

# CATTLE EGRET MIGRATION IN SOUTH-EASTERN AUSTRALIA AND NEW ZEALAND: AN UPDATE

By MAX MADDOCK and DAVID GEERING

## ABSTRACT

The migration pattern for Cattle Egret in south-eastern Australia and New Zealand (Maddock 1990) is further clarified as a result of intensified observations of patagial-tagged birds and reporting of arrivals and departures of flocks by the observation network of Project Egret Watch in Australia and OSNZ in New Zealand since 1989.

Seasonal outward migration from colonies in New South Wales after the breeding season to winter feeding ranges elsewhere in NSW, in Victoria and Tasmania, with return to the breeding colonies has been confirmed. Marked birds have been located in the same winter ranges, after having been recorded in the breeding colony for up to four consecutive years. Two cases of birds migrating to different locations in consecutive years have been recorded. The main movement is southward, but some birds migrate northward. The mean distance for southward migration is greater than for northward migration. Staging along southerly and northerly migration routes has been identified. The pattern of arrivals and departures in New Zealand identified by Heather (1978, 1982, 1986) has been maintained, with tagged birds from Australia found in 1990 and 1991, but to date no marked birds have been located back in Australia after being seen in New Zealand. Birds tend to be restricted to highly localised ranges at the winter destination, using pasture on a single property or adjoining or closely related properties. Australian winter locations are generally restricted to coastal plains. Movements from the colonies take place in waves over a period of three months after the breeding period, although variation in dates from season to season has been identified. Birds tend to return to their natal colonies but some degree of colony exchange has been identified, particularly between neighbouring sites.

## INTRODUCTION

Maddock (1990) reported the results up to 1989 of a study of the migration of the Cattle Egret (*Bubulcus ibis*) by the Hunter Wetlands Trusts Project Egret Watch, based at the Wetlands Centre at Shortland, Newcastle, NSW. Movements of the birds were determined from sightings of Cattle Egrets carrying colour bands or patagial tags and inferred from fluctuations in the size of flocks present in the Hunter Valley, NSW, during the year. Tagged birds and number fluctuations were reported by a network of observers in Australia and New Zealand.

The study confirmed a pattern of movement in waves from colonies in NSW and Queensland in a south to south-easterly direction to Victoria, Tasmania and New Zealand during autumn, with a return movement in spring. Circumstantial evidence at that time suggested that the same birds travelled the same routes to the same destinations each year. Northern movement was identified for only four birds. The Hunter Valley of NSW

was identified as a staging place for Cattle Egrets from breeding colonies in northern NSW and Queensland en route south and on the return journey. A significant number of birds remained in their general natal area, with some evidence of somewhat nomadic movements within that area. The evidence suggested that well-defined local territories were used at the wintering locations.

Since 1989, patagial tagging has been done in more colonies, the observer network has expanded and over 12 500 sightings of tagged birds have been reported, many individual birds on more than 100 occasions. This paper provides an update of the results reported in Maddock (1990), further confirming an out-and-return migration pattern for Cattle Egrets and clarifying the nature and extent of this pattern.

The ornithological definition of migration has traditionally been in terms of seasonal to-and-fro movements on a geographical scale. Cramp & Simmons (1977) defined migration as seasonal movements between breeding and winter ranges, implying a return to the breeding range. As Maddock (1990) indicated, Cattle Egrets display a range of movements from precise returns after long- and short- distance migration to local nomadism and to some birds being completely resident. Any definition of migration must take into account the range of movements observed. In this paper treatment of migration and terminology follows Baker (1978), the general definition of migration being the act of moving from one spatial unit to another.

## METHODS

Since the 1985-86 breeding season, the Project Egret Watch team has been attaching patagial tags to Cattle Egrets at breeding colonies at the Wetlands Centre at Shortland ( $32^{\circ}53' S$   $151^{\circ}42' E$ ) and Seaham Swamp Nature Reserve ( $32^{\circ}40' S$ ,  $151^{\circ}43' E$ ) in the Hunter Valley of NSW. David Geering began tagging at the Lawrence colony ( $29^{\circ}30' S$ ,  $153^{\circ}06' E$ ) in the 1988-89 season and at the Junction Hill colony ( $29^{\circ}38' S$ ,  $152^{\circ}55' E$ ) near Grafton, NSW, in 1989-90. Jack Willows and Charlie Morris, working at the Murwillumbah ( $28^{\circ}21' S$ ,  $153^{\circ}25' E$ ) and Ballina ( $28^{\circ}51' S$ ,  $153^{\circ}32' E$ ) colonies, NSW, and Roy Sonnenburg at the Bracken Ridge colony ( $27^{\circ}18' S$ ,  $153^{\circ}01' E$ ) in Queensland joined the project in the 1989-90 breeding season. In the 1991-92 season Bill Lane began tagging at the Boambee colony ( $30^{\circ}20' S$ ,  $153^{\circ}04' E$ ) near Coffs Harbour, NSW. A total of 3265 Cattle Egrets has been tagged at these colonies, 959 in the 1991-92 breeding season.

