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Terrestrial mammals of Bannerghatta National Park, Karnataka, India: A camera-trap inventory and seasonal assessments

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Abstract

There seems to exist a knowledge gap in the information available on diversity or spatio-temporal distribution of mammals in Bannerghatta National Park (hereinafter BNP), as very few studies have been conducted here in the past decade. Hence, an evaluation of the richness, seasonal habitat use and diel activity patterns of mammals in the BNP was carried out from camera-trap records obtained between the years 2012 and 2016. This assessment has ascertained the presence of 17 terrestrial mammals belonging to 5 orders and 12 families, including 8 threatened species. This includes the first confirmed evidence of 3 species, tiger (*Panthera tigris*), rusty-spotted cat (*Prionailurus rubiginosus*) and honey badger (*Mellivora capensis*). Eight species were recorded in all three seasons, suggesting there are resident populations of these species in Bannerghatta National Park. Movement of unauthorized people, domestic and feral animals within the forest, quantified from photo-captures, were found to be low with only 23 encounters (6.27%), however, it occurred up to 2.2km from the forest boundary. Our analysis provides guidance on suitable season, operational duration and deployment positioning for camera-trap research in this landscape, as well as improving our understanding of mammals in this part of south India.

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Introduction

The knowledge on diversity and spatio-temporal distribution of wild fauna governs management procedures within protected areas. However, information on the mammalian taxa of Bannerghatta National Park (hereinafter BNP) landscape in the past decade has been limited to a few sources. These include the park's management plan (Karikalan, 2013) which is largely a compilation of former field surveys supplemented with opportunistic observations. These observations may either be from the frontline staffs that is limited towards the diurnal animal community, and/or secondary data from the park-edge communities. Though these additions of information to the knowledge base can be considered reliable, there are limited or no systematic on-field assessments to check the current status of the listed species, its absence or local extinction. Other sources include a field assessment that was carried out by external agencies that attempted to address this lacuna of information through a brief sampling using distance sampling methods (Kumara *et al.* 2011). This sampling technique though, provide reliable estimates of the diversity and densities (Rowcliffe *et al.*, 2008), is generally unable to document the cryptic and low density species (Rowcliffe *et al.*, 2008; Silveira *et al.*, 2003) which have low capture probabilities during short term assessments. These two sources (Karikalan, 2013; Kumara *et al.*, 2011) collectively state that the terrestrial mammalian richness in BNP, excluding rodents and primates, stands at 23 species as of 2013. However, occurrence of some species that are currently distributed in the adjoining forest habitats (Menon, 2014) is expected, but is unclear. Thus, there exists a gap in the contemporary data on the faunal species that inhabit this part of the Nilgiri-Eastern Ghat landscape.

In that regard, camera-traps with the capability to get remotely and automatically triggered with minimum environmental changes (Rowcliffe *et al.*, 2008; Henschel and Ray, 2003), have been applicable in obtaining a holistic account of wildlife. The spectrum of information available from camera-traps is not limited to faunal diversity, many studies have reported reliable data on diel activity patterns (van Schaik and Griffiths, 1996) and spatio-temporal distribution (Kays and Slauson, 2008) of animals as well. Activity periods and distribution of animals not only provide baseline information for the management of forests, they have also aided in revealing aberrations in their behavioural patterns caused from anthropogenic movements (Santiapillai *et al.*, 1982; Griffiths and van Schaik, 1993; van Schaik and Griffiths, 1996; Zapata-Rios and Branch, 2016).

With the above stated, it is evident that there exists a lacuna of information available on the mammalian species richness of Bannerghatta National Park, sources confining to few surveys (Karikalan, 2013; Kumara *et al.*, 2011). Hence, our primary objective is to compile camera-trap records collected over a period of 5 years and present an update to the mammalian species richness inhabiting this Protected Area. We have also attempted to compare the richness obtained through this camera-trap survey to the richness earlier reported (in Karikalan, 2013; Kumara *et al.*, 2011), in order to indicate the presence, absence or local extinction of terrestrial mammalian species.

