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Population Survey of the Bengal Slow Loris, *Nycticebus bengalensis*, in Meghalaya, Northeast India

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Abstract: The Bengal slow loris *Nycticebus bengalensis* is a nocturnal prosimian that inhabits the forests of northeastern India. As with many nocturnal prosimian species, little is known about its behavior or ecology; even less information is available on its distribution and population status in northeastern India. We conducted a survey of forest patches in the state of Meghalaya, in northeast India, in order to assess its distribution. A secondary aim of our study was to estimate the severity of threats that may affect the long-term survival of the slow loris in Meghalaya. We surveyed sixteen sites in six districts. Slow lorises were seen in only two sites; however, information obtained through secondary sources indicated that they were present in a number of other forest patches across the state. Many of the forests surveyed were severely affected by logging, poaching and forest fires; it is imperative that conservation measures, aimed at protecting existing forest patches, be implemented in order to ensure the long-term survival of the slow loris and other mammals in the state.

Key words: Bengal slow loris, distribution, survival threats, conservation, Meghalaya, India

Introduction

The Bengal slow loris (*Nycticebus bengalensis*) is one of two nocturnal primates found in India. It is poorly known, even when compared to the relatively little-studied nocturnal prosimians (Nekaris and Bearder 2006). Until 2007, the IUCN Red List had listed the species as Data Deficient, pointing out the lack of “adequate information [...] on its distribution and/or population status”. The IUCN Red List assessment carried out in 2008 classified the species as Vulnerable, and noted that “the species is predicted to decline by more than 30% in the next three generations over its entire range due to continuing hunting pressures and loss of habitat” (IUCN 2009).

Until a few years ago, information on the distribution and behavior of the slow loris in India was almost entirely lacking. Preliminary population surveys had reported the presence of the species in the northeastern states of Assam, Arunachal Pradesh, Mizoram, Nagaland, Meghalaya, Manipur, and Tripura (Choudhury 1992, 1996; Srivastava 1999). These studies also indicated that the species was seriously threatened by hunting and deforestation, and that it had already been extirpated in a number of forests in the region (Srivastava 1999; Choudhury 2001). However, the lack of information

on habitat variables and population densities for the species in these areas impedes the development of any conservation strategies to protect the Bengal slow loris.

Following these initial surveys, efforts were begun to map the current distributional status of the species in northeastern India. Slow lorises were seen in less than 20% of the sites surveyed in the states of Assam, Meghalaya and Tripura (Radhakrishna *et al.* 2006; Swapna *et al.* 2008). Mortality from road kill, disturbance caused by tree felling, trapping and hunting were identified as the main threats to the species (Radhakrishna *et al.* 2006). A study on the feeding ecology of the species in Tripura indicated that Bengal slow lorises feed largely on tree exudates, thereby making them vulnerable to habitat loss and disturbance (Swapna *et al.* 2009). These findings underline the need for surveys in the other states of northeastern India in order to understand better the limits of their range and the threats to their survival.

The main aim of this study was to conduct a rapid preliminary assessment of the distribution and relative abundance of *Nycticebus bengalensis* in the forested areas of the state of Meghalaya in northeastern India. An important secondary objective was to assess the nature and extent of potential threats that may affect the long-term survival of slow loris populations in the state.

Methods

The survey was conducted in six districts of the state of Meghalaya. Meghalaya (24°58'N to 26°03'N and 89°51'E to 92°49'E) is a small state in the southern part of northeastern India, bounded by the state of Assam on the north and east and Bangladesh on the south. The terrain is largely hilly, and nearly 70% of the state is forested. Temperatures range from about 38°C in June to about 2°C in January—the western part of the state is warmer, while the central uplands remain cool throughout the year (FSI 2005). The major forest types found in the state have been identified as Tropical Wet Evergreen, Tropical Moist Deciduous, Tropical Semi-Evergreen Forest, and Assam Sub Tropical Pine Forests (FSI 2005). The West Khasi Hills and West Garo Hills districts have the largest forest cover, amounting to almost 4,029 and 2,974 km², respectively (FSI 2005). More than 90% of the total forest area of the state is either private or clan/community owned, and falls under the control and management of the Autonomous District Councils. Notified forest land that is administered by the State Forest Department comprises two National Parks, three Wildlife Sanctuaries and more than 24 Reserved Forest patches scattered across six of the seven districts in the state.

