

Socio-ecology of Two Species of Non-Human Primates, Rhesus Monkey (*Macaca mulatta*) and Hanuman Langur (*Semnopithecus entellus*), in Shimla, Himachal Pradesh

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ABSTRACT Niche construction by some non-human primates, adjacent to or amidst the human habitat has led to a fierce competition between man and monkey. We assessed various socio-ecological parameters of two non-human primates in the 25 municipal wards of Shimla. In addition human influence and demographic features of the two species of monkeys were quantified in this study area. In all, 49 rhesus monkey and 14 Hanuman langur groups were counted in 22.07 km² of Municipal Corporation Shimla. The density of rhesus monkeys was 37.02 individuals/km², but it was 14.54 individuals/km² for the Hanuman langurs. Most of the rhesus monkey groups were habituated and routinely commensal with human population; though the langurs have also become habituated to humans, none of them were commensal.

INTRODUCTION

All over the world primates are under varying degrees of human influence which is affecting the population status and behavior of these species (Hill 2000; Lee and Priston 2005; Scott and Lockard 2006; Plumptre and Cox 2006; Mittermeier et al. 2007; Eudey 2008; Hanya et al. 2008; Isabirye-Basuta and Lwanga 2008; Mori et al. 2008; Nahallage et al. 2008; Struhsaker 2008; McCarthy et al. 2009; Pirta 2009). However, for long there is an assumption that a moderate level of human influence is conducive to the proliferation of macaques (Teas 1978; Bishop et al. 1981; Rawlins and Kessler 1986), perhaps this may be the case in Shimla, Himachal Pradesh, where the rhesus macaques thrive in the urban area (Camperio-Ciani 1986; Ross et al. 1993; Pirta et al. 1997). In addition, rhesus monkeys are regarded as the incarnation of monkey god Hanuman due to which they are protected, worshipped and provisioned (Jolly 1985; Medhi et al. 2007; Choudhury 2008). Under such conditions the macaque population is likely to increase. This hypothesis finds support in a current report of the forest department indicating an increase of rhesus macaque population in the state of Himachal Pradesh as well as in its capital at Shimla (Gulati and Sood 2003). Considering previous reports and sporadic trapping of monkeys in Shimla (Kumar 1992; Pirta et al. 1997; Sahoo 1993), this increase is alarming and raises important

questions. It has a political nuance, which is apparent from two important documents on this issue: a report prepared by primatologists Mohnot and Chhangani (2005), and a booklet compiled by Bhureta (2006) on behalf of a voluntary organization, the Himachal Gyan Vigyan Samiti, conceptualizing rhesus monkeys as 'menace' and recommending its eradication through unethical measures.

The human-monkey conflict is a pervasive phenomenon (Hill 2000; Imam and Yahya 2002; Lee and Priston 2005; Estrada 2006; Sprague and Iwasaki 2006; Berman et al. 2007; Marchal and Hill 2009), and the issue was highlighted much earlier by Pirta and Gadgil (1988) in the context of western Himalayas. Primarily two factors were reported to affect non-human primates in this region: social and ecological. The social factors included changing attitudes of people, traditional subsistence habits, change in economic value, and the paradox of not being a wild animal. The ecological factors included destruction of natural habitat, isolation of forest areas, monoculture plantation, agriculture and horticulture expansion, spatial constraints in rural and urban areas, artificial feeding, and ecological imbalance. Therefore, the factual information pertaining to socio-ecology and the nature of human-monkey interaction is important in planning conservation and management strategies. While the findings on the latter issue are part of Chauhan and Pirta (2010), this paper is on the socio-ecology of two species of

monkeys in various wards of the Municipal Corporation Shimla to ascertain the magnitude of threat particularly due to human influence on the two types of monkeys.

