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Conservation of Threatened Primates of Northeast India

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Abstract: The northeastern region of India also, referred to as a "biogeographical gateway," is the transition zone between Indian, Indo-Malayan and Indo-Chinese biogeographical regions. Primates are an important component of this region's biodiversity. The objectives of our study were to map the distribution and status of the different primate species to record habitat fragmentation, and to assess present forest status and human population pressures in Northeast India. Between 1994 and 2001, we surveyed several protected, reserved, and unclassified forests (about 650,000 ha) using a modified line-transect method to cover all representative areas in a randomly stratified manner to estimate density and distribution of primate species. Four species of macaque (rhesus, Assamese, northern pig-tailed, and stump-tailed) and three species of langur (capped, golden, and Phayre's), the hoolock gibbon, and the Bengal slow loris were sighted. The species recorded occur in very low densities with low numbers of immatures, and are threatened due to habitat loss and hunting. Recommendations were made to upgrade the status of many reserved forests, to make improvements to the country's wildlife laws, to increase the number of protected areas in the region, for public education and community participation programs, and political action to implement effective conservation strategies.
Key Words: Primates, Northeast India, conservation, golden langur, hoolock gibbon

Introduction

Extensive deforestation and habitat fragmentation continue at alarming rates throughout the world, and the survival of innumerable forest species, mainly in the tropics, is in jeopardy (Marsh and Mittermeier 1987). Officially only 3.7% of the world's total land area is protected as national parks or forest reserves (McNeely *et al*. 1990) and most of it is under tremendous pressure of human population growth. Based on estimated numbers of endemic species and degree of threat, Myers *et al*. (2000) recognized 25 'hotspots' worldwide, and as more data became available their number has been recently increased to 34 (Conservation International 2006). These hotspots cover 2.3% of the land surface, yet harbor 50% of all plant species and 42% of all vertebrate species, and in some less than 12 percent of the original natural habitat remains (Myers *et al*. 2000). Of the three biodiversity hotspots in India, the Indo-Burma Hotspot (includes northeastern India) is in greater danger than the Western Ghats and the Eastern Himalayas (India, Forest Survey of India 1999). Sandwiched between the Himalayas and the Bay of Bengal, the narrow strip of land known as Northeast India serves as a corridor connecting the people, fauna and flora of the Indian subcontinent to tropical Southeast Asia and the more temperate northern Asian climes. Periodically covered by glaciers during the Pleistocene, this area today is rich in ethnic and biological diversity (Srivastava 1999). It is the western limit for some south Asian species and the eastern limit for some Indian species. In spite of the variety of taxa found in this region, only recently have concerted efforts have been made to explore and study its biodiversity.

Northeastern India is made up of seven political states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura) with a total area of 255,083 km², of which 164,043 km² is forested and only 13,555 km² (5.3%) is protected. These forests are composed of evergreen rain forest, semi-evergreen, and moist deciduous forests. About one third of this area (34%) is protected as reserved forests and (9.2%) as strictly protected wildlife sanctuaries and national parks. Over half (56.8%) remain unclassified. According to the National Remote Sensing Agency, actual forest cover is now declining and is being degraded, mainly due to illegal felling and encroachment (India, Forest Survey of India 1999). The human population in Northeast India has grown exponentially from about 4 million people in 1901 to 14.5 million by 1961 and 38.5 million by 2001 (India, Census of India 2001).

The population pressure on natural habitats, combined with hunting, and live capture, has driven numerous species to the brink of extinction. It is therefore important to identify the species most susceptible to extinction in isolated fragments and the habitats that are most likely to support them. Such generalizations will allow for predictions to be made for areas for which data are as yet unavailable.

Primates are valuable subjects for such studies for several reasons (for review, see Marsh and Mittermeier 1987). In order to prevent the extinction of a significant percentage of primates, empirical information about these species and their habitats was required. In 1994, therefore, we set up an integrated, collaborative Indo-U.S. Primate Project to conduct systematic status surveys, record fragmentation of primate habitats, and develop eco-ethological profiles of individual species to provide a basis for the conservation and management of primate habitats and species living therein.

Between 1994 and 1999, our research team surveyed over 650,000 ha of protected, unprotected, and unclassified forests using the line transect method, modified to cover all representative areas in a randomly stratified sample (Burnham *et al.* 1980; NRC 1981; Kent and Coker 1994, Srivastava *et al.* 2001a, 2000b). Many long-term studies on ecology and behavior of particular species were also conducted to understand plasticity in behavior, responses to habitat change, and the long-term consequences of these changes on the future of primate populations. The detailed analysis of these results is beyond the scope of this paper and reported elsewhere. Here I provide a brief summary of the status, distribution and conservation of the primates in Northeast India, with special reference to golden langurs and hoolock gibbons, both of which are confined to this region in the Indian portions of their ranges.

