Observations on the breeding behaviour of the Tanga'eo or Mangaia Kingfisher (*Halcyon tuta ruficollaris*)

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ABSTRACT

The breeding behaviour of Tanga'eo or Mangaia Kingfisher (*Halcyon tuta ruficollaris*) on the island of Mangaia in the Cook Islands was investigated in 1992. Calls and breeding behaviour are described from a study of pairs and trios. At least six calls were distinguished. Clutch size appeared to be two eggs for pairs and three eggs for trios. Incubation time was between 21 and 23 days, while the fledging period was estimated at approximately 26 days. Both birds of a pair and all members of a trio excavated nest holes, incubated, brooded and fed the chicks. In trios with two males, both males courtship fed and copulated with the female, suggesting a polyandrous relationship. The breeding behaviour and relationship of trios, and the effects of Mynas on breeding success warrant further investigation.

KEYWORDS: Mangaia kingfisher, *Halcyon tuta ruficollaris*, breeding, Cook Islands.

INTRODUCTION

The Tanga'eo or Mangaia Kingfisher (*Halcyon tuta ruficollaris*) is endemic to the island of Mangaia in the southern Cook Islands group (Forshaw & Cooper 1985). The subspecies was first described by Holyoak (1974) but breeding behaviour is little known. At the instigation of Gerald McCormack, Director of the Natural Heritage Project of the Cook Islands, a team of volunteers from the Ornithological Society of New Zealand carried out a study of the Tanga'eo's breeding behaviour following a survey of the population (Rowe & Empson 1996). This paper reports the results of observations of breeding Tanga'eo between 13 October and 8 December 1992.

STUDY AREA AND METHODS

Mangaia, about 5180 ha, is second in size only to Rarotonga in the Cook Islands group. It consists of two main geological zones, a central core of low volcanic hills surrounded by an outer rampart of raised coral reef known as the makatea (Fig. 1).

The Tanga'eo occupied three types of forest habitat: coastal barringtonia forest and indigenous mixed forest on the makatea, and secondary forest in the volcanic interior of the island (Rowe & Empson 1996).

Calls and breeding behaviour of Tanga'eo pairs and trios were observed in all three habitats. Detailed observations were made at 13 nest sites (including two trios). Activities at another seven nest sites (including one trio) were observed only occasionally (Fig. 1). All sites were visited as often as possible, but because of their widespread location, it was not possible to visit each site on a daily basis.

The female Tanga'eo (determined from observations of copulation) had a

buffy-orange wash that extended from her orange or buff collar right across the breast. In the male, this suffusion was sometimes present but if so, it extended only as far as the shoulders or sides of the throat. Males had a white chin and breast giving them a paler appearance than the deeper-hued females. Birds of the same sex in trios were able to be identified from variation in the colour tone and pattern of the head plumage. Of the three trios observed, two consisted of two males and a female while the third was two females and a male.

RESULTS AND DISCUSSION

Calls

A characteristic that distinguishes the Tanga'eo from other closely-related kingfishers is the diversity of its calls (Holyoak 1974, Fry 1980). These are made singly or in a variety of combinations and at least six calls were distinguished during our 1992 study. A repeated single note call, a strong clear "kek-kek-kek-kek", served both as a contact call with a mate and as a territorial or warning call. A distinctive two-note call (which gave the bird its onomatopoeic Maori name "tanga'eo") ranged from a loud long-range contact call to the softest of intimate courtship calls with all gradations of intensity and tempo in between. It was often repeated in a sequence. A