METHODOLOGY

Study Area

The town of Shimla lies between 31° 6' N latitude and 77° 13' E longitude and its average elevation is 2206 meter above sea level. It is under the jurisdiction of the Municipal Corporation Shimla, and consists of 25 wards with an area of 22.07 km², including the recently merged areas of Dhalli, New Shimla, and Totu (see Municipal Corporation Shimla 2010). The Municipal Corporation Shimla was established in 1815 for the provision of infrastructure for 25,000 people, in 2001 the population was 142,555 (Table 1), and is likely to be 235,970 in the 2011. There are in addition more than 76,000 heads of floating population in this town. Though in future the area is likely to be a huge one (99.50 km²) by the

inclusion of Ghanahatti, Kufri and Shoghi, and will have 61 per cent of forest cover, the emphasis will be more upon urbanization. An introduction to the monkey population of Shimla and its habitat is available in Camperio-Ciani (1986); Ross et al. (1993) and Pirta et al. (1997).

Measures

The socio-ecology of two species of non-human primates was studied by using a "Monkey Population Survey Inventory" (Pirta 1990; Pirta et al. 1997). It consisted of fifteen items with four options for each. The first two items included the sighting cue and activity of the group, the other seven comprised the habitat features (water source, forested land, forest disturbances, forest status, rural land, rural land ownership, and urban land), the human influence (feeding strategy, habituation to humans, harassment of monkeys, and man-made hazards) was noted on the next four items, and the last two items measured the demographic characteristics (group count and group composition).

Table 1: The human (Census of India 2001) and non-human primate populations inside the Municipal Corporation Shimla (present survey in May-June 2008).

S. No.	MunicipalWards	No. of Households	Humans	Rhesus monkeys	Hanuman langurs
1	Bharari	1001	4311	60	26
2	Ruldu Bhatta	1575	6329	13	0
3	Kaithu	1125	4621	36	33
4	Annadale*	1346	5175	0	0
5	Summerhill	1272	5058	47	19
6	Totu	2246	7154	26	0
7	Boileauganj	1998	7208	58	34
8	Tuti Kandi	1261	4596	7	38
9	Nabha	1264	4819	27	0
10	Phagli	1137	4558	29	0
11	Krishna Nagar	1404	5899	51	0
12	Ram Bazaar	963	4228	23	0
13	Mall Road	1182	4975	49	18
14	Jakhoo	883	3292	111	30
15	Banmore	1273	5156	102	0
16	Engine Ghar	1307	5119	35	0
17	Sanjauli	1436	5395	12	27
18	Dhali	1381	5063	16	30
19	Chamyana*	2200	7040	0	0
20	Malyana**	2069	7003	0	0
21	Kasumpti	2016	7425	11	0
22	Chhota Shimla	1000	4292	58	0
23	Pateyog	3195	11418	7	0
24	Khalini	1873	7249	17	22
25	Kanlog	1349	5172	22	44
Total		37756	142555	817	321

Note: *Local people informed presence of monkeys in Annadale and Chamyana;

**Neither people nor investigators sighted monkeys in Malyana.

Procedure

The information on socio-ecology of two species of monkeys namely rhesus monkey (*Macaca mulatta*) and Hanuman langur (*Semnopithecus entellus*) was collected during May and June 2008 from all the 25 wards of Shimla (Table 1). For this purpose, the investigator utilized quadrant method of population survey (Altman et al. 1981). The investigator used the map of the area under Municipal Corporation Shimla. This map was divided into grids of 250 cm² roughly equivalent to 250 m² on land. Four quadrants were chosen from each ward for socio-ecological survey. In each ward, a transect line was chosen, which was a road or pathway. The observer walked on the transect line and counted 436 steps, covering a linear distance of 250 m (based on previous trials), and by glancing about 125 m on the right and 125 m on the left side for noting the socio-ecological characteristics. In this way a strip of approximately 250 m X 250 m was surveyed in each ward; since four quadrants were chosen in a ward, thus an area of about 0.25 km² was surveyed per ward, and there were 25 wards so 6.25 km² in all.