We obtained information on the presence of Bengal slow loris (*Nycticebus bengalensis*) through field surveys and secondary sources of information. Night transects were conducted along established human and animal trails, roads, streams, and rivers. In the case of paved roads passing through the forest, we used four-wheel-drive vehicles driven slowly (<5 km/hr), most especially in areas with high numbers of rogue elephant incidents. Once, we used a boat to survey forests along the river, as it provided the best access in that terrain.



Figure 1. Bengal slow loris, *Nycticebus bengalensis*, in the state of Meghalaya, northeast India. Photograph by Anirban Datta-Roy.

Line transects were not feasible in most of the survey sites due to limited time, lack of existing transects and steep terrain. Hence we employed an encounter rate survey, using reconnaissance sampling (Walsh and White 1999), based on direct sightings of the animals. This was done to maximize coverage of forest areas and because of the methodological constraints of the traditional line transect method used for distance sampling (Burnham *et al.* 1980.). Slow loris encounter rates were calculated based on the total number of sightings and the distance surveyed as an Index of Relative Abundance of the species.

Nocturnal surveys were conducted between 19:00 and 23:00 hours. Two to four observers walked slowly (1 km/hr) and silently, flashing torches and headlamps to detect the characteristic orange eye-shine of *Nycticebus*. Whenever an eye-shine was detected, a high powered spotting light was used in conjunction with binoculars to confirm the identity of the species. We recorded details of all animal sightings, including species, numbers and age, and sex. Calls and sounds were also registered.

We also recorded disturbance levels and habitat types of the survey locations. We traversed nightly survey routes during the day to record information on habitat and disturbance parameters. We evaluated disturbance levels with particular reference to certain factors that may prove to be significant threats to the long-term survival of the slow loris. These factors were hunting pressure, habitat destruction through logging or conversion to agricultural land, habitat disturbance through people/cattle movement, collection of firewood and non-timber forest products (NTFP), and forest fires. We also collected information on more direct survival threats to the slow loris such as electrocution, road kills, and instances of capture for pets.

Secondary information on the presence of slow loris was obtained from forest department personnel and local experts. We investigated State Forest Department records wherever maintained, for details of confiscation or rescues of captured slow lorises. When available, this provided us with the origin of the animals as well as their number, age and sex. Additional information on slow loris presence was obtained through informal, semi-structured interviews with local experts, hunters and knowledgeable elders living in the vicinity of forests. Locals were shown photographs of the slow loris to identify, and questioned to provide information on slow loris sightings over the last five years in that area.

Results

The survey was conducted from February 2009 to April 2009, and we surveyed 16 locations in six districts of Meghalaya (Table 1). The survey sites included 11 forest areas under the control of the State Forest Department (National Park, Wildlife Sanctuary, Reserve Forest) and five areas that were community-controlled forest lands. We covered 144.45 km during the course of the survey, of which 96.45 km were on foot, 39 km in four-wheel-drive vehicles, and 9 km in a non-motorised boat.

Distribution of the Bengal slow loris in Meghalaya

We saw slow loris individuals on two occasions in two different field sites. Both were adult males. One was seen in Nongkhylllem Wildlife Sanctuary (WLS) in Khasi Hills district, and the other was in the Narpuh Reserve Forest (RF) of Jaintia Hills district (Table 1). The relative abundance based on sightings in the two field sites was calculated to be 0.04 (Narpuh RF) and 0.1 (Nongkhylllem WLS). Apart from slow lorises, we also saw two species of flying squirrels, four species of viverrids and many bat species during our night transects in the different field sites. Apart from direct sightings, information collected from secondary sources such as forest department personnel and local people living near the forest areas indicated the presence of slow lorises in eight forest patches across the districts of South Garo and Jaintia Hills (Table 1).

Data gathered during the study attests that slow loris populations are present in fragmented forest patches at the southern end of South Garo Hills district, in the northern parts of Ri-Bhoi district around the Nongkhylllem Wildlife Sanctuary, and in the southern parts of Jaintia Hills district (Fig. 2). Slow loris populations may also be present in the forest patches of central East Garo Hills. However, repeated enquiries did not elicit any information on the presence of slow lorises in the southern parts of East Khasi Hills district. Indigenous people living in these areas also appeared quite unfamiliar with the species, which argues that slow lorises, if present earlier, may have become locally extinct from these parts.

