


STRUCTURE OF AVIAN COMMUNITIES IN SUBURBS OF RUNDU AND GROOTFONTEIN, NE NAMIBIA

Grzegorz Kopij

University of Namibia, Department of Integrated Environmental Science; Ogongo Campus, Private Bag, 5520, Oshakati, Namibia

✉ g.kopij@unam.na;  Grzegorz Kopij <https://orcid.org/0000-0001-7614-1983>

Структура населення птахів у передмістях Рунду і Грутфонтейна, Північно-Східна Намібія. - Г. Копій. - Беркут. 30 (1). 2021. - Структура населення птахів вивчалася у двох містах, розташованих у саванні. Всього зареєстровано 14 видів птахів у Рунду і 22 у Грутфонтейні. Тільки 6 видів були спільними, тому індекс подібності Соренсена виявився низьким ($I = 0,33$). Густота населення більшості звичайних видів, тобто горлиць і горобців, була різною. Південний сіроголовий горобець домінував у Рунду, де взагалі не зареєстровано хатнього горобця, що був домінантом у Грутфонтейні. Там сіроголовий горобець зустрічався лише випадково. Таке ж зворотнє співвідношення відмічене і для більшості звичайних видів горлиць. Дивно бачити такі відмінності у структурі населення птахів міст із подібним рівнем річної кількості опадів (557–568 мм), що знаходяться в одному біомі на відстані всього 260 км одне від одного. Оскільки Рунду лежить біля великої річки (Окаванго), видове різноманіття птахів тут повинно б бути більшим, але по факту – воно значно менше. Рослиність більш багата у Грутфонтейні, ніж у Рунду, можливо саме це і є основною причиною таких відмінностей.

Ключові слова: екологія угруповань, міська орнітологія, густота населення, домінування, подібність

Abstract. Structure of avian communities was quantified in two selected towns situated within the tree and savannah biome. In total, 14 breeding resident bird species were recorded in Rundu, and 22 in Grootfontein. Only six species were common for both towns: Laughing Dove, Cape Turtle Dove, Rock Dove, Grey Lorie, Fork-tailed Drongo and Southern Grey-headed Sparrow. Therefore, Sørensen similarity index was surprisingly low ($I = 0.33$). Population densities of the most common birds, i.e. doves and sparrows, were different. The Southern Grey-headed Sparrow was a dominant species in Rundu, with no House Sparrow recorded at all, while the House Sparrow was a dominant species in Grootfontein, with the Southern Grey-headed Sparrow occurring there only accidentally. Such reverse proportions were recorded also among most common dove species: while the proportion of the Laughing Dove in relation to Cape Turtle Dove breeding pairs was much higher in Grootfontein than in Rundu, the reverse was true in the case of the Cape Turtle Dove. It is surprising to find that the structure of avian communities in towns with similar annual precipitation (557–568 mm), laying within the same major biome (savannah), and separated by relatively short distance (c. 260 km) is so different in terms of the number of species and population densities of the most common species. Since Rundu is located along a larger river, it was expected that the avian community will be richer in terms of the number of species, but in fact it is much lower. However, greenery is richer in Grootfontein than in Rundu, and this probably was the main reason for this discrepancy.

Key words: community ecology, urban ornithology, population density, dominance, similarity.

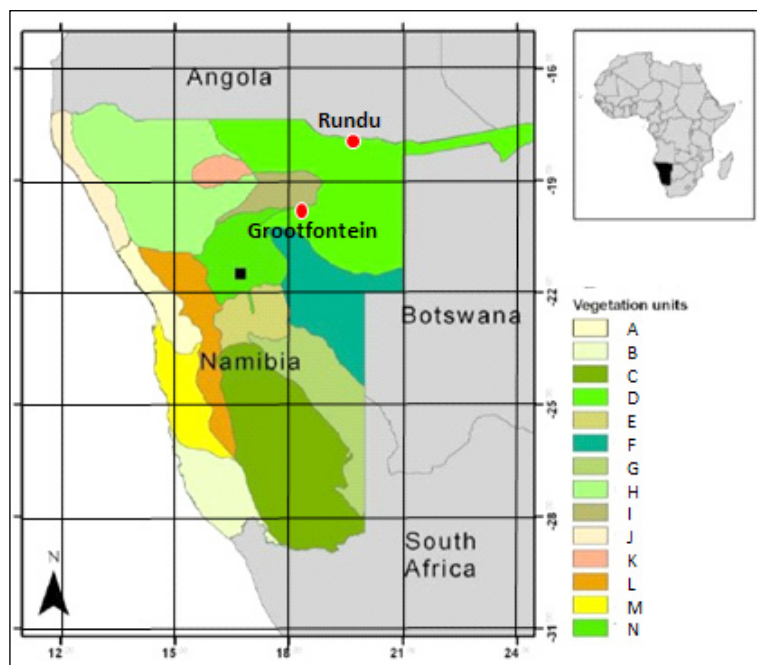


Fig. 1. Vegetation types in Namibia.

