

A successful mass translocation of commensal rhesus monkeys *Macaca mulatta* in Vrindaban, India

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Abstract Rhesus monkeys *Macaca mulatta* and people have coexisted for many years in Vrindaban in Mathura District, Uttar Pradesh, India. The monkeys are highly valued both by locals and pilgrims to the area, in part because of their quasi sacred status, but during the last two decades the increasing human and monkey populations of the township have led to severe human-monkey conflict and a decrease in people's respect for the monkeys. To ease this situation one of the world's largest ever translocations of monkeys was undertaken. In 1995, 30 groups of rhesus monkeys, comprising an estimated 1,338 individuals, were recorded in Vrindaban.

Of these, 12 groups, a total of 600 individuals, were translocated in January 1997 to eight sites in semi-natural forested areas within the same District. A post-translocation study indicated that the translocated monkeys were settled and appeared to be exhibiting normal behaviour. This study indicates that translocation of commensal monkeys to forested areas can be a successful technique for their rehabilitation.

Keywords Human-animal conflict, India, *Macaca mulatta*, rhesus monkey, translocation, Vrindaban.

Introduction

Ten per cent of the world's primate species are found in India, and all are commonly known in the country as *bandar* (monkeys). Orthodox Hindus consider monkeys to be sacred animals, to be revered and protected. This reverence stems partly from the role of the monkey god, Hanuman, in the *Ramayana* Hindu Sanskrit epic. Hanuman is usually depicted as a langur, a long tailed monkey with a black face, but he has come to stand for all monkeys, including the rhesus monkey, and all species thus enjoy to some extent the privileges of deification (Dutt, 1987).

Public perception of monkeys in India has been negatively affected by the increase in monkey-human conflict that has resulted from growth in the populations of commensal rhesus monkeys *Macaca mulatta* (Malik & Johnson, 1994). There are over 0.3 million rhesus monkeys in northern India (Malik, 1992), approximately 86% of which are living in areas of human habitation (Southwick & Siddiqi, 1994), due in part to the conversion of extensive areas of natural forest into agricultural land, and the concomitant movement of rhesus monkeys into inhabited or intensively cultivated agricultural areas. The large numbers of rhesus monkeys is a result of

people's religious and traditional attachment to monkeys, the absence of a natural predator within inhabited areas, and the ban on the export of primates from India in 1978 (Southwick & Siddiqi, 1988).

Rhesus monkeys in urban areas frequently damage or destroy property such as cars, gardens and house furnishings. Irrate owners have resorted to stoning, or sometimes shooting, the monkeys, and troops have become over-aggressive and bite humans more frequently. This increase in the nuisance activities of rhesus monkeys has had a detrimental effect on the traditional bond that exists between people and monkeys in India (Southwick & Siddiqi, 1998) and, if it extends to other primate species, will erode public support for primate conservation projects in the country in general.

In 1992 the problems created by the relatively high density of rhesus monkeys in Vrindaban in Mathura District, Uttar Pradesh, were so great that the senior citizens of the town submitted a petition to the government to revive the practice of monkey trapping. The petition was approved by the Municipal Corporation and forwarded to the State government for further action. In September 1995, during a public hearing, a resolution to trap and translocate the monkeys was passed by the people of Vrindaban. The Divisional Forest Officer of Mathura recommended this resolution to the Chief Conservator of Forest (Wildlife), Uttar Pradesh Government, for final approval. The spiritual leaders and *swamis* (religious teachers) of Vrindaban then requested WWF-India to facilitate the translocation, which was carried out by the non-governmental organisation Vatavaran.

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Received 23 March 2000. Revision requested 17 August 2000.
Accepted 26 September 2001.

Translocation, the movement of individuals from a particular area to a suitable new site, has been found to be the best non-destructive control measure for the rhesus monkey in India (Southwick *et al.*, 1984; Forthman-Quick, 1986; Else, 1991). Southwick *et al.* (1984) translocated 60 monkeys from a population of 140 at Chatatri-do-raha in Aligarh to a tree-plantation near Pritampura village in Aligarh district. In August 1989, a troop of 21 rhesus monkeys was translocated from Tughlaqabad Air force station, New Delhi to a rural area of Meethapur 10 km away (Malik & Johnson, 1991, 1994). In 1988, a subgroup of 20 rhesus monkeys was trapped in a mango grove in Chatari-do-raha and translocated to a canal-bank forest patch in Sumera in Aligarh district (Southwick & Siddiqi, 1994). In February 1995, five groups of rhesus monkeys, comprising 40 individuals, were successfully translocated from the Central Zoological Park, New Delhi, and rehabilitated in Tughlaqabad fort, New Delhi (Imam & Malik, 1997). In the same year seven individuals trapped in Friendicos, New Delhi, were also successfully rehabilitated in Tughlaqabad fort (E. Imam, unpublished data).

