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Habitat Selection by Gray-Backed Camaroptera (*Camaroptera brachyuran)* at the Amurum Forest Reserve, Nigeria

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ABSTRACT: *Camaroptera brachyura* is common and widespread but not much has been done to understand its habitat requirements. This study was carried out at the Amurum Forest Reserve located on the Jos-Plateau, Plateau State (9°53´N, 8°59´E), Nigeria. Located in Laminga village, 15 km Northeast of Jos at an altitude of 1,280 m above sea level and covering an area of about 300 hectares of land. *C. brachyura* were counted using line transect of 200 m each laid on existing foot tracks and access road traversing the study area. Quadrats of 10 m x 10 m square were laid at the locations where *C. brachyura* were recorded to measure habitat variables. The same measurements were carried out 50m away from the locations as random point. A total of 54 individual *C. brachyura* were recorded in Amurum Forest Reserve. *C. brachyura* significantly selected number of shrubs, number of grasses in the actual point compared with the random point. This study demonstrated that the abundance of shrubs and grasses best predicted the abundance of *C. brachyura* in the actual point compared with the random point. There is a positive relationship between the vegetation and *C. brachyura* in the actual point compared with the random point.

Keywords: Habitat selection, Amurum Forest Reserve, Vegetation

Introduction

Habitat is place that meets the requirements of a given species. It provides the conditions needed for the reproduction and survival of its populations (Boyce and McDonald, 1999). The occupation of a place by a species leads to habitat use (Estades, 1997; Jones, 2001). Habitat selection implies a discriminate use of an area by the species. Habitat use studies point out the importance of knowing the limiting factors for their conservation (Luck, 2002; Oppel *et al.*, 2004; McFarland *et al.*, 2012), specially for threatened species or with a high degree of habitat specialization that requires a more specific scale analysis rather than a general habitat scale (Cahill and Matthysen, 2007).

Grey-backed Camaroptera (*Camaroptera brachyura)* is common and widespread in sub-Saharan Africa (Ryan, 2006). Sixteen or seventeen subspecies are recognized, which are generally divided into the green-backed ‘nominate group’ and grey-backed ‘brevicaudata group’, and sometimes treated as separate species, Green-backed Camaroptera *C. brachyura* and Grey-backed Camaroptera *C. brevicaudata* (Ryan, 2006, Dickinson and Christidis, 2014). In Cameroon, as over the rest of western Africa, there are two races, the forest zone form tincta and the paler savanna form brevicaudata (Borrow and Demey, 2014). Grey-backed Camaroptera has a dark grey head, neck and back, a paler grey breast, fading to whitish on the central belly. The short wings are green and the tail is brown. The tibial feathers are orangey. The legs are pinkish, the eyes brown and the bill

black. *C. b. brevicaudata* assumes a nonbreeding, mainly ashy-brown, plumage in the dry season (Borrow and Demey, 2014).

