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THE EFFECT OF DROUGHT-BREAKING RAIN ON THE RE-ESTABLISHMENT OF EGRET COLONIES IN NORTH COASTAL NEW SOUTH WALES

D. J. GEERING

The Wetlands Centre, Shortland, P.O. Box 130, Wallsend, NSW 2328

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The re-establishment of five breeding colonies of egrets on the north coast of New South Wales was monitored over a period during which drought-breaking rain fell. Colonisation was affected by the water level of the colony site prior to this rainfall event. Dry sites were not colonised until flooding of the site occurred whilst those with water were only colonised by Cattle Egrets. Great, Intermediate and Little Egrets commenced nesting in significant numbers only after this rainfall event. Where nesting of all four species commenced at the same time, Cattle Egrets were able to respond more quickly and were more synchronised. Availability of water seemed to be the major limiting factor for Cattle Egrets but the case is less certain for the other egret species.

INTRODUCTION

The breeding biology of herons and egrets has been well studied in the northern hemisphere (Jenni 1969; Dusi and Dusi 1970; Pratt 1974; Maxwell and Kale 1977; Pratt and Winkler 1985) and interest in this group has increased in Australia over the last decade or so (McKilligan 1985, 1990, 1991; Maddock 1986; Maddock and Baxter 1991; Baxter 1992). Emphasis in Australia to date has primarily been on breeding success and behaviour.

In north coastal New South Wales breeding generally commences in late October to early November with most nestlings having fledged by the end of February. In some wet years breeding may commence as early as September, the Shortland colony commencing on September 17 in 1988 (Maddock 1988).

During the breeding season of 1991–92 an opportunity arose to monitor the establishment of egret breeding colonies under differing conditions at the breaking of a relatively short, though severe drought at five breeding colonies in north-eastern ew South Wales and the Hunter Valley.

SITE DESCRIPTIONS

The Lawrence colony (29°30'S, 153°06'E) is located in a natural amphitheatre bounded on the eastern side by the Clarence River with a road between the wetland and the river. The colony, in past years, has occupied about 80 per cent of the available nest trees in the 10 ha wetland although during the 1991/92 season only 50 per cent of these contained nests. Nesting occurs primarily in *Melaleuca quinquenervia*, most of which are young trees less than 4 m high. Birds also nest in scattered *Casuarina glauca* and in the 1991/92 season *Typha* sp.

At Junction Hill (29°38'S, 152°55'E), 5 km north-west of Grafton and some 22 km south-west of Lawrence, the colony is again situated in a natural amphitheatre, the wetland being about 3 ha in size and fed by a number of springs, several of which run into an intermittently flowing gully. This gully retains some remnant dry rainforest vegetation, predominantly *Acacia melanoxylon*, with a number of camphor laurel *Cinnamomum camphora* and large *M. quinquenervia* around the springs. The wetland itself has a dense area of small (generally less than four metres) *M. quinquenervia* occupying less than 1 ha. About one-third of the colony nests in the wetland with the remainder in the gully.

The Boambee colony (30°20'S, 153°01'E) is situated in an artificial wetland created by the damming of a tributary of Boambee Creek by Lindsays Road 10 km south of Coffs Harbour. Nesting occurs in the small *M. quinquenervia* in the wetland as well as taller trees on the margins, in bamboo,

Pinus radiata, cultivated poplars and *Hibiscus* sp. and, until recently removed, camphor laurels.

The Seaham colony is situated within the Seaham Swamp Nature Reserve (32°39'S, 151°43'E), a small natural wetland of 7.5 ha, in which egrets generally occupy 6 m tall *M. quinquenervia* around the margins. Nesting also occurred in several trees approximately 25 m high in the 1991/92 season. The colony is rather open and nesting space seems to be restricted by the small number of trees available.

The breeding colony at Shortland (32°52'S, 151°41'E) occupies a 2.4 ha wetland. Nesting occurs in mature *M. quinquenervia* and *M. linariifolia* about 15 metres in height. To date nesting has only occupied a maximum of about half the available trees in any one season.

All of these colonies are adjacent to residential areas, their location being shown in Figure 1.

METHODS

Regular observations were made throughout the breeding season from the first arrival of egrets at the Lawrence, Junction Hill and Boambee colony sites and from early January at Shortland and Seaham. Information concerning the latter two colonies was obtained from Max Maddock and Michael Murray prior to 6 January.

