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Population density of Red-throated Bee-eaters *Merops bullocki* in a pristine habitat

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Summary

Red-throated Bee-eaters *Merops bullocki* in essentially pristine Guinea savanna bordering the major river valley system in Yankari Game Reserve, northern Nigeria, had an average population density of 25-50 birds per km², with a peak density of 50-90 per km² along the central 7 km of the central river valley. The population mean was *c.* 2-4 times as dense as that recorded in a high density area of degraded savanna around the city of Zaria. Colony size was also 2-5 times larger and several low-quality sites were used. It is suggested that colony site shortage occurs in the pristine habitat.

Résumé

Dans la savane guinéenne essentiellement intacte, qui borde le réseau de vallées des rivières principales de la Yankari Game Reserve du nord du Nigéria, le Guêpier à gorge rouge *Merops bullocki* atteignait une densité moyenne de 25-50 oiseaux au km², avec un maximum de 50-90 sur les 7 km du cours moyen de la vallée centrale. La densité moyenne était de *c.* 2-4 fois plus élevée que celle relevée sur une zone à forte densité dans une savane érodée autour de la ville de Zaria. La taille des colonies était aussi de 2-5 fois plus grande et plusieurs sites médiocres étaient utilisés. On suggère que dans un habitat intact il y aurait pénurie de sites propices.

Introduction

The Red-throated Bee-eater *Merops bullocki* is a medium-sized bee-eater weighing 20-25 g (Crick & Fry 1986). It inhabits Guinea savanna dissected by streams and rivers,

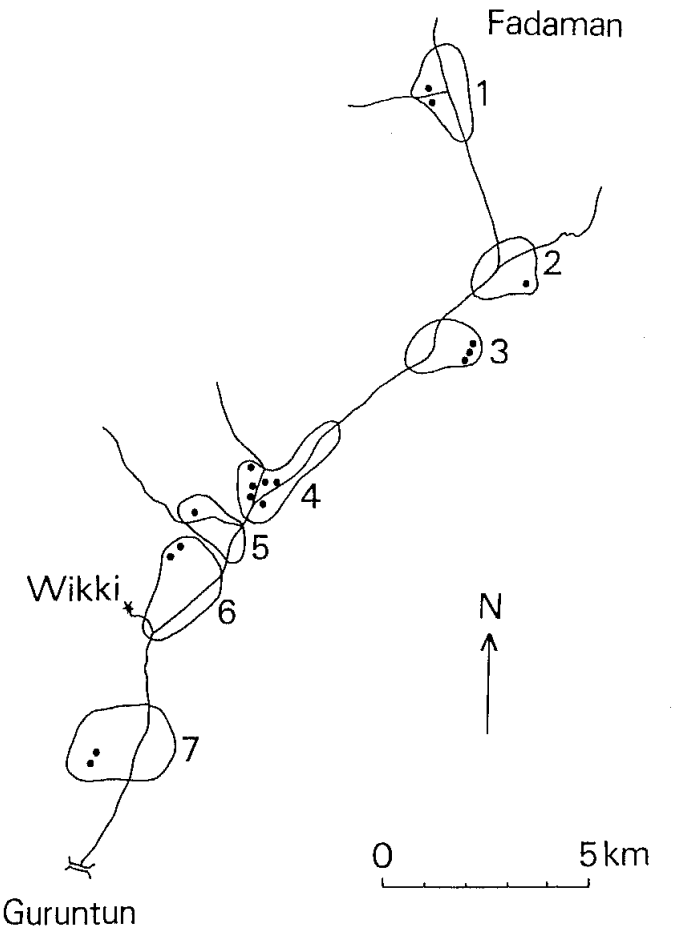

Figure 1. Map of the centre of Yankari Game Reserve showing the approximate ranges used by seven numbered populations of Red-throated Bee-eaters in the valley of the River Gajt. Colony sites are denoted by filled circles and Wikki village by a star.

between about 8° and 12°N from Senegal to the Sudan, and nests in compact colonies dug into earth banks or cliffs (Fry 1984).

