

## AGGRESSION AMONG STARVING CATTLE EGRETS

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Cattle Egrets (*Bubulcus ibis*) flying over the Gulf of Mexico often land at the Dry Tortugas, a group of small islands 70 miles west of Key West, Monroe County, Florida. Food suitable for Cattle Egrets is scarce locally and many egrets die at the Dry Tortugas, presumably from starvation (Harrington and Dinsmore, 1975). In June 1975 an infestation of a Sea Grape (*Coccoloba uvifera*) tree by caterpillars of the moth *Sarasota plumigerella* Hulst. (Pyralidae: Phycitinae) provided a natural, albeit limited, food supply at which we observed Cattle Egret behavior. With assistance from several observers, we were able to compare aggression, feeding frequency, plumage condition, and to some extent death weights of the starving birds. Of especial interest was the opportunity to test relationships between aggressiveness and feeding frequency under the unusual circumstance of starving birds competing for a concentrated, but limited food supply.

We observed Cattle Egrets on the parade ground within Fort Jefferson, Garden Key, Dry Tortugas, under an isolated Sea Grape tree about 10 m tall and roughly circular in spread. Branches radiated about 7 m outward, but all exceeded 1 m from the ground. Cattle Egrets did not roost at the Sea Grape tree, but assembled daily before dawn to forage on the lawn beneath it in an area of about 154 m<sup>2</sup>. By mid-afternoon each day foraging waned and the egrets gradually dispersed. The birds foraged neither at night nor during periods of rain. About 50 Cattle Egrets were on Garden Key each day, 17 to 26 June 1975, but no more than 25 foraged beneath the Sea Grape at any one time. Others either foraged over the mowed lawns in a widely dispersed pattern under feeding conditions that appeared decidedly less favorable than those beneath the tree, or rested, often by a nearby water fountain.

The caterpillars appeared to be the only food available beneath the Sea Grape tree. The egrets took them from the ground, or, rarely, near the ground from suspension threads of silk, but the birds never foraged in the tree. Heinrich (1956) reports *S. plumigerella* larvae feeding under a light silk webbing on the leaves and flower buds of Sea Grape. Perhaps they pupate in the leaf litter, but this remains to be proven. Obtaining the prey required little more of the egrets than a few steps, sometimes a brief search, a peck and a swallow; however, not all foraging strides and searches resulted in food capture. Brief flurries of foraging followed the occasional light breezes that rustled the leaves, and presumably caused more caterpillars to fall to the ground. Swallowing sometimes was prolonged, presumably because the prey was small (ca. 0.025 g, 16 × 2 mm). At times, when debris was picked up along with a caterpillar, the egrets gave brief, rapid lateral head shakes.

On 21 and 23 June we recorded the activities of egrets beneath the Sea Grape tree around midday. We watched the egrets with

binoculars from distances of 10-15 m. Hunger probably overcame their normal wariness and allowed such close approach. Observations from greater distances and from a blind indicated our nearness did not affect the behavior of the egrets. We watched two to four birds simultaneously for 10-minute intervals, recording all feedings and all chases, whether aggressions or retreats, and a few rarer activities such as resting and fighting. Only rarely did a bird leave the area beneath the tree during the observation period. Our observations totaled 300 bird-minutes.

Aggressive encounters were frequent. During the 300 bird-minutes we recorded 190 chases and 241 retreats. Supplanting runs, which are described by Blaker (1969), rarely required more than a few steps in order to force retreat of another bird. Almost always the bird initiating an aggression dominated the individual it pursued. Sometimes harsh squawks were given by one or both birds, especially when the aggressor grabbed the tail of the retreating bird. Occasionally target birds of supplanting runs faced their aggressors and brief fights resulted. The two birds would grab with their toes and peck, often as they fluttered upward. A few dominant egrets successfully defended small areas (ca 5 m<sup>2</sup>); however, because the birds were not marked we were unable to study possible relationships between dominance and territory. For nonterritorial birds, inter-individual distance was about 1.5 m.

## RESULTS

### *Aggression and Feeding*

Probably the high level of aggression we observed among the Cattle Egrets represented competition for the limited and concentrated food resource. This interpretation is supported by the fact that supplanting runs, which usually occur during competition for a single food item (Blaker, 1969), were common under the Sea Grape tree but rare elsewhere on the island.