On locating a group, its count was taken according to age-sex class of individuals. Effort was made to ascertain the presence or absence of monkeys in a quadrant by inquiring people also. The number of monkeys per square kilometer (density) was calculated by adding all the monkeys counted and dividing it by the total area (22.07 km²). The demographic characteristics included: population, groups, average group size, and group composition (adult males, adult females, juveniles and infants). The habitat features and human influence were assessed for all the 25 wards of Municipal Corporation Shimla. The score for these socio-ecological aspects was the percentage of presence/absence of a feature (e.g., Harassment of monkeys: Undisturbed %; Minimal %; Occasion specific %; Intense %).

RESULTS

The results obtained on the socio-ecology of the two species of monkeys provide important information on the habitat features of the 25 wards of Municipal Corporation Shimla, the factors detrimental to the growth of these monkeys, and their demographic characteristics. The main features of the habitat are given in table 2.

Macaques and langurs were mostly seen (68%) drinking polluted water from drainage channels of the city, which was particularly the case in Kaithu, Totu, Phagli, Krishna Nagar, Ram Bazaar, and Engine Ghar. The forest cover in the Municipal Corporation of Shimla was sighted in 75% cases, suggesting that most of the wards had vegetation, except Ram Bazaar, and Mall Road, which were typical bazaars and the forest was in depleted state in Annadale, Boileauganj, Chamyana, Malyana and Pateyog.

The human influence on the rhesus monkeys and Hanuman langurs in the hilly terrain of Shimla has been favorable for the growth of these species, but its intensity is on an increase (Table 3). In Shimla, the rhesus monkeys were largely sighted taking provisioned food (77.01%) whereas the Hanuman langurs depended less on it (45%). Most of the macaque groups were habituated and routinely commensal, on the other

Table 2: The main features of the habitat of monkeys

Main Feature of Habitat	Percentage
<i>Water Source</i>	
River/ Stream	1
Lake/Pond	3
Tap water	28
Polluted water	68
<i>Forested Land</i>	
Protected forest	0
Sacred forest	1
Unprotected forest	29
Other forest	45
<i>Forest Disturbance</i>	
Commercial timber extraction	1
Shifting cultivation	6
Grazing/Lopping	12
Commercial plantation	8
<i>Forest Status</i>	
Dense	28
Depleted	32
Forest edge	13
Regenerating forest	1
<i>Rural Land</i>	
Village	4
Agricultural field	4
Road side	1
Others	0
<i>Rural Land Ownership</i>	
Modern farmer	0
Traditional farmer	8
Tribal farmer	0
Common land	1
<i>Urban Land</i>	
Temple /Village/Cities	33
Bazaars	35
Outskirts of Cities/Town	23
Others	0

Table 3: Human influence on rhesus monkeys and Hanuman langurs.

<i>Factors</i>	<i>Categories</i>	<i>Rhesus monkey</i>	<i>Hanuman langur</i>
<i>Feeding Strategy</i>	Natural	9.19%	50%
	Crop raiding	4.59%	5%
	Scavenging/Provisioned	77.01%	45%
	Snatching/Stealing	9.19%	0%
<i>Habituation to Humans</i>	Wild	0%	0%
	Semi-habituated	16.09%	25%
	Habituated	35.63%	75%
	Habituated and routinely commensal	48.28%	0%
<i>Harassment of Monkeys</i>	Undisturbed	0%	0%
	Minimal	6.89%	35%
	Occasion specific	32.18%	60%
	Intense	60.91%	5%
<i>Man-made Hazards</i>	No Hazards	0%	0%
	Partial	9%	9%
	Sufficient	58%	58%
	Extreme	33%	33%

hand, though the langurs have become habituated to humans, none of them were commensal. While the rhesus monkeys were seen snatching and stealing food from humans, none of the langurs were engaged in these behaviors. The rhesus monkeys faced intense harassment (61%) whereas it was rare for langurs (5%). The man-made hazards of sufficient level were present in all the wards for the two species.

In all we located 87 groups of macaques and 20 groups of langurs mainly by visual cues, of these, 49 and 14 groups, respectively, were counted, and their demographic parameters are given in table 4. A population of 817 rhesus monkeys and 321 Hanuman langurs lived in the 22.07 km² of Municipal Corporation Shimla. Out of the twenty-five wards, the rhesus monkeys were found in twenty-four, one ward Chamyana did not have monkeys (Table 1). On the other hand, the Hanuman langurs were seen only in half of the wards having green canopy.