The network of observers referred to in Maddock (1990) has been extended to include new key locations in north-coastal and south-coastal NSW, in Victoria and in South Australia. Dates of arrival and departure of flocks, fluctuations in flock size and the presence of tagged birds have been reported regularly by the network. The Ornithological Society of New Zealand's Cattle Egret project team has continued to co-operate by providing similar information.

Max Maddock, Neville Foster and Ian Harvey have closely monitored the Cattle Egret foraging areas and night roosts of the flood plain, the junction of the Hunter, Williams and Paterson Rivers which extends from the City of Newcastle to Maitland, Clarence Town and Raymond Terrace. The area

contains both the Shortland and Seaham breeding colonies (see Figure 1). The Seaham breeding colony has been visited twice daily and the Shortland colony at least once a week throughout each breeding season.

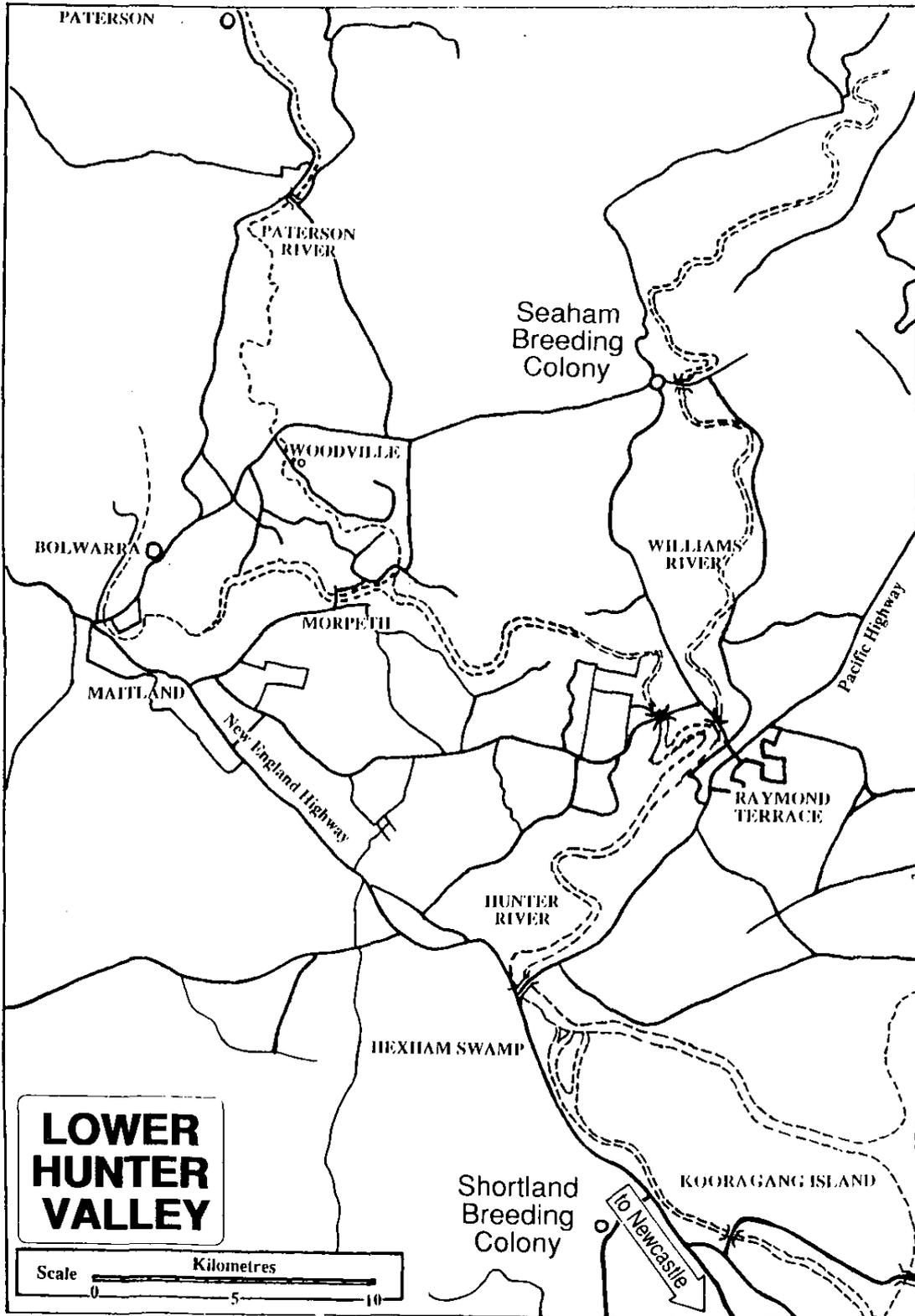


FIGURE 1 — Location map: Hunter Valley, NSW

## RESULTS

**Tag sightings: natal colony region**

A post-breeding pattern of decreasing number of tagged birds in the natal colony, similar to that reported in Maddock (1990), has continued at all eight colonies in the study.