During the 30 ten-minute watches of about 15 different Cattle Egrets, we recorded all instances of aggression, defined as the supplanting of another egret, and feeding, defined as the swallowing of a caterpillar, and the data plotted in Figure 1 show a positive significant correlation ( $r = 0.637$ ;  $r \neq 0$  at .01 level,  $t$ -test) between frequencies of aggression and feeding. Mere presence under the tree usually meant that an egret captured some prey, and a few subordinate egrets persisted by avoiding the dominant birds. Even though they rarely showed aggression, these birds were able to feed occasionally, and thus weakened the correlation.

### *Plumage and Dominance*

Cattle Egret plumage is either all white or white with patches of pale orange-buff on the forehead, lower foreneck, and mantle. The three buffy regions bear elongated plumes in the definitive plumage (Palmer, 1962). For our observations, we divided individuals into three plumage classes: white, buff, and plumed. On close examination, birds classed as white often had obscure

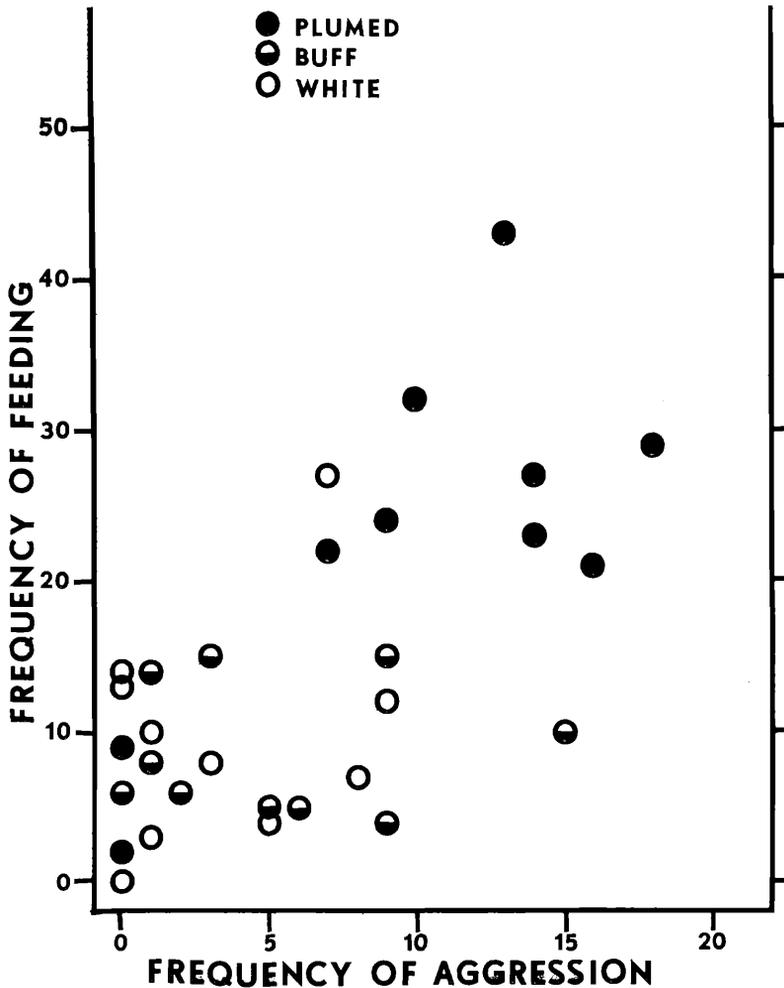


FIGURE 1. Frequency of feeding versus aggression during 30 ten-minute watches of Cattle Egrets at Dry Tortugas, Florida. See text for definitions of color patterns.

patches of pale buff on the forehead and foreneck. Buff birds had conspicuous buff patches, in all three regions, but lacked the plumes that distinguished plumed individuals.

Plumage characteristics of Cattle Egrets relate to age and breeding condition but not to sex. However, plumage varies too much to indicate either age or breeding condition reliably (Palmer, 1962), as was borne out by the 18 fresh dead specimens we examined, which included both males and females among our three designated plumage classes. None of the 18 dead had greatly enlarged gonads, and we noted no molt. Thus the reproductive

status of the birds we studied at Dry Tortugas, where the species has never bred, was not determined. Dispersal or migration by pre-, post-, or non-breeders are all possibilities.

