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POPULATION DENSITY AND HABITAT PREFERENCES OF THE KENYA LESSER GALAGO (*GALAGO SENEGALENSIS BRACCATUS*) ALONG THE EWASO NYIRO RIVER, LAIKIPIA, KENYA

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ABSTRACT

Surveys of the Kenya lesser galago (or bushbaby) *Galago senegalensis braccatus* on Mpala Ranch near the Mpala Research Centre, Kenya, were conducted in June and July 1995. Data were collected along two transects. *Galago s. braccatus* reached its highest density in Fever Tree *Acacia xanthophloea* riverine woodland and was found primarily at a height of 4–6 m above the ground, followed by 14–16 m. Within *A. xanthophloea*, *G. s. braccatus* was closely associated with trees having dense liana tangles. We suggest that lianas provide *G. s. braccatus* with protection both while sleeping during the day and while foraging at night.

Keywords: *Acacia xanthophloea*, Kenya lesser galago, *Galago senegalensis*, Laikipia, Primates

INTRODUCTION

The species-specific boundaries of the family Galagidae Gray, 1825, are under debate (Zimmerman, 1990). Because galagos (*Galago, Galagoides, Otolemur, Euoticus* and *Sciurochirus*) are small, nocturnal and cryptic, there is still relatively little published information on their behaviour and ecology (Nekaris & Bearder, 2007). Bearder *et al*. (1995)

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contended that the number of nocturnal prosimian species has been seriously underestimated and, as such, called for more field studies on galagos and other nocturnal species. As might be expected when basic information on natural history is sparse, more species are identified as more studies are conducted. For example, the number of known galago species increased from six in 1975, to 11 in 1985, to 17 in 1995, and to 24 in 2007 (Bearder *et al.,* 1996; Nekaris & Bearder, 2007). Since closely related species typically differ in their ecological niches, it is expected that each of these newly identified species will have its own particular niche. Indeed, as habitat destruction by humans is one of the main threats to non-human primates, the continued survival of primates may depend on our ability to identify ecological niches so that we can determine the conservation needs of each species.

Galago senegalensis E. Geoffroy St. Hilaire, 1796, appears to be the most common and widespread of all the galagos (or bushbabies). The geographic range of *G. senegalensis* extends across Africa from the coastal forests of West Africa to the Gulf of Aden in the area between the Sahara and the forests of the Congo Basin (Kingdon, 1997; Groves, 2001). In Kenya, the Kenya lesser galago, *G. senegalensis braccatus* Elliot, 1907, occurs in suitable woodland habitat (Nash *et al.*, 1989). We undertook this study to determine the population density and habitat preferences for *G. s. braccatus* in woodlands near and along the Ewaso Nyiro River, Laikipia District, north-central Kenya. The study revealed a sizable population of *G. s. braccatus* that was densest in riverine woodlands dominated by Fever Trees *Acacia xanthophloea* Benth. Within these riverine woodlands, *G. s. braccatus* was associated with *A. xanthophloea* trees that had dense liana tangles, which may provide critical microhabitats for protection against predators.

STUDY SITE

Field observations took place on Mpala Ranch near the Mpala Research Centre (1500 m; figure 1). The Ewaso Nyiro River is a medium-sized, historically permanent river that has its origins in the Central Kenya highlands. The Upper Ewaso Nyiro Basin is the upstream section of the greater Ewaso Nyiro River Basin, bounded by the natural topographic divide, and controlled downstream at Archer's Post. The Basin covers an area of 15 634 km^2. Although the Basin traverses a diverse topography and Climatic Zones I –VI (Sombroek *et al.*, 1980), about 70% of the Basin comprises the Laikipia Plateau (Mati *et al.,* 1989).

Laikipia is a major livestock-producing area but is managed on most properties in a way that allows for co-existence with natural flora and fauna (Isbell & Chism, 2007). The District lies between 0°17'S–0°45'N and 36°15'–37°20'E. Predominant habitats include Whistling Thorn *Acacia drepanolobium* Harms wooded grassland, *Acacia spp.* bushland and *A. xanthophloea*-dominated riverine woodland (Taiti, 1992).

