

Feeding.—The cormorants caught fish after a direct chase in which no special tactics were used. The neck was held in a slight S-shape, allowing maneuvering of the head when grabbing the prey. In all cases, the cormorant took the fish to the surface and swallowed it headfirst. If prey was not visible, the bird would cruise along the bottom, investigating hiding places such as drain holes.

Drying.—On leaving the water, the bird flapped its wings periodically for about 10 min. As drying took place, actual flapping became less frequent and the wings were gently waved in a characteristic outspread position. Body-shaking, head-shaking, head-flicking, and tail-wagging were regularly noted at this time (terminology from McKinney, Behaviour 25:120–220, 1965). Shivering was occasionally observed.

Preening.—Preening began once the concerted flapping had subsided. This behavior, which could last as long as 30 min, was usually associated with the drying procedure; the water would understandably cause feather matting. Completely dry birds preened less and with reduced intensity.

The neck and breast were invariably preened first. The neck was held erect and beak inserted down into the lower neck feathers, which were pushed, nibbled, and finally stroked into place. The bird worked in the same way down the breast, belly, and sides, often dislodging much down. Following this, the bird reached along the underside of its wings to stroke the individual primaries and secondaries, although all were not treated in a given session. The head was next twisted around to reach the back, the feathers of which were preened in a similar manner to those of the breast. The rectrices were treated like the wing feathers. Preening at the base of the tail often involved its deflection to one side, possibly associated with release of oil from the uropygial gland. There was apparently no widespread distribution of oil during any given preening bout. After this procedure, the cormorant rubbed its head over its back and under its wings. Although the various sections of the body were initially treated in this order, some areas were preened several times. Body-shaking then ensued, followed by a slow settling of the feathers into place.

Scratching.—The neck was lowered and stretched to one side and the nearest foot brought up to scratch the ear area. This behavior was not necessarily associated with preening.

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Adaptiveness of foraging in the Cattle Egret.—Heatwole (Anim. Behav. 13:79–83, 1965) and Dinsmore (Am. Midl. Nat. 89:242–246, 1973) have shown that Cattle Egrets (*Bulbulcus ibis*) feeding in close association with cattle catch insect prey at a significantly higher rate and expend less energy than do those foraging alone. The purpose of this study is to confirm their results and to evaluate the adaptiveness of the Cattle Egrets' site tenacity about a cow's head and muzzle, and their defense of cows against conspecifics.

Observations were made of egrets foraging with black angus cattle over a Bermuda

TABLE I
FORAGING EFFICIENCIES OF CATTLE EGRETS FORAGING WITH A COW, WHILE
SHARING A COW WITH ONE OTHER EGRET, AND ALONE

	With cow	Sharing cow	Alone
Minutes watched	225	185	145
Captures	462	147	84
Steps	6336	6467	6425
Steps/minute	28.2	34.0	44.3
Steps/capture	13.7	44.0	76.5
Captures/minute	2.0	0.8	0.6
Efficiency ratio	6.8	55.0	127.5

grass pasture at the north end of St. Catherine's Island, off the coast of Georgia from 07:00-10:00 and 17:00-20:00 during August 1974. Grasshoppers (Orthoptera), the dominant component in the diet of Cattle Egrets in neighboring northern Florida (Jenni, Auk 90:821-826, 1973), were abundant in the pasture.

The Cattle Egrets always jerked back the head characteristically when swallowing prey. I tallied number of head-jerk swallows and number of steps per unit time as measures of energy intake and energy expenditure, respectively. Cattle Egrets fed away from cattle, fed solitarily within 2 m of a cow, or shared a cow. The feeding sites within 2 m of a cow were scored according to whether the egret's eyes were in front of the cow's shoulders, between the shoulders and the hips, or behind the hips. Because an egret foraging near a cow often attacked a conspecific joining it, I recorded the events which followed within 5 min of an egret's arrival within 2 m of a cow already attended by another bird.

Analyses were performed with the distribution-free Kruskal-Wallis test with Dunn's multiple comparison (Hollander and Wolfe, Nonparametric Statistical Methods, John Wiley, N. Y., 1973) and were confined to the activities of birds in adult (nuptial) plumage, but of unknown sex.

Egrets within 2 m of a cow almost never foraged for 5 consecutive min in just one zone (near head, side, or rear of cow). Because the egrets often made short quick dashes into another zone after an insect, and then returned to their original zone, the time intervals were short and variable. Ninety-nine egrets foraging alone with a cow foraged mostly about the head (79%), second most frequently along the cow's side (17%), and considerably less often about the rear (3%). Captures/minute were 2.0 for egrets feeding near the head (121.7 min), 0.7 for egrets feeding along the side (38.4 min), and 0.4 for those feeding near the rear (20.8 min). Thus, birds foraged most often in the most productive region about cows.

Twenty-two of 38 egrets (58%) flying to join another egret near a cow were driven off by the resident rather quickly ($\bar{x} = 7.8 \pm 4.6$ sec). Twelve arrivals (32%) left the cow within 5 min (mean = 86.5 ± 23.7 sec). The resident left once and was driven off by the arrival once in 2 of the 38 cases (32 and 8 sec, respectively). In only 2 instances were both egrets still foraging within 2 m of the same cow 5 min later.