Fry (1972) suggested that colony distribution was determined by the occurrence of cliffs suitable for nesting. Dyer (1979) predicted that Red-throated Bee-eaters in Nigeria's effectively pristine Yankari Game Reserve would have fewer suitable nest sites than in the degraded savanna farmland around Zaria in northern Nigeria (11°08'N, 7°47'E) where agricultural bush-clearance has promoted the formation of steep-sided lateritic erosion gullies. This paper documents Red-throated Bee-eater colony dispersion, size and habitat in Yankari Game Reserve in 1978-81 for comparison with the population near Zaria.

Study Area and Methods

Yankari Game Reserve, in Bauchi State, Nigeria, is about 100 km south-east of Bauchi City, and has an area of 2240 km² between 9°30' and 10°00'N and between 10°15' and 10°45'E in the Northern Guinea Savanna zone. It has been relatively undisturbed by man and can be considered an example of savanna in its pristine state (Gadzama *et al.* 1974), containing, at the time of study, healthy populations of large vertebrates including *c.* 350 African Elephant *Loxodonta africana* (Jia *et al.* 1982).

The major topographical feature of Yankari is the River Gaji (Hausa for "tired") which flows perennially from north to south through the centre of the reserve and is a tributary of the River Benue. It is fed by numerous warm springs and seepages which are important in maintaining flow during the dry season. The River Gaji has cut a valley up to 1 km wide, bounded in places by sheer sandstone escarpments up to 30 m high. At various places along the escarpments, water run-off from the surrounding land has caused severe erosion, leaving large areas of bare lateritic gullies and cliffs suitable for bee-eater colonies.

The vegetation of Yankari consists of riparian formations and savanna woodland (Geerling 1973). The former comprise *Cyperus exaltatus* swamp, *Jardinia congoensis* grassland, *Mimosa pigra* scrub, and dense evergreen forest. The savanna woodland is intermediate between Northern Guinea and Sudan types (Keay 1959) dominated by *Afzelia africana*, *Burkea africana*, *Anogeissus leiocarpus*, *Detarium* spp. and *Combretum* spp. On the well-drained, sandy and eroded soils found along gullies, seasonal stream beds and bordering the highly eroded areas along the escarpment of the River Gaji are dense stands of 10-15 m tall *Pteleopsis habeensis*.

Red-throated Bee-eaters return to the area of their previous breeding colony as the rainy season ends in September. Nest-tunnel excavation begins adjacent to the old colony, or up to 0.5 km distant, and continues until November. In September 1979 and 1980, a systematic search was made along the valley of the River Gaji to find colony sites. Eroded areas and gullies were investigated on foot, after having been identified from aerial photographs. New colonies were also found by observing the flight direction of bee-eaters to and from night-time tree-roosts. Areas outside the valley were also

searched, particularly in areas located from aerial photographs where seasonal streams occurred, but no colonies or Red-throated Bee-eaters were found.

Results

All colonies were found within 2 km of the River Gaji and no bee-eaters were seen to forage further than 3 km from the river. Colonies were found on the banks of the Gaji (which were exposed as water-levels dropped in September), in highly eroded areas along the escarpments of the river valley and in gullies cut into the surrounding plain.

There were seven main populations of Red-throated Bee-eaters whose boundaries (Fig. 1) were determined from sightings of marked individuals and of interchange between colony sites. Bee-eaters were rarely seen, and marked individuals never seen, in the larger gaps between foraging areas.

Table 1. Red-throated Bee-eater populations in Yankari Game Reserve between Guruntun Bridge and Fadaman Valley, 1978-81.