A – Central Namib, B – Desert & Succulent Steppe, C – Dwarf Scrub Savanna, D – Forest Savanna & Woodlands, E – Highland Savanna, F – Camel Thorn Savanna, G – Mixed Tree & Shrub Savanna, H – Mopane, I – Mountain Savanna & Karsveld, J – North Namib, K – Saline Desert with Dwarf Savanna, L – Semi Desert & Savanna Transition, M – Southern Namib, N – Thorn Bush Savanna.

Рис. 1. Типи рослинності в Намібії.

Introduction

Each town/city in the world is unique both in regard to its historical development, citizens, man-made structures, urban landscaping, remains of natural vegetation, presence of exotic plants, and animal communities. Namibian towns present a good example of this variation and uniqueness.

Animals show different degree of adaptation to live under diverse urban conditions. Among vertebrates, birds appear to be best adapted to live under such conditions. Their presence is usually greatly appreciated, as they bring back life to degraded urban environment, increasing in this way general living conditions both for wildlife and for human.

In this paper, a comparative study was undertaken on avian communities in two 'neighbouring' Namibian towns. Special attention was paid to species diversity and the proportions of the dominant (i.e. the most common) species, such as sparrows and doves.

Study areas

Studies were conducted in two towns, Rundu and Grootfontein, in north-eastern part of Namibia, separated by a distance of c. 260 km (Fig. 1). Both towns lay within the Kalahari Woodland (forest savannah).



Photo 1. Rundu.

Rundu is situated c. 260 km NE of Grootfontein in Kavango West Region (17° 55' S, 19° 46' E; 1095 m a.s.l.) on the right bank of the Okavango River. Although the city was established later than Grootfontein (in 1936), it is now much larger (63431 inhabitants in 2011). There are six secondary schools and five tertiary institutions. Rundu has hot semi-arid climate. The average annual precipitation (568 mm) is much the same like in Grootfontein. Similar is also the distribution of the rainfall over the year (Mendesohn et al., 2009).

In Rundu, transects to count birds were designed in older and better developed part of the city, laying between the river, Kakakuru Street to the east, and Independence Street to the south (c. 150 ha in surface size). Unlike rest of the town, it is well-timbered with mostly indigenous trees, but there are no palms (Photo 1). There is only one sport field (c. 2 ha in size) and one other open space (c. 3 ha). There is, however, a large un-built floodplain of the Okavango River just north to the town.

Grootfontein is located at 19° 34' S, 18° 07' E; 1430 m a.s.l., Otjozondjupa Region. There are no rivers in the town as well as in the countryside, but a fairly large pan (hot spring) surrounded by marshlands (so called 'grootfontein') is situated on the southern outskirts of the town (c. 2 km from the study area). Grootfontein town was established in 1885 and it

grown to 23793 inhabitants in 2011. It is a seat of six primary, and four high schools. The average annual rainfall is 557 mm. Almost all rain falls from October to April, with a peak in December – March (Mendesohn et al., 2009).

In Grootfontein, transects to count birds were designed in town proper, laying NW of the Okavango Road (B8). It covers c. 150 ha. The town is well-timbered with acacias (*Acacia* spp.), jacaranda (*Jacaranda* sp.), Washingtonia palms (*Washingtonia filifera*), northern lala palms (*Hyphaene petersiana*), flamboyant tree (*Delonix regia*), and many others (Photo 2). It has also two sport fields (each one c. 1 ha in size) and three other larger (each one 2–3 ha in size) open places. There are three small (each c. 1 ha) wooded areas.

Methods

The line transect method (Sutherland, 1996; Bibby et al., 2012) was employed in this study. In Grootfontein, birds were counted twice: on 1st of May 2014 (time: 07³⁵–08⁴⁵) and 4th of May 2014 (time: 07⁰⁰–09⁰⁰). In Rundu: on 7th of April 2013 (time: 16²⁵–18⁵⁰).

All surveys were conducted by walking slowly along streets. All seen and heard birds were identified, sexed and



Photo 2. Grootfontein.

Фото 2. Місто Грутфонтейн.