Materials and methods

The study was carried out at the Amurum Forest Reserve in Laminga, Jos, Plateau State (Latitude 9°53´N, Longitude 8°59´E) (Ezealor, 2001), Plateau State, Nigeria. The reserve is located on an altitude of 1,280 m above sea level and covering an area of about 300 hectares (Vickery and Jones, 2002). Amurum Forest Reserve is a key biodiversity hotspot in West Africa and it is recognized internationally as an Important Bird Area (IBA) in Nigeria with at least 300 bird species such as *Lagonosticta sanguinodorsalis* (Rock Fire finch) and *Vidua maryae* (Jos Plateau Indigo bird) (Ezealor, 2001). Other fauna species include rock hyraxes, bat, rabbits and several species of reptiles (Ibrahim, 2002). It comprises of three major habitats: the gallery forest, dry savannah and rocky outcrops, all of which differ remarkably in floristic composition (Dawang *et al*., 2010). In spite of this, gallery forests surrounding seasonal streams, which form parts of the fragmented system of lush gullies that extended into the Jos Plateau and other savannah areas, still persist and are likely acting as biological corridors for species movements (Seaman and Schulze 2010). Amurum Forest Reserve is a vulnerable site of conservation concern because of its small size and proximity to the urban community of Jos. Though the reserve is a protected area, there are still a few sporadic cases of wood cutting, grazing and setting of fire (Abiem, 2013).
Birds were counted using lines transects (Bibby *et al*., 1998; Bibby *et al*., 2001) of 200 m each laid on existing foot tracks and access road traversing the study area. Transect of 200m was selected by random stratification. A 100 m was used to separate each 200 m from another. Birds seen outside the line transect were recorded but used for analyses. All birds seen were identified, counted and recorded along the line transect. During each visit in the study area, transect were walked listening, looking and recording the birds. Birds were identified using a pair of binoculars (Bushnell 10×42) and the Field Guide of the Birds of Western Africa (Borrow and Demey 2001). Bird surveys were carried out in the morning 0630 -1030 hours and evening 1600 - 1830 h. Transects were visited and bird surveys were repeated thrice a week between August and October 2019.
Quadrats of 10 m × 10 m square were laid at the exact locations (actual site) where Grey-backed Camaroptera was sighted to measure the number of trees, trees height, number of shrubs, percentage canopy cover with objective lens, percentage ground cover, number of fruiting plants, number of bush, number of birds seen, type of habitat, number of flowering plants, nearest to stream and line transect. The same measurements were carried out 50 m away at random site from the locations of actual site.
Data were inputted in Excel spread sheet and analysed using R statistical package version 3.5.2.1.
Shapiro test was used to determine normality of data. Since data was not normally distributed, Generalized Linear Model (GLM) with family = Poisson was used to test the relationship between abundance of Grey-backed Camaroptera and vegetation variables.
Full model = glm (abundance ~ Habitat + distance to water + trees + shrubs + % canopy cover + % ground cover + no grasses, flowering plant + fruiting plant, family = Poisson).
Kruskal Wallis test: the differences between abundance of Grey-backed Camaroptera and habitat types.

Results

A total of 54 individual Gray-backed Camaroptera were recorded at the Amurum Forest Reserved. Gray-backed Camaroptera significantly selected number of shrubs (P = 0.00038), Number of grasses (P = 0.018) in the actual point compared with the random point (Table 1). However, Gray-backed Camaroptera did not significantly selected other variables namely; number of trees (P = 0.26), percentage canopy cover (P = 0.29), percentage ground cover (P = 0.309), number of grasses (P = 0.018), number of flowering plant (P = 0.77), number of fruiting Plant (P = 0.544) in the actual point compared with the random point (Table 1).

Table 1: Relationship between habitat variables and number of Gray-backed Camaroptera.

	Mean	Std. Error	z-value	P
Intercept	-4.423954	1.278750	-3.460	0.000541 ***
Rocky outcrops	-0.1533782	0.892985	1.196	0.232
Savanna woodland	0.361407	0.748546	0.483	0.629
Distance to water	-0.003480	0.002092	-1.663	0.096
Number of trees	0.062763	0.055309	1.135	0.256
Number of shrubs	0.111002	0.031278	3.549	0.000387 ***
Percentage Canopy cover	0.010278	0.009680	1.062	0.288
Percentage ground cover	0.012638	0.012415	1.018	0.3088
Number of grasses	0.234734	0.098847	2.375	0.0175 *
Flowering plant	0.041957	0.146044	0.287	0.774
Fruiting Plant	0.149721	0.247102	0.606	0.545

Pseudo $R^2$0.494, intercept (gallery forest)

The number of trees did not significantly affect the abundance of Gray-backed Camaroptera (R^2 = 0.494, Z-value = 1.663, P = 0.26, Figure 1). However, data showed that as the number of trees increased, number of Gray-backed Camaroptera also increased.

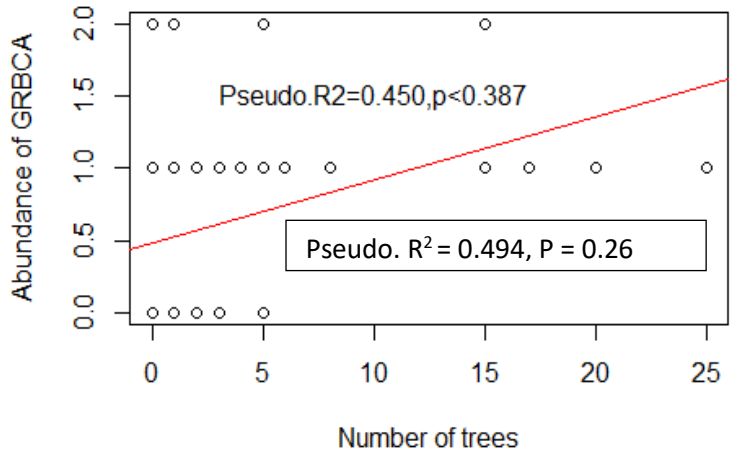

Figure 1: Relationship between number of trees and abundance of Gray-backed Camaroptera.

