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RESEARCH ARTICLE

Temporal variability in food choice and availability for the semi-captive critically endangered mountain bongo in the Mount Kenya Wildlife Conservancy

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Abstract

Dietary selection and preference are poorly understood for the mountain bongo (*Tragelaphus eurycerus isaaci* Thomas, 1902). Focal animal sampling was used to determine seasonal food choice and preference for captive-bred individuals at the Mount Kenya Wildlife Conservancy, in preparation for reintroduction into the wild at a proposed sanctuary within the surrounding forest reserve. Food availability was assessed using nested plot sampling. Plant life forms contributed differently to the diet ($H[4] = 28.93$, $p < 0.01$), with shrubs accounting for 55%. Relative abundance of the principal food plant species influenced their contribution to the diet in both wet and dry seasons ($\chi^2 = 7.33$, df = 1, $p = 0.07$; $\chi^2 = 2.47$, df = 1, $p = 0.116$ respectively). Despite having a high relative abundance (1.88%), *Trichocladus ellipticus* Eckl. & Zeyh. was less preferred during the wet season (E* = 0.20). It was however most preferred during the dry season (E* = 0.78), possibly reflecting relative nutritive value. The bongos included a large proportion of grass (27%) in their diet like other browsing herbivores that inhabit forest glades. Compared to the conservancy, plant foods were well represented at the proposed sanctuary with 72% and 80% similarity in both wet and dry seasons. This potentially enhances the likelihood of bongos adapting and establishing once reintroduced.

KEYWORDS
diet selection, food preference Mount Kenya Wildlife Conservancy, Mount Kenya forest reserve, *Tragelaphus eurycerus isaaci*

Résumé

La sélection et les préférences alimentaires sont mal comprises pour le bongo des montagnes (Tragelaphus eurycerus isaaci Thomas, 1902). Un échantillonnage focal d'animaux a été utilisé pour déterminer le choix alimentaire saisonnier et la préférence pour les individus élevés en captivité au Mount Kenya Wildlife Conservancy, en vue de la réintroduction dans la nature dans un sanctuaire proposé dans la réserve forestière environnante. La disponibilité de la nourriture a été évaluée à l'aide d'un échantillonnage de parcelles imbriquées. Les formes de vie végétales ont contribué différemment au régime alimentaire ($H(4) = 28.93$, $p\langle 0.01$), les arbustes représentant 55 %. L'abondance relative des principales espèces de plantes alimentaires a influé sur

leur contribution au régime alimentaire en période humide ou sèche.saison (χ^2 = 7.33, df = 1, p = 0.07 ; χ^2 = 2.47, df = 1, p = 0.116 respectivement). Malgré une abondance relative élevée (1.88%), Trichocladus ellipticus Eckl. & Zeyh. était moins appréciée pendant la saison des pluies (E* = 0.20). Il était cependant le plus préféré pendant la saison sèche (E* = 0.78), reflétant peut-être la valeur nutritive relative. Les bongos incluaient une grande proportion d'herbe (27%) dans leur alimentation comme les autres herbivores brouteurs qui habitent les clairières forestières. Par rapport à la réserve, les aliments végétaux étaient bien représentés dans le sanctuaire proposé avec une similitude de 72 % et 80 % à la fois en saison sèche et en saison humide. Cela augmente potentiellement la probabilité que les bongos s'adaptent et s'établissent une fois réintroduits.

1 | INTRODUCTION

Studies on food availability, preference, choice and selectivity are useful because feeding has a direct impact on an animal's growth rate, reproduction and health (Newman et al., 1992). Food preference measures animal's food consumption assuming there are no variations among food items available in the diet (Chesson, 1983). Food choice on the other hand investigates food species attributes influencing consumption while food selection examines variations in food items consumption by comparing their nutritional and chemical contents (Ganas et al., 2008; Milton, 1979). Knowledge of dietary selection contributes to the understanding of resource partitioning, habitat preference, competition and energy transfer (Ganas et al., 2008; Kleynhans et al., 2011). This sheds light on an animal's nutritional requirements, reproduction, fitness, and survival (Altmann, 1998; Orians & Wittenberger, 1991). Assumptions made prior to reintroduction require knowledge on potential foods, their distribution in space and time and how these meet nutritional requirements (Robbins, 1983). An understanding of the habitat-animal interplay is, therefore, necessary in order to optimise the chances of establishing a self-sustaining population after reintroduction.