In Maddock (1990) a plot of 25 tagged Cattle Egrets which had been seen regularly from December 1986 to January 1989 in the Shortland-Seaham area showed that all but two disappeared from the observation area during winter. The majority returned to the colony area in the breeding season. Since the 1990 report, much more intensive observations by Maddock, Foster and Harvey on the floodplain about Hunter-Williams-Paterson junction (see Figure 1) have confirmed the general pattern. Most tagged birds disappear from the study area at some time during the winter. Some move from the immediate natal area to winter roosts about 20 km from the natal colony, where they remain for the winter. Others move to the same winter roosts for the early part of winter and then disappear.

Although observations in the vicinity of the Clarence Valley colonies have not been as intensive or as regular as those in the Shortland-Seaham area, they have shown a similar pattern. Figure 2 shows the pattern of sightings for birds in the Hunter area and Figure 3 for the Clarence area.

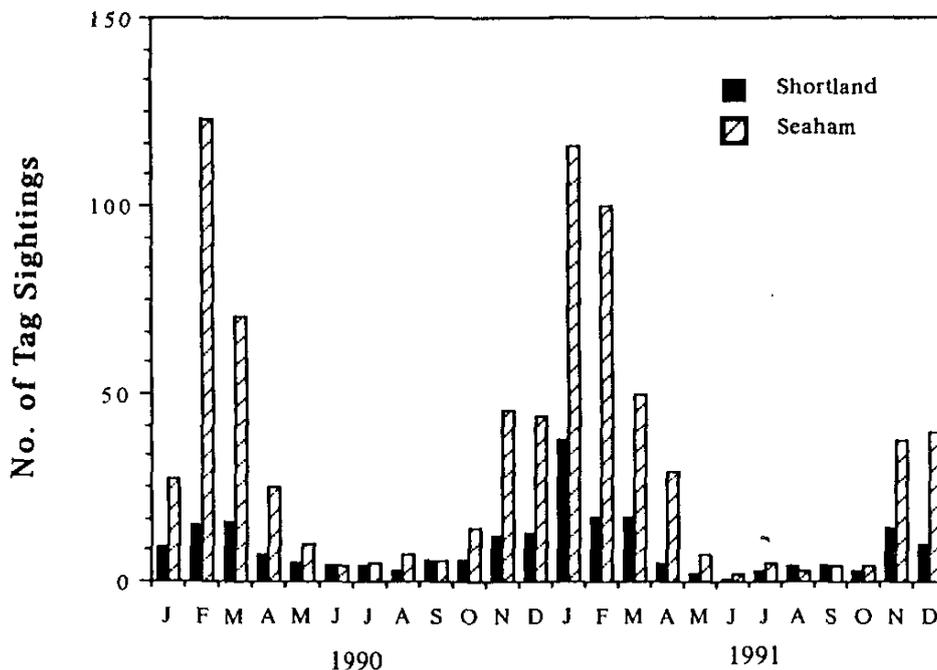


FIGURE 2 — Pattern of tag sightings in Hunter Valley, 1990-91. Age cohorts not separated. Shortland — to 1990, 267 birds tagged; to 1991, 339 birds tagged. Seaham — to 1990, 343 birds tagged; to 1991, 462 birds tagged.

To date only Junction Hill No. 087 and Seaham No. 178 have been identified as remaining in the immediate area of their natal colony for their entire lives. Junction Hill No. 087 did, however, display the usual post-fledging nomadic movements in its first few months, although it was not seen further than 6 km from the natal colony. From the June of its first year to the time of writing, this bird has always been found in one or other