The weather in Laikipia is mild, with annual mean monthly minimum and maximum temperatures *ca*. 11° and 30° C, respectively (Isbell & Jaffe, in press). Located in the rain shadow of nearby Mount Kenya (5200 m), annual rainfall for the Mpala area is 500–600 mm in a weakly trimodal pattern (raining most in April–May, July–August, and October–November). The mean monthly rainfall in June and July over a 10-year period was *ca*. 60 and 70 mm, respectively (L.A. Isbell, unpub. data).

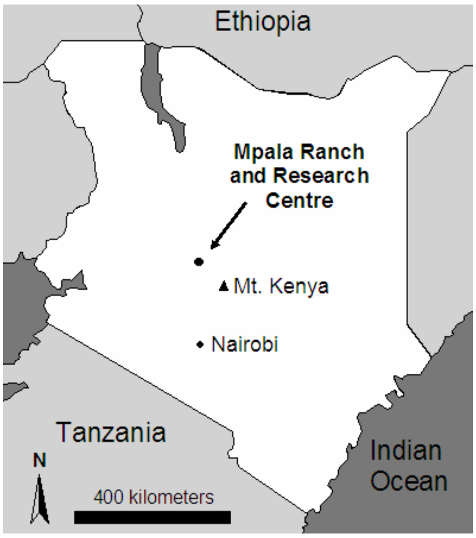

Figure 1. Map of Kenya showing the location of the Mpala Research Centre. Courtesy of David Augustine.

METHODS

Galago s. braccatus was censused on each of two transects (Route 1 and Route 2) on alternating nights between 19:00 and 23:00 h from 29 June 1995, through 14 July 1995. Data were collected during a total of 12.7 h on 15 nights. Each transect (or route) consisted of one riverine area and one dry bush area. In addition, they shared one dry bush area and one seasonally dry riverbed area, and these areas were censused each time. Route 1 was 6.1 km and Route 2 was 6.5 km. Censuses were conducted by vehicle travelling 4–10 km/h along transects coinciding with narrow dirt roads (roads provide better visibility than a trail or footpath). A Coleman Night Sight 12-volt halogen spotlight was used to locate *G. s. braccatus* by the bright orange tapetal reflection from their eyes. When an individual was sighted, the vehicle was stopped. With the aid of binoculars, the following data were collected for each sighting: number of individuals of *G. s. braccatus* present, height of each individual relative to the ground, tree species used by *G. s. braccatus*, presence of lianas in that tree, our location along the transect, observer distance from the animal(s), and the time of the observation. The vehicle continued on once all individuals were out of sight. The only other small mammals seen during censuses were Guenther's dik-diks *Madoqua guentheri* Thomas, 1894 and hares *Lepus* sp.

We also conducted walking surveys along subsets of the census routes during daylight hours to determine the percentage contributions of each tree species along the transects. In the riverine areas, transects included all trees between the road and the river. In the dry bush areas, transects included all trees within *ca*. 10 m of the road. All trees taller than 3 m and >5 cm DBH were identified to species by the authors and field assistant (n = 860 trees).

To obtain rough estimates of *G. s. braccatus* densities, we used the maximum perpendicular distance method (National Research Council, 1981). We estimated that we could observe *G. s. braccatus* up to an average of *ca.* 10 m into the woody vegetation in the dry riverbed area and dry bush transects. In the riverine transect, virtually all of the *G. s. braccatus* sightings were in *A. xanthophloea* trees, and we estimated that the narrow strip of *A. xanthophloea* vegetation averaged *ca*. 20 m in width (one large canopy on either side of the river). For each section of each transect, we used the maximum number of *G. s. braccatus* individuals seen over all the census days as our estimate of the minimum number present. Home ranges of *G s. braccatus* are small relative to the lengths of our transects. As such, it is unlikely that this over-estimated the total number of *G. s. braccatus* individuals present.