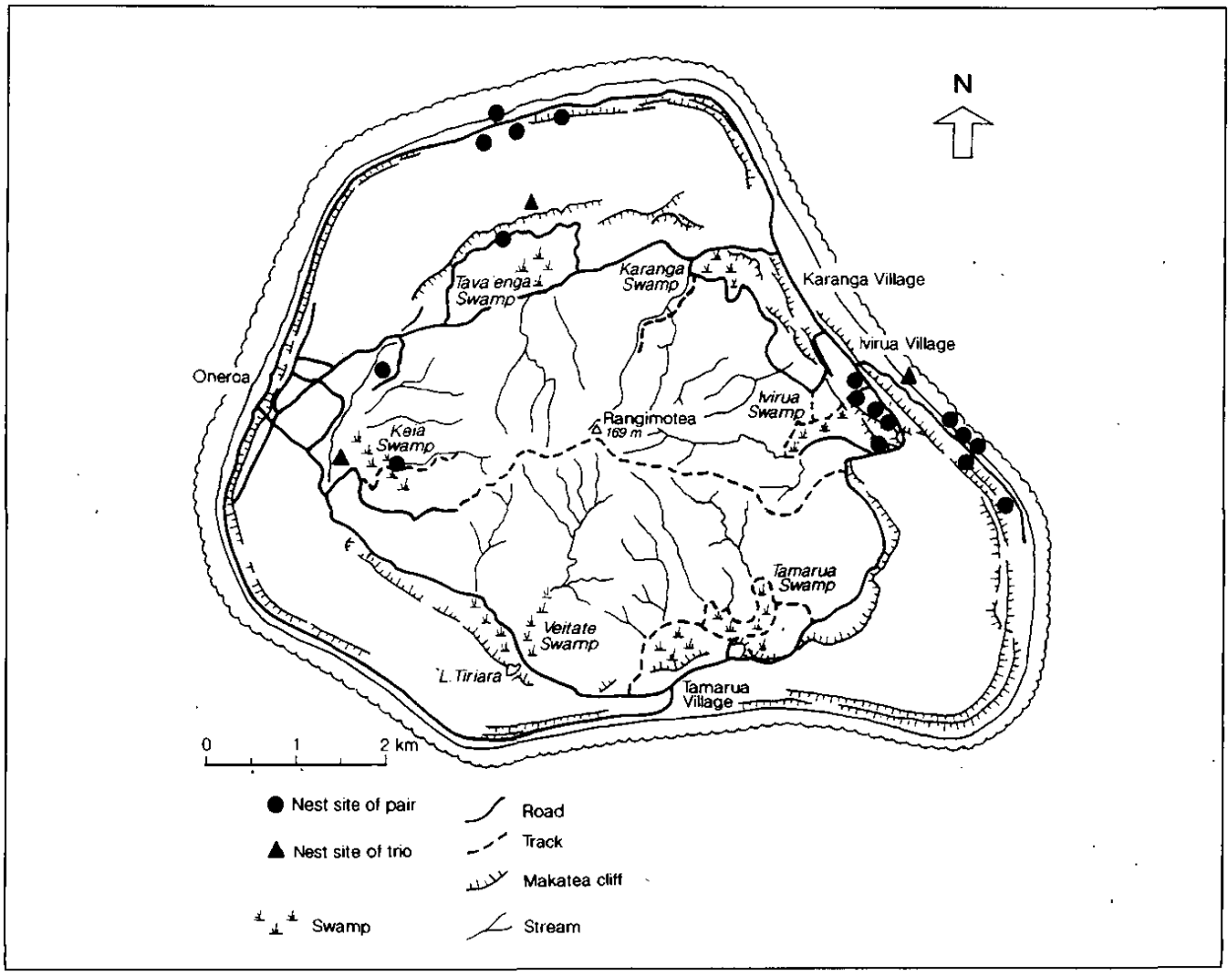

FIGURE 1 - Map showing key features of Mangaia Island and location of Tanga'eo study nests.

harsh "scrark" was made when a bird chased off an intruder or was otherwise startled or alarmed. "Scrark" calls were often followed by repeated "tanga'eo"s, lessening in intensity as a perceived danger decreased. A close contact "chucka-chucka" call was heard when a pair re-established contact after separation. "Tui-tui" twittering calls were another intimate close-contact call which reached a crescendo of excitement during copulation. A "tui-tui-chuck" often signified a successful copulation and was also heard when a bird went into or out of a nest-hole, during excavation or at an incubation changeover. Other courtship calls consisted of "mew"s and "croon"s.

Few chick contact calls were heard since only three clutches hatched during the study, of which two were located in high nests. However, a soft churring whistle was heard once when an adult approached chicks in the nest with food, and older unfledged chicks made raspy "churr" sounds while adults were absent from the nest.

Food and feeding behaviour

Tanga'eo ate live prey taken at all levels of the forest: from the ground, leaf and trunk in the mid-story and upper canopy, and aerially within and above the canopy.

