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THE STATUS OF HERON COLONIES IN THE INNER NIGER DELTA MALI

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INTRODUCTION

The Inner Niger Delta in Mali is well known for its importance for wintering palearctic migrants, particularly waterfowl (Roux 1973, Curry & Sayer 1979, Roux & Jarry 1984) but its importance for Afrotropical species has been neglected in the literature. The delta supports large populations of Ciconiiforme and Pelecaniforme birds which usually nest in colonies in flooded Acacia kirkii woodlands. Whilst some historical data on these populations are available (Lamarche 1980), elsewhere the importance of the delta for these birds has been ignored or misrepresented (Brown et al. 1982, Hancock & Kushlan 1984).

In this paper we present the results of a survey carried out in the breeding seasons of 1985-1986 and 1986-1987. Such a survey is timely as there is evidence that the amount of suitable breeding habitat in the delta is declining. The reasons for this decline include the degradation of the woodlands due to extensive dry season grazing by goats, and wholesale clearance of some woods to make way for rice cultivation. These problems have been exacerbated by the decline in the height of the annual flood of the River Niger. Since most of the species prefer to nest in flooded woodland (pers. ob., Brown et al. 1982) this decline has rendered otherwise healthy woodlands unavailable.

For general descriptions of the delta, its flood and climate, refer to Curry & Sayer (1979).

METHODS

During the 1985 flood all major heron colony sites in the delta south of Lake Debo and Lake Korientza were located by observing the orientation of crepuscular movements to roosts, by aerial survey and by asking local fishermen. The recent history of these colony sites was determined from aerial photographs dating from 1952 and 1971 (Institut Geographique National, Paris). Because the large size of the colonies made a direct count of all nests impossible, we used two methods to estimate the number of breeding birds in heronries. The main method was to count the birds as they flew back into the colony to roost in the evenings. When most nests in the colony were at the incubation stage, or had small chicks which were still being brooded, we considered that each bird flying into the colony represented a nest. When most nests contained large (non-brooded) chicks we assumed two birds flying into the colony represented a nest. This method depends on a large degree of synchrony between all the nests of each species.

It also makes two assumptions:

- a) The proportion of non-breeding birds is negligible.
- b) All birds nesting in the colony roost there as well.

we recognise that both of these assumptions will have been violated to an unknown extent and so the resulting estimates can only be considered as approximations. In addition, as shown in detail by van Eerden and Zijlstra (1985) for European Cormorants, Phalacrocorax carbo the transition from brooding to non-brooding behaviour is a gradual one, and will not be as abrupt and clear-cut as we have assumed.

The counts were carried out by positioning two or more observers so that each was able to count the birds flying into the colony along a major flight line. Counting started three hours before dark and continued until nightfall. The numbers of birds flying into the colony usually declined abruptly shortly after sunset and so we believe that few birds were missed because they arrived after dark (Fig. 1). For the larger colonies it was necessary to count on two or three consecutive evenings in order to cover all the flight lines.

The colonies were occupied for an extended period (June-April for some colonies) and thus there was turnover of birds present. For some of the colonies we were able to make more than one count in 1986 for August/September, October and November. However, we were only able to count the two southern colonies (Kouakourou and Koumbe Niasso) once each in 1986. Only a single count was made at each colony in 1985.

For two of the colonies we were able to make a second estimate in 1986 of the number of pairs of Cattle Egrets, using aerial photographs taken by P. Hiernaux on July 23, September 26 and November 3. At Koumbe Niasso we estimated the mean number of nests per tree by direct counts on the ground and used the aerial photographs to count the number of occupied trees. At Kouakourou, where the colony was not in Acacia woodland but in a dense stand of Zizyphus amphibia and where the distribution of nests was very homogeneous, we estimated the mean number of nests per 100 m² along two transects. The total area of the colony was estimated from the aerial photograph.

Migratory Little Egrets, Squacco Herons and Night Herons, from the Palearctic, spend the winter in the delta and may roost in colonies after their arrival. Accurate estimates of the locally breeding populations of these species can only be obtained through roost counts in August and September, or subsequently by counting nests.

In some smaller colonies and for some conspicuous but rare species (e.g. African Darter, Anhinga melanogaster, African Spoonbill, Platelea alba, Sacred Ibis, Threskiornis aethiopia, Black-Headed Heron, Ardea melanocephala and Openbilled Stork, Anastomus lamelligeris) we were able to make complete nest counts.

