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Home Range of Hanuman Langur (*Semnopithecus Entellus*) in Bidar District, Karnataka.

Shivakumar Patil and Sanjeevareddy Modse
[1]Research Centre, Department of Zoology, Government First Grade College, Bidar,Karnataka. email:sukmrpa@gmail.com.
[2]Research Centre, Department of Zoology, Government First Grade College, Bidar,Karnataka. email:sanjeevareddymodse@yahoo.co.in

ABSTRACT
The Hanuman Langurs occur in various habitats like different types of forests, agricultural area in and around human habitation. Bidar district has unimale, multimale and allmale troops of Hanuman Langurs. To understand the behavioural ecology and habitat requirement of a species it is necessary to know its home range. Home range size of a species depends on various ecological factors, social interaction, behaviour and several other factors like body size of the animal. Human influences such as provisioning and habitat disturbance, such as logging also strongly affect home range. The study was conducted to know the size of the home range in different habitats and influence of troop size on home range. This provides a baseline data for future study of Hanuman Langur in Bidar district, Karnataka. The study was conducted from January 2013 to December 2014. For the study, three separate troops living in three different habitats such as Forest (F), Agricultural Area (A) and Urban area (U) were selected. We followed the troops three days per month, that is, one day per troop per month, a total of seventy-two days of observation was made by direct and focal animal sampling method At the end of the study, the home range was analysed by using QGIS (Quantum Geographic information System) soft ware 3.2 at NRDMS (Natural Resource Data Management System) Centre, Zilla Panchayat, Bidar. In this study, the home range used by focal troop – F (Shahapur) of forest was 348 hectares, that of the focal troop – U (SSKB) of urban area was 347 hectares and that of the focal troop – A (Janwada) of agricultural area was 880 hectares. The Focal troop - A had greater home range size, whereas focal troop - F and U had smaller home range. The home range of all the three focal troops living in three different habitat was not uniform. Variation in home range size was negligible between focal troop - F and U, but it was conspicuous when the home ranges of focal troops – F and U were compared with that focal troop - A. This may be due to scanty availability of food in agriculture area.
KEY WORDS: Home range, Hanuman Langur, Troop, roosting

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INTRODUCTION

The Hanuman Langurs are highly adaptive species occur various habitats, like different types of forests, agricultural area in and around human habitation. Bidar district has larege number of unimale, multimale troops of Hanuman langurs. These belong to the class Mammalia, order primates. All the mammals make their movements in a well defined area, and follow a well defined path instead of wandering randomly and thus the concept of home range developed. Primates live in a definite home range. As non-human primates Hanuman langurs are also live in definite home range.

To understand the behavioural ecology and habitat requirement of a species it is necessary to know its home range [18]. Such an understanding provide baseline data for conservation of a species [3].Home range size of a species depends on various factors like change of

season and climate [1]. Ecological factors, social interaction, behaviour and several other factors like body size of the animal (weight) in mammals and lizards varies the size of the home range [14]; and habitat disturbance, such as logging [13], also strongly affect home range size and ranging behaviour.

Folivorous primates occupy smaller home range compared with frugivores and omnivores, terrestrial folivores have longer home range than arboreal folivores [16]. The folivorous Colobinae of Asia and Africa display considerable variation in home-range size and ranging patterns among genera, species, and populations, although ranges are generally <100 ha [10]. Species with larger home ranges tend toward lower population densities [25].

Colobine day range laengths are similarly linked to the availability of food resources; species such as *Presbytis rubicund* [9] and *Semnopithecus dussumieri* [17] travel the farthest distances when fruits are available. By contrast , *Trachypithecus pileatus* travels the shortest distances when mature leaves are more in the diet [22].

In Hanuman langurs home ranges of adjoining troops overlap [16]. In bisexual troops home ranges can vary from 7 to 1,300 ha, and can be even larger for all-male bands — 430 to 2,200 ha [12]; [23]; [24]; [15]; [19]; [21]; [4]; [5]; [6].

According to [15]; [19] "The home range size differs widely in different distributional zone of *Semnopithecus entellus* and we may tentatively generalize that they are more extensive in open habitats than in forest". The study was conducted to know the size of the home range in different habitats and influence of troop size on home range Hanuman Langur (*Semnopithecus entellus*). This provides a baseline data for future study of Hanuman Langur in Bidar district, Karnataka.

