GLOBAL JOURNAL OF BIO-SCIENCE AND BIOTECHNOLOGY

www.scienceandnature.org

THE STATUS AND DISTRIBUTION OF HANUMAN LANGUR (*SEMNOPITHECUS ENTELLUS)* (DUFRESNE) IN BIDAR DISTRICT KARNATAKA

Shivakumar Patil & Sanjeevareddy Modse
Research Centre, Department of Zoology, Government First Grade College, Bidar, Karnataka.
*Corresponding author's email: sukmrpa@gmail.com

ABSTRACT
Hanuman Langurs are widely distributed nonhuman primates in South Asia. There are no reports on their status and distribution in Bidar district, Karnataka, India. Hence, the study was conducted to know their present status and distribution. Bidar District has considerable population of the Hanuman Langur with a total of 225 troops of which 142 are unimale troops, 55 were multimale groups and 28 all-male troops. These 225 troops constitute 6384 langurs of which 828 adult males, 2792 adult females, 1558 juveniles, and 1206 infants. The study reveals that, there was statistically significant difference in the number of unimale, multimale and all-male troops among the talukas of Bidar district ($P<0.05$). In the study it was also observed that there was a statistical significant difference of social composition of Hanuman Langurs among talukas of Bidar district ($P<0.05$) and The six focal troops showed increasing trend in Hanuman Langur population and there was no statistically significant difference of focal troop1 and 2 with respect to different years of habitats in forest, agricultural field and in urban areas ($P>0.05$).

KEYWORDS: Hanuman Langur, Distribution, Troops, Population.

INTRODUCTION

India is rich in the heritage of non-human primates having 17 species and about 30 subspecies. These 17 species are accorded different conservation status (Molur *et al.*, 2003), among them Hanuman Langurs (*Semnopithecus entellus*) with several subspecies are considered as 'least concern' species in IUCN red list categories, CITES Appendix I and schedule II in Wildlife Protection Act, 1972, since they occupy large area geographically (Fooden, 1980; Prater, 1993) and exploit diverse habitats from dense forests to human-dominated landscape. Such species are usually considered as "not at serious risk" (Wolfheime, 1983; Choudhury, 1988). Hanuman Langurs belong the family Cercopithecidae, subfamily Colobinae are stout and highly adaptable species occurring in wide range of habitats (Roonwal and Mohnot, 1977; Oppenheimer, 1977), the most widely distributed non-human primates in South Asia (Choudhury, 2007; Napier and Napier 1967). They are distributed throughout most of India and Sri Lanka (Ellerman and Morrison-Scott, 1966; Oates *et al.* 1994) and are also found in parts of Pakistan, Nepal (Oates *et al.* 1994; Roonwal, 1984), Bhutan and Bangladesh (Choudhury, 2007). The Hanuman Langur (*Semnopithecus entellus* (Dufresne)(=*Presbytis entellus*) is a common primate found in wide range of habitats from arid regions on the edge of the desert in Rajasthan to the rain forests of Western Ghats and at altitudes of 100–4270 m above Mean Sea Level (MSL) in the Himalayas (Bishop 1978; Hrdy, 1977), forests, human habitations that is, cities, villages, roadside, except in north-eastern states *(*A. Murmu, S. Chaudhuri, P. C. Mazumdar and B. Talukder, 2004) in India, but in Bangladesh they are found only in the open wooded villages and not in forest (Khan & Ahsan, 1981 a; Ahsan, 1984). The Hanuman Langur is largely a deciduous or dry deciduous forest animal and prefers dry tropical forest, scrub jungles and arid rocky area with xerophytic vegetation. Since the natural habitat of the langur is being eroded at fast pace, its presence near human habitation and religious places is a common sight (Chhangani, 2000*)*. Different authorities have studied the distribution and behavioral ecology of Hanuman Langurs in India and abroad (Sugiyama, 1964, 1965a, b, 1966, 1967; Sugiyama *et al*., Oppenheimer, 1977, Roonwal Mohnot, 1977). In Bangladesh Akonda (1976) and Bhuiyan (1977) studied the activity pattern of Rhesus Macaque (*Macaca mulatta*). The troops were categorized into adult male, adult female, juveniles and infants (Southwick *et al*., *1961 a)*. Bonnet Macaques and Hanuman Langurs are widely distributed in the state of Karnataka, probably due to the adaptation to live in a wide variety of habitats from plains to 2100 m as in Western Ghats (Simonds, 1965; Kurup, 1981).

The status and demography of common species have been surveyed in India and there is evidence of negative impacts on their population that might be of concern for wildlife management. In 1961, the census of Hanuman Langur in Dharwar was carried out by Sugiyama (1964). He later found a decline in the number of troops present in the same study sites (Sugiyama and Parthasarathy 1978). Decrease in the population of Hanuman Langurs and rhesus macaque in Shimla (Ross *et al*., 1993) and West Bengal was due to conversion of forestlands into agricultural fields (Das-Choudhuri and Roy, 1989), changes in troop size and decline in population size in bonnet macaques around Mysore (Singh and Rao, 2004) and a sharp decline in primate populations in certain regions of the Western Ghats was due to hunting (Kumara Singh, 2004). Hanuman Langurs largely prefer temples

and tourist spots, where they receive handouts from people (Singh and Rao, 2004).

