Home range size estimates for two endangered endemic species from the Angolan Scarp Forest

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Information on the endemic threatened birds of Angola is limited or non-existent. In this pilot study, two individuals of Gabela Akalat *Sheppardia gabela* and Gabela Bush-shrike *Laniarius amboimensis* were radio-tagged and followed during 10 days. Home range sizes were estimated through Minimum Convex Polygons (MCP) and Kernel contours. Depending on the analytical method used, home range sizes varied between *c.* 1 and 4 ha for the Akalat and between *c.* 4 and 24 ha for the Bush-shrike.

Keywords: Gabela Akalat, Gabela Bush-shrike, habitat use, home range size

The Angolan Scarp Forest is one of the most important areas for biodiversity in the country, yet information regarding the biodiversity is limited due to three decades of armed conflicts. Kumbira Forest is the largest known and single most representative area of the Central Scarp, holding significant populations of the Endangered endemics: Gabela Bush-shrike *Laniarius amboimensis*, Pulitzer's Longbill *Macrosphenus pulitzeri* and Gabela Akalat *Sheppardia gabela* (Mills, 2010). Unfortunately these forests are being cleared by human populations for agriculture and timber. It is therefore crucial to understand the impacts of these human activities, especially on the threatened endemics, in order to implement effective conservation strategies. For this to be possible, the habitat requirements of the species of concern need to be identified.

Since 2010, bird and habitat surveys have been conducted in Kumbira Forest at least once a year and in the dry season (June-October). However the low detectability of the endemic species and the complex mosaic-like landscape have made difficult the identification of their habitat requirements (Cáceres et al., 2014). Therefore a pilot study was performed to assess if radio-tracking could be used to: (i) estimate home range size and (ii) evaluate habitat use of endemic threatened species.

Fieldwork was performed in Kumbira from 14 June to 17 July 2013. Kumbira is located in the western Angolan province of Kwanza Sul and the municipality of Conda (11.107°S, 14.336°E).

The terrain varies from relatively flat in the valley bottom to steep on the slopes of Njelo Mountain.

Gabela Akalat (mass: 12.5 g) and Gabela Bush-shrike (mass: 45 g) were the target species of this study and mist netting was used to capture them. Pulitzer's Longbill was not considered because previous studies have shown that it is rarely present in forested habitats in the study site (Cáceres et al., 2014).

VHF radio transmitters (Biotrack, Dorset) not exceeding 5% of the birds' body mass were attached with glue to the mantle feathers of Gabela Akalat (0.47 g) and with cotton eight-shape harnesses (Rappole and Tipton, 1991) in the Gabela Bush-shrike (1.25 g). Tagged birds were followed during 10 days and located every 2 hours (from 07:00–17:00) using a TR-100 telemetry receiver (Communication Specialist, California) and a 3-element Yagi antenna. Birds' locations were obtained with triangulation using the software Locate III (Pacer Computing, 2011). The software R and the extension package "adehabitat HR" (Calenge, 2006, R Development Core Team, 2013) were used to estimate home range size using 95% minimum convex polygons (MCP) and fixed Kernel contours (Kenward, 2001). Smoothing parameters for Kernel were calculated using least square cross-validation (LSCV) (Kernohan et al., 2001).

To identify land cover/habitat types in the study site, ISOCLUST unsupervised classification was performed on Landsat 8 OLI/TIRS satellite image (WRS-2 path 181 row 68). Classification was performed using the software IDRISI Selva (Eastman, 2012). The resulting image was then reclassified to three habitat types: open areas, sparse forest and dense forest using ground truth data collected during 2010 and 2012. Percentage of each habitat type was estimated for the MCP home range size of each bird. MCP was used because it is the most frequent methodology to estimate home range size (Kenward, 2001) allowing comparisons with other studies.

Two individuals from each targeted species were tagged. It was not possible to follow all individuals during 10 days, either because the signal was lost (one Gabela Bush-shrike) or the tag fell (one Gabela Akalat) (Table 1).

The percentage of successful locations (amount of bearings that successfully gave a location) obtained for the Gabela Bush-shrike was 40% and 45%, whereas there was an 82% success for the Gabela Akalat. Signals from Gabela Bush-shrikes' tags were difficult to locate and changed direction often. As both species occurred in the same area, the difference in location success between species could reflect different behaviours, with the Bush-shrike moving more than the Akalat.

Even though estimations should be done with at least 30 locations (Kenward, 2001), I made the most of scarce data and calculated home range sizes for all individuals including one Gabela Bush-shrike for which only 10 fixes were available. MCPs for Gabela Bush-shrike were

Table 1. Home range size and habitat use of two threatened Angolan endemics: the Gabela Bush-shrike and the Gabela Akalat. Radio-tracking effort of pilot study is presented; home range size were estimated with Kernel contour and minimum convex polygons (ha). Percentages of different habitat types in each MCP for both species are also presented.

Individuals	Days followed (days)	Locations measured (#)	Successful locations (#)	Success Percent (%)	Kernel (ha)	MCP (ha)	Habitat types (% of MCP)		
							Open areas	*Sparse Forest*	*Dense Forest*
Gabela Akalat 1 (GA1)	5	29	24	82.8	3.8	1.1	42.9	28.6	28.6
Gabela Akalat 2 (GA2)	10	57	47	82.5	2.2	0.8	14.3	14.3	71.4
Gabela Bush-shrike 1 (B1)	10	59	27	45.8	16.2	5.3	33.9	20.3	45.8
Gabela Bush-shrike 2 (B2)	4	25	10	40	23.8	3.9	37.8	13.3	48.9

about five times smaller than home range sizes estimated by Kernel contours (3.9 and 5.3 ha versus 16.2 and 23.8 ha, respectively; Figure 1a, Table 1). Gabela Akalat had a smaller home-range size, with again MCP estimates smaller than those obtained from Kernel contours (0.8 and 1.1 ha versus 2.2 and 3.8 ha, respectively; Figure 1b, Table 1). Despite the advantages of MCP, it does not assess probability of occurrence and the home range size estimates increase with the addition of locations (White and Garrot, 1990). Kernel estimation is superior as it includes probability of occurrence (Kernohan et al., 2001) but, in this case, it appears to have over-estimated home range sizes, most likely because LSCV does not perform accurately when sample sizes are small (n<50) (Blundell et al., 2001).

