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BREEDING BEHAVIOUR OF THE LONG-TAILED CUCKOO ON LITTLE BARRIER ISLAND

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ABSTRACT

Long-tailed Cuckoos (*Eudynamys taitensis*) were studied on Little Barrier Island during three summers. The only species of host was the Whitehead (*Mohoua albicilla*). Rates of brood parasitism on the island were 18.1% overall, 35.7% at altitudes above 250 m, and 5.4% at altitudes below 250 m. The breeding season for cuckoos probably lasted for 4-6 weeks from mid-November, suggesting that early nests of the Whitehead escaped brood parasitism. The available information suggests that the major hosts of the cuckoo are the Whitehead, the Yellowhead, and possibly the Brown Creeper, although other hosts are used occasionally. As adult cuckoos call in small groups during the breeding season, I speculate that Long-tailed Cuckoos may have a lek-type social organisation.

INTRODUCTION

The Long-tailed Cuckoo (*Eudynamys taitensis*) breeds only in New Zealand. Little information is available on its behaviour or breeding, although a range of hosts has been reported, and the cuckoo is said to breed in November and December (Fulton 1904). While in New Zealand from October to February, the Long-tailed Cuckoo gives loud screeching calls from high in the canopy and occasionally (St Paul 1976) is reported to call in small groups. Like many cuckoos (Wyllie 1981), its behaviour is cryptic, and so it is often heard but rarely seen. Males and females are indistinguishable in the field, although juveniles may be identified by white spots on the back and white tail barring.

Here, I report on the numbers, breeding success, and timing of breeding of Long-tailed Cuckoos on Little Barrier Island. I also review reports of host species and the evidence for brood parasitism of each host and speculate on the breeding system of the species.

METHODS

Long-tailed Cuckoos were studied on Little Barrier Island ($36^{\circ}12'S$, $175^{\circ}7'E$) during the summers 1984/85 and 1985/86 and for one week in early January 1987.

Between 26 October 1984 and 19 January 1985, I walked 10 transects at intervals of 1-2 weeks up the Summit Track from sea level to 600 m (just below the summit). I counted all cuckoos heard or seen ahead of me during the transect. To estimate the timing of breeding and breeding success, I noted presence and species of dependent fledglings in flocks of Whiteheads (*Mohoua albicilla*) encountered. Although similar, the begging calls of fledgling Whiteheads and Long-tailed Cuckoos are distinctive (McLean & Waas 1987).

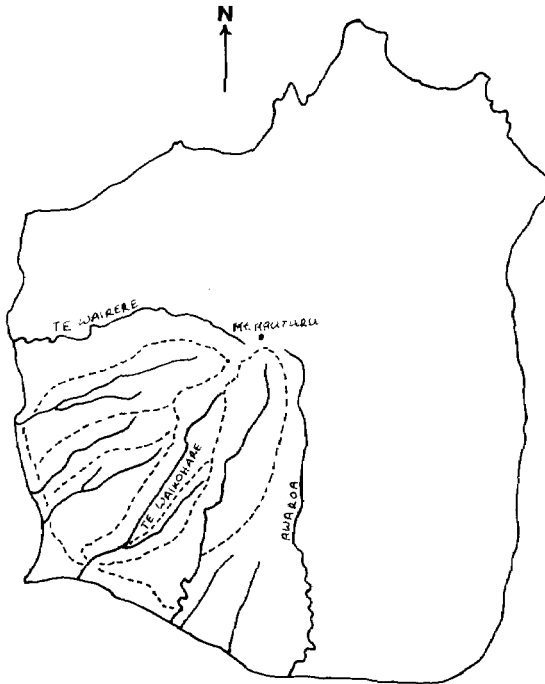


FIGURE 1 — Little Barrier Island, showing the tracks and ridges sampled during three surveys in early January, 1985-1987. Solid lines indicate valley bottoms (creeks). Dotted lines indicate tracks along which surveys were made.