The main objective of the present study was to assess the present status and distribution of Hanuman Langur in Bidar district of Karnataka State, India. The study was conducted between January, 2012 to March, 2016. As there are no reports of any kind of study on these animals from this area, we surveyed almost all the villages, many temples, tourist spots, forests, agricultural fields and horticultural land of Bidar district and gathered information on the occurrence of Unimale, Multimale and All male troops by direct observation and through informal interaction with the people of the village, temple authorities and people living around.

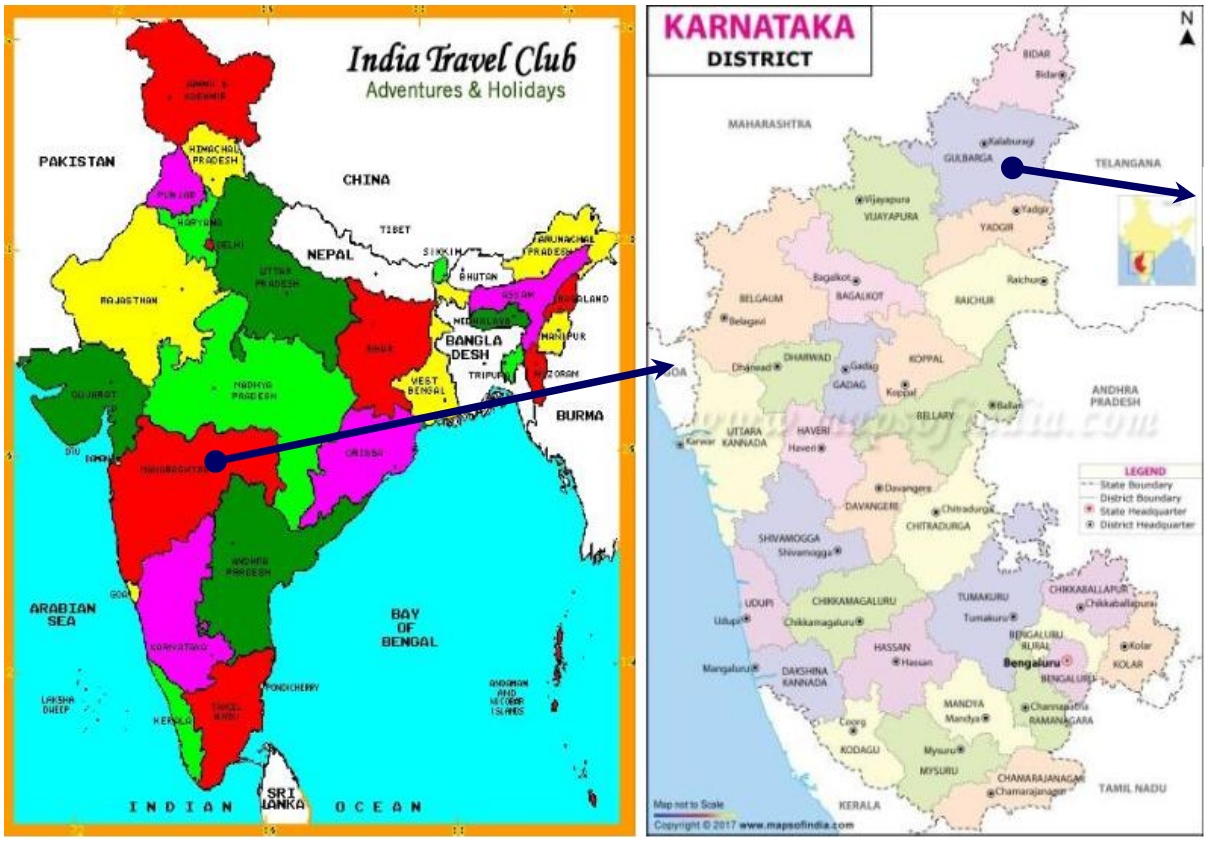
MATERIALS & METHODS

The study on present status and distribution of Hanuman Langur was carried out in the entire district of Bidar from January, 2012 to March 2016 using a two wheeler, between 6.00 a.m. and 11a.m. and in the afternoon between 3.00 p.m and 6.00 p.m. driving the vehicle at 20 km/hr. The study was initiated by carrying out enumerations in 2012 and was repeated in 2013. During the study period the numbers of unimale, multimale and all-male troops of Hanuman Langurs were observed. The troops were categorized into adult male, adult female, juveniles and infants. This was recorded by direct visual method and through informal interaction with people. The observations were made with the use of Bushnell binoculars of 8X48 magnification and photography, by Canon Power shot SX150 IS, Canon Power Shoot SX 50X HS and Canon 5D Mark II. During the study period, that is, January 2012 to December 2014, 6 troops living in different ecological habitats such as forest, agricultural fields and urban areas were selected as focal troops to study the troop structure and activities (Table – 4). These focal troops were F1- Khanapur located in Bhalki Taluka, F2- Shahapur located in Bidar Taluka, (Forest), A1- Janwada located in Bidar, A2- Dhanur located in Bhalki Taluka, (Agricultural fields) U1- SSKB located in Basavakalyan Taluka and U2–GFC located in Bidar (Urban areas). These focal troops were observed for 216 days or 972 hrs, periodically, 1 day for each troop/month that is 36 days/troop or 162 hrs/ troop. In this study troop data was collected on Ad - libitum basis as well as by focal animal sampling method of Altmann (1974). The meteorological data from January, 2012 to December 2014 was procured from District Statistical Department Bidar, and the district map was collected from PWD, Bidar.

