The Blue Waxbill *Uraeginthus angolensis*, in an acacia savanna: methodological implications in population density estimations

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Abstract. The population density of the Blue Waxbill was assessed in a study plot (400 ha) composed of natural and man-modified acacia savanna, by the mean of territory mapping method. The plot was located in Ogongo, Omusati Region, north-central Namibia. The breeding population density of the Blue Waxbill changed slightly from 11.3 to 12.0 in particular months However, if the records from all these months were put together on the map, then the population density was assessed at 20.8 p./100 ha. This is because territory boundaries have shifted in the course of breeding (second or third clutches) and these territories are counted twice It is therefore recommended to conduct such studies over a shorter period of time (1-2 moths).

Keywords: Namibia, savanna, population density, territoriality, mapping method.

1. Introduction

The Blue Waxbill *Uraeginthus angolensis* is a member of the family Estrildidae. The genus includes two other species, the Red-cheeked Cordon-blue *U. bengalus* and Blue-capped Cordon-blue *U. cyanocephalus*. All occur in Africa south of Sahara. The Blue Waxbill is parapatric with the other congenerics, while the Blue-capped Cordon-blue is sympatric with the Red-cheecked Cordon-blue to a large extend (Payne 2010). The Blue Waxbill is a typical representative of small granivore passerines from such as Estrildidae, Ploceidae, Viduidae, Passeridae and Fringillidae.

The Blue Waxbill a common inhabitant of savanna, especially partly human-modified Acacia savanna in a close proximity to water. It feeds mainly on grass seeds, with admixture of insects, especially termites. Therefore, it starts to breed about two month after rain, i.e. in

January/February in northern Namibia, when the grass seeds are developed and termites abundant (Payne 2010). It is monogamous and territorial, but it defends only immediate vicinity of nest. It nests solitary, but sometimes in loose colonies (Nuttall 2005). Little is known about population density of this species. The presented study was undertaken to partly fulfil this gap in our knowledge. The specific goal was to estimate population density is a selected large plot; to investigate monthly changes in this density; to show site tenacity, if any; find whether there are any micro-habitat preferences; and to compare population densities across Africa. In addition to these, the mapping method (Bibby et al. 2012) is tested. The ecological question is how the number of counts conducted over certain period of time may affect results interpretation (estimation of population density).

2. Methods

2.1 Study area

The study area was located on the UNAM Ogongo campus, Omusati Region, N Namibia (17°700S, 15°310E). The total surface of the study area was 400 ha. Detailed description of the study area has been published by Kopij (2025).

2.2 Data collection

Studies were conducted in 2020. The territory mapping method (Sutherland 1996; Bibby et al. 2012) has been employed to assess the population densities of the Blue Waxbill breeding in the study plot. Four surveys, each one consisted four counts, of the whole area were conducted in three distinguished periods: February/March, April and Amy/June. Therefore, the total number of morning devoted to the study was 48. Records were plotted on a map 1: 5000. For more details of the method see Kopij (2025).

2.3 Data analysis

At least two records in a clump were required to distinguish an occupied territory (Bibby et al. 2012). Each such clump was interpreted as an occupied territory, while occupied territory was considered as an equivalent of one breeding pair. Population density was calculated as the number of breeding pairs per 100 ha.

3. Results and discussion

In a mixture of natural and man-modified acacia savanna in the Ogongo, the breeding population density of the Blue Waxbill changed slightly from 11.3 to 12.0 pairs per 100 ha in particular month (Table 1). However, if records from all these months were put together on the map, then the population density was assessed at 20.8 p./100 ha. Most territories were established in a close proximity to water reservoirs, canals, oshanas, sand-pits and fences (Fig. 1).

The only reliable population density estimate (25-75 pairs / 100 ha) for the Blue Waxbill originates from an open *Acacia-Dichrostachys* savanna in Limpopo province, South Africa (Tarboton 1980). However, in recent years, Blue Waxbill population density was estimated by means of the territory mapping method in a few urbanized habitats in the northern Namibia and north-eastern Botswana. It ranged from 29.4 to 69.0 pairs / 100 ha (Table 1), which falls well within the range given by Tarboton (1980). In all these Namibian studies (Table 1), and also in Tsumeb (Kopij 2021c) and Grootfonetin (Kopij 2021d), and in the norther Namibia at large (Kopij 2021a) the Blue Waxbill was a dominant breeding bird species (>5% of all breeding pairs of all specie), reaching much higher population densities than in the acacia savanna in Ogongo. It should be, however, pointed out that both in the mopane savanna and in acacia savanna in Ogongo, population densities of the Blue Waxbill were similar (i.e. 9.4 pairs / 100 ha) in mopane savanna (Kopij 2023) against 11.3-12.0 pairs / 100 in acacia savanna (this study). This short review indicates that the Blue Waxbill reaches higher population densities in urbanized than in natural savanna or woodlands habitats, which is often a case of granivore species (e.g. sparrows, finches, doves), well-adapted to live in urbanized environment which often offer abundant seed food.