The mountain bongo (*Tragelaphus eurycerus isaaci* Thomas 1902) is an endemic, critically endangered (IUCN category C2a[i]) montane forest antelope that occurs in fragmented subpopulations on Mount Kenya, Aberdares, Mau and Eburu (Elkan & Smith, 2013). The other subspecies, lowland bongo (*T. e. eurycerus* Ogilbyi, 1837), inhabits forests in west and central Africa (Faria et al., 2011; Reillo, 2002). Its populations have remained stable over the years and are hence considered to be at lower risk.

The four remaining wild Mountain bongo subpopulations have declined precipitously over the last few decades with uneven distribution of between 75 and 140 individuals based on camera trap and surveillance data (East, 1999; Estes et al., 2011; IUCN, 2017; Svengren et al., 2017). The species previously occurred in the Cherengani, Chepalungu and Mount Elgon but has since been exterminated in these forests (Kingdon, 1982). Few studies have highlighted the plight of the species and threats to remnant populations (Estes et al., 2008; Svengren et al., 2017). The cause of decline includes poaching (Estes, 1991; Prettejohn, 2004), predation by lions in the Aberdares (Cheffings, 1997; Prettejohn, 2004), habitat loss and periodic toxicity by *Mimulopsis solmsii* Schweinf. (Glover et al., 1966; Kingdon, 1982). Despite the rapid decline in the wild, there is a remarkable success in captive breeding and management in European and North American zoos (Combe et al., 2018), creating a source pool for population augmentation and reintroduction (Bosley, 2015).

Few comprehensive studies of forest-dwelling African herbivores exist, particularly those residing in Afromontane habitats (Estes et al., 2008). There is scanty knowledge of dietary selection, habitat association and group composition for the mountain bongo. More is known about the feeding ecology of the lowland bongo (Elkan, 2003; Hillman & Gwynne, 1987; Klaus-Hügi et al., 2000; Turkalo & Klaus-Hugi, 1999). These studies denote bongos to be predominantly browsers with Hofmann and Stewart (1972) describing the species as a 'tree and shrub foliage eater' and as 'selectors of juicy, concentrated foliage'. Investigations by Elkan (1996) indicated that bongos feed predominantly on dicotyledonous plants selecting high protein vegetation and feeding on diverse plant parts. They use their long, flexible tongue and the horns to access browse (Kingdon, 2015). Grass may form most of the diet even in forest habitats (Klaus-Hügi et al., 2000) and forest glades (Estes et al., 2008).

A small habituated population of the highly elusive mountain bongo that had been held captive at Mount Kenya Wildlife Conservancy (MKWC) was used to study food selection and preference. This population was founded on five wild individuals (two bulls and three cows) captured from the Aberdare forest in the early 1970s (Svengren et al., 2017). Mountain bongos have been breeding in captivity within the conservancy since then in paddocked enclosures alongside a mix of free-ranging wild herbivores. The population had grown to 18 by 2004, before an additional 18 individuals were repatriated from fourteen zoos and private parks in the USA. By 2010 when a plan to reintroduce the population to Mount Kenya forest was initiated, the population had grown to 70 animals (35 cows and 25 bulls). The reintroduction plan prompted the release of 20 males considered resilient comprising of twelve adults and eight juveniles into a forested sanctuary within the conservancy for

pre-reintroduction training and adaptability monitoring. This group was monitored to determine seasonal variability in food selection and preference in a semi-natural setup comprising of a fenced and paddocked area. In addition, we assessed food availability at the proposed bongo reintroduction sanctuary. The study hypothesised that seasonal similarity in food availability did not differ between the conservancy and the proposed reintroduction sanctuary. We predicted seasonal variation in food availability at the proposed sanctuary and seasonal variability in food selection and preference by mountain bongos. All study individuals had international studbook names, making them easily identifiable for focal animal follow up, and were well habituated to human presence enabling approach at close distance. This study coincided with the selection of the location for mountain bongo reintroduction into Mount Kenya forest, with the objective of ascertaining the suitability of the habitat in collaboration with the Kenya Wildlife Service (KWS).

