The Distribution and Status of Hoolock Gibbon, Hoolock hoolock, in Manipur, Meghalaya, Mizoram, and Nagaland in Northeast India

Author: Choudhury, Anwaruddin

Source: Primate Conservation, 2006(20) : 79-87

Published By: Conservation International

URL: https://doi.org/10.1896/0898-6207.20.1.79

Primate Conservation 2006 (20): 79–87

The Distribution and Status of Hoolock Gibbon, *Hoolock hoolock*, in Manipur, Meghalaya, Mizoram, and Nagaland in Northeast India

Anwaruddin Choudhury

Deputy Commissioner, Baksa, India

Abstract: In India, the hoolock gibbon, *Hoolock hoolock*, occurs only in a small part in the northeast, south of the Brahmaputra River and east of the Dibang River. This article describes its distribution, habitat, status, and conservation in the states of Manipur, Meghalaya, Mizoram, and Nagaland. The hoolock gibbon still occurs in all four states but in much depleted numbers. It has been recorded from altitudes of less than 50 m in Meghalaya to above 2,600 m in Nagaland. The gibbon is nowhere abundant due to hunting and, except a few protected areas, it is found in scattered groups, where their survival is doubtful in the long term. A rough population estimate indicates that the total numbers could be between 1,700 and 2,200. Habitat destruction and fragmentation and poaching are the main threats. The hoolock gibbon is protected by law in India and occurs in at least 17 protected areas in these four states. The creation of more protected areas, adequate protection of existing protected areas, control of *jhum* cultivation and poaching, and awareness and involvement of churches and village headmen in conservation are recommended.
Key Words: Hoolock gibbon, *Hoolock hoolock*, northeast India, Manipur, Meghalaya, Mizoram, Nagaland

Introduction

Formerly in the genus *Hylobates*, Prouty *et al.* (1983a, 1983b) argued for the placement of the hoolock gibbon in a separate subgenus, *Bunopithecus* Matthew and Granger, 1923, based on its distinct karyotype. Groves (2001) accepted its distinctiveness and placed it in the subgenus *Bunopithecus* accordingly, but doubted the validity of the name. Brandon-Jones *et al*. (2004) and Groves (2005) placed it in the genus *Bunopithecus* based on the findings of Takacs *et al.* 2005, while still doubting the validity of the name. Eventually, Mootnick and Groves (2005) showed that *Bunopithecus* was not applicable to the species (or to gibbons at all), and named instead a new monotypic genus, *Hoolock* Mootnick and Groves 2005.

The hoolock gibbon is the only ape found in the Indian subcontinent. Adult males and juveniles of both sexes are black with white eyebrows. When subadult, the pelage of the females changes to greyish and then to a tan color, which they retain as adults. In India, the hoolock gibbon occurs in only a small part in the northeast, where it is restricted to the south of the Brahmaputra River and east of the Dibang River (Parsons 1941; Choudhury 1987). Across the border, its range extends into a small area of southern China, eastern Bangladesh and Myanmar (Burma). Its range in northeast India was not shown correctly in Corbet and Hill (1992). The type locality of the species is the Garo Hills in Meghalaya (originally recorded as Assam), India (Harlan 1831).

A fair amount of information is now available on hoolock gibbons in northeast India (see Tilson 1979; Choudhury 1987, 1989, 1990, 1991, 2000, in press; Das 2002) and there are number of synoptic works on primates or wildlife in general which also mention the species (Pocock 1939, 1941; Prater 1948; Choudhury 1988, 1992, 1996, 1997a, 1997b, 2001, 2003b). McCann (1933) provided some information on the gibbons of Naga Hills, and likewise Alfred and Sati (1990) and Choudhury (1998) on populations in Meghalaya, Misra *et al.* (1994) on gibbons in Mizoram, and Choudhury (2003a) for Arunachal Pradesh. In this article, we describe the distribution, habitat, status, and conservation of the hoolock gibbon in four of the northeastern states: Manipur, Meghalaya, Mizoram, and Nagaland.

Study Area

The states of Manipur (23°49′–25°42′N, 93°00′–94°45′E; 22,327 km² in area), Meghalaya (25°02′–26°07′N, 89°49′–92°50′E; 22,429 km²), Mizoram (21°58′–24°30′N, 92°16′–93°25′ E; 21,081 km²), and Nagaland (25°10′–27°01′N, 93°17′–95°15′E; 16,600 km²) are located in northeast India (Fig. 1). All are hilly and mountainous. A broad valley plain

(elevation about 792 m a.s.l.) extends through central Manipur. Toward the north-northwest is the Barail mountain range, and in the east and west are the Manipur Hills. Mt. Tenipu or Iso (2,995 m a.s.l.), part of the Barail range, is the highest peak in Manipur. Meghalaya is part of an Archaean plateau with undulating tablelands. Shillong Peak (1,961 m a.s.l.) is the highest point on the plateau.

In Mizoram, the highest ranges are toward the east, with Phawngpui or Blue Mountain (2,157 m a.s.l.) and Lengteng (2,141 m a.s.l.) being the highest peaks. In Nagaland, the main ranges are the Barail in the south and southwest and Patkai in the north. A high range exists along the border with Myanmar, and Mt. Saramati (3,842 m a.s.l.) is the highest point. Saramati is also the highest peak in continental Asia south of the Himalaya–Mishmi Hills. The highest peak of the Barail range is Mt. Japfu (Japvo), which reaches 3,043 m a.s.l.

Temperature generally ranges from less than 0°C in winter (notably on Mt. Saramati) to 35°C in summer (maximum). Mt. Saramati experiences snowfall in winter, as do, on occasion, some of the other peaks along the India-Myanmar border, including Mt. Japfu and Mt. Tenipu. The Tropic of Cancer passes through central Mizoram.

Figure 1. Map showing the four states in northeast India where hoolock gibbons were surveyed. Map by Anwaruddin Choudhury.