DISCUSSION

Our study area had some unique socio-ecological characteristics. Although it was largely urban, there was considerable forest cover. And thus, it provided good habitat for an omnivore macaque (Jolly 1985) and the folivore Hanuman langur (Brandon-Jones 2004). At the same time, the habitat at Shimla was full of man-made hazards. Monkeys were drinking polluted water and feeding from garbage. Above all, the growing human population, from 142,555 in 2001 to projected 235,970 in 2011 (Municipal Corporation Shimla 2010) was likely to intensify the

competition between man and monkey for food and space. Though the inclusion of Ghanahatti, Kufri and Shoghi would increase the area of Municipal Corporation Shimla enormously (from 22.07 km² to 99.50 km²), with marginal increase in human population but with more than 60 per cent increase in forest cover, the emphasis will be on urbanization. It is unlikely that the urban monkeys would prefer to take refuge in the forest area (Pirta et al. 1997; Eudey 2008; Isabirye-Basuta and Lwanga 2008), and may require behavioral strategies of co-existence (Fuentes 2006; Sprague and Iwasaki 2006; Medhi et al. 2007; McCarthy et al. 2009).

The results obtained on human influence revealed that rhesus monkeys were more in conflict with humans than the langurs. The feeding strategy of rhesus monkeys was mostly scavenging but they received provisioned food as well, they were also engaged in stealing and snatching behavior. They were mostly habituated and routinely commensal and thus harassed by humans. In contrast, the Hanuman langurs fed from natural resources, and were engaged in scavenging to lesser extent; as a result their harassment was occasion specific. Various field studies in Shimla have reported this trend (Camperio-Ciani 1986; Kumar 1988, 1992; Pirta et al. 1997; Ross et al. 1993; Sahoo 1993). The abundance of food and its quality in the human habitats are important factors affecting the behavior of non-human primates (Hill 2000; Scott and Lockard 2006; Eudey 2008; Hanya 2008; Nahallage 2008).

In our survey, 49 groups of rhesus monkeys were counted in 22.07 km² of Shimla with 817 animals, including 117 adult males, 251 adult

Table 4: Demographic characteristics of rhesus monkey (n = 49) and Hanuman langur (n = 14) groups living in 22.07 km² of the Municipal Corporation Shimla.

		<i>Rhesus Monkey (n = 49 groups)</i>			
<i>Group Size</i>		<i>Group Composition</i>			
		<i>Adult Males</i>	<i>Adult Females</i>	<i>Juveniles</i>	<i>Infants</i>
Mean	16.65	2.39	5.12	4.92	4.24
SD ($\pm$)	6.95	1.03	2.41	2.22	2.29
Range	6-38	1-5	2-10	1-11	1-11
Total no. of Individuals	817	117	251	241	208
Adult Sex-ratio (male : female)	01:02.1				
Density (In 22.07 km ²)	2.22 groups/km ² 37.02 individuals/ km ²				
		<i>Hanuman Langur (n = 14 groups)</i>			
<i>Group Size</i>		<i>Group Composition</i>			
		<i>Adult Males</i>	<i>Adult Females</i>	<i>Juveniles</i>	<i>Infants</i>
Mean	22.93	2.14	7.78	7	6
SD ($\pm$)	8.13	0.74	3.25	3.93	2.03
Range	11-38	1-3	3-13	2-14	2-9
Total no. of Individuals	321	30	109	98	84
Adult Sex-ratio (male : female)	01:03.6				
Density (In 22.07 km ²)	0.63 groups/km ² 14.54 individuals/ km ²				