Up to 6 January the Junction Hill colony was visited daily and the Lawrence and Boambee colonies at least weekly. After this date a five day field trip was conducted each fortnight with the Lawrence and Junction Hill colonies being visited on at least three of these days and the Boambee colony on the first and final day.

The water cover of each of the wetlands was assessed throughout the establishment of the breeding colony with counts or estimates of the number of pairs nesting at each of the colonies during the incubation period. Counts were obtained by counting the number of nesting pairs in each section of the colony although at Junction Hill the density of trees in the wetland portion of the colony meant that an estimate only was possible. During December individual birds rather than pairs of Great and Intermediate Egrets were counted during the courting stage prior to the establishment of nests at Junction Hill. Counts obtained are minimum numbers only as it was not possible to see all parts of any colony other than Seaham.

Daily rainfall figures for the colony areas were obtained from Lawrence Post Office, Maryville, 7 kilometres south-east of Shortland, and Coffs Harbour meteorological stations.

RESULTS

The winter and spring of 1991 was a period of drought on the New South Wales north coast with well below mean rainfall being received (Fig. 2). As a result a number of wetlands dried for the first time in many years, at least 8 years for the Lawrence colony site.

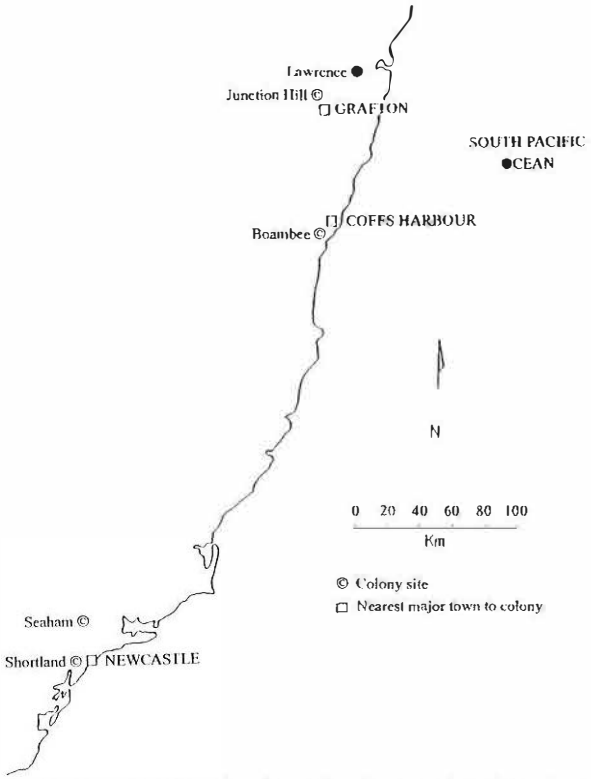

Figure 1. *Location of colony sites in central and northern coastal New South Wales.*

Cattle Egrets *Ardeola ibis* commenced roosting at the Junction Hill colony site in the first week of November but were extremely unsettled and left the colony area at the slightest disturbance. It was not until 23 November that birds were sufficiently settled to allow access to the colony site. At this stage there was much courting activity, nest building and some birds were on eggs. The wetland at this time had water covering about one quarter of its area and the springs were not flowing. A count of the upland portion indicated an overall number of about 2 500 pairs of Cattle Egret for the whole colony in late November. There were only two pairs of Great Egret *Egretta alba* nesting and six Intermediate Egrets *E. intermedia* using the colony as a night roost.

During November the Lawrence colony site was completely dry and there was no sign of birds attempting to nest there. The Boambee colony, on the other hand, was active with the majority of the estimated 1 500 pairs of Cattle Egret on eggs. This site, however, is fed by a constantly