RESULTS

Twenty five colony sites were located in the delta of which only six were active during our survey; the others having been destroyed or rendered unavailable due to the recent low floods (Table 1, Fig. 2). Sixteen species were found breeding (Table 2) although not all species occurred in all colonies.

In addition to the six colonies discussed in detail in this paper we also located four small colonies (consisting of three pairs of Cattle Egrets, 45 pairs of Cattle Egrets, 100 pairs of Longtailed Cormorants and 100 pairs

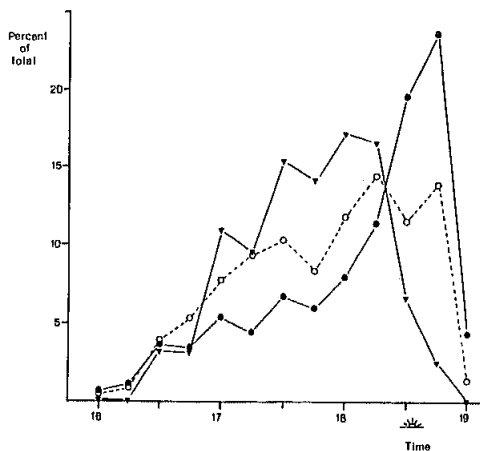


Figure 1 Arrival times of Cattle Egrets (●), Great White Egrets (○), Long-tailed Cormorants (▼) during a roost count at Koumbé Niasso in August (Table 4).

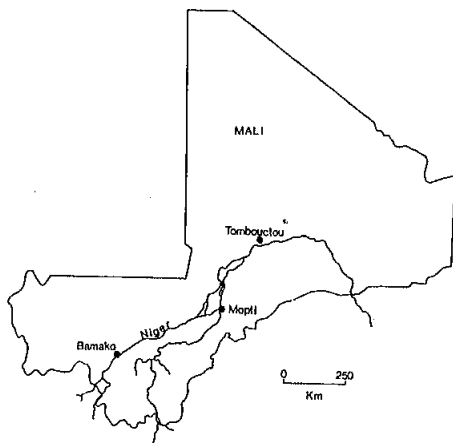


Figure 2a Map of Mali.

Table 1. History of woodlands holding colonies

Sites with colonies: 1985

- | | |
|------------------|--|
| 1. Koumbe Niasso | Extent of woodland in north colony increasing |
| 2. Timisobo | Completely destroyed by fire in 1959; growth since 1973. |
| 3. Kepadou | Increased in extent in last 15 years. |
| 4. Gourao | Less extensive than previously. Clearing for rice. |
| 5. Dentaka | Grown since 1952. Invisible on 1952 aerial photos. |
| 6. Kouakourou | Colony moved from <u>Acacia</u> to <u>Zizyphus</u> wood in 1985. |
| 7. Akkagoun | In decline since at least 1952. Only 120 trees left. |

Sites unoccupied due to low flood

- | | |
|------------------------------|---|
| 8. Kerdial | |
| 9. Beima | |
| 10. Koussouma | Alternative sites; perhaps some breeding 1979-81. |
| 11. Toba | |
| 12. Gome | |
| 13. In Tariouel
(Goundam) | Cited by Morel (1961), abandoned in 1973. |
| 14. Owa (Mayo
Ambiri) | No historical data. |

Sites destroyed

- | | |
|----------------|---|
| 15. Kota | Progressively cut, abandoned as colony in 1982. |
| 16. Sobesaga | Appears in 1952 photos, not in 1971. No precise data. |
| 17. Tomina | Slow cutting finished with clearance in 1983 for rice. |
| 18. Wilibana | Cleared for rice growing in 1972. |
| 19. Ngomi | Slow cutting finished with clearance for rice in 1983. |
| 20. Barangasse | Cleared in the 1940s. |
| 21. Korientze | A small colony in <10 trees in 1979 (Jarry, pers. comm.). |
| 22. Tilembay | Cited in Guichard (1946), no longer exists. |
| 23. Djibitaga | Cleared for rice growing in last ten years. |
| 24. Bora Bora | Cut and degraded. No nesting since 1982. Small roost. |
| 25. Kadial | Cut and degraded. Only small <u>Zizyphus</u> remain. |

