BREEDING OF THE BANDED DOTTEREL, *Charadrius bicinctus*, ON THE CASS RIVER DELTA, CANTERBURY

By MARY BOMFORD

ABSTRACT

Laying began in August, peaked in late September to early October and finished in December. Eggs were laid at intervals of three days to a normal clutch of three. The site and dimensions of 47 nests are described. The female did 82% of daytime incubating, and incubation averaged 26.5 days. Most eggs were lost to predators and only 44% hatched. In fine weather chicks made trips away from the nest within a few hours of hatching. Once hatching was completed the nest was deserted, but parents and chicks stayed in the territory until the chicks fledged at 5-6 weeks. Post-breeding flocks contained 23% juveniles.

INTRODUCTION

There has been no comprehensive study of the Banded Dotterel's breeding biology, and only Stead (1932), Stidolph (1971), Child (1970), Soper (1972) and Phillips (1980) have published some observations on breeding dates, habitats and behaviour at the nest. This study describes nest construction and breeding performance in a typical high-country breeding site. All observations were made between July 1977 and January 1978.

STUDY SITE

The study site was the Cass River Delta, west of Lake Tekapo, Canterbury (Figure 1). The greywacke shingle of the delta is dissected by shallow dry stream channels and is stabilised by mat plants, the main species being common raoulia *(Raoulia hookeri)*, scabweed *(Raoulia australis)*, the moss *Racomitrum ptychophyllum*, white clover *(Trifolium repens)* and various grasses, mainly *Poa* spp. More detailed descriptions of this site are given by Bomford (1978) and Pierce (1983).

METHODS

Nests were visited on foot twice a day during laying and hatch, and every second day during incubation. All eggs were marked with pencil to show the order they were laid in. The hide used to observe nests was a one-man tent erected about 20 m from the nest on the evening before the observation day.

RESULTS

Territories: The first isolated breeding pair of birds was seen on 2 August, and from the second week of August onwards many pairs were seen actively defending territories against intruders. The displays and behaviour used for territorial defence are described by Bomford (1986).

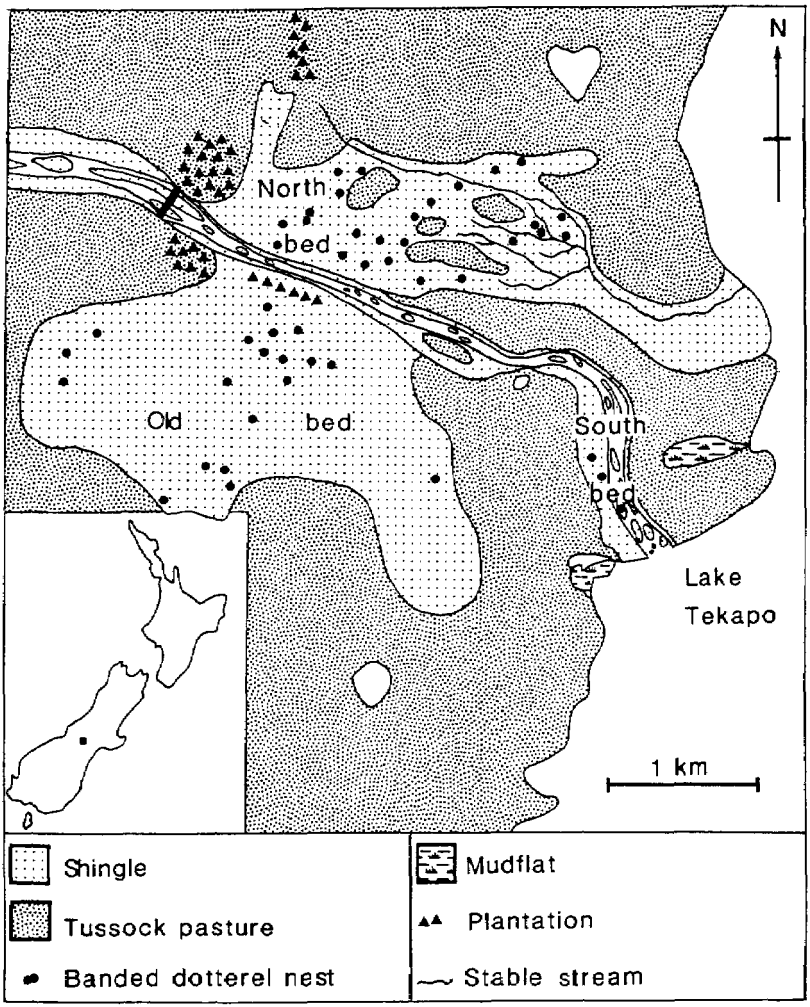

FIGURE 1 — The Cass River delta study area. At the time of the study the Cass River flowed down the south bed. In the past century the river twice changed course and the north bed and the old bed are both stable shingle beds left from these times. Nests marked on the map were not all present at the same time, and not all nests on the delta were found.