females, 241 juveniles and 208 infants. Whereas, earlier, in this town, Pirta et al. (1997) counted 18 groups of rhesus monkeys with 747 individuals comprising of 96 males, 238 females, 282 juveniles, and 131 infants. Later, the forest department reported 61 groups with 720 rhesus monkeys having 199 males, 336 females and 185 infants (Gulati and Sood 2003). A conspicuous observation is that despite frequent trapping and translocation of rhesus monkeys, the macaque population is more or less thriving in Shimla. But its consequences are perhaps reflected in the social structure, the fragmentation in groups, note the alarming increase in the number of groups and decrease in the group size. In our present survey the average group size of 16.65 individuals in 2008 is much lower from the 41.50 individuals in 1990 of our previous survey (Pirta et al. 1997). These demographic changes have implications for theory and conservation (Struhsaker 2008), particularly documented in reports on infant mortality (Camperio-Ciani 1986; Berman et al. 2007; Casar et al. 2008; Hanya et al. 2008).

We counted 14 groups of Hanuman langurs in 22.07 km² of Shimla with 321 animals including 30 adult males, 109 adult females, 98 juveniles and 84 infants. No survey was conducted by the

forest department in Shimla, however, 13 groups of langurs with the population size of 528 were located in an earlier survey (Kumar 1992; Pirta et al. 1997). This comprised of 28 males, 189 females, 186 juveniles, and 125 infants. Although it suggests a decrease in Hanuman langur population, we are hesitant to make this conclusion. Perhaps our present counts of langur are on lower side, census of langurs requires greater effort and time as they prefer forest canopy. In our previous survey the langurs groups were followed over three years, moreover there is no report on its trapping. There are several studies which provide comparable data on the habitat and demographic features of langurs in Himalayas (Pirta 1993; Mohnot and Chhangani 2005; Choudhury 2008; Kumar and Solanki 2008; Sayers and Norconk 2008), and there is apprehension that the Hanuman langur, like other primates, may also engage in direct conflict with humans due to loss of forest cover (Ross et al. 1993; Isabirye-Basuta and Lwanga 2008; Struhsaker 2008).

Our brief survey suggests that the population of rhesus macaques have proliferated in Shimla along with its urbanization. Although they have become habituated and routinely commensal to humans, these macaques received intense harass-

ment. It was also noted that the Hanuman langurs were also becoming habituated to humans and were often seen consuming provisioned food, however they relied more on the rich oak forest of Shimla. The man-made hazards for the two species of monkeys in Municipal Corporation Shimla were present over all the twenty-five wards, and are likely to become extreme in intensity. Lastly, in our view, the conservation of rhesus monkeys and Hanuman langurs which are biologically, socially, and spiritually associated with the people (Pirta 2009) requires an approach of coexistence guided by interdependent nature of the universe (Naess 1986; Ehrlich and Kennedy 2005; Sprague and Iwasaki 2006; Mittermeier et al. 2007).