In 1985/86 I searched for groups of calling cuckoos on the upper ridges of the island during late November and early December. Groups were watched until the birds flew off.

In early January 1985, 1986, and 1987, I spent one week surveying about 30% of the island. I traversed all ridges and valleys on the southwestern slopes between track 2 on the western side and track 20 on the southern side (Fig. 1). As I walked, I checked for dependent fledglings in all flocks of Whitehead encountered within a corridor extending 30 m on either side of the track. If I heard no begging calls or saw no fledglings after 5 min, I assumed that the flock contained no fledglings.

All adult cuckoos heard calling were counted during the surveys. Each valley was surveyed once.

Surveys were made in calm or reasonably calm weather with no rain.

To determine the likely host species of the Long-tailed Cuckoo, I surveyed the literature, appealed for observations of fledgling cuckoos in the local Ornithological Society newsletter, and spoke with many ornithologists about the species.

RESULTS

Numbers

The number of cuckoos seen or heard calling during transects up the Summit Track in 1984/85 reached a peak in early January (Table 1). I therefore assumed that the number of cuckoos counted in early January would give the best estimate of the number of cuckoos on the island.

The number of adult cuckoos calling during the surveys in early January was about the same in each year: 81 in 1985, 85 in 1986, and 70 in 1987 (mean 78.6). Assuming that cuckoos are evenly distributed across the island and that I therefore surveyed 30% of the population, these values suggest a minimum of 262 adult cuckoos on the island in January. Fledgling cuckoos were still dependent on their hosts at this time and were not giving adult calls. I do not know whether both sexes of the adults call.

Breeding success

Cuckoo breeding success was closely linked with Whitehead breeding success on Little Barrier Island. All 17 cuckoo chicks encountered during surveys between 3 and 12 January were being fed by Whiteheads. The only nestling left the nest 1-2 days after being found.

The proportion of Whitehead flocks with fledglings (Whitehead or cuckoo) varied significantly between years ($\chi^2_1 = 20.29$, $P < 0.001$, Table 2; columns 3 and 4 were added together for this test), indicating a significant variation in Whitehead breeding success between years (also see McLean & Gill, in press). One large flock in 1985 contained Whitehead fledglings and a cuckoo fledgling, presumably because it contained more than one Whitehead breeding group. I did not see Whiteheads feeding both Whitehead and cuckoo fledglings at the same time.

Brood parasitism rate was calculated as the proportion of successful Whitehead groups (i.e. those with fledglings) which had a cuckoo fledgling.

TABLE 1 — The number of Long-tailed Cuckoos heard or seen on 10 transects made from sea level to 600 m on the Summit Track, Little Barrier Island.

Date of Transect	No. of Cuckoos	Weather
26/10/84	18	clear, calm
4/11/84	12	clear, calm
10/11/84	14	clear, calm
18/11/84	3	windy, cold
29/11/84	17	clear, calm
14/12/84	12	overcast, mod. wind
20/12/84	17	clear, calm
6/ 1/85	20	clear, calm
12/ 1/85	25	overcast, some rain
19/ 1/85	18	clear, calm

The rate did not vary significantly between years ($\chi^2_1 = 0.04$, n.s.; test conducted on columns 3 and 4, Table 2), indicating that the variation in Whitehead breeding success between years was not directly related to brood parasitism. Mean brood parasitism rate was 16.5% (range 12.9-20.8).

Of the 16 fledgling and one nestling cuckoos found, 14 were above 250 m in altitude and 3 were below 250 m. I assessed the relation between altitude and brood parasitism by recording the altitudes of all Whitehead groups encountered in 1986 and 1987 (Table 3). Brood parasitism rate was significantly higher above 250 m (35.7%) than below 250 m (5.4%) ($\chi^2_1 = 7.88$, $P < 0.05$). The overall breeding success (i.e. including fledgling cuckoos) was not significantly different for Whiteheads above (22.6%) and below (28.7%) 250 m altitude ($\chi^2_1 = 0.80$, n.s). However, the first Whitehead fledglings were encountered above 250 m on 29 November, a full month after the first fledglings were found at sea level (October 26), suggesting that Whiteheads at higher altitudes began breeding later than those at low altitudes.