Secondly, camera-traps becoming a useful tool in population monitoring of wildlife (for a detailed account, see Trolliet *et al.*, 2014), we assess the diel activity patterns of all wild animals captured during the study period. This was carried out to provide preliminary time-activity patterns of different species to optimize detection probability during future camera-trap studies. Maximizing detection probability is crucial in many ecological studies, especially during occupancy, abundance and density estimations (O'Connor *et al.*, 2017) which are of key importance in protected area management.

Moreover, BNP is linear in shape and experiences high anthropogenic pressures including cattle grazing, lopping, collection of non-timber forest products and for other domestic purposes (Varma *et al.*, 2009). Hence, we attempted to check the intensity of anthropogenic captures in the camera-traps including human, feral and domestic animal movements within the Protected Area and the extent of its occurrence.

However, assessment of the distribution of mammals in response to the anthropogenic movements is beyond the scope of this presented paper.

Lastly, we have also made an attempt to assess the seasonal distribution of wild animals within BNP. This is expected to highlight the variation in usage of this deciduous forest by the wild animals and also provide information on their movement patterns. Both of which may aid in better management of connectivity between Bannerghatta National Park and the adjoining forested areas. This paper also presents a species-wise comparison between encounter rate of wild animals in forest trails and water bodies. This may aid in framing appropriate deployment plan for camera-traps in this BNP landscape during future surveys.

Materials and methods

Study Area

Bannerghatta National Park encompasses an area of ca. 260sq. km in the Nilgiri-Eastern Ghat landscape and is largely covered in a tropical dry deciduous forest type, characterized by *Anogeissus latifolia, Acacia chundra* and *Cedrela toona* (Gopalakrishna *et al.*, 2015). It is contiguous with the Cauvery Wildlife Sanctuary of Karnataka in the south-west and the North Cauvery Wildlife Sanctuary of Tamil Nadu in the south-east. BNP experiences three seasons, a dry season (January to April), a 1st wet season (May to August) indicated by the onset of south-west monsoons and a 2nd wet season (September to December) with the north-east monsoons. Mean temperatures between the years 2012 and 2016 ranged from 20°C to 33°C in the dry seasons, 21°C to 31°C in the 1st wet seasons and 18°C to 29°C in the 2nd wet seasons (World Weather Online, 2017). BNP has no natural river systems originating or flowing through it; the Karnataka Forest Department has installed close to 250 man-made water bodies (Karikalan, 2013). These initiatives were taken to provide water for wildlife within the park boundary which reduces the excursions of wild fauna outside the park, and as part of their soil moisture conservation efforts. Human activity within the limits of the protected area are by the local communities, primarily for cattle grazing and collection of firewood (Varma *et al.*, 2009).

Methods

Ten motion-triggered un-baited camera-traps (four Bushnell, four Cuddeback and two Moultri with IR and white flashes) were deployed in BNP during 2012 to 2016 for a variety of research purposes. Thus, the number of camera-traps, mode of capture (image and/or video), number of captures per detection and latency period between captures, were not constant. Based on the research purpose, the camera-traps were deployed intermittently in two strategic deployment positions *viz.*, forest trails for a total of 143 trap days and water bodies for a total of 62 trap days, amounting to a consolidated survey period of 205 trap days. This survey covered 69 trap days in dry season, 73 days in 1st wet season and 63 days in 2nd wet season. The camera-traps had an average sampling period of 15 trap days (min = 1, max = 35) that were active 24h a day. Camera-traps either single or paired were positioned between 0.45 m and 3m from the ground level. The camera-traps were deployed at 14 independent trap stations in BNP, located at a distance between 0.2km and 2.2km from the park boundary. Exact locations of the camera-traps is not disclosed here in order to ensure safety to the wild animals.

Encounters were considered independent after a lapse of > 30 minutes between triggers. The first time stamp for an encounter was used for the analysis. Images from paired camera-traps were pooled in order to estimate number and timing of encounters.