Prey included worms, caterpillars, grubs, termites, grasshoppers, stick insects, cockroaches, moths, spiders and lizards. A resident reported once seeing a bird with a small marine fish (T. Parima pers. comm.). Lizards were an important part of the diet, particularly during courtship feeding.

Territory and aggression

By mid-October when our study began, pairs and trios were vigorously defending territories, especially in the vicinity of the nest site. Territorial clashes between neighbouring pairs or trios were not seen, the birds apparently being well aware of their territorial boundaries and their neighbours' presence from one anothers' calls. Both sexes chased off intruders such as Common Mynas (*Acridotheres tristis*) from the vicinity of the nest tree.

Selection and excavation of nest sites

Some nest cavities were already complete by mid-October, while excavation at others continued up to the third week of November (Fig. 2). Often a bird of either sex flew at the trunk of a nest tree making an audible thwack with its bill before returning to a nearby perch. This action accompanied by a "tui-tui-chuck" was often repeated several times and usually initiated an excavation session. At other times this behaviour appeared to be connected with site selection or site bonding, or to be an invitation by the male to the female to enter the nest.

Both sexes and all members of trios took turns in excavating the nest in short intensive shifts of less than one and up to five minutes duration. One digging session observed involved all members of a trio alternating bursts of digging with short breaks for over an hour. Several holes were sometimes investigated or cleaned out before one was chosen or a new one excavated.

Nests comprised holes excavated in the trunks of dead coconut palms (*Cocos nucifera*) or in decaying limbs of living trees of other species. Of the 20 study nests,

11 were in coconut stumps, six in barringtonia trees (*Barringtonia asiatica*), two in trees of *Albizia* sp. and one in a lantern tree (*Hernandia moerenhoutiana*).

Three or four holes in a single tree-trunk were common, but one four-metre coconut stump had 23 holes in it, with the lowest less than two metres from the ground. Multi-holed trees may indicate a strong attachment to a nest site, especially since there were usually several apparently suitable nesting trees in each territory.

No preference was indicated in the direction faced by the nest hole and tunnel. Holes ranged in height above the ground from 1.5 m to 10 m or more near the top of tall palms and albizzias. The hole was usually circular with a diameter of about 45 mm, while the tunnel was short (limited by the tree's diameter) and level, ending in an enlarged nesting chamber wide enough to allow the adult bird to sit at right angles to the tunnel.

No nesting material was taken to the nest chamber. Birds removed surplus material before egg-laying, and nests checked contained no wood dust or chips. However at one nest, just before the last egg was laid, fine wood chips were found under the other two eggs after a male was seen in this nest stretching his bill to the ceiling, probably excavating this fresh nest material.

Three pairs of birds apparently failed to lay after excavating holes and we saw no evidence of further nesting attempts. Mynas were seen investigating two of these holes, but we do not know if this was a contributing factor in their being abandoned.

Courtship

Once the nest was nearly complete, courtship feeding became more frequent and copulation started. Both activities continued for 2-3 weeks until the last egg was laid and incubation began. Courtship feeding did not necessarily precede a copulation, but was carried out at frequent intervals during the courship period. Of 18 recorded copulations by seven different pairs, seven were preceded by courtship feeding. Of 27 recorded copulations within a trio, four were preceded by a food offering. Birds copulated several times throughout the day with a bias towards the morning and late afternoon.

Polyandry was indicated in trios with two males since both males courtship fed and copulated with the female. A day-long observation of a trio recorded seven copulations, five by one male and two by the other male. Detailed observations of