Results

Nine species of primates were found: hoolock gibbon (*Hoolock hoolock*) (formerly in the genus *Hylobates*, and briefly in the genus *Bunopithecus*; see Mootnick and Groves 2005), golden langur (*Trachypithecus geei*), capped langur (*Trachypithecus pileatus*), Phayre's leaf monkey (*Trachypithecus phayrei*), stump-tailed macaque (*Macaca arctoides*), Assamese macaque (*Macaca assamensis*), northern pig-tailed macaque (*Macaca leonina*), rhesus macaque (*Macaca mulatta*), and Bengal slow loris (*Nycticebus bengalensis*). There have been reports of silvered leaf monkey (*T. cristatus*), Tibetan macaque (*M. thibetana*), and golden snub-nosed monkey (*Rhinopithecus roxellanae*) in the past (Roonwal and Mohnot 1977; Choudhury 1998) but our detailed survey indicated that these reports were either based on indirect observations or misidentification. Several forms are represented by distinct subspecies, as in the case of Assamese macaque, where the western and eastern subspecies are as genetically distinct as the different species of macaques (Hoelzer and Melnick 1996). Though recorded earlier, Hanuman langurs (*Semnopithecus entellus*) were not encountered in the areas surveyed.

Distribution and conservation status

A number of primates were evidently restricted to the south of the Brahmaputra River: Stump-tailed macaque, pigtailed macaque, hoolock gibbon and Phayre's leaf monkey. Rhesus macaques were encountered more often in areas adjacent to forest rather than in the forest proper. Capped langurs, the most widely distributed of the species, with five distinct subspecies, were encountered frequently, even though occurring in very low densities. Phayre's leaf monkey was observed thriving well in degraded habitats and bamboo forests. Hoolock gibbons were encountered with low densities in primary, secondary and regenerating forests. Table 1 contains the data on primate sightings in different forest types and sympatry with other primate species.

The number of groups for each species, total forest area surveyed, number of individuals, the male-female sex ratio, and percent availability of immatures are given in Table 2. These results indicate that all the primates in Northeast India occur in very low densities: low encounter rates were very low as were the numbers of immatures in the populations—suggestive of population decline, but census figures before 1994 are not available for comparison.

Although nonhuman primates do survive in the forests of Northeast India, their habitats are under severe pressure. Most of the reserved forests which had once been a rich primate habitat have been degraded, and populations are small, barely able to subsist, and in rapid decline. These surveys revealed that most of the species in Northeast India are threatened and their legal status is inadequately addressed by the various conservation agencies (Table 3).

Habitat loss is the principal threat to wild primate populations in Northeast India. Table 4 shows the loss of forest by state between 1997–1999 and 2001–2003 (India, Forest Survey of India 1999, 2003) and the remaining primate habitat. Habitat loss results from clear cutting for settlements and agriculture, and forests are also selectively logged for fuelwood and construction material and exploited for natural products. In many areas the damage is substantial and locally threatening to the survival of the primates.

Table 1. Primate sightings in different forests types and sympatric species.

Species	Forest Types	Sympatric Species
1. *Macaca arctoides*	MF, SEG, MD	2,3,4,6,7,8,9
2. *Macaca assamensis*	EG, SEG, DD, MD	1,3,4,5,6,7,8,9
3. *Macaca mulatta*	DD, MD, BF, SG, HH	1,2,4,5,6,7,8,9
4. *Macaca leonina*	SEG, EG, SG, MF	1,2,3,6,7,8,9
5. *Trachypithecus geei*	MD, EG, SEG	2,3
6. *Trachypithecus phayrei*	EG, BF, MD	1,2,3,4,7,8,9
7. *Trachypithecus pileatus*	EG, BF, MD	1,2,3,4,6,8,9
8. *Hoolock hoolock*	EG, SEG	1,2,3,4,6,7,9
9. *Nycticebus bengalensis*	EG, SEG, SG	1,2,3,4,6,7,8

[1]M = Mixed forests; EG = Evergreen; SEG = Semi evergreen; MD = Moist deciduous; DD = Dry deciduous; BF = Bamboo forests; SG = Secondary growth; HH = Human habitation.

Table 2. Demographic profile of primates of Northeast India.

