Patterns and Perceptions of Human–*Rhesus macaque* Conflict in Humid Subtropical Climate of Jabalpur Forest Division

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Abstract: The human–rhesus macaque conflict has become a significant conservation and management issue in India, particularly in human-dominated landscapes where macaques increasingly depend on anthropogenic resources. The present study was undertaken to assess the impact of troop dynamics and spatio-temporal behaviour of rhesus macaques on human-wildlife conflict in Territorial Forest Division of Jabalpur, Madhya Pradesh. Jabalpur city is situated in the humid subtropical climatic zone. For present study the primary data were collected through direct observations, semi-structured questionnaire surveys of 350 respondents, and interviews with local communities, forest staff, and NGOs, supplemented with secondary literature. Results revealed that rhesus macaques were perceived as the most problematic species (40.86%), surpassing snakes, langurs, wild boars, leopards, crocodiles, and other animals. Conflicts were concentrated in residential colonies, religious sites, marketplaces, and croplands, where macaques found easy access to food, water and shelter. Medium-sized troops (11–30 individuals), primarily composed of adult females and juveniles, were most frequently encountered, with peak activity during morning and evening hours. The conflict was associated with economic losses, property damage, injuries, and psychological stress among local residents. The findings underscore the urgent need for integrated mitigation strategies, including waste management, controlled feeding practices, habitat restoration, and community-based awareness programs, supported by coordinated action from government agencies and non-governmental organizations.

Keywords: Human–rhesus macaque conflict, *Rhesus macaque*, Troop dynamics, Spatio-temporal behaviour

India is recognized as one of the most primate-rich regions globally, both in terms of species diversity and population density. Among these, the rhesus macaque (*Macaca mulatta*) is one of the most widely distributed non-human primate species, inhabiting a broad range of environments from dense forests to heavily human-modified landscapes (Kumara et al., 2010). It is estimated that 80–90% of India's *Rhesus macaques* reside in close proximity to human settlements (Pathak 2023), where they have developed a high dependency on anthropogenic food sources (Pragatheesh 2011). Devi and Saikia (2008) reported that primates across India have exhibited remarkable adaptability to human-dominated areas, facilitating their successful co-existence. However, this increased proximity has also led to intensified competition for space and resources, often resulting in direct human–macaque conflict (Patari and Dasgupta 2021). Across many regions, *Rhesus macaques* are considered a public nuisance damaging property, raiding crops, and causing frequent disturbances to daily human activity (Karayathil et al., 2023). The reverence of macaques as sacred being, combined with the absence of natural predators in urban environments and a national ban on primate export, has allowed macaque populations to grow unchecked (Govindrajan 2015). Consequently, human–macaque conflicts have escalated in both urban and rural settings. As natural habitats are increasingly fragmented by human expansion, macaques are compelled to infiltrate residential areas in search of food, water, and shelter. Their interactions often involve damage to household items, vehicles, and gardens, alongside aggressive behaviours such as food-snatching, intimidation, and biting. Efforts to deter them, such as the use of stones, loud noises, dogs, or firecrackers, are largely ineffective and sometimes provoke even more aggressive responses. Considering the above facts, the present study was undertaken to assess the impact of troop dynamics and spatio-temporal behaviour of rhesus macaques on human-wildlife conflict in Territorial Forest Division Jabalpur, Madhya Pradesh.

MATERIAL AND METHODS

Study area: The present study was conducted in the urban and semi-urban landscapes of Territorial Forest Division Jabalpur, Madhya Pradesh. Jabalpur is situated in central region of Madhya Pradesh, India, between 22°49′ to 23°07′ N latitude and 79°21′ to 80°35′ E longitude. It spans 5,211 km², with a mean elevation of 425.7 m and an average slope of 7.56%.

Data collection: Both primary and secondary data were collected with the methodology outlined by Singh and Sharma (2011). The information pertaining to the status of human–rhesus macaque conflict and the factors influencing

its occurrence was collected through direct observations at identified conflict sites, interactions and interviews with local residents, forest frontline staff, non-governmental organizations, and volunteers as well as through a semi-structured questionnaire surveys in the affected areas. Secondary data refers to the analysis and use of information that has already been collected for purposes other than the present study. Its sources include published literature, earlier research studies, government reports, official records, scholarly journals, technical documents, books, computerized databases, and newspaper articles.