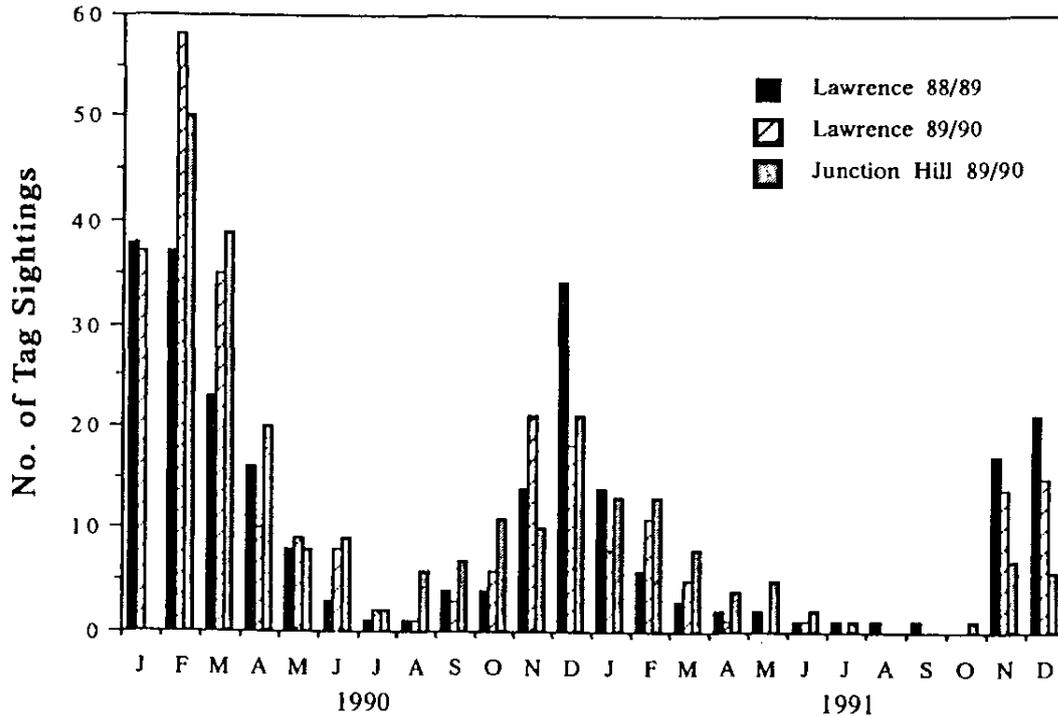


FIGURE 3 — Pattern of tag sightings in Clarence Valley, 1990-91. Age cohorts separated. Lawrence 88/89, 282 birds tagged. Lawrence 89/90, 218 birds tagged. Junction Hill 89/90, 201 birds tagged.

of three places — in a night roost 2 km from the colony, at the colony, where it nested as a second-year bird, or in a very localised feeding range midway between the two. These two birds represent less than 1% of all tagged birds observed.

### Long-distance movements and staging

Figure 4 shows the direction ratio, in 45 degree sectors, based on Baker (1978), for birds undergoing long-distance migration from the Hunter and Clarence Valley colonies, together with the mean distance travelled in that direction. The pattern of migration from the two Clarence Valley colonies, constructed from the long-distance movements of 109 birds, is a general southward movement, much the same as that outlined in Maddock (1990). Migration from the Hunter Valley colonies, compiled from the movements of 48 birds, differs somewhat from this pattern with 48% northward movements compared with 9% northward movements for the Clarence birds. The mean distance of southward movement, 629 km for Hunter birds and 615 km for Clarence birds, is greater than for birds moving north, 256 km for Hunter birds and 137 km for Clarence birds.

Almost all of the reports of Cattle Egrets on migration or in their wintering range were on the coastal plain. A small flock was in Canberra from May to November 1991 (D. Purchase, pers. comm.) and a roost at Tamworth was reported during winter 1991 (M. Rowe, pers. comm.). The presence of a tagged bird of uncertain origin at Bungendore, near Canberra, suggests that these birds came from coastal breeding colonies rather than the inland colonies that are occasionally set up in conjunction with other colonially breeding species.

