Research Paper

Population density of rhesus monkey, *Macaca mulatta* (Zimmermann, 1780) in saraswati plantation wildlife sanctuary in district Kurukshetra, Haryana (India)

*Ajay Kumar[1] and Kadian Anita[2]
[1]Department of Zoology, Kurukshetra University, Kurukshetra-136119, Haryana, INDIA
[2]Forensic Science Laboratory, Madhuban, Karnal - 132 001, Haryana, INDIA

Abstract

Line transect method was used during study period from February, 2008 to January, 2009 to record population density of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India). During monthly periodic visits average population density/Km^2 of sighted rhesus macaques varied from a minimum of 90.27 individuals/Km^2 (July, 2008, December, 2008) to a maximum of 183.33 individuals /Km^2 (April, 2008) with an average of 132.63±5.95 individuals/Km^2 were recorded in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India). Seasonal variation in average population density/Km^2 of sighted rhesus macaques varied from a minimum of 354.16 individuals/Km^2 (winter season) to a maximum of 476.38 individuals/Km^2 (summer season) were recorded from the study period in Saraswati Plantation Wildlife Sanctuary. No significant difference (p≤0.05) in average population density of sighted individuals of all males, all females, juveniles and infants in different seasons were recorded in Saraswati Plantation Wildlife Sanctuary of district Kurukshetra, Haryana (India). Conflicts with man and his pets (domestic dog, *Canis familiaris*), habitat destruction through illegal felling, less numbers of fruit trees and shifting of rhesus macaques for feeding in particular day, *i.e.,* Tuesday and Friday as well as in particular season nearby agricultural areas, villages areas and Hanuman Mandir (a holy temple) were the major reasons in monthly as well as seasonally variation in population density of Rhesus Macaques, *Macaca mulatta* in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India).

Keywords: Rhesus Monkey, Sanctuary, Haryana, Population Density, Seasonal Variation, Stress Factors.

Introduction

Among mammals, primates are the most complex creatures which appeared on the planet Earth around 63 million years ago in Eocene period of Coenozoic Era[17]. This group consists of limurs, lorises, monkeys, apes and their relatives including human creatures[1]. Primates are classified in two major streams, viz., Prosimii (primitive primates such as lemurs, tarsiers and lorises) and Anthropoidea (advance primates such as monkeys, apes and humans)[7]. Rhesus Monkey (*Macaca mulatta*) and Bonnet Monkey (*Macaca radiata*) are the old world monkeys. Rhesus Monkey is mostly distributed in Afghanistan, Bangladesh, Bhutan, Cambodia, China, India, Loas, Myanmar, Nepal, Pakistan, Thailand and Vietnam[20,22]. The mega biodiversity country, India supports eight species

of macaques from out of the total ten species of macaques occur in South Asia[22]. In India, rhesus monkey thrive in 8 diverse habitats namely, temples, urban, villages, village-cum-pond, pond, roadside, canal side and forest having varying degrees of human interactions[22]. In urban areas of India, they are found on roadside, in railway stations, villages, towns and temples[19]. Primate populations are being reduced or eliminated in many parts of the world due to habitat destruction, competition for food and space, bushmeat hunting, biomedical research and the pet trade[26,16]. The Rhesus macaque (*Macaca mulatta*) which is a "Least Concern" species (IUCN, 2012) has been put in the Schedule-II category by the Wildlife (Protection) Act of India, 1972 (amended upto 2002). Less and scanty information are available on the various aspects of population density of Rhesus Monkey, *Macaca mulatta* in Haryana, particular. Hence the present study was planned to record population density of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India).

Materials and Methods

Saraswati Plantation Wildlife Sanctuary (76° 33' E latitude and 29° 56' N longitude) is located in between two districts (Kurukshetra and Kaithal) of Haryana and occupies an area of 11,003 acres (Fig. 1). The climate of area is subtropical, semi arid type and contain alkali soil. Annual rain fall in the area is 516 mm and average temperature is 32.4°C and vegetation of the Saraswati Plantation Wildlife Sanctuary is categorized as "Sub–group 5B tropical deciduous forest" [6].

