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Conservation Status of the Golden Langur *Trachypithecus geei* in Chakrashila Wildlife Sanctuary, Assam, India

Dilip Chetry[1,2], Mridupaban Phukan[3], Rekha Chetry[4], R. N. Boro[5], Arup Kumar Das[1] and P. C. Bhattacharjee[6]

[1]*Aaranyak, Beltola, Guwahati, Assam, India*
[2]*Gibbon Conservation Centre at Aaranyak, Hollongapar Gibbon Wildlife Sanctuary, Mariani, Assam India*
[3]*Rainforest Conservation Education Centre, Assam. India*
[4]*Department of Zoology, Jawaharlal Nehru College, Boko, Kamrup, Assam, India*
[5]*Kokrajhar Wildlife Division, BTAD, Assam, India*
[6]*Department of Zoology, Gauhati University, Assam, India*

Abstract: The golden langur, *Trachypithecus geei*, is among the world's 25 most endangered primates. It is endemic to India and Bhutan. Its distribution is limited to a small forest belt in western Assam in India and in Bhutan, between the River Manas in the east, River Sankosh in the west, and the Brahmaputra in the south. We carried out a survey of the golden langur in the Chakrashila Wildlife Sanctuary, the sole protected habitat for golden langurs in India, from December 2016 to March 2017. Modified line transects and total count methods were used for data collection. A total of 558 individuals in 72 groups were counted along the transects through direct sightings. Group size ranged from 2 to 18 individuals, with a mean size of 7.75. The adult male to female sex ratio was 1:2.06 and the ratio of adult females to infants was 1:0.461. The age structure of the population observed comprised 62.4% adults, 22.4% juveniles, and 15.2% infants. Encroachment, illegal tree felling, fuelwood collection and grazing by the different fringe villages are identified as major threats for golden langurs in and around the sanctuary. This information on the status and threats spectrum of the golden langur in Chakrashila Wildlife Sanctuary will help in formulating the future conservation and management guidelines.

Key words: Golden langur, endangered species, conservation status, Chakrashila, India

Introduction

The golden langur (*Trachypithecus geei*) is one of the world's 25 most endangered primates (Chetry *et al.* 2017, 2019). It is found in only two countries, namely India and neighboring Bhutan. Its distribution lies north of the Brahmaputra River, bounded on the east by the Manas River, and on the west by the Sankosh River. The range in south-central Bhutan is between the Sankosh River and a high mountain ridge (running across Pele-la) in the west, and Manas River, Mangde Chu and the high mountain ridge west of Chamkhar Chu in the east (Choudhury 2008). A number of studies have been initiated to work out the exact range and total population status of the species in the two countries where it occurs (Gee 1961; Khajuria 1956, 1961; Wayre 1968; Mukherjee and Saha 1974; Mukherjee 1978, 1994, 1995; Mukherjee *et al.* 1992, 1997; Mukherjee and Southwick 1997; Subba 1989; Choudhury 1992; Wangchuk 1995; Mohnot 1995−2001, 2002). Srivastava *et al.* (2001b) estimated a population of 1,500 in India. Bhutan sustains 86% of the global population of golden langurs, the major stronghold of the species. Wangchuk (2005) estimated a population of 6,637 in Bhutan. In India, Ghosh (2009) and Biswas *et al.* (2010) sighted 5,141 individuals in 566 groups. Thus the global population of the species was estimated as >12,000 (Chetry and Chetry 2009; Horwich *et al.* 2013). Thinley *et al.* (2019), however, reported an alarming decline of the population of golden langurs in Bhutan.

The golden langur is a schedule–I species in the Bhutan Wildlife Protection Act. There it occurs in three major protected areas, namely the Jigme Singye Wangchuk (Black Mountains) National Park (173,000 ha), the Royal Manas National Park (103,300 ha) and the Phibsoo National Wildlife Sanctuary (26,600 ha). Anthropogenic pressure, changing patterns of land-tenure, developmental activities, shifting cultivation, and commercial logging are the principal threats to

