

MORTALITY OF TRANSIENT CATTLE EGRETS AT DRY TORTUGAS, FLORIDA

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In a recent paper Browder (1973) presented evidence suggesting that Cattle Egrets (*Bubulcus ibis*) pass through the isles of the Dry Tortugas in the Gulf of Mexico with seasonal regularity. She further stated that large numbers die after landing, especially in the spring, but provided no quantified observations. As a part of her presentation Browder posed two questions, here paraphrased:

Why to Cattle Egrets land at the Dry Tortugas?

Do Cattle Egrets die at the Tortugas because they are exhausted upon arrival or because they starve after arriving?

Because Browder provided no numbers of birds that stop at the Dry Tortugas, nor any estimates of the numbers that may die there, the purpose of this report is to present such data and to reconsider some of the questions that she posed.

METHODS AND RESULTS

Dinsmore arrived at the Dry Tortugas on 29 March 1968; only one Cattle Egret was present. He remained there until 10 July and counted living and dead Cattle Egrets on Bush and Garden keys on all except two days. From 27 March to 7 June 1970 Harrington lived on Garden Key. He counted dead egrets each day, and made several daily counts of foraging birds in the "Parade Grounds" of Fort Jefferson on all but nine days. He also made frequent counts of foraging egrets on nearby Bush Key and four additional counts on Loggerhead Key. These latter counts showed that only a few egrets used Loggerhead Key. Because of this, and because vantage points on top of Fort Jefferson allow counts of this conspicuous white bird on both Garden and Bush keys, we consider that the counts from Bush and Garden keys accurately reflect the numbers present in the atoll.

Figure 1 presents the highest daily counts of living and dead Cattle Egrets made on Bush and Garden keys in spring 1968 and 1970. Only seven of the dead egrets found in 1968 were on Bush Key, and all of those found in 1970 were on Garden Key. The arrival and departure patterns in 1968 were similar to those in comparable periods in 1970 (Fig. 1). Table 1 presents counts of all Cattle Egrets seen arriving at or departing from the atoll.

For analyses the counts are divided into four quarters A-D. The number of Cattle Egrets estimated to have arrived at the atoll and the number dying during each quarter is given in Table 2.

- A. 27 March-24 April. This quarter is characterized by rapid increases and decreases of the population and occasional deaths. Virtually all birds foraged on Garden Key during the day and roosted on Bush Key at night. On most days the population was less than 20 birds.

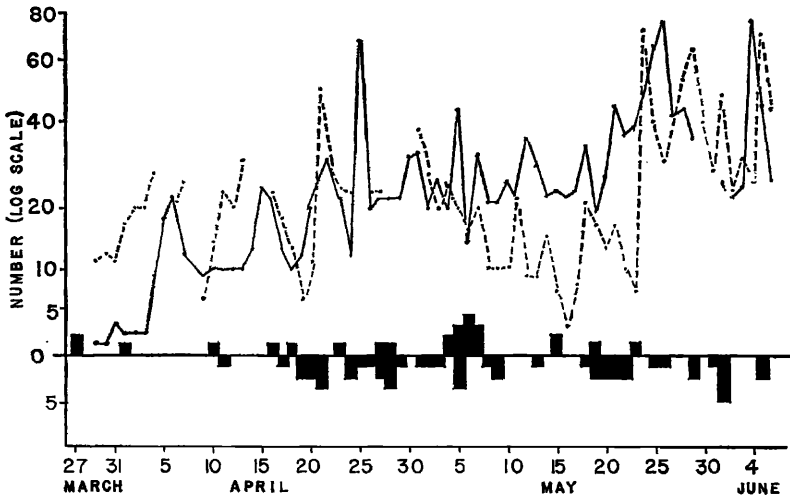


FIGURE 1. Counts of living and dead Cattle Egrets at the Dry Tortugas, Florida. Solid lines are 1968 counts, dotted lines are 1970 counts. Gaps occur in lines on days when no count was made. Bars below the zero line are counts of dead birds in 1968, those above are counts in 1970.

- B. 25 April-16 May. This quarter is characterized by relatively stable numbers of egrets in 1968 and gradually decreasing numbers in 1970. During this period most egrets foraged on Garden Key.
- C. 17 May-6 June. In this quarter numbers of egrets fluctuated rapidly with more than 20 birds present on most days. Most foraging was on Bush Key.

