

ECOLOGICAL FACTORS CONTRIBUTING TO NESTING FAILURE IN A HERON COLONY

JULIAN L. DUSI AND ROSEMARY T. DUSI

THE nesting failure in a heron colony because of predation, interaction between species, and drought, is reported here. The colony, which is one of several studied by the writers, was located about 15 miles southeast of Dothan, Houston County, Alabama. It was a large composite colony for the years 1963 and 1964, during which we observed it. The land manager, I. B. Bodiford, said that it was a thriving colony as long as he could remember. The Little Blue Heron (*Florida caerulea*); the Cattle Egret (*Bubulcus ibis*); and the White Ibis (*Eudocimus albus*), were the major species, and the Snowy Egret (*Leucophoyx thula*); the Common Egret (*Casmerodius albus*); and the Anhinga (*Anhinga anhinga*), were the minor species present.

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PROCEDURE

During the winter, 1964–1965, the 14-acre swamp colony area was subdivided into quadrats 200 feet square, to facilitate nesting success studies to be made. This is illustrated (Fig. 1) to show the areas used by the nesting birds.

After the nesting population arrived, several studies were made. Nests were tagged and nesting success data taken. Young were weighed and banded. Food pellets, regurgitated by the young, were saved for food habits studies. Ectoparasites, in the form of hippoboscids, were removed and saved. Behavioral observations were made and predation recorded. Finally, weather and other habitat observations were made and were supplemented by precipitation data supplied by Rufus O. Crosby, U.S. Weather Bureau Airport Station, Dannelly Field, Montgomery, Alabama.

RESULTS AND DISCUSSION

Nesting Activity.—The sequence of nesting and roosting activity for the colony in 1965 is given in Table 1.

Several species were present when the area was initially visited on 17 March but no nests were found until 29 April. After that, nests with young were present until 7 June, when nesting had stopped after a prolonged drought. Nests were again found on 17 July and were present in the colony until 31 July.

Predators affecting the nesting activities were seen in the form of five large gray rat snakes (*Elaphe obsoleta spiloides*), taken from and near