Statistical data was analyzed using IBM SPSS 20.0 version software. For qualitative data chi-square test and for quantitative data applied ANOVA and t-test was applied for statistical significance. If P value is less than 0.05 ($P<0.05$) it was considered as significant.

Study area

The study was conducted in five talukas: Bidar, Bhalki, Aurad, Basavakalyan, and Humnabad of Bidar district, Karnataka. Map of the Study area is given in Figure - 1 located on the Deccan plateau about 669 meters above mean sea level, it is the northernmost part of Karnataka which is 700 km away from Bangalore.



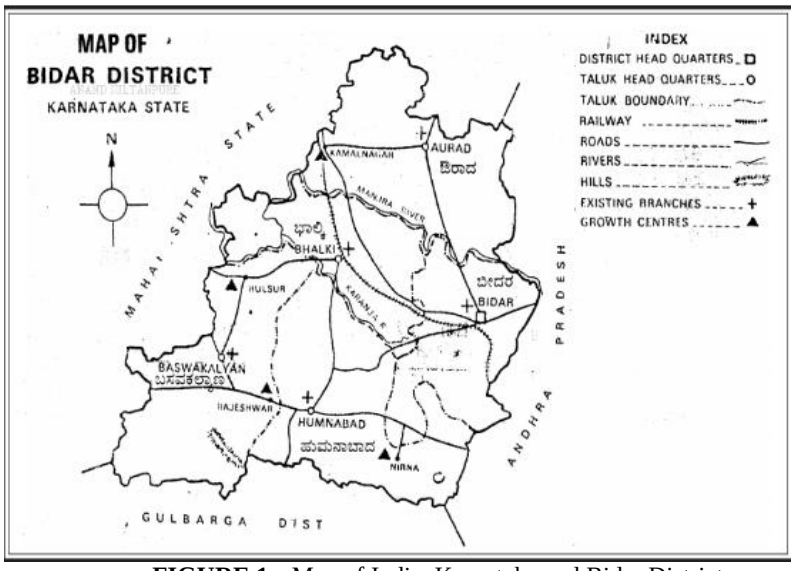


FIGURE 1:- Map of India, Karnataka and Bidar District

Bidar district covers an area of 5458.9 square kilometers of land and lies between 17˚35 ' & 18˚25 ' North latitudes and 76˚ 42 ' & 77˚ 39 ' East longitudes. There are two rivers and one stream *viz.* Karanja, Manjra and Naranja which flow in the district. Karanja flows from the east of the district. Naranja comes from the north of the district and joins the former at Bhalki taluka and both flow commonly as Manjra towards east of the district.

Climate

The climate of this district 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 from January to December, 2012, 2013 and 2014 was 774.72 mm, 980.54 mm and 692.3 mm respectively. The rainfall of the study area is as given in Table – 1. 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.

TABLE 1: Annual rainfall in the study area from January 2012 to December, 2014

Sl. No.	Taluka	Year		
		2012	2013	2014
1.	Bidar	678.8 mm	116.8 mm	643.5 mm
2.	Bhalki	770.3 mm	1059.0 mm	602.8 mm
3.	Aurad	1040.7 mm	1070.5 mm	592.5 mm
4.	Basavakalyan	634.5 mm	708.5 mm	927.0 mm
5.	Humnabad	749.2 mm	947.9 mm	695.7 mm
Average (Mean), S. D., S. E.		774.72 ±112.29	980.54 ± 142.71	692.3 ± 96.71

Forest

The forest in Bidar division comprises of dry deciduous forest and thorn forest (Champion and Seth, 1968). The existing forests of Bidar are natural as well as manmade. Forests of Bidar division are classified as reserve forest, protected forest and unclassified forest. Bidar has 43,592.96 hectares of forests. This area is about 8.5% of total geographical area of the district.

Crops

Bidar district is covered mainly with agricultural fields with varieties of crops. The major crops are sugarcane, jowar, pigeon pea, chick pea, soya bean, black gram and green gram. Some millets, such as pearl millet, foxtatil and finger millet are also grown. Kharif and Rabbi are the two season of crops in a year and maximum land is non irrigated in this area. From the last few years sugarcane is the leading crop which was not so before 2000. Many new breeds of sugarcane have been developed, but over cultivation of only sugarcane has caused imbalance in the total crops of the district. The major crops of the district are jowar, pigeon pea and sugarcane.

