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SINGING AND SWINGING APE : THE HOOLCK GIBBON OF INDIA

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INTRODUCTION

The Hoolock gibbon, *Hylobates hoolock*, is familiar by its song and special way of locomotion, known as brachiation. It uses its extremely long arms for swinging from one branch to the other or from tree to tree with incredible speed. The gibbon hardly leaves the forest and is seldom destructive to ground crops. The gibbons, smallest among the apes, are represented by 16 species. The Hoolock gibbon or the white browed gibbon, is the only ape found in India. The rest of the species are found out side this country. It occurs in all the seven states of Northeastern India. Gibbons are also known as Lesser or smaller apes. The distribution of Western hoolock, *H. hoolock*, is restricted to the evergreen rain forests of Northeastern India, extending from south of Brahmaputra river system to Mizoram and Manipur and also in Bangladesh, southern Yunnan in China to west of Chindwin river in Myanmar. Earlier records show that this ape was widely distributed in this region and was fairly common (Fig. 1) but now it is fragmented in distribution (Fig.2) and is much reduced in numbers.

The Eastern hoolock, *H. leuconedys*, is distributed from east of Chindwin to Salween rivers in Myanmar and western Yunnan Province in China at an altitude of 1066-1219 m. It has recently been reported from Lohit district of Arunachal Pradesh (Das *et al.*, 2006).

A total of 28 species of gibbons, under four genera have been identified. These genera are *Bunopithecus* (with 2 species), *Hylobates* (with 15 species), *Nomascus* (with 9 species) and *Syamphalangus* (with 2 species) (Brandan-Jones et. al., 2004). However, the taxonomy of the Hoolock gibbon has recently been revised and gibbons have been placed into the genus *Hoolock* and split into two discrete species, the Western Hoolock Gibbon, *H. hoolock* (Fig.3), and the Eastern Hoolock Gibbon, *H. leuconedys* (Fig.4) (Mootnick and Groves, 2005). Many workers considered these two species as distinct sub-species.

The field studies on gibbons were started in late 1930's with the pioneering study on Lar gibbon, in Thailnd. The studies were resumed in 1960's on the Lar gibbon and Siamang in Malaya Peninsula. This was followed by extensive studies of different species in Malaysia and Indonesia. By 1980's comprehensive studies were undertaken on most of the species like Lar, Agile, Maloch, Muller's, Kloss, Siamang and Crested gibbons in the erstwhile Indo-China. During this period, the field studies of Hoolock gibbon in Northeastern India and Bangladesh were also intensified.

TAXONOMY

Earlier the Hoolock gibbon was placed to the genus *Hylobates* under the family Hylobatidae. The genus *Hylobates* consisted of four subgenera viz. *Bunoptithecus, Hylobates, Nomascus* and *Symphalangus*. Recent molecular studies have shown that the phylogenetic distance amongst these subgenera was as large as or larger than the distance between chimpanzees and humans (Roos and Geissmann, 2001). As a consequence,

all the subgenera were elevated as full-genera (Gupta *et.al.* 2005) and, thus, the name *Hylobates hoolock* was changed to *Bunopithecus hoolock* (Brandan Jones *et.al.*, 2004). But again its generic name was resuscitated as *Hoolock* by Mootnick and Groves (2005).

Characteristics

Head and body length:

Male : 45.7-63.0cm

Female : Almost the size of male

Body Weight:

Male : 6.1-7.9 kg

Female : 6.0-6.6 kg

Head : Small and round.

Face : Black with silver white band above eye-brows; snout is not protruding; nostrils are widely spaced.

Hands and Feet: Long hands and feet; arms are more than double the length of legs.

Coat : Fur shaggy, long and dense.

Sexual dimorphism : Adult females are a little smaller than adult males, golden buff or brownish grey in colour (Fig.5), with clitoris; adult males are black. According to some observers both the sexes of Hoolock gibbon are black in Arakan in Myanmar, and they believe that Arakan population is different from that inhabiting the forests of Northeastern India.

Juvenile : At birth, the infant is pale grayish white with yellowish tinge and face, palms, and soles black; the body colour gradually darkens with age, becoming black in adult males; but in adult females, the black colour fades at puberty and becomes golden or yellowish brown.

Distribution : Fragmented distribution in Northeastern India- south and east of Brahmaputra river extending up to south-eastern part of Dibong river in Arunachal Pradesh-the southern limit in India is Mizoram. Also found in eastern Bangladesh, southern China and northern Myanmar.

Population : The exact status is not known. However, most of the population is threatened.

Intraspecific variation : Two sub-species, *H.h. hoolock* and *H.h. leuconedyes*, are recognized but some workers consider them as distinct species.

Similar species : *Hylobates lar* of south-east Asia and Indonesia and *Hylobates concolor* of China.

Legal status : This species is protected under schedule I of Indian Wild Life (Protection) Act 1972 and Appendix-I of CITES. It is treated as endangered under the Red Data Book of Indian Animals,1994. Mukherjee *et.al.*, (2008) reported the fragmented distribution of this species in Northeastern India and considered it as rare and threatened.

ECOLOGY

Hoolock gibbons are exclusively forest-dwelling ape and inhabit forest with contiguous canopy. They are usually found in (i) broad-leaf, moist deciduous forests, (ii) mixed evergreen and semi-evergreen forests with tall trees and (iii) thick under-story in mountains, valleys, slopes and low land. They are found in all the three kinds of forest - primary, secondary and regenerating (Mukherjee, 1986, Mukherjee *et.al.*, 1991-1992: Chowdhury, 1996, 2000, 2006: Das *et.al.*, 2003). In general, Hoolock gibbon's habitats are tropical forests having wet, hot summer, monsoon rains and dry cool winter. The annual rainfall ranges from 130 to 140 cm.

Hoolock gibbon of northeastern India inhabits all the seven states viz. Assam, Arunachal Pradesh, Meghalaya, Manipur, Tripura, Mizoram and Nagaland ($21^{0}57'$-$29^{0}30'$ N to $89^{0}46'$-$97^{0}30'$ E). The whole area is rich in flora and fauna and has been recognized as one of the two biodiversity hot spots in India, the other being the Western Ghats in southern India. Among all the other animal communities, the non-human primates form an important group of animals in this region. The Hoolock gibbon that shares this habitat is sympatric with other non-human primates of the region and they subsist together.