MATERIAL AND METHOD

The study on home range and foraging of Hanuman Langurs (*Semnopithecus entellus*) of Bidar district, Karnataka, was conducted from January 2013 to December 2014. For the study, three separate troops living in three different habitats such as Forest (F), Agricultural Area (A) and Urban area (U) were selected. The troop present in Shahapur Forest, of Bidar taluka was designated as focal troop - F, Janwada Village of Bidar taluka as focal troop - A and S.S.K.B. College of Basavakalyan taluka as focal troop-U. **(Table – 1).**

We followed the troops three days per month, that is, one day per troop per month, a total of seventy-two days of observation was made by direct and focal animal sampling method**.** The observation was made with the use of Bushnell binoculars of 8X48 magnification and photography by Canon Power shot SX150 IS, Canon Power Shot SX 50X HS and Canon 5D Mark II Camera. We followed the troop on foot from dawn to dusk**.**

Prior to the initiation of the thorough study, an overall assessment of the study area and the troops present in Janwada, SSKB, and Shahapur forest was made. The maps of the study areas and roosting sites were drawn roughly (hand-drawn) using permanent landmarks. One day prior to the study of every troop, we confirmed the roosting site and reached the site early in the morning and followed the troop till the end of their activities and till they reach roosting site. During each sampling day, we carried with us a copy of the hand-drawn map and the location of the troop was marked in the morning. During the study period, roosting trees were identified; their total number and local and scientific names were recorded by drawing a table in the field itself. We also gathered information through informal interaction with the local people.

We recorded focal animal data on single adult female member of the troop. We selected single adult female as target animal before beginning to follow the animal it was closely followed throughout the day. The individual target animals were identifiable by distinguishing morphological characters.

At the end of the study, the home range was analysed by using QGIS (Quantum Geographic information System) software 3.2 at NRDMS (Natural Resource Data Management System) Centre, Zilla Panchayat, Bidar.

Study Area:

The study was conducted in three different habitats such as forest, agricultural area and urban area of Bidar district, Karnataka. Bidar district covers an area of 5458.9 sq.km. The District has 8.5% of forest out of its total geographical area.

Shahapur Forest:
Shahapur forest is located in taluka and district Bidar of Karnataka State. It is situated 7 km towards south from the district head quarters. It is located on Deccan Plateau (Fig.2). It lies between 17˚35 ' & 18˚25 ' North latitudes and 76˚42 ' & 77˚39 ' East longitudes. It has an elevation of 673 - 675 meters above the mean sea level. It is natural and manmade forest spread over 485 hectares. Towards south-east of the forest Shahapur village and towards south-west agricultural lands are situated, apart from grass land.
Shahapur forest is a dry mixed deciduous forest. In this forest, thorny plants occur, grass is conspicuous, and a few climbers also occur. The dominant trees of this forest are *Azadirachta indica, Accacia catechu, Terminalia bellerica, Madhuca longifolia, Madhuca indica, Tectona grandis, Buchnania lanzan, Terminalia tementosa* etc., This forest has a unimale troop of Hanuman Langurs (*Semnopithecus entellus).* Wildlife in the forest consist of black buck, porcupines, foxes, wild boars, hares, wild cats and jackals.
Janawada:
It is a village located in taluka and district Bidar of Karnataka State. It is located 11 km towards north from the district head quarters. It is located on Deccan Plateau (Fig.1). It lies between 17˚35 ' & 18˚25 ' north latitudes and 76˚42 ' & 77˚39 ' east longitudes and has an elevation of 673-570 meters above the mean sea level. The Janwada village has a total area of 1323.19 hectares. It has one multimale troop of Hanuman Langur (*Semnopithecus entellus).* Janwada village is covered mainly with agricultural fields with many varieties of crops, such as sugarcane, jowar, pigeon pea, chick pea, soya bean, black gram and green gram. Kharif and Rabbi are the two seasons of crops in a year. Most of the agricultural practices in the study area were confined to non-irrigated land. It has two water tanks, one towards south-east of the study area and another towards south-west and Manjra river towards north of the study area.
S.S.K.B
It is located in Basavakalyan City Muncipal Corporation in Bidar district of Karnataka state. It is located 85 km towards south-west from the district head quarters on Deccan Plateau (Fig.3). It lies between 17˚35 ' & 18˚25 ' north latitudes and 76˚42 ' & 77˚39 ' east longitudes and has an elevation of 673-570 meters above the mean sea level. The total area of Basavakalyan City Muncipal Corporation is 3167.9 hectares. It has a Unimale troop of Hanuman Langur (*Semnopithecus entellus).* The study area has a Tripurant water tank towards south-west. Towards south-east and south-west has agricultural land.
Climate:
The climate of the study areas is generally dry throughout the year, except during the Southwest monsoon which remains till the end of September. The months of October and November constitute the post-monsoon or retreating monsoon season. The total annual rainfall during the year 2013 and 2014 was 774.72 mm, and 980.54 mm respectively. The Winter season is from December to middle of February and the temperature begins to fall from the end of November. December and January are the coldest months with an average maximum temperature of 27.3 ˚ C and minimum of 16.4 ˚ C. From the middle of the February, both day and night temperature begins to rise rapidly. The month of May is the hottest with the daily maximum temperature of 38.8˚C and minimum of 25.9˚C. The withdrawal of Southwest monsoon occurs in the first week of October. There is slight increase in day temperature but night temperature decreases steadily after October, both day and night temperature decreases progressively.
No data on home range of hanuman langurs (*Semnopithecus entellus*) of the study area was available hence felt the necessity of this work. The data we obtained is a baseline data for the future study in Karnataka, as well as in addition to the data existing in the other parts of the country.
The aim of this study is to provide information on the home range of Hanuman Langurs (*Semnopithecus entellus*) in Bidar district. This baseline information will provide needed insights for future study of the species.

