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Diversity and population densities of coraciiform birds in Zambezi riparian forest

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Abstract

Diversity and population densities of coraciiform birds in Zambezi riparian forest. A territory mapping method was used in 2015 to assess the population density of coraciiform species breeding in a riparian forest on the Zambezi River near Katima Mulilo, NE Namibia. The forest, c. 280 ha in surface area, was partly transformed by human settlement and arable grounds. A total of 13 species and 42 breeding pairs were recorded. Population densities were (pairs/100 ha) as follows: grey–headed kingfisher 4.3; giant, pied and woodland kingfisher, each one with 1.1; malachite kingfisher 0.7; striped kingfisher 0.4; white–fronted bee–eater 1.4; little bee–eater 1.1; lilac–breasted roller 0.7; broad–billed roller 1.1; African hoopoe 0.7; red–billed wood–hoopoe 1.1; and scimitar–billed wood–hoopoe 0.4.

Data published through GBIF (Doi: 10.15470/s9rlud)

Key words: Coraciiformes, Census, Riparian forest, Population density

Resumen

Diversidad y densidades de población de aves coraciformes en un bosque de rivera de Zambeze. En el año 2015 se empleó un método de mapeo del territorio para evaluar la densidad de población de las especies de coreciformes que se reproducen en un bosque de ribera del río Zambeze, en las proximidades de Katima Mulilo, al NE de Namibia. El bosque, de unas 280 hectáreas de superficie, está parcialmente transformado por asentamientos humanos y tierras de cultivo. Se registraron un total de 13 especies y 42 parejas reproductoras. Se establecieron las siguientes densidades de población (parejas/100 ha): alción cabeciblanco 4,3; martín gigante africano, martín pescador pío y alción senegalés, 1,1 cada uno; martín pescador malaquita 0,7; alción estriado 0,4; abejaruco frentiblanco 1,4; abejaruco chico 1,1; carraca lila 0,7; carraca picogorda 1,1; abubilla africana 0,7; abubilla arbórea verde 1,1; y abubilla arbórea cimitarra 0,4.

Datos publicados en GBIF (Doi: 10.15470/s9rlud)

Palabras clave: Coraciformes, Censo, Bosque de rivera, Densidad de población

Resum

Diversitat i densitats de població d'ocells coraciformes en un bosc de rivera de Zambeze. L'any 2015 es va utilitzar un mètode de mapatge del territori para avaluar la densitat de població de les espècies de coreciformes que es reprodueixen en un bosc de ribera del riu Zambeze, prop de Katima Mulilo, al NE de Namíbia. El bosc, d'unes 280 hectàrees de superfície, està parcialment transformat per assentaments humans i terres de conreu. S'hi van registrar un total de 13 espècies y 42 parelles reproductores. S'hi van establir les densitats de població següents (parelles/100 ha): alció capgris 4,3; alció gegant africà, alció garser i alció del Senegal 1,1 cadascun; blauet malaquita 0,7; alció estriat 0,4; abellerol frontblanc 1,4; abellerol petit 1,1; gaig blau de clatell verd 0,7; gaig becgròs africà 1,1; puput africana 0,7; puput arbòria verda 1,1, i puput arbòria simitarra 0,4.

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Paraules clau: Coraciformes, Cens, Bosc de rivera, Densitat de població

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Introduction

Coraciiforms (kingfishers, bee–eaters, rollers and allies) belong to a highly attractive group of birds and may play an important ecological role in some habitats. They are especially well–represented in sub–Saharan Africa where they are grouped in three families: bee–eaters (Meropidae), rollers (Coracidae) and kingfishers (Alcedinidae). Some authorities also include the hoopoe (Upupidae) and wood–hoopoe (Phoeniculidae) families, as I also do in this study.

Many southern African species belonging to the order Coraciiformes are relatively well–studied (e.g. Fry et al., 1992), especially in regard to their breeding biology and diet (Kopij, 2000, 2018a). However, little information on population density is yet available for most of them (Hockey et al., 2005). Since many coraciiform species breed in low densities, such studies are difficult because they have to be conducted on relatively large study plots.