2 | MATERIALS AND METHODS

2.1 | Study area

This study was conducted at MKWC and the proposed bongo reintroduction sanctuary on the northwestern slopes of Mount Kenya. The conservancy lies within Latitude $0^0$2.3′–$0^0$3.6′S and Longitude $37^0$6.9–$37^0$7.8′E at 2200 m above sea level (Figure 1), and covers a total area of 1200 ha largely dominated by grass and scattered trees. Average rainfall on the mountain ranges from 2300 mm on the southeastern slopes to 900 mm in the north (KWS, 1996) and occurs in two distinct wet and dry seasons. The minimum temperature range is about 2°C–6°C, creating hot diurnal conditions and cold nights. Since 2004, the 100 ha forested section of the conservancy along the Nanyuki River was fenced and set aside a riverine enclosure where the study population was confined. The enclosure was a luxuriant montane forest dominated by red cedar (*Juniperus procera* Hochst. ex Endl), podo (*Podocarpus falcatus* [Thunb.] Mirb) and African olive (*Olea europaea* subsp. *africana* [Mill.] P.S. Green). Other herbivores at the enclosure include bushbucks (*Tragelaphus scriptus* Pallas 1976), Defassa waterbucks (*Kobus ellipsiprymnus defassa* Ruppel, 1835), common duiker (*Sylvicapra grimmia* Linnaeus, 1758) and common warthog (*Phacochoerus africanus* Gmelin, 1788). A salient of indigenous forest about 5 km into the surrounding forest reserve and south-east of the conservancy had been identified as a possible mountain bongo reintroduction sanctuary where the captive population would eventually be released, given the minimal human disturbance and connection to the indigenous forest and bamboo zones of Mount Kenya forest.

2.2 | Methods

2.2.1 | Seasonal food selection survey

Focal animal sampling (Altmann, 1974) was used to study food selection by mountain bongos for a period of 7 months covering wet and dry seasons (October–December 2010 and January–April 2011, respectively) in a 100 ha riverine forested enclosure. All the 20 study individuals had been habituated and could therefore be observed to a distance of 5 meters radius. Individual's activity data were recorded continuously for 10 min switching to a different individual after 5 min. The data were collected for five continuous days repeated every month commencing at 7:00 am to 11:00 am and again

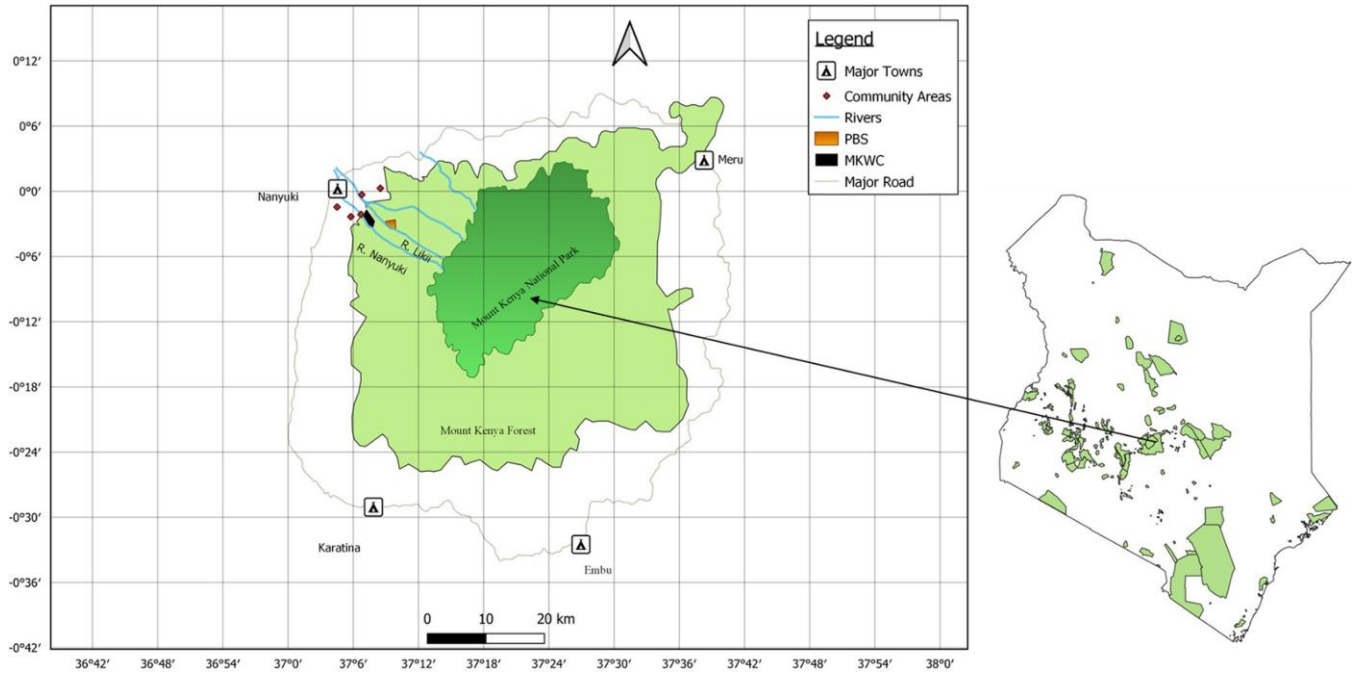

FIGURE 1 Study area map indicating the locations of Mount Kenya Wildlife Conservancy (MKWC) and the Proposed Bongo Sanctuary