There was significant relationship between the number of shrubs and the abundance of Gray-backed Camaroptera (R^2= 0.494, Z-value = 3.549, P = 0.000387, Figure 2). As the number of shrubs increased, the number of Gray-backed Camaroptera also increased.

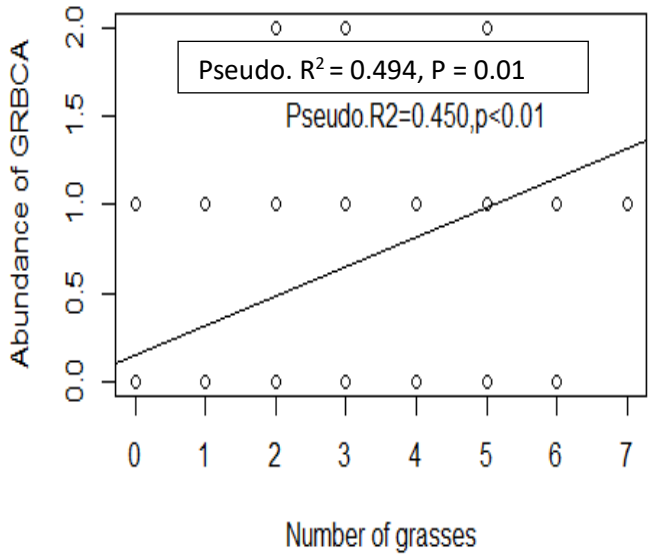

Figure 2: Relationship between number of shrubs and abundance of Gray-backed Camaroptera.

The number of grasses significantly affected the abundance of Gray-backed Camaroptera (R^2 = 0.494, Z-value = 2.375, P = 0.01, Figure 3). As the number of grasses increased, the abundance of Gray-backed Camaroptera increased.

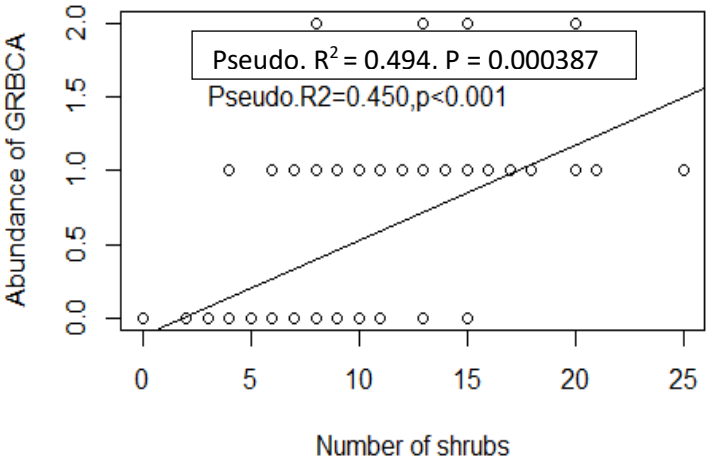

Figure 3: Relationship between number of grasses and abundance of Gray-backed Camaroptera.

There was no significant relationship between percentage canopy cover and the abundance of Gray-backed Camaroptera (R^2 = 0.494, Z-value = 1.062, P = 0.29, Figure 4). As the percentage canopy cover increased, the abundance of Gray-backed Camaroptera also increased. Percentage ground cover does not have any significant effects on the abundance of Gray-Backed Camaroptera.

