

# NOTORNIS

is the journal of the Ornithological Society of New Zealand (Inc.)

Editor: B. D. Heather,  
10 Jocelyn Crescent  
SILVERSTREAM

---

VOLUME 31

PART 2

JUNE, 1984

---

## BREEDING OF THE CHATHAM ISLAND WARBLER (*Gerygone albofrontata*)

By M. D. DENNISON, H. A. ROBERTSON and D. CROUCHLEY

### ABSTRACT

The breeding of the Chatham Island Warbler was studied over five seasons on three islands in the Chatham Group. The breeding season is short, and only one brood is raised per year. On predator-free 'petrel islands', nests were low to the ground in dense vegetation, whereas on Chatham Island nests were high and in the open. Mean clutch size was 3.1 eggs ( $n=79$ ). Incubation and nestling periods were both about 20 days. Density of breeding birds was highest in regenerating forest clumps on predator-free islands, with about 10 pairs per hectare. Comparisons are made with the breeding biology of the Grey Warbler (*G. igata*) of the New Zealand mainland and with other *Gerygone* species. Brood parasitism by the Shining Cuckoo (*Chrysococcyx lucidus*) and how vulnerable the Chatham Island Warbler is to extinction are discussed.

### INTRODUCTION

The Chatham Island Warbler (*Gerygone albofrontata* Gray, 1844) is endemic to the Chatham Islands. It belongs to the genus of Australasian warblers, *Gerygone*, which contains about 18 species, extending from South-east Asia through New Guinea and Australia to the islands of the South-west Pacific, including New Zealand, where it is represented on the mainland and on many offshore islands by the Grey Warbler *G. igata* (Meise 1931, Gill 1982). Robertson & Dennison (in press) have suggested that the Chatham Island Warbler was derived from a warbler that has become extinct on the New Zealand mainland, and not from *G. igata*, a species whose breeding

biology has been closely studied recently (Gill 1982, 1983a). The breeding of other *Gerygone* species has not been studied in depth; only approximate clutch sizes, some incubation and nestling periods and a few other details are known (e.g. McGill 1970, Courtney & Marchant 1971).

In recent years the Chatham Island Warbler has been used as a host for the eggs and chicks of Black Robins (*Petroica traversi*) in an attempt to save that species from extinction (Merton 1981).

## STUDY AREAS

### *Chatham Island*

Warblers on Chatham Island were observed mostly in the Tuku-a-Tamatea River valley (176° 37'W, 44° 05'S) and the forest to the west of it, between December 1977 and February 1978 and in November/December 1978. The vegetation has a 6-12 m canopy and is mainly composed of *Coprosma chathamica*, *Pseudopanax chathamica*, *Hymen-anthera chathamica* and *Dracophyllum arboreum*, with the *Dracophyllum* dominant on the drier slopes and ridges. The understorey and ground layers are fairly open on the ridges and flat areas, reflecting the influence of feral pigs, sheep and cattle, but in the steep valleys, the forest is denser and supplejack (*Rhipogonum scandens*) and tree ferns (*Cyathea* spp.) are numerous.

### *South East Island*

On South East Island (176° 10'W, 44° 20'S) observations were concentrated in 5.5 ha of the northern part of the island in December 1978, November/December 1979 and December 1981. The area consisted of clumps of coastal forest with *Olearia traversii*, *Myoporum laetum* and *Hymen-anthera chathamica* predominating; a large area of old farmland which was clear until 1963 when stock were removed from the island, and which is now mainly bracken (*Pteridium esculentum*) and *Muehlenbeckia australis*; and an area of continuous forest of *O. traversii*, *H. chathamica*, *Coprosma chathamica* and *Plagianthus betulinus* var. *chathamica*. The forest edge and tree clumps were often partly covered by *Muehlenbeckia*, creating very dense thickets. The continuous forest had a canopy at 7-10 m, and the understorey and ground layer were open because of intensive petrel burrowing activity. Within this study area, 2.7 ha of reverting farmland, tree clumps and some continuous forest were used for an intensive study of warbler pairs.

### *Mangere Island*

Nesting warblers on Mangere Island (176° 17'W, 44° 16'S) were observed in 4.2 ha of coastal forest at the north-eastern end of the island in September/December 1980 and 1981. The history of clearing, and current vegetation types are similar to those on South East Island. *Olearia traversii* is dominant, with *P. betulinus* var. *chathamica* and *H. chathamica* the other tree species in the bush remnant. Much of the forest edge and tree clumps is covered by

*M. australis*, creating the dense thickets which were the favoured habitat of warblers on South East Island.