There is an assumption for the territory mapping method, that the more counts are conducted, the more accurate results are obtained. When all breeding bird species are counted in temperate or boreal forests of Europe, 8-12 surveys (depending on the habitat, weather conditions and researcher's perception) are required for reliable estimation (Sutherland 1996, Bibby et al. 2012). The period when the birds can be counted lasts there no more than 100 days (April-June in Central Europe). In southern Africa, the breeding season of many bird species is much more extended. For example in northern Namibia, it starts in August/September and ends in May/June. However, birds should not be counted in the whole period, as the number of territories and their locations may show marked seasonal variation. The studies conducted on the Blue Waxbill population breeding in Ogongo, showed that 12 surveys conducted over a longer

study period (Fig. 4) may significantly overestimate the real number of this species. This is because territories of many bird species may shift in the course of breeding (second or third clutches), and may be counted twice, as showed for the Blue Waxbill in this study (Fig. 3). It is therefore recommended to conduct such studies over a shorter period of time (1-2 moths), and for most insectivorous bird species preferable on the onset of the rainy season. For granivorous and frugivorous species more suitable would be probably the end of this season.

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Table 1. Population density of the Blue Waxbill (400 ha).

Month	Pairs	Pairs/100 ha
February/March	48	12.0
April	45	11.3
May/June	47	11.8
Overall	82	20.5

Table 2. Breeding population density of the Blue Waxbill in urbanized habitats in northern Namibia and north-eastern Botswana.

Habitat	Location	Density [p./100 ha]	Plot size [ha]	Source
Urbanized acacia savanna	Onguediva, Oshana Region, N Namibia	69.0	100	Kopij 2021b
Urbanized acacia savanna	Outapi, Omusati Region, N Namibia	47.7	130	Kopij 2019
Urbanized mixed woodland/savanna	Katima Mulilo, Zambezi Region, NE Namibia	40.8	476	Kopij 2019, 2020a, 2020b
Urbanized Zambezi riparian forest	Katima Mulilo, Zambezi Region, NE Namibia	38.9	54	Kopij 2023
Urbanized mixed woodland/savanna	Kasane, NE Botswana	29.4	160	Kopij 2018

Fig. 1. The Blue Waxbill.

Fig. 2. Natural (left) and human-modified (right) acacia savanna in the study area.