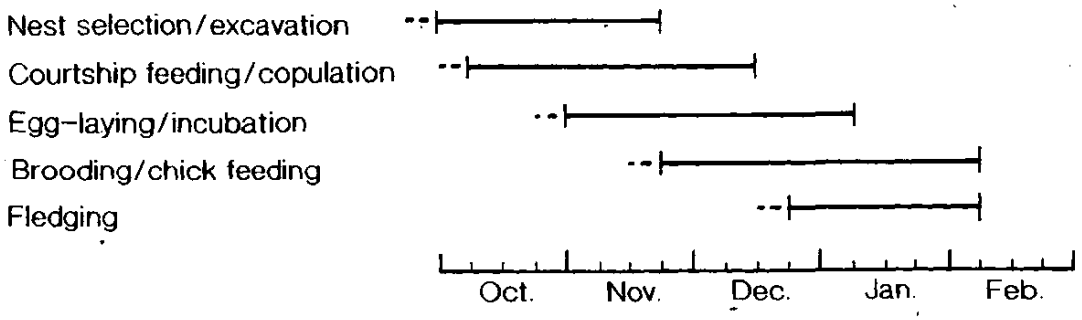

FIGURE 2 - Timing of the breeding season of the Tanga'eo based on observations between October 1992 and February 1993.

the trio with two females were not made during courtship and egg-laying, so it was uncertain whether a polygynous relationship existed.

Other activities such as pair- or trio-flying and bill-clasping at this time were also interpreted as courtship or bonding behaviour. Pairs and trios sometimes flew in close formation in the vicinity of the nest tree. On two occasions, a bird flew to its mate perching near the nest and grasped it, bill to bill, while still in flight. Both birds vigorously flapped their wings before the perching bird fell away and they separated.

Eggs, incubation and parental care

The 2-3 eggs of a clutch were laid on consecutive days. Observations of a trio's nest on the day before, and during egg-laying, showed that all birds made frequent visits to the nest and spent up to 30 minutes inside it. Incubation began once the clutch was complete. The clutch size was only determined for one (trio) nest before hatching, but egg-shell remains located under the nests of an additional four nests indicated that 3 pairs had 2-egg clutches and two trios (one with one female and one with two females) had 3-egg clutches (assuming all eggs laid had hatched). The eggs were white with a diameter ranging from 22.1 mm to 23.0 mm (n = 4, with measurements made on egg-shell remains of two clutches following hatching).

Both sexes and all three birds of a trio took turns in incubating the eggs. Shifts ranged from three to 97 minutes duration with an average shift time of 41.5 minutes (n = 18). Before a changeover, the off-duty bird often thwacked the tree trunk below the nest hole with its bill. This activity appeared to be a signal to the bird in the nest that the mate was ready to take the next incubation shift. The length of the incubation period was determined for one nest only and was between 21 and 23 days.

Hatching, brooding and breeding success

Once the chicks hatched, the egg-shell "halves" were dropped from the nest entrance to the ground below. The earliest known hatching date was between 17 and 24 November 1992 (Fig. 2). All adults fed the chicks and shared brooding.

Observations to determine chick survival were not possible given the timeframe of the study, but observations at one nest indicated that Mynas were a threat to chicks. This nest, with chicks 1-2 weeks old, was watched for over five hours during which time two Mynas were observed at the nest almost continuously, despite aggressive flights at them by the male Tanga'eo. Only the male of the Tanga'eo trio (one male and two females) approached the nest with food but was chased off by the Mynas, so the chicks remained unfed throughout the five hours. Although two adults of the trio fed the chicks the next day, they ultimately failed to fledge (G. McCormack pers. comm.) and the Myna attack may have contributed to this.

We did not observe fledging, but observations by local volunteers (G. McCormack, V. and V. Ongoua) indicated that the young of one trio left the nest approximately 26 days after hatching. The fledglings were seen a few days later still in the natal area.

Of the 13 main study nests, nine were known to have resulted in laying and incubation, but the outcome of most of them was not determined. Only one nest was known to have produced fledglings, and one to have had chicks that failed to fledge (G. McCormack, V.& V. Ongoua pers. comm.).

As a result of our observations and the known habit of Mynas to destroy the eggs and young of other hole-nesting birds (Bull 1985), a detailed study of the nesting success of Tanga'eo is recommended. The breeding behaviour and relationships of Tanga'eo trios also warrant further investigation, particularly since we are unaware of the existance of trios in other Kingfishers in the Pacific.

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SHORT NOTES

A Barn Owl (*Tyto alba*) on Little Barrier Island

At about 22:00 on 30 June 1992, Gerald and Janet Cubitt (visitors from the UK) saw and photographed a large pale owl near the west landing at Little Barrier Island (36°13'S 175°03'E). GC said that the bird looked like a Barn Owl (*Tyto alba*), and noted that a Morepork (*Ninox novaeseelandiae*) which landed nearby was smaller.

