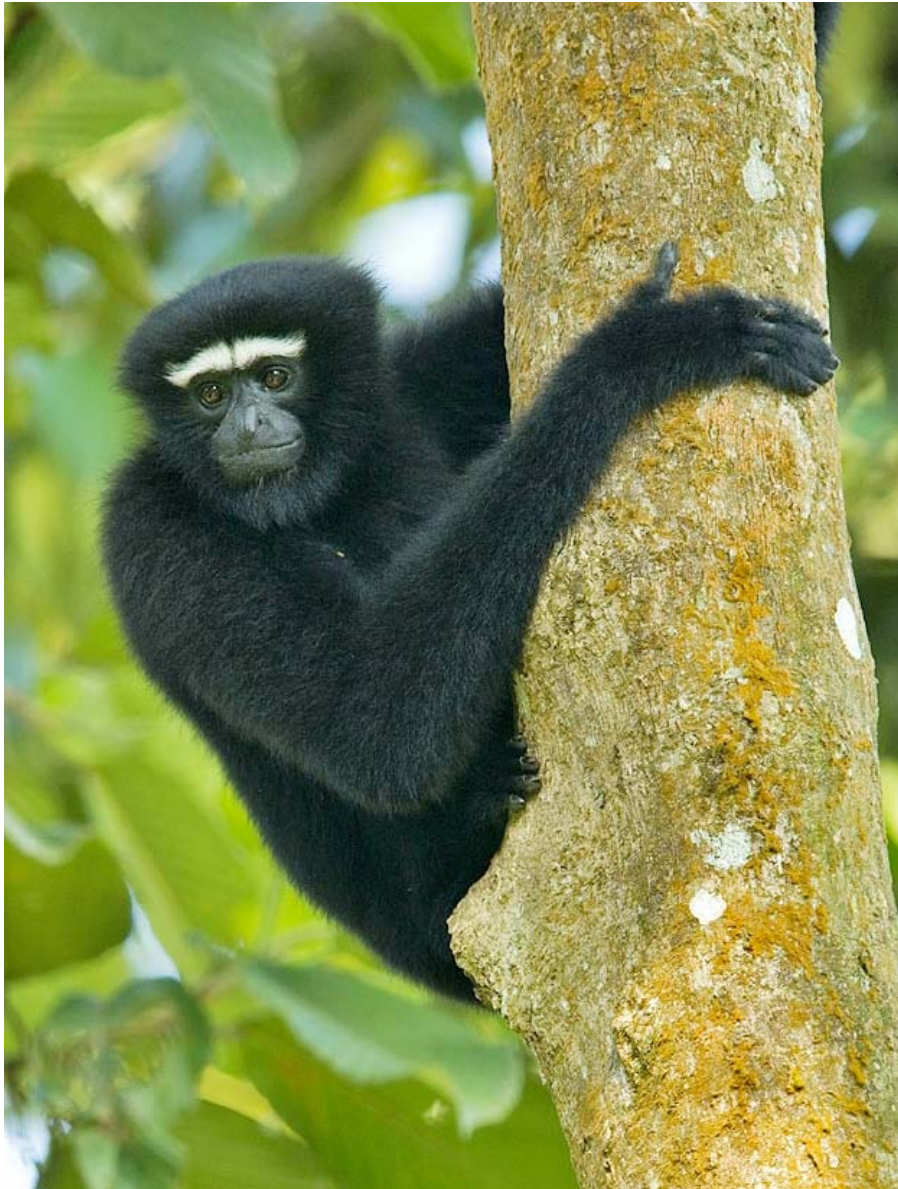


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#### Cover legend

Western hoolock (*Hoolock hoolock*), adult male, Borajan Wildlife Sanctuary, Tinsukia District, Assam, India, 14 June 2008. Photo: Dhritiman Mukherjee.

Westlicher Hulock (*Hoolock hoolock*), erwachsenes Männchen, Borajan Wildlife Sanctuary, Tinsukia District, Assam, Indien, 14. Juni 2008. Foto: Dhritiman Mukherjee.