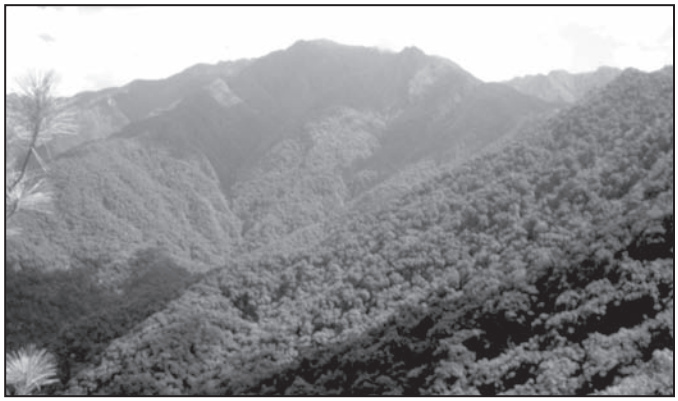

Photo 1. Mt. Saramati on the Nagaland-Myanmar border is the highest peak on the Asian mainland south of the Himalaya. Some of the finest subtropical and temperate forests of northeast India are found on its slopes. This is the last stronghold for hoolock gibbons in Nagaland. Photo by Anwaruddin Choudhury.

Methods

From 1987 to January 2005, I carried out field surveys in areas where hoolock gibbons occur in the states of Meghalaya, Manipur, Mizoram, and Nagaland as part of a broader survey of wildlife in general. The presence of the gibbon was ascertained by direct sighting or by hearing their calls, as well as through finding preserved skulls in the tribal villages and interviews of local forest staff, villagers, and hunters, using visual aids such as photos and drawings. Some of the skulls were identified at the Zoological Survey of India, Kolkata (Calcutta). Direct observations and censuses were carried out along trails, roads (by car), and rivers (by boat).

The data were obtained during numerous field surveys carried out since 1987. Manipur in April 1988, January 1996, and January 2001; Meghalaya, over a number of field trips between 1987 and January 2005; Mizoram in April 2000 and February 2001; and Nagaland in June 1996, January, February, April and October 2001, February 2002, and February 2004.

Distribution and Habitat

Manipur (Fig. 2.)

Hoolock gibbons are confined to six districts: Chandel, Churachandpur, Senapati, Tamenglong, Ukhrul, and Imphal East (only in the Jiribam sub-division). Of these, only in Churachandpur, Tamenglong, and Ukhrul do large tracts of contiguous suitable habitat remain. No forests able to sustain gibbons are left in the Manipur Valley. The species has been recorded in the following wildlife sanctuaries: Bunning, Jiri-Makru, Kailam, Yangoupokpi-Lokchao, and Zeilad (Table 1). Among the larger reserved forests and proposed reserved forests where gibbons were recorded were Irangmukh, Moreh, and Tolbung (full list in Table 1). Sizeable numbers still occur in the Shiroi and Anko (Anggo Ching) ranges, but elsewhere populations are small and scattered.

Suitable gibbon habitat in the form of tropical wet evergreen and semi-evergreen forests occur in patches in the lower and middle elevations in Manipur. *Dipterocarpus turbinatus*, *Artocarpus chaplasa*, and *Mesua ferrea* are some of the notable trees. Deciduous species are dominated by *Tetrameles nudiflora* and *Gmelina arborea*. In the higher hills, especially on the Barails, in Shiroi, and in other hilltop areas, there is subtropical broadleaf (evergreen) forest, with small areas of conifers in the eastern parts. Temperate broadleaf forest is found higher up, on Mt. Tenipu, but gibbons can no longer be found there.

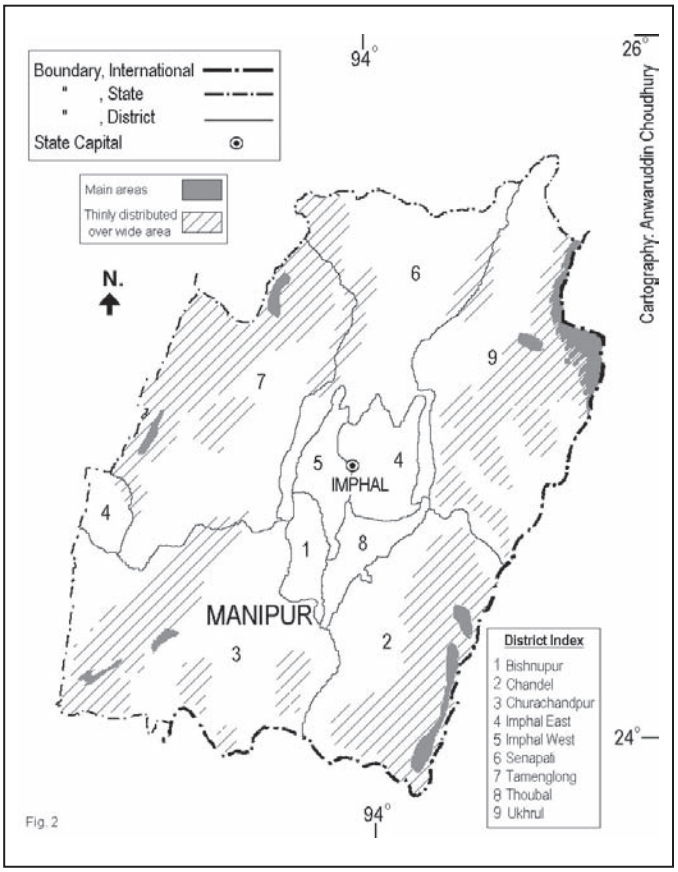

Figure 2. The state of Manipur showing the approximate range of the hoolock gibbon and the main areas where it occurs. Map by Anwaruddin Choudhury.