Resident (breeding) bird community in suburbs of Rundu and Grootfontein
Гніздове населення птахів передмість Рунду і Грутфонтейна

Common species name	Scientific species name	Rundu		Grootfontein	
		N	%	N	%
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>	0	0.0	4	1.4
African Palm Swift	<i>Cypsiurus parvus</i>	0	0.0	11	4.0
African Reed Warbler	<i>Acrocephalus beaticatus</i>	0	0.0	1	0.4
Black-backed Puffback	<i>Dryoscopus cubla</i>	0	0.0	1	0.4
Black-throated Canary	<i>Serinus atrogularis</i>	0	0.0	1	0.4
Blue Waxbill	<i>Uraeginthus angolensis</i>	0	0.0	21	7.6
Cape Glossy Starling	<i>Lamprotornis nitens</i>	0	0.0	3	1.1
Cape Turtle Dove	<i>Streptopelia capensis</i>	10	11.1	15	5.4
Fork-tailed Drongo	<i>Dicrurus adsimilis</i>	1	1.1	1	0.4
Golden-tailed Woodpecker	<i>Campethera abingoni</i>	0	0.0	1	0.4
Grey Lourie	<i>Corythaixoides concolor</i>	1	1.1	5	1.8
House Sparrow	<i>Passer domesticus</i>	0	0.0	5	1.8
Laughing Dove	<i>Streptopelia senegalensis</i>	26	28.9	122	44.2
Lilac-breasted Roller	<i>Coracias caudatus</i>	0	0.0	1	0.4
Little Swift	<i>Apus affinis</i>	0	0.0	10	3.6
Pied Crow	<i>Corvus albus</i>	7	7.8	0	0.0
Red-breasted Swallow	<i>Cercopsis semirufa</i>	1	1.1	0	0.0
Red-eyed Bulbul	<i>Pycnonotis nigricans</i>	0	0.0	37	13.4
Red-eyed Dove	<i>Streptopelia semitorquata</i>	6	6.7	0	0.0
Red-faced Mousebird	<i>Urocolius indicus</i>	10	11.1	0	0.0
Rock Dove	<i>Columba livia</i>	8	8.9	7	2.5
Rosy-faced Parrot	<i>Agapornis roseicollis</i>	0	0.0	15	5.4
Senegal Coucal	<i>Centropus senegalensis</i>	0	0.0	1	0.4
Southern Grey-headed Sparrow	<i>Passer diffusus</i>	14	15.6	4	1.4
Speckled Pigeon	<i>Columba guinea</i>	0	0.0	9	3.3
Village indigobird	<i>Vidua chalybeata</i>	1	1.1	0	0.0
White-bellied Sunbird	<i>Cinnyris talatala</i>	0	0.0	1	0.4
White-crowned Helmet-shrike	<i>Prionops plumatus</i>	3	3.3	0	0.0
Wire-tailed Swallow	<i>Hirundo albigularis</i>	2	2.2	0	0.0

N – number of potentially breeding pairs, % – dominance (percentage of the number of breeding pairs of a given species in relation to the total number of all breeding pairs of all species). Values for dominant species are given in bold case.

aged whenever possible. Special care was taken to not count the same birds twice. Therefore records of simultaneously calling/cooing birds (at the same time) were important in this regard. Recorded were also movements of birds. As recommended in the mapping method, a pair, not an individual, was a census unit. It has been assumed that one isolated or two adult birds associated to each other represented one (potentially breeding) pair; 3 or 4 adult birds – 2 pairs, and so on. However, a flock composed of 1–2 adult birds and few juveniles was regarded as representing one pair (a family).

The dominance is expressed as the percentage of the total number of pairs of a given species in relation to the total number of all pairs of all species recorded. Dominant species is defined as that comprising 5% and more of all pairs of all species recorded, while subdominant – that comprising 2.00–4.99%. The cumulative dominance is defined as the sum of

Table 1 dominance value of all dominant species. The community dominance index was calculated as follow:

$DI = (n_1 + n_2)/N$,
where n_1, n_2 – number of pairs of two most abundant species, N – total number of pairs of all species.

The following guilds were distinguished.

• Diet: G – granivorous, I – insectivorous, F – frugivorous, O – others (nectarivorous, vegetarian, omnivorous).

• Nesting: TS – in trees or shrubs, H – in holes, B – in/on buildings, O – others vegetation.

The following indices were used to characterize the diversity and evenness of the communities.

• Shannon's diversity index:

$H' = -\sum p_i \ln p_i$
where: p_i is the proportion of breeding pairs belonging to the i th species.

• Pielou's evenness index:

$J' = (-\sum p_i \ln p_i) / \ln S$,
where p_i is the proportion of breeding pairs belonging to the i th species; S – total

number of species. J' varies between 0 and 1. The less variation between species in a community, the higher J' is.