Identification of species from the photo-captures followed Prater (1971) and Menon (2014). Age-sex classification for a few species was carried out for both group and solitary encounters based on external morphological features and by using size references, wherever image quality permitted. An analysis of the seasonal habitat use and capture probability of species between the two deployment positions were carried out. Daily activity patterns were analysed and each species categorized as diurnal, nocturnal (unimodal or bimodal), matutinal, vespertine, crepuscular or cathemeral (Schmitz and Motani,

2010) based on the standardization (Table 1). Diel category can be considered accurate and representative of the species where encounters are equal to or exceed 30, and if more than 90% of the observations fall within the time frame for a category (van Schaik and Griffiths, 1996). The daily activity patterns for the species composition were visualized using ggplot in R-Software vers. 3.4. Anthropogenic movements indicated by photo-captures of unauthorized people, domestic and feral animals were also assessed.

Table 1. Standardized time zone for activity pattern categorization.

Activity Pattern		Time Zone	Start Time	End Time	Total hours	Activity Pattern	
Cathemeral	Diurnal	Dawn	0531h	0930h	4	Matutinal	Crepuscular
		Daylight	0931h	1530h	6		
		Dusk	1531h	1930h	4	Vespertine	
	Nocturnal	Night 1st Phase (N1)	1931h	2330h	4	Nocturnal unimodal 1	Nocturnal
		Night time	2331h	0130h	2		
		Night 2nd Phase (N2)	0131h	0530h	4	Nocturnal unimodal 2	

Results

A total of 4714 media files have been recorded in the camera-traps during the survey period. This included 344 independent encounters of wild animals captured in 1711 media files, along with 3003 photo-captures of human, domestic animals, vehicular movements and false triggers indicated with sequences of blank images.

Diversity of Mammalian Fauna

Identification of the wild fauna captured has revealed the presence of 17 terrestrial mammals belonging to 5 orders and 12 families, in BNP (Table 2).

Order Carnivora

This order constituted 14.53% of the total encounters of wild fauna captured. The Indian grey mongoose (*Herpestes edwardsii,* E.Geoffroy Saint-Hilaire, 1818) was encountered the most (n=14) among this order. Apart from 2 encounters (14.29%) during the dry seasons, the remaining were of solitary individuals. Solitary adults of dhole (*Cuon alpinus* Pallas, 1811) (n=2, sex undetermined) (Fig. 1), leopard (*Panthera pardus* Linnaeus, 1758) (1 male, 1 female and 1 undetermined), common palm civet (*Paradoxurus hermaphrodites* Pallas, 1777) (n=9, sex undertermined) and small Indian civet (*Viverricula indica* E. Geoffroy Saint-Hilaire, 1803) (n=7) were also encountered during the survey period. The presence of tiger (*Pathera tigris* Linnaeus, 1758) has been ascertained by the encounters of an adult male (Fig. 2), based on individual identification marks, in 7 independent events from different camera-trap stations. Adults (sex undetermined) of rusty-spotted cat (*Prionailurus rubiginosus* E.Geoffroy Saint-Hilaire, 1831), were also encountered twice (Fig. 3) during the survey period. An adult honey badger (*Mellivora capensis* Schreber, 1776) was encountered once (Fig. 4). Sloth bear (*Melursus ursinus* Shaw, 1791) was encountered 5 times. Though 4 events were of solitary adults (sex undetermined) on forest trails, one sequence had two adults together visiting a water body during a dry season.

Table 2. List of species encountered in BNP during the camera-trap survey.

S.No.	Order	Family	Species	Common Name	IUCN Status	Encounters					
						Total	Season of encounter			Location of encounter	
							Dry season (%)	First wet season (%)	Second wet season (%)	Forest Trail (%)	Water Body (%)
1	Carnivora	Canidae	*Cuon alpinus*	Dhole	Endangered	2	50	0	50	100	0
2		Felidae	*Panthera pardus*	Leopard	Vulnerable	3	66.66	0	33.34	66.66	33.34
3			*Panthera tigris*	Tiger	Endangered	7	14.28	0	85.72	100	0
4			*Prionailurus rubiginosus*	Rusty-spotted Cat	Near Threatened	2	100	0	0	100	0
5		Herpestidae	*Herpestes edwardsii*	Indian Grey Mongoose	Least Concern	14	92.86	0	7.14	100	0