TABLE 1.
Sightings of Cattle Egrets arriving at or departing from the Dry Tortugas,
27 March - 7 June 1970.

Date	Arrivals			Departures			
	Time	No.	Direction of flight	Date	Time	No.	Direction of flight
30 Mar.	16:35	1	N				
10 April	13:25	6	?				
11 April	14:20	8	E	11 April	15:30	29	ENE
				20 April	15:00	27	E
				24 April	15:30	4	E
4 May	15:35	9	E	4 May	09:55	7	E
	18:50	3	NE		10:55	4	E
					15:35	4	E

TABLE 2.
Cattle Egret mortality on the Dry Tortugas in 1968 and 1970, based on the number of birds estimated to have arrived at the atoll.

Quarter	No. estimated to have arrived at the atoll		Number found dead		Percent dead	
	1968	1970	1968	1970	1968	1970
A	58	98	12	7	20.7	7.1
B	127	39	18	16	14.2	41.0
C	126	191	20	2	15.9	1.0
D	58	—	29	—	50.0	—
	369	328	79	25	21.4	7.6

D. 7 June-10 July. This quarter, censused only in 1968, is characterized by a gradual decline in the population with few new birds arriving, and high mortality of those that remained on the atoll. Again, most egrets continued to forage on Bush Key.

During periods A and B, when most foraging was on Garden Key, small insects were the major prey. However, as other observers have noted before (e.g. Fogarty and Hetrick, 1973), some egrets captured and ate small birds, especially after waves of migrants landed on the islands. In 1970 Harrington saw egrets catch and eat with difficulty three weak Barn Swallows (*Hirundo rustica*), a Black-throated Blue Warbler (*Dendroica caerulescens*), a Blackpoll Warbler (*D. striata*), an unidentified waterthrush (*Seiurus* sp.), and a Red-eyed Vireo (*Vireo olivaceus*).

During period C most foraging Cattle Egrets moved from Garden to Bush Key where in 1970 (but not in 1968) they caught and ate recently-hatched Sooty Terns (*Sterna fuscata*). Catches were made most frequently when two Cattle Egrets walked slowly near adult terns brooding chicks. When an adult tern made an aggressive lunge at one egret, the second would catch and devour the unattended chick. At no time did we see Cattle Egrets eat tern eggs as they do in the Seychelles (Ridley and Percy, 1958), but we did see them eat dead fish dropped to the ground by adult Sooty Terns feeding their young (Dinsmore, 1972).

As already noted, during periods A and B most Cattle Egrets at the Dry Tortugas foraged on lawns of the Parade Grounds of Fort Jefferson. Here Harrington saw small insects captured at rates as high as 3/min by single and usually widely spaced egrets, but he saw no evidence of "cooperative" foraging. Beginning about 10 May, almost a week after the first Sooty Tern eggs hatched on Bush Key, some egrets remained on Bush Key during the day instead of commuting to Garden Key. By 15 May, when

many Sooty Tern eggs were hatching, more than one-half of the egrets remained on Bush Key each day.

Based on the emaciated condition of dead and dying Cattle Egrets, we agree with Browder (1973) that the major cause of Cattle Egret mortality at the Dry Tortugas is starvation. We find it difficult to determine precisely the percent mortality because it is difficult to determine exactly how many birds used the atoll during this study. We have estimated this number by tallying increases of five or more birds in the peaks in Figure 1. By this method we estimate that 311 and 328 egrets arrived in the Tortugas between 27 March and 6 June 1968 and 1970, respectively (Table 2). As a check on these figures we similarly estimated the numbers of birds that departed from the atoll, and added to these the number we found dead. By this method we estimate that 341 and 308 egrets used the atoll in the same periods as above. These two sets of estimates are in reasonable agreement. Using the first figures, and the numbers of birds found dead, we estimate that the mortality between 27 March and 6 June in 1968 was about 16% and that during the same period in 1970 it was about 7%; the differences between the mortality figures in the two years are statistically significant ($\chi^2 = 9.72$, $P < .01$).

