Distribution and abundance of the Tanga'eo or Mangaia Kingfisher (*Halcyon tuta ruficollaris*)

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ABSTRACT

In October-November 1992 the island of Mangaia, Cook Islands, was surveyed for Tanga'eo (*Halcyon tuta ruficollaris*). The Tanga'eo was found to be primarily a forest bird, preferring continuous forest canopy. Its abundance was influenced by forest type, extent, and degree of habitat modification. A number of potential threats to the survival of Tanga'eo were identified including habitat loss and disturbance by Common Mynas (*Acridotheres tristis*). A brief survey of rodents was carried out. Although the Tanga'eo population was estimated to have been between 250 and 450 birds, low numbers of birds in apparently suitable forest in the southwest of Mangaia indicate that further research is needed to determine population trends and conservation requirements.

KEYWORDS: Mangaia, Kingfisher, *Halcyon tuta ruficollaris*, Cook Islands, population survey

INTRODUCTION

The Tanga'eo (Fig.1) or Mangaia kingfisher (*Halcyon tuta ruficollaris*) is endemic to Mangaia, the southernmost island in the Cook Islands group (Fig. 2). It is one of five surviving indigenous landbirds on Mangaia, although the subfossil record shows that at least eight further species were originally present (Steadman 1985).

The status of the Tanga'eo is uncertain. Although it was recorded as "fairly common" as recently as 1987 (Pratt *et al.* 1987), estimates of numbers have varied from 100 to 1000 in August 1973 (Holyoak 1980), 100 to 300 in March/April 1984 (Steadman 1985), and less than 200 six years later (Steadman & Kirch 1990). Older residents of Mangaia report that it had declined in numbers during their lifetime (G. Tuara, A. Tuara & T. Parima pers. comm.).

During October - November 1992, at the instigation of Gerald McCormack, Director of the Natural Heritage Project of the Cook Islands Government, a team of volunteers from the Ornithological Society of New Zealand carried out a survey of the distribution and abundance of the Tanga'eo. An important requirement was to use methods that could easily be repeated by future field workers to enable changes in abundance and distribution of the Tanga'eo to be detected. A brief survey of rodents was also carried out to determine species present and their distribution.

STUDY AREA AND METHODS

Mangaia (21° 54'S, 157°58'W), is the second largest island in the Cook Islands group with an area of about 5180 ha. It has a population of approximately 1250 people. The island has two main geological zones, a central area of low volcanic hills rising to 169 m a.s.l. at Rangimotea, surrounded by an outer rampart of raised coral reef known as the makatea (Fig.2).