Species	Forest surveyed (km²)	No. troops sighted	No. individuals	Sex ratio (M:F)	% of immatures
Nycticebus bengalensis[1]	–	–	7	–	–
Macaca arctoides	1,732	14	133	1:1.9	68
Macaca assamensis	13,998	68	449	1:2.6	45
Macaca mulatta	5,913	141	1,804	1:2.5	39
Macaca leonina	993	11	71	1:1.5	31
Trachypithecus geei	1,547	131	1,035	1:2.5	24
Trachypithecus phayrei	1,060	21	145	1:1.5	47
Trachypithecus pileatus	43,509	152	844	1:2.5	40
Hoolock hoolock	3,055	76	244	1:1	26

[1]Night surveys were not conducted; individuals confiscated from various locations.

Table 3. Status of primates of Northeastern India as per different agencies.

Species	Status (WPA 2002)[1]	IUCN Red List 2004	Current status[2]
Nycticebus bengalensis	Schedule – I	Data Deficient	Data Deficient
Macaca arctoides	Schedule – II	Vulnerable	Critically Endangered
Macaca assamensis	Schedule – II	Endangered	Endangered
Macaca mulatta	Schedule – II	Least Concern	Forest populations dwindling
Macaca leonina	Schedule – II	Vulnerable	Critically Endangered / Endangered[3]
Trachypithecus geei	Schedule – I	Endangered	Critically Endangered / Endangered[4]
Trachypithecus phayrei	Schedule – I	Not Evaluated	Critically Endangered / Endangered[5]
Trachypithecus pileatus	Schedule – I	Endangered	Endangered
Hoolock hoolock	Schedule – I	Endangered	Endangered

[1]Wildlife (Protection) Amendment Act 2002
[2]Based on Indo-U.S. Primate Project Survey and Molur *et al.* (2003)
[3]Molur *et al*. (2003) assessed the species as Endangered
[4]Molur *et al*. (2003) assessed the species as Endangered
[5]Molur *et al*. (2003) refer to Phayre's langur as *T. obscurus phayrei* and assessed it as Endangered

Table 4. State wise forest cover loss and remaining primate habitats in Northeast India.

States	Total area (km²)	Dense forest cover loss 1997–1999[1] (km²)	Dense forest cover loss 2000–2003[1] (km²)	Remaining dense forest (more than 40% crown density)[1]
Arunachal Pradesh	83,743	798	2,671	51,261
Assam	78,438	1,328	3,547	12,283
Manipur	22,327	218	2,116	3,594
Meghalaya	22,429	28	1,767	3,913
Mizoram	21,087	1,106	5,155	3,781
Nagaland	16,579	4	1,910	3,483
Tripura	10,477	206	684	2,779

[1]India, Forest Survey of India, 1999; 2003 (Source: IRS- 1B LISS II; IRS-1C & 1D LISS III)

The hunting of primates in Northeast India takes place for a number of reasons, but by far the most important is for food. Although hunting is prohibited by the Wildlife (Protection) Act of India of 1972 (amended 2002), its enforcement is usually nonexistent in the remote areas. In areas where the hunting of primates for food is common, it can represent a threat even more severe than forest destruction. In Arunachal Pradesh, Mizoram and Nagaland, for example, there are large tracts of primary forest remaining where primate populations have been either exterminated or pushed to the brink of local extinction by excessive hunting.

Primates may also be killed when they raid and damage crops; this is especially true for the rhesus macaque in most of Northeast India. Other macaques are also reported crop-raiding in a number of areas: pig-tailed macaques in Meghalaya, stump-tailed macaques in Nagaland, and Assamese macaques in Arunachal Pradesh are hunted as agricultural pests (Srivastava 1999). Golden langurs are reported to damage cardamom crops and capped langurs maize fields in Northeast India. In general it appears that the more locally abundant species are the more they raid crops, and the persecution of crop-raiding species is not, it would appear, a cause of endangerment to the species in any particular area (Srivastava and Mohnot 2001c). This issue is important, however, and, being poorly understood, certainly needs further investigation.

Status of golden langurs

The golden langur (*Trachypithecus geei*) is found only in a small portion of western Assam, India and neighboring

regions of Bhutan. Its distribution lies north of the Brahmaputra River and is bounded on the east by the Manas River and in the west by the Sankosh River (Srivastava 1999). Surveys carried out over 733 km of transects indicated that 93% of the total population inhabits just three reserved forests and the western part of Manas National Park. The seven percent of the remaining population encountered in other reserved forests of various sizes are often isolated and sometimes in areas under very heavy human population pressures (Srivastava *et al*. 2001a). Ethnic violence that broke out in 1989 in the range of the golden langur resulted in considerable loss of their forests. As such they were victims of the "tragedy of the commons," and one-third of the original golden langur habitat has been lost over the last ten years (Data IRS-1B LISS II images taken in 1989 and 1999). A total of 1,035 individuals were counted, and the estimate was that about 1,500 animals were surviving in India. A much larger population may exist in Bhutan. The percent of immature individuals was 24%. Our survey suggested that less than 500 km² of suitable habitat is available in the northeast and that the golden langur should be placed in the category of Critically Endangered in India.