This note reports on the distribution and population density of coraciiform species breeding in a riparian forest in NE Namibia. Since the riparian forest is under threat of degradation, it is important to create a basis for monitoring bird species that may be indicative of habitat naturalness.

Material and methods

Study area

The study area was located in the Zambezi Valley near Katima Mulilo in the Zambezi Region, NE Namibia. The study area comprised a forest stretching between the river and the international road from Zambia through Katima Mulilo to Botswana, lying on the left bank between the Wenela Bridge (border pass) and the Zambezi River lodge. This forest area is 7 km long and 200–700 m wide (mean = c. 400 m). The approximate surface area is therefore c. 280 ha.

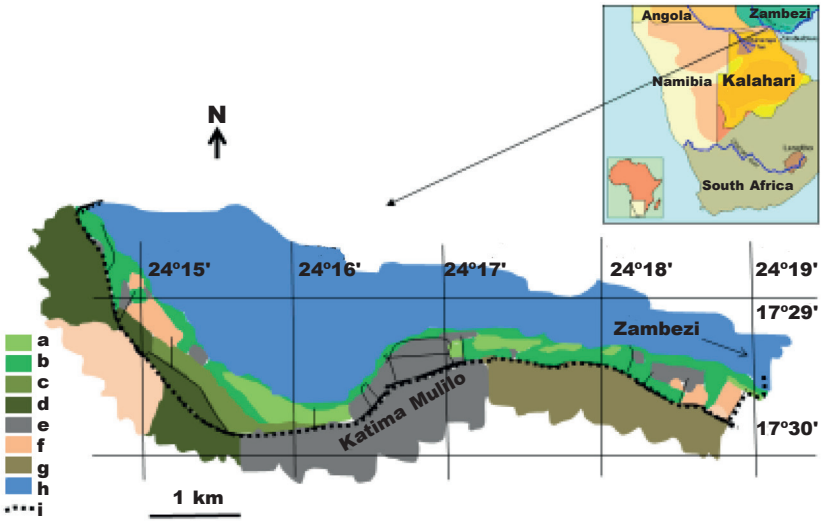

Fig. 1. Distribution of breeding pairs/occupied territories/cooperatives groups of the: kingfishers, bee–eaters, rollers, and hoopoes and woodhoopoes in a Zambezi Forest in NE Namibia: a, Zambezi riparian forest; b, grassland (flooded area); c, *Colophospermum mopane* forest; d, Kalahari woodland; e, arable grounds; f, urbanized built–up areas; g, rural area; h, Zambezi River; i, border of the study area.
Fig. 1. Distribución de parejas reproductoras/territorios ocupados/grupos cooperativos de: alciones, abejarucos, carracas, y abubillas y abubillas arbóreas en un bosque de Zambeze al NE de Namibia: a, bosque de ribera en Zambeze; b, pradera (zona inundada); c, bosque de Colophospermum mopane*; d, arboleda de Kalahari; e, tierras de cultivo; f, zonas urbanizadas edificadas; g, área rural; h, río Zambeze; i, límite del área de estudio.*

The natural vegetation is classified as Riparian Zambezi Forest (Mendelsohn et al., 2009). It is composed of large trees such as African teak *Pterocarpus angolensis*, albizias *Albizia* spp., apple leaf *Lonchocarpus nelsii*, baobab *Adansonia digitata*, burkea *Burkea africana*, combretum *Combretum* spp., camel–thorn *Acacia erioloba*, corkwoods *Commiphora* spp., false mopane *Guibourtia coleospermum*, jackal berry *Diospyros mespiliformis*, knob–thorn *Accacia nigrescens*, makalani palm *Hyphaene petersiana*, manketti *Schinziophyton rautanenii*, marula *Sclerocarya birrea*, mopane *Colophospermum mopane*, pod mahogany *Afzelia quanzensis*, silver cluster–leaf *Terminalia sericea*, sausage tree *Kigelia africana*, sycomore fig *Ficus sycomorus*, white bauhinia *Bauhinia petersiana*, Zambezi teak *Baikiaea plurijuga*.