During an intensive study of Whitehead breeding at low altitude on Little Barrier Island in 1984/85 and 1985/86 (McLean & Gill, in press), no brood parasitism occurred. One colour-banded female known to have bred at 30 m a.s.l. in 1985/86 was feeding a newly fledged cuckoo on 3 January 1987, about 40 m from her 1985/86 nest site, indicating that Long-tailed Cuckoos do occasionally breed at low altitude.

Time of breeding

When a young Long-tailed Cuckoo first leaves the nest, its tail is about one-third the length of an adult's tail, it sits for long periods in one place, and it flies poorly. During the surveys in early January, I saw dependent cuckoo chicks with tails ranging from one-third (i.e. newly fledged) to full adult length. Cuckoo chicks with full-length tails flew well, were hard to

approach, and flew up to 200 m in ine flight (with the attendant Whiteheads in pursuit). Their flying ability suggested that they had been out of the nest for several weeks.

It is typical for cuckoos to have shorter incubation and longer nestling periods than their hosts (Payne 1977, Wyllie 1981). These periods are 18.0 and 17.4 days respectively for the Whitehead (McLean & Gill, in press). Thus, to estimate conservatively the timing of breeding for Long-tailed Cuckoos, I assumed that the incubation period was 16 days (the average for 5 species of cuckoo of reasonably similar size to the Long-tailed Cuckoo listed by Payne 1974), that the the nestling period was 21 days (Fulton 1904 reported a Long-tailed Cuckoo which remained in a Robin *Petroica australis* nest for at least three weeks), and that fledgling cuckoos with full-length tails had been out of the nest for at least two weeks.

The oldest and youngest cuckoo chicks found were a fledgling with a full-length tail and flying well on 6 January and a nestling which left the nest on 13-14 January. Given the above assumptions, eggs giving rise to these cuckoos would have been laid on 16 November and 11-12 December respectively. These dates are the extremes during which the eggs giving rise to all cuckoo chicks found during this study would have been laid.

During the transects in 1984/85, the first Whitehead fledglings were encountered above 250 m on 29 November. Thus, at altitudes preferred by cuckoos for breeding, Whiteheads began incubation in late October, much earlier than the 16 November estimate above for first laying by cuckoos. No cuckoo fledglings were found during the transects on 29 November, 14 and 20 December, or 6 January, although Whitehead fledglings were seen above 250 m during each of these transects. However, two and one cuckoo chicks (one still in the nest) were found during the 12 and 19 January transects respectively (the chick found on 19 January was assumed to be the same one found in the same location on 12 January). Thus, I believe that 16 November is close to the earliest date at which Long-tailed Cuckoos breed.

I cannot comment further on when cuckoo breeding ends, except to note that I saw two dependent fledglings with adult-length tails on 31 January (McLean 1982) and R. Powlesland (pers. comm.) saw one on 23 February (tail length not recorded but it flew reasonably well). Lovegrove (1985) reported a chick on 8 February on Kapii I. Wilkinson & Wilkinson (1952) reported a chick being fed until March 31.

Behaviour of adults

Adult Long-tailed Cuckoos are first heard calling on Little Barrier in early October (A. & M. Dobbins, pers comm.). They call throughout summer, usually from a perch high in the canopy. Calling is sometimes accompanied by a display involving tail-fanning, slow wing-flapping, and a hunched posture; the overall effect being to greatly increase the apparent size of the bird. The full call consists of one or several shrieks followed by a series of loud chatters. The full display is always associated with the chatters. Often, only the shriek is given for long periods, particularly if the bird is calling alone. While shrieking, the cuckoo sits in a hunched posture and occasionally partly extends its wings.