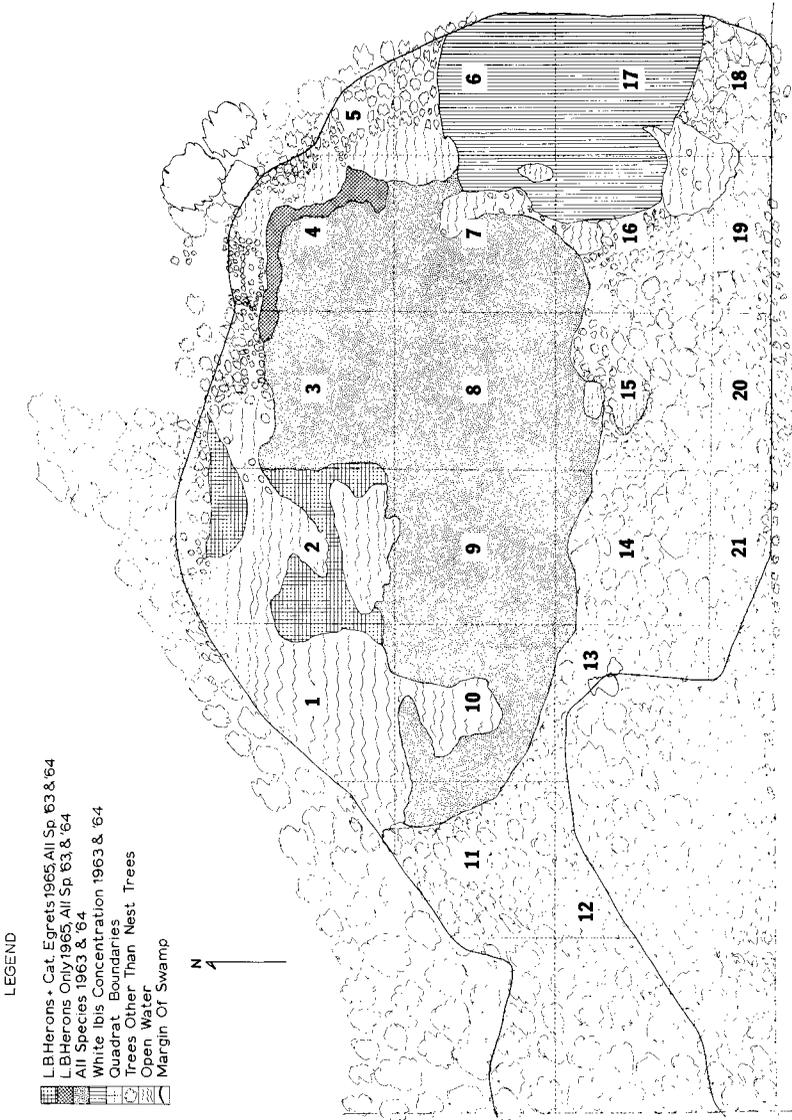


FIG. 1. The 14-acre swamp colony area. Quadrats are outlined and numbered. The area used for nesting during the three years and that portion used in 1965 is shown separated from the rest of the wooded area. The major trees of the nesting area are swamp tupelo (*Nyssa biflora*) and the common baldcypress (*Taxodium distichum*).

TABLE 1
SPECIES COMPOSITION AND ACTIVITY AT THE NESTING COLONY AREA

Date	Species composition					W.I.	Activity
	L.B.H.	Cat. E.	Com. E.	Sny. E.	Anh.		
17 Mar	250	16	2	2	1		Roosting
						42	Feeding
3 April	30	60				45	Roosting
29 April	47						Nests Marked
7 May	190	169				200	Roosting
	51	28					Nests Marked
8 May	16	10					Nests Marked
	22						Young Measured
7 June		17				19	Roosting
23 July	25	950				30	Roosting
24 July		40					Nests Marked
		10					Young Measured
	62	1157	2			97	Roosting
25 July		7					Young Measured
30 July	3	6					Young Measured
	8	59				30	Roosting

Abbreviations: Little Blue Heron (L.B.H.), Cattle Egret (Cat. E.), Common Egret (Com. E.), Snowy Egret (Sny. E.), Anhinga (Anh.), White Ibis (W.I.).

several empty Little Blue Heron nests on 14–16 May. Two more rat snakes were removed on 1 June and an additional one on 25 July. Barred Owl (*Strix varia*) vocalizations were heard in the afternoons through most of the nesting period. Fish Crows (*Corvus ossifragus*) were present in the general area throughout the study period and they nested in a pine grove at the periphery of the swamp.

During the week-end of 14–16 May we re-measured and permanently banded the nestlings in Quadrat 4. Several empty nests were found. In Quadrats 1 and 2 there was little Cattle Egret activity and many nests were empty.

We decided to check the general area for some explanation of the decline in population density, and on 21 May we rented a Cessna 172 at the Dothan Airport and flew over the corner of the state, southeast of Dothan, looking for other possible nesting colonies and counting groups of herons. A number of Cattle Egrets was seen feeding with cattle, no White Ibises were seen, and no other colonies were found. The rest of the day and 22 and 23 May were spent in the colony area, measuring and banding nestlings and checking nests. About 45 nests were active at this time. The lack of rainfall had resulted in the swamp water level being about one foot below normal.

The water level was even lower by the week-end of 30 May to 1 June. The number of active nests was further reduced. Two more large rat snakes were removed from nests and Barred Owl feathers were found in one empty nest.

By 7 June, population density was at a low. Only 17 adult Cattle Egrets and 19 White Ibises came in to roost that night. The remaining nestling Little Blue Herons were all too large to catch and measure. No rain had fallen in several weeks and the swamp was at a low for the season.