Line transect method[21] was used to record population density of rhesus monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India). Different age classes *viz.,* adult male, adult female, juvenile and infants were identified following age-sex wise classification of rhesus monkey[11]. Four transects, namely, T-1 (0.30 Km^2), T-2 (0.17 Km^2), T-3 (0.17 Km^2) and T-4 (0.08 Km^2) with a total area 0.72 Km^2 were selected in the study areas. The total area scanned in Saraswati Plantation Wildlife Sanctuary was measured with the help of GPS (Geographical Positioning System). The data collected from study sites was analysed to estimate the population density of rhesus monkey on monthly basis, seasonally as well as on annual basis using following formula[4].

$$\text{Population density} = \frac{n}{L} \times 2 \times B$$

n = Number of individuals sighted
L= Length of transect
B= Perpendicular visual distance along each transect (a distance of 50 meter was scanned in each side of all selected transects in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India).

Results and Discussion

Due to increases in human populations and rapid urbanization, the existing forested areas are still facing continuous threats of degradation. In addition to this, human population pressures have accelerated the fragmentation of wildlife habitats, including those of rhesus macaques[9,10]. Rhesus macaques are more common in villages and towns than in forest[23]. The declining trend of Hanuman langur population in Southern India from a demographic study where immature constituted less than 50%[14]. A semi isolated study on population of 162 Barbary macaques (six groups) inhabiting the Ghomaran fir forests of the Moroccan Rif mountains had a density of 6.73 individuals/km² during study period[15]. The population density of Golden langurs using line transect method covering the area of 58.5 km² was found to be 2.1 langurs/km² during study period[25]. A total of 213 Assamese macaques were encountered in 9 groups with mean group size was 23.66 individuals and the group density was 0.0790 groups/km² with a population density of 1.8691 individuals/km² during study period[18].

In the present study, population density/Km^2 of all male rhesus macaques varied from a minimum of 12.50 individuals/Km^2 (July, 2008, December, 2008) to a maximum of 29.16 individuals/Km^2 (April, 2008, August, 2008) with an average of 19.89±1.89 individuals/Km^2, population density/Km^2 of all female rhesus macaques varied from a minimum of 52.77 individuals/Km^2 (July, 2008) to a maximum of 116.66 individuals/Km^2 (April, 2008) with an average of 81.70±3.45