RESULT AND DISCUSSION
The home range of Hanuman Langur (*Semnopithecus entellus*) in three different habitats of Bidar district, Karnataka, was studied from January 2013 to December 2014. In this study, the home range used by focal troop – F (Shahapur) of forest was 348 hectares, that

of the focal troop – U (SSKB) of urban area was 347 hectares and that of the focal troop – A (Janwada) of agricultural area was 880 hectares **(Table -2).**

The Focal troop - A had greater home range size, whereas focal troop - F and U had smaller home range (Table - 2). The home range of all the three focal troops living in three different habitat was not uniform. Variation in home range size was negligible between focal troop - F and U, but it was conspicuous when the home ranges of focal troops – F and U were compared with that focal troop - A (Table – 2). This may be due to scanty availability of food in agriculture area.

According to [8], [21], The size of the home range increases with increase in troop size. Our results are in agreement with them. The focal troop – A with troop size 60 in 2013 and 69 in 2014 had 880 hacters of home range whereas the focal troop – F with troop size 36 in 2013 and 43 in 2014 had 348 hacters and focal troop – U with troop size 28 in 2013 and 33 in 2014 had only 347 hacters **(Table – 1 & 2).** The size of the home range affected not only by the troop size but also depends on availability of resources in it. Greater the resources available smaller will be the home range and smaller the resources greater will be the home range size.

In the present study, it was observed that focal troop – A had greater home range size because the food was randomly distributed over the habitat, whereas focal troop – F had greater availability of food in the form of trees, hence it had smaller home range size. The home range size of focal troop – U of urban area was 347 ha. It is quite larger than those of Rankapur temple troop (45 ha) [7], garden troop of Jodhpur (60 – 96 ha) and open habitats of Jodhpur (74 – 132 ha) as estimated by [15], (150 ha) [21], Kailana Jodhpur (40 ha) as reported by [1] and Mt.Abu (38 ha) as studied by [11].

The home range of focal troop – F (Shahapur) of forest habitat was 348 ha. It is also quite large to those of forest habitat at Simla (150 ha) as studied by [20], Kumbhalgarh Wildlife Sanctuary (70 ha) as reported [6] and Vogel [24] estimated (60 ha) in Sarsika National Park, Rajasthan.

The focal troop – A was a multimale troop with 60 - 69 individuals (**Table - 1**). The home range of focal troop – A was also larger 880 hacters. In bisexual troops home ranges can vary from 7 to 1,300 ha, and can be even larger for all-male troops - 430 to 2,200 ha [12]; [23]; [24]; [15]; [19]; Srivastava (1989); [4]; [5]; [6].

The larger home ranges of Hanuman Langur (*Semnopithecus entellus*) troops of our study area may be because of scanty availability of food, open fields with less vegetation, larger agricultural area and dry mixed deciduous forest with small trees and sparse vegetation. **(Table – 4).**

According to Mohnot [15]; [19], "The home range size differs widely in different distributional zones of *Semnopithecus entellus* and we may tentatively generalize that they are more extensive in open habitats than in forest".

Hanuman Langurs (*Semnopithecus entellus*) are social animals known to live in a well-defined territory. During the present study, opportunistically, we have observed that the focal troop – F and A defended their home range by fighting with some other troop of Hanuman Langurs.

It also has been observed that the focal troops used certain parts of their home range more frequently during the activity period, for instance focal troop – F used the nursery at forest information centre and Shahapur research centre more frequently but did not prefer to roost at that location. They used roosting location 7 and 1 more frequently so, most used sites and roosting sites of Hanuman Langurs are not necessarily the same. Most used sites in our study area are such parts of their home range where they get water for drinking. So this may be considered as core area of the focal troop F. Core area may be defined as an area used relatively more frequently than other locations of the home range. Likewise the core area of Focal troop-U was location 2 and for focal troop - A was location 9.