Status of hoolock gibbons

The hoolock gibbon (*Hoolock hoolock*), India's only ape, is confined to small forest patches of the northeast, to the south of the Brahmaputra River. Surveys have indicated that the free-ranging populations of gibbons are the most seriously threatened of the primates, even where habitat destruction is minimal. We monitored the hoolock population at Borajan Reserved Forest (5 km²) for more than four years, between 1995 and 1999, during which time there was a population decline of 68% (Srivastava *et al*. 2001b) (Table 5). Eleven groups, 34 individuals in all, were found in the reserve in the 1995 survey, but by 1999 only five groups remained, with a total of 11 individuals—all in an isolated stand of trees that required they go to the ground to reach additional food trees. The number of immature animals was only 20% of the population. A total of 3,055 km² of forests with different degrees of protection were surveyed, and a population of 244 individuals living in 76 family groups was recorded (Srivastava and Mohnot 2001c). The total population in India may not exceed 5,000 individuals. The adult male to female ratio was 1:1, and 26% of the langurs counted were immature. The survey estimated 18,669 km² of available suitable habitat in Northeast India, and recommended the species should be placed in the Endangered category in India. Choudhury (2006) reported similar trends for the status of gibbons based on cross-sectional surveys carried out between 1987 and 2005 covering the states of Meghalaya, Manipur, Mizoram and Nagaland of northeast India.

Discussion

Primate conservation in India requires that three main issues be addressed—forest conservation, hunting pressure and legal status.

Since, forest loss is the principal threat to primates, habitat protection should be given highest conservation priority. The most valuable direct means of assessing species conservation is the establishment and management of strictly protected areas as well as community-based conservation areas. Over 60% of the closed forests (canopy cover of 40% or more) in Northeast India remain without any kind of legal or community protection, and it is imperative to prepare a conservation plan which would bring these areas into the protected area network; be they managed by local communities or by administrative authorities with local participation. Joint forest management programs have been adopted by a number of states elsewhere in the country and have shown some remarkable results. They could well be applied in the northeast; with modifications to account for the regional and local culture and traditions. The National Forest Commission recently submitted a report that gave the following recommendations: 1) to bring one-third of the landmass of the country under tree cover into protected area categories; 2) to revise and update the Indian Forest Act of 1927; and 3) to carry out periodic revisions of the Wildlife (Protection) Amendment Act (India, National Forest Commission 2006). Conservation education can be very effective and many people understand the value of wildlife and natural habitats. There is already a basic and, in many areas deep-seated, respect for living creatures and pride in the nation's natural heritage. Conservation education and conservation action projects should involve NGOs, and the local communities that live in and around forested areas.

Primates in Northeast India are hunted for a variety of reasons, but by far the most important is for food. Although hunting is prohibited by the Indian Wildlife (Protection) Act of 1972 (amended in 1993), its enforcement is often very difficult in remote areas and even local communities are unaware of the regulations. Hunting is a threat even more severe than forest destruction in some of the more remote areas. Efforts

Table 5. Hoolock gibbon population change between 1995 and 1999 in the Borajan Reserved Forest.

Transects	1995	1995	1997	1997	1998	1998	1999	1999
	Groups	Total	Groups	Total	Groups	Total	Groups	Total
T-1	2	4	1	3	1	4	2	6
T-2	3	11	0	0	0	0	0	0
T-3	4	11	3	6	3	5	2	3
T-	2	8	3	8	1	2	1	2
Total	11	34	7	17	5	11	5	11

Photo 1. Rhesus macaques, *Macaca mulatta,* are captured young and trained to perform at roadside shows by charmers. Photograph by Arun Srivastava.

Photo 2. Golden langur habitat near Ultapani (Chirrang Reserved Forest) cleared for cultivation. Photograph by Arun Srivastava.