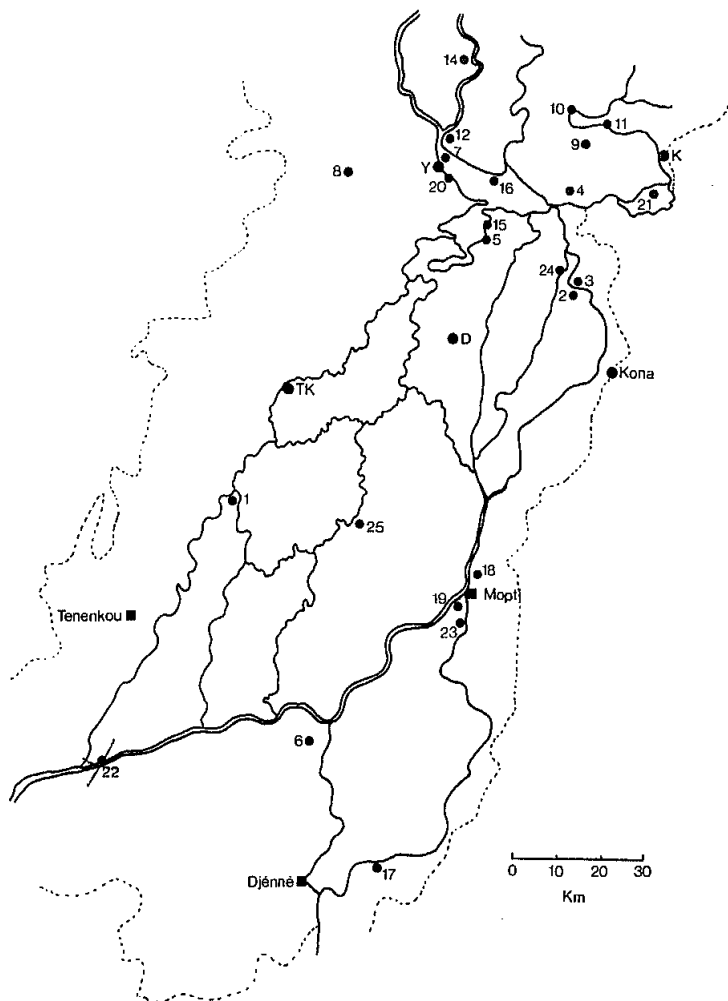


Figure 2b Colony sites past and present. Numbering as shown in Table 1. (TK = Toguere Koumbe, D = Dialloubé, Y = Youvarou, K = Korientze).

Table 2. Species found breeding in the Inner Niger Delta

Long Tailed Cormorant	Phalacrocorax africanus
African Darter	Anhinga melanogaster
Grey Heron	Ardea cinerea
Black Headed Heron	Ardea melanocephala
Great White Egret	Egretta alba
Intermediate Egret	Egretta intermedia
Black Heron	Egretta ardesiaca
Little Egret	Egretta garzetta
Reef Heron	Egretta gularis
Cattle Egret	Bubulcus ibis
Squacco Heron	Ardeola ralloides
Little Green Heron	Butorides striatus
Night Heron	Nycticorax nycticorax
Openbilled Stork	Anastomus lamelligerus
Sacred Ibis	Threskiornis aethiopica
African Spoonbill	Platalea alba

NB Black Headed Herons and Little Green Herons do not breed exclusively in the colonial breeding sites treated in this paper.

Table 3. Roost count and estimate of breeding pairs at Kouakourou, 13 August 1986.

Species	Estimate of Breeding pairs from Nests per 100m ²	Estimate of Breeding Pairs from roost count*
Cattle Egret	9,900 +/- 1,500	12,500
LT Cormorant	-	2,100
Gt White Egret	-	290
Intermediate Egret	-	95
Little Egret	-	155
Squacco Heron	-	50
Reef Heron	-	1

*Estimated as half the number of birds coming to roost.

of Little Egrets respectively). A colony of 80-100 pairs of African Spoonbills was present in a bed of reedmace, *Typha* sp, at Lake Horo in both February 1986 and January 1987. In February 1986 a few pairs of Grey Heron, were also associated with the spoonbills.

We may have overlooked some other small colonies but we consider that they are likely to account for only a small fraction of the total population of breeding herons in the delta.