Our present study reveals that Hanuman Langurs (*Semnopithecus entellus*) do not use all the roosting sites at the same rate instead they use it at varying rates, namely Focal troop-F used location 7 and 1, 36% and 32% respectively, focal troop - U used location 2, 38%, 1 & 3, 30% each and focal troop - A used location 9, 16%, and locations 3,8, and 12 14% (Table – 3).

Table: 1- Social Composition and troop size of focal troops.

Habitat	Focal Troop	Year	Infants	Juveniles	Adult Females	Adult Males	Total
Forest	F	2013	9	10	16	1	**36**
		2014	11	13	18	1	**43**
Agricultural Area	A	2013	13	14	28	5	**60**
		2014	16	17	31	5	**69**
Urban Area	U	2013	8	8	11	1	**28**
		2014	10	10	12	1	**33**

Table: 2 - Troop size and approximate home range

Focal Troop	Troop Size		Approximate home range in ha
	2013	2014	
F	36	43	348 ha
A	60	69	880 ha
U	28	33	347 ha

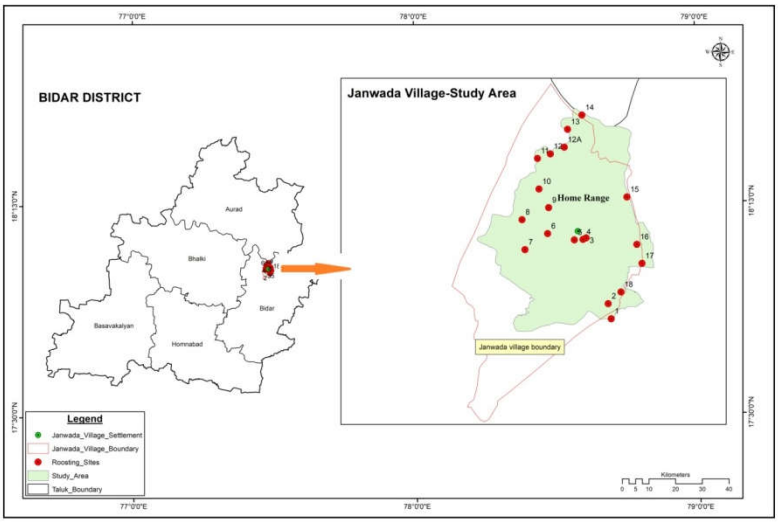
Table: 3 - Preference of roosting sites by Hanuman Langurs of Bidar, Karnataka.

Roosting Site.	Preferance of roosting sites in %		
	Focal troop U	Focal troop F	Focal troop A
1	30%	32%	11%
2	38%	18%	6%
3	30%	9%	14%
4	15%	27%	8%
5	19%	27%	6%
6	23%	27%	11%
7	19%	36%	11%
8	7%	18%	14%
9	7%	18%	16%
10	15%	27%	11%
11	27%	9%	11%
12	23%	-	14%
13	15%	-	6%
14	-	-	8%
15	-	-	8%
16	-	-	8%

Table:- 4 - Showing geographical area, Forest cover, Barren land and Agriculture area of Bidar

Taluka	Geographical Area sq. km.	Forest cover sq. km.	Barren land sq. km.	Agricultural area sq. km.
AURAD	1224.4	231-1	321.3	266.1
B KALYAN	1205.9	714.3	768.7	325.4
BHALKI	1117.3	258.4	39.5	526.0
BIDAR	926.0	465.5	252.5	429.9
HUMNABAD	985.3	1101.4	530.9	653.2

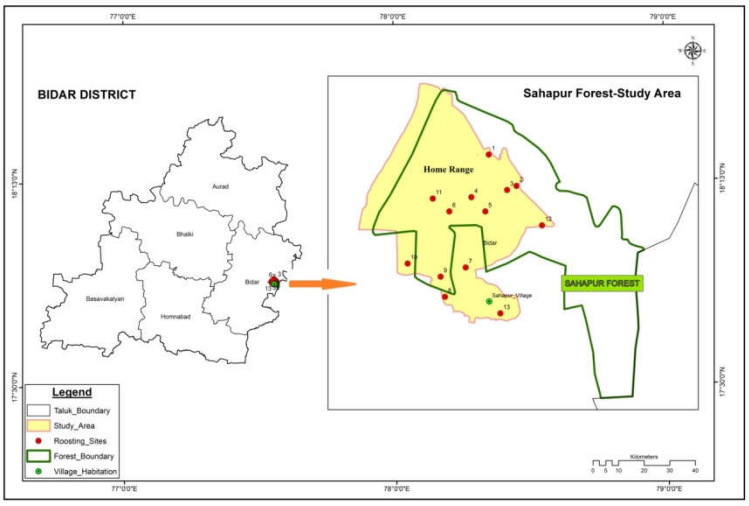
Fig: 1 - Showing Bidar district, study area of focal troop - A and Home range