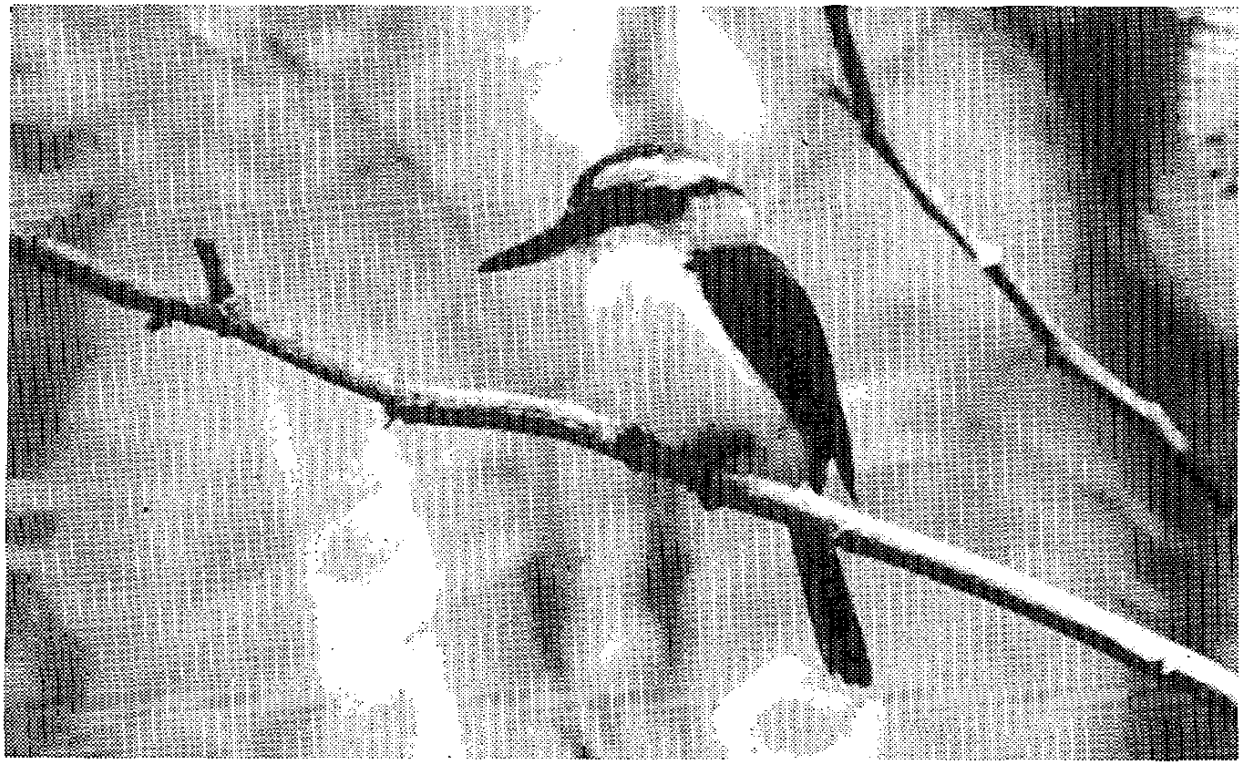

FIGURE 1 - Male tanga'eo showing white breast. Photo: G. McCormack

The island was originally forested but has been extensively modified since earliest human occupation (Steadman & Kirch 1990). Today remnants of this forest occur only on or near the makatea, and can be divided into four types (Fig. 2).

Coastal barringtonia forest consisted of almost pure stands of barringtonia (*Barringtonia asiatica*) on the lower makatea terraces in the north, northwest, southwest and east of the island. Coconut palms (*Cocos nucifera*) were scattered through this forest. The indigenous mixed forest, contiguous with the barringtonia forest, occurred on the more fertile upper terraces of the makatea. It comprised a variety of indigenous species, including *Elaeocarpus tonganus* and lantern tree (*Hernandia moerenhoutiana*), and introduced species, including candlenut (*Aleurites moluccana*) and scattered emergent coconut palms. Where the forest was relatively open, au (*Hibiscus tiliaceus*) was common. Mature secondary forest was found as a discontinuous belt on the volcanic soils adjacent to the inland makatea cliffs. The secondary forest was often dominated by au, which formed large dense thickets, interspersed with *Elaeocarpus*, candlenut and coconut palms. Albizzia (*Albizia* sp.), introduced in the 1950s, also formed a distinctive canopy in some areas. Narrow ribbons (c. 100 m wide) of au and albizzia extended up some stream valleys towards the centre of the island. In the southeast, the makatea terraces supported a fourth habitat type, the coastal shrubland. Pandanus (*Pandanus tectorius*) was generally scattered throughout this community, in places forming dense stands. Small groves of casuarina (*Casuarina equisetifolia*) occasionally occurred.

The island can be subdivided into five distinct geographical zones (Fig. 2). The northwest zone was an area of largely unmodified forest adjacent to and covering the makatea terraces north of Oneroa village, and extending to a relatively barren makatea landscape north of Karanga swamp. The east zone was an area of forest