Colony accounts

1. Kouakourou (Table 3)

When we visited this colony in August 1986 it was occupied by Cattle Egrets, most of which had large (non-brooded) chicks. The site was not yet flooded and no other species were nesting, though Great White Egrets, Intermediate Egrets, Little Egrets and Squacco Herons were beginning to display. The colony was still occupied in late September and so we believe that all the birds using the site as a roost in August went on to breed there later on. Halving the roost count totals for these species therefore gives an estimate of the number of breeding pairs.

We estimated the mean density of Cattle Egret nests to be 78.9 per 100m² (s.d. = 24.6) from 20 100m² quadrats. The total area of the colony, calculated from the aerial photograph of 23 July 1986, was 1.25 ha giving an estimate of 9900 +/- 1500 (95% conf. limits) pairs. This is encouragingly close to the estimate of 12,500 obtained by halving the roost count.

Assuming that this wave of Cattle Egrets fledged about two weeks later, this would be early enough to allow a second wave of Cattle Egrets to complete their breeding cycle before the end of the usual breeding season. Unfortunately we were unable to visit the site subsequently to confirm this.

2. Koumbe Niasso (Table 4)

This colony is composed of two sites 1.5 Km apart. We have considered it as a single colony. When we visited it in August 1985 there was a remarkable degree of synchrony, with the vast majority of birds of all species incubating. The same was not true in August 1986 when we encountered some Cattle Egrets which were feeding chicks (up to 10 days old) whilst a second wave of Cattle Egrets started nesting at or soon after the time of our visit. We were thus unable to estimate the number of breeding Cattle Egrets with any confidence from the roost count alone.

The mean number of first wave Cattle Egret nests per tree (from a sample of 40 trees) was 30.95 (s.d. = 19.1), and 200 occupied trees were counted on the aerial photograph of 23 July 1986 giving an estimate of 6200 +/- 1200 (95% conf. limits) pairs. A second photograph, taken on 24 September, showed 540 trees to be occupied. Assuming that the second wave of Cattle Egrets nested only in the additional 340 trees and at the same density as the first wave birds, this gives an estimate of between 8000 and 12500 pairs of Cattle Egrets in the second wave. This conservative figure underestimates the true breeding population as the roost count of 37,000 birds must represent a minimum of 18,500 pairs if all birds are breeding. Assuming that the first wave comprised 6,200 pairs, then 6,200 roosting birds would have a partner on the nest. This left 30,800 birds which had not yet begun

breeding, or 15,400 pairs in the second wave. Combining the roost count and nests per tree techniques gives an overall upper estimate of 21,600 pairs.

All other species had not yet begun breeding and the estimates are therefore half the roost count.

Table 4. Roost counts and estimates of breeding populations at Koumbe Niasso in 1985 and 1986.

Species	Roost Count 20.8.85	Estimated No breeding Prs	Roost Count 22.8.86	Estimated No breeding Prs
Cattle Egret	17,000	17,000	37,000	21,600
LT Cormorant	14,000	14,000	17,000	8,500
Gt White Egret	1,600	1,600	1,200	600
Intermediate Egret	530	530	780	390
Little Egret	300	300	480	240
Squacco Heron	230	230	180	90
Black Heron	4	4	60	30
Reef Heron	9	9	5	5
Darter	5	5	3	3
Black Headed Heron	4	4	-	-
Egret sp	980	-	31	-

3. Dentaka (Table 5)

This woodland was used for the first time in 1985/86 and it was possible to carry out a complete nest count as the colony was rather small. In 1986/87 the colony was considerably larger and a complete count was not possible. At the time of our visit in early September 1986 most birds were incubating although some Great White Egrets and Long tailed Cormorants were still nest building. From the aerial photographs taken on 3 November 1986 we counted 210 occupied trees. If the estimate of 17,500 pairs (all species combined) obtained from the roost count is correct, this gives 83 nests per tree and 57 per tree for Cattle Egret alone. Despite the different tree structure which may allow establishment of more pairs per tree than elsewhere, this figure is rather high compared to densities observed in other colonies. The roost count may therefore have overestimated the true size of the colony. Unfortunately we have no nests per tree count for this colony.

The site was still occupied by several species in February 1987. These nests were counted directly.