Photo 2. Tree felling for shifting cultivation at the edge of Lengteng, Mizoram. Photo by by Anwaruddin Choudhury.

The hoolock has been recorded at altitudes of less than 100 m in Jiri-Makru Wildlife Sanctuary to above 2,500 m in Shiroi. The known "area of occupancy" (IUCN 2004) of hoolock gibbons in Manipur is around 2,300 km².

Meghalaya (Fig. 3)

Gibbons are still found in all the districts, namely: Jaintia Hills, Ri-Bhoi, East Khasi Hills, West Khasi Hills, East Garo Hills, West Garo Hills, and South Garo Hills. The main strongholds in this state, however, are in Jaintia Hills, Ri-Bhoi, West Khasi Hills, East Garo Hills, and South Garo Hills. Protected areas where the species has been recorded are in the national parks of Balpakram and Nokrek, Nongkhyllem, and Siju wildlife sanctuaries, and some key reserved forests include Narpuh block I, Narpuh block II, Saipung (all in Jaintia Hills), Nongkhyllem (in Ri-Bhoi), Chimabongshi, Darugiri, Dambu, Songsak (all in East Garo Hills), and Angratoli, and Baghmara (both in South Garo Hills) (full list in Table 1). Elsewhere, populations were found to be small and isolated, in forest patches dispersed through *jhum* (slash-and-burn shifting cultivation of the hill tribes) fields. There are a number of sizeable, privately owned forests in the catchment of the Jadukata River in West Khasi Hills district. A few gibbons still survive in sacred groves such as those in Chiehruphi in the Jaintia Hills. There are specimens in the collections of Zoological Survey of India from Ri-Bhoi district [Manihar Basti, 13 km north of Nongpoh at 760 m a.s.l., from 8 km east and 11 km west of Nongpoh] and Garo Hills (obtained in 1870).

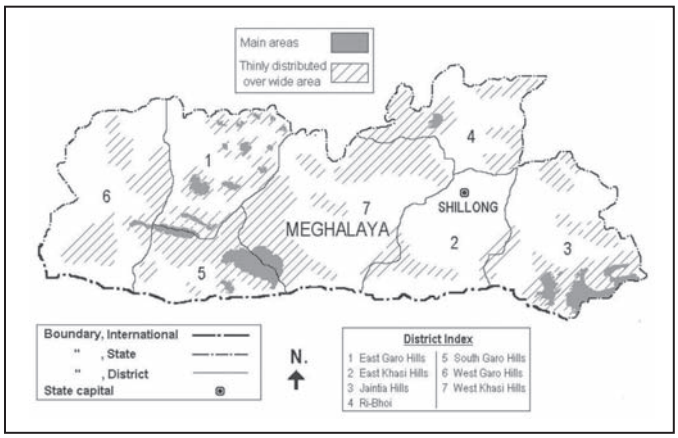

Figure 3. The state of Meghalaya showing the approximate range of the hoolock gibbon and the main areas where it occurs. Map by Anwaruddin Choudhury.

The high rainfall, south-facing slopes, gorges, and canyons are covered with tropical wet evergreen and semi-evergreen forests, and constitute important habitat for gibbons. Grasslands and pine (*Pinus kesiya*) groves predominate in the tablelands, and gibbons are absent. In northern Meghalaya, the habitat is dominated by deciduous species such as the 'sal' (*Shorea robusta*) and *Tetrameles nudiflora*. The gibbons evidently prefer the mixed patches over the 'sal'-dominated areas. Subtropical broadleaf (evergreen) forest with oaks (*Quercus* spp.) and rhododendrons (*Rhododendron* sp.) is found in the narrow stream gorges on the plateau, but gibbons probably disappeared from these areas during the early part of the last century.

In Meghalaya, the hoolock gibbon has been recorded from less than 50 m in Narpuh block I Reserved Forest (near the India-Bangladesh border where the Prang River spreads out over the plains) to above 1,400 m in Nokrek National Park. The known "area of occupancy" in Meghalaya is about 1,650 km².

Table 1. Protected Areas, Reserved Forests and other areas with known hoolock gibbon populations. Population range: A= >100; B= 50–100; C= 20–50; D= <20. NP= National Park; WS= Wildlife Sanctuary; RF= Reserved Forest; PRF= Proposed Reserved Forest.

Name of area	Area (km²)	Hoolock gibbon population range	Remarks
Manipur			
Bunning WS	115.80	C	
Jiri-Makru WS	198.00	B	
Kailam WS	157.80	B	
Yangoupokpi-Lokchao WS	184.00	B	
Zeilad WS	21	D	
Other areas: Anko range [recommended WS], Ch-as-ad PRF, Cheklaphai RF, Dampi RF, Irangmukh RF, K.N.RF, Kangbung RF, Longya RF, Moreh PRF, Shiroi proposed NP, Tolbung RF, Vangai Bongmukh RF, Yangenching RF.			
Meghalaya			
Balpakram NP	312.00	A	The area is less than 200 km² as there was some anomaly in computing.
Nokrek NP	68.01	C	
Nongkhyllem WS	35.00	C	
Siju WS	5.18	D	Contiguous with Balpakram NP
Other areas: Angratoli RF, Baghmara RF, Chimabongshi RF, Dambu RF, Darugiri RF, Dhima RF, Dibru Hill RF, Dilma RF, Emangiri RF, Ildek RF, Narpuh RF block 1, Narpuh RF block 2, Nongkhyllem RF, Rajasimla RF, Rewak RF, Rongrenggiri RF, Sacred forests in Jaintia Hills, Saipung RF, Songsak RF, Unclassed forests near Lumshnong.			
Mizoram			
Dampa WS	500.00	A	
Khawnglung WS	41.00	D	
Lengteng WS	80.00	B	
Murlen NP	150.00	B	
Ngengpui WS	110.00	B	
Phawngpui NP	50.00	D	
Tawi WS	?		Continued existence doubtful
Other areas: Inner Line RF, Ngengpui RF, Palak Dil; unclassified forest in southern Lawngtlai and Saiha districts and in western Lunglei district.			
Nagaland			
Intanki NP	202.02	B	
Fakim WS	6.42	C	Contiguous with Saramati area
Pulie-Badge WS	9.23	Extinct	Habitat in good condition but extirpated due to hunting
Rangapahar WS	4.70	Extinct	Severely degraded habitat and past hunting
Other areas: Ghosu 'Bird Sanctuary' and adjacent areas; unclassed forests in Saramati-Noklak areas; Singphan FR; Satoi area; unclassed forests of Peren and Mon districts.			