The forest is interlaced with pans covered with grass and sedges flooded almost on a yearly basis. About one quarter of the land has been converted into arable grounds and built–up areas, but large trees usually remain even in these converted areas (fig. 1).

The annual temperature for Katima Mulilo is 21 ºC. The average maximum temperature during the hottest month (September) is 35 ºC; the average minimum temperature during the coldest month (July) is 3 ºC. Humidity is 80–90 % in the most humid month (February)

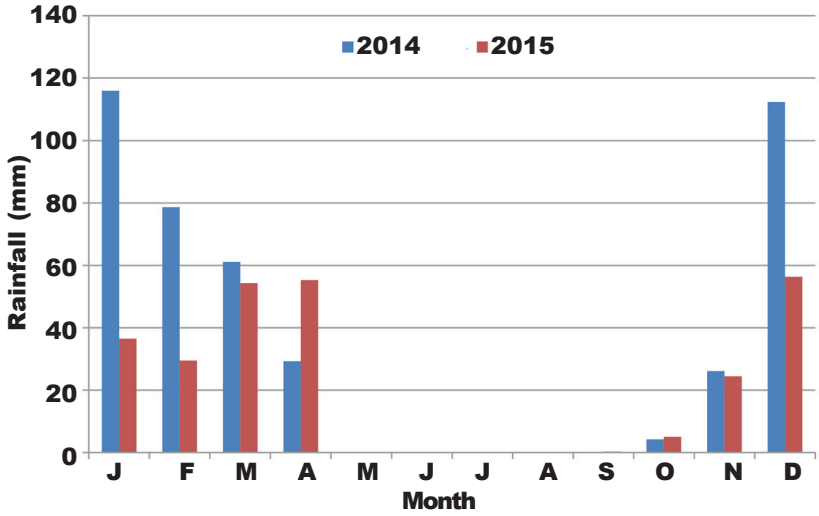

Fig. 2. Monthly rainfall in Katima Mulilo in 2014 and 2015.
Fig. 2. Pluviosidad mensual en Katima Mulilo, años 2014 y 2015.

and only 10–20 % in the least humid month (September). The average annual rainfall is c. 700 mm, the highest in Namibia. Median annual rainfall is 550–600 mm. Most rains fall between November and March. The rainfall was below the long–term average in 2014 and in 2015 (fig. 2).

Methods

A territory mapping method (Bibby et al., 2002) was used to assess the population densities of all coraciiform species nesting in the forest. The study area was divided into six sections. Birds were counted in each of the sections in one morning.Therefore, the whole study area was covered in six mornings. Such complete coverage was achieved four times in 2015, in August, September, October and November. During each count, all coraciiform birds seen or heard were plotted on the map 1:500. Special attention was paid to birds showing territorial behaviour or breeding display. Recordings of two or three simultaneously calling males were important in interpreting the results. A bird or pair of the same species recorded at the same site in at least two out of the four months was interpreted as residential/breeding/territorial (following Bibby et al., 2002).

Results and discussion

In total 13 coraciiform species were recorded as breeding in 2016: six kingfishers, two bee–eaters, two rollers, two wood–hoopoes, and one hoopoe species (see dataset published in GBIF, Doi: 10.15470/s9rlud).

The coraciiform community in the riparian forest was dominated by kingfishers, which comprised more than 50 % of all breeding coraciiform species. By far, the most numerous

Table 1. Population densities of coraciiform species in a Zambezi forest: N, number of pairs.
Tabla 1. Densidades de población de coraciformes en un bosque de Zambeze: N. número de pares.