Similarity among avian communities (dry and wet seasons) were investigated using the Sørensen's Coefficient:

$$I = 2C/A+B,$$

where A – the number of bird species in one plot, B – the number of bird species in another plot, C – the number of bird species common to both plots.

Systematics and nomenclature of bird species follow Hockey et al. (2005). Latin names of species see in Table 1.

Results and discussion

In total, 29 bird species were recorded as breeding resident on transects in both towns. 14 breeding resident bird species were recorded in Rundu, and 22 in Grootfontein (Tables 1 and



2). Due to improper season, only one Palearctic (non-breeding) species (one individual) was found in Rundu, while none in Grootfontein. The number of breeding bird species are similar to that recorded in towns in north-central Namibia (Kopij, 2014, 2019a), but much lower than that recorded in Katima Mulilo (Kopij, 2016, 2019b, 2020).

Only six species were common for Rundu and Grootfontein: Laughing Dove, Cape Turtle Dove, Rock Dove, Grey Lorie, Fork-tailed Drongo and Southern Grey-headed Sparrow. Therefore, Sørensen similarity index was surprisingly low ($I = 0.33$).

Population densities of the most common birds, i.e. dove and sparrows, were different. The Southern Grey-headed Sparrow was a dominant species in Rundu, while no House Sparrow was recorded at all. On the other hand, the House Sparrow was a dominant species in Grootfontein, while the Southern Grey-headed Sparrow was only accidental (Table 1). Such reverse proportions were recorded also among most common dove species: while the proportion of the Laughing Dove in relation to Cape Turtle Dove breeding pairs was much higher in Grootfontein than in Rundu, the reverse was true in the case of the Cape Turtle Dove. In addition, another dove species, the Red-eyed Dove, was recorded in Rundu, while it was not recorded at all in Grootfontein. Despite these evident differences in proportions, the overall contribution of doves to the avian community was remarkably similar in both towns compared (46.7% in Rundu vs. 49.6% in Grootfontein).

In other towns in northern Namibia the proportion of various dove species was different. The proportion of the Laughing Dove to Cape Turtle Dove was 0.88 : 0.12 ($n = 138$) in Grootfontein, while in Rundu it was 0.63 : 0.37 ($n = 41$). In Katima Mulilo, situated at extreme north-east of the country, the proportion of the Laughing Dove to other dove species (58.4%) was even lower than in Rundu. Similarly, in Kasane, laying c. 100 km south of Katima Mulilo, where Laughing Dove comprised 53.9% of all *Streptopelia* doves recorded (Kopij, 2018a). In towns in north-central Namibia (Cuvelai drainage system) the Laughing Dove comprised everywhere more than 90% of breeding pairs of all *Streptopelia* doves (Kopij, 2014, 2019a). In Opuwo, a town laying in the extreme north-west of Namibia, only the Laughing Dove was recorded among *Streptopelia*-doves. It appears, therefore, that in urbanized habitats of northern Namibia the proportion of the number of breeding pairs of the Laughing Dove to other *Streptopelia* dove species

Characterization of breeding bird community in Rundu and Grootfontein
Характеристика гніздового населення птахів Рунду і Грутфонтейна

Parameter	Rundu	Grootfontein
Number of species and pairs		
Number of species	14	22
Number of breeding pairs	90	276
Dominance		
Number of dominant species	7	5
Cumulative dominance (%)	90.1	76.0
Community dominance (DI)	0.44	0.58
Indices		
Shannon's Diversity Index (H')	2.13	2.08
Pielou's Evenness Index (J')	0.81	0.67

in increasing gradually westwards. The proportion is therefore increasing with decreasing precipitation. A similar gradual longitudinal change is apparent in the numerical proportion between the House Sparrow and Southern Grey-headed Sparrow. While in Opuwo, only House Sparrow was recorded, only the Southern Grey-headed Sparrow was present in Katima Mulilo (Kopij, 2016, 2019b). In towns laying between this western and eastern extremes, various proportions of these two sparrow species were recorded (Kopij, 2014, 2020).

While the Blue Waxbill, Red-eyed Bulbul and Rosy-faced Parrot were dominant species in Grootfontein, in Rundu they were not recorded at all. On the other hand, the Pied Crow, Red-eyed Dove and Red-faced Mousebird were recorded as dominant in Rundu, but were not recorded at all on transects in Grootfontein.

Both in Rundu and Grootfontein, granivorous birds were by far more numerous than birds of all other feeding guilds taken together. Similarly, birds nesting in trees or shrubs were by far more numerous than birds of all other nesting guilds (Fig. 2). It is rather surprising as birds nesting on/in building are usually the most common nesting guild in urban habitats in Namibia (Kopij, 2018a, 2018b, 2018c, 2019a, 2019b, 2020).