Threats affecting Bengal slow loris in Meghalaya

We investigated the presence of some potential threats—hunting, capture for pets, electrocution, road kill, and man-made forest fires—on the long-term survival of the slow loris in Meghalaya (Table 2).

Hunting. Interviews with local people indicated that slow lorises were hunted for food. However, because of their small size, hunters were not interested in the species specifically

as a regular source of meat. Instead, hunting appeared to be opportunistic, and individuals were killed only when encountered accidentally, or during hunts for other mammals. There also did not appear to be a commercial trade of loris body parts, and people did not report hunting slow lorises for reasons other than for its meat.

Capture for pets. Capture of slow lorises and other primates to be kept as pets is a widespread custom in many parts of the state. This was especially evident in the Garo Hills, which has retained much of the original fauna when compared to the Khasi and Jaintia Hills. Hunters and local people said that the slow loris was a preferred pet and was captured whenever found for that reason. Sometimes, loris pets were confiscated by the forest department and released in adjacent forest patches, while in the large majority of the cases they would remain and die in captivity.

Electrocution and road kills. We did not encounter any evidence of slow loris road kills during our study; there was one report of a slow loris being electrocuted on overhead power lines near Siju WLS in Garo Hills.

Man-made fires. This is distinguished from the *jhum* (slash-and-burn cultivation) fires that are typical of the hill community-controlled forest areas. Low lying areas in Meghalaya, such as parts of Garo Hills, are extremely susceptible to fires in the dry season. These Reserve Forest areas are predominantly teak (*Tectona grandis*) or sal (*Shorea robusta*) plantations, and during the summer the forest floor is covered with dry leaves. Fires are common during this season and are almost entirely deliberate and man-made. Forest patches are usually surrounded by human habitation or fields and there is nowhere safe for the animals to flee. These fires usually prove fatal for the wildlife in these areas.

Habitat disturbance. Mining and conversion to agricultural land pose two significant habitat disturbance threats to the slow loris in Meghalaya. In large parts of the state, community-controlled forests are rapidly being converted to monoculture stands of cashew, rubber and areca nut. We did

Table 1. The presence of Bengal slow loris, *Nycticebus bengalensis*, in the state of Meghalaya, northeastern India.

	Year	Location	Secondary Information	Direct Sighting	Age/Sex	Secondary source
1	2009	Nongkhylllem WLS, Ri Bhoi District	-	×	1 adult	-
2	2009	Narpuh RF, Jaintia Hills District	-	×	1 adult	-
3	1996	Angratoli RF, South Garo Hills District	×	-	2 adults	Reported by forest beat officer
4	2002	Darugiri RF, East Garo Hills District	×	-	1 adult male	Reported by forest beat officer
5	2008	Angratoli RF, South Garo Hills District	×	-	3 adults	Reported by forest guards
6	2007-08	Sibbari-Jacksongram CRF, South Garo Hills District	×	-	2 adults 2 infants	Reported by local villager
7	2008	Dambuk adingre CRF, South Garo Hills District	×	-	1 individual	Reported by local villager
8	2004	Siju Dobakol caves, South Garo Hills District	×	-	1 adult	Reported by forest guard
9	2008	Siju Forest complex, South Garo Hills District	×	-	1 adult	Reported by forest guard, animal electrocuted on overhead wires
10	2005	Matcha nokpante CRF, South Garo Hills District	×	-	1 juvenile	Reported by local villager
11	2007	Jowai vicinity, Jaintia Hills District	×	-	1 adult	Forest department seizure
12	2008	Baghmara, South Garo Hills District	×	-	1 adult	Crossing road near the Baghmara town