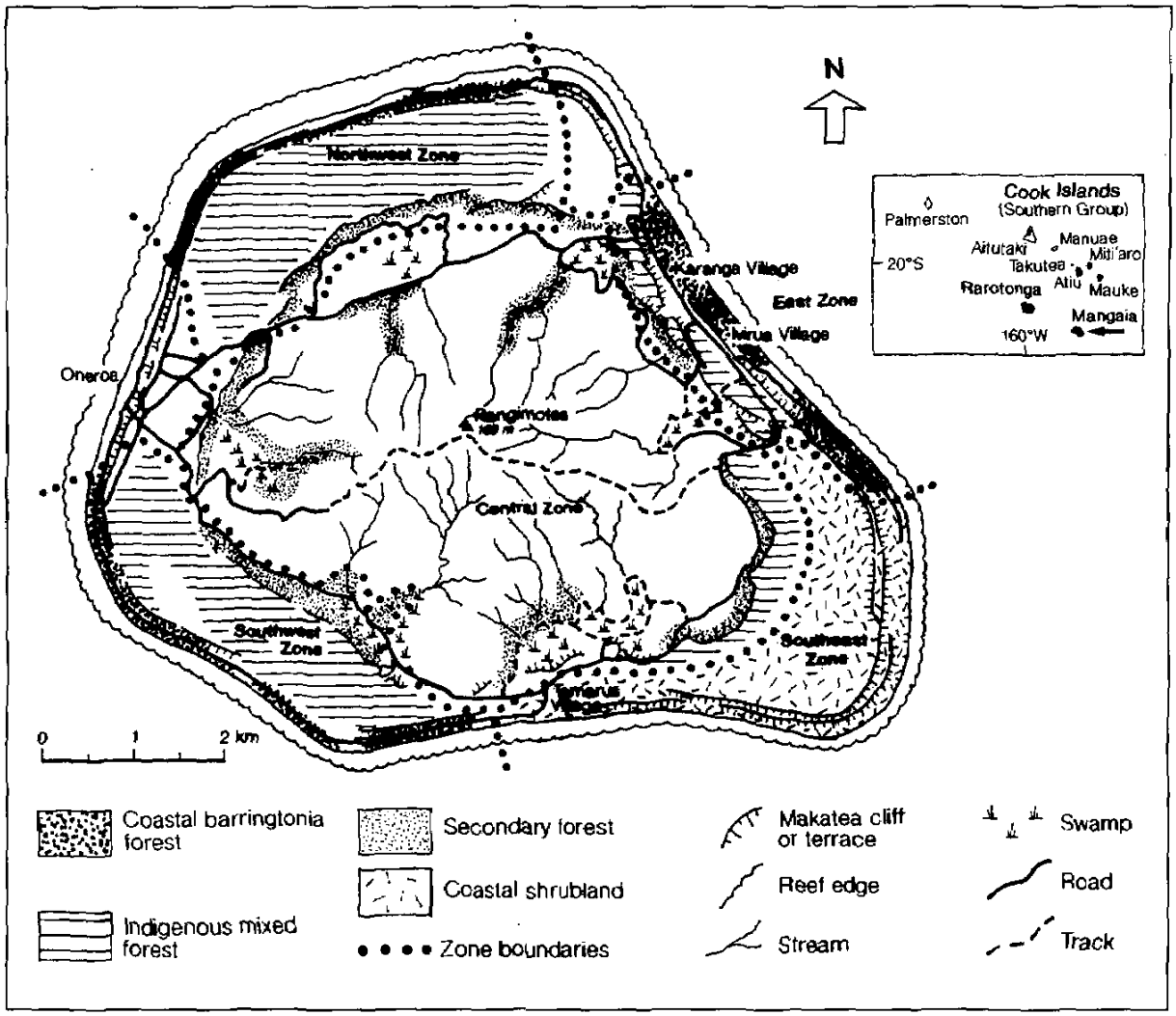

FIGURE 2 - Map showing location of Mangaia Island in the southern group of the Cook Islands, and the distribution of forest types and geographic zones on Managaia Island.

on makatea encompassing the villages of Karanga and Ivirua. The southwest zone was an area similar in extent and composition to the northwest zone, but separated from the northwest forest by Oneroa village. The southeast zone was a possibly natural landscape of low shrubland interspersed with barren areas on makatea between Tamarua and Ivirua villages. The central zone was a highly modified area dominated by fern and grassland with isolated patches of shrubland and plantations, and secondary forest remnants located at the base of the makatea cliffs and in the lower parts of valleys radiating from Rangimotea.

Tanga'eo survey

The Tanga'eo survey was carried out between 13 October and 10 November 1992. Taped territorial calls of the New Zealand Kingfisher (*Halcyon sancta vagans*) were used due to their similarity to those of the Tanga'eo, and they proved successful in attracting the kingfishers. The survey method entailed playing two or three calls on a small tape recorder (audible for a distance of about 100 m), counting all Tanga'eo seen or heard in the next five minutes at that site, and then repeating the action at intervals of c. 160 m (200 paces). Checks were made to ensure that birds were not counted twice by placing observers simultaneously at adjacent count stations to

observe those birds present at each site and their response to tapes played at adjacent stations. The few birds located between stations were also recorded. All main roads (except in villages) and most tracks through the makatea were traversed. As the survey progressed it became apparent that Tanga'eo were only found near or in forest. Accordingly, where the road was distant from forest cover, we walked at right angles from it to play the tape as close as possible to the forest edge. In the central zone, along the road on the eastern side of Rangimotea, the tape was played only at the heads of forested valleys, and no taped calls were played along the road on the western side.

Tanga'eo surveys were carried out throughout the day in temperatures ranging from 19° to 28°C. The weather was fine and broken by only one 4-day spell of heavy rain. The timing of the survey corresponded to the early stages of the Tanga'eo breeding season, so birds were territorial and responsive to tapes, although they did not always respond vocally.