It is surprising to find that the structure of avian communities in towns with similar annual precipitation, laying within

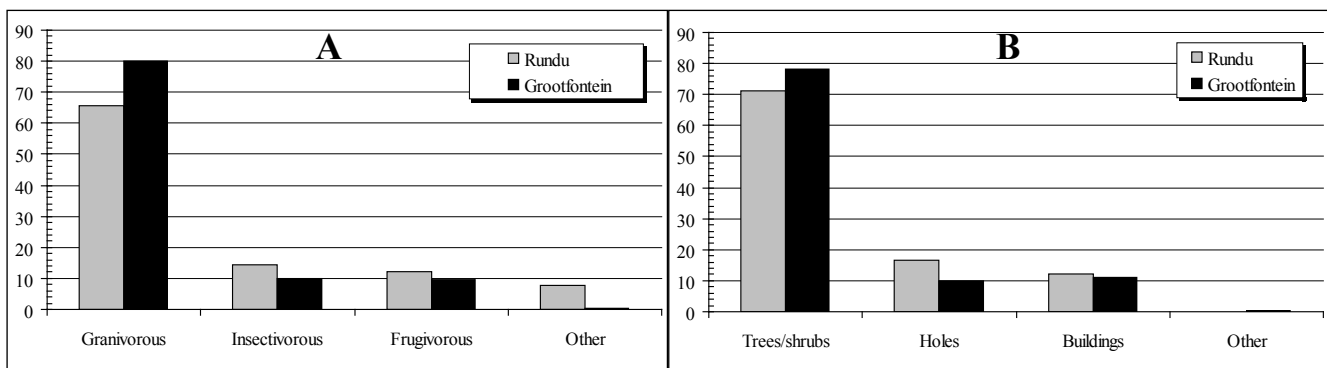


Fig. 2. Percentage of feeding (A) and nesting (B) guilds in avian community in Rundu and Grootfontein.
Рис. 2. Співвідношення кормових (A) і гніздових (B) гільдій у населенні птахів Рунду та Грутфонтейна.



the same major biome, and separated by a distance of only c. 260 km are so different in terms of the number of species and population densities of the most common species. Since Rundu is located along a larger river, it was expected that the avian community will be richer in terms of the number of species, but in fact it is much lower. However, greenery is richer in Grootfontein than in Rundu, and this probably was the main reason for this discrepancy.

REFERENCES

- Bibby C.J., Burgess N.D., Hill D.A., Mustoe S. (2012): Bird Census Techniques. Academic Press, London.
- 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.
- Kopij G. (2014): Avian Assemblages in Urban Habitats in North-central Namibia. - Int. Science & Technology J. of Namibia (Windhoek). 3 (1): 64-81.
- Kopij G. (2016): Birds of Katima Mulilo town, Zambezi Region, Namibia. Int. Science & Technology J. of Namibia (Windhoek). 7: 85-102.
- Kopij G. (2018a): Provisional atlas of breeding birds of the Walvis Bay town in the Coastal Namib Desert confirms its status as an artificial wildlife oasis. - 2nd Int. Confer. on Agriculture and Natural Resources Research and Innovation ('Sustainable Agriculture for Food and Feed Security'). Neudamm Campus, University of Namibia, 15–16 October 2018. Programme and Book of Abstract. 52.
- Kopij G. (2018b): Atlas of breeding birds of Kasane. - Babbler. 64: 3-15.
- Kopij G. (2018c): Provisional atlas of breeding birds of Swakopmund in the coastal Namib Desert. - Lanieturdus. 51 (2): 2-12.
- Kopij G. (2019a): Population density and structure of birds breeding in an urban habitat dominated by large baobabs (*Adansonia digitata*), Northern Namibia. - Biosystem Diversity. 27 (4): 354-360.
- Kopij G. (2019b): Structure of avian communities in a mosaic of built-up and semi-natural urbanised habitats in Katima Mulilo town, Namibia. - Welwitschia Int. J. of Agricultural Sciences. 1: 68-75.
- Kopij G. (2020): Structure of breeding bird community along the urban gradient in a town on Zambezi River, north-eastern Namibia. - Biologija. 66 (1): 1-9.
- Mendelsohn J., Jarvis A., Roberts C., Robertson T. (2009): Atlas of Namibia. A Portrait of the Land and its People. Sunbird Publishers, Cape Town.
- Sutherland W.J. (1996): Ecological Census Techniques: a handbook. Cambridge University Press, Cambridge (U.K.).