TABLE 2 — The number of Whitehead (WH) flocks encountered, and the proportion containing Whitehead and Long-tailed Cuckoo (LTC) fledglings, during three surveys on Little Barrier Island in early January.

Year	No. of WH flocks	No. (%) with WH fledglings	No (%) with LTC fledglings	No of * single WH
1985	116	39 (34%) +	10 (9%) +	28
1986	116	16 (14%)	3 (3%)	34
1987	74	27 (36%)	4 (5%)	15

* These were either singing males, probably representing Whiteheads with a nest, or solitary birds temporarily separated from their flock. This value can be added to column 2 (No. of WH flocks) for the total number of Whitehead groups encountered, but I have excluded it for calculating the parasitism rate because I do not know whether these birds had a nest or what species might fledge from that nest.

+ One large flock contained Whitehead fledglings and a cuckoo fledgling. Thus a total of 48 flocks was used for calculating the parasitism rate, rather than the 49 implied here.

TABLE 3 — Whitehead (WH) breeding success and brood parasitism in relation to altitude on Little Barrier Island. Data for January 1986 and 1987 combined. LTC = Long-tailed Cuckoo.

	No. of WH flocks without chicks	No. of WH flocks with WH chicks	No. of WH flocks with LTC chicks
Below 250 m	91	35	2
Above 250 m	48	9	5

Occasionally, up to five cuckoos may call together in a group, where birds sit as little as 2 m apart. Twice, I noted an additional non-calling cuckoo sitting 20-30 m from a calling group, apparently watching. Once, on 29 November, a group of four or five birds formed in which there was considerable chasing along with much calling and displaying.

Adult cuckoos may sometimes take an interest in fledgling cuckoos. Of the 16 fledglings found, I saw adult cuckoos within 30 m of six. In two cases the adults were watching the fledgling from 10 m and 15 m away (in three other cases I detected the adult only when it flew off). T. Lovegrove (pers. comm.) watched one fledgling which appeared to be calling back to the calls of adults nearby.

Hosts of the Long-tailed Cuckoo

All 17 cuckoo chicks found during this study were being fed by Whiteheads. Three cuckoos found by T. Lovegrove, R. Powlesland, and a visitor to the island were being fed by Whiteheads (Lovegrove's bird is probably one that I also found). However, Lovegrove (pers. comm.) saw a second cuckoo fledgling which was fed twice by Robins. I located what appeared to be this same bird (based on tail length and location) two days later, and it was being fed by Whiteheads.

During this study I noted cuckoo fledglings begging from a female Stitchbird (*Notiomystis cincta*), a juvenile and an adult Tui (*Prothemadera*

novaeseelandiae), a juvenile Bellbird (*Anthornis melanura*), and a Red-crowned Parakeet (*Cyanoramphus novaeseelandiae*). The Stitchbird may have fed the cuckoo, although the true "parents" were Whiteheads which were gathering food nearby.

The Yellowhead (*Mohoua ochrocephala*) (Fulton 1904; Elliott 1986, pers. comm.) and Whitehead (Fulton 1904; Stead 1936; Wilkinson & Wilkinson 1952; this study) are the only known hosts of the Long-tailed Cuckoo for which the reports are better than anecdotal. Elliott found cuckoos in Yellowhead nests in his study area in Fiordland.

The Brown Creeper (*Mohoua novaeseelandiae*) may be a commonly used host. According to descriptions in Stead (1936) and Wilson (1959) they found two creeper nests and one robin nest with cuckoo eggs, and a creeper nest with a nestling cuckoo, on Jacky Lee Island. Stead deposited several complete Brown Creeper clutches containing a cuckoo egg in the Canterbury Museum. The lack of other records of Brown Creeper hosting Long-tailed Cuckoo may be due to the cryptic breeding behaviour of the creeper (Cunningham 1985; pers. obs.).