No further trips were made to the colony area until 17 July. Several rains had fallen and in order to see whether any renewed nesting activity had occurred, we again flew over the colony area. We saw a large number of white birds in the trees of Quadrats 1 and 2, where the earlier groups had nested. Even though we flew within 50 feet of the birds, they did not fly as most adults usually do, so we assumed that they were young unable to fly. We could not visit the colony area until 23 July. Then we were surprised to find that the birds in the trees were nesting adult Cattle Egrets. At dusk the roosting composition was an estimated 25 Little Blue Herons, 25-30 White Ibises and about 950 Cattle Egrets. The next day we marked 40 Cattle Egret nests in Quadrats 1 and 2 and measured 10 recently hatched young. It had been raining at Dothan that morning but did not rain near the colony area. The roosting population that night was 1,457 Cattle Egrets, 62 Little Blue Herons, 97 White Ibises, and 2 Common Egrets. Seven additional Cattle Egret nestlings were measured and marked on 25 July. A gray rat snake was taken from a nest. Three adjacent nests that were now empty had contained eggs the day before.

Finally, on 30 July, most of the nests were empty or the eggs present were punctured. We measured three Little Blue Heron nestlings and six Cattle Egrets. The evening flight was approximately 30 White Ibises, eight Little Blue Herons, and 59 Cattle Egrets. When we returned the following morning, a large flock of Fish Crows was in the colony area and left when we approached. On examination, all of the remaining nests were empty of nestlings and eggs. This was the final nesting attempt in this colony area in 1965.

Nesting Success.—During this nesting study, 117 Little Blue Heron and 214 Cattle Egret nests were marked and studied. No Common Egret, Snowy Egret, White Ibis or Anhinga nests were seen.

Of the 117 Little Blue Heron nests, 17 or 14.5 per cent contained young that matured and left the nests. An additional 16 nests contained young that hatched but perished. In the 17 successful nests, 73 eggs were laid, 65 of these hatched, and a total of 52 young was produced.

The 214 Cattle Egret nests were all unsuccessful.

Unfortunately, during the two preceding seasons no nests were marked but

they were concluded to be highly successful seasons because all of the species nested and in 1963, with partial effort, 30 Little Blue Heron and 283 Cattle Egret nestlings were banded, as well as 4 Common Egrets, and 5 White Ibises. In 1964, 326 Little Blue Herons, 413 Cattle Egrets, 24 Common Egrets, 10 Snowy Egrets, and 82 White Ibises were banded.

Predation Effects.—Predators present were: alligators, gray rat snakes, Barred Owls, Fish Crows, and man.

The alligators were important as predators only when the nestlings fell into the water so that their effect was as scavengers. They did, however, restrict the other predators from moving through the water to the nest trees.

The gray rat snakes travelled from tree to tree, passing over the alligators and reaching the nests. A total of eight gray rat snakes was taken from the nests. It is difficult to assign the amount of nest failure that these snakes caused. In the case of the snake taken 25 July, four nests that contained eggs the day before were empty and it was fairly certain that the rat snake had eaten the eggs. If all eight snakes caused just that amount of predation, 32 nests, or 10.2 per cent of the unsuccessful nests of Little Blue Herons would have been a result of their action. They could have caused much more or less nest failure and there could have been other rat snakes present that we did not find.

The pair of Barred Owls has been present in the swamp for the several years it had been studied by us. We had not considered the potential of the owls as predators until 1 June, when owl feathers were found in nests that had contained young. During their early nestling life, herons would be easy prey and an owl could quickly empty an entire nest. After the young reached the age of two weeks, they could climb well enough that an owl could probably catch only one individual from a nest at any visit. A pair of owls could account for a fairly large number of young during a nesting season. We found the first young of 1965 on 9 May, and they were present until 1 June. Then from 24 July until 30 July, young were again present. This totals at least 31 days when nestlings were present. If each owl of the pair removed only one nestling for each day they were available, it would total 62 nestlings. This may partially explain why the Little Blue Herons of 16 nests hatched young but they were not successful in rearing them and why in the successful nests, 65 nestlings were hatched but only 52 were reared. It might also account for Cattle Egret young that disappeared.

Predation by Fish Crows was high, from all apparent indices, but it was not measured. Almost synonymous with the appearance of eggs in the nests, eggs with punctured shells were found in the water near the nests, or still in the nests. The punctures were large and indicated crow damage. On 31 July, the damage to eggs and nestlings was very evidently crow predation. Large

numbers of Fish Crows have been present in the colony vicinity during the several years of our studies. During high heron population levels and periods of adequate nest protection, their predation effect has been minimal but the low population levels of 1965 and poor Cattle Egret nest attention, made it possible for the crows to be important predators.