### METHODS

Standard (9 m x 2 m) 38-mm mesh mist-nets were erected in the forest understorey on South East and Mangere Islands. No artificial lures were used. We caught 42 adult and 33 juvenile Chatham Island Warblers in 420 net-hours in 1979 and five adult and six juvenile warblers in 80 net-hours in 1981 on South East Island; and four adult and four juvenile warblers in 27 net-hours in 1981 on Mangere Island. These birds were measured, weighed, aged, sexed (Robertson & Dennison, in press), and individually marked with a colour combination of celluloid bands and a numbered metal band, before being released. We plotted sightings of these banded birds and breeding pairs on 1:3500 aerial photographs of South East Island and 1:1750 grid maps of Mangere Island.

Nesting was studied most intensively on Mangere Island, where the Chatham Island Warbler was being used as a host in cross-fostering experiments with the Black Robin. Most observations of post-fledging behaviour came from the South East Island study area. We found nests by following birds or by searching trees where pairs were often seen. Nests were checked daily during the nest-building, laying, hatching and fledging stages, and periodically in between. If we found a nest during incubation or brooding, we checked it on most days until one of the above stages was reached.

### RESULTS

#### *Territories*

Chatham Island Warblers nest solitarily and are monogamous. During the breeding season, territories were defended from all other warblers, other than their own dependent young. Boundary disputes, mainly by males, consisted of long chases interspersed with bouts of singing, not physical contact. Females occasionally joined in the chases. Throughout the breeding season some 1-year-old birds remained non-territorial and did not attempt to breed; these birds frequently trespassed into territories and induced chases. Towards the end of the breeding season flocks of up to 15 juveniles began to form in inter-territory gaps, and this may indicate that flocking occurs during the non-breeding season; however, nothing is known of the social system in autumn and winter. Some pairs defended the same territories for at least three breeding seasons on South East Island.

On Chatham Island, the density of warblers was about 0.3 pairs/ha in *Dracophyllum*-dominated forest, but it was lower in the pure broadleaf forest. On South East Island, from observations on territorial pairs and birds feeding nestlings or flying young, we mapped 28 warbler territories in the 2.7 ha intensive study area in 1979 and 22 territories in 1981. These were densities of 10.4 and 8.2 pairs/ha

respectively and are minimum estimates since some of the area was open grassland, which the warblers did not use. In the 4.2 ha study area on Mangere Island, breeding densities of 9.3 and 10.5 pairs/ha were recorded in 1980 and 1981 respectively.

#### *Breeding season*

The breeding season of the Chatham Island Warbler was from September to early January, but timing varied from year to year. In 1980, warblers were occupying territories on Mangere Island in mid-September, but nest-building did not start until late September. Laying was from 3 October to 21 November. In 1981, however, laying began on about 13 September and continued until 6 December. Although re-nesting was artificially induced on Mangere Island in both years, nests with eggs were found in December on both Chatham and South East Islands, suggesting that there were also natural replacements. The peak of laying was in mid-October in both 1980 and 1981 on Mangere Island, and from extrapolation of nestling and fledgling data, also on South East Island in 1979.

The single peak of laying suggests that only one brood is normal for this species, although pairs can re-nest if the first clutch fails.

#### *Nests*

The enclosed pendant nest of the Chatham Island Warbler is very like that of the Grey Warbler. Dimensions of nests were ( $\bar{x}$ , n, range in cm): outside depth 14.3, 4, 8.0-10.5; outside frontal diameter 8.3, 4, 7.0-9.5; outside lateral diameter 9.1, 4, 8.0-10.5; width of entrance 3.2, 7, 2.5-3-8. These dimensions are similar to those given by Gill (1983a) for the Grey Warbler.

Nests were composed of rootlets, mosses, lichens, leaves, bark, small twigs, grass stems, feathers, *O. traversii* flower heads, and spider egg cases and webs. They were thickly lined with feathers.

On Chatham Island, four nests averaged 6 m above the ground (range 1.5-10.0 m). Three were in terminal branches of *D. arboreum*, and the fourth and lowest was on the trunk of a ponga (*Cyathea dealbata*). All these nests were freely hanging in the open or near a gap in the vegetation.

On South East Island, 17 nests averaged 2.1 m above the ground (range 0.5-8.0 m). Eight were in *M. australis*, five in sapling *H. chathamica*, two in *O. traversii*, one in *Myoporum laetum* and one in *C. chathamica*. Most nests were attached with lateral and basal connections in dense foliage. That is, they were not freely hanging.