Table-1: Geographical area, % of forest cover, % of dense forest and forest types in seven states of Northeastern India.

States	Geographical area (km^2)	% of forest cover	% of dense forest	Forest types
Assam	78,438	30.2	18.5	LSW, STBH, STP, TMD, TSE, TWE.
Arunachal Pradesh	83,743	82.2	68.9	MWT, SAF, STP, TWE
Meghalaya	22,429	69.7	26.4	STP, TMD, TSE, TWE
Mizoram	21,081	86.9	17.9	STP, TMD, TWE
Tripura	10,492	54.8	21.2	STBH, TMD
Nagaland	16,579	85.4	30.9	MWT, STP, TMD, TWE
Manipur	22,327	77.9	26.6	MWT, STP, TSE

Abbreviation : LSW–Littoral and Swamp. MWT- Montane wet temperate. SAF-Sub-alpine forest. STBH- Sub- tropical broad leaved hill. STP- Sub-tropical pine. TMD-tropical moist deciduous. TSE- Tropical semi-evergreen. TWE- Tropical wet evergreen.

Lowland rain forests, the ideal habitat of Hoolock gibbon(Fig.6), in all the seven states of Northern India is one of the richest terrestrial ecosystems. However, this ideal habitat is greatly damaged by biotic disturbances. The types of forests found in this region are ranging from tropical moist deciduous, tropical wet evergreen and semi-green, and sub-tropical broad leaved, pine and alpine forests to montane wet temperate, swamp and secondary forests. The Hoolock gibbons mostly inhabit wet evergreen forests and less in deciduous and scrub forests (Gupta *et.al.*, 2005). The trees found in these forests are mostly Sal, moist deciduous, savannah, riverine, etc. The climbers are common and the forest floor is covered with scrub and ferns. In the National Parks, Reserve Forests and Wildlife Sanctuaries, the trees are generally tall with close canopy. Geographical area, percentage of forest cover, percentage of dense forest and forest types of each state are given in Table-1.

Assam is the second largest in geographical area after Arunachal Pradesh. In this state, the forest area of 28, 185km^2 is divided into 36 forest divisions. Nearly half of this area at present can be considered as dense and the remaining as open (Gupta *et.al.*, 2005).

These forests can further be classified as reserved forests (14,958km^2), protected forests (3,436km^2), district council reserved forests (1,081km^2), proposed reserve forests (2,815km^2) and unclassified forests (5,894km^2). There are 23 protected areas of which 5 are National Parks(1,969km^2), which constitute about 2.5% of the total geographical area, and 18 Wildlife Sanctuaries (1,440km^2), which are about 1.9% of the total geographical area (Gupta *et.al.*, 2005). The state of Assam is composed of mountainous areas and flood plains. It is surrounded by hill states like Meghalaya, Arunachal Pradesh, Mizoram, Manipur, Nagaland, Tripura and the kingdom of Bhutan. Till 1980's, out of 78,438km^2 area of Assam, *i.e.*, more than 33% was covered with forests. However, in recent years, it has reduced to about 30%, due to various factors.

The state of Mizoram consists of hill ranges which run in north-south direction. The state is situated between 20°20' to 24°21' N latitude and 92°20' to 93°29' E longitude. The average height of the hills are about 1000m. The forests are of three types - tropical wet evergreen, tropical moist deciduous and montane sub-tropical. Deciduous forests, grassland and evergreen forests are found at higher altitude. The total forest cover is about 15,935km^2 (about 75.59% of the total geographical area). The forest is a mixed one, with various species of bamboo confined to the lower areas of the forests. Various species of orchids are found in this state. The protected areas are about 1200km^2 which constitute roughly 6% of total geographical area. The protected areas in Mizoram are the best in Northeastern India. The monsoon rain is very heavy, 2000-4000mm. There are 2 National Parks, one Tiger Reserve and 9 Wildlife Sanctuaries in

Mizoram. There is a proposal for setting up more sanctuaries in the state.

Arunachal Pradesh is the biggest state in Northeastern India (26°28'-29°31' N and 91°30'-97°30' E). The state is rich in forest cover. It is about 68, 620km^2 which accounts to about 81.9% of the total geographical area. This is the highest forest cover among the seven north-eastern states of India. The closed and the open canopy cover consist of about 79.4% and 20.6% respectively. The reserve and the district community forests cover an area of 37.3% and 62.2% respectively. The forests are tropical, sub-tropical, temperate, Pine, Alpine and Secondary.

The state is mostly hilly and sparsely populated and is divided into three sections viz, high hills, foot hills and flood plains. The altitude varies from 50m in the foot hills to about 7,000m in the northern parts of the state. The soil in the majority of the area is rocky. There are 2 National Parks and 11 Wildlife Sanctuaries.

The whole of Meghalaya is a plateau (25°5'-26°10' N and 89°47'-92°47' E). The western, central and eastern parts commonly known as Garo, Khasi and Jaintia hills respectively. The topography is irregular. The type of forests are tropical, sub-tropical and temperate. The tropical forests are confined to 1,200m elevation and temperate forests between 1,200 to 1,800m elevations. Bamboo forests also grow within these forest types. The state is rich in a variety of orchids. The total area of forest is about 9,496 km^2 which is about 42.3% of total geographical area. The dense and open forest areas are about 25.8% and 74.2% respectively. About 89.5% of forest is under the control of autonomous district council. The forest department controls only 10.5% of the forests as reserved and protected areas. There are 5 protected areas out of which 2 are National Parks and 3 are Wildlife Sanctuaries.

The Nagaland is also rich in forest resources the forest cover of the state is 14,221km^2 i.e. about 86% of the land area. About 0.9% of the forest area is reserved forest. Protected and the unclassified private forests are about 5.9% and 93.1% of the total forest land respectively. About 30.9% of the geographical area is dense forest. The forest cover has considerably reduced due to practice of shifting cultivation. The forests are tropical wet evergreen, tropical moist deciduous, mountane wet temperate and sub-tropical pine. The state has one National Park and 3 Wildlife Sanctuaries.