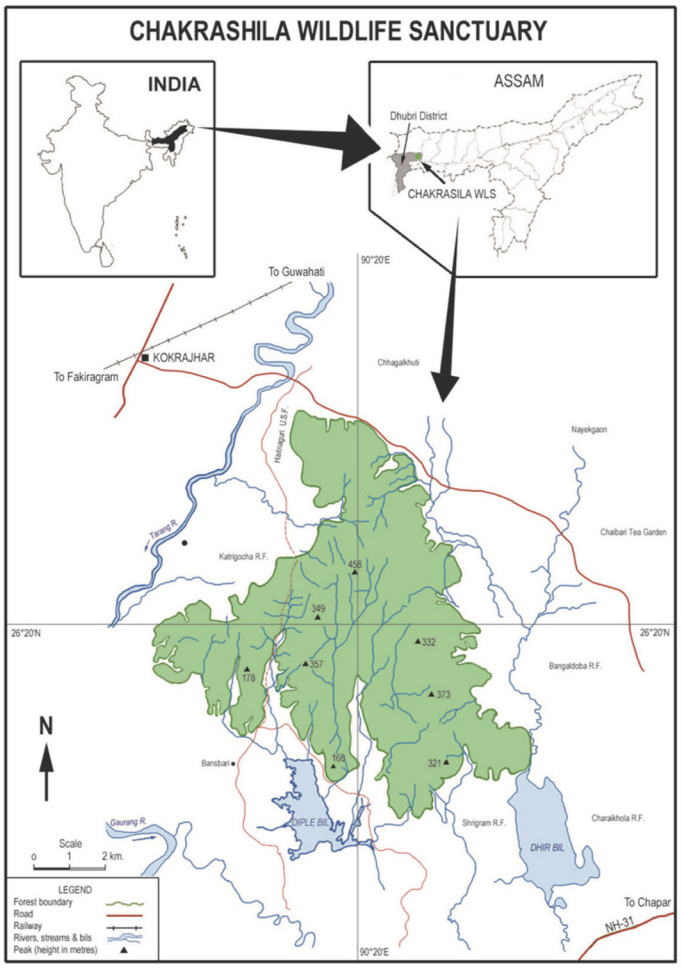

Figure 1. The study site: Chakrashila Wildlife Sanctuary.

golden langurs in Bhutan (Wangchuk 2005). Hybridization between capped langur and golden langur reported by Choudhury (2008) and Ram *et al.* (2016) has emerged as another major threat to the golden langur in Bhutan.

In India, the golden langur also receives the highest legal protection as a Schedule-I species in the Indian Wildlife Protection Act (1972). Unlike in Bhutan, however, nearly all of the forest patches where it is still found lie outside the protected area network. The Chakrashila Wildlife Sanctuary in the districts of Kokrajhar and Dhubri is the country's only protected habitat for golden langurs (Fig. 1). The first report on their occurrence in Chakrashila was by Datta (1998). A handful of studies on the species' ecology and behavior have been conducted there (Mukherjee 1996; Chetry 2002a; Chetry *et al.* 2002a). Chetry *et al.* (2005) also carried out an educational and awareness program for the conservation of the golden langur in the vicinity of the sanctuary.

Chetry *et al.* (2010) made the first systematic attempt to estimate the population status of golden langurs in Chakrashila, following its declaration as a protected area specifically for the species. Rapid loss of habitat and habitat fragmentation are the major threats for the golden langur in India (Srivastava *et al.* 2001b; Choudhury 2002). Chetry (2002b; Chetry *et al.* 2002b; Chetry and Chetry 2009; Chetry *et al.* 2010, 2018) reported substantial anthropogenic pressure in and around Chakrashila. As such, a decade on since the last survey in this prime protected habitat, we felt the need for a reassessment of the status of the golden langur population there. Here we provide an estimate of the size (number of individuals and groups, and average group size) and composition of the golden langur population in the Chakrashila Wildlife Sanctuary.

Methods

Study site

Chakrashila Wildlife Sanctuary is the only protected habitat for the southernmost population of the golden langur. It is located in the districts of Kokrajhar and Dhubri in Assam, and lies between 26°15' and 26°26'N and 90°15' and 90°20'E, with an area 4,500 ha. The entire sanctuary is woodland and dominated by Sal (*Shorea robusta*) mixed with some deciduous, semi-evergreen and evergreen species. Patches of bamboo and cane also occur. Grasses are found in the valleys and flat plains. According to Champion and Seth (1968), the Forest Types of Chakrashila can be broadly classified as: i) Assam Valley Semi-Evergreen Forests − 2B/C1 (a, b); ii) Northern Secondary Moist Mixed Deciduous Forests − 3C/C3/2SI; iii) Moist Plain Sal Forests − 3C/C2 (d); iv) Eastern Hill Sal Forests − 3C/C1 (a); and v) Moist Plain Sal Forest − 3C/C2 (d). The climate is hot and humid and is typical of the semi-evergreen temperate zone, with dry winters and hot summers followed by heavy rain. The driest months are January to March. Mean annual rainfall is between 2,000 and

Figure 2. The golden langur, *Trachypithecus geei*, in the Chakrashila Wildlife Sanctuary, Assam. Photo by Dilip Chetry.