at 3.00 pm to 6:00 pm. This was because mountain bongo had been shown to rest in dense vegetation between mid-morning and mid-afternoon (Elkan, 1996). Focal individuals were randomly selected on a rotating basis based on studbook names ensuring that no individual was repeated before all other focals were sampled. During the focal observations, we recorded data on 1) the focal animal activity was performing; 2) length of time to the nearest second a given plant species was fed on and 3) plant species being fed on. Feeding time on a given plant species ended when an individual 1) stopped eating for >10 s (period behavioural repertoires were distinct), or 2) changed from one feeding site (= individual plant) to another or 3) switched activity. Where possible, plant foods were identified in the field immediately after the focal sampling, otherwise samples were collected in plastic bags, pressed and dried for identification at the herbarium of the National Museums of Kenya.

2.2.2 | Seasonal food availability

To determine temporal variation in food availability, 3 km baselines along rivers Nanyuki and Likii (at MKWC and proposed sanctuary respectively) were used in systematically placing eleven line transects at intervals of 300 m. Using random numbers, four transects were selected for sampling in both sites and three nested plots were systematically placed at intervals of 100 m. We established 24 vegetation plots (12 per site), each measuring 50 m by 20 m (plot size based on consideration of the large tree canopies at the sanctuary and the homogenous microhabitats at MKWC). In each plot, trees above 10 cm in diameter at breast height (DBH) were identified to species level, the DBH measured and individuals counted. Shrubs and saplings were identified and counted within four plots measuring 5 m by 5 m placed at each corner. Six 1 m by 1 m plots were also placed at the four corners and at the east–west ends of the main plot, and used for identifying and counting herbs and grasses. Plant food species were then identified and counted in each plot to determine their frequency of occurrence and/or relative abundance of the food resource in the habitat.

2.3 | Data analysis

2.3.1 | Food selection and preference

Food choice was illustrated using multiple line graphs while multiple bar graphs were generated to illustrate the variation in the amount of time devoted to feeding on various food types in different seasons. The paired Student's *t*-test was then used to compare mean feeding duration during the wet and dry periods while Kruskal-Wallis test was used to test for monthly variation in time spent feeding on different food types. Species that contributed more than 1% of the overall diet during the study period were considered principal food plants (Conklin-Brittain et al., 2006; Rothman et al., 2006) and used in seasonal and monthly comparisons of dietary contribution.

Preference for all plant foods was calculated using Vanderploeg and Scavia's (1979) Relativised Electivity Index (E*). The index uses both the relative abundance of plant foods in the diet and in the environment to measure dietary selectivity. The relative abundance of each food species in the diet was obtained by dividing the amount of time a particular species was fed on by the total amount of time all the food species were consumed during wet and dry seasons. Relative abundance of plant foods was calculated by dividing the total number of individuals counted for each species in all the plots by the total number of individuals counted for all species in all the plots during wet and dry seasons.

$$\text{Vanderploeg \& Scavia's Electivity Index } (E*) = Wi - (1/n) \;/\; Wi + (1/n)$$

$$\text{In this case } Wi = (ri / pi) / \Sigma(ri / pi)$$

where E* is the Vanderploeg and Scavia Electivity Index, *Wi*, Selectivity coefficient, ri, Relative abundance of food resource in the diet, pi, relative abundance of food resource in the habitat, and *n*, total number of food types consumed.

The chi-squared test was used to check whether the relative abundance of the principal food plants corresponded with their contribution in the diet. Kruskal-Wallis test was then used to test their monthly variation in dietary contribution. In addition, Pearson's correlation measured the relationship between the time bongos spent feeding on all the plant foods and their abundance during wet and dry seasons.

2.3.2 | Food availability

The degree of vegetation and plant food species similarity between the conservancy and proposed bongo sanctuary was assessed using the Jaccard similarity coefficient (Muller-Dombois & Ellenberg, 1974).

$$CC_J = \frac{C}{S_1 + S_2 - C}$$

where, CC_J, Jaccard coefficient (as a percentage), S_1 and S_2, number of species in communities 1 (conservancy) and 2 (proposed sanctuary) respectively, and *C*, number of species common to both communities.

To estimate plant food species density in both sites, we quantified the number of individual plant species per unit area (acre).

Paired Student's *t*-test was then used to compare seasonal variations in food availability between the conservancy and the proposed bongo sanctuary.