After dark on 1 July we searched the area where the owl had been seen the previous night, and eventually found it at 21:20 in a small grove of kanuka (*Kunzea ericoides*). We observed it closely with a spotlight and binoculars until 22:40. It was clearly a Barn Owl, and appeared to be in excellent condition. During this time it was quite active, doing a low sweeping flight over the grazed pasture and then returning to the kanukas, where it made short flights from branch to branch as if searching for prey. It also regurgitated a pellet which contained fur and bone fragments of kiore (*Rattus exulans*). At one point it descended towards a crotch about one metre above the ground and extracted a small kiore, which it probably cached earlier. The rat fell to the ground and the owl followed and began to consume it there. It tore off and swallowed a few small pieces, and then ate the rest whole. While it ate, a Morepork arrived and watched from less than ten metres away.

In Australia the diet of Barn Owls consists mostly of small mammals, small birds and night-flying insects (Frith 1969). During July, trapping indicated that kiore were especially numerous in the rank grassland of the ungrazed portions of the flat. The Barn Owl would have had a plentiful food supply.

The owl was seen several times during July and August. On 18 September, Sue Moore found its daytime roost in a dense copse of kanuka about 200 metres from where it was first seen. There were many pellets containing kiore fur on the ground below the branches where it was roosting at a height of about three metres. All around the roost numerous moulted pale contour feathers were caught up in the kanuka brush. The owl was easily approached, and remained at its roost while being sketched from a few metres away. It was last seen during the first week of October in the same area.

A Barn Owl was seen in June 1992 at Whenuapai Airport about 80 km south-west of Little Barrier (Taylor & Parrish 1994). Michael Taylor tells us that this bird is assumed to have been accidentally transported from Australia in an Orion aircraft. It was apparently healthy when seen. It is possible that the Whenuapai and Little Barrier birds were the same individual. If not, these were the seventh and eighth records of this species in New Zealand (Turbott 1990, Guest 1990).

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The calls of Murphy's Petrel (*Pterodroma ultima*)

Described in 1949 on the basis of specimens obtained in 1922 by the Whitney Expedition (Murphy 1949), Murphy's Petrel *Pterodroma ultima* is one of the less well-known gadfly petrels. The first detailed account of the breeding biology of this central south Pacific species was based on studies in the Pitcairn Islands by Brooke (1995) who did not, however, provide information on the species' calls.

The usefulness of calls as an aid to understanding petrel relationships is being increasingly recognized (Bretagnolle 1995). However, although Imber (1985) used calls as one character in his major study of *Pterodroma* phylogeny, he did not document Murphy's Petrel calls, and did not mention Holyoak & Thibault's (1984) description of calls they had heard in French Polynesia. "During display, the voice of the birds is less resonant than that of *P. neglecta* or *P. arminjoniana*. It consists of a series of fairly rapid notes: *Ouin-hi-hi-hi, Hou-hou-hou-hou, Ki-ki-ki,* this last call being fairly shrill" [My translation from the French].

This description does not match closely those calls I heard on the Pitcairn Islands during the 1991 breeding season (Brooke 1995), and therefore this note describes the calls of Murphy's Petrels heard on the breeding islands of Ducie, Henderson and Oeno.

Two calls were heard, recorded, and then analysed using a Kay DSP Sonagraph (Model 5500-1). Examples are provided in Figure 1. The first call was a soft owl-like hoot (Williams 1960; Fig. 1a) that was usually uttered on the ground, often while a pair was allopreening in the pre-breeding period. To make the sound the petrel did not open its bill, although the throat pulsated in time with the call. When the call was given in the air, the bird arched backwards and flew with characteristic shallow fluttering wingbeats. This call might be rendered *hoo-hoo-hoo-hooooooooo*, the final syllable lasting about 3 seconds. In my opinion, it would not be termed "fairly rapid" (see above). I have no definite observations of both members of a pair giving this call simultaneously, and therefore the call may be given by birds of only one gender.

The second call (Fig. 1b), given with an open bill, was a tri- or quadri-syllabic yelping cry, usually with the stress on the first syllable. This call was heard both from