Later they were washed and transferred to 30% isopropanol. The food items were identified, counted, dried on paper toweling, and their volumes measured.

Collections from four Florida colonies (Figure 1) were made in 1960: Lake Alice, Alachua County, collected between 27 May and 26 July; Lake Griffin, Lake County, 27 June; Lake Okeechobee spoilbanks, Glades County, 7 July; and Tampa Bay, Alafia River spoilbanks, Hillsborough County, 8 July. Field work was sponsored by grants to the Florida State Museum from the Florida Audubon Society and from the National Wildlife Federation. J. Alan Holman helped identify the amphibians.

Cattle Egret nestlings were fed a wide variety of invertebrate and vertebrate prey. Detailed analyses of samples from these colonies suggested that they differed significantly in prey composition (Table 1), though comparisons of percentages by volume of all orthopteran insects and of all amphibians showed remarkable agreement among the four breeding populations (Table 2). The food fed nestling Cattle Egrets at these localities averaged nearly 60% orthopterans and 34% amphibians. Together they comprised 94% of the diet. Although spiders averaged only 3.6% in the four samples, they were the third, fourth, or fifth most frequently taken class of prey. Reptiles varied from none at Tampa Bay, one lizard at Lake Okeechobee, one lizard and one snake at Lake Griffin, to four small snakes at Lake Alice. The remaining 1.3% of the prey was composed of a wide variety of prey items, none of which con-

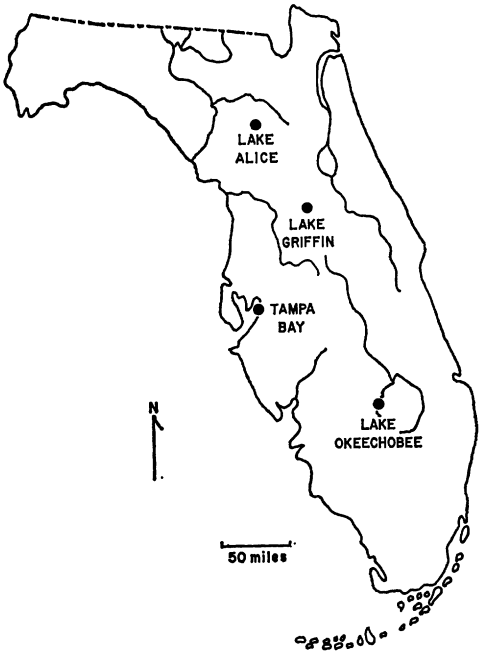

Figure 1. Location of the four Florida heronries.

tributed as much as 1.0% of the diet of any one population (Table 1). A total of 5,271 individual prey items were identified.

The diet of nestling Cattle Egrets in Florida appears opportunistic. Although composed primarily of grasshoppers, crickets, frogs, and toads, it may include almost any other small creature the adults encounter.

The nestlings were fed different amphibians at the different localities. Leopard frogs (*Rana pipiens*) and cricket frogs (*Acris gryllus*) were important at all four colonies. Common toads (*Bufo terrestris*) were prominent in the Lake Griffin sample, but none were found in the other samples. Oak toads (*B. quercicus*) were important at Tampa Bay and were also taken at Lake Okeechobee. This variation in composition of the amphibian prey is interesting because of the relative stability of amphibians in the four samples (30–38% of the volume). Under different ecological conditions where the relative abundance of different amphibians varied, Cattle Egrets fed their young different species.