MAP:

1. Ariculture Research Station.
2. Gurudwara (on Bidar-Aurad Road)
3. Private Land (Near Main Road)
4. Private Land (Near Nala).
5. Private Land (Near West Water TanK).
6. Private Land (Near Moun eshwar Temple)
7. Private Land (Near Pande Farm)
8. Pande Farm
9. Private Land (Near Ram Mandir)
10. Private Land(on the road to Yarnalli).
11. Private Land (behind Shiva-Parvati Mandir).
12. Shiva Parwati Mandir.
13. Private Land (Near Manjra River).
14. Private Land (Towards Factory)
15. Private Land (towards factory)
16. Private Land (Infront of Tank –east)
17. Private Land (Infront of Tank –east)
18. On the Bank of East Tank (Towards Bidar-Aurad Road).

Fig: 2 – Showing Bidar district, study area of focal troop - F and Home range

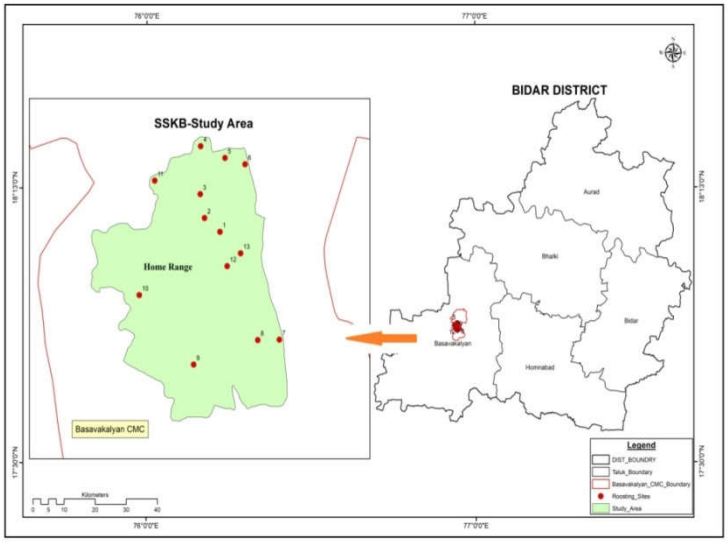


MAP:

1. Bidar- Jahirabad Road (Near Ring Road)
2. Devadeva Vana Gate
3. Entrance of Devadeva Vana.

4. Huts of Forest Department.
5. Forest Department Guest house.
6. Nursary at Forest Information Centre.
7. Private land.
8. Siddalingeshwar Temple.
9. Shahapur Research Centre .
10. Eucalyptus tree plantation .
11. Lingapeeth.
12. Bidar-Jahirabad Road (Near Welcome gate).
13. Shahapur Village.

Fig: 3 – Showing Bidar district, study area of focal troop - U and Home range



MAP:
1. S.S.K.B.College Campus.
2. BKDB Guest House.
3. Private Land (Near Arivina Mane).
4. Allamprabhu Gaduge.
5. Court Premises.
6. Public Garden
7. Private Land (towards Kawdyal).
8. Private Land
9. Ambigar Chaudaya Cave.
10. Anubhava Mantap.
11. Madivala Machidevara Honda.
12. Noolichandaya Cave.
13. Tripurant I B.

CONCLUSION

In this study, the home range used by focal troop – F was 348 hectares, that of the focal troop – U was 347 hectares and that of the focal troop – A was 880 hectares. The Focal troop - A had greater home range size, whereas focal troop - F and U had smaller home range. The home range of all the three focal troops living in three different habitat was not uniform. Variation in home range size was negligible between focal troop - F and U, but it was conspicuous when the home ranges of focal troops – F and U were compared with that focal troop - A.

In the present study, it was observed that focal troop – A had greater home range size because the food was randomly distributed over the habitat, whereas focal troop – F had greater availability of food in the form of trees, hence it had smaller home range size.

It also has been observed that the focal troops used certain parts of their home range more frequently. Most used sites in our study area are such parts of their home range where they get water for drinking. So this may be considered as core area of the focal troop F. Our

present study reveals that Hanuman Langurs (*Semnopithecus entellus*) do not use all the roosting sites at the same rate instead they use it at varying rates.

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