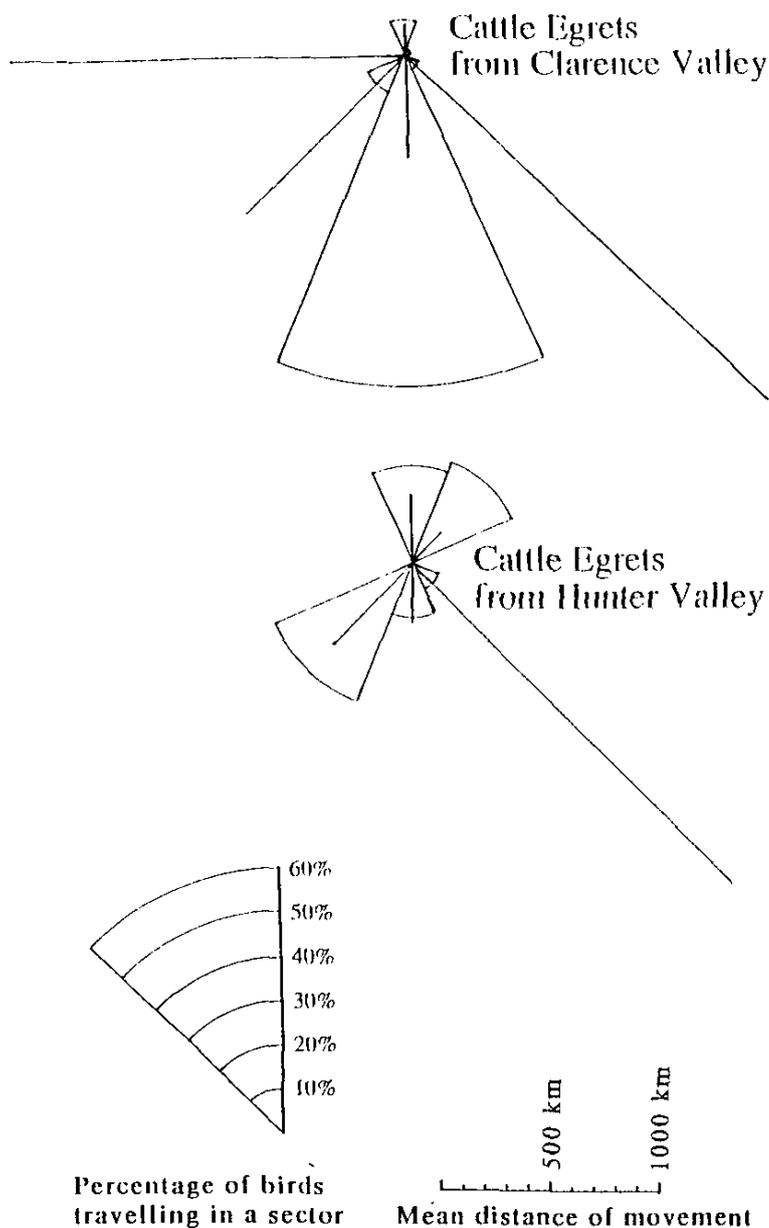


FIGURE 4 — Direction ratio of long-distance movements of Cattle Egrets from Hunter Valley and Clarence Valley colonies, and mean distance moved in each sector: radius of sector indicates % of birds travelling within this compass range: length of line indicates mean distance from colony to point of destination within that sector.

Maddock (1990) reported the autumn arrival and departure of flocks of birds in transit in the Hunter region, and such a pattern has been identified in each year of this study. Individually marked birds from Maryborough, Doboy and Gatton in Queensland and from Murwillumbah, Ballina, Lawrence, Junction Hill and Boambee in northern NSW have been recorded in the Hunter.

The arrival and departure of flocks of 100 to 150 Cattle Egrets in transit have also been reported in the Nowra area, on the NSW south coast (Wilson Graham, Egret Watch). One such flock arriving on 27 March 1992, the first Cattle Egrets to arrive for the season, departed the next day. Such staging

has been confirmed by repeated sightings of tagged birds along migration routes. In 1990, Lawrence No. 036 was seen at Morpeth, near Maitland, NSW, on 6 April and at Wyong, where it had spent the previous winter, the next day. It remained at this location until 8 May. Another second-year bird, Seaham 215, was at Lawrence on 29 January 1990 and at Mullumbimby on 6 June, a northward movement. In 1991, three first-year birds were reported at two locations on their southward migration. Junction Hill No. 205 was seen at Raymond Terrace on 11 February and again at Nowra on 22 March. Ballina No. 674 was also seen at Raymond Terrace on 13 March and at Nowra on 2 April. Ballina No. 691 was seen at Nowra on 27 April and then at Scottsdale, Tasmania, on 17 November.

As indicated in Maddock (1990), the regular pattern of increase and decline in numbers shows that many birds stage for relatively short periods. In the lower Hunter Valley, where observer effort is high, many tagged birds from the Clarence Valley colonies are seen only once or for a week at most. Of 34 birds seen during the general southward migration 23 were seen for less than a week, 7 for less than a month and 4 for 1 – 2 months. Almost all of those birds spending longer than a week in the Hunter Valley subsequently disappeared. As some of these birds were located back at their natal colonies in the next breeding season, it is assumed that they were in fact staging in the Hunter en route further south.

### **Out-and-return migration**

Records of tagged birds include 45 cases (30 Lawrence, 8 Junction Hill, 4 Seaham, 3 Shortland) of at least one out-and-return movement between the breeding colony and a distant wintering place well beyond the natal colony area. Of these, 3 Seaham, 2 Shortland, 13 Lawrence and 2 Junction Hill birds returned to the same wintering place for two or more years. Figure 5 shows the locations of the out-and-return sightings. The lines do not represent flight paths but only link the colony and the wintering location.

Seaham No. 215 (to and from Jamberoo, NSW, to the south in 1989 and to and from Mullumbimby, NSW, to the north in 1990) and Lawrence No. 167 (to and from Edithvale, Vic., in 1989 and to and from Portland, Vic., in 1990) went to different wintering places in each of two years.

Several birds have returned to the same wintering location they used in the first year of their life. Examples are Lawrence No. 142 to Bairnsdale, Vic. (1051 km southwest) for four years, Shortland No. 249 to Wyong (60 km south) for four years and Seaham 250 to Gloucester (70 km north) for three years.