On Mangere Island, 109 nests averaged 2.5 m above ground (range 0.2-6.0 m). Of these, 65 were in *O. traversii*, 39 in *M. australis*, three in *H. chathamica* and two in *P. betulinus* var. *chathamica*. In 1981, the average height (2.7 m) of 37 nests in *O. traversii* was significantly higher than the 2.1 m in *M. australis* ( $t = 2.26$ ,  $p < 0.05$ ). Most nests were in dense foliage and had lateral and basal connections.

### *Nest-building*

Only females constructed nests, although males often accompanied their mate to the nest, and once a male appeared to work at a partly built nest. The male often sang as the female collected material and worked on the nest.

Nests took up to 13 days to build, and 1-12 days (average 6.0,  $n=25$ ) separated the completion of building and the laying of the first egg. The prelaying interval of first nests was 6.4 days ( $n=21$ ) and that of renesting attempts was 4.0 days ( $n=4$ ).

### *Eggs*

The eggs of the Chatham Island Warbler are similar to those of the Grey Warbler, being white with reddish-brown speckles, usually concentrated towards the larger end. Average measurements of 25 eggs from Mangere Island, to the nearest 0.1 mm, were 18.09 mm long (SD 0.62, range 17.2-19.2) and 12.96 mm wide (SD 0.38, range 12.0-13.7), with a mean volume index (length  $\times$  breadth<sup>2</sup>) of 3043.1 (SD 237.1, range 2476.8-3429.6). If the relationship between the egg volume index and the fresh egg weight is the same as in the Grey Warbler (Gill 1982, 1983a), the fresh egg weight would be 1.82 g, which is 19.1% of the average weight of an adult female in the breeding season (9.51 g, Robertson & Dennison, in press). Like Grey Warblers, Chatham Island Warblers have much heavier eggs than would be expected for a passerine of their size, and a complete clutch represents, on average, 59% of the body weight of a female.

### *Clutch size and breeding success*

Eggs were laid at 2-day intervals in all nests checked daily. The average clutch of 79 nests (all on Mangere Island) was 3.1 eggs, there being 11 2-egg clutches, 51 3-egg clutches and 17 4-egg clutches. Unfortunately breeding success could not be directly determined because most clutches were manipulated in the Black Robin cross-fostering programme. However, on South East Island in late November-early December 1979, the average number of fledged young in 31 family groups was 2.7, there being 1 group with 1 young, 10 with 2, 18 with 3, and 2 with 4 young. Although complete nesting failures are not represented by family parties, most pairs seemed to have fledged young with them. The breeding success on South East Island, therefore, seemed to be very high (87%), if we assume an average clutch of 3.1 eggs.

### *Incubation and care of young*

Only female Chatham Island Warblers incubated, and they began when the last egg was laid. Brooding periods were recorded at three nests when nestlings were 3, 10, and 12 days old. Periods on the nest were generally short:  $\bar{x} = 9$  minutes ( $n = 10$  periods), and the proportion of time spent brooding was 48% (58 minutes' observations), 49% (51) and 55% (69) for the three ages respectively.

The average incubation period (interval between the laying and hatching of the last egg — Skutch 1945) for 13 nests was  $19.5 \pm 1.3$  days ( $\bar{x} \pm SD$ ), range 17-21 days.

Only the female brooded, but both parents usually fed the young in the nest and after fledging, except at three nests with well-grown chicks and only one adult in attendance. The nestling period in seven nests was  $20.0 \pm 1.5$  days, range 19-23 days. One fledgling was still being fed by its parents 24 days after leaving the nest. Sometimes the fledglings were split between the parents, and these groups occasionally coalesced. Adults were occasionally seen with the small flocks of juveniles, but none of these juveniles was seen to be fed.

### *Cuckoo parasitism*

The Shining Cuckoo is a brood parasite of the Chatham Island Warbler (e.g. Potts 1884). In many breeding pairs of warblers we found a very low rate of parasitism by cuckoos. On Chatham Island no cuckoos were seen or heard during the study, but on Mangere Island one was seen in November 1981 (D. V. Merton, pers. comm.). On South East Island we saw one or two cuckoos in two seasons, two Shining Cuckoo fledglings were seen in January 1981 (B. D. Bell, pers. comm.), and a nest with a well-grown cuckoo nestling was found on 14 January 1982 (W. F. Cash, pers. comm.).

## DISCUSSION

The breeding of the Chatham Island Warbler has not been studied before. Of the genus *Gerygone*, only the Grey Warbler (*G. igata*) has been studied in depth (Gill 1982, 1983a). Table 1 compares the breeding systems of Chatham Island Warblers and Grey Warblers.