RESULTS & DISCUSSION

The study of Hanuman Langurs has not been done so far in Bidar district. Observations on their distribution were carried out from January 2012 to December 2014. Some researchers (Kumar *et al.*, 2010, Kurup 1981 & 1984, Srinivasulu and Nagulu, 2001, Choudhury, 2007) mentioned the presence of Hanuman Langurs in Bidar district, Karnataka, India, but it was limited to their distribution over a small area. Hence, we felt the necessity

of this work. In Bidar district, we were unable to locate Hanuman Langurs in 20 villages though their presence was reported by villagers. During the period of study, we sited totally 225 troops (Table – 2) which yielded at the rate of 0.0412 troops/sq km. In Aurad taluka we sited a total of 42 troops with 26 unimale, 9 multimale and 07 all-male troops and in Bhalki we sited 71 troops with 49 unimale, 17multimale, and 05 all-male troops. With respect to Bidar we have sited 55 troops with 37 unimale, 11 multimale, and 07 all-male troops. As far as Basavakalyan is concerned we sited 25 troops with 13 unimale, 8 multimale, and 04 all-male troops, and in Humnabad we sited 32 troops with 17 unimale, 10 multimale, and 05 all-male troops (Table-2, Fig.-2). In Bidar district a total of 142 unimale troops which constitutes 63.11%, 55 multimale troops which constitutes 24.44% and 28 all-male troops which constitutes 12.44%. In Bidar district the troop size varied from 6 to 108. The study reveals that there is statistically significant difference in the number of unimale, multimale and all-male troops among the talukas of Bidar district which is highly significant (P<0.05).

TABLE 2: Number of troops of Hanuman Langur (*Semnopithecus entellus)* of Bidar District, Karnataka

Sl.No.	Name of the Taluka	Number of Unimale troops	Number of Multimale troops	Number of All Male troops	Total Number of troops
01.	AURAD	26	09	07	42
02.	BHALKI	49	17	05	71
03.	BIDAR	37	11	07	55
04.	BASAVAKALYAN	13	08	04	25
05.	HUMNABAD	17	10	05	32
TOTOAL		142	55	28	225
Mean		28.4	11	5.6	45
SD		14.75805	3.535534	1.341641	18.39837
ANOVA TEST		F= 9.174			
P-Value and Significance		P=0.004	highly significant		

(P<0.05)

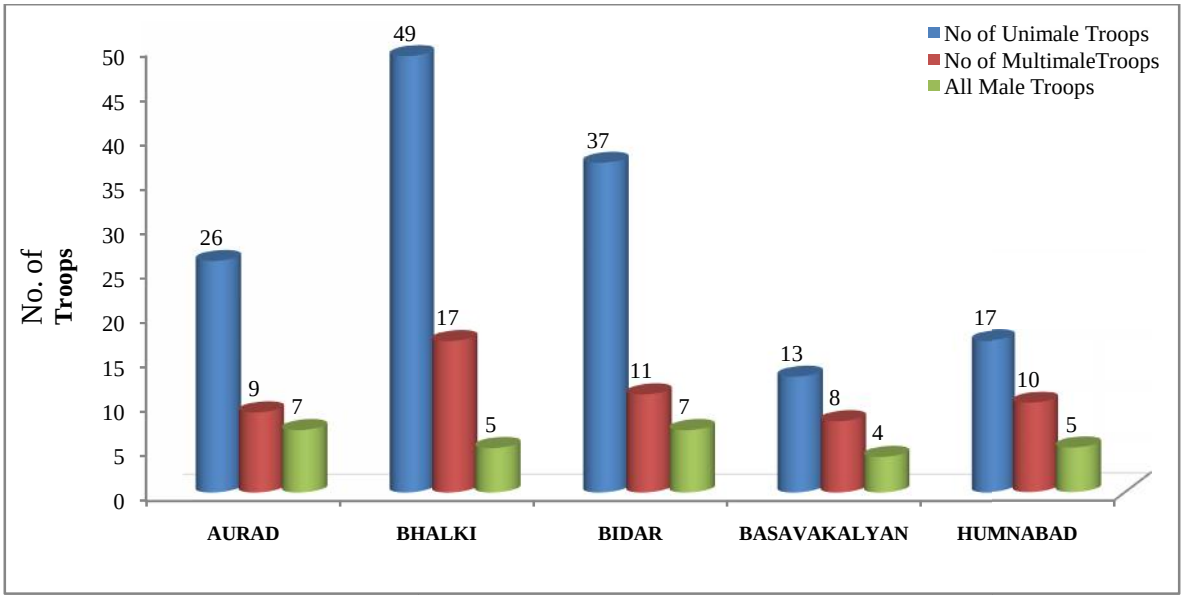


FIGURE 2: Multiple bar diagram represents Number of troops of Hanuman Langurs of Bidar District, Karnataka

TABLE 3: Distribution and social composition of Hanuman Langur (*Semnopithecus entellus)* of Bidar District, Karnataka