Mizoram (Fig. 4)

Hoolock gibbons occur in all the districts, namely: Aizawl, Champhai, Kolasib, Lawngtlai, Lunglei, Mamit, Saiha, and Serchhip. The main populations, however, survive in Champhai, Lawngtlai, Lunglei, Mamit, and Saiha districts. Protected areas where they have been recorded include the wildlife sanctuaries of Dampa, Khawnglung, Lengteng, and Ngengpui, and the Murlen and Phawngpui (Blue Mountains) national parks. Although gibbons could be found in the Tawi Wildlife Sanctuary in the 1980s, their present status there is not clear. They have been recorded in Inner Line (= Innerline), and Ngengpui reserved forests, and they also occur in the now-degazetted, Palak Dil Sanctuary. Isolated groups were also found scattered along the river gorges and hilltops. There are sizeable populations in southern Saiha and Lawngtlai districts.

Gibbon habitat in this state is mostly tropical wet evergreen and semi-evergreen forest with bamboo. Bamboo has invaded much of the original tropical evergreen forest due to felling and *jhum*, and is common in the older, abandoned *jhums*. Gibbons can also be found in small forest patches in plantations of deciduous species such as teak (*Tectona grandis*). Some of the best rainforest of northeast India is found in southern Mizoram, covering parts of the districts of Lawngtlai and Saiha and has relatively good gibbon populations. *Dipterocarpus turbinatus*, *Artocarpus chaplasa,* and *Palaquium polyanthum* are some of the notable trees of the tropical evergreen forest. Subtropical broadleaf forest occurs in the higher areas in the east, especially near the peaks of Phawngpui, Lengteng, and Vapar. Deciduous species typical of the semi-evergreen forest include *Tetrameles nudiflora*, *Gmelina arborea,* and *Bombax ceiba*. The main bamboo species are *Melocanna bambusoides* (= *baccifera*) and *Steinostachyum dulloa*. In broad terms, the forests of Mizoram are classified as 'Cachar Tropical Evergreen (1B/C3)' and 'Cachar semi-evergreen (2B/C2)' (Champion and Seth 1964).

Gibbons were recorded from altitudes of less than 60 m near Bhairabi to above 2,000 m in Lengteng Wildlife Sanctuary. The known "area of occupancy" in the state is about 2,600 km².

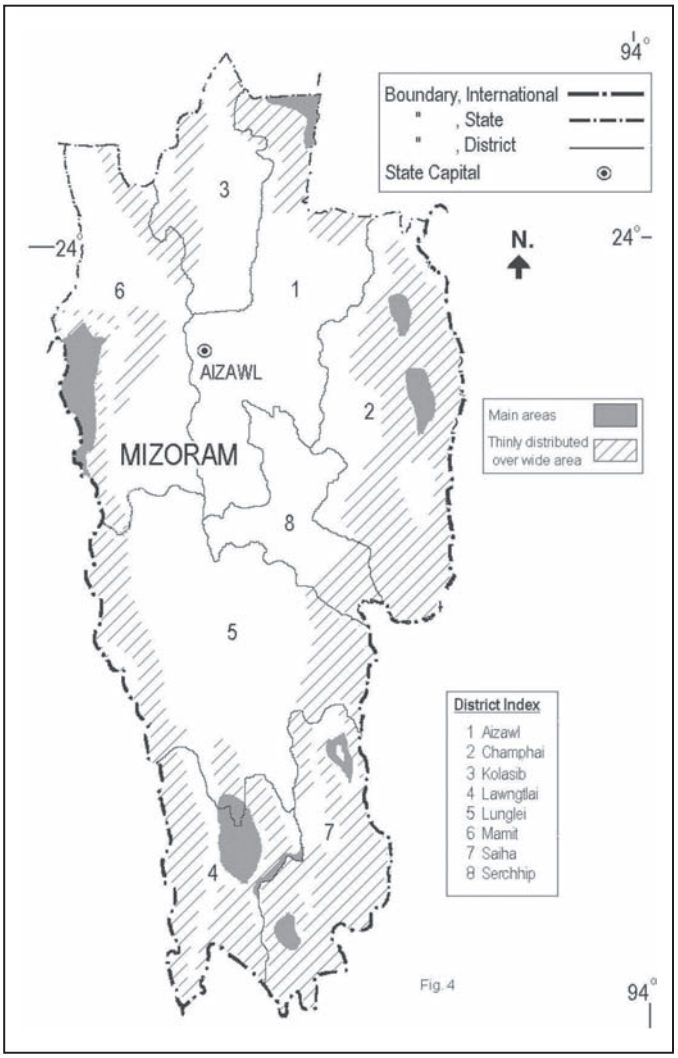

Figure 4. The state of Mizoram showing the approximate range of the hoolock gibbon and the main areas where it occurs. Map by Anwaruddin Choudhury.

Photo 3. Completely denuded hills by the Shilloi Lake, Phek District (Nagaland). Photo by Anwaruddin Choudhury.