In this paper we describe and assess the translocation of 600 rhesus monkeys from urban Vrindaban to semi-natural forest areas within the same district.

Study area

The municipality of Vrindaban (4.4 km²) lies in Mathura District, 160 km from Delhi on the Delhi-Agra road, and is bounded on three sides by the river Yamuna. This temple township is a well-known pilgrimage centre because it is believed that Lord Krishna spent his childhood in this area. The human population is about 48,000 (1991 figures) and an almost equal number of pilgrims visit the town annually. About 60% of the area of Vrindaban is residential, of which 26% is occupied by temples and *ashrams* (Hindu meditation and spiritual places). Historical evidence (Kumar & Majumdar, 1995) indicates that before independence there were many forested areas within Vrindaban, but the only remaining green areas within the town are now mostly in the form of temple *bagichas* (temple orchards).

Methods

A pre-translocation study to estimate the total population of rhesus monkeys in Vrindaban was conducted during 23 August – 30 September 1995. The entire area of Vrindaban (4.4 km²) was divided into ten sectors (Fig. 1). Adjacent sectors were monitored on separate

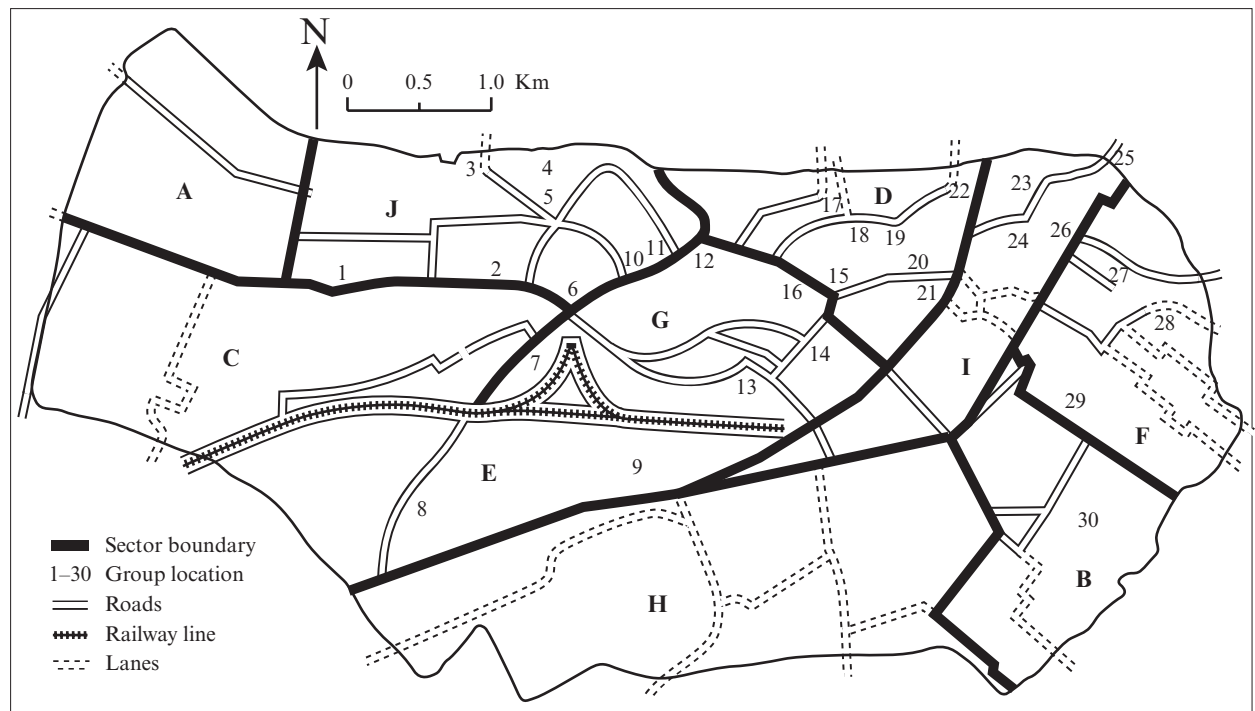


Fig. 1 Location of the 30 groups (numbered 1–30) of rhesus monkeys (see Table 1 for details) located and counted in Vrindaban in 1995. The 10 sectors (labeled A–J) used for this census are demarcated by heavy lines.