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## Instructions for authors

The Gibbon Journal publishes original papers in English or German on all aspects of gibbon natural history. It is distributed electronically and published annually by the Gibbon Conservation Alliance.

An English abstract is to be provided, preferably no longer than 250 words.

Figures and tables should be numbered and referred to by number in the text. Each figure and table should have an accompanying caption. Colour figures are welcome, but should be understandable if printed in black-and-white.

Citations in the text should include author name(s) and year in parentheses. Where there are three or more authors, only the first author's name is given in the text, followed by „et al.“.

List cited references alphabetically at the end of the paper.

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Traeholt, C., Bonthoeun, R., Virak, C., Samuth, M., and Vutthin, S. (2006). Song activity of the pileated gibbon, *Hylobates pileatus*, in Cambodia. *Primate Conservation* **21**: 139-144.

### Books:

Groves, C. P. (2001). *Primate taxonomy*, Smithsonian Institution, Washington, D.C., viii+350 pp.

### Papers in edited books:

Brockelman, W. Y., and Gittins, S. P. (1984). Natural hybridization in the *Hylobates lar* species group: Implications for speciation in gibbons. In Preuschoft, H., Chivers, D. J., Brockelman, W. Y., and Creel, N. (eds.), *The lesser apes. Evolutionary and behavioural biology*, Edinburgh University Press, Edinburgh, pp. 498-532.

### Theses:

Whittaker, D. J. (2005). *Evolutionary genetics of Kloss's gibbons (Hylobates klossii): Systematics, phylogeography, and conservation*, PhD thesis, Faculty in Anthropology, The City University of New York, xiv+201 pp.

Manuscripts should be submitted as e-mail attachment (the preferred word-processing package is MS-Word) to the Editor:

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Das Gibbon Journal veröffentlicht Originalarbeiten in englischer oder deutscher Sprache über alle Aspekte der Gibbon-Naturkunde. Es erscheint jährlich und wird elektronisch publiziert von der Gibbon Conservation Alliance.

Dem Manuskript soll eine englische Zusammenfassung von bis zu 250 Worten beiliegen.

Abbildungen und Tabellen sollten beide fortlaufend nummeriert sein und im Text genannt werden. Jede Abbildung und jede Tabelle sollte eine Legende haben. Farbabbildungen sind willkommen, sollten jedoch auch verständlich sein, wenn sie in schwarz-weiß gedruckt werden.

Von zitierten Publikationen sollen im Text Autorennamen und Veröffentlichungsjahr in Klammern genannt werden. Bei mehr als zwei Autoren wird nur der erste genannt und die übrigen mit „et al.“ abgekürzt.

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Manuskripte sollten als E-mail-Beilage (bevorzugtes Format ist ein MS-Word-Dokument) an den Editor gesandt werden:

## Hoolock gibbon status and conservation: Editorial

Stephen Browne<sup>1</sup>, Frank Momberg<sup>1</sup> and Thomas Geissmann<sup>2</sup>

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The hoolock gibbons (genus *Hoolock*) are one of four known genera of gibbons or small apes. Their natural range extends from east of the Brahmaputra River to west of the Salween River, and includes forested areas from eastern India, Bangladesh, Myanmar, and southern China.

Currently, two species of hoolock gibbons are recognized; the western hoolock (*H. hoolock*) and the eastern hoolock (*H. leuconedys*) (Geissmann, 2007). Their respective ranges are separated by the Chindwin River (Groves, 1967, 1972). However, the boundary between the two species is uncertain in the Chindwin headwaters in northern Myanmar and possibly includes a zone of intermediates or variable population (e.g. Groves, 1967; Ngwe Lwin *et al.*, 2011, this issue). Furthermore, it has been suggested that an undescribed new taxon of hoolock gibbons may occur in the northeastern part of India's Arunachal Pradesh State (Das and Biswas, 2009).