Fulton (1904) listed many likely hosts of the Long-tailed Cuckoo, but most reports were based on unusual eggs which he *suggested* were laid by the cuckoo, or on observations of birds feeding fledgling cuckoos but with little or no information on the number of feeds seen or the length of observation. Apart from one Whitehead and one Yellowhead report, the only fully acceptable observation in Fulton (1904) is of a cuckoo egg hatched and raised to 21 days by Robins. Fulton's report of a cuckoo nestling in a Tomtit (*Petroica macrocephala*) nest is suspect because he gave no information on how the nest was identified; both he and Prickett (1958) reported cuckoo eggs in abandoned Tomtit nests. Fulton's report of adult cuckoos feeding their own young on the Kermadec Islands, based on observations made by a resident in the 19th century, is intriguing because cuckoos are present on the Kermadecs all year but there are no likely hosts (Merton 1970).

Falla *et. al.* (1978) added the Fantail (*Rhipidura fuliginosa*) to a summary of the lists of hosts given by Fulton and Stead, presumably based on a photograph by Roberts (1963) clearly showing a Fantail feeding a Long-tailed Cuckoo in a Fantail nest.

Two recent observations which I accept are a Long-tailed Cuckoo seen to lay in the nest of a House Sparrow (*Passer domesticus*) on Kapiti Island (P. Jenkins, pers. comm.) and a cuckoo nestling being raised by Silvereyes (*Zosterops lateralis*) in the Waikato (P. Harper, pers. comm.). Fulton (1904) also noted these two species as hosts based on eggs found in nests. Stidolph (1949) reported a cuckoo chick and two cuckoo eggs from three nests of Silvereyes located "within a few chains of each other" in an area of the Tararua where Whiteheads were scarce. These were probably all laid by the same cuckoo. Both nests with eggs were abandoned and the nest with chick failed because the chick fell through the bottom of the nest. Stead (1936) suspected that Long-tailed Cuckoos laid in nests of introduced species, citing cuckoo-like eggs found in two Song Thrush (*Turdus philomelos*) nests and a Greenfinch (*Carduelis chloris*) nest. As with Stidolph's Silvereyes, these were all found in the same gully and were probably laid by the same cuckoo.

Suggestions that honeyeaters (Tui, Bellbird) are parasitised by Long-tailed Cuckoos (Fulton 1904; Ramsay 1865, in Cunningham 1966) remain unsubstantiated.

Potts (1885), in an ambiguously worded article, suggested that Long-tailed Cuckoos "frequently" parasitised Grey Warblers (*Gerygone igata*). Fulton (1904) disputed this, despite a drawing of a warbler feeding a young Long-tailed Cuckoo in Buller (1888). Oliver (1955) agreed with Fulton that the reports were probably based on confusion with the Shining Cuckoo (*Chrysococcyx lucidus*).

In conclusion, it appears that the Whitehead, the Yellowhead, and probably the Brown Creeper are the usual hosts of the Long-tailed Cuckoo. Other species known or likely to have been parasitised are Robin, Silvereye, Fantail, probably Tomtit, and several introduced species. The cuckoo is known to be raised successfully by Whitehead, Yellowhead, and probably Robin (one observation of a 21-day-old nestling).

DISCUSSION

The breeding system: timing and altitude

The results of this study support earlier anecdotal observations that Long-tailed Cuckoos breed in November and December (Fulton 1904). The pattern of Whitehead breeding on Little Barrier suggests that cuckoos could, in theory, begin breeding as early as late October. My data are not extensive enough to exclude breeding in early November, but they suggest that most occurs after mid-November. Thus, early nests of the hosts probably escape parasitism, as with the Grey Warbler and its brood parasite, the Shining Cuckoo (Gill 1983). Many Whiteheads breed only once in a season (McLean & Gill, in press). With high brood parasitism rates at higher altitudes (36%), there must be strong selection pressure on Whiteheads to begin breeding as early as possible or to breed at lower altitudes.