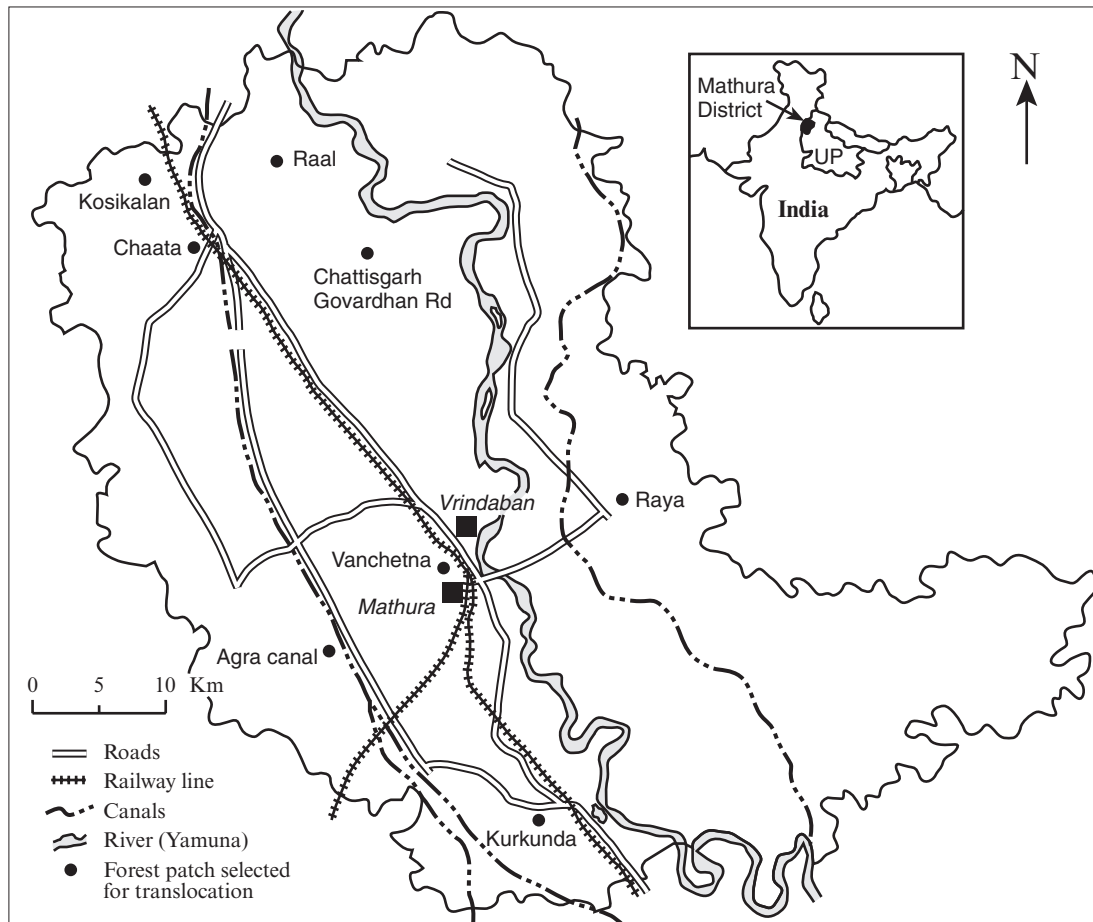


Fig. 2 The location of the eight sites within Mathura District in Uttar Pradesh to which the rhesus monkeys captured in Vrindaban (see Fig. 1 and Table 1) were translocated in 1997.

days to avoid counting the same monkeys more than once. Roads and lanes were used as transects and, on the days that they were surveyed, each sector was monitored twice a day at around dawn and dusk, the time when monkeys were most active, by the same two researchers. Surveys were conducted on a motorbike, which was driven slowly ($10\text{--}15\text{ km h}^{-1}$) and halted whenever a troop of monkeys was encountered. Monkeys were also counted in places where they were being fed by Hindu devotees. The population census of each sector was carried out on four non-consecutive days, and a mean count was used as the estimated population of that sector. Individual monkeys were categorised as adult males (with red scrotum, indicating an age of >4 years), adult females (with red skin on the rump, indicating an age of >3 years), juvenile (maintaining proximity to mother, indicating an age of 1–3 years), and infant (dependent on mother and therefore <1 years old).

