

POPULATION SIZE AND DISTRIBUTION OF THE CAPPED LANGUR *Trachypithecus pileatus* (Blyth, 1843) IN MADHUPUR NATIONAL PARK, BANGLADESH

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ABSTRACT

We studied the population size and distribution of the Capped Langur *Trachypithecus pileatus* in Madhupur National Park, Bangladesh, from February to October 2015. Altogether, we recorded 99 individuals. We found 98 individuals from 12 groups and one isolated adult male. The group size ranged from 4 to 14 (mean 7.62 ± 3.2) individuals; 48.5% were adults and 51.5% were non-adults. The ratio of adults to non-adults was 1:1.06, and the adult sex ratio of males to females was 1:2.69. We recorded most (61.5%) of the groups within the park boundaries in undisturbed dense forest with a high diversity of food plants and a high canopy layer.

Keywords: group composition, group size, sex ratio

INTRODUCTION

Bangladesh has a comparatively poor forest cover (1.4 million hectares) accounting for only 11% of the country's land area (FAO, 2010). There are three species of colobines in Bangladesh: the Capped Langur *Trachypithecus pileatus* (Blyth), Phayre's Langur *T. phayrei* (Blyth), and the introduced Northern Plains Sacred Langur *Semnopithecus entellus* (Dufresne). In Bangladesh, the Capped Langur is found in dense forest and bamboo patches of both moist deciduous and mixed evergreen forests (IUCN Bangladesh, 2015). In the early 1970s and 1980s it occurred in Gazipur District to Jamalpur, Sherpur, Netrokona and Mymensingh under Mymensingh Division to the forests in Sylhet and Chittagong Divisions. At present, there are only a small number of individuals left in the Mymensingh Division while the remaining populations are only present in the mixed-evergreen forests of Sylhet and Chittagong Divisions (Khan, 2015). This species is also found in northeastern India, northwestern Myanmar, Bhutan and southern China (Srivastava, 1999). It is assessed as nationally Endangered (IUCN Bangladesh, 2015) and globally Vulnerable (Das et al., 2008). Populations of this species face a range of threats, particularly to their habitat, with the most severe stemming from human alteration to the forests (Das et al., 2008). Some major causes are *jhum* cultivation, plant monocultures, timber and firewood

harvests, and other development, resulting in a loss of trees in which this species feeds, travels and sleeps (Das et al., 2008). Also, these langurs are subject to trade for their meat and other body parts, and as pets (Molur et al., 2003).

A few studies have reported on the population status of this species in Bangladesh (Gittins, 1980; Feeroz, 2001) and India (e.g. Kumar & Solanki, 2008; Biswas et al., 2009), and there is some information on its activity patterns, diet and reproductive behaviour in Madhupur National Park and other areas in Bangladesh (e.g. Green, 1981; Islam & Hussain, 1982; Stanford, 1987; 1991; Kabir, 2006; Das et al., 2008; Mandal & Kabir, 2014). The Madhupur National Park is under severe pressure due to the harvesting of fuelwood and dry leaf litter for cooking, grazing of livestock, illicit tree felling, and fire hazards (Khan, 2010). Large numbers of people (~60,000) live in this area, and the demand for fuelwood, timber, building materials, and land to cultivate exerts heavy pressure on the remaining forest (Hossain et al., 2004). An estimate from more than a decade ago showed that over 70% of the Shal *Shorea robusta* Gaertn. forest is now either degraded or encroached upon (Nishat et al., 2002). The underlying key causes to the destruction of langur habitat are high population pressure and weak forest management. In this study, we investigated the population status and distribution of the Capped Langur in Madhupur

National Park. The aim was to determine the population size and number of groups living in the national park, including group and age-sex composition.

METHODS

Study area

The study was carried out in the Madhupur National Park, Tangail (Fig. 1) from February to October 2015. The Madhupur forest is the largest tropical moist deciduous forest (24,150 ha) in Bangladesh, a portion (8,436 ha) of which is protected as the Madhupur National Park. The national park is in the northern part of the Bhawal-Madhupur Shal forest tract (24° to 25°15'N and 90° to 91°E, about 20m asl), some 50km south of the Garo Hills of the Meghalaya State of India, and about 150km north of Dhaka, the capital of Bangladesh. Geologically it is a terrace from one to ten metres above the adjacent floodplains. The soils of the tract have developed largely on Madhupur clays, which are nutrient poor and somewhat acidic, and red or brown in colour. The forest ranges from dense stands of trees to areas with sparse stands, including some scrub forests and human settlements. The topography includes numerous depressions with gentle slopes intercepting the ridges. The climate is moderate with warm weather from March to October and a recorded maximum temperature of 34.8°C in April. The minimum was 13.3°C recorded in February. The highest rainfall was recorded in July and lowest in March.