### **Migration to New Zealand**

The pattern of arrival and departure of Cattle Egrets in New Zealand (Heather 1978, 1982, 1986, Maddock 1990) has been maintained and the origin of these birds in Australian colonies confirmed. A Ballina bird was recorded in winter 1990 and a Shortland bird in winter 1991 on a property bordering Churchill Road, near Rangiriri, North Island, and another Shortland bird was seen at Tauroa Point in Northland in April 1991 (OSNZ

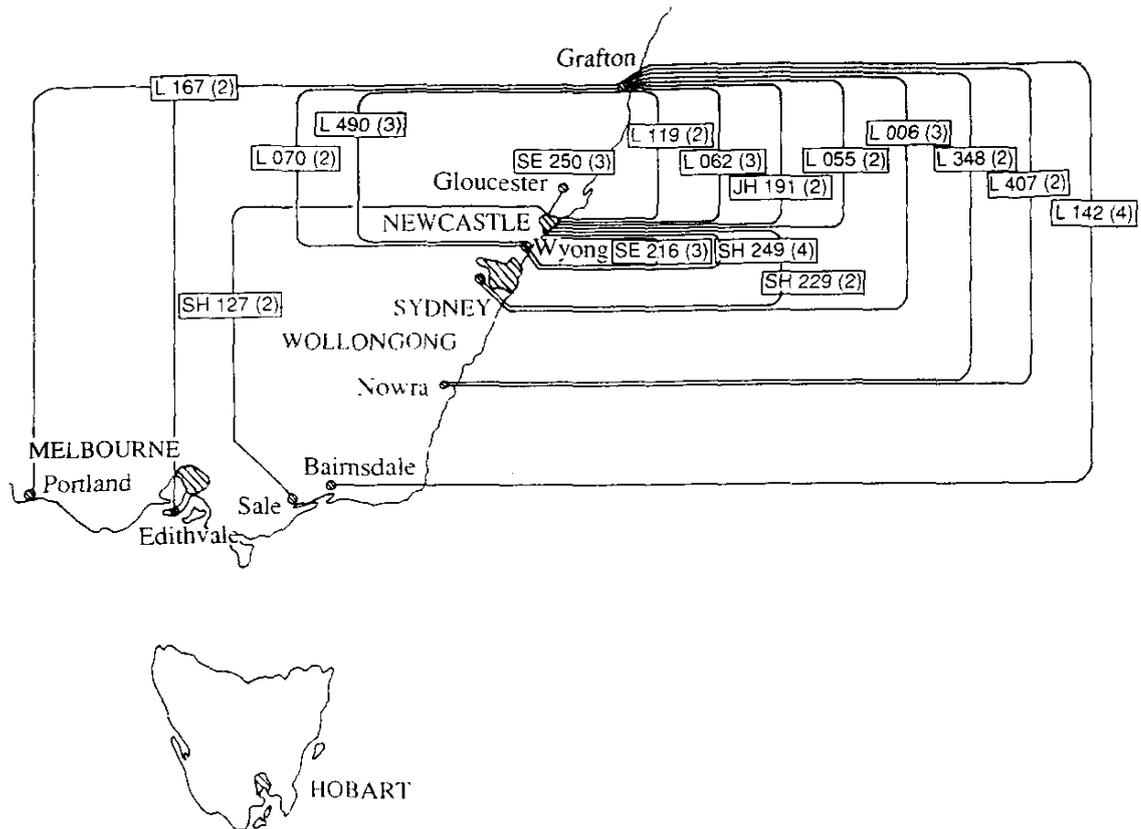


FIGURE 5 — Long-distance movements: Cattle Egrets which have returned from known wintering locations for two or more years in succession.

egret watchers). However, no marked Cattle Egret seen in New Zealand has been seen back in Australia.

### Localised feeding territories

Heather (1986) and Maddock (1990) stated that Cattle Egrets maintain very localised feeding territories in their winter range. This has been further confirmed by multiple observations of tagged birds in areas where Egret Watch observers have continuously been active during the winter period. Twenty-seven marked birds have been found consistently in the same night roost or on pastures on properties at or near the roost.

Observers in New Zealand reported that the Ballina bird in 1990 and the Shortland bird in 1991 which wintered near Rangiriri were always located on farmland bordering about 4 km of Churchill Road. The Lawrence birds seen in Bairnsdale, Victoria, during the 1989-91 winters were always found in the same evening roosts or on pasture in a very localised area. Similar patterns of localisation have been recorded near Colac, Victoria, and at Nowra, Cattai, Ourimbah, Wyong, Morisset, Maitland and Gloucester, NSW. The Seaham bird recorded at Ourimbah for two winters in a row was seen almost daily on the same property throughout the 1991 winter (Louise Evans, Egret Watch), and the Seaham bird at Cattai (Jenny Daly, Mark Hale, Egret Watch) was on the same properties for two winters in succession.

### Timing of migration

Tagged adults have been known to leave the nesting colony area before nesting has finished at the colony and juveniles very soon after fledging. First-year bird Seaham No. 215 returned to the Seaham colony from Jamberoo, south of Sydney, on 24 November 1989, nested unsuccessfully, was seen near Seaham on 4 January and was then found at Lawrence (374 km north) on 29 January, 1990. Nesting finished at Shortland in the 1990-91 season in the second week of February, but many birds had left the colony area well before that. Shortland No. 249, which had successfully raised chicks, arrived at Wyong, NSW (60 km south), where it had spent the previous two winters, on 18 February.