Tanga'eo abundance and population estimate

The distribution and numbers of Tanga'eo recorded during the survey were correlated to location and forest type. The length of transect through a forest type and the total number of Tanga'eo recorded along that transect were determined. The number of birds per 100 m was then calculated and, because birds had been attracted using a tape with an audible range of c. 100 m, the number of birds per 100 m was interpreted as the estimated abundance of Tanga'eo per hectare (ha) for that forest type and location. The abundance in the northwest zone was calculated twice, with

TABLE 1 - The number of Tanga'eo *(Halcyon tuta ruficollaris)* recorded in relation to forest type on Mangaia, Cook Islands.

Forest type	Number of birds recorded (% seen)			
	Singles	Pairs	Trios	Total
Coastal barringtonia	13 (69)	18 (89)	0 (0)	49 (84)
Indigenous mixed forest	9 (33)	9 (94)	0 (0)	27 (74)
Secondary forest	25 (28)	15 (53)	1 (100)	58 (45)
Coastal shrubland	0 (0)	0 (0)	0 (0)	0 (0)
Total	47 (40)	42 (77)	1 (100)	134 (65)

TABLE 2 - Total forest area, survey effort, number of birds recorded, and estimated abundance in the different forest habitats of Mangaia, Cook Islands.

Forest type	Estimated forest area (ha)	Distance surveyed (m)	Number of birds recorded	Estimated abundance (birds ha^{-1})
Coastal barringtonia	227	11,000	49	0.41
Indigenous mixed forest	701	7,300	27	0.37
Secondary forest	271	27,140	58	0.21
Coastal forest	325	1,600	0	0

Northwest1 determined from all birds recorded/total distance surveyed, and Northwest2 from birds recorded/distance surveyed along the makatea edge. The estimated abundance of birds and estimated forest area were used to determine an estimate of the size of the Tanga'eo population.

Rodent survey

A rodent survey was carried out between 12 and 24 November. Traplines were established near Ivirua Village in three forest types (barringtonia forest, indigenous mixed forest, and secondary forest). Each trapline consisted of 40 to 50 Ezeset snap traps set in pairs at sites 25 m apart. Traps were placed in locations with natural cover or were covered to exclude non-target species and minimise interference. Each trapline was operated for three consecutive nights. The first line, in barringtonia forest, was used to assess bait preferences, comparing cheese, a mixture of peanut butter and rolled oats, salami, corned beef and pawpaw (*Carica* sp.). Traps on the other lines were baited only with a mixture of peanut butter and rolled oats as this was found to be the most effective bait. An index of abundance (number of rodent captures per 100 trap-nights) was calculated for the latter two lines from the total number of rodents caught and the total number of corrected trap-nights (see Cunningham & Moors 1983).

RESULTS

A total of 134 Tanga'eo were recorded during the survey (Table 1) and an additional 15 birds were located after the survey. Most birds (65%) were seen rather than heard, although where secondary forest was at a distance from the observer, Tanga'eo were often heard but not seen. Sixty-three percent of birds were recorded as pairs and three birds as a trio, but two other trios were confirmed following the survey. The finding of additional birds after the survey indicated that some birds were missed on survey transects. However, the survey was still regarded as a reasonable baseline for assessing future changes in distribution and abundance of Tanga'eo.

The results of the survey relating Tanga'eo abundance to forest type are set out in Table 2. Coastal barringtonia and indigenous forest supported significantly

TABLE 3 - Estimated forest area, relative abundance of barringtonia/indigenous forest, survey effort, number of birds seen and the estimated abundance of Tanga'eo in the different geographical zones of Mangaia, Cook Islands. Abundance in the northwest was estimated twice, with Northwest1 derived from total distance surveyed, and Northwest2 from distance surveyed along the makatea edge only.

Geographic zone	Estimated forest area (ha)	Percent(%) barringtonia/ indigenous forest	Distance surveyed (m)	Number of birds recorded	Estimated abundance (birds ha^{-1})
Northwest1	489	91	11,880	55	0.46
Northwest2	489	91	10,400	38	0.37
East	105	89	6,700	30	0.45
Southwest	425	88	12,960	17	0.13
Southeast	325	0	1,600	0	0
Central	181	0	14,800	32	0.21

TABLE 4 - The number of rodents caught and their index of abundance (number of rodent captures per 100 trap-nights) in relation to forest type on Mangaia, Cook Islands.