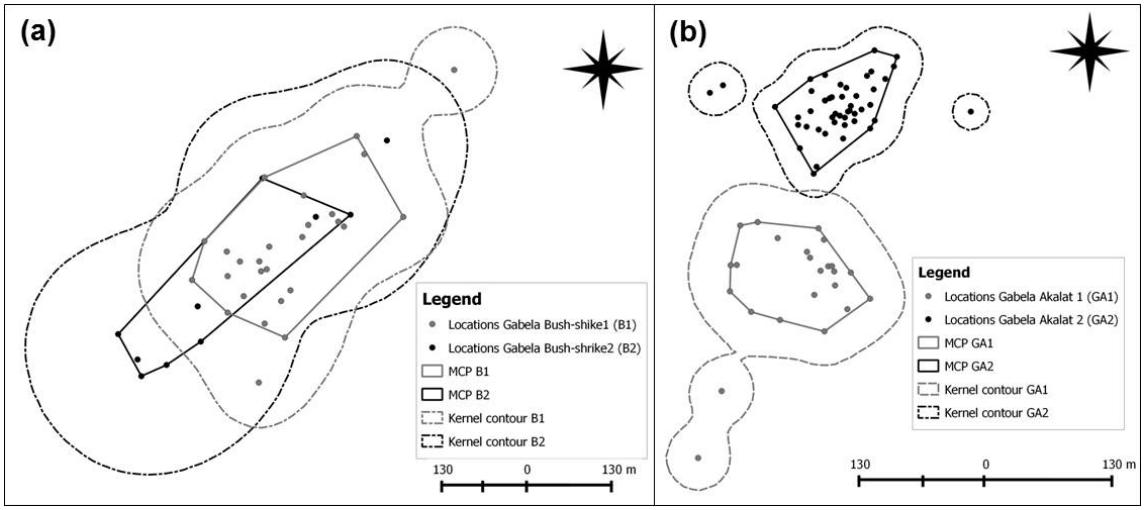

Figure 1. Home range estimates and habitat use of two endangered Angolan endemics: **(a)** the Gabela Bush-Shrike and **(b)** the Gabela Akalat. Estimates were obtained from minimum convex polygons (MCP) and Kernel contours with 95% of the observations for two individuals of each species

For three out of the four birds, dense forest was the habitat with the highest percentage of cover within the estimated MCP home ranges (45.8–71.4% (Table 1, Figure 2). The home range of one of the Gabela Akalats included a large percentage of open area (42.9%), but forest remained the dominant habitat (57.2%), equally split between dense and sparse forest.

These results are important because they represent the first estimates of home range size for these little known and endangered endemic species. The estimates of Gabela Akalat are within the range of territory sizes described for other *Sheppardia* species (0.5–3 ha per pair) (Keith et al., 1992). Akalats are highly sedentary and therefore expected to hold small territories Results of Gabela Bush-shrike are also within the range reported for the Malaconotidae family, often around 10–20 ha (Fry, 2009).

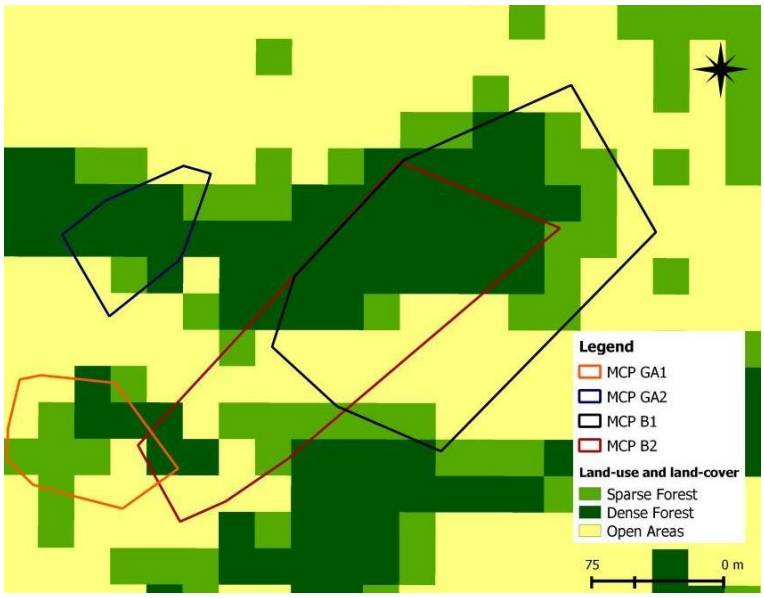

Figure 2. Minimum convex polygons (MCP) of each bird overlapped with the habitat type/land cover map for the study site.

Although these results are preliminary indications of range sizes and habitat use, they provide important insights into two of Angola's least known species. This information is particularly important in the forest area of Kumbira, and the Angolan scarp in general, where forests are restricted to small patches and/or narrow bands. Further and more extensive studies need to be performed to draw solid conclusions regarding the home range size and habitat use by these species, assessing uncertainties such as the possible existence of seasonal patterns and how these species are likely to respond to the rapid rates of land-use change that characterise this region (Cáceres et al., 2014).

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