S.No.	Order	Family	Species	Common Name	IUCN Status	Encounters					
						Total	Season of encounter			Location of encounter	
							Dry season (%)	First wet season (%)	Second wet season (%)	Forest Trail (%)	Water Body (%)
6	Cetartiodactyla	Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern	1	0	0	100	100	0
7		Ursidae	*Melursus ursinus*	Sloth Bear	Vulnerable	5	20	60	20	80	20
8		Viverridae	*Paradoxurus hermaphroditus*	Common Palm Civet	Least Concern	9	100	0	0	100	0
9			*Viverricula indica*	Small Indian Civet	Least Concern	7	71.43	28.57	0	100	0
10		Bovidae	*Bos gaurus*	Gaur	Vulnerable	7	28.57	14.28	57.15	71.43	28.57
11		Cervidae	*Axis axis*	Chital	Least Concern	45	82.22	8.89	8.89	28.89	71.11
12			*Muntiacus muntjak*	Indian muntjac	Least Concern	4	100	0	0	75	25
13			*Rusa unicolor*	Sambar	Vulnerable	72	84.72	8.33	6.95	8.33	91.67

Table 2. (continued)

S.No.	Order	Family	Common Name	Species	IUCN Status	Total	Encounters				
							Season of encounter			Location of encounter	
							Dry season (%)	First wet season (%)	Second wet season (%)	Forest Trail (%)	Water Body (%)
14	Cetartiodactyla	Suidae	*Sus scrofa*	Wild Pig	Least Concern	31	51.61	32.26	16.13	45.16	54.84
15	Lagomorpha	Leporidae	Black-naped Hare	*Lepus nigricollis*	Least Concern	98	70.41	7.14	22.45	96.94	3.06
16	Proboscidea	Elephantidae	Asian Elephant	*Elephas maximus*	Endangered	30	36.67	26.66	36.67	50	50
17	Rodentia	Hystricidae	Indian Crested Porcupine	*Hystrix indica*	Least Concern	7	14.29	14.29	71.42	100	0

Fig. 1. Representative photo-capture of a dhole (*Cuon alpinus*) during the survey period.

Fig. 2. Representative photo-capture of a tiger (*Panthera tigris*) during the survey period.

Fig. 3. Representative photo-capture of a rusty-spotted cat (*Prionailurus rubiginosus*) during the survey period.

Fig. 4. Representative photo-capture of a honey badger (*Mellivora capensis*) during the survey period.

Order Cetartiodactyla

This order represented the highest number of encounters (46.22%) among the wild fauna documented. Sambar (*Rusa unicolor* Kerr, 1792) (Fig. 5) was found to be the most abundant of ungulates recorded, representing about 64.05% (n=72) of the Cetartiodactyla population captured. Sambar was found both solitary (n=33, 45.83%) and in groups (n=39, 54.17%). The grouping were mostly of one or two adult females (n=9), with one juvenile (n=8). A maximum of two adult males were found associated with one or two adult females (n=11), sometimes along with a juvenile (n=3) and a calf (n=1) during the dry seasons; age-sex classification of 7 captures could not be carried out. Chital (*Axis axis* Erxleben, 1777) was the second most encountered species among the ungulates, constituting 21.17% of the encounters. Solitary individuals of males (n=15) and females (n=10) were captured in a considerable proportion (55.56%) with that of groups (44.44%, n=20). The group composition, however, varied between the captures. The maximum group size encountered consisted of 6 individuals. Calves were observed during dry season in 2 instances and a maximum of one juvenile was observed with adults, with or without calves, during both the dry seasons (n=8) and the 1st wet seasons (n=1).

Fig. 5. Representative photo-capture of a sambar (*Rusa unicolor*) during the survey period.

Encounters of the wild pig (*Sus scrofa* Linnaeus, 1758) amounted to 11.59% of the ungulates captured. They were predominantly found solitary (n=24, 77.42%), however, groups of two or three adults (sex undetermined) (n=5, 16.13%) were also present.