Nests: Nests were scrapes in loose shingle or sand. To scrape out a nest, a bird would sit, pivot on its breast and kick backwards. The nest was lined before eggs were laid with small fragments of grass, leaf, moss, dung or stones, which the bird picked up from the surrounding shingle and threw back over its shoulder towards the nest. The bird then sat in the scrape,

collecting these fragments in its bill and placed them in the nest. About 90% of nest scraping and lining was done by males. The amount of lining varied between nests from none to a layer 2-3 cm deep.

The dimensions of 47 nests were mean depth 32 ± 5 mm (1 SD) and mean diameter 97 ± 7 mm. Of these 47 nests, 46 were on shingle stabilised by mat-plants. The exception was on an island in the main river, a site that was flooded later in the season. The ground surrounding 46 of the nests was level or very gently sloping, and only one nest had a rise nearby that would have blocked much of the incubating bird's view of its surroundings.

Nests were not made beside large stones or other objects that would have protected the incubating bird from the prevailing winds, which were often strong. By contrast, the nests of Wrybills *(Anarhynchus frontalis)* on the delta were often against a protecting stone or piece of driftwood. Banded Dotterels did not nest in areas with small bushes or shrubs such as the common matagouri bushes *(Discaria toumatou)*, which grew on the oldest, most stable shingle beds.

Laying: Six empty nests were checked daily before the first egg was laid, and so I recorded the laying times of all eggs in these nests. I found six more nests while they had only one egg, and so I recorded the time interval between the second and third eggs. I estimated the average interval between the laying of first and second eggs as 87 ± 28 (1 SD) hours, and the interval between the second and third eggs was 66 ± 13 h.

Figure 2 gives the estimated laying dates for the first egg in 35 nests. When I did not know the date the first egg was laid, I estimated it by counting back from the date the second or third egg was laid, or from the date of hatching, allowing 26.5 day for incubation. The first egg of the season was found on 22 August, and a second egg was found in the same nest on 25 August. On 28 August this scrape still had only 2 eggs, and incubation had not started. That night the eggs were covered by 5 cm of snow, and next morning Banded Dotterel tracks in the snow showed unsuccessful attempts to visit the nest. On the morning of 31 August the snow had melted but the eggs were gone. Laying spread from mid-August to mid-December, but peak laying was in late September and early October.

The weights of 51 eggs were recorded either before incubation started or within 24 h of laying. The mean weight was 11.5 ± 0.8 g (1 SD).

The ground colour of eggs was usually pale aqua or pale olive green, but a few were light grey or light brown. Eggs were marked with black or brown spots, blotches or squiggles. During laying the male was very active in adding lining to the nest, and before incubation started many nests had eggs that were almost buried in lining material which matched them in colour and pattern and formed an effective camouflage (photograph *in* Bomford 1978).

A nest with an incomplete clutch of two eggs was observed from a hide from 0500 h to 1930 h on a sunny day on 16 October. Incubation did not start in this nest until the third egg was laid two days later. At dawn the nest was unattended, and between 0600 h and 0900 h the nest was visited only 3 times by the male, which stayed on the eggs for less than a minute

each visit and added lining material to the nest for several minutes when he left. Between 0900 h and 1230 h the nest was visited more frequently by both parents, and in this period the eggs were sat on about half the time, mainly by the female. Between 1230 h and 1620 h the eggs were sat on almost continuously by the female. This behaviour would have shaded the eggs and perhaps prevented them from overheating in the hot part of the day when the shingle surface temperature reached well above incubation temperature. At 1620 h the female left the nest, and from then until dark at 1930 h it was infrequently visited by the male, which again added lining material after each visit. In total, the eggs were sat on for 34% of the daytime.

Of 40 nests in which the eggs were incubated, 36 had 3 eggs, 2 had 2 eggs, and 2 had 1 egg. I do not know whether the smaller clutches had lost eggs or were complete.

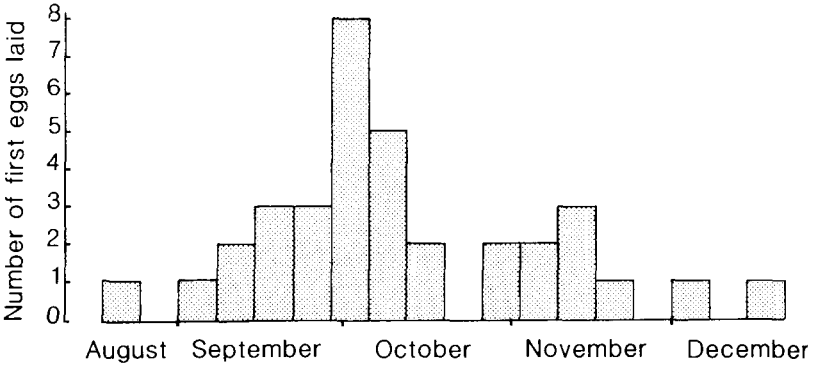

FIGURE 2 — Laying dates (first egg) for clutches found on the Cass River Delta in the 1977-78 breeding season

Incubation: Once incubation started, the eggs were placed on top of the nest lining, rather than being buried in it. They were arranged haphazardly, not neatly with the pointed ends inwards (photograph *in* Bomford 1978).

