SUMMARY

Similarities between man and non-human primates have made monkeys and apes focus of research in a variety of scientific disciplines such as anthropology, biology, psychology, philosophy, behavior and biomedical sciences. The rhesus monkey which is perhaps one of the hardiest and adaptable species, is also most widely distributed primate in India. Though some useful researches on their ecology and population dynamics have been conducted, there is hardly any systematic account on their behavioral traits. Keeping this in view, the present study was undertaken with following objectives:

1. Present distribution and population dynamics of Aligarh monkeys
2. Study of Home range
3. Study of relationship among adult males
4. Study of relationship between adult male and adult female
5. Study of relationship between mother and infants
6. Envisaging conservation and management of commensal monkeys

Methods

The study was conducted during 1993-95 at Achaltal and Chatari-do-raha of Aligarh and Bulandshahar districts. To collect data for above objectives, following methods were adopted:

Population distribution: Direct visual count method was used to estimate the population of rhesus monkey and entire population was categorized in different age-sex classes.

Home range: Movement of group was marked on a grid map. Size of each grid was kept 20m x 20m. To estimate the day range length, the movement between
the adjacent quadrates was taken as 20m. The home range size was computed by summing up all quadrates entered by member of the group. Each quadrate encompassed a unit area of 20m x 20m = 400m².

**Relationship among adult males:** Observations were made by using "Focal animal" sampling and "Zero time" sampling techniques on 15 second interval checklist. This method was also used to study the relationship between adult male and female and between mother and infant. For studying the ranking order, dyadic interactions of competitive feeding, grooming, approach, withdrawal, threats and submission were considered. All these events were classified into win and lose category. An individual was considered to win if he was able to fetch food from other, groomed by other, approached by other, withdrawal of others on his arrival and showing threats to other. Landau's index of linearity was used to measure the relative dominancy of different individuals. Kendall's test was used for analyzing the relationship in number of encounters and ranking order. Spearman's correlation was applied to find out relationship between number of encounters and probability of winning the encounters.

**Relationship between adult male and female:** Adult male was considered as focal animal and all events directed towards this male were recorded. Hinde's index was used to find out the animal responsible for maintaining the proximity. Kendall's test and Spearman's test was used for correlation analysis.

**Relationship between mother and infants:** The methods discussed above were also used to record this relationship. Mother-infant interactions on ventro-ventral contacts, suckling of nipple, rejection of nipple, etc. were recorded and analyzed. t-test was used to find out the difference between percentage time spent by mother-infant dyads on different activities. Multiple regression analysis was applied to ascertain any significant correlation between age of infant and different
activities performed by mother-infant dyads. Spearman's correlation was used to know whether mother-infant dyads of both the groups followed similar trend in behavioral activities with the change in infant age.

**Conservation and management:** As a part of present study, in 1997, 600 commensal monkeys of Vrindaban were translocated to semi-forest patches in Mathura district. Selected groups were baited and portable iron-made trapping cages of various dimensions were used for trapping.

**Results**

**Population**
The rhesus monkey in Aligarh and its adjoining areas has wide distribution, occurring in almost all types of habitats. Twenty groups of rhesus monkey of different size were monitored each year. In March 1993, the total population of rhesus monkeys was 963, which increased to 1337 in 1995. During 1993-94, 20.4% and in 1994-95 15.4% annual growth was recorded. During March 1993, monkey population constituted 15.9% adult male, 35.5%, adult females, 22.8% subadults-juveniles and 27.7% infants respectively. A marginal difference in population composition was recorded during March 1994 (15.2% adult males, 36.2% adult females, 22.8% subadults-juveniles and 26% infants) and in February 1995 (16.2% adult males, 34% adult females, 23.7% subadults-juveniles and 26% infants). The established monkey groups of the study areas showed high natality and low mortality. A total of 700 offsprings (total of both breeding seasons) were born, giving a gross birth rate of 0.81 infant/female/year. The birth rate (%) computed for the Achaltal monkeys varied from 91.7% in 1993-94 to 91.3% in 1994-95, while for Chatari-do-raha it varied from 89.7% to 93.8%. A loss of 2.7% and 1.5% was recorded during 1993-94 and 1994-95 respectively.
Homerange