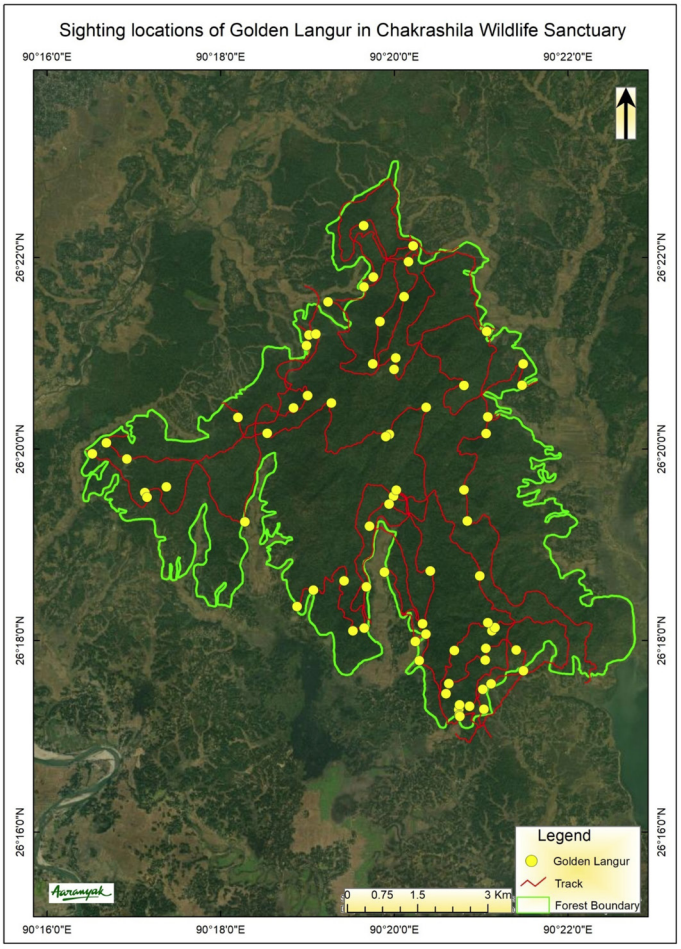

Figure 3. Map of Chakrashila Wildlife Sanctuary showing the trails/transects and location of the golden langur groups.

4,000 mm, the maximum being in July 2,500−5,000 mm and the minimum in January at less than 500 mm. Temperatures range from 8ºC minimum to 30.6ºC maximum. People in the vicinity of the sanctuary belong to diverse ethnic groups, viz. Bodo, Rabha, Garo, Rajbanshi, Nepali and Muslim.

Two other primates have been recorded in the Chakrashila Wildlife Sanctuary: rhesus macaque (*Macaca mulatta*) and the Bengal slow loris (*Nycticebus bengalensis*). Other mammal species include tiger (*Panthera tigris*), leopard (*Panthera pardus*), clouded leopard (*Neofelis nebulosa*), wild pig (*Sus scrofa*), barking deer (*Muntiacus muntjak*), sambar (*Cervus unicolor*), and Chinese pangolin (*Manis pentadactyla*).

Survey

The first survey was carried out in 2006, and the second survey of the sanctuary's golden langur population reported here was from October 2016 to March 2017. Data were collected using both direct and indirect methods, similar to the 2006 survey (Chetry *et al.* 2010).