3 | RESULTS

A total of one hundred and six plant species were recorded at the conservancy of which sixty-four species belonging to fifty-five

genera and thirty--two families were fed on by mountain bongos. The most common plant families in the diet included Compositae, Gramineae, Leguminosae and Acanthaceae. Out of the sixty-four plant species consumed by mountain bongos, twenty-one were designated as principal plant food species. Among these, *Stipa keniensis* (Pilg.) Freitag and *Olea europaea* subsp *africana* (Mill.) P.S. Green. were most consumed while Microglossa densiflora Hook.f. and *Scutia myrtina* (Burm.f.) Kurz were the least utilised. Sixty-six percent of the consumed plant species were available at the proposed reintroduction site.

3.1 | Seasonal food selection

Mountain bongos spent relatively more time feeding on shrubs than any other food types within the study period (Figure 2) although the difference was not significant (t = 1.14, df = 6, p = 0.17). The difference in the amount of time they spent feeding on same plant species during wet (fifty-six plant foods) and dry (fifty-eight plant foods) periods was still not significant (t = 0.77, df = 63, p = 0.44). Using the time bongos spent feeding on a given plant life form, green plants (trees, shrub, herb and grass) comprised 97.6% of their diet while 2.4% of the time was spent feeding on mosses and fallen leaf litter (χ^2 = 2.56, df = 3, p = 0.01). Plant life forms contributed differently to the diet (H[4] = 28.93, p < 0.01) with shrubs accounting for 55% during the study period. Mountain bongos, however, spent a good proportion of time feeding on grass (27%) while 7% of the time was spent feeding on herbs (Figure 2). Shrubs were consumed more during the dry season, compared to grass, herbs and trees largely selected during the wet season (Figure 3). Mosses and leaf litter were only included in the diet during the dry season.

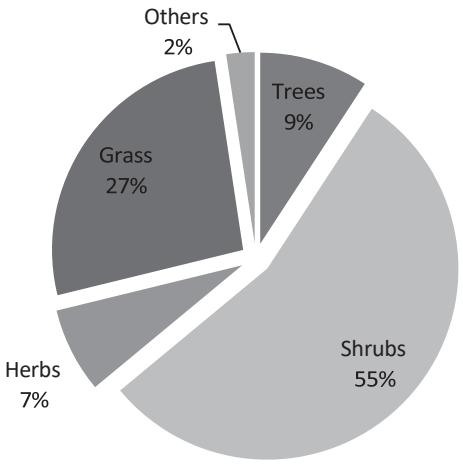

FIGURE 2 Pie chart showing percentage time mountain bongos spent feeding on different plant life forms during the 7 months study period. The category 'others' comprises of mosses and leaf litter (trees = 6 species; shrub = 32 species; herb = 18 species; grass = 8 species; others = 2 food types)

There was a significant variation in the amount of time spent feeding on the principal plant food species (H[21] = 56.97, p < 0.01) across the study period. On comparing the time they spent feeding on these between seasons, the variance was not significant (W = -539, p = 0.590, N = 21). Mountain bongos spent more time, feeding on shrubs and grasses compared to herbs, trees and other foods which included mosses and leaf litter in both seasons (Figure 4). The time they spent feeding on trees, shrubs, herbs, grasses, mosses and leaf litter however did not exhibit significant variation between seasons (W = -135, p = 0.893, N = 5).

3.2 | Food preference

Overall, preference indices for mountain bongo plant foods indicated that *Lantana trifolia* L. (shrub), *Microglossa pyrifolia* (Lam.) Kuntze (shrub), *Panicum monticola* Hook.f. (grass) and *Glycine wightii* (Wight & Arn. Ex Arn) Verdc. (herb) were more preferred during wet season. Conversely, *Trichocladus ellipticus* Eckl. & Zeyh. (shrub), *Pennisetum clandestinum* Hochst. ex Chiov. (grass), *Carex chlorosaccus* C.B. Clarke (grass) and *Microglossa pyrifolia* (Lam.) Kuntze (shrub) were preferred more during dry season (Table 1). Despite having a low contribution in the diet, *Lantana trifolia* L. (2.01%) had the highest Electivity Index (E* = 0.81) during the wet season. *Stipa keniensis* (Pilg.) Freitag which contributed the highest in the diet (16.46%) still had the highest Electivity Index (E* = 0.78) during the dry season.

Plant species which were highly abundant and resulted in low preference scores included *Stipa keniensis* (Pilg.) Freitag, *Toddalia asiatica* (L.) Lam., *Mystroxylon aethiopicum* (Thunb.) Loes. and *Maytenus heterophylla* (Eckl. & Zeyh.) N. Robson. These species however had a major contribution on the bongo diet in both wet and dry seasons (Table 1).