4. Akkagoun (Table 6)

This colony was small enough and sufficiently accessible for several complete nest counts to be made in both years. In 1986 the dramatic increase in the size of the colony at Dentaka, which serves part of the same feeding areas as the breeding colony at Akkagoun may have depleted the latter colony.

5. Timisobo and Kepagou (Tables 7, 8 and 9)

These two woodlands, approximately 4 Km apart, are not usually occupied

Table 5. Roost counts and estimates of breeding populations at Dentaka, 1985-1987

Species	Roost Count 20.9.85	Nest Count 26.12.85	Nest Count 26.2.86	Roost Count 1.9.86	Estimated no. pairs 1.9.86	Roost Count 29.11.86	Nest Count 21.2.87
Cattle Egret	380	-	-	12,000	12,000	3,300	-
Long-tailed Cormorant	11	120	-	4,400	4,400	12,000	-
Great White Egret	28	5	5-10	630	630	1,300	50-75
Little Egret	22	2	-	320	320	1,300	20-30
Intermediate Egret	3	-	-	30	30	190	-
Squacco Heron	11	-	-	140	140	180	2
Black Heron	-	1	5-10	90	90	170	35-50
Night Heron	*270	-	-	*120	1*	280	-
Reef Heron	-	-	-	1	1	20	5-10
Darter	1	-	-	-	-	-	9
Sacred Ibis	-	14	young fledged	-	-	180	30-40
African Spoonbill	-	-	50-70	-	-	200	200-250
Openbilled Stork	-	-	20	-	-	-	36

* Non breeders

* A single incubating adult

Table 6. Counts of number of breeding pairs at Akkagoun : 1985-86

	1985				1986				Total No. of Pairs	Total No. of Pairs
	14.10	10.12	23.2	6.3	3.6	30.6	28.8	17.9	24.10	18.11
Cattle Egret	1,031	20		1,100	155	573	300	53	5	800-900
Long-tailed Cormorant	41	1,246		1,300					192	531
Great White Egret	56	422	1+	2			23	11	100	132
Intermediate Egret	5	34		34-40						10
Little Egret	13	250	3	10	2	1	3	9	45	20
Reef Heron	33	11	7+	20	8	2	28	24	17	15
Squacco Heron	71	14		71-85					2	4

Table 7. Roost count and population estimate for Timisobo, September 1985.

Species	Roost Count 25.9.85	Estimated No. Breeding Pairs
Cattle Egret	27,000	14,000-20,000
L-T Cormorant	600	300-600
Gt. White Egret	200	700-800
Little Egret	380	190-380
Intermediate Egret	70	35-70
Squacco Heron	200	100-200
Reef Heron	18	10-20
Black Heron	90	45-90
Darter	0	7 (counted)
Egret sp.	730	

+An unknown number of rarer species were flooded out. Conservative and maximum estimates of breeding population are given.

Table 8. Roost counts and population estimate for Kepagou, 1985.

Species	Roost Count 28.9.85	Estimated No. Pairs 12.11.85
Cattle Egret	5,300	<100
L-T Cormorant	90	2,000-4,000
Gt. White Egret	200	1,000-1,500
Little Egret	70	100-200
Intermediate Egret	60	25-50
Squacco Heron	90	50-100
Reef Heron	3	-
Black Heron	2	70-80
Darter	7	12
Sacred Ibis	-	15-20

Table 9. Population estimates at Kepagou, 1986, based on nests/trees counts.

Cattle Egret	15,000-17,000
Long-Tailed Cormorant	1,250-1,800
Great White Egret	1,050-1,300
Intermediate Egret	275-350
Little Egret	30-50
Squacco Heron	250-350
Reef Heron	15-30
Black Heron	35-70
Black-headed Heron	10 (actual count)
Darter	30 (actual count)

simultaneously and so we consider them as alternative sites for the same breeding colony. The trees at Timisobo have only been large enough to support a colony since 1983/84 and in August 1985 following a higher flood than usual, which inundated many nests, Timisobo was abandoned in favour of Kepagou. When we visited Timisobo in late September 1985 all species were either incubating or had recently hatched young. Some Cattle Egrets and Squacco Herons had already been flooded out and were rebuilding. The majority of Great White Egrets, which nest highest in the trees, were not affected. Breeding had not yet begun at the Kepagou site at this time.