TABLE 2

KRUSKAL-WALLIS TESTS WITH DUNN'S MULTIPLE COMPARISONS FOR CATTLE EGRETS FORAGING WITH A COW, WHILE SHARING A COW WITH ONE OTHER EGRET, AND ALONE

	Comparisons	N	P
Steps/minute	With cow: sharing cow	82	.62
	With cow: alone	74	<.001
	Sharing cow: alone	66	.002
Captures/minute	With cow: sharing cow	82	<.001
	With cow: alone	74	<.001
	Sharing cow: alone	66	.63
Efficiency ratio	With cow: sharing cow	78	<.001
	With cow: alone	67	<.001
	Sharing cow: alone	59	.49

During 5-min observation periods, birds with exclusive access to a cow took fewer steps and caught significantly more prey per minute than did those sharing a cow (Tables 1 and 2). Egrets with exclusive "rights" to a cow had significantly better foraging efficiencies (steps/capture divided by captures/minute; Dinsmore, *op. cit.*) and caught slightly more prey per minute than did those foraging away from cattle, than did those sharing a cow. Clearly it is adaptive for an egret to defend its exclusive use of a cow. Those egrets sharing cows took significantly fewer steps resulting in a superior foraging efficiency, though not significantly so.

Neither Heatwole (*op. cit.*) nor Dinsmore (*op. cit.*) mentions egrets defending cattle, but the cattle-per-egret ratios between their study areas (as many as 5 egrets per cow) and mine (mean = 2.4 ± 1.2 cows/egret, $n = 12$) were quite different. It is also clear that it pays an egret to share a cow rather than forage away from cattle completely. Apparently the tendency to defend a cow is weak and easily swamped by large influxes of egrets.

The function of aggression shown by these egrets appears uncommon. They were defending the space around another animal as the means to an end. A possibly similar case is the aggression of antbirds (Formicariidae) around army ant columns (Willis, *Auk* 85:253-264, 1968; Hilty, *Wilson Bull.* 86:479-481, 1974).

I assume that the egrets were defending the vicinity of cattle, but they could have been defending a critical individual distance (*sensu* Hediger, *Wildtiere in Gefangenschaft*, 1942, English ed. *Wild Animals in Captivity*, Butterworth, London, 1950). The latter interpretation is unlikely because many times the egrets fed peacefully less than a meter apart when away from cattle. Bird species dependent on food clumped in small discontinuous packets tend to be solitary, while those dependent on food evenly distributed tend toward group-dwelling (Crook, *Symp. Zool. Soc. Lond.* 14:181-

218, 1965). If differential prey vulnerability is analogous to differential prey abundance, the Cattle Egret behavior conforms nicely to Crook's model. When prey is highly vulnerable locally (around cattle) a solitary (antisocial) system emerges from the group feeding socially in the absence of cattle on homogeneously vulnerable prey.

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Wood Duck incubates eggless clutch.—While checking Wood Duck (*Aix sponsa*) nest boxes on the Great Meadows National Wildlife Refuge (Concord, Massachusetts) on 21 May 1970, we found a box in which down was mixed in with the box shavings but no eggs were present. Normally down is not added to a Wood Duck clutch until 5 or more eggs are laid. The box was rechecked on 28 May and a large depression was noted in the down and shavings mixture. On 4 June, the condition was the same except that duck fecal matter was present in the box. There was no further use of the box that year.

On 21 May 1971, the same box was again discovered to have a mixture of down and shavings but no eggs. When checked 3 June, a hen was incubating. The hen was left undisturbed until 22 June when it was captured on the nest. There were no eggs in the box but there was a large quantity of down. The hen had been previously trapped and banded as an immature female at Great Meadows in September 1966. The bird was returned to the box and not checked again that year.

On 28 April 1972, the same box was found to contain a large amount of down but no eggs. It was in the same condition 1 May when we added 4 hollow plastic eggs. On 6 May, there was no evidence of change and the plastic eggs were replaced with 7 Wood Duck eggs gathered from an abandoned nest.

By 9 May a hen was observed incubating in the box. The hen was captured 17 May and proved to be the same hen handled in 1971. She had not added any eggs to the clutch. The 7 eggs were replaced with 14 fresh game-farm Wood Duck eggs. The hen was returned to the box and left undisturbed until 8 June when the eggs were checked for signs of hatch. Thirteen of the eggs hatched 12 June and 10 ducklings were web-tagged.

One of the web-tagged ducklings was captured later that summer indicating at least partial brood survival. The hen was not found in later years.

We do not know the reason for this hen's peculiar behavior. Dane (Reproductive Endocrinology—Discussion: 195, *in* Breeding Biology of Birds, D. S. Farner, ed., Natl. Acad. Sci., Wash. D. C., 1973) suggests that among indeterminate layers, some stimulus such as number of eggs or surface area of eggs leads to specific clutch size. Welty (The Life of Birds, W. B. Saunders Co., Philadelphia, 1962) adds that the feel of enough eggs against the bird's belly may stimulate the pituitary gland to suppress ovulation and initiate incubation behavior. In the case of this hen, however, no eggs were present to cause such stimulation. Other factors must have initiated the in-