RESULTS

Habitat and distribution

We recorded 185 individuals in 152 encounters. They were found as solitary in 123 encounters (81%), in pairs in 24 encounters (16%), and in groups of three in five encounters (3%). We could not identify age classes. *Galago s. braccatus* was found at an average height of 7.4 m (SD = 6.6, n = 185) (figure 2). There were two sightings (1.1%) of single individuals on the ground. *Galago s. braccatus* was recorded at a height of <10 m 59% of the time. Overall, we estimate that this species was at highest average density in the two riverine areas (depending on transect, a minimum of 1.4–2.4 animals/ha), followed by the dry bush areas (minimum: 0.4–1.9 animals/ha) and the dry riverbed area (minimum: 0.7 animals/ha) (table 1).

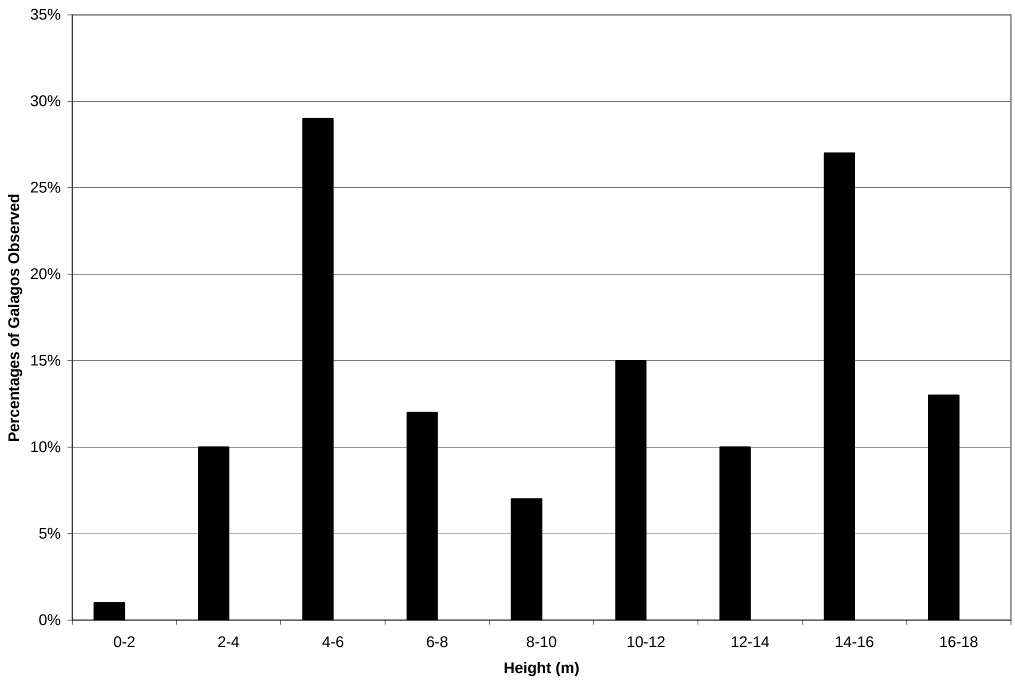

Figure 2. Percentage of Kenya lesser galagos Galago senegalensis braccatus *encountered (n = 185) at various heights in trees near the Mpala Research Centre, Laikipia District, Kenya.*

A total of 860 trees were identified in the census area. Overall, riverine areas along the transects were dominated by *A. xanthophloea* (40% of stems), followed by *Acacia etbaica* Schweinf. (33%), *Acacia brevispica* Harms (22%), and *Acacia gerrardii* Benth. (5%). Dry bush areas were occupied primarily by *A. etbaica* (51%), followed by *A. brevispica* (31%), *A. gerrardii* (13%), and *Acacia nilotica* (L.) Willd. ex Delile (4%). Dominant trees in the dry riverbed area were *A. gerrardii* (46%), *A. xanthophloea* (33%), and *A. etbaica* (21%). Although there are non-acacia trees in this ecosystem (*e.g. Boscia angustifolia* A.Rich. and *Balanites aegyptiaca* (L.) Del.), they were not represented in the census.