Sl.No.	Name of the Taluka	Number of Individuals				Total
		I	J	F	M	
01.	AURAD	189	251	446	157	1043
02.	BHALKI	401	536	993	232	2162
03.	BIDAR	280	365	683	189	1517
04.	BASAVAKALYAN	150	181	302	115	748
05.	HUMNABAD	186	225	368	135	914
TOTAL		1206	1558	2792	828	6384
Mean		241.2	311.6	558.4	165.6	1276.8
SD		101.403	142.684	282.413	46.171	511.31
ANOVA TEST		F= 3.082				
P-Value and Significance		P=0.048	Significant			

Parenthesis - I = Infants, J = Juveniles, F = Adult females, M = Adult male. (P<0.05)

The 225 troops constituting 6384 Hanuman Langurs, yielded at the rate of 1.1696 individuals/sq km. The social composition of Aurad taluka was 189 infants, 251 juveniles, 446 females, and 157 males, Bhalki 401 infants, 536 juveniles, 993 females, and 232 males, Bidar, 280 infants, 365 juveniles, 683 females, and 189 males, Basavakalyan, 150 infants, 181 juveniles, 302 females, and 115 males. Humnabad, 186 infants, 225 juveniles, 368 females, and 135 males (Table – 3, Fig - 3). In Bidar, of the total 6384 individuals, 828 were adult Males, 2792 were adult females, 1558 were juveniles and 1206 were infants (Table – 3, Fig - 3). The study observed that, there was significant difference in social composition of Hanuman Langur among the talukas of Bidar district which is significant at P<0.05. From our study, it is evident that, the population of Hanuman Langurs is not distributed uniformly in Bidar district. A number of factors are responsible for this fact (Table – 2 & 3).

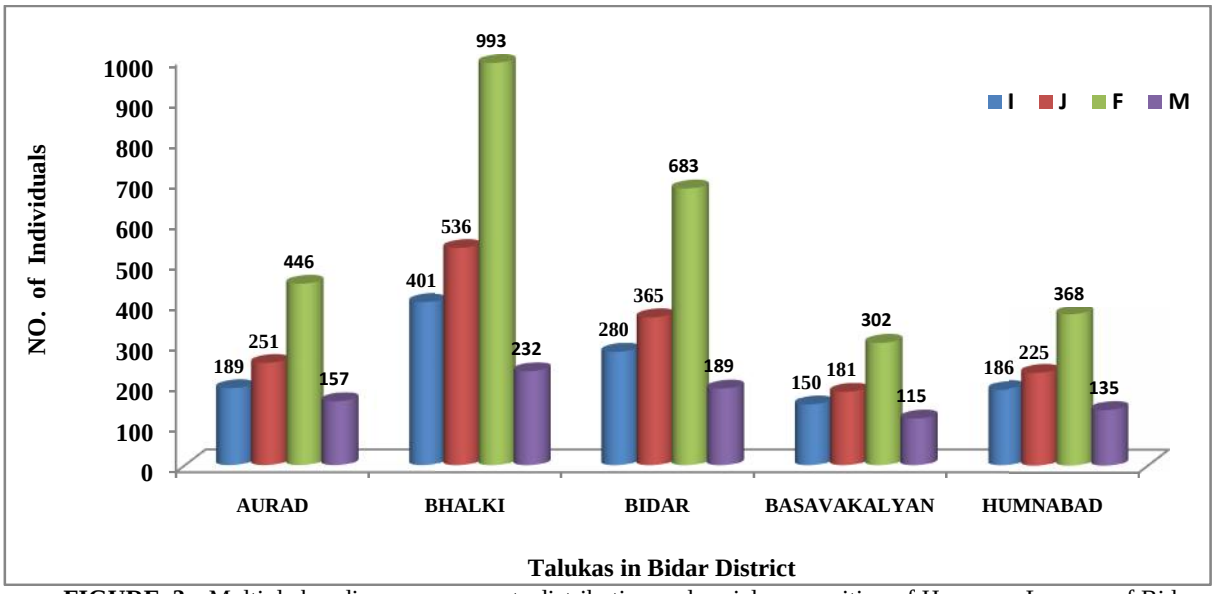


FIGURE 3:- Multiple bar diagram represents distribution and social composition of Hanuman Langurs of Bidar District, Karnataka

TABLE 4: Composition of focal troops- F1, F2, A1, A2, U1 and U2 from January 2012 to December, 2014

Habitat	Focal Troop	Year	Infants	Juveniles	Adult Females	Adult Male	Total	Chi-square test P-value & Significance
Forest	TROOP-F1	2012	5	8	14	1	28	X^2= 1.015,
		2013	7	10	15	1	35	
		2014	8	12	15	1	36	P>0.05,
	TROOP-F2	2012	6	8	14	1	29	
		2013	9	10	16	1	36	NS
		2014	11	13	18	1	43	
Agricultural fields	TROOP-A1	2012	10	13	25	6	54	X^2= 2.23,
		2013	13	14	28	5	60	
		2014	16	17	31	5	69	P>0.05,
	TROOP-A2	2012	8	12	19	3	42	
		2013	9	14	20	2	45	NS
		2014	14	14	22	2	52	
Urban areas	TROOP-U1	2012	5	6	10	1	22	X^2= 1.971,
		2013	8	8	11	1	28	
		2014	10	10	12	1	33	P>0.05,
	TROOP-U2	2012	5	8	10	1	24	
		2013	7	9	12	1	29	NS
		2014	10	12	14	1	37	

(P>0.05), NS= not significant.