*Achaltal monkey group*

Daily movements of this monkey group occurred in and around the Achaltal tank. During nights they generally lodged on the roof tops of adjoining buildings. Group movements began about half an hour before dawn (approximately at 0700 during winter and 0630 during summer). The monkeys began their movement slowly out of their sleeping sites. Most individuals of the group crossed the tank and moved towards the Girl's College compound, northwest temple, north market and then would cross the Aligarh-Kanpur road to enter the premises of D.S. college and Hospital. Occasionally, some members of this group were observed near railway crossing temple. To perform various activities the group traveled a mean distance of 4.4 km per day. The average home range for this group was estimated 0.59 km$^2$ during 1993-94 and 0.60 km$^2$ during 1994-95. The core and extended home range was 0.13 km$^2$ and 0.0128 km$^2$ respectively.

*Chatari-do-raha monkey group*

This group performed most diurnal activities along the roadside. During nights they lodged on the branches of road side trees. Some individuals spread upto the cultivated lands and often raided the crops. At times their movements also extended upto the school yard and bus stand of Chatari-do-raha. Occasionally members of this group moved towards nearby 'Jamun' (*Syzygium cuminii*) tree plantation. They traveled a mean distance of 3.2 km in 1993-94 and 3.8 km in 1994-95. Average homerange size of this group was 0.50 km$^2$ during 1993-94 and 0.52 km$^2$ in 1994-95. The size of core home range was calculated as 0.15 km$^2$.

*Relationship among adult males*

The dominant male used to run towards subordinates and showed some typical postures and behavior such as lowering of heads, craned neck, open mouth and stretched ears accompanied with deep-throated growls. The dominant males were
considerably larger, more muscular, had stronger canines than others and showed more activeness. In response to this, subordinate individuals expressed their fear by avoiding direct stare to the dominant male. Subordinate males also showed a characteristic grin in which lips were retracted to expose the teeth and gums followed by rapid smacking of the lips. On sharing the feeding place, subordinate males showed their fear by bending the back and avoided direct eyes contacts with the dominant male. While walking near the dominant male, the subordinate males used to make several submissive postures such as looking away from dominant male and presenting their hind quarters.

**Achalta monkey group**

During 1993-94 a total of 1571 encounters were recorded in 300 hours of observations and adult male named 'UP' was found to be the most dominant. *Landau's index of linearity* ($h = 1.72$) revealed that hierarchism of this group was linear. During this year no correlation was found between rank order of adult male individuals and number of encounters faced by them, while a positive significant correlation was recorded between number of encounters and chances of winning it.

During 1994-95, 1922 dyadic encounters were recorded in 300 hours and 'UP' was found again the most dominant. The value of *Landau's index of linearity* ($h = 0.56$) revealed that hierarchism of this group was non-linear. *Kendall's test* showed that during this year negative significant correlation was found between rank order of adult male individuals and number of encounters faced by them, while a positive significant correlation was recorded between number of encounters and chances of winning it.

**Chatari-do-raha monkey group**

A total of 2210 dyadic encounters were recorded during 1993-94 in 300 hours of observations, declaring 'CL' as the most dominant. The value of *Landau's index of linearity* ($h = 1.07$) revealed that hierarchism in this group was almost perfect
During this year no correlation was found between rank order of adult male individuals and number of encounters faced by them, while a positive significant correlation was recorded between number of encounters and chances of winning it. During 1994-95, 290 hours were spent on this group and 2324 dyadic encounters were recorded declaring 'HB' as the most dominant. The value of Landau's index of linearity \((h=0.9)\) revealed that during 1994-95 the hierarchism in this group was almost strong linear. Kendall's test showed that positive significant correlation was found between rank order of adult male and number of encounters. A positive significant correlation was also recorded between number of encounters and chances of winning it.