Some principal plant food species did not constitute the top twenty preferred plant food species including *Senecio hadiensis* Forssk., *Scutia myrtina* (Burm.f.) Kurz and *Dodonaea angustifolia* L.f. In addition, a number of species in the top twenty preferred list did not constitute the principal plant food species including *Senecio syringifolius* O. Hoffm., *Clematis brachiata* Thunb., *Cynodon dactylon* (L.) Pers., *Solanum aculeastrum* Dunal and *Carex chlorosaccus* C.B.Clarke in both seasons.

The relative abundance of the principal plant food species corresponded with the proportion of time mountain bongos spent feeding on these plant species with no significant difference in both wet (χ^2 = 7.33, df = 1, p = 0.07) and dry (χ^2 = 2.47, df = 1, p = 0.116) season. Pearson's correlation between the proportion of time bongos spent feeding on these plant species and their relative abundance was both positive and significant (r_s = 0.61, p < 0.05) during the wet season. It was positive but not significant (r_s = 0.35, p > 0.05) during the dry season. The electivity values of wet and dry seasons for the twenty-two principal plant food species did not show significant difference (W = 852, p = 0.394, N = 22).

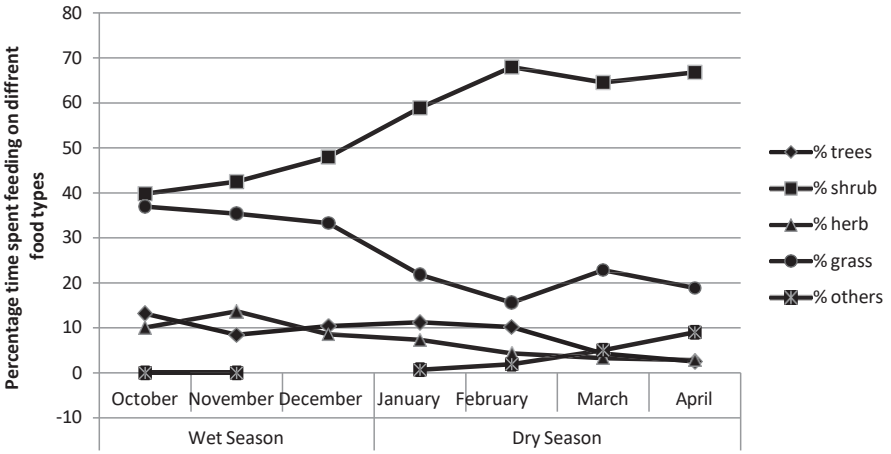

FIGURE 3 Monthly variation in amount of time bongos spent feeding on different plant life forms across seasons for the 7 months study period at Mount Kenya Wildlife Conservancy

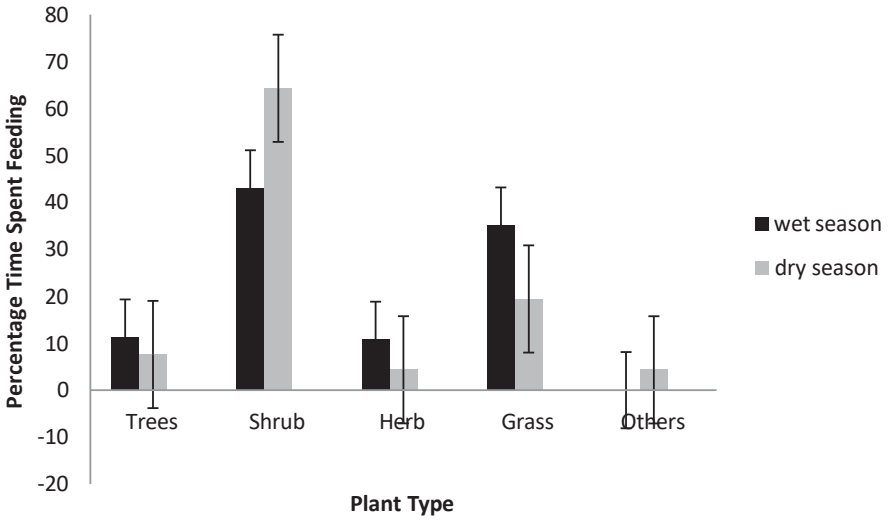

FIGURE 4 Percentage time bongos spent feeding on different food types during wet (N = 56 plant foods) and dry season (N = 58 plant foods)

3.3 | Seasonal plant food availability at the proposed reintroduction site

At the proposed sanctuary, one hundred and seventy-five plant species were identified, of which, 33% were fed on by bongos at MKWC. Of these potential plant foods, 75% were recorded during wet season and 68% were available during dry season. Despite an overall low level of community similarity between the two sites as indicated by Jaccard Similarity Coefficient (28%), 72% of preferred plant foods were common between the two sites during wet season and 80% during dry season. Mean densities of top twenty preferred plant foods within the conservancy (17.8 ± 4.9 plants per acre) and the proposed sanctuary (9.8 ± 3.2 plants per acre) during the wet season were not significant (t = 1.44, df = 19, p = 0.17). At the same time, mean densities of the top twenty preferred plant foods did not differ significantly between the conservancy (38.3 ± 10.8 plants per acre) and the proposed sanctuary (27.5 ± 5.1 plants per acre) during the dry season (t = 2.09, df = 19, p = 0.05).