Direct methods. We used the modified line-transect method (Burnham *et al.* 1980; NRC 1981; Struhsaker 1997) depending on the habitat and the forest condition. Twelve transects/trails with a total length of 120 km (Fig. 3) were set up in a stratified random manner to cover all representative areas of the wildlife sanctuary (Mueller-Dombois and Ellenburg 1974; Kent and Coker 1994). Three observers walked through existing forest trails and occasional open areas, covering an average of 10 km per day. Transect surveys were initiated in the morning (07:00) and terminated in the evening (16:00). The observers walked slowly along the transect pausing at intervals of 500 m. On seeing a golden langur group, they recorded the GPS coordinates, altitude, group structure and individual details, such as age, sex and number of the individuals seen. Every 500 m and at each location where golden langur were encountered, the observers estimated the tree height canopy cover, ground cover, and dominant tree, shrub and herb species in a radius of 10 m. Observers also noted any evidence for and degree of grazing and logging in the study area.

Indirect methods. The presence of non-human primates was recorded by indirect sources such as grunts, calls, branch-shaking, sounds associated with locomotion and feeding. All such indications were used to trace the primates, and we stopped for about 10 min to collect the details of the group or the animal. Secondary information was gathered through talking with the local people from the vicinity and as well as the forest department staff.

Table 1. Age-sex composition in golden langur groups in the Chakrashila Wildlife Sanctuary.

Group Composition												Total	Density ind/km²
AM	AF	A?	Total	JM	JF	J?	Total	IM	IF	I?	Total	558	12.4
82	169	97	348	7	2	116	125	4	3	78	85		

AM=Adult male, AM= Adult female, A?= Adult unidentified, JM=Juvenile male, JF= Juvenile female, J?= Juvenile unidentified, IM=Infant male, IF=Infant female, I?=Infant unidentified

Table 2. Age-sex ratios in the golden langur groups in the Chakrashila Wildlife Sanctuary.

No of Groups	AM:AF	AF: Immature	Adult: Immature	AF: Infant
72	1:2.06	1:0.74	1:0.60	1:0.50

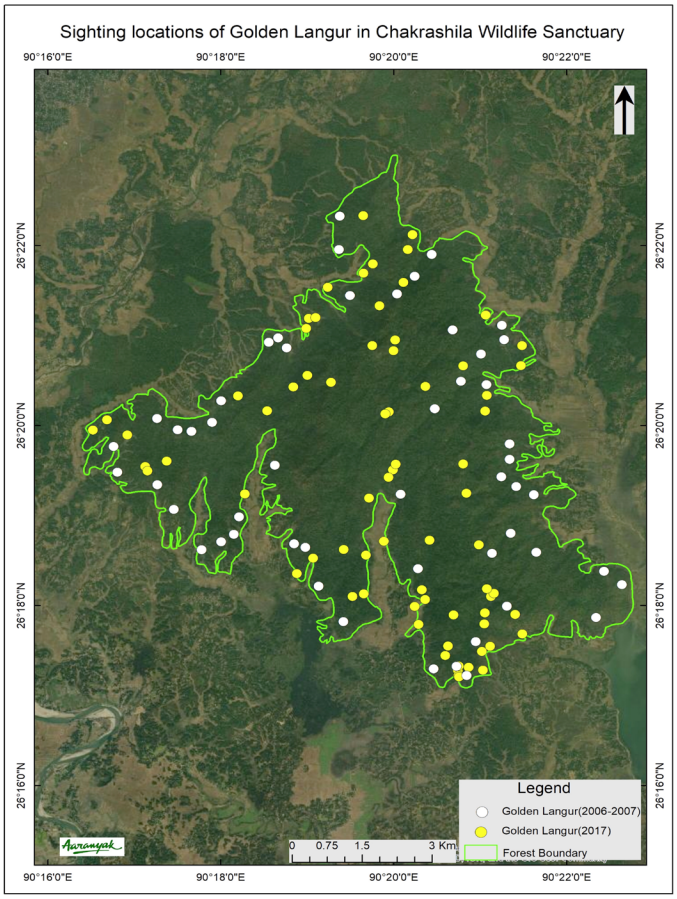

Figure 4. The location of golden langur groups sighted during the surveys.

We visited each transect twice to avoid double counting. We also cross-verified the group size and group composition.

Results

Population of golden langurs

During our survey we encountered a total of 558 individuals in 72 groups through direct sightings. The average group size was 7.75, ranging from 3 to 18 individuals. These 72 groups were recorded from the peripheral and core areas of the sanctuary (Fig. 4). Altitudinal range for the groups sighted were from 29 m to 445.6 m above sea level.