A questionnaire, which is available from the authors, was used to survey the attitudes of 270 inhabitants

towards the rhesus monkeys resident in Vrindaban. Those questioned included people of different professions and from different areas within the town.

Trapping within Vrindaban took place from early morning to sunset during 5–20 January 1997. To avoid artificial group fission, attempts were made to capture as many animals as possible from a single social group on the same day. Monkeys were captured using a portable iron trapping cage, measuring $2 \times 2 \times 2\text{ m}$, with a heavy sliding door that could be operated from a distance using a pulley and rope. The operator was hidden 20 m away, in a drum that had a viewing hole through which monkeys could be observed. Banana *Musa paradisiaca* and dry-roasted bengal gram *Cicer arietinum* were selected as baits because they are among the favoured foods of the Vrindaban monkeys. Trapped monkeys were transferred into a holding cage ($0.5 \times 0.5 \times 0.5\text{ m}$) and finally into a releasing cage ($5 \times 2.5 \times 2.5\text{ m}$) that was used to transport the monkeys on a small truck. All cages had ample provision of food and water. One

trapping cage, 12 holding cages and two releasing cages were used. In total 28 people were involved, four of whom carried out the trapping.

Monkeys were transported to suitable, pre-selected sites and released near trees. All relocations were done late at night to avoid conflict with any members of the local populace that did not favour the translocation (see Results) and to minimise any offence to people's sensibilities.

There is no remaining intact natural forest in Mathura District (we were not allowed to translocate the rhesus monkeys outside Mathura District, see Results), so the only habitats available for translocations were small forest patches under the administration of Social Forestry, Government of Uttar Pradesh. In selecting these sites, the availability of food, water and shelter for the monkeys was considered, as was the attitude of the local people. Pre-release surveys of potential sites were carried out, and nearby villagers were interviewed to determine their attitudes towards the potential release of monkeys in their vicinity. Monkeys were only moved to sites that did not already have resident monkeys because no health checks were made on the monkeys to be translocated and we wished to avoid competition with resident troops.

Between 20 January and 20 April 1997, immediately after completion of the translocation programme, all release sites were visited once per week to determine whether the monkeys had remained in the area. A detailed post-release study was conducted on the group translocated to the forest patch of Chaata to investigate changes in the daily activity pattern of released monkeys. Daily activity budget was studied according to the protocol of an earlier study of rhesus monkeys in Tughlaqabad (Malik, 1986a). Monkeys were monitored for a total of 300 hours by one person using the scan sampling method, in which the behavioural states of individuals are scored at predetermined points in time.

E.I. visited Vrindaban, and all eight of the translocation sites, during 1–5 July 2001 to assess the situation 4 years later.

Results

In the pre-translocation study 30 groups of rhesus monkeys, comprising 1,338 individuals, were recorded in Vrindaban (Table 1, Fig. 1). Group size varied from 14 to 142 individuals (mean 43). The largest groups were found in temple orchards. Of the total population, 20.4% were adult males, 41.3% adult females, 13.3% juveniles and 25.0% infants. Of the 553 adult females, 335 (60.6%) were carrying infants.

Out of 270 local respondents to the questionnaire, the majority felt harassed by the monkeys' nuisance

activities, with biting, spectacle-snatching and house-raiding being common complaints (Table 2). Sixty-nine per cent of the residents were in favour of translocating the monkeys.

Eight forest patches were chosen as potential translocation sites (Table 3, Fig. 1). Six hundred rhesus monkeys were captured and translocated to the eight sites during the 15 days of trapping (Table 1). Troops trapped at particular sites within Vrindaban were each translocated to separate release sites. In Vrindaban there was resistance by some local people during the trapping. They shouted slogans, harassed team members, and tried to release the captured monkeys. Trapping continued however because the local police, prominent citizens, local WWF-India employees, other local people and the *swamis* of the area provided the team with their cooperation and protection.