The Manipur is also very rich in forest resources and is covered by plains and hills. The forest area constitutes about 17,418km^2 which is about 78% of the total geographical area of the state. The reserved and protected forests cover are about 9.7% and 27.5% respectively and the unclassified and private forests cover about 62.8%. The presence of autonomous areas in 6 districts are further cause of this faulty land use. The unclassed forested areas are controlled and managed by the councils. This multilevel control of forest lands is the reason for the loss of forest cover to the tune of 267 km^2 within a span of 6 years i.e. between 1991 and 1997. The state though lose the area of dense forest but it gains the open forest area. The practice of shifting cultivation leads to huge reduction in forest cover. The state has one National Park of about 40km^2 and 5 Wildlife Sanctuaries covering an area of 185km^2.

The Tripura is located between 22°56' and 24°32' N latitude and 91°09' and 92°20' E longitude. The total forest cover is 7,065km^2 of which 3,463km^2 is dense forest and 3,602km^2 open forest. Out of this, about 3,588 km^2 are reserved forest and 2,195km^2 as unclassified.

The type of forest vary from east Himalayan lower bhabar Sal, tropical evergreen, moist mixed deciduous, low alluvial savannah woodland, dry bamboo breaks and secondary moist bamboo breaks. Hill ranges of Tripura are in close continuity with the Chittagong hill tracts of Bangladesh and the hills of southern Assam. About 30% of the total area of the state is under autonomous district council. There are 4 Sanctuaries in the state.

In the Northeastern India, the lay of the land is flat with gentle slopes and high hills. Plains and hills form the whole area and the elevation varies from place to place. It is as low as 33m in Assam to

1,260-1,400m in Arunachal Pradesh. The climate is characterized as sub-tropical, with hot and wet summer and cold dry winter. The rivers originate from the high hills of Himalaya's. The longest among them is the Brahmaputra, which criss-cross the plains and runs north-south. Its tributaries drain the plains and forests. During monsoon, when the rain is heavy, these rivers over-flow and inundate many areas including the reserve forests and National Parks. These rivers though very turbulent during the monsoon are practically dry during the winter and the summer months. The tract at places are formed by boulders and gravelly sand. The top soil consists of humus, varying from almost nil to over 30cm in thickness. The rainy season lasts from June to October, the summer from March to May or June and the winter from November to February. The coldest months are December and January. The snow falls at the high altitude during the winter months. The winter and the summer rains are also common. Rivers and streams are the main source of water supply. Almost the entire rain occurs during the monsoon period. At times, mild frost also occurs in low-lying areas during the winter months.

DISTRIBUTION

The vibrant economy of the over-populated developing countries of Asia and Africa is largely dependant on exploitation of natural resources including the forest. The non-human primates inhabit these forests. The loss and fragmentation of the forests have an adverse effect on their population in general and Hoolock gibbon in particular. Forest survey of India recently made an estimation of forest cover in India and came to the conclusion that the country had lost almost 5,500km^2 of forest in two year's period. Hoolock gibbon, the only ape found in India, inhabits the dense, contiguous, broad leaved, wet evergreen forests of Northeastern India from 100m to about 1,400m altitude, upto 2,500m estimated by Choudhury, 2006, is affected by these loss and fragmentation of the forests.

The species, once well distributed and abundant in all the seven states of Northeastern India (Fig.1), is now not continuous in distribution but is found in fragmented areas (Fig.2). Its population is drastically reduced, as is evident by some recent reports. Some population, in certain areas, have lost so many members that only a few individuals are left in isolated habitats and cut of from the main population. These tiny populations as a result of inbreeding have no future and are unlikely to survive for long. Alfred and Sati (1990) surveyed 200 localities in Garo hills, Meghalaya, for the presence of Hoolock gibbons but recorded them only in 32 localities. As-far-as the information goes the remaining 168 localities had gibbons in the past but now they have disappeared. These forest patches are now separated from each other.

This species is now treated as one of the world's 25 most endangered primates and is likely to become extinct faster than expected, because they are arboreal, frugivorous, highly territorial, brachiater, monogamous, and of low reproductive out put. In recent years, the population of hoolock gibbon were wiped out in 18 localities in India and Bangladesh in just 3 to 5 years. Mukherjee *et.al.*, (1986, 2008) reported that six groups of this ape were wiped out in Tripura within a period of six years.

The hoolock gibbon is distributed in Northeastern India, south of Brahmaputra river (Dibong-Brahmaputra river system), from Arunchal Pradesh to Mizoram and Manipur. Outside India it is found in Bangladesh, southern Yunnan in China to west of Chindwin river in Myanmar.

According to Groves (1967) the distribution of *H. h. hoolock* and *H.h. leuconedys* are demarcated by two rivers, Chindwin and Irrawaddy, in Myanmar. *H. h. hoolock* occurring west and *H.h.leuconedys* to the east of Chindwin river. The distribution of *H.h. leuconedys* continues east as far as the Salween river in Myanmar. However, Das *et. al.*, (2006) has reported the occurrence of *H. h. leuconedys* in Lohit district of Arunachal Pradesh. Detailed present distribution is given in Table 2.

In Arunachal Pradesh, the gibbons were reported from Subansiri district till 1975 (Borang

Table-2: Distribution of Hoolock gibbon in Protected areas of Northeastern India (Chetry et.al. 2007)