Nagaland (Fig. 5)

Gibbons have been recorded in all the districts, namely: Dimapur, Kiphire, Kohima, Longleng, Mokokchung, Mon, Peren, Phek, Tuensang, Wokha, and Zunheboto. Reasonable populations in relatively large forests are found in only three, however: Kiphire, Peren, and Tuensang. They occur in Intanki National Park and Fakim Wildlife Sanctuary and the Singphan Reserved Forest, but have disappeared from Pulie Badge and Rangapahar wildlife sanctuaries. Outside the protected areas, there is sizeable habitat in Japfu-Dzukou but the gibbon is probably extinct there due to hunting. There are gibbon populations elsewhere in the Barail range (western areas), the slopes of Saramati, and along the high ridges on the Mon-Tuensang border. There is a specimen in the collection of Zoological Survey of India from Chumukedima (originally recorded as Samaguting) obtained in 1872.

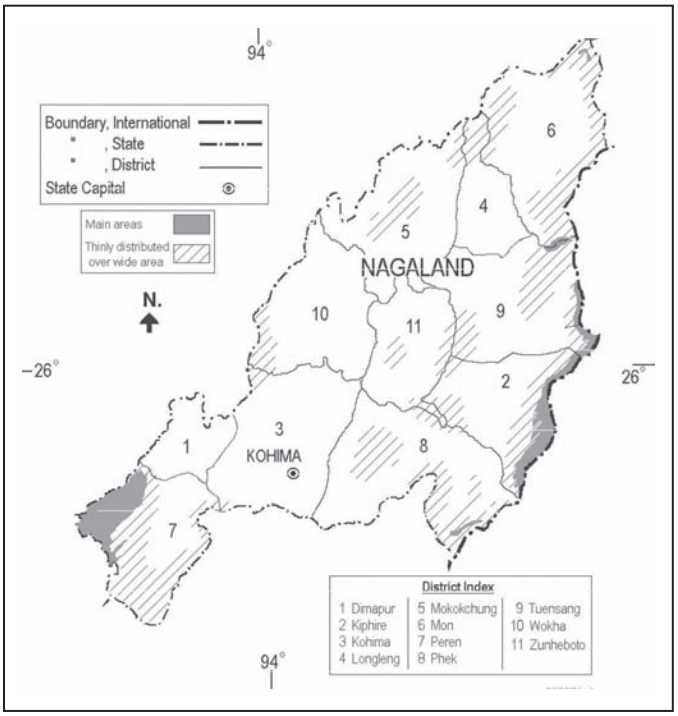

Figure 5. The state of Nagaland showing the approximate range of the hoolock gibbon and the main areas where it occurs. Map by Anwaruddin Choudhury.

Tropical wet evergreen forest occurs in patches throughout the lower and middle elevations, except in the southwest where tropical moist deciduous and semi-evergreen forests dominate. Many of the river valleys and gorges are covered with evergreen forest. *Dipterocarpus macrocarpus*, *Shorea assamica,* and *Mesua ferrea* are some of the notable tree species of the tropical evergreen forest. *Tetrameles nudiflora*, *Gmelina arborea,* and *Dillenia scabrela* occur in the deciduous forest of the southwest. Subtropical broadleaf (evergreen) forest occurs in the higher hills, especially on the Barails, in Satoi, Mt. Japfu, and on the slopes of Mt. Saramati. Small areas of conifers are found in the Kiphire and Phek districts. Temperate broadleaf forest is found at higher altitudes on Saramati, with sub-alpine vegetation on the peak. Like Manipur and Mizoram, the *jhum* has greatly altered the original vegetation types throughout Nagaland.

The hoolock gibbon has been recorded from about 150 m a.s.l. in Intanki National Park to above 2,600 m in Saramati. The known "area of occupancy" in Nagaland is around 1,400 km².

Status

Although quite widespread, the hoolock gibbon is very rare in all these states except for a few protected areas. It is nowhere abundant because of hunting. Dun (1886) mentioned that it was plentiful in Manipur, and McCann (1933) found it to be ubiquitous in the area between Mokokchung and foothills in Nagaland. Likewise it was plentiful in the Jaintia Hills of Meghalaya in the 1950s (the late Hena Choudhury, pers. comm.) but the situation is today very different.

In Manipur, the known area of occupancy of the hoolock gibbon is around 2,300 km² but excepting about 450 km² in some protected areas and inaccessible areas such as the Anko range, it is always rare. In places, lone animals or groups can be isolated by 5 or 10 km from other groups. Similarly, in Meghalaya, their distribution over about 1,300 km² is thin and scattered except for *c.*350 km² of more continuous forest. In Mizoram, the area of occupancy is around 2,600 km², but in about 2,000 km² it is encountered only in widely separated valleys and hilltops in isolated and highly fragmented populations. The situation in Nagaland is no better. Of about 1,400 km², only *c.*350 km² has continuous forest.

With very small numbers thinly distributed across large areas, population estimates are difficult to obtain. We have some idea of crude density for selected sampled sites in only six areas. In Meghalaya — 1.4 individuals/km² in the Nongkhyllem Wildlife Sanctuary and the Narpuh block I Reserved Forest, and 1.6/km² in the Darugiri Reserved Forest. In Mizoram — 0.7/km² in the Ngengpui Wildlife Sanctuary, 1.0/km² in the Lengteng Wildlife Sanctuary. In Manipur — 0.4/km² in the Yangoupokpi-Lokchao Wildlife Sanctuary (compared with 8.58/km² in parts of the Dum Duma Reserved Forest and 4.71/km² in Dangori Reserved Forest of Assam; see Choudhury, in press). No estimates were obtained for sites in Nagaland.

The mean of these samples is 1.08/km² (mean of three Meghalaya sites [1.47/km²] and of two Mizoram sites [0.85/km²]). But because of the relatively higher density in the Meghalaya sites, the mean of the sites of Mizoram and Manipur — 0.7/km² — should be taken as more typical for an overall population assessment for the 450 km² in Manipur, 600 km² in Mizoram, and 350 km² in Nagaland. For the 350 km² in Meghalaya, the estimate of 1.47/km² would be more appropriate. This indicates populations (including those that are widely scattered) of 350–500 gibbons in Manipur, 500–600 in Meghalaya, 500–600 in Mizoram, and 350–500 in Nagaland. The total comes to about 1,700–2,200 in the four states.