During the brief post-translocation study we verified that all troops had remained at their release sites. The local people had accepted the presence of these released monkeys and showed willingness to tolerate them. Passers-by, truck drivers and local people were observed offering food to the newly-released monkeys. The monkeys appeared to be healthy and any minor injuries that may have occurred during trapping and transportation had healed. No particular signs of stress were observed, and the monkeys appeared to be behaving normally. The troop released at Chaata (115 individuals) spent 30.0% of their time in locomotion, 18.6% grooming, 11.5% feeding on food given to them by people, 9.5% playing, 9.3% foraging, 8% eating, 3.4% drinking and the remaining 9.7% on other activities.

Discussion

Aggression is known to occur between captive rhesus monkeys under crowded conditions (Southwick, 1967), and the marked aggression that we observed in Vrindaban, mostly at feeding sites, was presumably a result of the very high densities there. This aggression extended to the local populace and included the stealing of clothes and edible items, and the uprooting of vegetables and other garden plants. The monkeys appeared to snatch spectacles with the purpose of obtaining food from pilgrims, because whenever food was offered they dropped the spectacles. In the absence of large trees, monkeys played on television antennae, electric wires and electric poles, and often damaged them. At Ramkrishna Charitable Hospital rabies vaccinations were frequently administered following monkey bites, especially to children.

Our survey of public opinion indicated that although 69% of local people were in favour of translocating rhesus monkeys out of the urban area of Vrindaban,

Table 1 Mean number (\pm SE) of adult male, adult female, juvenile, infant and total rhesus monkeys in each of the 30 troops located in Vrindaban (see Fig. 1 for locations of each numbered troop) in 1995, and the number of monkeys trapped from 12 of these sites in 1997 and the release sites to which each troop was translocated (see Table 3 and Fig. 2).