Table 1. Estimated population densities of the Kenya lesser galago Galago senegalensis braccatus *in different areas of Routes 1 and 2 near the Mpala Research Centre, Laikipia District, Kenya (n=185).*

Route	Section	Habitat	Route Length (km)	No. galagos seen Max	Mean	Max/km	Minimum Density (#/ha)
1	Riverine 1	*A. xanthophloea*	2.4	11.5	6.5	4.8	2.4
1	Dry bush 1	*A. etbaica*	1.1	1.0	0.9	0.9	0.9
1	Dry bush 2	*A. etbaica*	2.1	3.0	1.1	1.4	1.9
2	Riverine 2	*A. xanthophloea*	2.6	7.5	5.0	2.9	1.4
2	Dry bush 1	*A. etbaica*	1.1	1.0	0.9	0.9	0.9
2	Dry bush 3	*A. etbaica*	2.3	1.0	0.8	0.4	0.4
	Dry riverbed	*A. gerrardii*	2.8	2.0	0.6	0.7	0.7

Within the riverine habitat of the two transect routes, the densities of *G. s. braccatus* differed by a factor of 1.6, with Route 1 containing the higher density (table 1). Route 1 also contained a higher percentage of *A. xanthophloea* than Route 2 (66% *vs*. 34%) (figure 3), differing by a factor of 1.9. These findings are consistent with our observation that virtually all *G. s. braccatus* sightings in the riverine transects were in *A. xanthophloea* trees. In addition, *G. s. braccatus* appears to preferentially use *A. xanthophloea* trees that have liana tangles. Liana tangles were found within 132 of 380 (35%) *A. xanthophloea* trees, and 58 of 135 (43%) *G. s. braccatus* individuals that were found in *A. xanthophloea* trees were found in trees with liana tangles. A chi-square test revealed a significant association between observed (58) and expected (47) *G. s. braccatus* presence in *A. xanthophloea* with liana tangles (n = 135, $\chi^2 = 4.03$, df = 1, $p<0.05$).

DISCUSSION

Our data suggest that *G. s. braccatus* prefers riverine areas dominated by *A. xanthophloea* over dry areas dominated by *A. etbaica*. Within riverine areas, it prefers *A. xanthophloea* with dense liana tangles and foliage. *Acacia xanthophloea* is usually found in riverine areas or in low-lying areas where there is a good supply of underground water. This species grows to be a relatively large tree of *ca*. 16 m in height, but can reach up to 26 m (Coe & Beentje, 1991).

At Mutara Ranch, also in Laikipia, the density of *G. s. braccatus* along the Suguroi River was estimated to be *ca*. 1.50 animals/ha, and thus within the range of the densities in the riverine areas of Mpala (Nash & Whitten, 1989). The Mutara Ranch study site was dominated by *A. xanthophloea* at the river and *A. drepanolobium* farther away (Nash &