We visited Kepagou in November 1985 when most nests contained small young. On this occasion we were able to make only rough visual estimates of the number of birds breeding. It is not clear if these birds had failed at Timisobo and were reneesting or were birds nesting for the first time. At the same time, 8 pairs of Grey Heron began breeding at Timisobo as the flood fell.

In 1986 only the Kepagou site was used. There was a large degree of asynchrony in the different breeding cycles both within and between species in different areas of the colony, making estimation of the colony size from roost counts very difficult (Fig. 3). We were unable to obtain an aerial photograph of this colony. Instead we estimated the mean number of nests per tree and roughly estimated the number of occupied trees from the ground. These estimates are given in Table 9.

Total population estimates for the whole delta for each species are given in Table 10.

DISCUSSION

Because of the difficulties involved in obtaining counts, the population estimates presented here must be regarded as only fairly rough approximations. However, in the absence of more precise data, even 'order of magnitude' estimates are useful. The total population of 87,000 pairs of fifteen species (Table 10), breeding throughout most of the year (Fig. 4), makes the Inner Niger Delta probably the most important area in West Africa for breeding colonial waterbirds. These birds are distributed between only five large colonies. For the most numerous species it is doubtful if these colonies could accommodate many more birds. We found Cattle Egrets feeding up to 35 Km from the colony. This is considerably further than the maximum foraging distances recorded elsewhere (19-20 Km in Africa, Morel & Morel 1961, Crauford 1966, Siegfried 1971), suggesting that available feeding grounds around these colonies are already fully exploited. Likewise, Long tailed Cormorants were encountered feeding at similar distances from the colonies.

Other studies have shown heron colonies to be limited in size by the area of available feeding habitat surrounding them (Fasola & Barbieri 1978, Gibbs et al. 1987). Under these circumstances the loss of any of the present sites is likely to have serious consequences for these populations as it is unlikely that the others could take up the excess birds. Already, large areas of apparently suitable feeding habitat are not exploited because of the absence of a breeding site within foraging range (Fig. 5).

The maintenance of the existing woodlands should, therefore, be a top

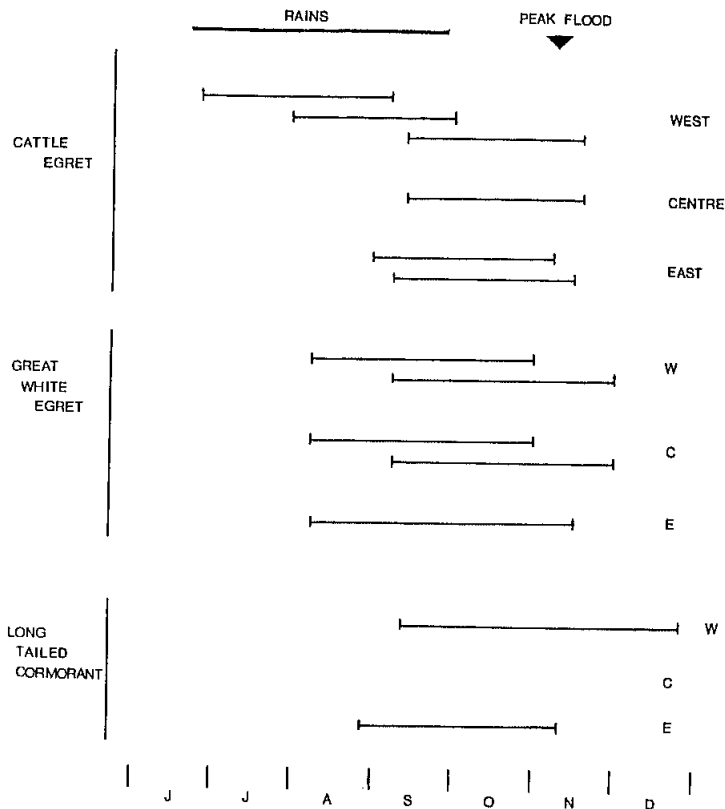


Figure 3. Breeding cycles of the three main species in the centre, west and eastern parts of the colony at Kepagou, 1986.

conservation priority. This must be done with the cooperation of the local fishermen and goat herders. It is important that these people recognise the heronries as an asset. The potential impact of Cattle Egrets on grasshopper populations (a serious crop pest in the region) and the enrichment of the water beneath colonies by droppings and pellets leading to increased fish production are both arguments to which local people have shown themselves to be favourably disposed. Encouraging signs of decreased wood cutting and increased regeneration have been observed in three woodlands (Timisobo, Dentaka and Akkagoun) where appropriate management agreements between all the interested parties have been achieved.