4 | DISCUSSION

Mountain bongos at MKWC spent more time browsing than grazing. As classified by Hofmann and Stewart (1972), their diet largely comprised of shrubs and herbs whose availability was tagged on rainfall availability. They did not exhibit wide variations on seasonal choice of food, and still, preference for the principal plant food species had no major variations between wet and dry seasons. Despite being browsers, they spent a large proportion of time feeding on grass. This confirmed findings by Klaus-Hügi, Klaus-Hügi et al. (2000) who reported on grass constituting a large proportion of mountain bongo food intake in forest ecotones enabling them to survive in a wide range of forest micro-habitats.

In this study, food selection was a function of food availability which was dependent on seasonality. Food availability played an important role in directing dietary choice for mountain bongos throughout the study period as occasioned by browsing shift to preferred plant species (mostly herbs) which would sprout when water is available. During the dry season, however, food choice was

TABLE 1 Dietary contribution, relative abundance in the habitat and Electivity Index E* for the top twenty plant foods selected by mountain bongos (N = 12 adult males and 8 juvenile males) during wet and dry seasons

Wet season				Dry season			
Food species	**Dietary Contribution**	**Relative Abundance**	**Electivity Index E***	**Food species**	**Dietary Contribution**	**Relative Abundance**	**Electivity Index E***
Lantana trifolia L.	2.01	0.21	0.81	Trichocladus ellipticus Eckl. & Zeyh.	11.91	2.09	0.78
Microglossa pyrifolia (Lam.) Kuntze	1.84	0.21	0.79	*Pennisetum clandestinum* Hochst. ex Chiov.	0.95	0.21	0.73
Panicum monticola Hook.f.	3.27	0.42	0.77	*Carex chlorosaccus* C.B.Clarke	0.81	0.21	0.68
Glycine wightii (Wight & Arn. Ex Arn.) Verdc.	2.69	0.56	0.65	*Microglossa pyrifolia* (Lam.) Kuntze	0.8	0.21	0.68
Rhus vulgaris Meikle	3.93	1.05	0.57	*Rhamnus prinoides* L'Hér.	8.36	2.3	0.67
Stipa keniensis (Pilg.) Freitag	19.15	7.09	0.45	*Toddalia asiatica* (L.) Lam.	12.4	4.8	0.56
Senecio syringifolius O. Hoffm.	3.31	1.25	0.44	*Clematis brachiata* Thunb.	0.34	0.14	0.54
Grewia similis K.Schum	3.92	1.67	0.39	*Mystroxylon aethiopicum* (Thunb.) Loes.	3.69	1.88	0.46
Clematis brachiata Thunb.	0.8	0.42	0.29	*Maytenus heterophylla* (Eckl. & Zeyh) Robson	3.55	1.88	0.44
Cynodon dactylon (L.) Pers.	1.06	0.56	0.29	*Dovyalis abyssinica* (A.Rich.) Warb.	2.61	1.67	0.36
Solanum aculeastrum Dunal	0.36	0.21	0.24	*Rhus vulgaris* Meikle	1.56	1.05	0.34
Rhamnus prinoides L'Hér.	4.1	2.5	0.22	*Glycine wightii* (Wight & Arn. Ex Arn.) Verdc.	0.63	0.42	0.34
Ocimum lamiifolium Hochst.	5.38	3.34	0.22	*Stipa keniensis* (Pilg.) Freitag	9.24	6.39	0.33
Trichocladus ellipticus Eckl. & Zeyh.	2.93	1.88	0.2	*Brachypodium flexum* Nees	7.07	5	0.32
Olea europaea subsp *africana* (Mill.) P.S. Green.	10.77	8.34	0.11	*Panicum monticola* Hook.f.	0.93	0.7	0.29
Maytenus heterophylla (Eckl. & Zeyh) N.Robson	2.26	1.88	0.07	*Senecio deltoideus* Less.	0.19	0.14	0.29
Dovyalis abyssinica (A.Rich.) Warb.	2	1.67	0.07	*Rhus natalensis* Bernh. Ex C. Krauss	7.68	6.46	0.24
Hibiscus lunariifolius Willd.	0.21	0.21	−0.05	*Grewia similis* K.Schum	1.36	1.67	0.05
Thunbergia alata Bojer ex Sims	0.24	0.28	−0.12	*Carissa edulis* Vahl	0.79	1.05	0.01
Zehneria scabra Sond.	0.55	0.7	−0.15	*Olea europaea* subsp *africana* (Mill.) P.S. Green.	5.75	8.34	0.04