Conservation Problems

Habitat destruction and fragmentation

Forest destruction through tree felling, encroachment, *jhum*, and monoculture tree plantations is a major threat to the survival of the hoolock gibbon in these states. The forest cover in northeast India is disappearing at an alarming rate. More than 1,000 km² of forest was destroyed annually in the region (including Assam, Arunachal Pradesh, and these four states) during the 1970s and 1980s (data from the National Remote Sensing Agency). In Manipur, dense forest cover has declined from 50.5% of the geographical area in 1980–82 to 25.6% in 2001. During the same period, the decrease in Meghalaya was from 33.1% to 25.3%, in Mizoram from 62.6% to 42.4%, and in Nagaland from 42.8% to 32.5% (India, NRSA 1983; India, FSI 2003).

Encroachment is a major problem in the reserved forests, and *jhum* cultivation is an important cause of forest loss and fragmentation in the hilly areas throughout these states. For instance, *jhum* currently covers more than 1,800 km², or 8.2% of the 22,327 km² of the small state of Manipur. Opencast mining for coal has affected the sacred grove of Chiehruphi in Jaintia Hills. Coal and limestone mining in the Garo Hills has also destroyed important gibbon habitat. Even the single protected areas and reserved forests in Manipur have fragmented into parts. Yangoupokpi-Lokchao Wildlife Sanctuary is cut into two by a national highway. The small reserved forest of Darugiri in Meghalaya is divided into three parts by major roads, which the gibbons are unable to cross. The number of fragmented units state by state is as follows: >16 in Manipur, >20 in Meghalaya, >22 in Mizoram, and >10 in Nagaland. This is excluding the scattered groups and individuals spread all over in the abandoned *jhums* and heavily degraded tracts, for which estimate of fragmentation was virtually impossible.

Poaching

The hoolock gibbon is hunted for food by many of the hill tribes of northeast India. The Nagas, Kukis, Hmar, Paite, Biate, Mizos, Chakmas, Khasis, Lais (Pawis), Maras (Lakhers), and Reangs all kill primates for food. Poaching is severe in Nagaland, the hills of Manipur, and Mizoram, and in Meghalaya, it is mostly in Khasi and Jaintia hills. In the past, traditional weapons such as snares and self-made muzzle-loaders were used, but the last two decades has seen the increased use of automatic firearms.

Trade

Commerce in primates is not significant, but occurs. We found smoked macaque and gibbon meat on sale in a market in Churachandpur in 2001. Young gibbons are occasionally captured for pets, and small numbers are also trapped (illegally) to supply zoos.

Other problems

Other conservation issues include the destructive harvesting of bamboo for paper mills, and open-cast coal mining (in parts of Meghalaya), which destroy forests, pollute, and generally disturb the wildlife.

Conservation Measures Taken

The hoolock gibbon is protected under Schedule-I of the Wild Life (Protection) Act of India, which prohibits its killing or capture, dead or alive. Enforcement, however, is virtually nonexistent, even in the protected areas. Most locals

Photo 4. Lengteng Wildlife Sanctuary in Champhai District is a major habitat of hoolock gibbon in Mizoram. Photo by by Anwaruddin Choudhury.

Photo 5. An adult female hoolock gibbon in a *Anthocephalus cadamba* tree, common in the states of Manipur, Meghalaya, Mizoram and Nagaland. Hoolock gibbons eat the fruits and use the trees for sleeping sites. Photo by Anwaruddin Choudhury.

are unaware of its legal status. IUCN (2004) has listed it as "Endangered." It is found in at least 17 protected areas in the four states (see Table 1).

Discussion

The hoolock gibbon is strictly a dweller of dense mature forest, evergreen and semi-evergreen in the plains, foothills, and hills. The dense forest recorded by the Forest Survey of India (India, FSI 2003) includes all forests with crown cover of 40% or more (i.e., plantation forest, village woodland, and scattered patches here and there). Hence a sizeable portion is unsuitable for gibbons. In much of the dense forest where the habitat is still ideal, gibbons have long since vanished due to hunting. On the other hand, a few groups do still survive in degraded areas. Hence, unlike Assam, and except in parts of Meghalaya, the extent of dense forest may not have much bearing on gibbon abundance and distribution. In the Garo Hills, they are generally not molested and hence still occur even in small patches near villages, but due to *jhum*, there are regular micro-level changes in gibbon home ranges there. Elsewhere in Meghalaya and in the three other states, individuals isolated by or exposed due to *jhum* are hunted down within a short time.

Earlier attempts to estimate populations in these states include those of Alfred and Sati (1990) who counted 130 gibbons in the West and South Garo Hills districts of Meghalaya, however, the coverage of larger forests such as Balpakram and Baghmara was inadequate as the number of groups counted indicated.

Except for parts of the Garo Hills, where there is some degree of community protection, the gibbons have survived in a number of pockets in these states merely because of inaccessible and difficult terrain (Saramati and Anko). The density estimate of 9.03 individuals/km² in parts of the Garo Hills, Meghalaya (Alfred and Sati 1990), is today too high for an overall assessment, but probably true for village patches. Areas such as Balpakram and Baghmara do not have such high densities.

Throughout its range in these states, the gibbon is sympatric with other primates including the Assamese macaque (*Macaca assamensis*), stump-tailed macaque (*M. arctoides*), pig-tailed macaque (*M. nemestrina*), rhesus macaque (*Macaca mulatta*), capped langur (*Presbytis pileatus*), and slow loris (*Nycticebus coucang*). In Mizoram and perhaps in southwest Manipur, it is also sympatric with Phayre's leaf monkey (*Presbytis phayrei*).