Population	Colony Sites	Position	Approximate Population Size
1	C6	Gully	200
	C7	Gully	
2	C14	Roadside bank	100
3	C11	Eroded area	150
	C12	Eroded area	
	C13	Eroded area	
4	C2	Man-made pit	300
	C3	River bank	
	C17	Dried river bank	
	C19	River bank	
	ODC	Dried river bank	
	NDC	Dried river bank	
5	C18	Eroded area	150
6	C1	Man-made pit	200
	C20	Eroded area	
7	C15	Eroded area	150
	C16	Eroded area	

The seven populations used or tried to use 17 colony locations (Table 1). Population estimates were made from observations of numbers of birds and nest-holes. The high number of colonies for Population 4 was a result of abandonment of sites due to tourist vehicle disturbance (ODC) or predator activity (Nile Monitor Lizards *Varanus niloticus* at C17 and C19). Most colonies were in eroded areas in vertical lateritic cliffs 2-5 m high, with nest-holes dug into a band 1-3 m wide, starting at about 0.5 m from the top. Exposed roots projecting from such cliffs were used as perches by bee-eaters. One unusual level-ground location (C3) has been described before (Crick & Fry 1980).

An estimate of population density from the figures in Table 1, although approximate, allows comparison with other published data. The seven populations contained *c.* 1250 Red-throated Bee-eaters (before nesting began), giving a mean of *c.* 180 individuals per population. Most foraging during the dry season (September to March) was made in the river valley (*c.* 1-2 km wide), so the bee-eaters occupied an area of 25-50 km² along the 25 km length of the River Gaji surveyed, i.e. 25-50 birds per km². However, this calculation includes some areas which were not used by Red-throated Bee-eaters and can be considered an underestimate. If one considers just the central section of river, containing three contiguous populations (4, 5 and 6), there were about 650 bee-eaters in 7-14 km², representing a density of 50-90 birds per km².

Discussion

Yankari is probably similar to the typical habitat of the Red-throated Bee-eater during its recent evolutionary history. The estimated maximum population density of Red-throated Bee-eaters in Yankari was 50-90 per km². Fry (1984) estimated the population of bee-eaters in degraded savanna woodland around Zaria, which he considered to be a high density area, to be 21 per km². This was in an area of 25 km² which included feeding territories but not unutilized areas. This high density area was separated from others by *c.* 5 km by watersheds. He calculated an average density over the terrain as a whole of 0.59 birds per km². The density of bee-eaters in Yankari Game Reserve was estimated as 0.56 birds per km², if measured over its full 2240 km² area.

Colony size was larger in Yankari than near Zaria. Most colonies contained 100 or more individuals in Yankari, but the normal size near Zaria was about 60, with a range of 9-110 (Fry 1973). Dyer (1979) predicted that Yankari would have more pressure on suitable nest sites because, without agricultural clearance of savanna woodland, erosion gullies would be rarer. Dyer's prediction appears to be born out because Red-throated Bee-eaters in Yankari not only form more crowded colonies and denser populations but also use unsuitable colony sites. One colony was set in a shallow sandy bank, sloping at about 30° and was destroyed when elephants walked across it (pers. obs.). Other colonies were dug in flat ground, not previously documented.

Lack of suitable nesting habitat is actually just one of a range of plausible explanations for the differences in colony size (Wittenberger & Hunt 1985). However, there has been little investigation into the consequences of colony size variation within

species and more work is needed (Brown *et al.* 1990). Red-throated Bee-eaters appear to be obligate colonial breeders (Siegel-Causey & Kharitonov 1990), having highly developed social behaviour which may result in energetic as well as anti-predator benefits. In their review, Siegel-Causey & Kharitonov (1990) concluded that an unpredictable and abundant food supply is the most likely cause of coloniality, perhaps through benefits such as information transfer (Brown *et al.* 1991), whereas predation will determine the form of a colony. Thus, although it may be true that nest-site shortage may limit nesting opportunities in Yankari, the greater size of colonies may reflect a more unpredictable or abundant food supply or higher predation risks than near Zaria.