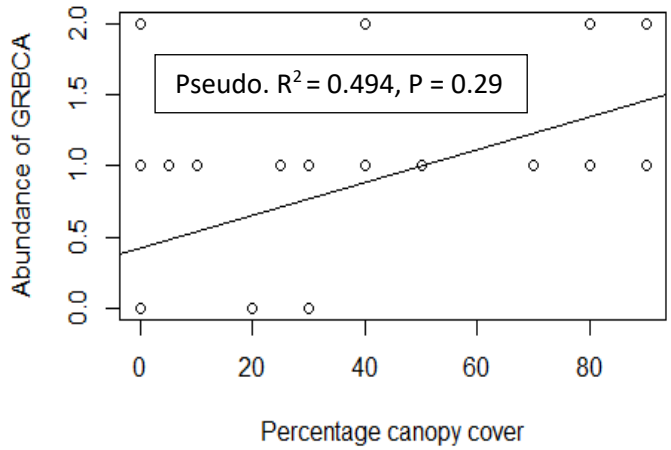

Figure 4: Relationship between percentage canopy cover and abundance of Gray-backed Camaroptera

There was no significant relationship between the percentage ground cover and the abundance of Gray-backed Camaroptera (R^2 = 0.494, Z-value = 1.018, P = 0.31, Figure 5).

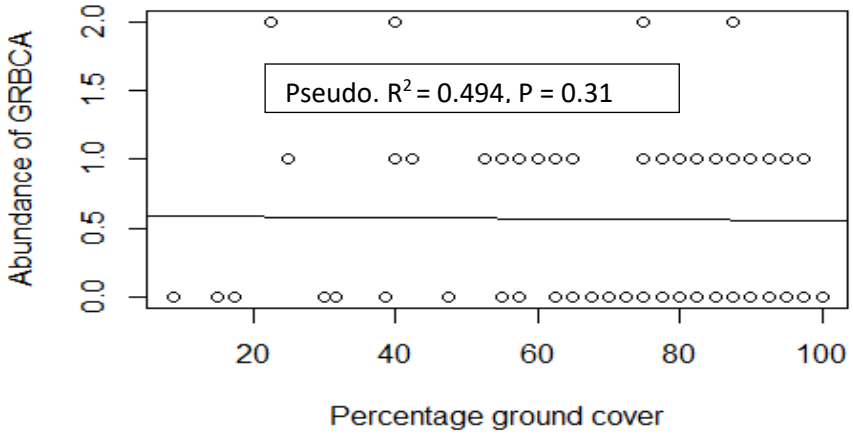

Figure 5: Relationship between percentage ground cover and abundance of Gray-backed Camaroptera.

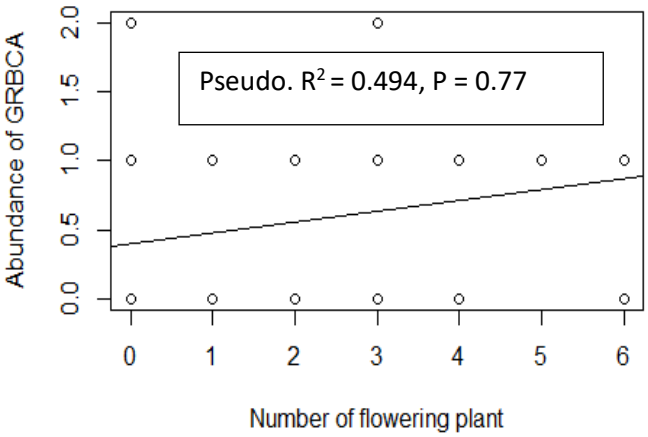

Figure 6: Relationship between flowering plant and abundance of Gray-backed Camaroptera.

Discussion

Environmental variations that determine habitat selection vary in time and space, often in different ways on different scales (Wiens, 1989b). Bird size can predict the scale at which they select a habitat (Hockey *et al*., 2005). Wiens (1989b) proposes that individual birds use a basic decision-making process in selecting their habitats, based on an internal template that is genetically determined or learned of what constitutes a suitable habitat. Isacch *et al*., (2005) assume vegetative structure and floristic composition to be the primary proximate factors that determine habitat selection, with vegetation acting as an ultimate factor for critical variables such as food, nesting sites and cover from predators. Vegetation has a direct link with breeding necessities because it affects the distribution of birds by providing shelter, food and potential nest-sites (Seoane *et al.*, 2004). Various behavioural strategies are employed by different birds to satisfy their different food preferences (Begon *et al*., 1996). The availability of food is an important determinant of population size, diversity, and community patterns (Steyn, 1996; Wiens, 1989a; Wiens, 1989b). Not only food availability, but also the suitability of feeding and perching sites is important (Wiens, 1989b).