The maximum number of juveniles encountered with an adult female was two (n=2), which occurred during the dry seasons. The encounters decreased gradually through seasons with 16 captures during the dry seasons (51.61%), 10 during the 1st wet (32.26%) and 5 during the 2nd wet seasons (16.13%).

Encounters of gaur (*Bos gaurus* C.H. Smith, 1827) were mostly of adults (solitary males in 5 instances and two females together in one of the encounters). A group of 1 adult female and 2 juveniles was captured during a dry season. The captures of Indian muntjac (*Muntiacus muntjak* Zimmermann, 1780) were of solitary adults (sex undetermined).

Order Lagomorpha

This was represented by a single family with one species, the *Lepus nigricollis* F. Cuvier, 1823, commonly called the black-naped hare, which was encountered in 98 independent events (28.49%). The captures were largely of solitary adults (sex undetermined) (n=96, 97.96%) with only 2 events of two adults together (2.04%).

Order Proboscidea

The Asian Elephant (*Elephas maximus* Linnaeus, 1758) were captured in 30 encounters (8.72%). Eighteen of the encounters (60%) were of solitary individuals, either adult or sub-adult males (n=10) or adult females (n=3); age-sex classification of 5 encounters could not be made. Nine out of the 10 captures of herds did not include any adult bull elephants except for one encounter during a dry season; the presence of adult males could not be determined in 2 of the encounters. Adult or sub-adult solitary males were encountered predominantly in the 2nd wet seasons (n=6, 60%), compared to the dry seasons (n=2, 20%) and the 1st wet seasons (n=2, 20%). A maximum of 13 individuals were encountered within a herd (Fig. 6).

The minimum group size was of an adult female with one calf on 4 encounters. Calves were encountered in 9 instances equally during the three seasons with 3 encounters each.

Fig. 6. Representative photo-capture of a herd of elephants (*Elephas maximus*) during the survey period.

Order Rodentia

One species, the Indian crested porcupine (*Hystrix indica* Kerr, 1792) was encountered from this order, constituting less than 1% of the total wild fauna captured, in 7 independent events. The encounters were of solitary adults (sex undetermined) in 5 instances (71.43%) and two adults together at 2 occasions (28.57%) during the 2nd wet seasons.

Activity Patterns of Species

Categorization of the encountered species into the standardized diel activity cycle was carried out (Table 3) and visualized (Fig. 7). Five species had sufficient sample size to categorize their daily activity cycle. Twelve species had less than 30 encounters each to be representative of the actual activity pattern (van Schaik and Griffiths, 1996). Carnivores exhibited 4 types of activity patterns namely, diurnal (n=1), nocturnal (n=5), cathemeral (n=2) and crepuscular (n=1). Out of the 5 ungulates recorded, 4 were cathemeral except for gaur which inclined towards a nocturnal pattern. While black-naped hare and porcupine exhibited nocturnal activity, elephants were found to be cathemeral.

Table 3. Time of encounter of the species recorded in BNP during the camera-trap survey.

S.No,	Species	Total Encounters	Dawn (%)	Daylight (%)	Dusk (%)	Night (N1) (%)	Night Time (%)	Night (N2) (%)	Category	Remarks
1	Dhole	2	50.00	50.00	0.00	0.00	0.00	0.00	Diurnal	
2	Leopard	3	33.33	0.00	66.67	0.00	0.00	0.00	Crepuscular	
3	Tiger	7	42.86	28.57	0.00	14.29	0.00	14.29	Cathemeral	
4	Rusty-spotted Cat	2	0.00	0.00	0.00	100.00	0.00	0.00	Nocturnal	
5	Indian Grey Mongoose	14	0.00	57.14	14.29	14.29	0.00	14.29	Cathemeral	
6	Honey Badger	1	0.00	0.00	0.00	0.00	100.00	0.00	Nocturnal	
7	Sloth Bear	5	0.00	20.00	0.00	80.00	0.00	0.00	Nocturnal	Facultative
8	Common Palm Civet	9	0.00	0.00	0.00	22.22	0.00	77.78	Nocturnal	Bimodal
9	Small Indian Civet	7	0.00	0.00	0.00	28.57	0.00	71.43	Nocturnal	Bimodal
10	Gaur	6	0.00	0.00	16.67	50.00	33.33	0.00	Nocturnal	
11	Chital	45	24.44	24.44	31.11	13.33	2.22	4.44	Cathemeral	
12	Indian muntjac	4	25.00	0.00	50.00	0.00	25.00	0.00	Cathemeral	
13	Sambar	72	16.67	16.67	33.33	13.89	9.72	9.72	Cathemeral	
14	Wild Pig	31	6.45	12.90	16.13	41.94	9.68	12.90	Cathemeral	
15	Black-naped Hare	98	6.12	0.00	2.04	48.98	19.39	23.47	Nocturnal	
16	Asian Elephant	30	3.33	20.00	16.67	40.00	10.00	10.00	Cathemeral	
17	Indian Crested Porcupine	7	0.00	0.00	0.00	14.29	0.00	85.71	Nocturnal	Obligatory