Semi-structured questionnaire survey: Field visits were conducted in areas affected by human–rhesus macaque conflict to design a semi-structured questionnaire. The questionnaire included a mix of open-ended and fixed-response questions. A pilot test was carried out in select conflict zones to validate the questionnaire before its final dissemination. The total of 350 respondents were surveyed, representing a diverse cross-section of stakeholders, including local residents, forest frontline staff, wildlife rescuers, volunteers, shopkeepers, farmers, students, housewives, saints, and devotees. Demographic information such as age, gender, and area of residence was recorded for each respondent. In addition to the survey, in-depth interviews and group discussions were conducted with forest staff, NGO personnel, wildlife rescuers, volunteers, and local inhabitants to gather insights into their experiences and perceptions regarding the conflict. Regular site visits were made to high-conflict zones, such as residential areas, marketplaces, temples, government offices, old buildings, military compounds, and agricultural lands frequently visited by rhesus macaques.

RESULTS AND DISCUSSION

Conflicting animal species in the region: The survey findings revealed that among the 350 respondents, the majority identified *Rhesus macaques* as the primary cause of human–wildlife conflict (40.86%) followed by snakes (18.57%), Hanuman langurs , wild boars , leopards , crocodiles (Table 1).

Rhesus macaques, Hanuman langurs, and wild boars were consistently reported as the most damaging species to agricultural crops, with rats also noted as crop pests in certain regions. Additionally, frequent leopard sightings and occasional crocodile encounters were reported, creating a significant psychological impact and fear among local residents. Areas with recurrent leopard sightings included Ranjhi, Khamariya, Thakurtaal, Nayagaon, Udana village, GCF Estate and New Colony, Andhuwa, Bahdan, Temar Bhita, Bhatauli, Dumna Road, Chulha Gulai, Bargi Hills,

IIITDM, Kundam, and Indrana Beet. Crocodile sightings were mainly reported from Rithori, Pariyat, Ranjhi, Ghana, Khamariya, Nanak Nagar, Manegaon, Umariya, and Sonpur.

Snakes, while commonly encountered, were largely considered non-threatening, as the majority were non-venomous and did not cause direct harm. Even in instances involving venomous snakes, prompt action by trained snake rescuers and forest department rescue squads helped mitigate risk, reducing the perceived threat from these species.

The intensity and frequency of *R. macaque* attacks were reported to be particularly distressing for residents, many of whom expressed a sense of helplessness in dealing with the problem. A notable concern among respondents was the perceived lack of support from government and non-government organizations, which may have contributed to rhesus macaques being perceived as the most problematic wildlife species in the area.

These results partially align with the findings of Saraswat et al. (2015), who reported that the majority of respondents (87.11%) identified Nilgai as the most problematic species in terms of human–wildlife conflict, followed by jackals (58.11%), *R.macaques* (57.11%), wild boars (48.00%), snakes (42.89%), and leopards (15.67%). While the species involved and their rankings differ somewhat, the commonality lies in the multi-species nature of human–wildlife conflict and the strong influence of local context on perceptions of severity.

Troop size: The majority of respondents (24.86%) reported encountering troops of *R. macaques* consisting of 11–20 individuals followed by 18.85% in larger groups comprising 21–30 macaques (Table 2). These observations reflect the dynamic social structure of rhesus macaque populations, which tend to form multi-male, multi-female troops with variable group sizes depending on resource availability, habitat type, and anthropogenic influences (Hasan et al., 2013). The predominance of medium-sized troops (11–30

Table 1. People perception on the most conflicting animal species in Territorial Forest Division, Jabalpur

Species	Percentage
Rhesus macaque (*Macaca mulatta*)	40.86
Hanuman langur (*Semnopithecus entellus*)	16.00
Leopard (*Panthera pardus*)	06.28
Snake (*Serpentes*)	18.57
Crocodile (*Crocodylus*)	04.57
Wild boar (*Sus scrofa*)	08.29
Others (birds, jackal, rats)	05.43
Total	100

individuals) may be linked to urban-edge habitats, where food availability from human sources can support moderately large groups without leading to intra-group resource competition or conflict.