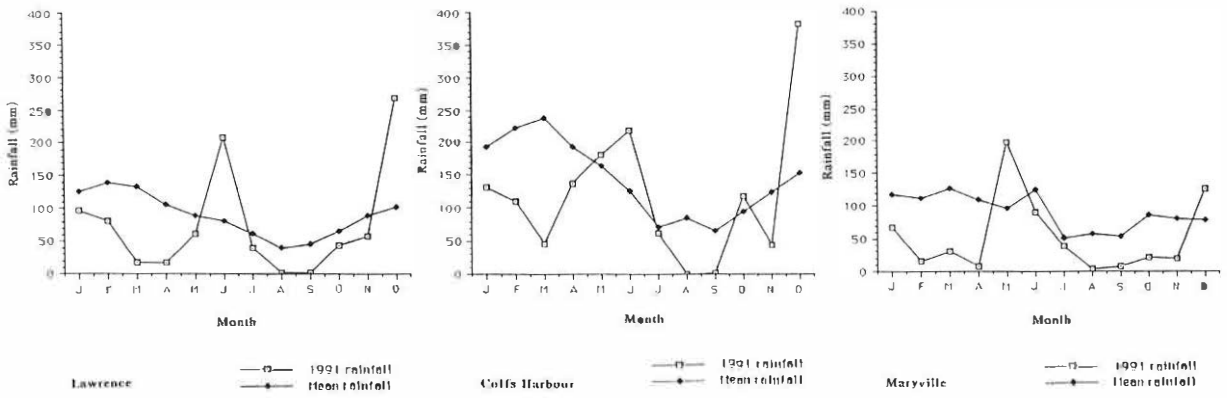

Figure 2. *Mean and 1991 rainfall at Lawrence, Coffs Harbour and Maryville.*

flowing creek with water being retained by a small weir. Hatching dates later confirmed that nesting began at Boambee about two weeks before Junction Hill.

On 12 and 13 December 177 mm of rainfall was received at Lawrence, followed by a further 39.4 mm between 19 and 24 December (Fig. 3). On 15 December Greg Baxter (pers. comm.) counted 20 Cattle Egret nests under construction with more birds in the area. By 1 January this had increased to an estimated 2 000 pairs with many birds still in magenta courting flush. Great, Intermediate and Little Egrets *E. garzetta* were also nesting as were Little Pied Cormorant *Phalacrocorax melanoleucos*, Little Black Cormorant *P. sulcirostris* and Sacred Ibis *Threskiornis molucca*.

Immediately following the rain on 12 and 13 December the number of Great and Intermediate Egrets increased at Junction Hill from the four Great and six Intermediate present prior to this rain to 25 Great and 12 Intermediate on 15 December and 48 Great and 48 Intermediate on 23 December. With few exceptions, these birds were showing a strong courting flush and many were displaying. Although nests were not counted

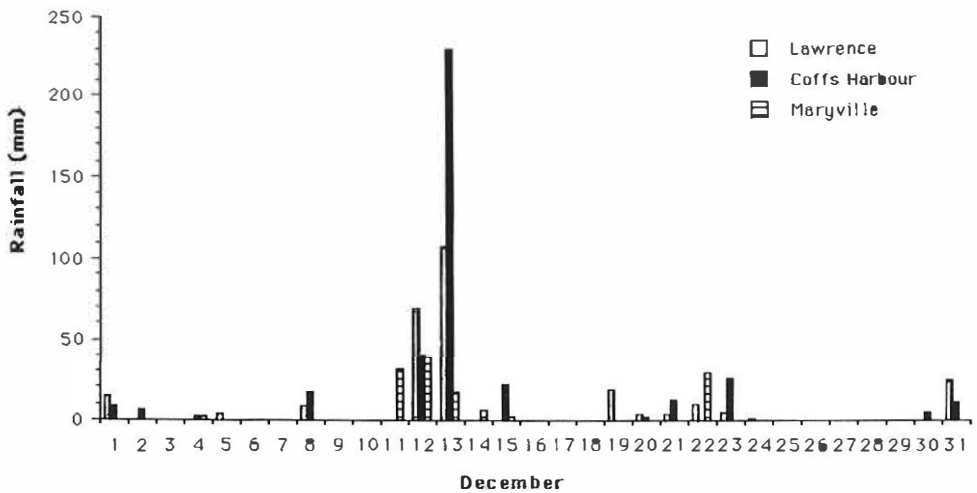

Figure 3. *Daily rainfall (mm) December 1991.*

TABLE 1

Estimated number of pairs of egrets nesting at each site.

Colony	Date	Cattle	Great	Intermediate	Little
Lawrence	15-12-91[1]	20[2]	0	0	0
	01-01-92	2 000	40	100	2
	12-01-92	2 800	49	112[3]	3
Junction Hill	23-11-91	2 500	2	0	0
	15-12-91	NC	(25)	(12)	0
	23-12-91	NC	(48)	(48)	0
	14-01-92	3 240	47	61	2
Boambee	22-11-91	1 500	0	0	1
	15-12-91[1]	1 206	1	1	1
	15-01-92	1 500	3	3	4
Seaham	17-12-91[1]	699	0	0	0
Shortland	17-12-91[1]	90[2]	0	0	0
	16-01-92	800	25	25	5

[1]Count by G. Baxter. [2]Nests under construction. [3]Further nesting commenced after this date, estimated total of 250 pairs. ( ) Count of number of individual Great and Intermediate Egrets only, not pairs nesting. NC No count available.

at this stage, observation suggested that the number of Cattle Egrets in the colony did not increase. There was, however, a resurgence in courting behaviour with a great many birds going into a magenta courting flush. This may have been a direct consequence of a storm with strong wind but little rain that affected the colony on 8 December (see Fig. 3) with the loss of many eggs.