individuals/Km^2, population density/Km^2 of sighted juvenile of rhesus macaques varied from a minimum of 11.11 individuals/Km^2 (July, 2008, December, 2008) to a maximum of 22.22 individuals/Km^2 (April, 2008, May, 2008) with an average of 16.15±1.72 individuals/Km^2 and population density/Km^2 of sighted infants of rhesus macaques varied from a minimum of 5.55 individuals/Km^2 (February, 2008) to a maximum of 22.22 individuals/Km^2 (May, 2008, June, 2008) with an average of 14.76±1.66 individuals/Km^2 were recorded from Saraswati Plantation Wildlife Sanctuary, Kurukshetra, Haryana (India) (Table 1). Overall population density/Km^2 of sighted rhesus macaques varied minimum of 90.27 individuals/Km^2 (July, 2008, December, 2008) to a maximum of 183.33 individuals/Km^2 (April, 2008) with an average of 132.63±5.95 individuals/Km^2 were recorded from study area (Table 1).
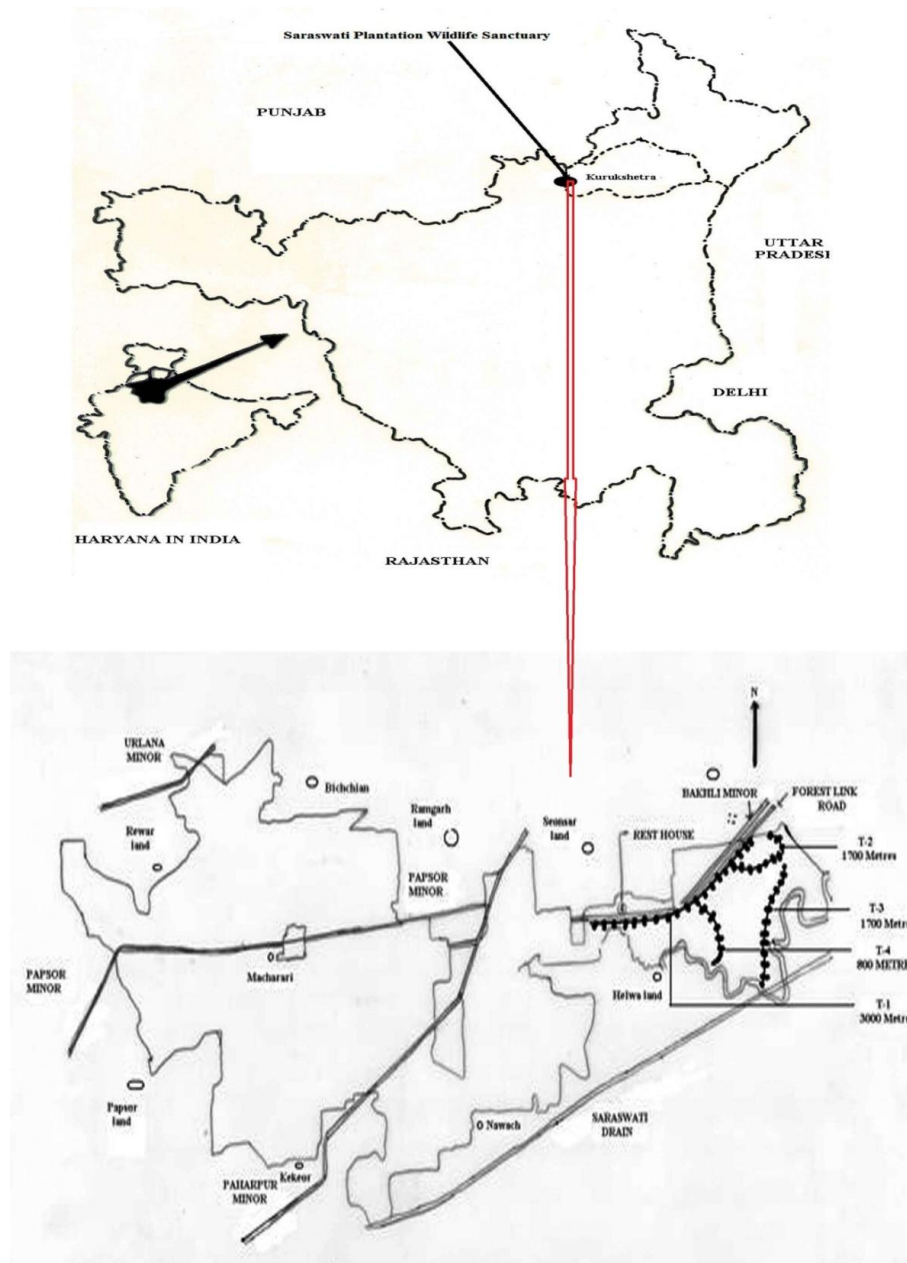
Figure 1: Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India)

As far as seasonal variation in the population density/Km^2 of sighted all male rhesus macaques varied from a minimum of 54.16 individuals/Km^2 (winter season) to a maximum of 69.44 individuals/Km^2 (summer season), population density/Km^2 of sighted all female rhesus macaques varied from a

minimum of 219.44 individuals/Km^2 (monsoon season) to a maximum of 298.44 individuals/Km^2 (summer season), population density/Km^2 of sighted juvenile of rhesus macaques varied from a minimum of 41.66 individuals/Km^2 (winter and monsoon seasons) to a maximum of 63.68 individuals/Km^2 (summer seasons) and population density/Km^2 of sighted infants of rhesus macaques varied from a minimum of 27.77 individuals/Km^2 (winter season) to a maximum of 55.55 individuals /Km^2 (monsoon season) were recorded (Fig. 2). Overall average population density/Km^2 of sighted rhesus macaques varied from minimum of 354.16 individuals/Km^2 (winter season) to a maximum of 476.38 individuals/Km^2 (summer season) were recorded (Fig. 2).

Table 1: Monthly variation in population density of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India) during February, 2008 to January, 2009

Months of year	Population density/Km^2				
	All male	All female	Juveniles	Infants	Overall
February, 2008	25.00	104.16	15.27	5.55	150.00
March, 2008	20.83	91.66	19.44	6.94	138.88
April, 2008	29.16	116.66	22.22	15.27	183.33
May, 2008	19.44	90.27	22.22	22.22	154.16
June, 2008	16.16	69.44	13.88	22.22	122.22
July, 2008	12.50	52.77	11.11	13.88	90.27
August, 2008	29.16	97.22	16.16	19.44	162.50
September, 2008	22.22	98.61	22.22	19.44	162.50
October, 2008	19.44	65.27	12.50	16.16	113.18
November, 2008	16.16	68.05	12.50	13.88	111.11
December, 2008	12.50	55.55	11.11	11.11	90.27
January, 2009	16.16	70.83	15.27	11.11	113.18
Mean ±S.E.	19.89±1.89	81.70±3.45	16.15±1.72	14.76±1.66	132.63±5.95