The Garo people are one of the largest indigenous communities (approximately 100,000 to 130,000 people) (Islam, 2008). They live in the northeastern part of Bangladesh with the highest presence in the Gazipur, Mymensingh, Netrokona, Tangail, Sherpur, Jamalpur and Sylhet districts (Muhammed et al., 2011). Two tribal clans, the Koch and the Mande (Garo), who are dependent on these forests, live in the Madhupur tract (Rahman et al., 2010). The Koch are among the earliest peoples of Bangladesh, while the Mande have their main centre of dispersal in the Garo hills in India (Rahman et al., 2010). Bengali-speaking people, who used to live along the fringes of the extensive forests, have entered in large numbers and cleared most of the forests (Rahman et al., 2010). Bengalis have developed stable agro-horticulture systems in the west (Rahman et al., 2010). Due to anthropogenic disturbances, the landscapes and ecosystems of most of the tract have changed drastically in the last 30 years, triggering the loss of invaluable biodiversity in the area (Rahman et al., 2010).

Shal (*Shorea robusta* Gaertn.) is the dominant tree species. The other common trees are Palash *Butea monosperma* (Lam.) Taub., Haldu *Adina cordifolia* (Roxb.) Benth. & Hook.f. ex B.D.Jacks., Shidah Jarul *Lagerstroemia parviflora* Roxb., Bazna *Zanthoxylum rhetsa* DC., Hargoja *Dillenia pentagyna* Roxb., Koroi *Albizia* spp., Menda *Litsea monopetala* (Roxb.) Pers., Kushum *Schleichera olosa* (Lour.) Merr., Udhal *Sterculia villosa* Roxb., Bahera *Terminalia belirica* (Gaertn.) Roxb., Kurchi *Holarrhena antidysenterica* (Roth) Wall. ex A.DC., Haritaki *Terminalia chebula* Retz., Pitraj *Aphanamixis polystachya* (Wall.) R.Parker, Shorea *Streblus asper* Lour., Sonalu *Cassia fistula* L., Assar *Grewia microcos* L. and Amlaki *Phyllanthus emblica* L. (Rashid, 2003).

Data collection

We carried out surveys for 36 days, totaling 432 hours. We conducted two-day surveys from dawn to dusk every two weeks using the line-transect method (Brockelman & Ali, 1987). We made nine transects (Table 1, Fig. 1) in and around the forest. The length of the total transects were 85km. The transects were established to avoid areas with spiny *Calamus* sp. (north and south of transect 3), which were practically difficult to establish given the limited time available for fieldwork. The lowland areas inside the forest are used for seasonal crop cultivation by the local people, which were also avoided during the study period. Some patches of the park area are used for pineapple, banana, arum cultivation and some areas (south of the highway) are used for monoculture plantations (*Acacia* sp.), and these areas were avoided while setting up the transects. The Kathalia Canal connects to the Banna River and runs through the transect 2 from east (transect 6) to west, and on both sides of the canal there are open paddy fields. Moreover, as the Capped Langurs live in the higher canopy, it is possible to observe them easily from the transects.

We repeatedly surveyed the transects, recording group size and age/sex class of all individuals and any disturbances due to human activities such as settlements, grazing, logging, agriculture, hunting and poaching. We classified the langurs into four age categories: adult, sub-adult, juvenile and infant, based on the morphological differences described by Stanford (1991). We recorded the sex only of adults. We differentiated the groups based on their group size, composition, locations and visible markings of members (injury, abnormalities or other characteristic features) as described by Hasan et al. (2013). We recorded the GPS locations of each group using a Garmin eTrex 20.