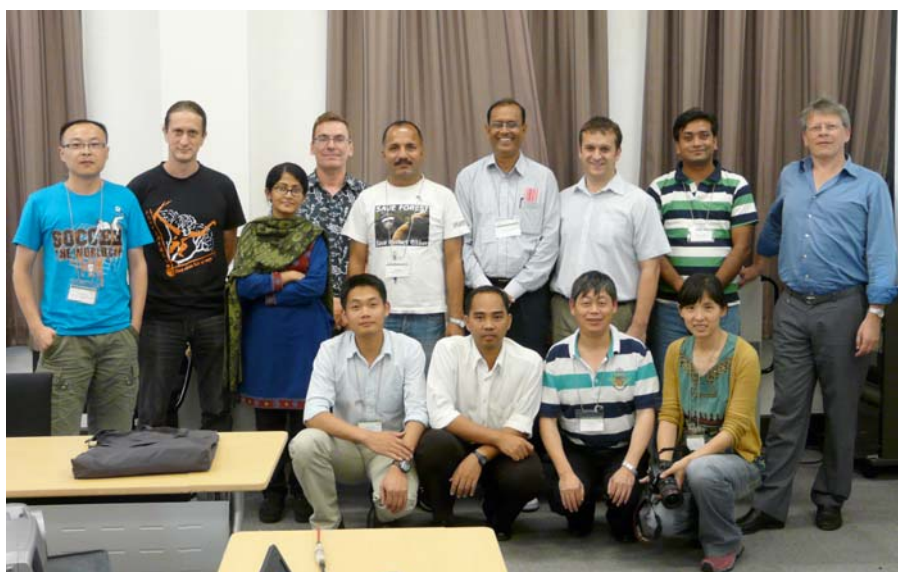
Main threats to hoolock gibbons include habitat loss and fragmentation, and hunting for food and traditional "medicine" (Geissmann, 2007).

According to the IUCN Red List assessment, the western hoolock is Endangered, whereas the eastern hoolock is Vulnerable (IUCN, 2010). The western form is considered less threatened mainly because of

the larger habitat areas that are believed to support this species in Myanmar. Whereas the status of the hoolock gibbons in Bangladesh, NE-India, and China has been assessed repeatedly (see articles in this issue), very little is known about the status of gibbons in Myanmar, where the main distribution areas and probably the main populations of both hoolock species are located.

Fauna & Flora International (FFI) has been working with partners to improve the conservation status of hoolock and recognizes the need for a concerted effort by all of those working on the species, if its extinction is to be avoided. In view of this FFI organized a symposium and workshop on hoolock gibbons (genus *Hoolock*) during the 23rd Congress of the International Primatological Society (IPS) in Kyoto, Japan in September 2010 (Fig. 1).

The goal was to improve the understanding of the conservation status of hoolock gibbons throughout mainland Asia, by bringing together all of those working on the species across its range. The specific objective was to better inform conservation practitioners working to protect and improve the status of the hoolock gibbon.



**Fig. 1.** Participants of the hoolock gibbon workshop in Kyoto, Japan, 16 Sep 2010. Standing, from left to right: Sun Guozheng, Paul Insua-Cao, Gawsia Wahidunnessa Chowdhury, Frank Momberg, Dilip Chetry, M. Anwarul Islam, Stephen Browne, M. Kamrul Hasan, and Thomas Geissmann. Front row: Fan Peng-Fei, Ngwe Lwin, Long Yongcheng, and Yan Lu.



The **specific objectives** were:

**Objective 1:** Provide an opportunity for researchers working on hoolock gibbons to share knowledge to inform and improve conservation of the genus.

**Objective 2:** Increase our knowledge of the hoolock gibbon by organizing a workshop to undertake a status review and produce a conservation action plan so that effort and resources are appropriately targeted.

To achieve these objectives we brought together over 40 people with an interest in hoolock gibbon conservation specifically, and more generally those working on other gibbon species. A series of presentations from each range country was given to provide an update on the species' status, plus presentations on ongoing conservation activities.