**Relationship between adult male and female**

Mating season in rhesus monkey was observed between the last week of September and February. During this period change in sex skin was observed in most of the adult males and females. For the maintenance of proximity, grooming by either sex was made, which later on established in the form of consortship. During the consortship period, frequently mounting by male was observed. He used to place his fore limbs on the female's back and grasped her hind legs with his hind limbs. After several thrusts male returned to the former resting or grooming behavior with the female. At times repeated mounts were recorded in a particular period and each mount consisted of several thrusts. Most mounts did not terminate in ejaculation. The mounts terminated as ejaculation, showed greater vigor and intensity. Mounts leading to ejaculation had a peculiar behavior of frequent baring the teeth and making khei..., khei..., khee... sound. During copulation females frequently turned their head towards male. Most mounts lasted for 4-5 seconds with 5-9 thrust in each attempt.
Achalta monkey group

For the maintenance of proximity, during 1993-94, males were responsible for 57.1% initiatives, females for 14.3% and neither partner for 28.6%. While in the next year males were primarily responsible for maintaining the proximity for 78.8% and females for 22.2%. During the mating period of 1993-94, males spent 56% of their time on grooming to females, while females spent 44% on grooming to males. In the next year, males spent average 60.3% time on grooming to females, while females spent average 39.7% on grooming to males. After soliciting the females, the focal males of study group (7 in nos.) made 96 attempts to grasp hip of the estrous females but were successful only on 56 occasions. Out of 56 successful grasping only 45 were recorded as real copulation and 37 as reproductive success. In the next year, focal males of study group (9 in number) made 113 attempts to grasp hip of the estrous females and became successful only on 60 occasions. Out of 60 hip grasping 49 were recorded as successful copulation and 37 as reproductive success. Statistical analysis revealed that during both the years higher ranking males were primarily responsible for proximity maintenance, positively correlated with mounting rate, copulation and reproductive success.

Chatari-do-raha monkey group

During mating period of 1993-94, males were found responsible 81.8% and females 18.2% for maintaining the proximity, while in the next year males were 100% responsible for the same. On average, for grooming males spent 65% time, while females spent 35%. During first year of study, 142 attempts were made by 11 focal males to grasp the hip of the estrous females but were successful only in 75. Out of 75 successful hip grasping, 62 were recorded as real copulation and 46 as reproductive success. While in the next year, 145 attempts were made by 11 focal males to grasp the hip
Conservation and management

India is endowed with one tenth of the world's primate species. By and large the country has adequate conservation and management policies, but the implementation part is unsatisfactory. Though some importance is being given to the conservation of endangered species, the area of management of common primates like rhesus monkeys is totally neglected. With the expansion of human settlements and consequent decline of the habitats, most monkeys of the country have been compelled to become ecological refugees. This is also true for the rhesus monkey. Population surveys of rhesus monkeys in north central India have shown that 85 to 88% populations of the rhesus monkey live in commensal or semi-commensal habitats. This inordinate increase in urban monkeys in the recent years has led to an unhealthy competition for space and food between the two primate species—man and monkeys. Consequently, urban residents are becoming increasingly hostile towards monkeys. Attracted by food, water or cover the monkey troops invade settlements and often destroy human property such as cars, gardens and even furnishings inside the houses. Due to their increased nuisance activities, the irate human has resorted to stoning, beating, poisoning and some times even shooting the monkeys. In retaliation monkey groups have become over--aggressive. An increasing number of monkey bites have been reported from the cities in the last few years.

Management of commensal monkey: Monkeys are an integral part of our cultural, historical and environmental heritage thus protecting and managing them in a scientific, simple and humane way is the ethical duty of the government, the animal welfare organizations and the people. Of those tried so far, translocation holds the greatest promise for India's commensal rhesus problem. Vrindaban, which is one of the most important sacred pilgrimage of Hindu's had approximately 1337 rhesus monkeys. The inhabitants were badly affected by nuisance activities of the monkeys. The monkeys of this area have developed a
very peculiar behavior of spectacles snatching, not reported so far from anywhere else. The opinion survey suggested that 95.5% of people were harassed by nuisance activities of rhesus monkeys, 69% had developed hostile attitude and wanted to shift them. Considering the seriousness of the problem, it was decided to translocate some of the monkey population. During January, 1997, 600 monkeys were trapped and translocated to the semi-natural forest of Mathura (Uttar Pradesh) district where they rehabilitated successfully. The successful translocations of monkeys from the Vrindaban and other areas clearly indicate that this method being eco-friendly, low costing, easy handling and less time consuming, is quite appropriate for managing the commensal monkeys. Therefore, this method can be strongly recommended to solve the problems of other monkey affected areas like Delhi, Shimla, Ranikhet, Bharatpur, etc. However, as opined by Prof. Yahya restoration and conservation of natural habitats remain the key factor to safeguard the monkeys vis-à-vis entire biodiversity of the country.