States	Protected Areas	Total area(km^2)
Arunachal Pradesh.	Kamlang Wildlife Sanctuary.	680.00
	Mehao Wildlife Sanctuary.	281.50
	Namdapha National Park.	1985.00
Assam	Amchang Wildlife Sanctuary.	79.00
	Barail Wildlife Sanctuary.	326.00
	Bherjan- Borajan- Podumani Wildlife Sanctuary.	7.21
	Dibru- Saikhow National Park.	340.00
	Dihing Patkai Wildlife Sanctuary.	111.00
	East Karbi Anglong Wildlife Sanctuary.	221.81
	Garampani Wildlife Sanctuary.	6.05
	Hollongapar Gibbon Sanctuary.	20.98
	Kaziranga National Park	860.00
	Marat Longri Wildlife Sanctuary.	451.00
	Nambor- Doigrung Wildlife Sanctuary.	97.15
	Nambor wildlife Sanctuary.	37.00
	North Karbi Anglong Wildlife Sanctuary (Proposed).	96.00
Manipur	Bunning Wildlife Sanctuary.	115.80
	Jiri-Makru Wildlife Sanctuary.	198.00
	Kailam Wildlife Sanctuary.	157.80
	Yangoupokpi Lokchao Wildlife Sanctuary	184.00
	Zeilad Wildlife Sanctuary	21.00
Meghalaya	Bghmara Pitcher Plant Wildlife Sanctuary	00.02
	Balpakhram National Park	220.00
	Nokrek National Park	47.48
	Nongkhyllem Wildlife Sanctuary	29.00
	Siju Wildlife Sanctuary	5.18
Mizoram	Dampa National Park	500.00
	Khaurnglung Wildlife Sanctuary	41.00
	Lengteng Wildlife Sanctuary	80.00
	Murlen National Park	150.00
	Ngenpui National Park	110.00
	Phawngpui National Park	50.00
	Tawi Wildlife Sanctuary	37.75
Nagaland	Fakim Wildlife Sanctuary	6.42
	Intaki	202.00
Tripura	Gumti Wildlife Sanctuary	389.50
	Trishna Wildlife Sanctuary	194.70

and Thapliyal, 1993) and also from the forests of Banderdeva, a place close to Itanagar, even in 1978 (Mukherjee *et.al.*, 2008).

In the past, no document was available about the distribution and status of hoolock gibbon in Bangladesh and Myanmar. In recent years some field studies on gibbons have been initiatd in Bangladesh but practically nothing is known from Myanmar.

Inspite of the studies conducted on Hoolock gibbon in Northeastern India, its status is not conclusively known, except some information on the groups inhabiting the protected areas. Recent studies show that the populations are equally good in outside the protected areas as well as in village forests. Gupta (1994) recorded 18 and 9 groups of Hoolock gibbon from primary and secondary forests respectively in Tripura. Groups of gibbon have been reported from the forests inside the villages, particularly in Meghalaya and Arunachal Pradesh and occasionally in the village orchards. The villagers are tolerant to these village groups. Out of 7 Northeastern states, Assam is probably the only state where extensive field studies have been carried out and some documents are available. The Annual Report – II (1995 – 1996) of Indo-US Primate Project reported the presence of Hoolock Gibbon from about 19 areas and Gupta et. al., (2005) reported from 13 protected areas, 2 National Parks and 11 Wildlife Sanctuaries, in Assam.

As regards the remaining states practically nothing is known about the gibbon populations.

Table-3 : Location of gibbon groups in different habitats of Meghalaya (Gupta et.al.2005 with certain additions and amendments).

Sl. No	Location	No. of groups in protected areas			No. of groups outside protected areas			
		RF	NP	WLS	VF	ADP	PF	Total
1.	Narpuh-I	3	-	-	-	-	2	05
2.	Narpuh-II	3	-	-	-	-	2	05
3.	Corridor	-	-	-	6	-	1	07
4.	Siju WLS	-	-	2	1	1	-	04
5.	Balphakram NP	-	1	-	1	1	-	03
6.	Baghmara	5	-	-	-	-	-	05
7.	Nongkhyllum WLS	4	-	10	-	-	1	15
8.	West Garo Hills	-	1	-	38*	-	-	39
	Total	15	2	12	46	2	6	83
	% of population in protected areas		34.94					
	% of population in outside protected areas					65.06		

Abbreviation : ADP-Adjacent to protected Areas. NP- National Park. PF-Private Forests. RF-Reserved Forests. VF-Village Forests. WLS- Wildlife Sanctuary.* Songacham is treated as Village Forests.

However, gibbons are known to occur in Kamlangnagar and Mehao Wildlife Sanctuaries, Dibang Wildlife Sanctuary and Namdapha National Park in Arunachal Pradesh and 5 Wildlife Sanctuaries, namely, Jiri- makru, Kellam hill, Yangoupokpi- Lockchao, Zeilad and Bunning in Manipur. They are supposed to occur in Intaki, Fakim and Pulie-Badge Wildlife Sanctuaries in Nagaland but no confirm reports are available.

Gupta *et al.,* (2005) studies in protected areas of Meghalaya, Mizoram and Tripura and revealed that a large population of gibbons still live outside the protected areas and village forests. These populations are under constant pressure of their survival. The information

Table-4 : Location of gibbon groups in different habitats of Mizoram (Gupta *et.al.,* 2005 with certain additions and amendments).

Sl. No	Location	No. of groups in protected areas			No. of groups outside protected areas		
		RF	NP	WLS	VF	ADP	Total
1	Dampa Tiger Reserve	10	---	---	---	---	10
2	Ngenpui WLS	---	---	4	5	1	10
3	LengtengWLS	---	---	6	6	---	12
4	Murlen NP	---	2	---	---	2	04
5	Khawnglung WLS	---	---	9	10	---	19
6	Tawi WLS	---	---	1	13	---	14
7	Phawngpui NP	---	3	---	---	---	03
	Total	10	5	20	34	3	72
	% of population in protected areas		48.61				
	% of population in outside protected areas.					51.39	

Abbreviation : ADP-Adjacent to Protected Areas. NP-National Park. RF- Reserve Forests. VF- Village Forests. WLS- Wildlife Sanctuary.

Table 5 : Location of gibbon groups in different habitats of Tripura (Gupta et.al.2005 with certain additions and amendments).

Sl. No	Location	No. of groups in protected areas			No. of groups outside protected areas			
		RF	NP	WLS	PF	VF	PF+RF	Total
1.	Phuldansai	3	-	-	-	-	-	03
2.	Bethingship	-	-	-	-	-	5	05
3.	Sabul	-	-	-	3	-	-	03
4.	Conzai	-	-	-	1	-	-	01
5.	Vangmung	11	-	-	4	-	-	15
6.	Manu (N. Tila)	-	-	-	-	-	1	01
7.	Kanchanchera	1	-	-	-	-	-	01
8.	Laxmanpara	-	-	-	-	-	1	01
9.	Chamanu	1	-	-	-	-	-	01
10.	Dewachera	-	-	-	-	-	1	01
11.	Thalchera	-	-	-	-	-	1	01
12.	Ambasa	1	-	-	-	-	-	01
13.	Harinchera	1	-	-	-	-	-	01
14.	Ganganagar	1	-	-	-	-	-	01
15.	Khowaichera	1	-	-	-	-	-	01
16.	Noonchera	1	-	-	-	-	-	01
17.	Gandachera	1	-	-	-	-	-	01
18.	Jiyalchera	1	-	-	-	-	-	01
19.	Trishna	-	-	1	-	-	-	01
	Total	23	-	1	8	-	9	41
	% of population in Protected areas. % of population outside Protected areas.	58.54			41.46			

Abbreviation: NP- National Park, RF- Reserve Forests. VF- Village Forests. PF- Private Forests. WLS- Wildlife Sanctuary.

regarding the distribution of gibbons collected by them from the three states are given in Tables 3-5.