Thomas (1974) drew attention to some adaptations for breeding in Australian passerines: (1) small clutches (usually 2-3 eggs), (2) 48-hour laying intervals, (3) delayed laying after nest building, (4) high longevity, (5) helpers at the nest, and (6) nomadism outside the breeding season. Gill (1982) found that points 1-4, but not 5 and 6, applied to Grey Warblers, except that their clutch of 3.9 eggs was higher than that of Australian relatives and that delay in laying was up to 8 days in Grey Warblers compared with several weeks in Australia. Points 1-4 apply even better to the Chatham Island Warbler. The clutch size of 3.1 eggs is much nearer the usual range of 2-3 eggs in Australian *Gerygone* (McGill 1970, Pizzey 1980), and the delay before laying was up to 12 days, and on average about 2 days longer than for the Grey Warbler. It is likely that Chatham Island Warblers are long-lived, judging by resightings of banded birds on South East Island over four years after capture. Helpers were not recorded at nests or in family parties. The lack of records of warblers outside forest areas, and their limited distribution, on the Chatham Islands (Robertson & Dennison in press) indicate that nomadism is unlikely.

TABLE 1 — Comparison of breeding systems of Chatham Island Warbler (*Gerygone albofrontata*) and Grey Warbler (*G. igata*) (Gill 1982).

	<u>albofrontata</u>	<u>igata</u>
Solitary/colonial	Solitary	Solitary
Monogamous/polygamous	Monogamous	Monogamous
Density (pairs/ha)	0.3-10.5	1.1-2.2
Period of egg-laying	10 weeks	16 weeks
Broods/year	1	2
Nest	Pendant	Pendant
Nest building by	Female	Female
Pre laying interval	6.0 days	4.3 days
Laying interval	48 hours	48 hours
Clutch size	3:1	3:9
Incubation by	Female	Female
Incubation period	19.5 days	19.5 days
Brooding by	Female	Female
Feeding by	Both adults	Both adults
Nestling period	20.0 days	17.2 days
Breeding cycle <sup>1</sup>	44.5 days	43.7 days
Eggs/season	3.1	7.8
Breeding success <sup>2</sup>	87%	38%
Young/pair/year <sup>3</sup>	2.7	2.9

1 Days required to lay a clutch plus incubation and nestling periods

2 Proportion of eggs that yielded fledglings

3 Eggs/season x breeding success

On Mangere and South East Islands, two different methods gave similarly high estimates of the breeding density of Chatham Island Warblers. Both islands have similar habitat of regenerating forest clumps with dense thickets formed by the vine *Muehlenbeckia*, and both are predator free. Continuous forest on South East Island had lower densities than the forest clump habitat. The continuous forest on Chatham Island, where rats and cats are present, had an even lower density of warblers, and of other forest birds too. Predation pressure may also have affected nest sites. On Chatham Island, nests were higher and in terminal branches, which probably made them less accessible to rats and, especially, to cats. On predator-free Mangere and South East Islands, a wider range of nest sites could be used. On these islands, however, nest siting may be influenced by the high numbers of nesting seabirds in the forest areas and the need to protect nests from petrels landing.

The shorter single-peaked laying season of the Chatham Island Warbler compared with the extended bimodal season of the Grey Warbler on the New Zealand mainland (Gill 1982) parallels the differences between the Chatham Island Fantail (*Rhipidura fuliginosa penitus*) and the two mainland subspecies of Fantail, and between the Chatham Island Tomtit (*Petroica macrocephala chathamensis*) and Black Robin and their mainland counterparts (Dennison & Crouchley, in prep.; Dennison *et al.* 1979). As climate and hence food supplies on the Chathams are probably suitable for a much shorter time than on the mainland of New Zealand, which Gill (1982) considers to show some characteristics of the tropics, a contracted breeding season with a more pronounced laying peak can be expected on the Chatham Islands. An additional factor affecting timing of the breeding season of the Chatham Island Warbler may be the need to avoid nest-parasitism by the Shining Cuckoo. The single peak of laying by the Chatham Island Warbler occurs before the cuckoos are ready to breed. Most of the cuckoo eggs in Grey Warbler nests at Kowhai Bush, on the New Zealand mainland, were laid in November (Gill 1983b), when most Chatham Island Warbler eggs would be well incubated or hatched. Gill (1983b) had only one record of a Shining Cuckoo laying an egg in mid-October, but he considered this record exceptional as it was 2-3 weeks earlier than any others. The three recent records of cuckoo parasitism of Chatham Island Warblers were of nestlings or newly fledged juveniles in January. By extrapolation, based on an incubation period of 15 days and a nestling period of 19 days (Courtney & Marchant 1971, Gill 1983b), parasitism occurred in late November-early December, right at the end of the Chatham Island Warbler's laying season; this may explain why so few Shining Cuckoos are in the Chatham Islands.