Fry (1973) concluded "that bee-eaters encounter very little direct competition for Hymenoptera and that they occupy the niche of predation on larger, venomous, flying Hymenoptera practically alone". It is interesting to ask why Little Bee-eaters *Merops pusillus*, which live in the same habitat as Red-throated Bee-eaters, nest solitarily in earth banks. Fry (1984) suggested that the prey of Little Bee-eaters, with a greater proportion of small Coleoptera and Diptera and fewer Hymenoptera than taken by Red-throats, are more stable and predictable in one locality, allowing the economic defence of breeding territories. Territoriality may limit their population density, which Fry (1984) estimated at 5 per km² near Zaria. Little Bee-eaters also appeared to be much less abundant than Red-throated Bee-eaters in Yankari (pers. obs.). It seems reasonable to hypothesize therefore that Red- throated Bee-eaters are colonial nesters because their food supply is relatively abundant but spatially unpredictable.

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References

BROWN, C.R., BROWN, M.B. & SHAFFER, M.L. (1991) Food-sharing signals among socially foraging Cliff Swallows. *Anim. Behav.* 42: 551-564.

BROWN, C.R., STUTCHBURY, B.J. & WALSH, P.D. (1990) Choice of colony size in birds. *Trends Ecol. Evol.* 5: 398-403.

CRICK, H.Q.P. & FRY, C.H. (1980) Level-ground nesting by *Merops bullocki*. *Malimbus* 2: 73-75.

CRICK, H.Q.P. & FRY, C.H. (1986) Effects of helpers on parental condition in red-throated bee-eaters (*Merops bullocki*). *J. Anim. Ecol.* 55: 893-905.

DYER, M. (1979) *The Adaptive Significance of Cooperative Breeding in the Red-*

*throated Bee-eater (*Merops bullocki*) (Vieillot) and Other Bee-eaters*. Ph.D Thesis, Aberdeen University.

FRY, C.H. (1972) The social organisation of bee-eaters (Meropidae) and cooperative breeding in hot climate birds. *Ibis* 114: 1-14.

FRY, C.H. (1973) The biology of African bee-eaters. *Living Bird* 11: 75-112.

FRY, C.H. (1984) *The Bee-eaters*. Poyser, Calton.

GADZAMA, N.M., MUSTAFA, S. & PARR, M.J. (1974) Notes on the history of human influence in the Yankari Game Reserve area, Nigeria. *Nigerian Field* 39: 76-85.

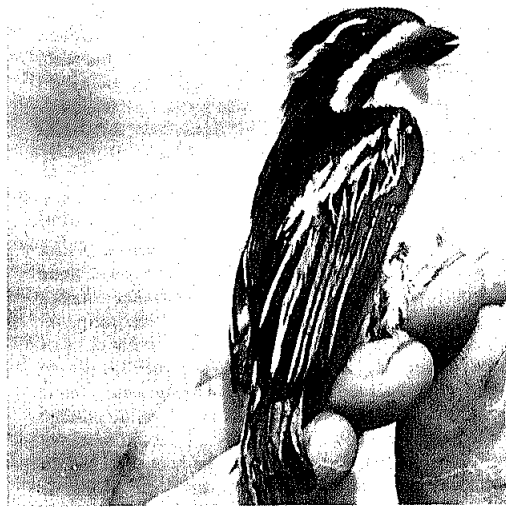
GEERLING, C. (1973) *The Vegetation of Yankari Game Reserve: its Utilisation and Condition*. Bulletin 3, Dept of Forestry, Ibadan University.

JIA, J., MARSHALL, P.J. & CRICK, H.Q.P. (1982) *A Guide to the Yankari Game Reserve*. Hudahuda, Zaria.

KEAY, R.W.J. (1959) *Vegetation Map of Africa South of the Tropic of Cancer*. Oxford University Press, Oxford.

SIEGEL-CAUSEY, D. & KHARITONOV, S.P. (1990) The evolution of coloniality. *Current Ornithol.* 7: 285-330.

WITTENBERGER, J.F. & HUNT, G.L. (1985) The adaptive significance of coloniality in birds. *Avian Biol.* 8: 1-78.



Lemon-rumped Tinkerbird – Barbion à croupion jaune – *Pogoniulus bilineatus*
Photo H.Q.P. Crick