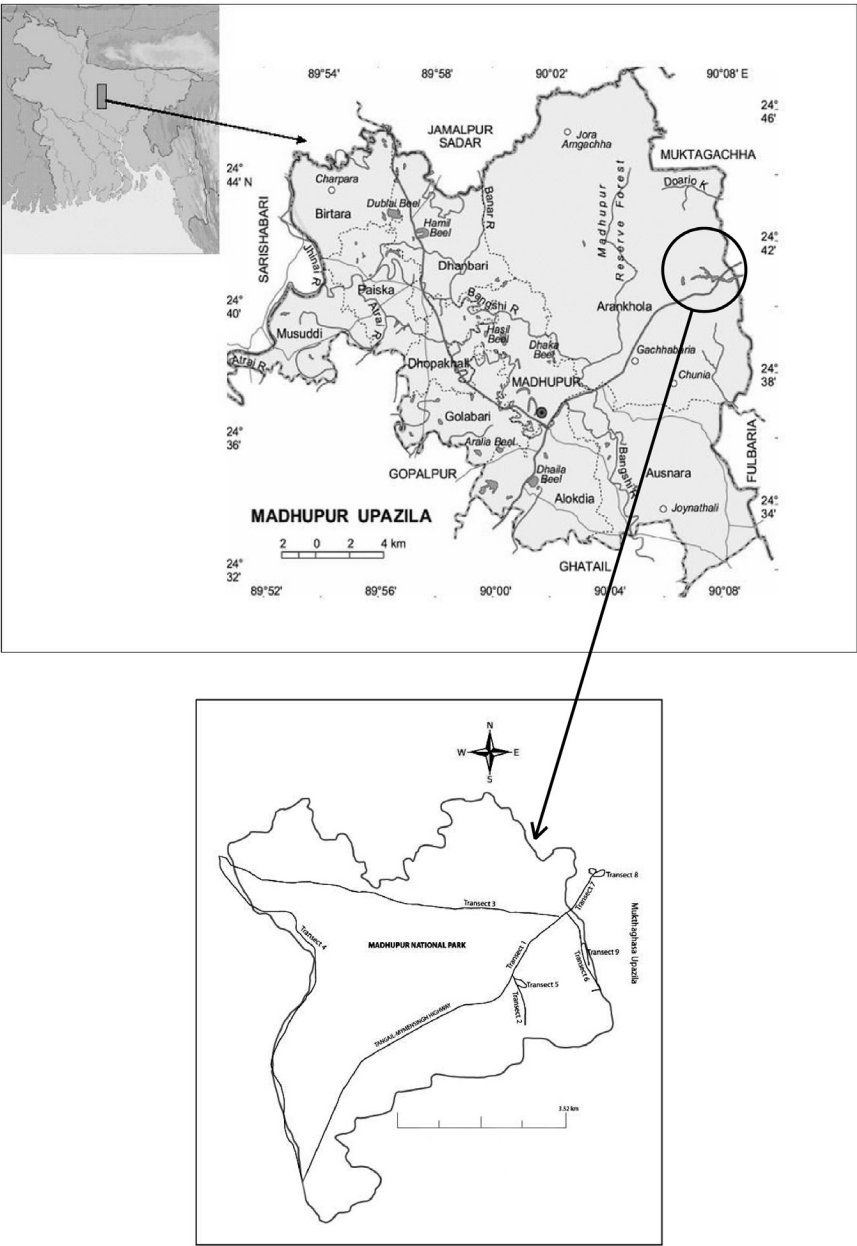


Fig. 1. Madhupur National Park and location of transect lines established during the study.

RESULTS
Population size

We recorded 98 Capped Langurs in 12 groups and one solitary adult male (Table 2). We observed this isolated adult male near Rasulpur Mazar (Fig. 2). We observed it several times taking food such as bread, bananas, and biscuits from the local people and

tourists. Local people reported that it regularly visited Rasulpur, at intervals of 3–5 days to take food from the people. No other langurs were observed taking food from people. We also saw this individual in other parts of the Beribaid forest beat.

We observed the largest sub-population (62.6%) of Capped Langurs in the Beribaid beat of the

Table 1. Location and length of transect lines, and Capped Langur groups recorded in Madhupur National Park.

Transect no.	Length (km)	Location	Group recorded	Frequency of transect walks
1	8.65	Rasulpur – Pochismail	5,6,7,8,9,10	12
2	1.11	Joloi rest house – Biman Bahini Camp	-	13
3	7.83	National Park Gate – Dokhola	3,4,11,12,13	7
4	8.66	Dokhola – Pochismail	-	5
5	0.59	Joloi resthouse – Garo Village	-	10
6	2.1	Rasulpur Bazar – Razabari	1,2	11
7	1.6	Rasulpur Bazar – Harinatala Village	-	12
8	0.55	Harinatala Village	-	8
9	0.67	Kathalia Village	-	7



Fig. 2. A solitary adult male Capped Langur, Madhupur National Park.