Note Dietary contribution is the percentage of feeding time assigned to particular food species (N = 9800 min) while relative abundance is the percentage assigned to each food species in the habitat (N = 12 vegetation plots).

based on availability as they fed on most abundant plant species, suggesting that food selection could have been based on preference during the wet season as opposed to dry season when selection was based on availability and palatability. An understanding of mountain bongo's foraging nutritional goals will however shed more light on how they prioritise food choice. Nonetheless, seasonal variations in food abundance might have pushed mountain bongos to adopt seasonal plasticity in feeding behaviour qualifying them to be generalist herbivores (Freeland, 1991). Such generalist foragers tend to cope with changes in food availability by shifting their dietary choice to include alternative resources (Lotze & Anderson, 1979).

As a functional response to food resources availability, mountain bongos fed on the most abundant *Trichocladus ellipticus* Eckl. & Zeyh. mosses and fallen leaf litter during the dry season. This follows the second strategy of optimal foraging theory which states that an animal can switch to the most abundant food when availability of preferred one decreases, assuming that food items, favourite and alternative are homogeneously mixed in the environment (Krˇıvan & Eisner, 2003; Stephens & Krebs, 1986). However, less available food item, *Lantana trifolia* L, with low relative abundance was most preferred during the wet season. Such choice of food could have been driven by the plant species nutritional qualities whereby an animal opts to obtain the best mix of nutrients within a fixed total intake (Stephens & Krebs, 1986).

Plant species with a high relative abundance including *Rhus natalensis* Bernh. Ex C. Krauss (6.3%), *Toddalia asiatica* (L.) Lam (4.4%) and *Scutia myrtina* Kurz (6.3%) were least preferred during the wet season. Food selection during this period could have been related to particular nutrients and not availability with a significant difference between the time they spent feeding on different food items and their relative abundance. During periods of low food availability, especially the dry season, poor quality but highly available foods tend to constitute the fallback foods (Ganas et al., 2008). This, however, requires further investigation with dietary study investigating bongo's temporal nutritional requirements. Even though herbaceous plants had a high abundance during the wet season and were fed on for a higher proportion of time, results indicated that they were not the preferred food items. Hence, food preference was the extent to which a food item is consumed in relation to its availability in the environment translating to high preference index for consumed plant foods with low relative abundance as confirmed by Viljoen (1989). Mountain bongos can therefore switch to the most abundant food when the availability of the preferred one decreases.

Despite the heavy browsing at MKWC, vegetation composition was comparatively similar to the proposed reintroduction sanctuary. Still, a large proportion of mountain bongo plant foods were recorded at the sanctuary. Such similarity in food availability coupled with high plant diversity at the sanctuary could enable reintroduced bongos adapt to the new habitat (Dublin, 2003). Further studies investigating nutritional variance in mountain bongo plant foods at the conservancy and the proposed reintroduction sanctuary will reveal nutritional availability at the sanctuary. Owing to the large size of the sanctuary, the high dietary plasticity of mountain bongos will enable them to sample a wide range of plant foods and widen their preference range once reintroduced. Consequently, the proposed release site had a comparatively high diversity of mountain bongo plant foods qualifying for a good habitat and identification of such a location is an important step in the reintroduction process (Stadtmann & Seddon, 2018).

Contrary to our prediction, there was no variation in food availability in both wet and dry seasons at the proposed bongo sanctuary, an indication of a stable food resource. Nonetheless, our results on food choice and preference are not different from what we expected of mountain bongos. Their high plasticity in food choice sheds light on how they can adapt to seasonal variations in food availability and cope in a new habitat. This information coupled with the results on food availability at the proposed reintroduction sanctuary reduces the probability of a reintroduced population encountering dietary challenges once released at Mount Kenya forest. However, to have a better understanding of mountain bongo's feeding ecology, we propose a long-term dietary study targeting both sexes across age classes in a more natural setup. Such a study should analyse the preferred plant foods to understand the nutrients and/or phenols characterising them. This will provide an in-depth understanding of the factors influencing the observed food choice and the mix of daily food requirements by the bongo.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

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