POPULATION ESTIMATION

It is believed that the population of Hoolock gibbon was over 1,00,000 individuals in 1970's but their number has reduced drastically in recent years (Gron, 2008). It was estimated to be between 1,70,000 and 5,32,000 individuals by Chivers (1977) and Mackinnon and Mackinnon (1987) respectively. Tilson (1979), however, gave an estimate of 78,800 gibbons in Assam and adjoining areas of Meghalaya and Mizoram. He estimated about 16,700 individuals only in Cachar, Hailakandi and Karimganj area of Assam. Gittins (1984) estimated a population of 3000 gibbons in Bangladesh.

After a lapse of two decades, Chowdhury (1995,1996) estimated a total population of 6200-6700 gibbons in Assam, with a population of 600-700 in North Cachar Hills, and 1100-1300 in Cachar, Hailakandi and Karimganj districts, and 30 gibbons in Borajan Reserve Forest, Assam.

In recent years, the population of gibbons in Northeastern India was estimated to be around 2500 by Menon (2003), between 1700 and 2200 by Chowdhury (2006), and around 200 in Bangladesh by Biswas *et.al.*, (2003), Molur *et.al.*, (2005), and Walker *et.al.*, (2007). Gron (2008) quoted the findings of Chowdhury, Biswas, Molur and Walker in the Primate Factsheets : Hoolock Gibbon (Hoolock).

No serious attempts has been made to assess the population of gibbons in Myanmar. A population estimate of 1,70,000-5,32,000 gibbons estimated by Chivers (1977) and Mackinnon and Mackinnon (1987) mentioned above appear to

include the population of both India and Myanmar. Gron (2008), however, estimated about 30000 gibbons only in Myanmar.

In China, the number of Eastern Hoolock Gibbons was estimated to be less than 150 individuals by Zhang (1998) and between 300 and 600 by Zhang Yongzu *et.al.*, (2002).

The population of Hoolock gibbon, in India, can not be estimated accurately, as their status in all the seven states of Northeastern India are not authentically known. This ape was studied from time to time by various workers particularly in the Protected areas like Sanctuaries and National Parks. Mukherjee *et.al.*, (1982,1992) estimated it in Assam and Arunachal Pradesh, Alfred *et.al.*, (1990, 1994) in Meghalaya, and Gupta *et.al.*, (2005) in Meghalaya, Mizoram and Tripura. No published account is available on its population in Nagaland and Manipur. Das *et.al.*, (2004) counted 62 groups containing 219 individuals in 20 forest divisions of Assam. However, they have estimated a total population of 4404 individuals in about 1246 groups in the undisturbed forest habitat, and 4980 individuals in 1429 groups in fragmented forest habitats.

The report of the Population and Habitat Viability Assessment (PHVA) workshop(2005) mentioned that from 600 to 700 gibbons are present in the wild in 126 localities with population ranging from 1-40 individuals in India and Bangladesh. The report further mentioned that the present population of Hoolock gibbon in India and Bangladesh will be extinct within a period of 20 to 40 years.

The variation in estimation mentioned above is actually due to observation based in a limited area. So it is necessary to study its population extensively in all the ecological habitat in seven Northeastern state of India to get an accurate idea about its status.

SOCIAL COMPOSITION

Monogamous gibbon groups comprise of an adult male and adult female, along with immature juveniles and infants. They maintain small group size of 2-6 individuals with an average of around 3. Majority of groups consist of monogamous mated pairs of adult male and adult female with one or two immature individuals. Rarely, groups with more than one adult male or more than one adult female occur. Mukherjee *et.al.*, (1991-92) recorded 16 gibbon groups in Lohit district of Arunachal Pradesh out of which 15 were bisexual groups whereas one was all male group of 7 members.

Table 6 : Population estimate and social composition of Hoolock gibbon in different locations at Meghalaya (Gupta *et.al.*, 2005 with certain additions and amendments).

Sl. No.	Location	Mode / No. of groups			Total No. of groups	Social Composition.				Total	Area(km^2)
		PC	SO	ST		AD Male	AD Female	JJ	II		
1.	Narpuh-I	5	-	-	5	-	-	-	-	-	9.2
2.	Narpuh-II	2	3	-	5	-	-	-	-	-	9.1
3.	Corridor	-	7	-	7	-	-	-	-	-	18.2
4.	Siju WLS	-	3	1	4	-	1	-	-	1	4.1
5.	Balphakram NP	1	1	1	3	1	1	1	-	3	6.0
6.	Baghmara	1	3	1	5	1	1	2	1	5	5.0
7.	Nongkhyllum WLS	-	12	3	15	3	3	3	3	12	28.1
8.	West Garo Hills	20	3	16	39	23	18	17	9	67	179.5
	Total	29	32	22	83	28	24	23	13	88	259.2
	Percentage	34.94	38.55	26.51							
	Distribution of a group										3.12

Abbreviation: PC-Personal Communication. SO- Song. ST- Sighting. AD- Adult. JJ- Juvenile, II- Infant. WLS- Wildlife Sanctuary. NP- National Park.

Table 7: Population estimate and social composition of Hoolock gibbon in different location at Mizoram (Gupta *et.al.* of 2005 with certain additions and amendments).