A nesting colony of 800 pairs of Cattle Egrets, along with Great, Intermediate and Little Egrets at Shortland only re-established after the drought-breaking rains of mid-December, two previous attempts by Cattle Egrets being aborted whilst the colony site was dry (M. Murray, pers. comm.). The Seaham colony successfully re-established in mid-November with water covering about 10 per cent of the colony portion of the wetland. No species other than Cattle Egrets nest at Seaham. Total counts of pairs nesting at each of the colonies is provided in Table 1.

This staggering of nesting between colonies was most noticeable for the Boambee, Junction Hill and Lawrence colonies where the peak of fledging occurred about mid-January, early February and late February-early March respectively. Timing for the Seaham and Shortland colonies was essentially the same as Junction Hill and Lawrence, again reflecting the relative water levels at the commencement of the breeding season prior to the rain on 12 December.

Breeding of the four species of egret at the colonies was also staggered with Cattle Egrets laying earlier than the other three species. This was particularly evident at Lawrence where, although breeding of all species was stimulated by a single rainfall event, Cattle Egrets seemed to respond more quickly and were more synchronised than Intermediate Egrets. On 24 March there were still quite a number of nests of Intermediate Egrets with young less than about three weeks of age indicating that nesting was still being initiated by Intermediate Egrets almost two months after the initial rainfall event that triggered breeding. By this date most of Cattle Egret chicks had fledged.

DISCUSSION

Drought conditions at the beginning of the breeding season affected the re-establishment of the breeding colonies of all four species of egrets. The one site that had a normal or near normal water level was colonised by Cattle Egrets before those with reduced water levels whilst the sites that had no water were not re-established before the drought breaking rain. The other egret species did not establish themselves at any colony until after this rainfall episode. Werschkul (1977) suggested that Cattle Egrets appeared to be stimulated to begin nesting by rain. This is contrary to observations presented here, providing the colony site had sufficient water.

Werschkul's observations were, however, at an upland colony and as such could be viewed in a similar light to the dry colonies in this study.

During a wet breeding season Great Egrets are generally the first egret species to establish themselves in the breeding colony at these sites followed by Cattle Egrets (Baxter 1992, pers. obs.). In the southern USA, Cattle Egrets were found to begin and finish nesting later than other species (Jenni 1969; Werschkul 1977). Due to the dry beginning to the 1991 92 breeding season all egret species nesting at Lawrence apparently reacted to the same stimulus, rainfall. Under these conditions Cattle Egrets required much less time than the other species to proceed through courtship, nest building and laying, although quantitative data to support this has yet to be obtained. Tomlinson (1979) found breeding to be highly synchronized among Cattle Egrets with most of the eggs being laid together and chicks hatching out within a few weeks of each other. This occurred at each site in this study, but particularly so at Lawrence.

Drought-breaking rains, such as those of mid-December 1991, may act as a stimulus in several ways. It provides the drinking water required by the male egret whilst it is guarding the female during her fertile period (McKilligan 1990). This appears to be particularly important for Cattle Egrets, which only re-establishes colonies where water is readily available at the site. It is less clear for the other egret species. At no colony site did more than two pairs of Great, Intermediate or Little Egrets nest prior to the rain of 12–14 December, even when water was available. The precise stimuli to which these birds reacted remain unclear.

Nesting of Great, Intermediate and Little Egrets only commenced after this drought-breaking rain, regardless of the amount of water available and Cattle Egrets commenced where the colony site had been dry. Even so, the ultimate level of breeding success may still be dependent upon food availability, Maddock and Baxter (1991) suggesting that Great, Intermediate and Little Egrets were less successful during dry seasons. Although evidence is lacking, these predominantly wetland dependent species may be reacting to the filling of wetlands in feeding areas around the colony.

The observations presented here suggest that whilst rainfall may trigger breeding in all egret species, at a colony site that was dry it is also required to trigger breeding of Great, Intermediate and Little Egrets in drought years even when conditions are suitable for Cattle Egrets.

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