For the rarer species, breeding habitat is probably not the only factor limiting the population. African Spoonbills, Sacred Ibis and Openbilled Storks are all dry season breeders and as such are susceptible to disturbance by goat herders using the wood whilst they are breeding. Here again cooperation with local people can help. At Dentaka there has been no grazing during the critical period since 1985 and the African Spoonbill population has gone from zero in February 1985 to 50-70 pairs in 1986 and 200-250 pairs in February 1987.

The African Darter was recorded as common by Guichard (1947), and more recently by Lamarche (1980), but appears to have declined considerably. The reasons for this decline are not fully apparent, but may include disturbance by local people during the breeding season as the chicks are considered a delicacy.

Table 10. Rounded population estimates for the Inner Niger Delta in 1986/87.

Cattle Egret	63,000 - 65,000
Long Tailed Cormorant	17,000 - 17,500
Great White Egret	2,800 - 3,100
Little Egret	900 - 1,000
Intermediate Egret	800 - 875
Squacco Heron	550 - 650
Black Heron	200 - 250
Reef Heron	80 - 110
Night Heron	1 - 10
Grey Heron	* 10 - 15
Black Headed Heron	+ 10
African Darter	40 - 45
Sacred Ibis	30 - 40
African Spoonbill	300 - 350
Openbilled Stork	30 - 40

* Bred in 1985 only

+ Does not include monospecific colonies

We were unable to find any indication of breeding by Wood Stork, Mycteria ibis, Glossy Ibis, Plegadis falcinellus, or Pink backed Pelican, Pelecanus rufescens, although all three are recorded as breeding by Lamarche (1980). The site where Morel & Morel (1961) found Glossy Ibis breeding, at In Tariouel near Goundam (pers. comm.), has been dry since 1973 according to local people.

In view of the vulnerability of the breeding populations of colonial

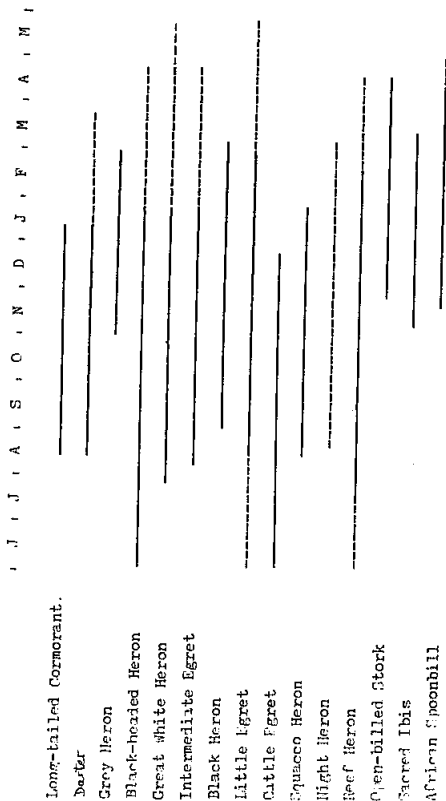


Figure 4 Breeding periods (courtship to fledging) for colonial waterbirds in the Inner Niger Delta. Continuous bars represent the most active periods.