SL No.	Location	Mode / No. of groups			Total No. of groups	Social Composition.				Total	Area(km^2)
		PC	SO	ST		AD Male	AD Female	JJ	II		
1.	Dampa TR	2	6	2	10	2	2	1	1	6	29.4
2.	Ngenpui WLS	8	2	-	10	-	-	-	-	-	33.7
3.	Lengteng WLS	8	4	-	12	-	-	-	-	-	73.5
4.	Murlen NP	4	-	-	04	-	-	-	-	-	46.0
5.	Khawangung WLS	8	11	-	19	-	-	-	-	-	48.0
6.	Tawi WLS	7	6	1	14	1	1	-	1	3	46.6
7.	Phawngphui NP	2	1	-	03	-	-	-	-	-	23.5
	Total	39	30	3	72	3	3	1	2	9	300.7
	Percentage	54.16	41.67	4.17	-	-	-	-	-	-	
	Distribution of a group										4.18

Abbreviation: PC- Personal Communication. SO- Song. ST- Sighting. Ad- Adult. JJ- Juvenile. II- Infant. WLS- Wildlife Sanctuary. NP- National Park. TR- Tiger Reserve.

Table-8: Population estimate and social composition of Hoolock gibbon in different locations at Tripura (Gupta *et.al.* 2005 with certain additions and amendments).

SL No.	Location	Mode / No. of groups			Total No. of groups	Social Composition.				Total	Area(km^2)
		PC	SO	ST		AD Male	AD Female	JJ	II		
1.	Phuldansai	2	1	-	3	2	2	-	-	4	4
2.	Bethingship	5	-	-	5	-	-	-	-	-	3
3.	Sabul	-	2	1	3	1	1	-	-	2	5
4.	Conzai	-	-	1	1	1	1	-	1	3	3
5.	Vangmung	5	9	1	15	1	-	-	-	1	14
6.	Manu (N.Tilla)	1	-	-	1	-	-	-	-	-	4
7.	Kanchan- chera	-	-	1	1	2	1	-	-	3	9
8.	Laxmanpara	-	1	-	1	-	-	-	-	-	-
9.	Chamanu	-	-	-	-	-	-	-	-	-	-
10.	Dewachera	1	-	-	1	1	2	-	-	3	-
11.	Thalchera	1	-	-	1	-	-	-	-	-	-
12.	Ambasa	-	-	-	-	-	-	-	-	-	-
13.	Harinchera	-	-	1	1	2	-	-	-	2	All male Group
14.	Ganganagar	-	1	-	1	-	-	-	-	-	-
15.	Khowaichera	-	1	-	1	-	-	-	-	-	-
16.	Noonchera	-	-	-	-	-	-	-	-	-	4
17.	Gandachera	1	-	-	1	-	-	-	-	-	-
18.	Jiyalchera	-	-	1	1	2	-	-	-	2	All male Group
19.	Trishna	-	-	2	2	2	2	-	1	5	7
	Total	16	15	08	39	14	09	-	02	25	53
	Percentage	41.03	38.46	20.51							
	Distribution of a group										1.36

Abbreviation: PC- Personal communication. SO- Song. ST- Sighting. Ad-Adult. JJ- Juvenile. II- Infant.

Blanford (1888-91) had observed groups of 5 to 100 individuals and more and also recorded solitary males occasionally. Groups with more than one adult male or more than one breeding adult female have also been reported by him. The occurrence of all male groups have also been reported by some field workers. Gupta *et.al.*, (2005) gave the social composition of Hoolock gibbon of three states, Meghalaya, Mizoram and Tripura (Tables 6-8), based on the personal communication by local people and forest staff, call of the gibbons and sightings. The sighting of the groups, which is more authentic than any other method, was limited in comparison to the other two methods in all the three states.

Hoolock gibbons of both sexes emigrate from their natal groups on maturity (Gupta *et.al.*, 2005). Maturity is reached from four to six years. On reaching the maturity the members are driven away from the group by the parents. The new groups can be formed by pairing of father and daughter, pairing of brother and sister, emigration and subsequent re-mating or dispersed sub-adult pair formation (Ahsan, 2001). The adult males might resort to polygamy, though rare, in sexually imbalanced groups in deteriorated habitat.

DAILY ACTIVITY

The agile Hoolock gibbons spend most of their time on upper and middle canopy of the tall trees at a height of 6 to 20m. Their routine activities are sleeping, feeding, singing, resting, grooming and moving by brachiation from branch to branch or from tree to tree in search of food.

They sleep on tall trees and are diurnal in habit. Hence their activities are confined to light hours of the day between sunrise and sunset. Invariably the gibbons woke up at down, before the sun comes up on the horizon. They change their positions on their perches, which signal the arrival of the new day. On waking up, the groups do not start to move immediately but they remain on the trees where they had slept the previous night for varying period of time, depending upon the morning weather conditions. The morning activity starts earlier in the summer than winter. In the winter months, the gibbons on waking up, bask in the sun for some time on high branches by exposing their back towards the sun light. Then they start their morning feeding activity by reaching to the ends of the twigs to nibble at the buds, fruits or young leaves.

Hoolock gibbons usually remain active for 8-10 hours every day, starting at dawn or in the early morning till late afternoon, except during the rainy day. Usually they defecate and urinate just before or after leaving their sleeping trees. Then they start feeding which gradually peaks up as the day proceeds. However, their feeding activity is not a continuous process and is usually interrupted with frequent spells of rest. During the feeding period they feed, rest and move by brachiation from tree to tree in search of food. With the rise in the day temperature their activity generally slows down and mid-day is invariably spent in resting. This period of rest is short during the winter and long in the summer months. Hoolock gibbons can feed in sitting and suspending positions. They feed on leaves, buds, flowers, fruits, insects, bird's eggs etc. Though they feed over 100 species of plants but their availability and density vary from habitat to habitat. Fruits and leaves form the main food items of the gibbons. Among the fruits, the fig is the dominant food item. However, they also feed on shoots, petioles, plant exudates, nector and lichens.

The typical diet of gibbons consist of 51-65% fruit, 5-23% leaves, 13% buds, 12% flowers and 0.1% animal prey (Tilson, 1979, Gittins and Tilson,1984).In a degraded habitat, the gibbons have been found feeding on bamboo shoots. It has been reported that they spend about 40% of time in feeding on fruits,40% on young leaves, 14% on leaf buds and about 6% on mature leaves (Gupta *et.al.*, 2005).