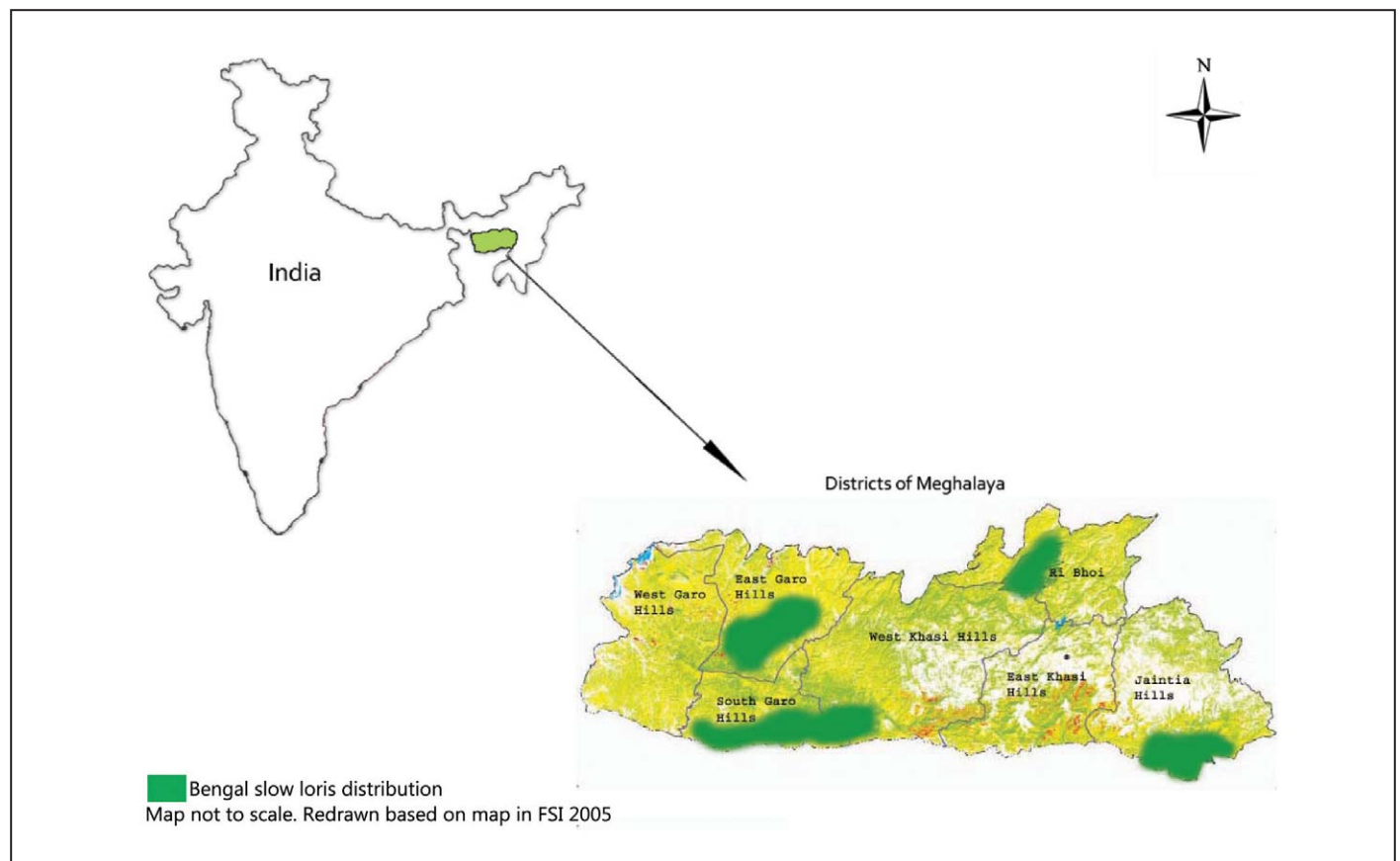
WLS=Wildlife Sanctuary, RF=Reserve Forest, CRF=Community Reserve Forest

Table 2. Threat levels and severity of fires in survey locations in the state of Meghalaya, northeast India.

	Location	Disturbance ranking*	Fire ranking*	Primary threats
1	Ringsangre/Selbalgre CRF, West Garo Hills District	+++	0	Small size, NTFP and bamboo extraction, <i>jhum</i> cultivation in the vicinity
2	Dariwokgre (Nokrek NP), West Garo Hills District	++	0	<i>Jhum</i> cultivation, firewood
3	Rongrengiri RF, East Garo Hills District	++	++++	Illegal logging, poaching, fire
4	Darugiri RF, East Garo Hills District	+++	+++	Surrounded by houses and crop fields, extensive firewood and NTFP extraction, highway, fire
5	Dambu RF, East Garo Hills District	+++	++	Incursion of cultivation and coffee plantation, highway, fire
6	Baghmara RF, South Garo Hills District	++	++	Illegal logging, poaching, highway, electric lines, fire
7	Angratoli RF, South Garo Hills District	+++	+++	Highway, electric lines, illegal logging and poaching, fire
8	Chambilgiri CRF, West Garo Hills District	++++	0	Small size, orchards and <i>jhum</i> cultivation, highway
9	Siju WLS, South Garo Hills District	+	++++	Small size, fire, coal mining
10	Rewak RF, South Garo Hills District	+++	+++	Highway, illegal logging, fire
11	Balpakram NP, South Garo Hills District	+	++	Fire, <i>jhum</i> cultivation, encroachment, coal mining
12	Matcha nokpante CRF	+++	+	<i>Jhum</i> cultivation, plantations, highway, small size, illegal logging
13	Dalengittim CRF, South Garo Hills District	+++	++	Poaching, illegal logging, firewood extraction, fire
14	Umblai, East Khasi Hills District	+++	++	<i>Jhum</i> cultivation, NTFP and firewood extraction, poaching, trapping, fire
15	Nongkhylliem WLS, Ri Bhoi District	+	+	Fire, encroachment of plantations
16	Narpuh RF, Jaintia Hills District	+++	++	Highway, encroachment, fire, water pollution