The total number of orthopterans in the four samples varied widely (Table 3). Number was negatively correlated with size, especially in the crickets. The Lake Alice sample included 523 crickets that averaged only 0.06 ml (total of 32.5 ml). The Tampa Bay sample included only 217 crickets, but they averaged 0.34 ml (total of 74.0 ml), more than five

TABLE 1

CONTENTS OF 50 BOLUSES REGURGITATED BY NESTLING CATTLE EGRETS AT FOUR COLONIES IN FLORIDA

	Lake Alice		L. Griffin		L. Okeechobee		Tampa Bay	
	No. of prey items	% of total vol.	No. of prey items	% of total vol.	No. of prey items	% of total vol.	No. of prey items	% of total vol.
INVERTEBRATES								
Insects								
Odonata								
Zygoptera	1	tr.	1	0.3				
Anisoptera	5	0.6	3	0.1	5	0.3	3	0.1
Dictyoptera								
Phasmida					1	tr.		
Isoptera								
Unident.			2	tr.	1	tr.		
Orthoptera								
Locustidae	679	36.2	367	31.4	715	46.1	511	28.1
Tettigidae	279	6.9	12	0.7	21	0.8	21	0.5
Tettigonidae			165	7.6	83	4.5	125	5.9
Gryllidae	523	13.5	303	17.5	427	13.5	217	24.2
Gryllotalpidae			2	0.4				
Dermaptera								
Unident.			2	0.1				
Hemiptera								
Unident.							1	tr.
Hymenoptera								
Symphyta							1	tr.
Formicidae							1	0.1
Coleoptera								
Unident.	10	0.2	8	0.1	3	tr.		
Elateridae	1	tr.	11	0.1	1	tr.		
Curculionidae	2	tr.	1	tr.				
Diptera								
Unident.	3	0.1	7	0.4	22	0.8	22	0.5
Tabanidae	5	0.5			7	0.3		
Lepidoptera								
Unident. larvae							1	0.1
Unident. adults	2	0.1			3	0.2	8	0.3
Spiders	88	5.2	31	1.7	96	3.7	100	2.9
VERTEBRATES								
Amphibians								
Scaphiopus holbrookii	1	1.3						
Bufo quercicus					13	4.1	21	10.5
B. terrestris			26	15.5				
Unident. frogs	2	0.8						
Unident. Hylidae	2	0.4						
Acris gryllis	69	13.3	34	4.0	73	12.4	63	10.5
Hyla spp.	2	0.4	1	0.2			1	0.1
Hyla ocularis							1	0.1
Pseudacris nigrita					3	0.8		
Rana pipiens	23	15.8	6	18.5	7	12.4	5	16.0
Gastrophryne carolinensis	2	0.4						

TABLE 1 (*continued*)

	Lake Alice		L. Griffin		L. Okeechobee		Tampa Bay	
	No. of prey items	% of total vol.	No. of prey items	% of total vol.	No. of prey items	% of total vol.	No. of prey items	% of total vol.
Reptiles								
Cnemidophorus sexlineatus			1	1.3				
Lygosoma laterale					1	0.4		
Thamnophis cauritus	2	2.1						
T. sirtalis	1	1.7	1	0.7				
Tantilla coronata	1	0.6						

times larger than the crickets taken at Lake Alice. The differences cannot be attributed to seasonal differences. Although size and number of orthopteran prey differed, their importance in the different samples was relatively constant. The average bolus volume was inversely correlated with average number of orthopteran prey.

There were also interesting differences in the sizes of leopard frogs fed the young in the different colonies. However, the fact that there is a positive correlation between the size of the leopard frogs and the number of toads taken suggests that the differences in the sizes of the leopard frog reflects the ecology of the feeding habitat rather than regional differences in the Cattle Egrets' preferences. If the Cattle Egrets are opportunistic feeders these data suggest an interesting and stable balance between the anuran and orthopteran biomasses of Florida cattle pastures.