We counted the numbers of all groups and individuals we saw. We further analyzed the age-sex composition of the groups. Of the 558 individuals, 348 were adults, 125 were juveniles and the rest (85) were infants (Table 1). Thus, 62.36% were adults, 22.40% were juveniles and 15.23% were infants. The demographic records further revealed that the adult sex ratio was 1:1.53 (Table 2). We also registered that, out of the total 72 groups, most (63 or 87.5%) were uni-male–multi-female, while 8.33% (6) groups were two-male–multi-female. Only three groups (4.17%) were three-male–multi-female. No all male groups were seen.

Threats

The sanctuary has no defined boundary demarcation. As such, encroachment (mainly agricultural and the expansion of habitable areas) by the communities in the vicinity of the sanctuary has emerged as a critical threat for the golden langur and its habitat. During the last 10 years, we estimate that 10.5% of the suitable habitat of the golden langur in the sanctuary was converted to degraded forest (Fig. 5). Different forms of anthropogenic exploitation such as the collection of fire wood and non-timber forest products, illegal logging, and grazing degrade the langur's forest habitat We also registered four cases of dogs killing golden langurs in the villages on the fringe of the sanctuary, and the death of two langurs due to electrocution. On the positive side, from our interviews as well as informal interactions and observations during the study period, we were able to find no record or evidence of the golden langurs being hunted in the sanctuary.

Discussion

The population is evidently growing. In 2006, Chetry *et al.* (2010) obtained an estimate of 474 individuals in 64 groups. In the current survey we encountered 558 individuals in 72 groups (Table 1). The average group size increased from 7.4 in 2006 (Chetry *et al.* 2010) to 7.75. From our results, therefore, it is evident that the Chakrashila Wildlife Sanctuary remains as an important protected area for the endangered golden langur in India. This minimum population size of 558 also indicates that Chakrashila holds the single largest population of the species in the country. As per our current study the adult sex ratio is 1:2.06 and the ratio of adult females to infants is 1:0.50. In Bhutan, the adult male to female sex ratio was 1:1.97 and adult female to infant ratio was 1:0.43 (Thinley *et al.* 2019).

With 63% single-male–multi-female groups in the current survey, it has been once again established that this social framework is the most stable and predominant social structure in golden langurs (Biswas 2004). Chetry *et al.* (2010) also reported that the majority of golden langur groups in Chakrashila Wildlife Sanctuary were single male–multi-female. The low ratio of adult female to infant (Table 2) indicates a probability of high mortality of the young in their successive stages. Comparison of current demographic data with that of the previous data (Chetry *et al.* 2010), however, depicts an increase of 15.05% in 10 years. From a conservation perspective this is a positive sign.

The threats to the golden langurs in Chakrashila result mainly from anthropogenic activities and are unaltered from the previous study (Chetry *et al.* 2010). Encroachment, illegal tree felling, fuel wood collection and grazing by the different villages surrounding the sanctuary are the major threats. This unchanged status regarding the threat indicates a lack of initiative for effective conservation measures, crucial when we are dealing with such an endangered species. Stopping the illegal felling of trees and encroachment in the sanctuary is vital. The fact that the sanctuary has yet to be demarcated is a matter of concern. This boundary is disputed, worsening the encroachment problem. We have notified the pertinent