Large contiguous habitats for long-term conservation are few. In Manipur—the Anko range, the Jiri-Makru Wildlife Sanctuary, Yangoupokpi-Lokchao Wildlife Sanctuary, Kailam Wildlife Sanctuary, and Tolbung Reserved Forest. In Meghalaya—Balpakram National Park, Siju Wildlife Sanctuary, Baghmara Reserved Forest complex, Nongkhyllem Wildlife Sanctuary and Reserved Forest, and Narpuh-Saipung Reserved Forests complex. In Mizoram—Dampa Wildlife Sanctuary, Ngengpui Wildlife Sanctuary and Reserved Forest, Lengteng Wildlife Sanctuary, and Murlen National Park. In Nagaland—the Saramati range and Intanki National Park.

The ultimate cause of habitat destruction is, however, the very rapid growth of the human population in these states. That of Mizoram grew from 0.33 million in 1971 to 0.89 million in 2001; in Nagaland, from 0.5 million in 1971 to 2.0 million in 2001; in Manipur, from 1.07 million in 1971 to 2.29 million in 2001; and in Meghalaya, from 0.98 million in 1971 to 2.32 million in 2001. Since the bulk of the rural population practice *jhum* as their main occupation, and

new villages and hamlets appear constantly, the large-scale destruction of natural habitat seems inevitable.

Despite this depressing prognosis, we believe, however, that if hunting can be reduced through community awareness, and if protective measures are successfully put in place in the sanctuaries and parks, then the forests remaining could support viable populations of gibbons in the long term. Already in Nagaland, many village councils have declared the forests within their control as sanctuaries with good protection; for example, in Khonoma. Although the gibbons have already died out there, they could be reintroduced, and such models could help in all the states.

With the support of International Primate Protection League, USA, I carried out awareness among the church leaders in Manipur's Churachandpur, where smoked gibbon meat was sold at the local market. But such effort needs to be followed up on a long term basis.

Recommendations

A number of important known habitats for gibbons, which are outside the protected area network, should be declared as wildlife sanctuaries. They are: in Nagaland — Saramati and Satoi; in Manipur — Anko range; and in Meghalaya, the area of Nongkhyllem Wildlife Sanctuary should be extended to include the entire area of the reserved forest. Parts of Narpuh (blocks I and II), Saipung, and Baghmara reserved forests should be declared as sanctuaries. Small pockets such as the Darugiri and Songsak Reserved Forests should be declared sanctuaries for the development of eco-tourism with community involvement. It is relatively easy to see the wildlife there and they are accessible by all-weather roads. In Mizoram, the Inner Line Reserved Forest should also be accorded sanctuary status, especially the area between the Sonai (Tuirial) and Barak rivers. The Palak Dil area should be re-notified as a wildlife sanctuary.

Existing protected areas such as Intanki, Lengteng, and Yangoupokpi-Lokchao should be better protected, with increased staff and regular patrolling. Measures should be taken to control *jhum* cultivation as well as hunting for meat. Awareness campaigns should involve the churches and the village headmen to promote conservation measures and programs should be set up for the regular monitoring of the gibbon populations in select sites in the four states.

Acknowledgments

During the field study, I was given considerable support and assistance from many civil and forest officials of Assam, Mizoram, Nagaland, and Meghalaya; NGOs spread across Assam, Nagaland, and Manipur; and a large number of villagers, relatives, and friends, and I thank them all collectively. I am grateful to the American Society of Primatologists for their support for the survey in Jaintia Hills in 1997, Oriental Bird Club for the Forktail – Leica Award of 2000, and the OBC-WildWings Conservation Awareness Award of 2002. For their assistance in the field, I thank the following: *Meghalaya* — S. B.Singh, T. Deb Roy, Lima Ao; *Manipur* — R. K. Ranjan Singh, Sameer Khan, K. Muivah, Ibohanbi Singh; Lungkiang Pamei and Ramkung Pamei; *Mizoram* — N. R. Pradhan, L. Pachuan, K. Hramzama, C. Buanga, C. Hranghimea, T. Zakiau, K. Kheilai, Khudu Ray, Lalkung, Zarlansanga, Khaikhu, S. Saikia, Muankima, Rinsanga, Vanlalpeka, M. Goswami, Jalal Mazumdar, Amaruddin, Anil Goswami; *Nagaland* — M. I. Bora, A. Sema, Thomas Kent Rengma, Khekiho Sohe, Ape, Zievinyu Yalietsu, Ms. Acuno Meyase, Kehevikho, Bano Meyase, D. Moses, Sipichu, Mon Bahadur, Sonthe Yamphar, Terhuchu Yitsithu, Zitinchu, Thepukedu, Thozhupu Mekrisu, T. Torechu. Mrs. Anne Wright, Ratul Talukdar and Hakim of The Rhino Foundation for Nature in northeast India, Kolkata and Guwahati. My thanks too to my late mother who provided valuable past information on Meghalaya, my wife and relatives, friends, and other well-wishers who gave me the benefit of their advice. Special thanks go to my father, the late Alauddin Choudhury, who introduced me to Manipur in 1988 and was also of constant help during my subsequent field trips to Manipur and Nagaland.

Literature Cited

Alfred, J. R. B. and J. P. Sati. 1990. Survey and census of the hoolock gibbon in West Garo Hills, northeast India. *Primates* 31(2): 299–306.

Brandon-Jones, D., A. A. Eudey, T. Geissmann, C. P. Groves, D. J. Melnick, J. C. Morales, M. Shekelle and C.-B. Stewart. 2004. Asian primate classification. *Int. J. Primatol*. 25: 97–164.

Champion, H. and S. K. Seth. 1964. A revised survey of the forest types of India. Forest Research Institutes and Colleges, Dehra Dun.