Species	N	Density (pairs/100 ha)	Dominance (%)
Alcididae	(24)	(8.6)	(57.1)
Grey–headed kingfisher	12	4.3	28.6
Giant kingfisher	3	1.1	7.1
Pied kingfisher	3	1.1	7.1
Woodland kingfisher	3	1.1	7.1
Malachite kingfisher	2	0.7	4.8
Striped kingfisher	1	0.4	2.4
Meropidae	(7)	(2.5)	(16.6)
White–fronted bee–eater	4	1.4	9.5
Little bee–eater	3	1.1	7.1
Coraciidae	(5)	(1.3)	(11.9)
Lilac–breasted roller	2	0.7	4.8
Broad–billed roller	3	1.1	7.1
Upupidae	(2)	(0.7)	(4.8)
African hoopoe	2	0.7	4.8
Phoeniculidae	(4)	(1.4)	(9.5)
Red–billed wood–hoopoe	3	1.1	7.1
Scimitar–billed wood–hoopoe	1	0.4	2.4
Total	42	15.0	100.0

kingfisher species was the grey–headed kingfisher *Halcyon leucocephala* comprising exactly half of all breeding pairs of kingfishers and nested in a density of 4.3 pairs/100 ha. Three other kingfisher species, the woodland *Halcyon senegalensis*, pied *Ceryle rudis* and giant kingfisher *Megaceryle maximus*, all nested in the same density (i.e. 1.1 pairs/100 ha). There were also two pairs of the malachite kingfisher *Alcedo cristata* (0.7 pairs/100 ha). The least numerous was the striped kingfisher *Halcyon chelicuti* (table 1).

The bee–eaters were represented by the white–fronted bee–eater *Merops bullockoides* breeding in a small colony on the bank of the river, and the little bee–eater *Merops pisillus* breeding in a built–up area within the forest. Overall density of bee–eaters was 2.5 pairs/100 ha (table 1).

Territories of three pairs of the broad–billed roller *Eurystomus glaucurus* and two territories of the lilac–breasted roller *Coracias caudatus* were recorded in the area. Rollers nested, therefore, in a density of 1.3 pairs/100 ha (table 1).