Not only did the mortality vary from year to year, but it also varied from period to period within each year (Table 2). In 1968 mortality during periods A, B, and C was relatively constant at about 16%, but during period D it was significantly higher (50%) ($\chi^2 = 26.26$, $P < .001$). In 1970 mortality fluctuated considerably—very high in period B but significantly lower during periods A and C (Table 2).

The mortality values calculated above are doubtless too high because many Cattle Egrets likely arrived on the same day as others departed, thereby deflating the estimates of actual numbers of birds that arrived and departed (e.g. see 4 May in Table 1). Therefore we have also calculated the mortality by a different method whereby the number of birds arriving in the atoll is considered to be the total of highest daily counts. By this method, and still using the numbers of birds found dead as the number that died, the mortality figures are 2.9% (79/2727) in 1968 and 1.8% (25/1415) in 1970. Doubtless these figures are too low because many birds remained for more than one day. However, on the basis of the two methods used above, it is reasonable to believe that the mortality values of Cattle Egrets stopping at the Dry Tortugas during this study were between the two estimates for each of the years.

A word of caution in interpreting the above mortality estimates is necessary. We have made our calculations based on counts of birds that remained in the atoll long enough to be counted, in some cases more than 24 hours. The figures do not necessarily represent the mortality of egrets crossing the Gulf of Mexico, for we also know that some unknown number pass the Tortugas without stopping. For example, on three occasions in 1970 Harrington saw flocks appear west of the Dry Tortugas and continue an eastward flight without stopping. We saw other flocks land and sit quietly

in groups separate from local foragers, and then leave within a few minutes, or in some cases a few hours. Additional flocks probably behaved similarly but were not seen.

DISCUSSION

The movement of Cattle Egrets through the Dry Tortugas in spring is a regular event, but does not seem to have some of the characteristics that typify migration of many of the landbird species also appearing on the same islands. Whereas landbirds appear regularly each year, they typically appear most abundantly on occasions when weather systems have apparently displaced them from more normal routes somewhere west of the Dry Tortugas (e.g. Robertson, 1968). The movement of egrets through the Tortugas is not as sporadic, nor as restricted in dates as the movement of most landbird species. Our counts show that less than 30 egrets are usually present from late March to the third week in April, and again after the third week in June. The major movements (Fig. 1) occur most frequently, and with the greatest numbers of birds, between the third week in April and the second week in June, dates corresponding to the dates nesting heronries are colonized in south Florida (April through July according to Browder, 1973). Virtually all of the egret flocks we have seen arriving at the Tortugas were in the afternoon and were coming from the west or southwest. Spring movement away from the atoll is almost always toward the east.

The times of arrival, the apparent weakness of some birds, and the direction of flight all suggest that many of the egrets that stop at the Dry Tortugas may be arriving on a flight from Central America. The closest mainland there is the Yucatan Peninsula, about 550 km WSW of the Dry Tortugas. Given favorable winds, an egret could probably fly this distance within 15 hours, or in other words, if it departed at dawn it would arrive at the Dry Tortugas in mid- or late afternoon. An alternate source of egrets at Dry Tortugas might be birds from Cuba, about 175 km to the south. With proper wind conditions an egret could probably fly this distance in less than four hours. In either case egrets could probably reach the Florida Keys instead of the Dry Tortugas in two or three hours' additional flying time.

In summary, our observations of transient Cattle Egrets at the Dry Tortugas suggest a seasonal, goal-oriented migration. If correct, it is a migration involving unknown numbers of birds with some proportion stopping at the Dry Tortugas. Because of the recent expansion of this species' range in North America (Crosby, 1972), this migration has probably been learned or evolved during the past two decades and therefore may still be in experimental stages. Therefore, the variable and sometimes high mortality rates mentioned, but not quantified by Browder (1973) are of special interest.

We have presented estimates of Cattle Egret mortality for different periods during spring migration at Dry Tortugas. These show that mortality shows seasonal and annual variations. For example, in 1968 mortality was consistently higher than in 1970, and

was especially high from 10 June to 10 July. In 1970 mortality was highest from 24 April to 16 May (period B) but was otherwise relatively low, at least prior to 7 June. We have little information to explain the annual variation or seasonal mortality within a year. In 1970 Harrington felt that the low mortality during period C occurred because Cattle Egrets began using a new food resource, namely recently hatched Sooty Tern chicks on Bush Key. Although he did not systematically document the extent to which this resource was used, during one afternoon of casual observations he saw 17 recently hatched chicks captured and eaten by egrets. On the other hand, in 1968 Dinsmore, who spent many weeks watching the terns on Bush Key from a blind, never saw egrets eat tern chicks. Robertson (1964) does not mention tern chick mortality caused by Cattle Egrets. Possibly Cattle Egrets have learned to eat Sooty Tern chicks more extensively between 1968 and 1970, and this new food aided a decline of egret mortality in 1970.