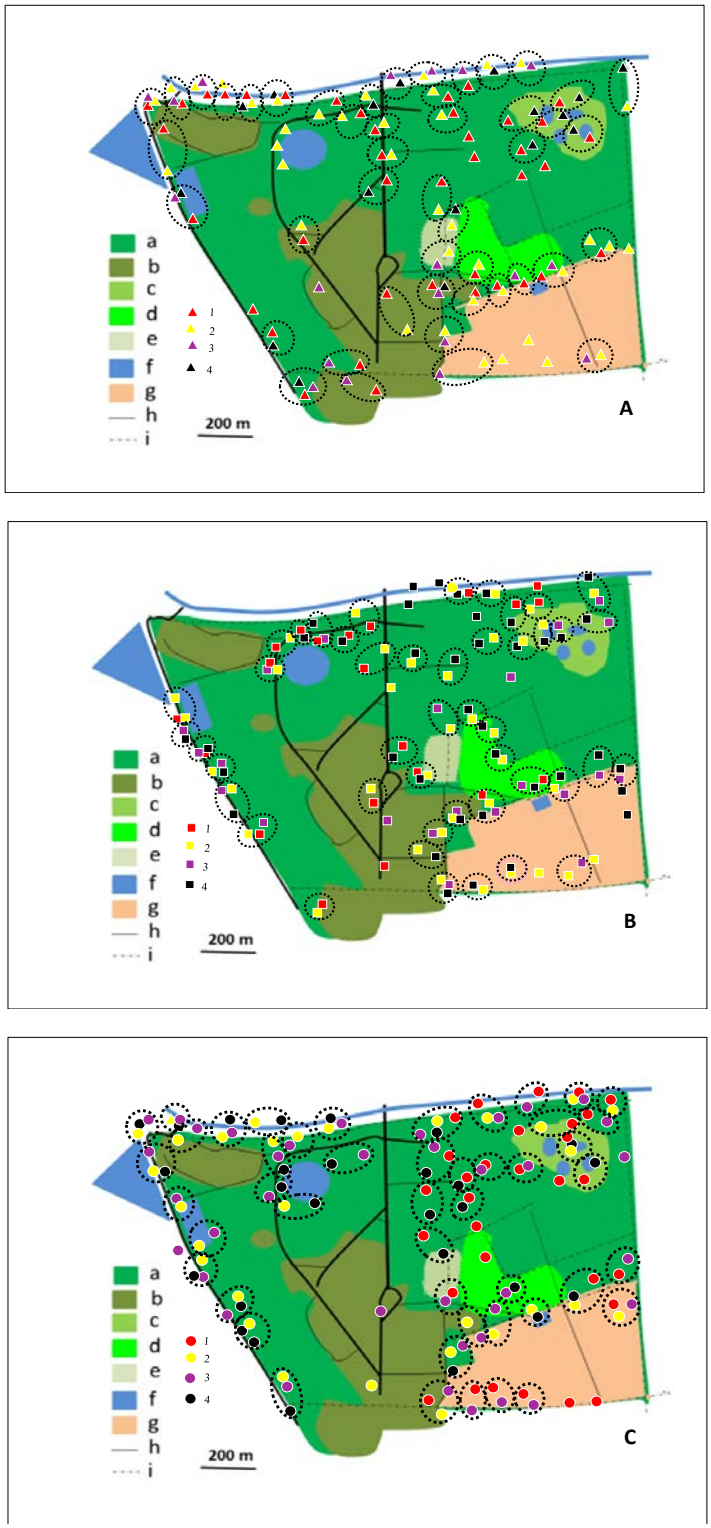

Fig. 3. Distribution of Blue Waxbill territories in Ogongo in (A) February/March, (B) April and (C) May/June 2020. Explanations: Surveys: 1, 2, 3, 4: first, second, third and fourth survey respectively in the year 2020. Habitats (land uses): a – acacia savanna, b – built-up area, c – disturbed acacia savanna, d – orchard, e – sport field, f – water bodies, g – arable ground, h – roads, i – fences. 1, 2, 3, 4 – records of birds during survey 1, 2, 3, or 4. Encircled are occupied territories.

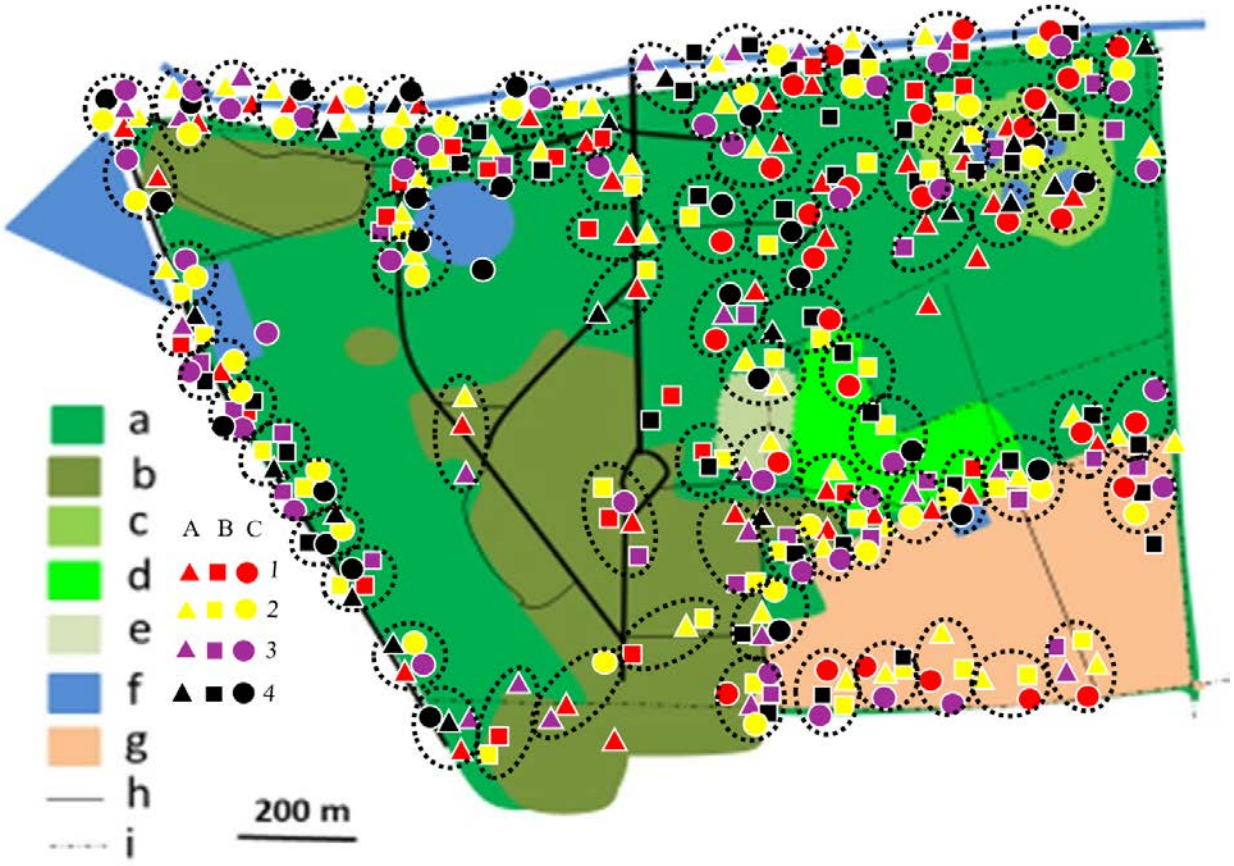

Fig. 4. Distribution of Blue Waxbill territories in February-June in Ogongo in 2020.
Explanations: 1, 2, 3, 4: records of the first, second, third and fourth survey respectively in February/March (A), April (B) and May/June (C) 2020 in the 2020. Habitats (land uses): a – acacia savanna, b – built-up area, c – disturbed acacia savanna, d – orchard, e – sport field, f – water bodies, g – arable ground, h – roads, i – fences.