An account of anthropogenic pressures

Movement of cattle and cattle grazers within the limits of the forest was encountered in 15 instances. The encounters were mostly during the early months of the dry season (73.33%, n=11), followed by 3 encounters in the 1st wet seasons (20%) and once during a 2nd wet season (6.67%). These photo-captures were found to be confined to 2 camera-trap stations deployed along a forest trail and a water body. Cattle grazing was found to occur mostly during the day (80%, n=12), however, cattle were captured even during the night (20%, n=3). People movement, apart from cattle grazing, was encountered at 5 instances. Movement of feral dogs was encountered at 3 occasions, capturing a pair of dogs near a water body during a dry season and 2 solitary adults on forest trails. These anthropogenic movements were encountered at 0.38 km up to 2.2 km from the forest boundary.

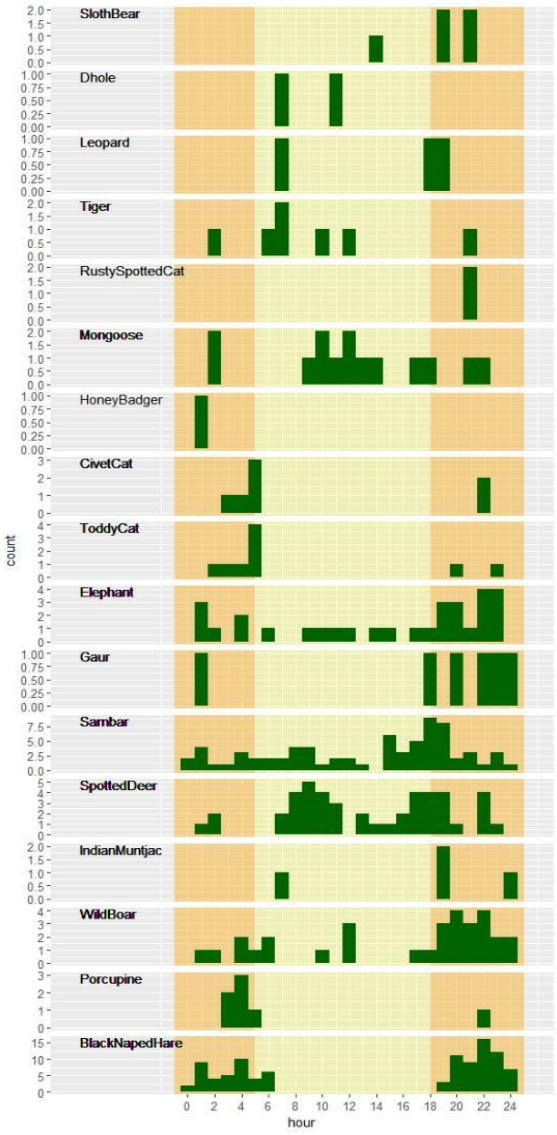

Fig. 7. Time activity patterns exhibited by the encountered species during the camera-trap survey, visualized using ggplot on R software.

Camera-trap encounter rate assessment

The encounter rate obtained for the various seasons and for the two deployment positions are presented in the table (Table 2). Eight of the species were encountered in all the three seasons, 4 during one of the seasons and 5 during two of the seasons. While 8 of the species were encountered only on forest trails, 5 were encountered more on forest trails, 3 more along water bodies and 1 equally in both the locations.