On 20 June, during 18 consecutive minutes, we recorded all encounters (102) among 20 egrets assembled beneath the tree, namely 10 plumed birds, 5 buffs and 5 whites (Table 1). We tested for departure from random frequencies for both aggression and submission with a Chi-square test that takes into account the effect of different numbers of individuals in the designated classes (Hailman, 1975), and for both aggression and submission the differences between observed and expected frequencies are highly significant ( $\chi^2 = 45.8$ ,  $\chi^2 = 24.6$ , respectively,  $P < .005$ , d.f. = 2). Plumed individuals dominated both buff and white more than twice as often as predicted, but they almost never were dominated except

TABLE 1.  
Dominance and plumage classes in Cattle Egrets.

Dominants	Subordinates			Totals
	Plumed 10	Buff 5	White 5	
Plumed 10 <sup>1</sup>	24 <sup>2</sup> (25.5)	33 (12.75)	28 (12.75)	85 (51)
Buff 5	0 (12.75)	3 (6.5)	3 (6.5)	6 (25.5)
White 5	2 (12.75)	1 (6.5)	8 (6.5)	11 (25.5)
Totals	26 (51)	37 (25.5)	39 (25.5)	102

<sup>1</sup>Numbers following the three plumage classes represent number of individuals present.

<sup>2</sup>Numbers outside parenthesis represent the observed, those within the expected.

by other plumed birds. Interactions were too few between buff and white birds to conclude whether one of these plumage classes selectively dominated the other. The frequencies of within-plumage class interactions are close to the expected number. Additional evidence of the relatively greater aggressiveness of plumed Cattle Egrets is their position in Figure 1. In this independent set of data, numbers of individuals belonging to each class are equal, and 8 of the 14 most aggressive birds were plumed.

#### *Plumage and mortality*

Daily from 18 to 25 June we collected all freshly dead Cattle Egrets from the parade ground, and recorded their plumage class and weights as follows: 6 plumed (177, 194, 197, 202, 205, and 238 g), 5 buff (152, 175, 179, 181, and 193 g), and 7 white (170, 172, 176, 178, 178, 179, and 188 g). Weights of Cattle Egrets usually average almost twice as heavy, about 350 g. For example, Palmer (1962) cites seven specimens that weighed 300-400 g;

another seven in the University of South Florida collections, taken from mainland Florida, average 338 g (233-432). Siegfried (1972), who studied Cattle Egret nestling growth in South Africa, showed weights leveling off at about 360 g., the approximate weight of adults.

Four daily counts of all Cattle Egrets beneath the Sea Grape tree, two of all egrets within the Fort, including those beneath the tree, and the 18 dead birds, produced the following plumage-class percentages:

	Plumed	Buff	White
Tree	59%	18	23
Fort	40	20	40
Dead	33	28	39

Comparison of these counts suggests a disproportionately large percentage of plumed birds stationed themselves beneath the tree at the concentrated food source. The four counts of all egrets beneath the tree revealed that plumage-class composition varied little here. For our two counts of all egrets within the Fort, the plumage-class ratios fluctuated widely. On 23 June we counted 15 plumed, 14 buff, and 15 white birds, on 24 June, 23 plumed, 5 buff, and 23 white. However, on both dates proportionately more plumed birds were counted under the tree than elsewhere within the Fort. The 18 dead Cattle Egrets include only 33% plumed, a lower percentage than that observed for all egrets within the fort on either day and especially lower than the percentage for the egrets beneath the tree. These data suggest that plumed egrets were more successful at holding space at the concentrated food source, fed more frequently and, thus, despite energy expended in aggression, suffered less mortality from starvation.

#### CONCLUSIONS

Under the conditions described for Fort Jefferson, Dry Tortugas in June 1975, the aggression of starving Cattle Egrets correlated positively with feeding frequency and with possession of plumed feathers. Furthermore the plumage-class distribution of all freshly dead egrets, when compared with all egrets within the Fort and those under the Sea Grape tree, suggests fewer of the dominant plumed egrets starved than did the subordinate nonplumed birds. Thus under the extreme stress of starvation, aggressiveness of Cattle Egrets seemed to enhance survival.

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