Location	Adult male	Adult female	Juvenile	Infant	Total	No. Trapped	Release site
1. Akhandanand Ashram	6 \pm 1.0	12 \pm 0.8	3 \pm 0.8	9 \pm 0.8	30 \pm 0.9		
2. Anand Mayee Ashram	8 \pm 1.2	25 \pm 1.4	10 \pm 1.4	17 \pm 1.6	60 \pm 1.4	60	Kosikalan
3. Bankhandi Mahadev	5 \pm 0.8	10 \pm 0.8	4 \pm 0.8	7 \pm 1.7	26 \pm 1.0		
4. Bihariji Orchard	6 \pm 0.8	13 \pm 1.2	3 \pm 1.0	7 \pm 0.8	29 \pm 0.9		
5. Bihariji Temple	9 \pm 1.4	24 \pm 1.3	2 \pm 0.5	12 \pm 0.8	47 \pm 1.0		
6. Fogla Ashram	18 \pm 1.8	14 \pm 0.8	5 \pm 1.4	11 \pm 1.8	48 \pm 1.5		
7. Goda Vihar Temple	4 \pm 0.8	8 \pm 1.0	2 \pm 0.5	5 \pm 0.8	19 \pm 0.8		
8. Gopeshwar	5 \pm 0.8	8 \pm 1.4	3 \pm 0.8	7 \pm 1.7	23 \pm 1.2		
9. Govind Dev Temple	14 \pm 1.4	35 \pm 1.0	16 \pm 1.4	21 \pm 1.6	86 \pm 1.4		
10. Jaipuria memorial building	5 \pm 0.8	11 \pm 1.7	3 \pm 0.8	6 \pm 0.8	25 \pm 1.0		
11. Jaisingh-ghera	14 \pm 0.8	28 \pm 1.7	7 \pm 0.8	16 \pm 1.6	65 \pm 1.2	90	Agra canal
12. Katayani-peeth	14 \pm 1.8	30 \pm 1.0	12 \pm 1.7	15 \pm 2.2	71 \pm 1.7	71	Kurkunda
13. Keshav Ashram	4 \pm 0.8	13 \pm 0.8	5 \pm 0.5	7 \pm 1.7	29 \pm 1.0		
14. Kesighat	10 \pm 0.8	20 \pm 0.8	7 \pm 1.4	13 \pm 0.8	50 \pm 1.0	50	Raya
15. Kishorepura	11 \pm 1.0	19 \pm 1.8	7 \pm 1.4	9 \pm 1.7	46 \pm 1.5		
16. Kishorvan	6 \pm 1.3	12 \pm 1.6	4 \pm 0.8	7 \pm 1.3	29 \pm 1.2	29	Raya
17. Madan Mohan Temple	3 \pm 1.3	8 \pm 1.8	1 \pm 0.0	3 \pm 1.0	15 \pm 1.0		
18. Munger Temple	15 \pm 1.0	36 \pm 0.5	8 \pm 0.8	18 \pm 1.4	77 \pm 0.9	77	Chattisgarh Govardhan Rd.
19. Nidhivan	32 \pm 1.8	64 \pm 1.3	20 \pm 2.2	43 \pm 1.4	159 \pm 1.7	115**	Chaata
20. Panna Bai Kunj	5 \pm 0.5	9 \pm 1.5	3 \pm 0.8	3 \pm 0.8	20 \pm 0.9		
21. Radha Govind Ji	5 \pm 0.8	9 \pm 1.3	3 \pm 0.8	2 \pm 0.5	19 \pm 0.8		
22. Ramkrishna mission	2 \pm 0.5	5 \pm 1.5	4 \pm 1.0	4 \pm 0.8	15 \pm 0.9		
23. Rangji Ka Bagicha	4 \pm 1.3	7 \pm 0.8	3 \pm 0.8	6 \pm 1.0	20 \pm 1.0	35	Vanchetna
24. Rasik Bihari Maharaj	5 \pm 1.2	10 \pm 0.8	3 \pm 0.8	6 \pm 1.4	24 \pm 1.1		
25. Sevakunj	23 \pm 1.0	47 \pm 0.8	13 \pm 1.7	32 \pm 1.8	115 \pm 1.4		
26. Shahji Temple	4 \pm 0.5	10 \pm 0.8	4 \pm 0.8	6 \pm 0.8	24 \pm 0.8	24	Agra canal
27. Shrotmuni Ashram	12 \pm 1.2	28 \pm 0.8	7 \pm 1.0	17 \pm 1.6	64 \pm 1.4	49	Raal
28. Sudama Kutir	8 \pm 0.8	16 \pm 0.8	5 \pm 1.4	11 \pm 1.7	40 \pm 1.2		
29. SVMC Hospital	3 \pm 0.5	5 \pm 0.8	3 \pm 0.8	3 \pm 0.8	14 \pm 0.7		
30. Thakur Ballabh Temple	12 \pm 0.8	17 \pm 0.8	8 \pm 1.0	12 \pm 1.8	49 \pm 1.1		
Totals	273 \pm 6.6	554 \pm 4.4	177 \pm 3.1	334 \pm 14	1338 \pm 3.7		
Percentage	20.4	41.4	13.2	25.0			

** Group trapped in two consecutive days.

Table 2 Attitudes of the inhabitants of Vrindaban towards rhesus monkeys. All values are percentages of 270 respondents.

Feel harassed by monkeys	Agree 95.5	Disagree 4.5		
Degree of harassment	Severe 74.5	Mild 20	Not responded 5.5	
Types of problem	Monkey bites 19	Spectacle snatching 17	Stealing of household items 28	Other 36
In favour of relocation of the monkeys	Yes 69	No 26.5	Not responded 4.5	

they were concerned that these monkeys should not to be taken outside the *Brij*, the area where Lord Krishna spent his childhood. Thus the monkeys had to be translocated within Mathura District, although it would have been better to have transferred them to a wildlife sanctuary.

The absence of any previous estimates of the density of the rhesus monkey population of Vrindaban made it impossible to know for certain whether there has been a recent increase. Senior citizens reported that the monkey population had multiplied by at least ten times following the ban on the export of rhesus monkeys in

Table 3 Characteristics of the eight sites selected for translocation of rhesus monkeys from Vrindaban.