Their feeding activity again picks up in the afternoon, much earlier than they go to their sleeping trees. During this period they feed most intensively. The end of activity period for the day is usually several hours before the sun set and

much earlier than the other non-human primates. This is possibly to avoid feeding overlap with other sympatric non-human primates (Gupta *et.al.*, 2005). Alfred and Sati (1994) stated that Hoolock gibbons spend nearly 35% of their total awakening time in feeding, and the adult female spends more time in feeding than the adult male.

Locomotion in Hoolock gibbon is primarily through brachiation by using their long arms. They also move by leaping, climbing and jumping. About 70-80% movement is by brachistion, 16-25% by leaping, climbing, and jumping and the rest 4-5% are bipedal walking. At times, they walk bipedally on the thick branches of the trees or on ground by holding the long arms over their head, or holding horizontally to support the body movements. But by this way they can hardly move to a small distance. Terrestrial bipedal movement usually occurs when the trees are too far apart to leap between the trees. One of us (VCA) observed a group of Hoolock gibbon crossing the forest gap on ground by holding the long arms over their head at Ambasa, Tripura. The daily travel distance is between 300 and 1000m depending upon the season and the dispersal of the food.

Home-range-size of Hoolock gibbon varies from habitat to habitat and can range between 0.15km^2 to 4.00km^2. However, the home ranges of neighboring groups overlap. They maintain their home range by morning song bouts. Their call can be heard even from a distance of one km. They defend their home range from intruders by their call and chase. This type of inter-troop encounters are frequent particularly during the feeding time, when the two groups meet they indulge in whooping contests and then the weaker group retreats.

The territory usually varies between 15 and 30 ha irrespective of group-size or composition (Alfred and Sati, 1986, 1990).

Gibbon groups sing, the stereotyped song bouts usually in the early morning, but they do not sing every morning. Generally the groups respond to the calls of other groups. They usually select tall trees for singing. The songs serve to defend their territory, food resources, maintenance of pair-bounds, to attract potential mates, maintaining communication and distance between the groups to avoid inter-group encounters. Thus, vocalization acts as an inter -group communication system. Mated pairs produce duet songs, where at times, young ones also participate. Usually the mated pairs sing in the morning between 7 and 10am but the timing may change depending upon the weather condition. The average duration of duet song is from 15 to 20 minutes. Unmated Hoolocks produce solo song. The song repertoires of male and female are markedly different, but they co-ordinate their singing to produce a double solo. The recital begins with a low measured cooing, generally by a male, when the female also joins and the sound grows into a family unison.

Hoolock gibbon spends less time in grooming which is a part of social activity. Gupta et.al.(2005) reported that grooming, play and social interaction take less than 10% of the total time. Grooming serves to maintain social bonds, reducing the aggression and helps in maintaining hygiene. Grooming is more common in the summer, when they spend more time in resting than in the winter months.

Play is common among juveniles and infants but the adults at times join the play group. The gibbons take up their sleeping position much before dusk and the female sleeps with her infant in ventro- ventral position. The adult male usually sleeps close to his partner. Older off springs sleep separately. They sleep high up on the canopy to avoid predators.

Monogamous gibbons usually mate between March and May. The extra pair mating are rare. They give birth to a single off spring between November and February. However, births have also been recorded in the monsoon months of July and August. The birth interval in Hoolock gibbons is about 2 to 3 years. Thus, their reproductive output is low, which means that even if the habitat is improved the population size can not exceed beyond a limit. Infants are born without much hair on their body and depend on

their mothers for warmth. Preweaned period lasts for about two years. The gibbons reach maturity in 6 to 8 years. The off spring leaves or chased off by parents from the natal group on maturity. For the first six months the infant depends entirely on mother's milk but after this period, it starts to eat other food items. Alfred and Sati (1986) stated that mother breast-feeds the infant for about 8 to 10 months and after one year the infant starts to feed on fruits and tender leaves. They also stated that infant before going to sleep feeds on breast milk. Chasing, wrestling or play with inanimate objects are the common forms of play in immature gibbons.

The infant starts to explore the surrounding at the age of three months and it becomes independent of its mother after attending the age of two and half years. The life span of wild gibbon is not known. Fall from high trees is supposed to be a major factor for the cause of the death in the wild. Infanticide by adult male has been reported by Alfred and Sati (1991).

CONSERVATION

The Hoolock gibbon is placed in Appendix-I of CITES, which lists species that are threatened with extinction. It is ranked endangered under IUCN (ENA1CD) Red Data List. The Indian Wildlife (Protection) Act, 1972 placed the species in schedule-I. It is treated as endangered under Red Data Book of Indian Animals,1994. These classifications mean that the species is facing a very high risk of extinction in days to come.

The species is threatend due to habitat loss, poor quality of habitat, fragmented distribution, hunting for food and slow reproductive rate.

In the past gibbons were even common in the foot hill forests of Sibsagar, Assam, but their population now decreased considerably. The last Hoolock vanished from Diroi or Rangoli reserve forest sometime in 1970's. Though no reasons are known but their number decline to as low as 10-15 (Chowdhury, 1988).

Chowdhury (2000) stated that population of Hoolock gibbon in Dibru-Saikhowa National Park was fragmented into four sub-populations due to habitat loss. He estimated that the total population in the park was about 160-170 individuals and at certain places they were living in the village woodlands. The strict arboreal habit and their way of movement restricted them within the forest.

In general, gibbons, both Western and Eastern, are threatened with extinction. The Western Hoolock Gibbon is listed as one of the world's 25 most endangered non-human primates. Their numbers, which was over 1,00,000 individuals in the 1970's, have decreased considerably and most of them are found in fragmented groups. Most of these isolated populations are very small in group-size and their long term viability is doubtful. Although the detail document on the population of Hoolock gibbon in Myanmar is not available. It seems that the gibbon population is better secured in Myanmar than in any other habitats.

Habitat-loss is also one of the main factors for the decline of gibbon population. Jhum(shifting cultivation), conversion of forest lands into agricultural lands, encroachment of forest for settlement purposes, extracting timber (legally or illegally), collection of fuel wood, mining, expansion of communication network, construction of dams, irrigation and hydel projects, exploration of oil and gas fields are some of the factors for the loss of viable habitat of Hoolock gibbon. Alfred and Sati(1990) while surveying the West Garo Hills of Meghalaya recorded 75% of gibbon population near the village forest. They have also noted that adult males and adult females comprised of nearly 67% while the non-breeding population comprised only 33% of the whole population. The occurrence of a large population in non-protected areas and low percentage of non-breeding population are the cause of great concern for their conservation.