These observations suggest an explanation for why most Long-tailed Cuckoos breed at higher altitudes on Little Barrier. The peak in Whitehead incubation at low altitudes was in late October and early November (McLean & Gill, in press), whereas the transect data suggest that Whiteheads breed later at higher altitudes. If Long-tailed Cuckoos cannot breed before mid-November (e.g. because they need time to recover from migration), they may breed at higher altitudes because more nests are available there. However, no information is available on whether cuckoos could breed before mid-November, and many other factors may influence their preference for higher altitudes.

Until we know how long Long-tailed Cuckoo fledglings remain with their hosts, it will be difficult to determine when cuckoos stop breeding, particularly as the host species continue to feed their own fledglings for many months (McLean & Gill, in press). However, Whiteheads at low altitudes on Little Barrier (McLean & Gill, in press) and Brown Creepers at low altitudes at Kaikoura (Cunningham 1985) ceased, or virtually ceased, laying in late December. Whiteheads ceased nesting in early December in one year. Thus, the breeding season of the Long-tailed Cuckoo probably ends when the hosts stop breeding and may be only 4-6 weeks long.

The breeding system: social behaviour

Long-tailed Cuckoos do not provide parental care. They are therefore freed from the primary constraint which seems to impose monogamy on about 90% of birds (Welty 1975). Polygyny usually occurs when males monopolise females either by defending female groups directly (mate-defence polygyny) or by defending a resource which is of value to females, thereby forcing them to clump in the defended area (resource-defence polygyny). Polyandry occurs when females monopolise and mate with several males either at the same time (this may also be called mate-defence polygyny) or in sequence, in which case each male is provided with a clutch of eggs which he fathered and incubates. Emlen & Oring (1977), Oring (1982), and Vehrencamp & Bradbury (1984) have discussed the factors underlying mating systems.

There is no evidence that Long-tailed Cuckoos form coherent (i.e. long-term) groups, and so it is unlikely that one sex is monopolised by the other. Nor do Long-tailed Cuckoos occur in pairs, as does the Koel (*E. scolopacea*) (Payne 1977), which suggests that they are not monogamous. The second form of polyandry described above is unlikely because females do not provide males with a clutch of eggs.

I suggest that the Long-tailed Cuckoo breeding system is some form of polygamy. I further suggest that groups of calling cuckoos represent groups of one sex (probably males) attempting to attract and compete for the other sex. The groups are ephemeral, constantly breaking up and reforming at the same or other locations. I observed no obvious defence; the chasing seen was neither rapid nor violent and seemed to be sexual rather than aggressive. The groups cannot therefore constitute a lek in the restricted sense of Oring (1982), in which small "courts" are defended through time. However, individuals come and go from leks in many species (e.g. Sage Grouse *Centrocercus urophasianus*, Gibson & Bradbury 1987), and the display arena may vary in location over short or long time intervals (e.g. Buff-breasted Sandpiper *Tryngites subruficollis*, Prevett & Barr 1976; Sage Grouse, Gibson & Bradbury 1987).

If calling groups of cuckoos are unisexual, and birds seen watching groups of calling cuckoos are of the other sex, the groups may provide a way for the choosing sex to make direct comparisons among the competing sex before copulating with one or several of them, perhaps at some other location (as occurs in Sage Grouse, Gibson & Bradbury 1987). Under this hypothesis, the incredibly loud calling and fearsome display of the cuckoo are equivalent to the tail of the peacock or the booming of the Kakapo (*Strigops habroptilus*, Merton *et al.* 1984). I speculate that Long-tailed Cuckoos are a lekking species.

Long-tailed Cuckoos call and display for reasons other than mating, because many birds call in January. Further work on their social organisation will involve investigating how often calling groups are formed during summer, comparing the behaviour of birds calling alone and in groups, and perhaps playing back tape-recorded calls to test the response of other cuckoos. Most importantly, a field method of sex determination is needed, probably using behaviour.

NOTE: In January and February, 1988, R. Powlesland found two Long-tailed Cuckoo fledglings being fed by Brown Creepers on Codfish Island.

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