Regardless of the reasons why Cattle Egret mortality is variable at different times in the Dry Tortugas, the important point as regards natural selection is that a high mortality occurs in what is probably an experimental stage of evolution or learning. The mortality for the brief time Cattle Egrets spend at the Dry Tortugas is high compared to the estimated annual mortality of 37% for first-year birds and 25% for older birds in South Africa (Siegfried, 1970). Browder (1973) questioned whether Cattle Egrets died at the Dry Tortugas because they were exhausted upon arrival or because the islands act as an "energy sink" for birds that arrived in healthy condition but lost weight continuously thereafter. These possibilities are not mutually exclusive. Because we were not working with marked birds, we do not know how long birds that died in the Tortugas had been present. However, our impression, occasionally bolstered by a distinctively marked individual, was that those which died had been present on the atoll more than four or five days, some perhaps for as long as two weeks. We analyzed our data from 1968 to look for a correlation of mortality values to the cumulative number of egrets counted for 3, 5, 7, 9, and 11 days earlier, but found no suggestion of a relationship. Neither did we find a correlation between mortality and peak counts on earlier dates.

Browder (1973) suggested that the wind patterns at the Dry Tortugas in spring are erratic, and that when travelling egrets encounter such weather changes, they might be forced to land on the islands, there to remain until the winds change. Although it is true that wind directions do change at the Dry Tortugas, our general impression is that their patterns are not erratic, and indeed that they are remarkably consistent by comparison to standards on the mainland farther north. For example, during the period of our observations in 1970 the weather records maintained by the United States Coast Guard on Loggerhead Key show that the wind direction was from the first quarter of the compass (0-90°) on 74% of the thrice daily records, from the second quarter (91-180°) in 23% of the records, and from the third quarter (181-270°) in 3% of the records, and there were no records from the fourth

quarter. Between 27 March and 7 June there were only eight days when the wind exceeded 10 knots and when the wind direction changed 60° or more. On seven of these days the egret counts were lower or unchanged from the previous day's count; on the 8th day there was no count from the preceding day. Therefore we find no pattern of high counts in 1970 occurring during periods of erratic winds, and what evidence is available is to the contrary. Indeed, we find no relationship of the counts in 1970 to wind direction, windspeed, rainfall, or sudden changes in any of these factors. The fact that most large peaks in Figure 1 are preceded by two or three days of gradually increasing counts also suggests that the factors causing Cattle Egrets to stop at Dry Tortugas are normally more than sudden weather changes. However, in 1968 Dinsmore's counts increased rather sharply following the passage of major storm fronts on 4-5 May and 2-3 June (Fig. 1).

We see little evidence, therefore, that the spring migration of Cattle Egrets through the Dry Tortugas in 1968 and 1970 was closely related to any particular weather conditions, or that the relatively high mortality was closely allied with weather conditions or to the numbers of egrets present. The daily counts show that many egrets stopping at the Tortugas remain there for only brief periods, and sightings of travelling birds showed that some do not stop at all. We believe, but cannot prove, that most of the mortality that occurred was in birds that remained at the islands for several days, during which time they slowly starved. Whether these birds were weaker when they arrived at the Tortugas than others that continued their eastward journey cannot be determined with currently available information. However, if this were the case, it would seem that those birds that learn to eat tern chicks, and that arrive when tern eggs are hatching, would have a better chance to recover the resources needed for a continued eastward flight.

SUMMARY

Counts of living and dead Cattle Egrets during two springs at Dry Tortugas, Florida show that a regular spring movement occurs with many egrets stopping at the islands. No obvious patterns of movement relative to weather were found. Many of the egrets that stopped in the Dry Tortugas died, apparently from starvation, especially in late June and in early July. The mortality in 1968 was higher than in 1970, and in both years mortality values varied significantly from period to period.

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