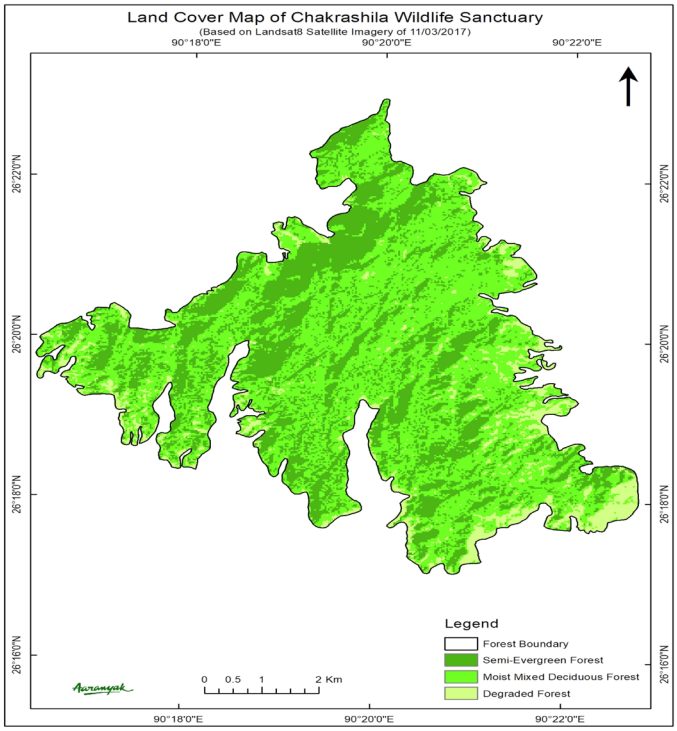

Figure 5. Land cover map of Chakrashila Wildlife Sanctuary.

government bodies and recommended an immediate solution to the issue.

We believe that the minimum density that we have estimated is high considering the extent of habitat degradation and general anthropogenic pressures. We observed golden langurs close to villages in the vicinity and they appeared to be tolerant or habituated to the activities of people. The proximity could lead to zoonotic infection. The absence of hunting is probably playing a key role in enhancing the survival of the langurs in the sanctuary (Chetry *et al.* 2010). It is therefore, important to understand how golden langurs and people co-exist in fringe areas and how the factors contributing to this co-existence can be maintained over time.

Chetry *et al.* (2010) recorded a higher concentration of groups in peripheral areas of the sanctuary than in the core area. In contrast to this, our current survey displays a somewhat altered picture of group distribution (Fig. 4). The data indicate a higher concentration of groups in the higher elevations in the core area. An overall loss in forest cover over the 10 years since the last survey is the principal cause behind this movement from the periphery to the core area. Increased human interference may also have triggered this change in the distribution of the groups. Chetry *et al.* (2005, 2010) and Thinley *et al.* (2020) have reported dogs as a threat to golden langurs. Fringe communities should be encouraged to chain their dogs during the day time. Our study is the first to report mortality through electrocution, and we have appealed to the government authority to insulate the wires passing through the forest areas. All these human-induced fatalities reduce group size and thereby affect the population.

The conservation value of Chakrashila Wildlife Sanctuary has long been recognized since it was declared as a sanctuary in 1994. Loss of historic connectivity of this sanctuary with the adjacent forest patches (Srivastava *et al.* 2001a; Medhi *et al.* 2004), however, combined with the increasing anthropogenic pressure, call for further conservation measures. Emphasis should be given to initiatives to restore the lost continuity between the sanctuary and other forest patches nearby, by planting natural corridors using bamboo species along with other preferred food plant species of golden langur (Chetry *et al.* 2010). Proper implementation of this corridor program will also be helpful in providing resources to the local communities. We feel deeply that this step of connecting Chakrashila with the adjacent isolated forest fragments should be initiated as soon as possible. We also advocate for raising awareness of the species through targeted education and awareness campaigns.

The comparative population status clearly shows that the golden langur continues to thrive despite the ongoing habitat loss, encroachment, and other anthropogenic pressures. From the long-term conservation perspective, however, we cannot allow these threats to continue in the coming years. We, therefore, advocate for an integrated management program of forest fragments, using the golden langur as a flagship species to safeguard its conservation and that of the rich wildlife in the sanctuary. Above all, strong political will can augur well for future protection of the golden langur and its habitats. The government should take the necessary steps to upgrade and expand the Chakrashila Wildlife Sanctuary that supports such a healthy population of golden langurs, to include its adjacent reserve forests viz. Sreegram Reserve Forest, Katrigacha Reserve Forest, Buxamara Reserve Forest and Nadangiri Hill Reserve Forest, to create a full-fledged national park.

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Authors' addresses

Dilip Chetry, Arup Kumar Das, Aaranyak, 13 Toyab Ali Bye Lane, Bishnu Rabha Path, Beltola Tinali, PO Beltola, Guwahati 781 028, Assam, India; **Mridupaban Phukan,** Rainforest Conservation Education Centre, Assam. India; **Rekha Chetry,** Department of Zoology, Jawaharlal Nehru College, Boko, Kamrup, Assam, India; **R. N. Boro,** Kokrajhar Wildlife Division, BTAD, Assam, India; and **P. C. Bhattacharjee,** Department of Zoology, Gauhati University, Assam, India. *Corresponding author:* <dilip.aaranyak@gmail.com>, <dilip@aaranyak.org>.

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