Jatiya Uddan Range (Table 2, Fig. 3). Beribaid is an undisturbed dense forest with a high diversity of food plants and a high canopy layer. The Tangail-Mymensingh highway passes through this beat, and there is a regular transit of forest officers and staff, who prevented the Garo people from hunting.

We did not record the Capped Langur in the peripheral zone of the north-western side of the Dokhola beat of the national park, which has fragmented forest with low tree density and canopy cover. Moreover, there was also high hunting pressure due to settlements of Garo people in this area. The Garo have a history of hunting

the langurs for food. This behaviour contrasts with that of the Bengali people (other local people, the majority of whom are Muslims) who do not hunt or consume the langurs. Local people informed us that the Garo people hunted and consumed the langurs opportunistically. Moreover, during our work we observed Capped Langur fleeing when they saw Garo people. Out of 12 groups, we recorded ten groups within the national park boundaries. During winter, when food is scarcer, two of the groups outside of the park moved from natural forest to human settlements (villages of Harinatala and Kathalia of Muktagacha upazila), near the eastern boundary of the national park. These villages are not

Table 2. Sighting records of Capped Langurs in Madhupur National Park.

Group No.	Location	Sighting date	GPS Location	AM	AF	J	I	Total
1.	Kathalia	Aug. 13	N24°40.734' E90°09.049'	1	3	2	-	6
2.	Rasulpur Mazar	Apr. 23	N24°41.227' E90°08.263'	1	-	-	-	1
3.	Beribaid	Sep. 30	N24°40.904' E90°08.08'	1	7	6	-	14
4.	Beribaid	Aug. 13	N24°40.812' E90°08.014'	2	2	1	1	6
5.	Beribaid, Jaloi Cottage (south) (tailless adult-female)	May 14	N24°41.156' E90°08.079'	1	4	3	3	11
6.	Dokhola beat	Jul. 24	N24°41.010' E90°07.531'	1	2	5	2	10
7.	Beribaid, BimanBhahini Camp	Jul. 24	N24°40.575' E90°07.506'	1	1	2	-	4
8.	Beribaid, Jaloi Cottage (north)	Apr. 3	N24°40.497' E90°07.386'	1	1	5	-	7
9.	Beribaid, Mahua cottage	Jun. 4	N24°40.460' E90°07.373'	1	4	3	-	8
10.	Beribaid	Jun. 5	N24°40.362' E90°07.251'	1	4	5	2	12
11.	Rasulpur – Lohoria road 2 (west)	Jul. 23	N24°41.353' E90°07.099'	1	2	1	1	5
12.	Lohoria beat (east side)	Jul. 24	N24°41.446' E90°06.179'	1	3	4	1	9
13.	Rasulpur – Lohoria road 1 (east)	Jul. 23	N24°41.441' E90°06.178'	1	2	2	1	6
Total				13	35	40	11	99
%				13.1	35.4	40.4	11.1	100