It includes the availability of food, roosting trees, agricultural practices, and interference, besides other environmental factors. During the study period we found that the highest number of unimale and multimale troops was in Bhalki and all male were in Bidar. The lowest number of unimale, multimale and all male troops were in Basavakalyan (Table–2). This may be due to more surface water irrigation in Bhalki and Bidar and less surface water irrigation in Basavakalyan taluka (Table-6). This may also be due to greater availability of food plants, high percentage of forest cover and roosting trees. For better understanding of Hanuman Langur activities, out of 225 troops of Bidar (Table -2), six troops living in different habitats were selected as focal troops (Table – 4). The six habitats had uniform climatic conditions but there were variations in biotic factors like agricultural activity,

artificial feeding, traffic and predation. The six focal troops showed increasing trend in Hanuman Langur population. Our study in 2012 covering six focal troops yielded 199 langurs, in 2013 their population increased to 233 with a net gain of 34 individuals, and in 2014, the population reached 270 with an increase of 37 individuals (Table -5). The study on Hanuman Langurs in Bidar, revealed the existence of unimale, multimale and all-male pattern which constitutes langur population in Bidar. Our study reveals that there was no statistically significant difference in focal troop1 and 2 with respect to different years of habitats in forest, agricultural fields and in urban areas ($P>0.05$) ($X^2 = 1.015$).

TABLE 5: Total number of individuals of focal troops in the study Area

Habitat	Focal Troop	Year		
		2012	2013	2014
Forest	Troop – F1	28	35	36
	Troop – F2	29	36	43
Agricultural fields	Troop – A1	54	60	69
	Troop – A2	42	45	52
Urban areas	Troop – U1	22	28	33
	Troop – U2	24	29	37
	Total	199	233	270

TABLE 6: Showing total geographical area, forest cover and surface water irrigation of Bidar in sqkm

Taluka	Total Area	Forest cover		Surface water irrigation in Sqkm			
	In Sqkm	In Sqkm	Percentage	Canal	Tank	Lift irrigation	Total
Aurad	1227.1	23.11	2.88	0	2.88	0.06	2.94
Bhalki	1117.2	25.84	6.74	5.34	1.08	0.26	6.68
Bidar	925.19	46.5	11.91	0	2.55	0.33	2.88
Basavakalyan	1202.97	180.84	4.79	0.50	1.54	0	2.04
Humnabad	987.56	110.14	7.22	0.35	0.45	0	0.8

Table - Source Govt. of India, Central Ground Water Board – 2008

ACKNOWLEDEMENT

The author expresses a deep sense of gratitude to his research supervisor for his able guidance during the research tenure. The President Sharanbasaveshwar Vidya Vardhak Sangh, Kalaburagi and Principal S.S.K. Basaveshwar College of Arts and Science, Basavakalyan & also deserve thanks for permitting me to carry out field study. Dr. Kedarnath M.P., Sri. Kudambal and Dr. Shreeshail Ghooli also deserve thanks for their valuable suggestions and support during the work. The author is also very much thankful to the Chairman Department of Zoology, Gulbarga University, Kalaburagi.

REFERENCES

Akonda, A.W. (1976) Study of population and activity patterns of rhesus monkey *Macaca mulatta Zimmermann*. Unpubl. M.Sc. thesis, Univ. of Dhaka, Dhaka.

Ahsan, M.F. (1984) Study of primates in Bangladesh: determination of population status and distribution of non-human primates in Bangladesh with emphasis on rhesus monkey. Unpubl. M. Phil. thesis, Univ. of Dhaka, Dhaka. 162 pp.

A. Murmu, Chaudhuri, S., Mazumdar, P.C. & Talukder, B. (2004) A Population Survey of Hanuman Langurs in the District Of Birbhum, West Bengal, India Rec. Zool. Surv. India: 107(Part-1): 109-118, 2007.

A. Murmu, Chaudhuri, S., Mazumder, P.C. and Talukder, B. (2004) Status of Assamese Macaque, Macaca Assamensis in Darjeeling District, West Bengal, India Rec. zoo/. Surv. India: 103 (Part 1-2): 33-41.

Anil Kumar Chhangani (2002) Group composition and Sex ratio in Hanuman Langurs (Semnopithecus entellus) in the Aravali Hills of Rajasthan, India Zoos print journal 17(8):848-852

Bhuiyan, M.H.K. (1977) Study of population and activity patterns of rhesus monkey *Macaca mulatta Zimmermann*. Unpubl. M.Sc. thesis, Univ. of Dhaka, Dhaka. 99 pp.

Bishop, N.H. (1978) Langurs living at high altitudes. Journal of the Bombay Natural History Society, 74, 518–520

Bennett, E.L. and Davies, A.G. (1994) The ecology of Asian colobines. In: Colobine Monkeys: Their Ecology, Behavior and Evolution, A. G. Davies and J. F. Oates (eds.), pp.129–172. Cambridge University Press, Cambridge, UK.