REFERENCES

- Altman NH, Brackett BG, Goy RG, Marriot BM, New AE, et al. 1981. *Techniques for the Study of Primate Population Ecology*. Washington D.C.: National Academy Press.
- Berman CM, Li J, Ogawa H, Ionica C, Yin H 2007. Primate tourism, range restriction, and infant risk among *Macaca thibetana* at Mt. Huangshan, China. *Int J Primatol*, 28: 1123-1141.
- Bhureta OP 2006. Manav aur jangli janvaron ke beech takrav: Himachal Vigyan Samiti ka kheti bachao abhiyan. Shimla: Himachal Gyan Vigyan Samiti.
- Bishop N, Blaffer-Hrdy SB, Teas J, Moore J 1981. Measures of human influence in habitats of south Asian monkeys. *Int J Primatol*, 2(2): 153-167.
- Brandon-Jones D 2004. A taxonomic revision of the langurs and leaf monkeys (Primates: Colobinae) of south Asia. *Zoos' Print Journal*, 19: 1552-1594.
- Camperio-Ciani A 1986. Intertroop agonistic behavior of a feral rhesus macaque troop ranging in town and forest areas in India. *Aggr Beh*, 12: 433-439.
- Casar C, Franco ES, Soares, GCN, Young RJ 2008. Observed case of maternal infanticide in a wild group of black-fronted titi monkeys (*Callicebus nigrifrons*). *Primates*, 49: 143-145.
- Chauhan A, Pirta RS 2010. Agonistic interactions between humans and two species of monkeys (Rhesus Monkey *Macaca mulatta* and Hanuman Langur *Semnopithecus entellus*) in Shimla, Himachal Pradesh. *J Psychol*, In Press.
- Choudhury A 2008. Primates of Bhutan and observations of Hybrid langurs. *Primate Conserv*, 23: 65-73.
- Ehrlich PR, Kennedy D 2005. Millennium assessment of human behavior. *Science*, 309: 562-563.
- Eudey AA 2008. The crab-eating macaque (*Macaca fascicularis*): Widespread and rapidly declining. *Primate Conserv*, 23: 129-132.
- Estrada A 2006. Human and non-human co-existence in the neotropics: A preliminary view of some agricultural practices as a complement for primate conservation. *Ecol Env Anthropol*, 2: 17-24.
- Fuentes A 2006. Human-nonhuman primate interconnections and their relevance to anthropology. *Ecol Env Anthropol*, 2: 1-4.
- Gulati, AK, Sood S. 2003. *An action plan for control and management of common monkeys (rhesus macaques) for Shimla town, Kalka-Shimla National Highway and Rampur Town of Shimla District Wildlife Wing Himachal Pradesh Forest Department*, Shimla, H.P., India.
- Hanya G, Matsubara M, Hayaishi S, Zamma K, Yoshihiro S, et al. 2008. Food conditions, competitive regime, and female social relationships in Japanese macaques: within-population variation on Yakushima. *Primates*, 49: 116-125.
- Hill CM 2000. Conflict of interest between people and baboons: Crop raiding in Uganda. *Int J Primatol*, 21: 299-315.
- Imam E, Yahya HSA 2002. Management of monkey problem in Aligarh Muslim University, Uttar Pradesh. *Zoos' Print Journal*, 17: 685-687.
- Isabirye-Basuta GM, Lwanga JS 2008. Primate populations and their interactions with changing habitats. *Int J Primatol*, 29: 35-48.
- Jolly A 1985. *The Evolution of Primate Behavior*. New York: McMillan.
- Kumar A, Solanki GS 2008. Population status and conservation of capped langurs (*Trachypithecus pileatus*) in and around Pakke Wildlife Sanctuary, Arunachal Pradesh, India. *Primate Conserv*, 23: 97-105.
- Kumar P 1988. *Population Survey of Rhesus macaques (Macaca mulatta) and Hanuman langurs (Presbytis entellus) in Himachal Pradesh*. M. Phil. Dissertation, Unpublished. Shimla: Himachal Pradesh University.
- Kumar P 1992. *Ecology and Behaviour of Rhesus macaques (Macaca mulatta) and Hanuman langurs (Presbytis entellus) in Shimla*. Ph. D. Thesis, Unpublished. Shimla: Himachal Pradesh University.
- Lee PC, Priston NEC 2005. Human attitudes to primates: Perceptions of pests, conflict and consequences for primate conservation. In: JD Patterson, J Wallace (Eds.): *Primate-human Interaction and Conservation*. Alberta: American Society of Primatologist Publications, pp. 1-23.
- Marchal V, Hill C, 2009. Primate crop-raiding: A study of local perceptions in four villages in north Sumatra, Indonesia. *Primate Conserv*, 24: Published electronically prior to print publication (Dec. 2008).
- McCarthy MS, Matheson MD, Lester JD, Sheeran LK, Li J, Wagner S 2009. Sequences of Tibetan macaque (*Macaca thibetana*) and tourist behaviors at Mt. Huanshan, China. *Primate Conserv*, 24: Published electronically prior to print publication (July 2009).
- Medhi R, Chetry D, Basavdatta C, Bhattacharjee PC 2007. Status and diversity of temple primates in northwest India. *Primate Conserv*, 22: 135-138.
- Mittermeier RA, Ratsimbazafy J, Rylands AB, Williamson L, Oates JF, et al. 2007. Primates in peril: The world's 25 most endangered primates, 2006-2008. *Primate Conservation*, 22: 1-40.
- Mohnot SM, Chhangani AK 2005. *Monkey menace in Himachal Pradesh*. Jodhpur: Primate Research Centre (PRC).
- Mori A, Yamane A, Sugiura H, Shotake T, Boug A, Iwamoto T 2007. A study on the social structure and dispersal patterns of hamadryas baboons living in a commensal group at Taif, Saudi Arabia. *Primates*, 48: 179-189.