Man did little predation at this colony. It was near the land manager's house and he kept people from shooting in the colony. Our presence may have had some undesirable effects but it was not predation.

Since nesting success had not been studied in previous years, it is difficult to compare the predation of this year with the others. It may have been at least as great in 1963 and 1964 but went unnoticed because there was such a sizable group of nesting birds. We did not find any snakes in previous years or find owl feathers in the nests. We therefore assume that the snake population had increased in numbers and that they exerted a much higher predation pressure.

Interaction between Little Blue Herons and Cattle Egrets.—There was apparently little interaction between the Little Blue Herons and Cattle Egrets except in nest establishment. The Little Blue Herons arrived first and established their nests first. The Little Blue Herons were incubating before the Cattle Egrets started nesting. The Egrets nested near the Little Blue Herons in the less favorable sites and often within a foot of a heron nest. There was a little strife observed during past seasons but no indication of nest desertion by Little Blue Herons. During the 1965 season, there was little strife observed in the form of threat postures and vocalizations during the first nesting attempt of the egrets. During the second nesting, the egrets swarmed into Quadrats 1 and 2, where a relatively small number of Little Blue Herons was still nesting. The nesting group seen from our reconnaissance flight of 17 July was fairly large (50–100), but the roosting group of 23 July was about 950 and on 24 July was 1,457. The nesting group apparently disturbed the Little Blue Herons somewhat but the added roosting mass caused practically all of the Little Blue Herons in that area to desert. In two instances, we found an egret egg in a heron nest and feel certain that the rapid establishment of some egret nests resulted from the taking over of heron nests, or at least the removal of sticks from heron nests for use in building egret nests.

Precipitation Effects.—Apparently precipitation has different effects on the different species which normally nest in this colony area, but most notably the Cattle Egrets and White Ibises. Bent (1926) stated that the Scarlet Ibis (*Eudocimus ruber*) nests in the rainy season. We believe that this is also the case with the White Ibis. We have not seen this stated in the literature regarding the Cattle Egret but is it a simple deduction, that if Cattle Egrets

TABLE 2
RAINFALL FREQUENCY NECESSARY TO PREVENT DROUGHT IN THE COLONY AREA

	May	June	July	August
Moisture holding capacity per foot of Norfolk Sandy Loam (inches)	1.2	1.2	1.2	1.2
Evapotranspiration rate (In./day)	0.142	0.173	0.154	0.141
Frequency which 1.2 inches of rain must fall to prevent drought (days)	8.4	6.9	7.8	8.5

obtain their food mainly from pasture insects and if pasture grasses wither and die if moisture is insufficient and no longer support the food population of insects, then Cattle Egret nutrition will be insufficient for reproduction physiological activities and the reproduction behavior ceases. Quite frequently the egrets also move from the drought areas to more lush pastures.

The colony area studied is in a belt which has received 56 to 58 inches of rainfall per year, based on 45 years of data from the U.S. Weather Bureau (Anonymous, 1965). The precipitation is not even and it is not unusual to have a two or three week period without rain during the nesting season. The soils surrounding the swamp are Norfolk sandy loam and related coastal plains soils that have a moisture holding capacity of about 1.0 to 1.2 inches per foot (Ward, 1959). Also, according to Ward, the major root occupancy zone of pasture plants is 0 to 8 inches. If we use his evapotranspiration data for the nesting months and then compute the number of days without rain during which a foot of Norfolk sandy loam with 1.2 inches of water holding capacity will supply moisture to pasture grasses, we see how frequently it must rain if pastures are to continue growth and supply Cattle Egrets with food (Table 1). In Figure 2, we have plotted the daily rainfall data for the Dothan weather station for the period 1 April, through 15 August, for the two good nesting years, 1963 and 1964 and the year of nesting failures, 1965. Then we added the evapotranspiration rate line, the computed days when drought conditions were present and finally the two nesting periods for Cattle Egrets in 1965. The Dothan airport weather station was the nearest station where complete records were available and it unfortunately was 23 miles northwest of the colony area. Our weather observations of presence or absence of rain were used to modify the 1965 data.