Troop composition: The adult females identified by the presence of red skin on the rump and estimated to be over three years of age constituted the largest proportion of individuals within the observed *R. macaque* troops, accounting for 35.43% (*n* = 124) followed by juveniles (aged between 1–3 years, typically seen in close proximity to their mothers), comprising 21.43% (Fig. 1).

Habitat use pattern: Most respondents reported that *R. macaques* mainly inhabited residential colonies and buildings (21.71%), followed by religious sites (20.29%) with easy access to food, water, and shelter. Croplands (17.72%) and marketplaces (14.86%) were also common habitats due to food availability, while 13.71% noted their presence in nearby forests and 11.71% in abandoned buildings or old monuments offering undisturbed shelter.

Time of maximum activity: Majority of respondents reported increased sightings and activities of problematic *R. macaques* during the morning hours (30.57%). A notable proportion also indicated evening hours (25.43%) as peak activity periods. Interestingly, 23.15% of the respondents observed that the macaques exhibited activity throughout the day, indicating potential site-specific variations in behavioural patterns (Table 3). Das and Mandal (2015) also documented that *Rhesus macaques* frequently visit residential areas during morning hours (07:00–10:00) and again in the afternoon to early evening (14:00–18:00). Such bimodal patterns of activity are likely influenced by factors such as human movement, food availability, and environmental conditions at different sites.

Fig. 1. Troop composition

Table 2. Troop size of rhesus macaques in the study area

Troop size	Percentage
1	07.43
2-5	12.00
6-10	16.86
11-20	24.86
21-30	18.85
31-40	09.14
41-50	06.00
51 and above	04.86
Total	100

Table 3. Time of maximum activity of rhesus macaques

Time of activity	Percentage
Morning	30.57
Afternoon	17.71
Evening	25.43
Night	03.14
All day	23.15
Total	100

CONCLUSION

This study underscores the growing severity of human–rhesus macaque conflict within the Territorial Forest Division of Jabalpur, driven largely by increasing anthropogenic pressures and shifting ecological dynamics. As macaques become more reliant on human-dominated environments, their interactions with people have intensified—often surpassing those with traditionally more feared species such as leopards and snakes. Conflict hotspots consistently include areas that offer easy access to food and shelter, such as residential zones, religious sites, markets, and agricultural lands. Medium-sized macaque troops, particularly those with a high proportion of adult females and juveniles, are most active especially during morning and evening hours. This pattern of behaviour reflects their adaptive strategies but also highlights the absence of effective deterrents or management frameworks. The resultant impact on local communities includes psychological distress, economic strain, and deteriorating tolerance towards wildlife. Effectively addressing the growing human–rhesus macaque conflict requires a comprehensive and coordinated strategy. Key measures include better waste management, strict regulation of feeding practices, habitat restoration, and targeted community awareness programs. Successful implementation will depend on collaboration among local communities, forest departments, and non-governmental organizations. Ongoing research and monitoring are also vital to guide these efforts and promote sustainable human–wildlife coexistence amid increasing urbanization.

AUTHORS CONTRIBUTION

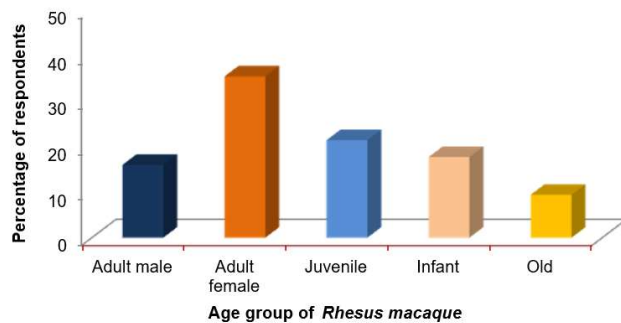Somesh Singh contributed to the conceptualization, data

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