Choudhury, A. (1988) Priority ratings for conservation of Indian Primates. Oryx 22:89-94.

Choudhury, A. U. (2007) The eastern limit of distribution of the hanuman langur Semnopithecus entellus dufresene. Journal of the Bombay Natural History Society, 104, 199–200.

Chhangani, A.K. (2000) Eco-behavioral diversity of Langurs (Presbytis entellus) living in different eco systems Ph D, thesis JNV University, Jodhpur

Chalise, M.K. (1995) Comparative study of feeding ecology and behaviour of Honnavalli N. Kumara Æ Shanthala Kumar Æ Mewa Singhmale and female langurs (Presbytis entellus). PhD thesis, Tribhuvan University, Kathmandu

Das-Choudhuri, A.B., Roy, B.N. (1989) A Preliminary note on the survival status of the Hanuman Langur *Presbytis entellus* in some villages of Nadia District, West Bengal. J Bombay Nat Hist. Soc 86:233-235

Dunbar, R. I. M. (1988) Primate Social Systems: Studies in Behavioural Adaptation. Croom Helm, London.

Doc Adimallaiah, Thiyagesan, K. and Gupta, A. K. (2014) Population Status of Phayre's Langur *Trachypithecus phayrei* in Sepahijala Wildlife Sanctuary, Tripura, Northeast India Primate Conservation 28: 159-163.

Fooden, J. (1980) Classification and distribution of living macaques (Macaca Laceped, 1979), In: Lindburg DG (ed) The Macaques: studies in ecology, behavior and evolution. Van Nostrand Reinhold, New York, p 1-9

Ellerman, J.R. & Morrison-Scott, T.C.S. (1966) Checklist of palaearctic and Indian mammals, 1758– 1946 (2nd ed.). London: Trustees of the British Museum (Natural History).

Hrdy, S.B. (1977) The langurs of Abu-female and male strategies of reproduction. Cambridge: Harvard University Press

Kumara, H.N., Mewa Singh, Shanthala Kumar, and Anindya Sinha (2010) Distribution, abundance, group size and demography of dark-bellied bonnet macaque *Macaca radiata radiata* in Karnataka, South India, Current Science, Vol.99, No.5.

Honnavalli, N. Kumara and Mewa Singh (2011) Distribution, status and conservation of primates of the Western Ghats (Commissioned Paper)

Hosur Subbarao Sushma, Rohini Mann, Honnavalli N. Kumara and Arumugam Udhayan (2014)Population Status of the Endangered Lion-tailed Macaque Macaca silenus in Kalakad-Mundanthurai Tiger Reserve, Western Ghats, India Primate Conservation (28): 171−178.

Jay, P.C. (1965) The common langur of north India. In: Primate Behavior: Field Studies of Monkeys and Apes, I. DeVore (ed.), pp.197–247. Holt, Rinehart and Winston, New York.

Kumara, H.N., Kumar, S. & Singh, M. (2010) Of how much concern are the 'least concern' species? Distribution and conservation status of bonnet macaques, rhesus macaques and Hanuman langurs in Karnataka, India. Primates, 51, 37 –42.

Kurup, G.U. (1981) Report on the census surveys of rural and urban populations of non-human primates of South India. Calicut: Zoological Survey of India.

Kurup, G.U. (1981) Report on the census surveys of rural and urban populations of non-human primates of south India. Man and biosphere programme: Project No. 124. Zoological Survey of India, Calicut.

Kurup, G.U. (1984) Census survey and population ecology of Hanuman langur, Presbytis entellus (Dufresne 1797) in south India. Proceedings of the Indian National Science Academy, 50, 245–256.

Khan, M.A.R. (1981) The non-human primates of Bangladesh. Tiger Paper. 8(1): 12-15.

Khan, M.A.R. (1984) Ecology and conservation of the common langur, Presbytis entellus, in Bangladesh. In: Current primate researches. (M.L. Roonwal, S.M. Mohnot & N.S. Rathore, eds.), pp. 33-39. Department of Zoology, University of Jodhpur, Jodhpur. Khan

Kumar, H.N., Singh, M. (2004) Distribution of primates and conservation of *Macaca silenus* in rainforests of the Western Ghats, Karnataka, India. Int J Primatol 25:1001-1018

Chetan Nag, K.S., Pramod, P., Praveen Karanth, K. (2011) Taxonomic Implications of a Field Study of Morphotypes of Hanuman Langurs (*Semnopithecus entellus*) in Peninsular India International Journal of Primatology, Volume 32, Issue 4, pp 830–848

Krishna Kant Tiwari and Mukherjee, R.P. (1992) Population Census of Rhesus Macaque and Hanuman Langur in India-A Status Survey Report Reo. Zooz. Suftj. India, 92 (1-4): 349-369.