AM: Adult Male, AF: Adult Female, J: Juvenile, I: Infant

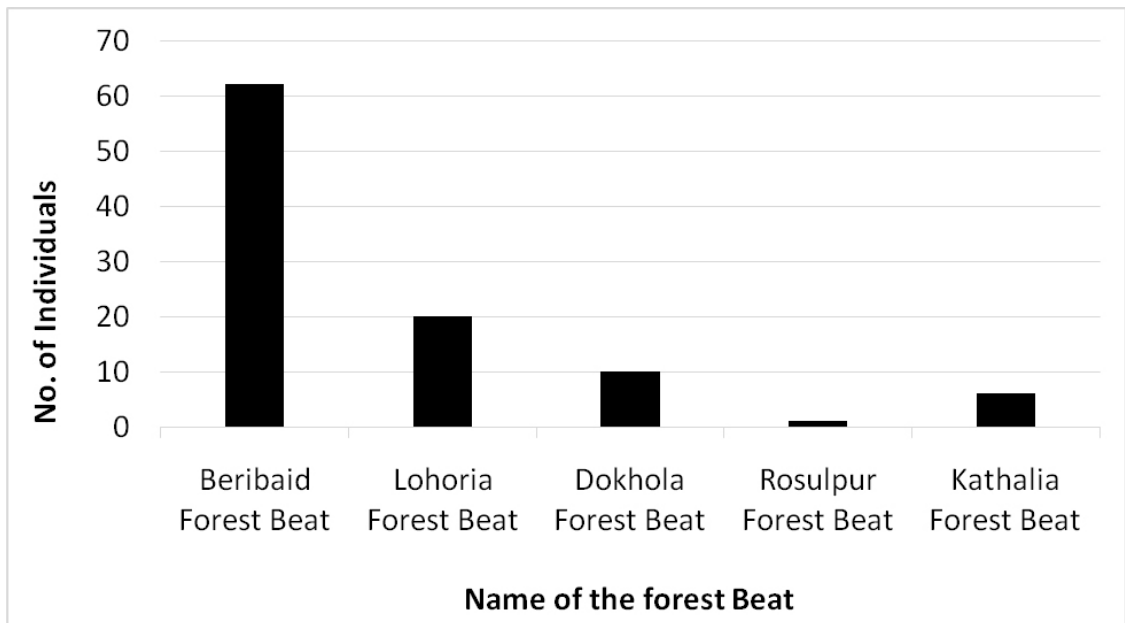


Fig. 3. Number of Capped Langurs across Madhupur National Park.

part of the ethnic community. The local people of these villages do not hunt the langurs but they chase them when the langurs raid crop fields or fruit plants. Of the groups in the park, we recorded three (25%) in the undisturbed deep forest area, and other groups (75%) near the park's east-central boundaries (Fig. 4).

Group size and composition

Group sizes ranged from 4 to 14, with an average of 7.62 ± 3.2 . We recorded the largest group (group no. 3) in Beribaid, the smallest group (group no.7) in Biman Bahini Camp area (Beribaid beat) (Fig. 5). The forest of Biman Bahini area was fragmented and had low dense canopy layer. We found non-adult individuals (sub-adult, juvenile and infant) to slightly outnumber the adults among the 99 Capped Langurs (51.5% to 48.5%). The mean ratio of adults to non-adults was 1:1.06 (Table 3). In each group, juveniles outnumbered other age groups. Most of the individuals in each group were juveniles. The number of adult females was similar to the number of juveniles, and the number of adult males was similar to that of infants.

Age-sex composition

We found that most of the groups (91.7%) had a single adult male and only one group (Beribaid, group no. 4, Table 3) had two adult males. Of the single-adult-male groups, we found most (83.3%) to be single-male multi-female groups and only 16.7% of the groups to be single-male single-female. When data from all

groups were combined, we found 27.1% adult males and 72.9% adult females, at a ratio of 1: 2.69 (Table 3).

DISCUSSION

We recorded 12 social groups along with one old solitary male in the study area. Old solitary males have also been reported for Hanuman Langurs *Semnopithecus entellus* (Dufresne) in India (Rajpurohit et al., 2004). We observed most of the groups within the high canopy layer in dense forest where the forest staff and officers patrol regularly. The Capped Langur avoided the forest area adjacent to the Garo settlements. This might be because the Garo people hunt the Capped Langur, consuming them as food during special occasions and even opportunistically (Naher et al., 2017). Garo aged between 15 and 25, who are mostly illiterate, are the most likely age-group to engage in hunting (Naher et al., 2017). The Garo community of the northern part of the country participates in group hunting during the winter (Naher et al., 2017). Rhesus Macaques *Macaca mulatta* (Zimmermann) have apparently been wiped out from the Shal forest of north Bengal due to over-hunting (IUCN Bangladesh, 2015). Hunting for medicinal purposes and artifacts for socio-cultural practices and religious and cult ceremonies are the primary causes of population decline in Assam (Biswas et al., 2009) and Arunachal Pradesh (Kumar & Solanki, 2004, 2008) in India. Hunting, poaching and habitat destruction are