Forest type	Ship rat	Pacific rat	Unidentified rat	Mouse	Index of abundance
Coastal barringtonia	4	1	0	0	n.a
Indigenous mixed forest	9	5	1	0	11.67
Secondary forest	1	1	4	2	6.25

more Tanga'eo than secondary forest (coastal barringtonia vs. secondary forest X^2= 25.9, d.f.= 1, p<0.001; indigenous forest vs. secondary forest X^2= 17.9, d.f.= 1, p<0.001).

Table 3 shows the abundance of Tanga'eo in relation to location, preferred forest types and area of forest. Although the forests in the northwest and southwest zones appeared to be similar in area and forest composition, significantly fewer Tanga'eo were recorded in the southwest (X^2= 6.34, d.f.= 1, p< 0.05). This may reflect a sampling bias since only a limited transect was made across the makatea in the southwest due to difficult access. However, estimated abundance of Tanga'eo derived from transects along the makatea edge of the northwest (Northwest2) and southwest zones (0.37: 0.13) supports the conclusion that Tanga'eo densities differed significantly (X^2= 19.46, d.f.= 1, p< 0.001) between the two locations (Table 3).

Three species of rodents were trapped during the rodent survey; ship rat (*Rattus rattus*), Pacific rat (*Rattus exulans*) and mouse (*Mus musculus*) (Table 4). Only one trapline, which was in secondary forest, caught all three species. Five rats were unidentified (Table 4) because either they had been scavenged or only tail-tips were present in the traps. An index of abundance was not calculated for the coastal barringtonia trapline (Table 4) since it was baited with five different baits compared with only one (peanut butter/rolled oats) on the other lines. However, three rats were caught in traps baited with the same bait as the other traplines (28 corrected trap-nights), suggesting a rodent abundance of a similar magnitude to that in the indigenous mixed forest.

DISCUSSION

The survey indicated that the Tanga'eo is a true forest kingfisher, not dependent on water and preferring a continuous forest canopy. However, birds were observed crossing open spaces to use nearby forest patches. Most birds were recorded in the large relatively unmodified tract of forest in the northwest zone, while few were located in narrow tracts of mature secondary forest in the central zone valleys. Therefore, it was unlikely that Tanga'eo inhabited the unsurveyed southeast zone of coastal shrubland.

The estimated abundance (0.45 birds ha^{-1}) derived for the eastern zone indicated that this was an important area for Tanga'eo, even though it was smaller than the northwest forest and was associated with two villages. The abundance (0.21

birds ha^{-1}) derived for the central zone indicated that secondary forest could support Tanga'eo, particularly if the forest was not too fragmented (as in the central plateau area). The effects of smaller forest area and relative isolation probably contributed to the lower abundance in the central zone compared with the northwest and east zones.

Forest fragmentation and habitat loss through browsing by goats and clearance pose significant threats to the viability of the Tanga'eo on Mangaia. Pigs and rodents affect forest regeneration and diversity, and were observed in all forest types.

The presence of Mynas (*Acridotheres tristis*) in modified and small forest tracts may be a significant factor in limiting Tanga'eo abundance in these areas, since Mynas competed with Tanga'eo for food (lizards and invertebrates such as stick insects, cockroaches, caterpillars and spiders) and were observed to harass breeding Tanga'eo and cause nest failure (Rowe & Empson, 1996). Long-tailed cuckoos (*Eudynamis taitensis*), potential predators of eggs and chicks, were seen on four occasions, although there is only anecdotal evidence of cuckoo harassment of Tanga'eo (G. Tuara pers.comm.). Cats and rodents were present in all forest types and are potential predators of Tanga'eo.

We estimate the Tanga'eo population to have been between 250 and 450 birds in 1992, and that at least 60% of the population were likely to be members of pairs or trios. Therefore, we suggest that the population had the potential to maintain itself. However, the subspecies is vulnerable to extinction. Approximately 50% of the population was found in the northwest forest tract, while the density of Tanga'eo was much lower in the apparently similar forest in the southwest. The reason for the difference was unclear. Mynas were not found within either of these forest tracts, but the northwest forest, being more remote from villages, may have suffered less disturbance. Factors limiting the population in the southwest may eventually limit the population in the northwest and this would have serious implications for the survival of the Tanga'eo.

Further research is needed to determine population trends in the different areas and the requirements for the long-term survival of the Tanga'eo. The survey should be repeated every three to five years, and survival and productivity of Tanga'eo investigated in the different forest areas.

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