*Evaluated on arbitrary subjective scale; 0: nil; +: low; ++: medium; +++: high; ++++: very high.

CRF=Community Reserve Forest, NP=National Park, RF=Reserve Forest, WLS=Wildlife Sanctuary

**Figure 2.** Distribution of the Bengal slow loris, *Nycticebus bengalensis*, in the state of Meghalaya, northeast India.

not detect slow lorises in patches of such monocultures; our findings conformed with those of local people, who said that they had never seen slow lorises in these plantations. Habitat destruction through *jhum* is another serious threat that has increased in magnitude due to the paucity of land and increase in human population. Clear felling and the eventual burning of patches of forests is seriously detrimental to slow lorises—local people reported that lorises are sometimes found moving towards human habitation for protection during the *jhum* fires. Clear felling precedes mining, not just in the area to be mined but also in the construction of access roads. Mining has also destroyed the forests in numerous sites due to the open dumping of coal on the roadsides and river banks; a practice that causes pollution of the water and soils.

Discussion

Despite the low encounter rates of *Nycticebus bengalensis* during this study (seen in only two of 16 sites), secondary information collected during the course of the survey does indicate the presence of Bengal slow lorises in many of the forest patches in Meghalaya. It would appear, however, that the species is generally present in very low densities. That this is not an artefact of the sampling methodology is borne out by the finding that surveys for slow lorises, in the north-eastern states of Tripura and Assam, using similar methodology, have resulted in low/nil encounter rates in many sites but high encounter rates in others (Radhakrishna *et al.* 2006; Swapna *et al.* 2008; Das *et al.* 2009). Nekaris and Nijman (2007) reported that encounter rates for *Nycticebus bengalensis* are 5–15 times lower than for *Nycticebus coucang*; the results of this survey underline the need to investigate in more detail the factors affecting slow loris abundance in different parts of northeastern India.

Indigenous people living in settlements near forest areas reported many instances of slow lorises wandering out of the forest and into the villages and houses. To some extent, these statements may be attributed to the fact that the slow loris is a popular pet and an excuse for the presence of lorises in their homes (rather than having captured them from the forest). Higher encounter rates of slow lorises at forest edges have, however, been reported in previous studies (Johns 1986; Radhakrishna *et al.* 2006; N. Swapna unpubl. obs.). A more detailed investigation into this aspect of slow loris behavior will provide a deeper insight into factors affecting the long-term survival of the species.

Severe habitat disturbance, affecting most of the forest patches in Meghalaya, is clearly an important factor that affects the distribution and abundance of *Nycticebus bengalensis* in the state. Apart from age-old threats such as logging and hunting, newer threats such as man-made fires and mining has virtually decimated forest cover across the state. Man-made forest fires of different levels of severity were found in more than 80% (13 out of 16) of the survey sites. Forest fires are especially fatal for slow-moving animals such as slow lorises, and were undoubtedly a major reason for

the low encounter rate of slow lorises (and flying squirrels) during this survey.

Widespread and illegal coal and limestone mining in many parts of Meghalaya in the past has led to widespread destruction of forest cover in the Khasi Hills and Jaintia Hills, and irreversible damage to the environment in the form of polluted water bodies. This threat is now rapidly spreading in the Garo Hills district, which still has large stretches of community-controlled as well as protected areas. The lack of a mining policy in the state has resulted in wanton destruction of community forests for mining and the construction of numerous access roads. Unless conservation measures that focus on ending such destructive activities and practices are implemented urgently, it may well mean the end of the road for the few remaining populations of slow lorises and other mammals that are still found there.

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