In 1991, first-year bird Seaham No. 394, which fledged on 3 February, was found dead near Taree, NSW, in late February. Seaham No. 352, which fledged on 21 January but was not found in the Hunter after that date, was seen alive at Austral Eden near Gladstone, NSW (214 km north), on 26 February. Seaham No. 418, fledged on 16 January, was killed by a vehicle near Gladstone, NSW, on 13 March. Junction Hill 205 was seen alive at Raymond Terrace, NSW (370 km south), on 11 February some 2 – 3 weeks after its estimated time of fledging. Lawrence No. 361, which fledged on about 25 January, was at Seaham, NSW (374 km south), on 2 March.

At the end of the 1990-91 breeding season, observers to the south of the Hunter and in New Zealand were alerted to keep a special watch for first arrivals. Table 1 shows the dates of the earliest reports in chronological sequence. A chronological progression is evident up to 9 March at Coolart in Victoria, after which Cattle Egrets begin to appear in Victoria, South Australia, Tasmania and New Zealand at about the same time. This progression is also evident in the arrival dates of tagged egrets in the wintering, or staging, areas as indicated in Table 2.

Maddock (1990) reported major fluctuations in the number of egrets in the Seaham area during the autumn and spring of 1987, equating them with waves of Cattle Egrets arriving from the north and moving on south during the autumn and passing through en route north in spring. Similar fluctuations occurred in both 1988 and 1989. Fluctuations consistent with such movements have been identified at Wyong (Diane Rogers, Egret Watch) and at Nowra (Wilson Graham, Egret Watch). Arrival dates of tagged egrets (Table 2) would also suggest such a movement of birds in waves.

Records of tagged birds also show variation of movement dates. Variation is not only between birds but also between years. In 1990 and 1991, first-year birds from the northern NSW colonies began arriving in the Hunter region in mid-February, whereas in 1989 and 1992, the first arrivals were in late March-early April. The same pattern was evident for the movement of young birds from the Seaham-Shortland colonies. Annual variation in movement dates is also evident by individual birds. Lawrence No. 036 was at Wyong from 26 April to 30 May in 1989 and from 7 April to 8 May in 1990. Lawrence No. 490 was at Wyong from 5 May to 22 October in 1990 and from 8 April to 19 August in 1991.



### Relationships between breeding colonies

Maddock (1990) reported that no northern birds had been found to remain in or near the two Hunter breeding colonies during the breeding season. Since then, some interchange has been recorded. During the 1989-90 season Seaham No. 163 was found breeding at Lawrence, 374 km north of its natal colony. In 1990-91 two Lawrence birds, No. 036 and No. 055, bred at the Shortland colony. In 1991-92 Lawrence No. 156 bred at Murwillumbah, Lawrence No. 009 at Seaham and Shortland No. 192 at Junction Hill. One of these birds, Lawrence No. 055, bred at Shortland as a second-year bird after returning to its natal colony the previous year without nesting. Lawrence No. 156 nested at Murwillumbah, 135 km north of its natal colony, after migrating south to Wyong the previous winter.

The majority of tagged birds are found breeding at their natal colony. A few have been recorded nesting at a nearby colony. During the 1990-91 breeding season 54 Lawrence birds, 61% of the birds known to have returned to the Clarence Valley after winter migration, were located at the Junction Hill colony, some 22 km southwest of the Lawrence colony, with six of these (11%) known to have nested. This was a year when the Lawrence colony was not active owing to a dry summer and water hyacinth (*Eichhornia crassipes*) covering the entire wetland. In 1991-92, a year when, after a dry start to the season, the Lawrence colony did not start until mid-December after substantial rain, 42 Lawrence birds, 82% of the birds known to have returned, were located at Junction Hill with 11 of these (26%) known to have nested. Seven of the Lawrence birds seen at Junction Hill were subsequently located at Lawrence. One of these (Lawrence No. 083) had a failed nesting attempt at Junction Hill but raised two chicks at Lawrence. Because of the large size of the colony and the difficulty of observing all nests at the Junction Hill colony it is highly likely that some nesting birds were overlooked.

Some Shortland birds have been recorded at the Seaham breeding colony each breeding season since 1987-88 – 4% to 16% of tagged birds known to have returned to the Hunter after winter migration – but few have nested (0 – 6%) (Table 3). Many of these have been the same birds in consecutive years. One bird (Shortland 102) nested at Seaham in 1989-90, at Shortland in 1990-91 and at Seaham again in 1991-92.

The 1991-92 season was complicated by early harsh drought, which prevented the Shortland colony from starting at the usual time, but sufficient rain at Seaham enabled a start at the end of October. Fifteen Shortland birds were located at Seaham, and of these, five made nesting attempts. When drought-breaking rains fell in mid-December, Cattle Egrets began nesting at Shortland. Three of the Shortland birds seen at Seaham were later found at Shortland but it is not known whether they nested there. Six Seaham birds which had been seen previously at Seaham, including four which had failed nest attempts, were also located at Shortland during the nesting period.