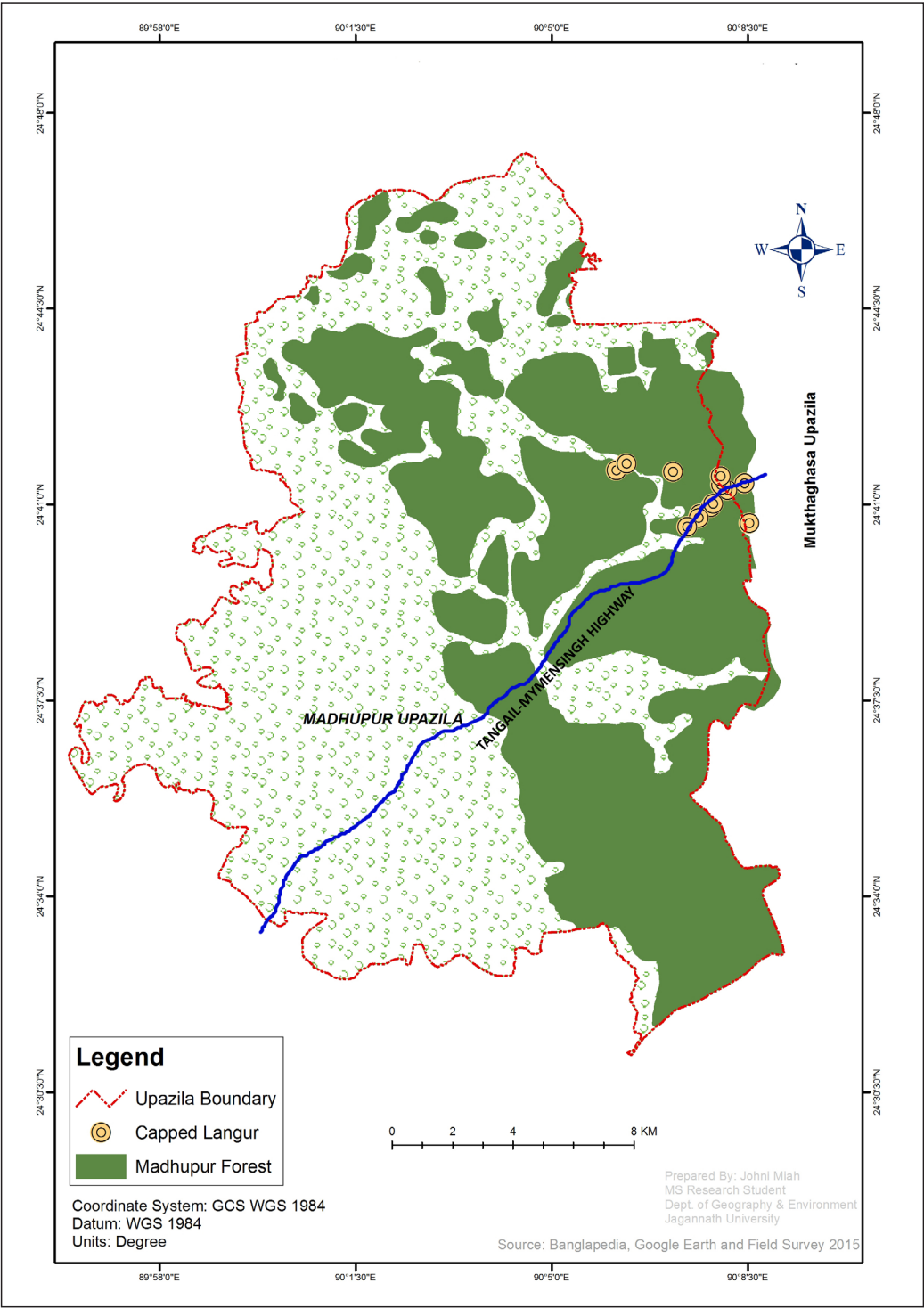


Fig. 4. Distribution of Capped Langurs in Madhupur National Park.



Fig. 5. A group of Capped Langurs at Beribaid Forest Beat.

Table 3. Age-sex ratio of Capped Langur groups in Madhupur National Park.

Group No.	Sighting area	AM	AF	AM:AF	Adult	Non-adult	Adult to non-adult	Total
1.	Kathalia (human habitation)	1	3	1:3	4	2	2:1	6
2.	Rasulpur Bazar	1	-	1:0	1	-	-	1
3.	Beribaid	1	7	1:7	8	6	1.33:1	14
4.	Beribaid	2	2	1:1	4	2	2:1	6
5.	Beribaid, Jaloi Cottage (south)	1	4	1:4	5	6	1:1.2	11
6.	Dhokhola range	1	2	1:2	3	7	1:2.33	10
7.	Beribaid, Biman Bhahini Camp	1	1	1:1	2	2	1:1	4
8.	Beribaid, Jaloi Cottage (north)	1	1	1:1	2	5	1:2.5	7
9.	Beribaid, Mahua Cottage	1	4	1:4	5	3	1.66:1	8
10.	Beribaid	1	4	1:4	5	7	1:1.4	12
11.	Rasulpur – Lohoria Road 2	1	2	1:2	3	2	1.5:1	5
12.	Lohoria beat (east side)	1	3	1:3	4	5	1:1.25	9
13.	Rasulpur – Lohoria Road 1	1	2	1:2	3	3	1:1	6
Total		13	35		48	51		99
Mean				1:2.69			1:1.06	

frequent in the adjacent forest areas of Pakke Wildlife Sanctuary (Kumar & Solanki, 2004).