Conflicts with man and his pets (domestic dog, *Canis familiaris*), habitat destruction through illegal felling, less numbers of fruit trees and shifting of rhesus macaques for feeding from forest area in particular day, *i.e.,* Tuesday and Friday as well as in particular season nearby its agricultural areas, villages areas and Hanuman Mandir (a holy temple) were the major reasons in monthly and seasonally variation in population density of rhesus macaques in study areas. Earlier coworkers was also recorded various reasons for minor variation in numbers in monthly as well seasonally population density [12,19,24,13,5,4,10,9].

No significant variation (t = 6.7, p<0.05) in average group size, group composition and population density was observed among the forest rhesus monkeys in different habitats, *i.e.,* semi-evergreen forest, evergreen forest, deciduous forest, mangrove forest, planted forest, tea garden and scrub forests[8,9,10]. In the present study, the maximum average population density/Km^2, *i.e.,* 23.14±1.07 (summer season), 95.52±4.88 (summer season), 21.99±2.09 (summer season) and 18.51±0.92 (monsoon season) of all male, all female, juvenile and infants of rhesus macaques respectively were sighted more frequently during the study year (Table 2). According to Duncan's multiple range test (DMRT) results revealed that there was no significant difference (p≤0.05)

recorded in average number of sighted individuals of all males, all females, juveniles and infants of rhesus monkey in different seasons in Saraswati Plantation Wildlife Sanctuary of district Kurukshetra, Haryana (India) (Table 2).

Table 2: Seasonal variation in average population density of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India) during February, 2008 to January, 2009

Sighted individuals	Seasons			
	Winter	**Summer**	**Monsoon**	**Autumn**
All male	18.05 ± 1.09^A	23.14 ± 1.07^A	19.44 ± 0.97^A	19.44 ± 0.97^A
All female	76.85 ± 3.07^A	95.53 ± 4.88^A	73.14 ± 3.01^A	77.31 ± 3.43^A
Juvenile	13.88 ± 1.53^A	21.99 ± 2.09^A	13.88 ± 1.53^A	15.74 ± 2.01^A
Infants	9.25 ± 1.21^A	14.81 ± 1.59^A	18.51 ± 0.92^A	16.16 ± 2.21^A

Mean with same letter in the same row are not significantly different ($p < 0.05$) (Duncan, 1955)
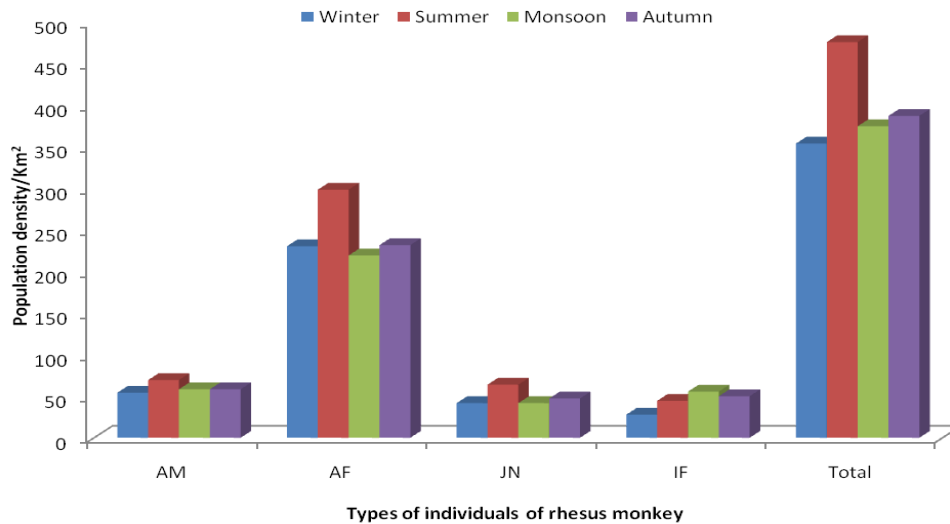
Figure 2: Seasonal variation in population density of Rhesus Monkey, *Macaca mulatta* (Zimmermann, 1780) in Saraswati Plantation Wildlife Sanctuary in district Kurukshetra, Haryana (India) during February, 2008 to January, 2009

Acknowledgement

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