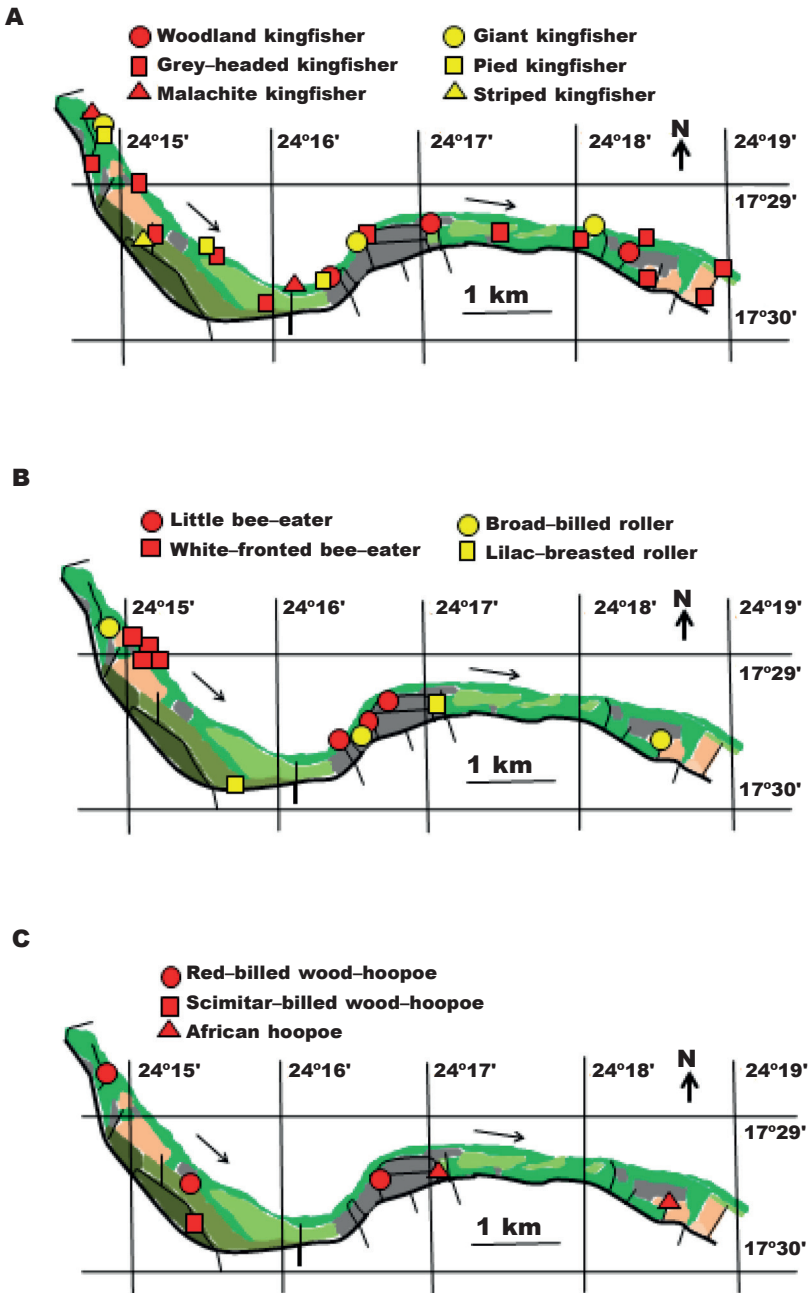

Fig. 3. Distribution of breeding pairs of particular bird species in the Zambezi riparian forest: A, kingfishers; B, bee-eaters and rollers; C, wood-hoopoes and hoopoes.
Fig. 3. Distribución de parejas reproductoras de determinadas especies de aves en el bosque de ribera de Zambeze: A, alciones; B, abejarucos y carracas; C, abubillas arbóreas y abubillas.

There were also two pairs of the African hoopoe *Upupa africana*, three breeding units of the red–billed wood–hoopoe *Phoeniculus purpureus* and one pair of the scimitar–billed wood–hoopoe *Rhinopomastus cyanomelas*. The overall density of all hoopoes and wood–hoopoes was 2.1 pairs/100 ha.

Out of 42 breeding pairs of coraciiform birds, 15 territories have been established in a pure forest (35.7%), 9 territories in built–up areas (21.4%), 11 on the border of built–up and forested areas (26.2%), 6 (14.3%) on the border of built–up and arable areas and only three territories (7.1%) located mainly in the grassy pans (fig. 3).

The number of coraciiform species recorded in the riparian forest near Katima Mulilo appears to be very high (N = 13), probably one of the highest in southern Africa. It should also be mentioned that in close proximity to the study area, a large colony (c. 500 nests in 2016) of the Southern carmine bee–eater *Merops nubicoides,* c. 50 pairs of the white–fronted bee–eater and a few pairs of the swallow–tailed bee–eater *Merops hirundineus* have been recorded (Kopij, 2018a). In the neighbouring town of Katima Mulilo, well–endowed with indigenous and exotic trees (highly modified riparian forest), the number of coraciiform species was nine (Kopij, 2016); in the Kalahari woodland (12 km long transect) in the same Zambezi Region (also 9; Kopij, 2017), in Kasane on Chobe River (5; Kopij, 2018c). Outside the Zambezi Region the number of coraciiform species was much lower, e.g. in urbanized areas in the north central Namibia it was four (Kopij, 2014); in Bloemfontein it was also four (Kopij, 2001a, 2015), in Roma Valley, Lesotho (3; Kopij, 2001b), in Swakopmund on Atlantic coast (none; Kopij, 2018b).