The similar figures for annual productivity of Chatham Island Warblers and Grey Warblers shown in Table 1 are achieved by different methods: the Chatham Island Warbler lays one small clutch and has a high breeding success because of low predation and parasitism



rates (on Mangere and South East Island, at least). The Grey Warbler lays two larger clutches but has a much lower breeding success, due mainly to predation by introduced mammals and nest parasitism by Shining Cuckoos (Gill 1982, 1983b). The Chatham Island Warbler can therefore be described as a 'k-selected' species, whereas the Grey Warbler is 'r-selected' by comparison. Moors (1983) has argued that in New Zealand, which lacked mammalian predators until recently, 'k-selected' species are much more at risk of extinction caused by exotic predators than 'r-selected' species. Therefore, the Chatham Island Warbler, with its low annual rate of egg production, may be vulnerable to extinction if mammalian predators reach the few islands in the Chatham Group where the warbler is still numerous.

#### ACKNOWLEDGEMENTS

This work was done during two 'Taiko Expeditions' led by D. E. Crockett to the Tuanui property near the Tuku-a-Tamatea River; a private expedition and a Wildlife Service expedition to South East Island Nature Reserve; and two Wildlife Service expeditions to Mangere Island Nature Reserve. We thank M. Dix for transport to the islands and the Department of Lands and Survey for permission to work in these Nature Reserves.

T. C. Dennison, R. W. Hornabrook, A. Munn, D. V. Merton and R. Morris provided valuable field assistance during our study, and B. M. Fitzgerald, B. J. Gill and D. V. Merton made valuable comments on an earlier draft of this paper.

#### LITERATURE CITED

- COURTNEY, J.; MARCHANT, S. 1971. Breeding details of some common birds in south-eastern Australia. *Emu* 71: 121-133.
- DENNISON, T. C.; DENNISON, M. D.; ROBERTSON, H. A. 1979. Breeding of the Chatham Island Fantail. *Notornis* 26: 392-395.
- GILL, B. J. 1982. Breeding of the Grey Warbler *Gerygone igata* at Kaikoura New Zealand. *Ibis* 124: 123-147.
- GILL, B. J. 1983a. Breeding habits of the Grey Warbler (*Gerygone igata*). *Notornis* 30: 137-165.
- GILL, B. J. 1983b. Brood-parasitism by the Shining Cuckoo *Chrysococcyx lucidus* at Kaikoura, New Zealand. *Ibis* 125: 40-55.
- McGILL, A. R. 1970. Australian Warblers. Melbourne: The Bird Observers Club.
- MEISE, W. 1931. Zur Systematik der Gattung *Gerygone*. *Novitates Zool.* 36: 317-379.
- MERTON, D. V. 1981. The Robin capable of full recovery on Mangere Island. *Forest and Bird* 13 (9): 6-7.
- MOORS, P. J. 1983. Predation by mustelids and rodents on the eggs and chicks of native and introduced birds in Kowhai Bush, New Zealand. *Ibis* 125: 137-154.
- PIZZEY, G. 1980. A field guide to the birds of Australia. Sydney: Collins.
- POTTS, T. H. 1884. Oology of New Zealand. *NZ J. Sci.* 2: 475-484.
- ROBERTSON, H. A.; DENNISON, M. D. in press. Sexual dimorphism of the Chatham Island Warbler (*Gerygone albofrontata*). *Emu* 84: 103-107.
- SKUTCH, A. F. 1945. Incubation and nestling periods of Central American birds. *Auk* 62: 8-37.
- THOMAS, D. G. 1974. Some problems associated with the avifauna. In Williams, W. D. (ed.), *Biogeography and ecology in Tasmania*. The Hague: Junk.

M. D. DENNISON, *Dept Zoology, University of Toronto, Toronto M5S 1A1, Ontario, Canada*; H. A. ROBERTSON, *Edward Grey Institute of Field Ornithology, Dept Zoology, South Parks Road, Oxford, England\**; D. CROUCHLEY, *Wildlife Service, Department of Internal Affairs, Private Bag, Wellington, New Zealand*

\* Present address: *Ecology Division, DSIR, Private Bag, Lower Hutt, New Zealand*