The small isolated populations in fragmented habitats, cut of from the rest of the populations, lead to inbreeding, thus, become genetically weak.

The Annual Report of Indo-US Primate Project (August 1998-July, 1999) revealed that Hoolock gibbons in Borajan Reserve Forest were reduced from 11 groups, consisting of 34 individuals, in 1995 to 5 groups and 11 individuals in 1999, a decline of 68%, and were living in an isolated area with a few trees. Thus, they had to move on the ground for access to other food trees. This population was represented by only 20% immature gibbons.

Hunting of gibbons in certain parts of Northeastern India is also the cause of concern to its population. They are hunted for food and for their various body organs which are used for medicinal purpose by certain tribes.

Although Hoolock gibbons are legally protected but the laws are not strictly implemented which is cause of great concern for its conservation.

The simulation Modeling Working Groups of Population and Habitat Viability Assessment (PHVA) Workshop Report (2005) stated that there is a very high probability of extinction of populations of less than 15 individuals within 20 years. It applies to more than 80% of existing population of Western Hoolock Gibbon (WHG) in India and Bangladesh. For populations more than 15 individuals, the probability of extinction is increased with higher levels of adult mortalities, negative trend in carrying capacity and hunting, which are common factors affecting most of the wild Western Hoolock Gibbon populations. The largest population of 156 individuals in India is relatively safe, if habitat destruction and hunting are reduced (Molur, et.al.2005).

DISCUSSION

Primates play an important role in maintaining the integrity of habitats in which they live by way of seed dispersers and pollinators. They also serve as food for many predatory birds and carnivore-mammals. Thus, the loss of a single primate species may lead to the extinction of a number of plant species.

Recent studies in Mexico, Brazil and India have documented drastic reduction in primate populations due to loss and fragmentation of their habitats. Forest report of India suggested that during a two year period from 1995 to 1997 there is a loss of 5,500 km^2 of forest land and it reflects on the dwindling populations of forest living primates, including the Hoolock gibbon of Northeastern India.

The conservation problem of Hoolock gibbon in all the seven states of Northeastern India is almost the same. The major factor is the loss and fragmentation of habitats and in some states it reached to an alarming stage.

Recent studies indicate that substantive population of Hoolock gibbon live outside the protected areas in Meghalaya (65.06%), Mizoram(51.39%) and Tripura(41.46%). This creates the management problem and make the conservation efforts more difficult. This also suggests that the unprotected areas are also potential sites for the survival of gibbons and need greater attention.

Hoolock gibbons are arboreal frugivorous and monogamous. They live in small family groups and their activity is restricted mostly to upper and middle canopy. Thus, they are very sensitive to any change in their habitats. Gibbons live long and their reproductive output are low, which means that even they are provided with an ideal environment the populations can not go beyond a certain limit.

Since the Hoolock gibbons are frugivorous they need large areas to explore for their food resources, as the fruiting trees are patchy in distribution. Thus, the fragmentation of habitats limit their food resources and isolate the populations, making them genetically weak.

To make the habitat more viable, the degraded areas and the corridors should be afforested and linked with each other to prevent the populations getting isolated. Small and isolated populations should be translocated to viable habitats, thus, prevent them from extinction. Local communities should be involved in the conservation programme. Field surveys should be intensified to collect more and more

information about this ape and regular monitoring of the population and habitats should be done to prevent their further loss. There is also a need of proper co-ordination among the implementing agencies at state and central level for management and conservation of the species.

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Fig. 1. : Earlier distribution of Hoolock gibbon in Northeastern India.

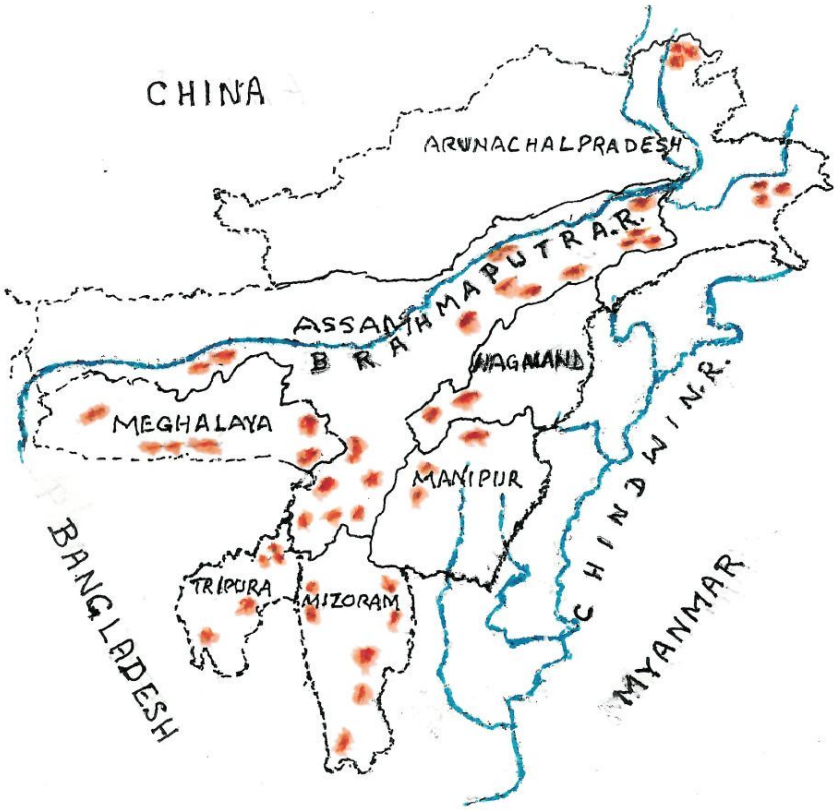

Fig. 2. : Present fragmented distribution of Hoolock gibbon in Northeastern India.

Fig. 3. : Male : Western Hoolock gibbon (Photo : NEWS).

Fig. 4. : Male : Eastern Hoolock gibbon (Photo : NEWS).

Fig. 5. : Female : Hoolock gibbon (Photo : NEWS).

Fig. 6. : Habitat of Hoolock gibbon (Photo : Kaushik Deuti).