To date, few data have been published on the population densities of coraciiform birds in Africa (Hockey et al., 2005). For the lilac–breasted roller the highest density was recorded in Mababe Depression in the Chobe National Park, Botswana (Herremans et al., 1997). However, the density varied considerably even within the same year. For example, in N and E Botswana, it was highest in August/October (10 birds/100 km), and lowest in November/December (2.5 birds/100 km) (Herremans and Herremans–Tonnoeyr, 1994). The little bee–eater nested at a density of two pairs/100 ha in broad–leaved woodland in the Limpopo Province, South Africa (Tarbotton et al., 1987). Kopij (1999, 2001a, 2015) recorded 32 African hoopoe breeding pairs (i.e. 0.6 pairs/100 ha) and three scimitar–billed wood–hoopoe breeding pairs (i.e. 0.1 pairs/100 ha) in 5,000 ha of urbanized, well–timbered habitats of Bloemfontein, South Africa (Kopij, 2001a, 2015).

High species diversity and population densities of coraciiform species recorded in riparian forest indicate that this vegetation, even if partly modified by human activities, may play a very important role in the protection of these species, which can be regarded as indicators of a high level of biodiversity. Protection of any remaining stretches of this rich and unique forest vegetation along the Zambezi River should be among the highest conservation priorities in Namibia.

References

Bibby, C. J., Burgess, N. D., Hill, D. A., Mustoe, S., 2002. *Bird Census Techniques*, 2nd ed. Academic Press, London.

Fry, C. H., Fry, K., Harris, A., 1992. *Kingfishers, Bee–Eaters and Rollers: A Handbook*. Princeton University Press, Princeton, NJ.

Hockey, P. A. R., Dean, W. R. J., Ryan, P. G., Maree, S. (Eds.), 2005. *Roberts' Birds of Southern Africa*. John Voelcker Bird Book Fund, Cape Town.

Herremans, M., 1997. Lilac–breasted Roller. In: *The Atlas of Southern African Birds*, 1: 678–679 (J. A. Harrison, Eds.). BirdLife South Africa, Johannesburg.

Herremans, M., Herremans–Tonnoeyr, D., 1994. Seasonal patterns in abundance of Lilac-breasted Rollers *Coracias caudata* and Purple Rollers *Coracias naevia* inferred from

roadside counts in eastern and northern Botswana. *Ostrich*, 65: 66–73.
Kopij, G., 1999. Distribution, numbers and habitat preference of the Hoopoe *Upupa epops* in Bloemfontein. *Mirafra*, 16(3/4): 29–31.
– 2000. Birds of Maseru. *NUL Journal of Research (Roma, Lesotho)*, 8: 104–151.
– 2001a. *Atlas of Birds of Bloemfontein.* Department of Biology, National University of Lesotho (Roma) and Free State Bird Club, Bloemfontein (South Africa).
– 2001b. *Birds of Roma Valley*. Department of Biology, National University of Lesotho, Roma.
– 2014. Avian Assemblages in Urban Habitats in North–central Namibia. *International Science and Technology Journal of Namibia*, 3(1): 64–81.
– 2015. Avian diversity in an urbanized South African grassland. *Zoology & Ecology*, 25(2): 87–100.
– 2016. Birds of Katima Mulilo town, Zambezi Region, Namibia. *International Science andTechnology Journal of Namibia*, 7: 85–102.
– 2017. Structure of avian assemblages in Zambezian Baikiaeae woodlands, northern Namibia. *Zoology and Ecology*, 27: 1–10.
– 2018a. Diet of sympatrically breeding Southern Carmine Bee–eater *Merops nubicoides* and White–fronted Bee–eater *Merops bullockoides*. *Ostrich*, 89(2): 191–194.
– 2018b. Provisional atlas of breeding birds of Swakopmund in the coastal Namib Desert. *Lanioturdus*, 51(2): 2–12.
– 2018c. Atlas of birds of Kasani. *Babbler*, 64: 3–15.
Mendelsohn, J., Jarvis, A., Roberts, C., Robertson, T., 2009. *Atlas of Namibia. A Portrait of the Land and its People*. Sunbird Publishers, Cape Town.
Tarbotton, W. R., Kemp, M. I., Kemp, A. C., 1987. *Birds of the Transvaal*. Transvaal Museum, Pretoria.