The 200 boluses contained no ticks, and none were found in 54 additional boluses analyzed in the laboratory. I also searched for ticks in literally hundreds of other Cattle Egret boluses during my daily visits to the Lake Alice Colony in 1960 and found none. The popular myth that Cattle Egrets remove significant numbers of ticks from cattle has been reviewed recently (Jenni 1969, Fogarty and Hetrick 1973). While

TABLE 2
COMPARISONS OF MAJOR FOOD ITEMS IN 200 BOLUSES REGURGITATED BY NESTLING CATTLE EGRETS

	Volume percentage of total diet				
	Lake Alice	Lake Griffin	Lake Okeechobee	Tampa Bay	Average
Insects					
Orthoptera	56.6	57.6	64.7	58.8	59.4
Others	1.5	1.1	1.6	1.1	1.3
Spiders	5.2	1.7	3.7	2.9	3.4
Amphibians	32.4	38.2	29.6	37.2	34.4
Reptiles	4.4	2.0	0.4	0.0	1.7

TABLE 3
COMPARISON OF THE BOLUSES AND THE ORTHOPTERAN PREY TAKEN BY CATTLE EGRETS IN FLORIDA

	Lake Alice	Lake Griffin	Lake Okeechobee	Tampa Bay
Average number of prey items per bolus	32	20	30	23
Average size of boluses (ml)	4.8	6.0	5.3	6.1
% of total volume occupied by orthopterans	57	58	65	59
Total number of orthopterans	1,481	849	1,246	853
Total volume of orthopterans (ml)	136	173	173	178
Average size (volume) of orthopterans (ml)	0.09	0.20	0.14	0.21

individual Cattle Egrets feed actively on ticks under certain special conditions (Skead 1966), they are exceedingly rare in systematic studies of Cattle Egret food habits (Fogarty and Hetrick 1973, Kadry Bey 1942, Siegfried 1971, and this study). Siegfried found one tick. Snoddy (1969) found two ticks in 20 Cattle Egrets collected in southern Georgia. Snoddy recovered 1,030 horse flies, 10 horn flies, and 10 stable flies from the stomachs of these 20 birds, which had been closely associated with cattle. There is no evidence that ticks form an important part of the Cattle Egret diet, nor that Cattle Egret-cattle associations are based on tick removal.

Adult Cattle Egrets appear to employ the same hunting strategies when they have young in the nest as they do at other times. Siegfried (1971) found that the diet of nestling Cattle Egrets in South Africa resembled that of the independent birds. The adults possibly take larger prey items for themselves, especially during winter months when fewer orthopterans are available. Invertebrate prey comprised 93% of the total volume of 841 stomachs taken from free-flying birds in north central Florida (Fogarty and Hetrick 1973). This differs significantly from the nestling diet reported here. These birds were shot in late afternoon between 19 June and 16 July 1969, and included birds of the year as well as nonbreeding adults. They were not collected from the colonies that provided the samples reported in this paper.

Siegfried (1971) analyzed 98 boluses regurgitated by nestling Cattle Egrets in South Africa. Although he presented his data for each food as a percentage of total weight, his data can be compared with those reported here because the specific gravity of the food is essentially 1. The diet of South African nestlings was: orthopterans, 36.1% (com-

parable value for Florida = 59.4%); other insects, 41.2 (1.3); spiders and scorpions, 0.4 (3.4); amphibians, 12.7 (34.4); snakes, 3.0 (1.7); birds, 3.8 (0.0). Orthopteran prey items did not dominate the diet as they did in Florida. Lepidopterans, primarily larvae and pupae, were extremely important (32.3% in South Africa as compared to 0.2% in Florida). Amphibians ranked a poor third, but were still an important part of the diet.

The differences between nestling diets in Florida and South Africa where Cattle Egrets are also relatively recent invaders demonstrate the adaptability of the Cattle Egret. The irrigated dairy land where the Cattle Egrets fed in South Africa was intensively managed, much modified grasslands compared to Florida pastures. The pastures near the four heronries discussed here were generally low-lying, wet grasslands. Improvement of these grasslands was often restricted to removal of herbaceous and woody growth. The data suggest that the existence of Cattle Egret colonies does not depend so much on the availability of particular prey species as on a particular habitat type in which the egrets hunt for prey.

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