Human disturbance, especially hunting pressure, evidently affects group sizes of Capped Langur. The langurs were scarcer and group sizes were smaller in areas where there was hunting, trapping or large numbers of ethnic people. Hunting, environmental constraints and human interference are also believed to affect the composition and group size of macaques in India (Kumar & Solanki, 2008). The size and composition of social groups of Capped Langur vary geographically, depending on habitat type and the abundance, distribution and quality of food (Stanford, 1991; Kumar & Solanki, 2008; Regmi & Kandel, 2008). Different group sizes have been recorded in Bangladesh and India. In Bangladesh, Islam & Hussain (1982) recorded an average of 6.4 individuals, Green (1978) and Stanford (1987) respectively recorded seven individuals and seven to nine individuals in Madhupur forest. In India, Mukherjee (1978) recorded group sizes ranging from seven to 13 individuals in Assam, Mukherjee (1982) reported five to six individuals in Tripura, Gupta (1994) recorded an average of 5.7 individuals in Tripura, and Choudhury (1995) recorded five to 15 individuals in Assam.

Our findings showed mostly single adult male groups, but there were also one group with two adult males and one solitary male. Kabir (2002) did not find any multi-male groups in Bangladesh. Nearly 90% of the Capped Langur groups were single-male, multi-female in Arunachal Pradesh, India (Kumar & Solanki 2008). Biswas et al. (2009) found Capped Langurs living in single-male (38.6%), two-male (30.6%) and multi-male bisexual groups (22.6%), along with an all-male group (4%) and solitary males (4%).

The sex ratio of the Capped Langur groups we recorded was female biased, which was also observed by Chopra et al. (2013). Chopra et al. (2013) further reported a large variation in the sex ratio among different habitat types and for different years.

Although the Capped Langur occupied all habitat types inside and outside of the national park, they were mainly concentrated in the peripheral region of the dense forest, and foraged only in the higher canopy layer and areas of human habitation other than human settlements. They primarily fed on immature leaves from a wide variety of trees. They also fed on fruits, buds, shoots and seeds. In Pakke Wildlife Sanctuary of Arunachal Pradesh in India, they occupied all habitat types inside and outside the sanctuary, but the tropical evergreen and semi-evergreen, deciduous forests with

trees such as *Ficus benghalensis* L., *F. racemosa* L., *Bombax ceiba* L., *Altingia excelsa* Noronha, *Gmelina arborea* Roxb. and *Morus macroura* Miq. have been found to be important in influencing the distribution of Capped Langurs in the region (Kumar, 2006), and the availability of food trees may be a limiting factor (Joseph & Ramachandran, 2003).

At Madhupur, the groups of Capped Langurs were distributed in a very limited area in the park. Moreover, local people informed us that in the past (almost 30 years ago), they were distributed throughout the park and forest area, but gradually their population dwindled and the remaining langurs are now concentrated in a very restricted area, mainly due to disturbance from the Garo people and habitat destruction. The opportunity to acquire more food (agricultural field, homestead vegetable and fruit garden) influenced the Capped Langurs to forage and live in human settlements during the winter months.

Habitat destruction due to illegal logging, firewood collection and encroachment of land for seasonal crop plantation are the main challenges for Capped Langur conservation. Rules and regulations of Bangladesh Wildlife (Security and Conservation) Act 2012 should be implemented effectively to stop the illegal logging and encroachment of land and hunter activities. Attempts should be made by educating, motivating and involving people under the eco-development strategy with aims to bring a reduction in the dependency of local people on the resources of the park, and thus lead to habitat improvement and overall conservation. Attenuation of habitat and reduction of food plants and shelter trees have led to the incursion of primates into human habitation resulting in primate-human conflict. Reconciliation between the two is possible if local communities and government agencies evolve a partnership to conserve the habitats, with critical support from NGOs and independent researchers.

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