Choudhury, A. U. 1987. Notes on the distribution and conservation of Phayre's leaf monkey and hoolock gibbon in India. *Tigerpaper* 14(2): 2–6.

Choudhury, A. U. 1988. Priority ratings for conservation of Indian primates. *Oryx* 22: 89–94.

Choudhury, A. U. 1989. Primates of Assam: Their distribution, habitat and status. PhD thesis, Gauhati University, Guwahati.

Choudhury, A. U. 1990. Population dynamics of hoolock gibbons in Assam, India. *Am. J. Primatol.* 20: 37–41.

Choudhury, A. U. 1991. Ecology of the hoolock gibbon, a lesser ape in the tropical forests of NE India. *J. Trop. Ecol.* 7: 147–153.

Choudhury, A. U. 1992. Wildlife in Manipur — a preliminary survey. *Tigerpaper* 19(1): 20–28.

Choudhury, A. U. 1996. A survey of hoolock gibbon (*Hylobates hoolock*) in southern Assam, India. *Prim. Rep.* 44: 77–85.

Choudhury, A. U. 1997a. *Checklist of the Mammals of Assam*. 2nd Edition. Gibbon Books and ASTEC, Guwahati.

Choudhury, A. U. 1997b. The imperilled biodiversity of Nagaland. *Sanctuary Asia* 17(2): 38–45.

Choudhury, A. U. 1998. A survey of primates in the Jaintia Hills. *ASP Bull.* 22(3): 8–9.

Choudhury, A. U. 2000. A survey of hoolock gibbon (*Hylobates hoolock*) in Dibru-Saikhowa National Park, Assam, India. *Prim. Rep.* 56: 61–66.

Choudhury, A. U. 2001. Primates in NE India: An overview of their distribution and conservation status. *ENVIS Bull: Wildl. Protected Areas* 1(1): 92–101.

Choudhury, A. U. 2003a. *The Mammals of Arunachal Pradesh.* Regency Publications, New Delhi.

Choudhury, A. U. 2003b. Meghalaya's vanishing wilderness. *Sanctuary Asia* 23(5): 30–35.

Choudhury, A. U. In press. The Hoolock gibbon *Hylobates hoolock* in Tinsukia and Dibrugarh districts of Assam, India. *Asian Primates*.

Corbet, G. B. and J. E. Hill. 1992. *The Mammals of the Indomalayan Region: A Systematic Review*. Oxford University Press, Oxford.

Das, J. 2002. Socioecology of hoolock gibbon *Hylobates hoolock hoolock* in response to habitat change. PhD Thesis, Gauhati University, Guwahati.

Dun, E. W. 1886. *Gazetteer of Manipur*. Superintendent, Government Printing, Calcutta (reprint, 1981 by Vivek Pub. Co., Delhi).

Groves, C. P. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC.

Groves, C. P. 2005. Order Primates. In: *Mammal Species of the World: A Taxonomic and Geographic Reference*, 3rd Edition, Volume 1, D. E. Wilson and D. M. Reeder (eds.), pp.111–184. Johns Hopkins University Press, Baltimore.

Harlan, R. 1831. Description of a new species of orang (*Simia hoolock*) from the north-eastern province of British east India, lately the kingdom of Assam. *Trans. Am. Phil. Soc*. 4(1): 52–59.

India, FSI. 2003. *State of Forest Report 2001.* Forest Survey of India (FSI), Dehra Dun.

India, NRSA. 1983. *Mapping of Forest Cover in India from Satellite Imagery 1972–75 and 1980–82*. *Summary report, North Eastern States/Union Territories*. National Remote Sensing Agency (NRSA), Government of India, Hyderabad.

IUCN. 2004. *2004 IUCN Red List of Threatened Species*. IUCN, Gland, Switzerland.

McCann, C. 1933. Notes on the colouration and habits of the white-browed gibbon or hoolock (*Hylobates hoolock* Harl.). *J. Bombay Nat. Hist. Soc*. 36: 395–405.

Misra, C., T. Raman and A. Johnsingh. 1994. Survey of primates, serow, and goral in Mizoram. Report, Wildlife Institute of India, Dehra Dun.

Mootnick, A. and C. P. Groves. 2005. A new generic name for the Hoolock gibbon (Hylobatidae). *Int. J. Primatol*. 26(4): 972–976.

Parsons, R. E. 1941. Rivers as barriers to the distribution of gibbons. *J. Bombay Nat. Hist. Soc*. 42: 434 and 926.

Pocock, R. I. 1939, 1941. *The Fauna of British India: Mammalia. Primates and Carnivora.* Taylor and Francis, London.

Prater, S. H. 1948. *The Book of Indian Animals.* Bombay Natural History Society, Bombay (Mumbai).

Prouty, L. A., P. D. Buchanan, W. S. Pollitzer and A. R. Mootnick. 1983a. A presumptive new hylobatid subgenus with 38 chromosomes. *Cytogenet. Cell Genet*. 35: 141–142.

Prouty, L. A., P. D. Buchanan, W. S. Pollitzer and A. R. Mootnick. 1983b. *Bunopithecus*: A genus-level taxon for the hoolock gibbon (*Hylobates hoolock*). *Am. J. Primatol*. 5: 83–87.

Takacs, Z., J. C. Morales, T. Geissmann and D. J. Melnick. 2005. A complete species-level phylogeny of the Hylobatidae based on mitochondrial ND3-4 gene sequences. *Molec. Phylogenet. Evol.* 36: 456–467.

Tilson, R. L. 1979. Behaviour of hoolock gibbons (*Hylobates hoolock*) during different seasons in Assam. *J. Bombay Nat. Hist. Soc*. 76: 1–16.

Author's address:
Anwaruddin Choudhury, The Rhino Foundation for Nature in NE India, c/o The Assam Co. Ltd., Bamunimaidam, Guwahati 781 021 India. E-mail: <badru1@sify.com>.

Received for publication: October 2005
Revised: April 2006