The present issue of the Gibbon Journal contains papers resulting from the presentations given at the Hoolock Symposium. The papers resulting from a similar event, focussing on crested gibbons will be collected in the following issue of the Gibbon Journal.

#### Acknowledgements

We thank all those who participated in the symposium and workshop sessions at the IPS, particularly those who gave presentations and produced papers for publication in the Gibbon Journal. We also thank the IPS Congress organizers and Scientific Committee for allowing us to hold these sessions. These sessions and the publication of these papers would not have been possible without funding from the IUCN/SSC Primate Specialist Group, provided by the

Arcus Foundation, and from Fauna & Flora International. We are particularly grateful to Liz Williamson and Helga Rainer for their help in securing the funding.

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## Hoolock gibbon conservation in India

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Over many years, efforts at various levels have been dedicated towards the conservation of the hoolock gibbon, the only ape species found in India. The northeast region supports the entire gibbon population in India. Their distribution is limited to the southern bank of the Dibang–Brahmaputra River system. The western hoolock gibbon (*Hoolock hoolock*) is distributed across the seven northeastern states of Assam, Arunachal Pradesh, Tripura, Meghalaya, Manipur, Nagaland and Mizoram, whereas the eastern hoolock gibbon (*H. leuconedys*) occurs only in the state of Arunachal Pradesh and a small fragment of Assam. Rapid loss of habitat, habitat fragmentation and hunting are the major threats to the hoolock gibbons across their entire distribution in India. Although there have been sporadic studies on the distribution of gibbons and other primates in northeast India, the Indo-U.S. Primate Project gave a boost to the study and conservation of primates in general and the hoolock gibbons in particular. Due to the initiation of the different activities of education, awareness, research, training and socio-economic development programmes, hoolock gibbon conservation has gained momentum in the country. With ongoing threats, however, it is of critical importance to reinforce conservation efforts and strategies for the species to ensure the long-term conservation of hoolock gibbons and their habitats in India.

### Introduction

As a megadiverse country India supports a rich floral and faunal diversity, including 25 primate species. Only two of these are apes: the western hoolock gibbon (*Hoolock hoolock*) and the eastern hoolock gibbon (*H. leuconedys*). Their distribution is restricted to the seven states of northeast India, including Assam, Arunachal Pradesh, Meghalaya, Manipur, Tripura, Nagaland and Mizoram (Fig. 1). Even in this region their distribution is further limited to the southern bank of the Dibang-Brahmaputra Rivers system.

The occurrence of the eastern hoolock gibbon in India was confirmed only recently (Das *et al.*, 2006) and is restricted to specific localities in Arunachal Pradesh and a small forest pocket in Assam (Das *et al.*, 2006; Chetry *et al.*, 2008; Chetry and Chetry, 2011).

The estimated abundance of the western hoolock gibbon in India is up to 7,000 individuals (Chetry *et al.*, 2007), whereas for eastern hoolock gibbon it is upto 3,000 individuals (Biswas *et al.*, 2007, 2010; Chetry and Chetry, 2011; Chetry *et al.*, 2008, 2011).

The western hoolock is recorded as Endangered, and the eastern hoolock gibbon as Vulnerable in the IUCN Red List (IUCN, 2010). Primate species in India, including the hoolock gibbons, are declining in number throughout their distribution ranges. North-east India, with the highest primate diversity, has also experienced a rapid decrease in biodiversity over recent years. Habitat destruction in various forms and

hunting are the major threats for the primates in the region. As a result, all the primate species of the region, especially the hoolock gibbon, need targeted attention to improve their conservation status.



Fig. 1. Distribution of hoolock gibbons in north-east India.

This paper summarises and evaluates past and current hoolock conservation efforts in India during three time periods and makes some suggestions for future activities.

### Pre Indo-U.S. Primate Project phase

Gibbon conservation efforts before the Indo-U.S. Primate Project (i.e. before 1994) were sporadic and mainly confined to inventorial and distributional studies (Choudhury, 1987, 1988, 1989, 1990, 1991, 1996; Mukherjee, 1982, 1988; Mukherjee *et al.*, 1988, 1991, 1992). In addition, two short studies on behaviour and ecology of hoolock gibbon were conducted in Assam and in the Garo Hills, Meghalaya (Alfred and Sati, 1990, 1994; Tilson, 1979). These pioneer studies are also of significance for hoolock gibbon conservation.