In two early nests with clutches completed on 17 and 20 September, continuous incubation did not begin until 4 and 5 days after the third egg was laid. In all other nests incubation started within a day either side of the third egg being laid, except in two late nests, in which the clutches were not completed until 10 November and 7 December and in which incubation started two days before the third egg was laid.

I made dawn to dusk observations from hides of eight nests at different stages of incubation, giving a total of 109 hours of observation. The female averaged 82% of the daytime incubating, ranging from 67% to 99% for individual nests, and there was no tendency for the male to do more daytime incubating as hatching approached. Only 1 of the 11 birds observed incubating at last evening light was a male, and this contrasted with observations made at first morning light, when 8 of 10 incubating birds were males. These data suggest that males may do a greater share of the night-time incubating.

The eggs were incubated for 93% of the daylight hours and were not left unincubated for more than 10 minutes. The incubating bird left the nest for short periods to throw lining material on the eggs, to feed or preen nearby, to chase an intruder from the territory, or when the parents changed over or predators were close.

In the eight nests observed from hides, the average time between change-overs was 177 minutes, ranging from 10 to 570 minutes. The non-incubating bird often stayed feeding or resting within 100 m of the nest, but sometimes left the territory.

Owing to a high level of nest predation, incubation periods were recorded for only four clutches. These were 26, 26, 26.5 and 27 days ± 1 day for each observation. Each period is taken from the laying of the last egg to the hatching of the last chick, and nests in which there was a delay between clutch completion and the start of incubation are not included in the sample.

Nest predation and egg loss: Despite the cryptic colouring of eggs and the willingness of parents to perform distraction displays (Bomford 1986), 56% of eggs were lost before hatching. The history of 37 clutches is known. Three clutches (5 eggs) disappeared during laying, 17 clutches (50 eggs) were lost during incubation, 16 clutches (44 eggs) hatched, and 1 clutch, consisting of a single egg half buried in lining in a scrape, was not attended by adult birds from the day it was found. This deserted egg was found to have an apparently normal yolk. Four of the successful nests hatched only 2 eggs: one 2-egg clutch, one cracked egg, one infertile egg, and one egg that disappeared from a nest during incubation.

The disappearance of eggs was attributed to predators but I could not identify the species responsible. Most eggs simply disappeared, but sometimes trace of egg yolk and shell were found in a nest, and one nest had three opened eggshells.

Hatching: Hatching was recorded for eight nests. The time interval between hatching of the first and third eggs ranged between 20 and 45 hours. In the four nests for which I recorded both laying and hatching, the eggs hatched in the order they had been laid in.

One or two days before an egg starred, the chick could be heard peeping inside the egg. Eggs hatched 2-50 h after they starred. Within minutes of hatch the incubating parent flew away with the large pieces of eggshell and dropped them 5-25 m from the nest. Smaller pieces were tucked under the nest lining. The mean weight of 32 chicks, weighed within 24 h of hatch, was 8.0 g ± 0.4 (1 SD). The colours of 36 downy chcicks were recorded: 18 were grey and white, 13 were gold or gold and white, and 5 were grey and gold. All chicks had black spots on the head, back and upper wings and white underparts.

In fine weather, chicks made trips away from the nest within 3-4 h of hatch, but at night or in bad weather they stayed in the nest, sometimes for over a day. At first chicks went only 1-2 m from the nest but soon moved around the whole territory. They pecked at the ground on their first trip and soon fed.

Chicks were seen in the nesting territory until fledging at 5-6 weeks of age. As feathers replaced down they spent less time being brooded and more time feeding, but both parents stayed in the territory with the chicks. Colour bands were put on 48 chicks, but their secretive behaviour and cryptic colouring made it impossible to follow survival rates. After fledging, parents and juveniles left the territories to join the post-breeding flocks. These flocks, seen from mid-December onwards, ranged in size from 4 to 40 birds, averaging 20. Of 497 birds observed in post-breeding flocks, 23% were juveniles.

DISCUSSION

Boyd (1962) made the generalisation that in the Charadrii 66-96% of eggs hatch, and Cramp *et al.* (1983) gave a similar range for *Charadrius* plovers in Europe. The low level of 44% in the present study could be caused by a lack of adaptation to introduced mammalian predators. Phillips (1980) found that only 12 of 116 (9%) Banded Dotterel eggs hatched in a North Island breeding ground, although most of his egg loss was caused by flooding.

Females did most of the daytime incubating throughout the incubation period in the present study, and the relative sitting times of the sexes did not change as incubation advanced, or during hatching. This contrasts with Soper's (1972) observation that "As incubation advances the male takes over a larger and larger share of the duty". Phillips (1980) also observed that female Banded Dotterels do most of the incubating. The present study indicated, however, that males probably play a greater role in night-time incubating. The male's major role was in territorial advertisement and defence and in nest construction. The method of nest construction was remarkably similar to that described and illustrated by Rittinghaus (1961) for the Kentish Plover *(Charadrius alexandrinus)*.

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