- Municipal Corporation Shimla 2010. <http://shimlamc.gov.in/page/CDPChap7.aspx> and <http://shimlamc.gov.in/page/CDPChap4.aspx> (Downloaded 20 February 2010).
- Naess A 1986. Intrinsic value: Will the defenders of nature please rise? In: ME Soule (Ed.): *Conservation Biology: The Science of Scarcity and Diversity*. MA: Sinauer Associates, pp. 504-515.
- Nahallage CAD, Huffman MA, Kuruppu N, Weerasingha T 2008. Diurnal primates in Sri Lanka and people's perception of them. *Primate Conserv*, 23: 81-87.
- Pirta RS 1990. Cooperation in urban macaques and langurs. New Delhi: Department of Science and Technology, Government of India.
- Pirta RS 1993. Imperilled western Himalaya and deteriorating man-nature relationship: A case study of Hanuman langur. In: V Singh (Ed.): *Eco-crisis in the Himalaya*. Dehra Dun: International Book Distributors, pp. 165-205.
- Pirta RS 2009. Biological and ecological bases of behaviour. In: G Misra (Ed.): *Psychology in India Volume 1: Basic Psychological Processes and Human Development*. Delhi: Pearson, pp. 1-67.
- Pirta RS, Gadgil M 1988. *Problems and Approaches in the Conservation of Non-Human Primates with Particular Reference to Western Himalaya*. Bangalore: Center for Ecological Sciences, Indian Institute of Sciences.
- Pirta RS, Gadgil M, Kharshikar AV 1997. Management of the rhesus monkey *Macaca mulatta* and Hanuman langur *Presbytis entellus* in Himachal Pradesh, India. *Biol Conserv*, 79: 97-106.
- Plumptre AJ, Cox D 2006. Counting primates for conservation: primate surveys in Uganda. *Primates*, 47: 65-73.
- Rawlins RG, Kessler MJ 1986. Demography of the free-ranging Cayo Santiago macaques (1976-1983). In: RG Rawlins, MJ Kessler (Eds.): *The Cayo Santiago Macaques: History, Behavior and Biology*. Albany: State University of New York Press, pp. 46-72.
- Ross C, Srivastava A, Pirta RS 1993. Human influences on the population density of Hanuman langurs *Presbytis entellus* and rhesus macaques *Macaca mulatta* in Shimla, India. *Biol Conserv*, 65: 159-163.
- Sahoo SK 1993. *Agonistic Behaviour of Rhesus monkeys (Macaca mulatta) and Hanuman langurs (Presbytis entellus) in Shimla*. Ph. D. Thesis, Unpublished, Shimla: Himachal Pradesh University.
- Sayers K, Norconk A 2008. Himalayan *Semnopithecus entellus* at Langtang National Park, Nepal: Diet, activity patterns, and resources. *Int J Primatol*, 29: 509-530.
- Scott J, Lockard JS 2006. Captive female gorilla agonistic relationships with clumped defendable food resources. *Primates*, 47: 199-209.
- Sprague DS, Iwasaki N, 2006. Coexistence and exclusion between humans and monkeys in Japan: Is either really possible? *Ecol Env Anthropol*, 2: 30-43.
- Struhsaker TT 2008. Demographic variability in monkeys: Implications for theory and conservation. *Int J Primatol*, 29: 19-34.
- Teas J 1978. *Behavioral Ecology of Rhesus Monkeys (Macaca Mulatta) in Kathmandu, Nepal*. Ph. D. Dissertation, Unpublished. Baltimore, Maryland: Johns Hopkins University.