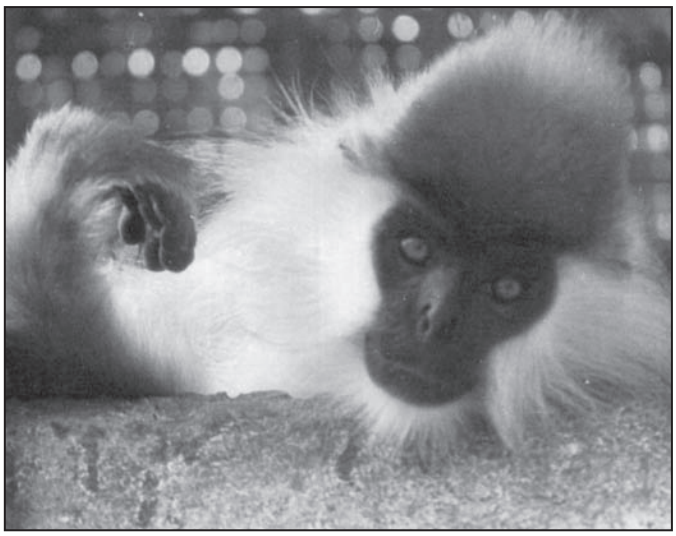

Photo 3. The capped langur, *Trachypithecus pileatus*, is an endangered colobine widely distributed in northeast India. Photograph by Arun Srivastava.

Photo 4. The slow loris, *Nycticebus bengalensis*, is being hunted for wildlife trade throughout its range in Asia. Photograph by Prabal Sarkar.

should be made to raise awareness among communities living in these fringe areas.

India's Wildlife (Protection) Amendment Act of 2002 needs revision. A number of species included in Schedule-II should now be listed in Schedule-I, which would prohibit their persecution, hunting and capture for any reason. Although the *2004 IUCN Red List of Threatened Species* is comprehensive and identifies a significant number of primates of Northeast India as threatened, this too needs revision; especially taking into account the careful assessments carried out during the South Asian Primate Conservation Assessment and Management Plan (CAMP) Workshop, organized by the Conservation Breeding Specialist Group – South Asia in 2002 (Molur *et al*. 2003) (Table 3). Molur *et al*. (2003) provide specific recommendations for conservation action and research to better assess the status of these Northeast Indian primates, particularly necessary for several macaque species, which are thought to be evenly distributed across south and southeast Asia. All the distinct threatened populations must be given proper consideration (for example, the eastern and western subspecies of Assamese macaques and the five subspecies of capped langurs).

The surveys of US-Indo Primate Project have helped us to identify the "focal areas" for the survival and for long-term conservation and management of the primates in Northeast India. They have also given us the opportunity to identify the threats and suggest specific measures. The next step is to identify the underlying causes of habitat loss and change affecting the primate populations; how different species are responding to each of threats; the demographic aspects which affect future generations; and to obtain some degree of understanding as to the fate of these monkeys in their natural habitats and how we can save them from extinction. The next phase of our conservation efforts, therefore, will aim to initiate species-specific long-term studies on behavior and ecology to provide information vital for establishing reserves and delineating their necessary size and boundaries; to understand the specific ecological and sociological requirements of each species; and allow us to predict trend in population change. Based on this, it is possible to set up a comprehensive conservation action plan for the species.

Conclusions

1. Revision of *2004 IUCN Red List of Threatened Species* is urgently required.
2. The Indian Wildlife (Protection) Amendment Act of 2002 also needs revision. Several species included in Schedule-II, should now be put in Schedule-I.
3. In Arunachal Pradesh, Meghalaya, Mizoram and Nagaland there are large tracts of primate habitat remaining, but primate populations have effectively been either exterminated or pushed to the brink of local extinction by excessive hunting.
4. Hunting of primates as agricultural pests is a major problem. The rhesus macaques can become significant crop-raiders in certain areas and are persecuted as such. The northern pig-tailed, stump-tailed and Assamese macaques are also hunted as pests.
5. It is important to note that the primates in northeastern India have been forced into crop raiding because of loss of natural habitat. In some cases, they have clearly learned to co-exist with humans by raiding crops. Conflicts of this kind are likely to increase in the future as the human population continues to grow exponentially in northeastern India, and encroachment on primate habitats continues.
6. Habitat destruction is the most significant threat to the survival of primates in Northeast India. It is evident, however, that certain species can survive in disturbed habitats, but the long-term consequences on reproduction and survival are unknown.
7. With the current rate of habitat loss it is estimated that some Critically Endangered species such as golden langurs could go extinct in the next quarter century.
8. Gibbons are confined to isolated forest fragments and are worst affected even with minimal levels of habitat destruction.
9. Differences in population density, demography, and social structure can be related to habitat quality at different reserve forests with varying degree of disturbance.
10. Detailed studies that combine field surveys and phylogenetic studies are needed to determine relatedness among newly recognized taxa, especially subspecies of the *Trachypithecus pileatus* group and the Hanuman langurs (*Semnopithecus entellus*) to implement effective conservation and management strategies.

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