From Figure 2, it is readily seen that drought conditions existed each of these three years.

In 1963, only five drought days occurred after 10 May, and the Cattle Egrets and White Ibises had a long nesting season. Summerour (1964) observed Cattle Egret nests with young as late as 10 August.

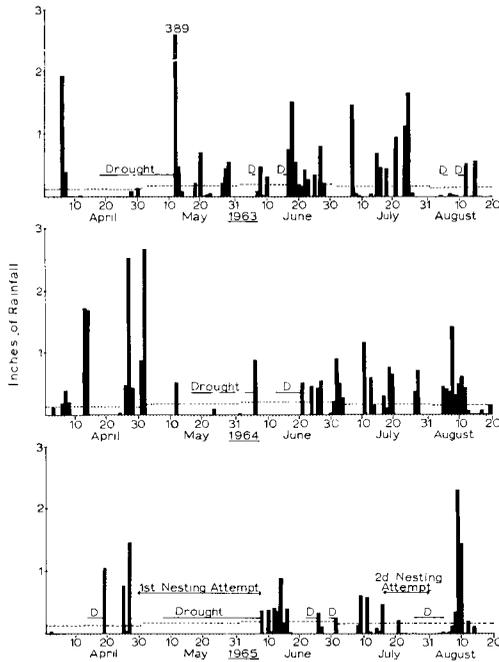


Fig. 2. The rainfall, evapotranspiration, drought periods, and nesting periods for the swamp colony area during the nesting periods of 1963, 1964, and 1965.

In 1964 drought was fairly continuous from 16 May to 19 June. This season it was quite wet until early May, and Little Blue Herons, White Ibises, and Cattle Egrets were nesting in large numbers by the start of the drought. Since most of the clutches were laid by the beginning of the drought period and with the important facilitation effects of the other species nesting in large numbers, the Cattle Egrets apparently retained their active nesting behavior. After 20 June, there was an abundance of rain, pastures regained their lushness and Cattle Egret and White Ibis nesting continued on into August. On 1 August, we counted more than 50 Cattle Egret nests with eggs and 30 nests with small young.

The 1965 season started with so much drought in April and May, that the White Ibises did not nest, even though a group roosted in the area. A much smaller group of Little Blue Herons nested than during the preceding two years. The Cattle Egrets started their first nesting period at the beginning of a long dry period. Actually no rain fell in the immediate colony area from 27 April until 8 June. With little facilitation from other nesting waders, little to eat, and with higher than usual predation pressure, they deserted.

The break in drought, in mid-June and early July, apparently incited nesting activity again and we first saw the nesting group on our 17 July flight. That was the start of another dry period and the slight rain of 20 July, delayed drought conditions only a few days. Very few other herons were nesting. The Little Blue Herons had deserted because of the interspecific strife from so many roosting Cattle Egrets. Therefore, there was no nesting facilitation from other herons or ibises. When the drought conditions again prevailed, nest attention lagged and the Fish Crows took care of what eggs and young remained.

SUMMARY

The nesting failures of the heron colony reported here, resulted from a number of interacting and contributing factors.

The very low nesting success of Little Blue Herons (14.5 per cent) appears to have been the result of a high predation pressure from gray rat snakes, Barred Owls, and Fish Crows. The interspecific pressure of a large number of roosting and nesting Cattle Egrets in mid-July caused a number of Little Blue Herons to desert, contributing further to the low degree of nesting success.

The White Ibises apparently did not nest because of the extensive drought in late April, May, and early June, that then continued in mid-July.

The Cattle Egrets were completely unsuccessful in their two nesting attempts because the long early drought and the late drought reduced the amount of food available. The apparently heavy predation pressure, especially from Fish Crows, and the lack of breeding behavior facilitation, caused by too few other nesting wading birds present in the colony area, resulted in many desertions and completed the factors resulting in complete failure.

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DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY, AUBURN UNIVERSITY, AUBURN,
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