### Indo-U.S. Primate Project phase

The launch of the Indo-U.S. Primate Project (1994-2003) led to an increase in primate conservation efforts in India. During the project, systematic primate surveys were conducted in various parts of India, especially in the regions with the highest primate diversity (i.e. northeast and south India). The project was also successful in creating a new generation of primate field biologists. Long-term ecological and behavioural studies on some of the least studied primate species in the country were initiated, and the project also laid the foundation for a more diversified approach to hoolock gibbon conservation. Some of this period's major achievements in hoolock gibbon conservation are described below.

#### Capacity building

The project was instrumental in generating a group of trained field primatologists. A group of young students were trained to undertake qualitative research on the primates of the region including the hoolock gibbon. This group contributed greatly to primate conservation in general and hoolock gibbons in particular, and their contribution continues after the closing of the project.

#### Generation of baseline information

For the first time, extensive and systematic surveys for hoolock gibbons (and other sympatric primates) were conducted by a trained team from the Indo-U.S. Primate Project. These surveys generated baseline information and the first comprehensive overview of the status, distribution and demography of the hoolock gibbon (Mohnot, 1995-2000).

During this period, the first long-term study on the behavioural ecology of the hoolock gibbon was initiated (Das, 2002).

Population monitoring of hoolock gibbon in Borajan (Borajan-Podumani-Bherjan Wildlife Sanctuary) documented the severe detrimental impact of canopy cover loss on the hoolock gibbon (Das *et al.*, 2005; Srivastava, 1999; Srivastava *et al.*, 2001). This was one of the major achievements of the project.

### Declaration of Gibbon Wildlife Sanctuary

The information generated for the hoolock gibbon by this project played a pivotal role in the declaration of the Gibbon Wildlife Sanctuary. The Hoollongapar Reserve Forest in the Jorhat District of Assam was identified as an Eden of primates, supporting hoolock gibbons and six other primate species, and is home to a further 34 mammal species (Chetry *et al.*, 2001). This finding acted as a catalyst in the government's decision to upgrade Hoollongapar Reserve Forest to a sanctuary in 1997. The area was renamed the Gibbon Wildlife Sanctuary. It is the only protected habitat in India to be named after a primate species and the first protected area in the country where the hoolock gibbon is the target species for conservation.

The Gibbon Wildlife Sanctuary is located south of the Brahmaputra River system in the district of Jorhat, Assam (26°40'-26°45'N and 94°20'-94°25'E). It is an isolated forest pocket of 21 km<sup>2</sup>, which sustains a substantial population of hoolock gibbons.

### Post Indo-U.S. Primate Project phase

Based on the foundation laid by the Indo-U.S. Primate Project phase, action-based gibbon conservation activities were initiated throughout the distributional region and particularly in Assam. A number of individuals, institutions and organizations contributed to hoolock gibbon conservation in the first decade of the new millennium. These included Gauhati University, Gibbon Conservation Centre, India (GCC), Aaranyak, Primate Research Centre, Northeast (PRC), School of Desert Science (SDS), Centre for Education and Environment (CEE), Ashoka Trust for Research, Environment and Ecology (ATREE), WII (Wildlife Institute of India), Zoo Outreach Organization (ZOO), Wildlife Areas Development and Welfare Trust, the Assam Forest Department, and the Arunachal Pradesh Forest Department.

The impact of forest fragmentation on the hoolock gibbon in Assam was first documented by Kakati (2004). Various papers were published on research related to hoolock conservation, the education and awareness programme, and the capacity building programme (Bhattacharjee, 2004, 2006; Biswas *et al.*, 2007; Chetry, 2002, Chetry *et al.*, 2003, 2004, 2005, 2006, 2007, 2008, 2011; Choudhury, 2000, 2006, 2009; Das, 2003; Das *et al.*, 2002, 2003, 2005, 2009; Gupta *et al.*, 2005; Kakati, 2004; Kakati *et al.*, 2009; Srivastava, 2006; Walker, 2007).