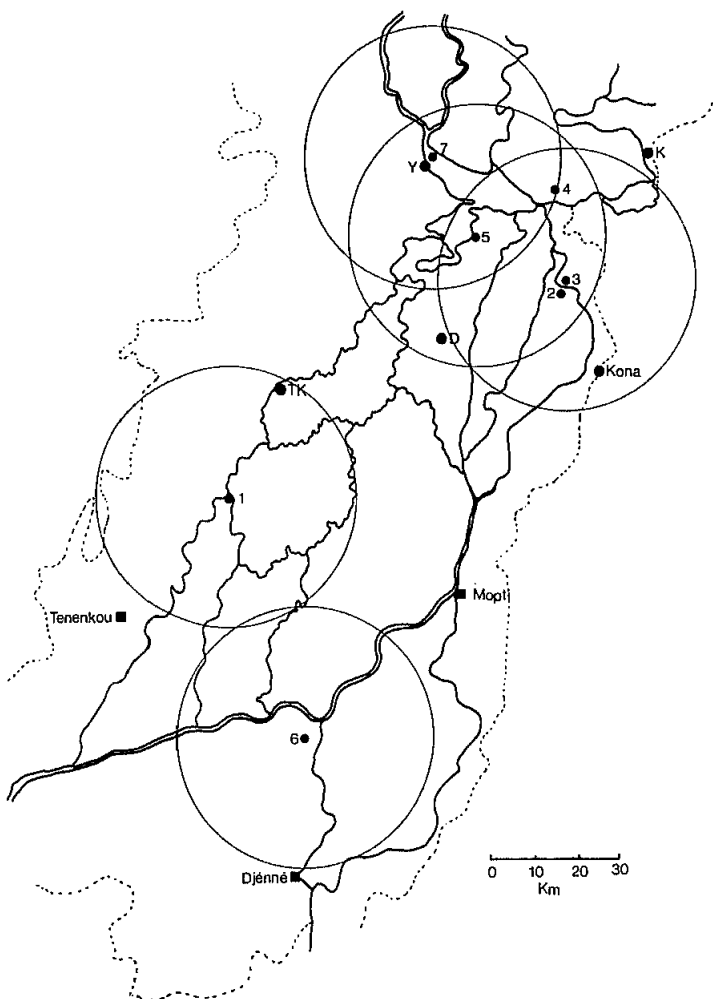


Figure 5 Active colonies with a 30 km radius approximating the feeding areas used by breeding birds in each colony. (Legend as in Figure 1).

Ciconiiforme and Pelecaniforme birds in the delta it is desirable that they should be closely monitored. Proposals for damming and irrigation projects upstream make this requirement even more urgent as such projects are likely to have a negative impact on the whole wetland ecosystem of the delta. Our experience suggests that this monitoring is best done by measuring nest density on the ground and counting occupied trees and/or measuring colony area from aerial photographs. Data from roost counts only are difficult to interpret. Ideally, colonies should be monitored several times during the breeding season as a single count at a colony occupied over a period of up to six months is likely to be misleading.

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SUMMARY

This paper describes the recent history and current status of heron colonies in the Inner Niger Delta. 25 historical sites were located from aerial photographs, crepuscular roosting movements and by asking local fishermen. Only 6 sites were occupied in 1986/87. Other sites have been destroyed or rendered unsuitable through cutting by goat herders or due to recent low flood levels.

Colonies are active from June until April and their breeding populations were estimated using roost counts, sample nest counts, aerial photographs or total nest counts as appropriate. The merits of the different methods are discussed. 87,000 pairs of sixteen species were recorded breeding.

The study concluded that feeding grounds around existing colonies were probably saturated and that available woodlands would be unable to take up displaced birds should further damage occur to any of the major sites. Parts of the delta suitable as feeding areas are already beyond reasonable daily foraging distance^{from} breeding sites, making them inaccessible during the breeding season. Management agreements have been developed with local people in three of the colony sites.

RESUME

Cet article décrit l'histoire et le statut actuel des colonies de hérons dans les bosquets d'Acacia inondables du Delta Intérieur du Niger. 25 sites historiques ont été trouvés à partir des photos aériennes, l'orientation des déplacements crépusculaires et en demandant aux pêcheurs autochtones. Seuls 6 sites étaient occupés en 1986/87, les autres ayant disparus à cause de la coupe, ou rendu inutilisable par manque de crue. Les colonies sont actives à partir de Juin jusqu'en Avril, et leurs populations nicheuses étaient estimées à partir de diverses méthodes à savoir: dénombrement du dortoir, échantillonnage des nids, photos aériennes et dénombrement des nids, ces différentes méthodes sont comparées dans le texte. 87 000 couples de 16 espèces étaient notées.

L'étude a conclu que les zones d'alimentation autour des colonies existantes étaient fort probablement saturées et que les bosquets actuellement disponibles ne seraient pas en mesure d'absorber d'autres oiseaux si les dégâts aux arbres auront lieu dans d'autres sites. Déjà il existe des superficies importantes du Delta qui se trouve au delà de la limite quotidienne de vol à partir des colonies actuelles ce qui les rend inaccessible aux oiseaux nicheurs pendant la saison de nidification.

Dans trois des sites les accords ont été développés avec les populations locales pour la conservation des bosquets.

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