Translocation sites	Approximate distance from Vrindaban (km)	Dominant plant species	Water source	Nearest Human habitation
Agra canal	25	<i>Azadirachta indica</i> , <i>Dalbergia sissoo</i> , <i>Ficus religiosa</i> , <i>Prosopis jflora</i>	Agra canal 100 m	Village 2 km away
Chaata	30	<i>Prosopis juliflora</i> , <i>Zizyphus jujuba</i>	Canal & tube-well 50 m	Village 1 km away
Chattisgarh Govardhan Rd	25	<i>Dalbergia sissoo</i> , <i>Azadirachta indica</i> , <i>Prosopis jflora</i> , <i>Ficus religiosa</i>	Canal 150 m	Village 2 km away
Kosikalan	45	<i>Syzygium cuminii</i> , <i>Azadirachta indica</i> , <i>Holoptelea integrifolia</i>	Canal 200 m	About 1 km
Kurkunda	35	<i>Ficus religiosa</i> , <i>Prosopis juliflora</i> , <i>Eucalyptus</i> spp.	Canal 500 m	Cafeteria 2 km away
Raya	35	<i>Acacia arabica</i> , <i>Prosopis juliflora</i> , <i>Ficus religiosa</i>	Canal nearby	About 5 km
Raal	40	<i>Ficus religiosa</i> , <i>Prosopis juliflora</i> , <i>Azadirachta indica</i>	Canal 200 m	About 10 km away
Vanchetna	5	<i>Azadirachta indica</i> , <i>Dalbergia sissoo</i> , <i>Prosopis juliflora</i> , <i>Zizyphus jujuba</i>	Small water body inside the area	Village in the immediate vicinity

1978. The density of monkeys at Vrindaban (1,338 in an area of 4.4 km²; 304 km⁻²) was much higher than that recorded in Aligarh District (0.236 km⁻²; Imam & Yahya, 1995), and four times higher than that of Tughlaqabad Fort (70.2 km⁻²; Malik, 1986b). We were able to translocate approximately 45% of the monkeys from Vrindaban, thus reducing their density to 168 km⁻². After the translocation of 600 monkeys, the residents of Vrindaban generally expressed their relief at the lessening of the 'monkey problem'. This successful programme demonstrated that translocation of rhesus monkeys in India can be employed as a successful measure to reduce the 'monkey problem' in urban areas, as long as the local populace and the *swamis* extend their support to the project team.

The translocation programme in Vrindaban has now been halted because there are no forest patches remaining within Mathura District that are suitable to accommodate more rhesus monkeys. Moreover, there were inter-state and inter-district administrative problems in arranging any further translocations, and the Chief Conservator of Forests of Uttar Pradesh did not allow the translocation of monkeys to areas outside Mathura district. Without the permission of the state's Forest Department, both trapping and transportation of rhesus monkeys is illegal because the monkey is listed in Schedule III of the Indian Wildlife Protection Act of 1972.

The immediate post-translocation study, albeit brief, revealed that the monkeys appeared to be behaving normally in their new locations. Time spent in different activities by the translocated monkey group of Chaata was found to be similar to the activity budgets of groups in northern India (Seth & Seth, 1986), Tughlaqabad

fort (Malik & Southwick, 1987) and Kathmandu-Nepal (Southwick *et al.*, 1982).

The post-translocation visit in July 2001 demonstrated that the translocation is providing continued relief from the 'monkey problem' to the people of Vrindaban, thus contributing to a continuation of the harmony that exists in India between people and monkeys. We also found that the translocated monkeys were still in their new locations, and that local people still accepted and supported the presence of the rhesus monkeys.

In India approximately 86% of the total rhesus monkey population are residing near human habitation (Southwick & Siddiqi, 1994). People's general attitude towards non-human primates is therefore strongly influenced by their attitude towards rhesus monkeys. The work described here has demonstrated that a mass translocation of primates can be successfully carried out, and that a reduction in the density of rhesus monkeys in Vrindaban from approximately 304 to 168 km⁻² was sufficient to cause a marked decrease in monkey-human conflict.

Acknowledgements

We acknowledge WWF-India and the Vrindaban Conservation Project for financial support, and Mr. Samar Singh and Dr S.M. Nair (WWF-India) for their assistance. The co-operation of the spiritual leaders (*Sadhus*), citizens of Vrindaban and the Forest Department is also highly appreciated. We thank two anonymous reviewers for their comments on the manuscript. E.I. thanks Dr Salim Javed and Tahmina Shafiq for their help in facilitating correspondence.

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Biographical sketches

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