### DISCUSSION

Since 1990, several aspects of Cattle Egret migration have been clarified. Migration often starts as soon as the bird has fledged, with many juveniles

TABLE 3 — Interaction between nearby colonies

		86-87	87-88	88-89	89-90	90-91	91-92
Tagged birds returning to Hunter	Seaham	2	13	15	37	53	39
	Shortland	2	13	24	23	21	17
Shortland birds	Seen at Seaham	2	6	12	17	8	16
	Nested Seaham	0	0	3	5	1	5
Seaham birds	Seen at Shortland	0	1	0	0	1	6
	Nested Shortland	0	0	0	0	1	2
Tagged birds returning to Clarence	Lawrence	-	-	-	87	86	58
	Junction Hill	-	-	-	-	33	25
Lawrence birds	Seen at Junction Hill	-	-	-	7	53	47
	Nested Junction Hill	-	-	-	0	5	10
Junction Hill	Seen at Lawrence	-	-	-	-	0	0
	Nested Lawrence	-	-	-	-	0	0

undertaking an exploratory nomadic migration, moving around the floodplain area in which the colony is situated, though not necessarily returning to the colony. Some of these birds remain at a particular site for the winter, whereas others undertake a further movement with a more rectilinear track pattern. Such movements usually result in a return migration, though some may be classified as a removal migration (Baker 1987), the bird not returning to its starting point. The degree of movement in these migrations is wide ranging with some birds undergoing regular seasonal migrations of 20 km and others over 1000 km.

Determining whether Cattle Egrets undergo a complete or partial migration is complicated by the presence of birds from other areas wintering in the areas around the colonies studied. Present evidence from observations of marked birds suggests that the Cattle Egret undergoes a virtually complete migration with fewer than 1% remaining at the natal colony. The almost complete lack of tagged birds identified as spending their entire lives in the immediate area of the natal colony in the Hunter area, given the intensity of observer effort, supports this hypothesis.

### Direction of season migration

Generally, there is a strong southward movement of Cattle Egrets after the breeding season to wintering sites in southern NSW, Victoria, south-east South Australia, Tasmania and New Zealand. There is, however, an element of the population that moves north from the natal colony. The number of these northerly movements is significantly higher than that reported in 1993

Maddock (1990) and can be partly attributed to the strengthening of the Egret Watch network on the NSW north coast. The percentage of northern movements in all migrations is 21%. The mean southward distance (618 km) still far exceeds that of birds moving north (220 km).

Cattle Egrets migrating south do so in waves over a period of up to three months after fledging. Some of the birds, at least, stage for periods from a day to a week in what appear to be certain key locations. Some birds remain at these staging points for longer periods before resuming their onward movement. When they reach their ultimate winter range the birds are generally confined to a very localised area of feeding habitat.

The slight shift in orientation of movements from the Hunter and Clarence Valley colonies from south to southwest, as seen in the direction ratios (Figures 4 & 5), is a result of the orientation of the coastline in relation to the location of the colony. Birds from the Clarence Valley colonies migrating south eventually move into the southwestern sector in Victoria while those moving on to South Australia end up in the western sector. Such a trend is clearly evident from the mean distances travelled. From the Hunter Valley, however, a much shorter distance is required before birds move into the southwestern sector. The direction ratio uses the direct bearing between the place of banding and sighting, which may have no relationship to the total distance flown or the route taken by the bird.

#### **Out-and-return migration pattern**

The pattern of sightings of tagged birds at distant locations on the migration route and back to their natal colonies strongly supports an out-and-return migration pattern. In general, birds return to their natal colony but may spend some time at a nearby colony, some nesting there. This is particularly so if conditions for breeding at their natal colony are not optimal, as at Lawrence in the 1990-91 breeding season and again at Lawrence, and to a lesser extent at Shortland, in the 1991-92 season. A further very small percentage of interchange also occurs between distant colonies. This has occurred between colonies both to the south and to the north of the natal colony. The birds involved had undertaken a range of movements, including those that had previously returned to their natal colony and others that had not. One bird is known to have migrated south and yet nested at a colony to the north.

The study has clarified the pattern of Cattle Egret migration in south-eastern Australia and New Zealand, but there are questions still to be adequately answered. Do the Cattle Egrets seen in New Zealand during the winter return to Australia? Sightings of marked birds in Australia after being seen in New Zealand are needed to properly answer this question. Many birds return to the breeding colonies each breeding season without being seen over winter. Where do these birds go? Birds have been reported in their second and third year of life without having been seen anywhere since being banded, for example, second-year Shortland 256 in New Zealand in 1991. Where have these birds been in the interim? The project is continuing with the aim of filling the remaining gaps in the migration picture.

## ACKNOWLEDGEMENTS

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- MAX MADDOCK, *Department of Education, University of Newcastle, NSW Australia 2308 and Shortland Wetlands Centre, P.O. Box 130, Wallsend, NSW 2287.*
- DAVID GEERING, *Shortland Wetlands Centre, P.O. Box 130, Wallsend, NSW 2287*