From our findings, Gray-backed Camaroptera preferred shrubby vegetation which agreed with the findings of Nik Borrow and Ron Demey (2004), which state that Gray-backed Camaroptera preferred dense shrubbery in various habitats. Shrubs did not only promote structural heterogeneity, but were also sources of cover and gleaning for the birds (Golet *et al.*, 2001; Abu *et al*., 2015; Laiolo *et al.*, 2004). The abundance of shrubs as it influenced the abundance of birds is in agreement with the findings of Morelli (2013) and, Kalinowski and Johnson (2010) which stated the proportions of shrub cover at a site predicted total abundance of birds positively. The abundance of birds in which was well predicted by the abundance of shrubs could possibly be due to the use of the shrubs as the source of cover and foraging by the birds as revealed in the finding of Abu *et al.*, (2015).

Congruent with Soderstrom *et al*. (2001) and Hartel *et al*. (2014), shrub density had a positive linear effect on both species' richness and abundance. This shows that shrubs have a similar effect to trees on bird communities; increasing habitat complexity and providing important nesting sites for many species (Soderstrom *et al*., 2001; Hartel *et al*., 2014). The distribution and abundance of many bird species are determined by the composition of the vegetation that comprises a major element of their habitats (Lee and Rotenberry, 2005). Shrubs have been acknowledged as important features of traditional woody pasture management (Vera, 2000; Bergmeier *et al*., 2010; Hartel *et al*., 2014), but as shrubs may indicate abandonment or low grazing pressure they are likely to be cleared from pastures by farmers to receive Common Agricultural Policy (CAP) subsidies (Jones 2008; Beaufoy *et al*., 2015).

The diversified vegetation composition and structure in riparian habitats, especially shrubs and the edge effect created are the key factors which influenced the abundance of bird species in this habitat (Larue *et al.*, 1995; Rajpar and Zakaria 2011). Shrubs improve the habitat quality for many bird species (Camprodon & Brotons 2006) and therefore it has a positive influence on bird communities in pastures (Soderstrom *et al*., 2001; Hartel *et al*., 2014), hence policies should be more open to their existence. A decline in their numbers would therefore mean a decline in their provided services (Şekercioğlu *et al*., 2004). The density of some bird species may be high in urban landscapes as their abundance was positively predicted by shrub and tree cover in urban

landscapes, but with shrubs being preferred over low-laying trees, while several other species were positively associated with tall trees.

There is a unique observation on Gray-backed Camaroptera from the result during the studies. Gray-backed Camaroptera also preferred shruby vegetation with grasses from the actual point compared with the random point in Amurum Forest Reserved. Bird species abundance and diversity increased with increasing ground vegetation cover in forest habitats. Increased ground vegetation cover often implies the removal of trees or canopy cover by man or natural causes. This allows more sunlight to reach the ground and support the growth of vegetation at that level. As a consequence, invertebrates (which serve as food for birds) tend to concentrate in these light gaps in the forest encouraging birds taking advantage of the food resource to concentrate in such areas (Inaoyom, 2007).

There is a positive relationship between the vegetation (number of trees, number of shrubs, percentage canopy cover, percentage ground cover, number of grasses and flowering plant) and Gray-backed Camaroptera in the actual point compared with the random point in Amurum Forest Reserved. As the number of vegetation increases, the number of Gray-backed Camaroptera increases.

This study has advanced understanding of the relative importance of habitat structure and heterogeneity on Gray-backed Camaroptera abundance in the actual point compared with the random point in Amurum Forest Reserved. It has also demonstrated that the abundance of shrubs and grasses best predicted the abundance of Gray-backed Camaroptera in the actual point compared with the random point in Amurum Forest Reserved. There is a positive relationship between the vegetation and Gray-backed Camaroptera in the actual point compared with the random point in Amurum Forest Reserved. As the number of vegetation increases, the number of Gray-backed Camaroptera increases.

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