Molur, S Brandon-Jones, D, Dittus W. Eudey, A. Kumar A. Singh M., Feroz M.M., Chalise, M., Priya, P., Walker, S. (2003) Status of South Asian Primates; conservation assessment and management plan (C.A.M.P.) workshop report, 2003, Zoo Outreach Organization/CBSG-South Asia, Coimbatore

Mohnot, S.M. (1974) Ecology and behavior of the common Indian langur, Presbytis entellus. PhD thesis, University of Jodhpur, Jodhpur.

Mohammed Asif & Sanjeevareddy Modse (2016) The distribution Pattern and population of Blackbuck Antelope Cervicappa Linnaeus in Bidar, Karnataka, Indian Forester, 141(10); 965-970.

Napier, J.R. & Napier, P.H. (1967) A handbook of living primates. London: Academic Press.

Oppenheimer, J.R. (1977) Presbytis entellus, the Hanuman langur. In: Rainer, H.S.H. and Bourne, G.H. (eds.): Primate Conservation. Academic Press, New York, 469-512 .

Oates, J.F., Davies, A.G. & Delson, E. (1994) The diversity of living colobines. In A. G. Davies & J. F. Oates (Eds.), Colobine monkeys: Their ecology, behavior and evolution (pp. 45–73). Cambridge: Cambridge University Press.

Prater, S.H. (1993) The Book of Indian animals, 4th impression. Bombay Natural History Society, India, Bombay.

Roonwal, M.L. and Mohnot, S.M. (1977) Primates of South Asia: Ecology, Sociobiology, and Behavior. Harvard University Press, Cambridge, Massachusetts

Roonwal, M.L. (1984) Tail form and carriage in Asian and other primates, and their behavioral and evolutionary significance. In M. L. Roonwal, S. M. Mohnot, & N. S. Rathore (Eds.), Current primate research (pp. 93–151). Jodhpur, India: Jodhpur University Press.

Rajpurohit, L.S. (1987) Male social organization in Hanuman langur (Presbytis entellus). PhD thesis, University of Jodhpur, Jodhpur.

Rajpurohit, L.S. and Sommer, V. (1993) Juvenile male emigration from natal one-male troops in Hanuman langurs. In: Juvenile Primates: Life History, Development, and Behavior, M. E. Pereira and L. A. Fairbanks (eds.), pp.86 –103. Oxford University Press, New York.

Ross, C. Srivastava A. Pirta, R.S. (1993) Human influences on the population density of hanuman Langurus *Presbytis entellus* and rhesus macaques *Macaca mulatta* in Shimla, India. Biol Conserva 65:159-163.

Schuelke, O. (1998) Bachelors and harem males: A comparison of feeding and ranging behavior in adult langur males (*Presbytis entellus*) at Jodhpur Rajasthan, India. Folia Primatol. 69(4): 220. (Abstract)

Sing, M., Rao, N. (2004) Population dynamics and conservation of commensal bonnet macaques, Int J Primatol 25:847-859.

Simonds, P.E. (1965) The bonnet macaque in south India. In: De Vore I (ed) Primate behavior: field studies of monkeys and apes. Winehart and Winston, New York, Holt, pp 175-196

Southwick, C.H. & Siddiqi, M.R. (1968) Population trends of rhesus monkeys in villages and towns of northern India 1959 to 1965. J. Anim. Ecol. 37: 199-204.

Southwick, C.H. & Siddiqi, M.R. (1961a) Population survey of rhesus monkeys northern India: II Transportation routes and forest areas 1959 to 1965. J.Ecol. 42 : 698-710.

Srivastava, A. (1989) Feeding ecology and behavior of Hanuman langur, Presbytis entellus. PhD Thesis. University of Jodhpur, Jodhpur.

Srinivasulu, C. & Nagulu, V. (2001) Status of primates in Andhra Pradesh. Envis Bulletin: Wildlife and Protected Areas, 1(1), 109–112.

Sugiyama, Y. (1964) Group composition, population density and some sociological observations of hanuman langurs (*Presbytis entellus*). Primates 5: 7-37.

Sugiyama, Y., Parthasarathy, M.D. (1978) Population change of the Hanuman langur (presbytis entellus), 1961-1976, in Dharwar area, India. I. Bombay Nat Hist Soc 75:860-867.

Sugiyama, Y., Yoshiba, K. and Parthasarathy, M.D. (1965) Home range, mating season, male group and intertroop relations in hanuman langurs (Presbytis entellus). Primates 6: 73 –106.

Sugiyama, Y. (1966) An artificial social change in a hanuman langur troop (Presbytis entellus). Primates 7: 41-72. Sugiyama, Y. 1967. Social organisation of hanuman langurs. In: Social communication among primates (S.A. Altmann, ed.), pp. 221-236. The Chicago University Press, Chicago.

Vogel, C. (1971) Behavioral differences of Presbytis entellus in two different habitats. In: Proceedings of the Third International Congress of Primatology, Vol. 3. Behavior, H. Kummer (ed.), pp.41– 47. S. Karger, Basel

Wolfheime, J.H. (1983) Primates of the world. Distribution, abundance and conservation. University of Washington Press, Seattle.

Yuimaru Sugiyama, M.D., Parthasarathy A Brief account of the social life of hanuman langurs Proc. natn. Inst. Sci, India. Vol, 35. B Plate. XXI.