Discussion

This analysis of various camera-trap surveys, conducted over a period of 4 years, has ascertained the presence of 17 terrestrial mammals in BNP. Occurrence of 14 species had been already been known (Karikalan, 2013; Kumara *et al.*, 2011), presence of 2 species that were suspected to occur (Kumara *et al.*, 2011) have been confirmed, namely tiger and rusty-spotted cat, and new record of honey badger (Karikalan, 2013; Kumara *et al.*, 2011; Krishnan *et al.*, 2016) from this landscape has been presented. Ten species that had been earlier reported to occur in BNP (Karikalan, 2013; Kumara *et al.*, 2011) were not encountered during the survey period including the threatened striped-hyaena (*Hyaena hyaena*), Indian pangolin (*Manis crassicaudata*) and four-horned antelope (*Tetracerus quadricornis*).

This survey aided in understanding the local social grouping and group size in the encountered species. Besides, the results obtained also suggest that the occasional encounters of 2 adults together in Indian grey mongoose, leopard, sloth bear, black-naped hare and Indian crested porcupine were possibly mating pairs. Further, the evidences of juveniles and/or calves in 5 species *viz.,* gaur, chital, sambar, wild pig and Asian elephant indicate the presence of a breeding population in BNP.

Considering that the higher encounter rate of sambar indicates higher population of the species, in comparison with other ungulates, the findings from this survey potentially indicates BNP to be a sambar-dominated forest.

It may be inferred from this survey that BNP may have a theoretical potential to sustain large carnivores, however, except for the presence of a lone male tiger whose presence has only been confirmed in this survey, there are not many.

The activity patterns have been found to be not significantly different from the general descriptions available from different parts of the country (Prater, 1971). The retained or adopted cathemerality in 7 species namely, tiger, Indian grey mongoose, chital, Indian muntjac, sambar, wild pig and Asian elephant suggests that direct physical disturbances in the recorded trap locations, may not be considerably high.

This is further reinforced by the low, however far ranging (up to 2.2km from the forest boundary) anthropogenic movements (n=23, 6.25%) observed during the survey.

The baseline information obtained on daily activity patterns, seasonality in social grouping and calving, seasonal habitat use in BNP and encounter rates between the two deployment positions may aid in obtaining a high capture probability and in designing the deployment strategies for future camera-trap studies.

This study has, thus, revealed that BNP is sustaining a significant population of terrestrial mammals. This assessment, however, reveals the lack of contemporaneous information available on faunal diversity from this part of the landscape, indicated by the first time supportive evidences of occupancy of 3 mammals. Undertaking further robust studies on species diversity, population densities, seasonal and temporal distribution of animals indicating their ranging patterns, habitat associations, and to an extent their movement patterns between the adjoining forest regions, preferably using camera-traps, may aid in formulating reliable managerial decisions.

Conclusions

The results of camera-trap surveys presented here, thus, provides a contemporaneous inventory of the terrestrial mammalian taxa of Bannerghatta National Park, Karnataka, India, with supportive evidence of 3 species that were indefinite earlier. This including a large carnivore, tiger, is expected to alter the ecosystem dynamics of the region and thus, demanding change in management planning and conservation. Moreover, it was also found that the current relative abundance of sambar is the highest among the ungulates. This seems to highlight the possibility of this habitat being potential in supporting large carnivores, from a resource availability requirement. The information on diel activity patterns, social grouping and seasonal habitat use of both wild animals and anthropogenic movements, has aided in providing two key findings, i. anthropogenic disturbance is occurring in BNP, including presence of free-ranging dogs, however, they are less abundant but not spatially restricted, ii. seven species still show cathemerality in their behaviour indicating no influence of anthropogenic movements on their behaviour. However, this finding needs validation on an individual scale, than on a population scale. The baseline information obtained through this compilation, especially on operational time period and deployment location is expected to facilitate in optimizing the capture probability during future camera-trap studies in this landscape.

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