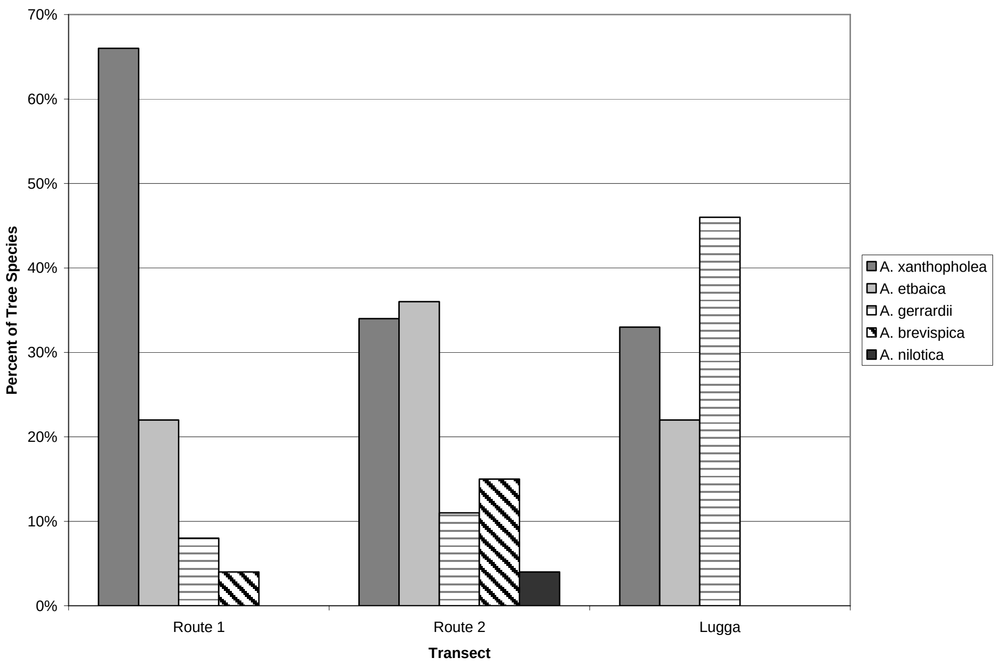

Figure 3. Percentages of tree species (n = 860 trees) represented in Routes 1 and 2 and the dry riverbed (labelled "lugga") near the Mpala Research Centre, Laikipia District, Kenya.

Whitten, 1989). Although *A. drepanolobium* is a typical dry woodland tree species, it was not obviously associated with a lower density of *G. s. braccatus* at Mutara Ranch as was the case for *A. etbaica* at our study site. This suggests that dry area trees are not always problematic for *G. s. braccatus*, and that its low density in the dry woodland at our study site occurred because *A. etbaica*, in particular, may not provide sufficient food. A large part of the diet of some species of galagos is gum (Bearder, 1987), and *A. etbaica* appears to produce less gum than either *A. drepanolobium* or *A. xanthophloea* (F. Erii, pers. comm.). We do not know if *G. s. braccatus* eats foods of *A. etbaica*, but it does eat foods (*e.g.* gum) of *A. drepanolobium*, even preferring them over the foods of *A. xanthophloea* (Nash & Whitten, 1989).

What benefits does *G. s. braccatus* derive from *A. xanthophloea* and, in particular, liana tangles within those trees? At Mutara Ranch, along the Suguroi River, *G. s. braccatus* eats the gum of *A. xanthophloea* (Nash & Whitten, 1989) and presumably also eats the gum of *A. xanthophloea* at our study site along the Ewaso Nyiro River. At Mutara, as at Mpala, *G. s. braccatus* along the river consistently sleeps in *A. xanthophloea*. At Mutara, *G. s. braccatus* away from the river avoids sleeping in *A. drepanolobium* and instead sleeps in dense *Grewia* spp. shrubs (Nash & Whitten, 1989). *Galago s. braccatus* near our study site appears to be similar in avoiding *A. drepanolobium*. In nearby *A. drepanolobium*-dominated woodland at Segera Ranch, we found two nests deep in the centre of two very dense and thorny *A. mellifera*; in 10 years, we have never found a nest in an *A. drepanolobium* (L.A. Isbell, pers. obs.). We agree with Nash & Whitten (1989) that *G. s. braccatus* may avoid sleeping in *A. drepanolobium* partly because of the aggressive behavior of the ants that are housed in the swollen thorns of that species.

Three individuals of *G. s. braccatus* were observed to emerge from within the same *A. xanthophloea* tree along the Ewaso Nyiro River nearly every day within minutes of 18:30 h for 6 months (L.A. Isbell & T.P. Young, pers. obs.). The timing of their emergence suggests they were using that tree as a sleeping site but we could not ascertain the type of nest because lianas limited our visibility. Lianas are not found with dry woodland trees such as *A. etbaica* and *A. drepanolobium*, but are fairly common among trees in riverine areas. We suggest that, in addition to providing *G. s. braccatus* with food, *A. xanthophloea* supports lianas that offer *G. s. braccatus* cover from diurnal predators and readily accessible refuges for escaping from nocturnal predators. Kar Gupta (2007, p.155) also suggested that canopy cover is important for slender lorises (*Loris tardigradus* Linnaeus, 1758) for hiding and escape from predators, and for sleeping sites. Like lorises, galagos also use dense lianas and vine tangles as pathways among trees.

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