In general, hoolock conservation efforts reached a new dimension in this period. Some of the major achievements are described below.

#### Establishment of Gibbon Conservation Centre

In 2004 the Forest Department provided a building of 86 m<sup>2</sup> as a permanent conservation and research base for work in the Gibbon Wildlife Sanctuary and in northeast India. The building was named



the Gibbon Conservation Centre (GCC). The centre is suitably furnished and equipped to conduct various field-based training programmes. The Gibbon Conservation Centre is run by a trust in collaboration with the Assam Forest Department and Aaranyak (an NGO).

### **Hoolock gibbon conservation programmes in the Gibbon Wildlife Sanctuary**

With support from the U.S. Fish and Wildlife Service and in collaboration with the Assam Forest Department, the Gibbon Conservation Centre organized two gibbon conservation programmes consecutively in the Gibbon Wildlife Sanctuary, a prime habitat of the western hoolock gibbon in Assam.

The sanctuary is surrounded by human habitations. Fragmentation of the habitat by a railway line through the reserve (since 1887) and anthropogenic pressures in the form of cattle grazing, and collection of fuel wood and non-timber forest products are the major threats for gibbons and other wildlife in the sanctuary.

From the beginning, the hoolock gibbon conservation programmes in the sanctuary were designed as a multi-dimensional approach addressing conservation activities including research, education and awareness, training and capacity building, plantation and habitat improvement, socio-economic development, and community involvement. These activities were carried out and evaluated in phases in order to improve long-term conservation of the endangered ape species.

The programmes produced a trained group of foresters, students, teachers, researchers and NGO workers to carry the message of gibbon conservation to a greater circle. Two popular books on hoolock gibbons were published: “Aamar Holou” (Assamese version) and “Hoolock: The ape of India” (English version). They provided basic information on hoolock taxonomy, distribution, ecology, and ethology, and proved to be instrumental in disseminating information on the gibbon. In addition, the education and awareness part of the programmes reached 33,425 students from primary to college level.

During the programmes, local people received alternative income-generation training in mushroom cultivation, honeybee keeping, and duck husbandry. Moreover, 29 self-help groups were formed (and are still operational) for economic improvement for fringe communities. To reduce the pressure on the forest, improved *chullah* (stove) and bio-gas plants were distributed among families selected through socio-economic studies. In addition, handlooms and ducks were also distributed among the self-help groups for income generation.

Training, monitoring and legal orientation programmes were carried out for the Forest Department staff in the sanctuary to boost their capacity.

The multi-dimensional initiatives of the hoolock gibbon conservation programmes produced very good

results in the Gibbon Wildlife Sanctuary. There was reduction in fuel wood pressure. The resulting changes were observed both in the gibbons as well as in the habitat. 64 gibbons in 17 groups were counted during a census in 2004. The population increased to 106 gibbons in 26 groups and five solitary males in 2009. Population sizes of elephant and the other six primate species in the sanctuary also increased. Canopy cover increased by 3.45%, and degraded forest decreased by 4.08%. It should be noted, however, that the apparent population increase may result not only in intensive conservation and management efforts, but also in improved survey methods.

### **Development of a conservation action plan for the western hoolock gibbon**

Das *et al.* (2005) developed an action plan for hoolock gibbon conservation in Assam for the first time. This was a major breakthrough for hoolock gibbon conservation during the post Indo-U.S. Primate Project phase.

### **Discovery of the eastern hoolock gibbon in India**

In 2006, the occurrence of eastern hoolock gibbons in India was first reported from Lohit District of Arunachal Pradesh (Das *et al.*, 2006). Subsequently this species was also reported from Lower Dibang Valley District of Arunachal Pradesh (Chetry *et al.*, 2007, 2008, 2009) and in the Sadiya area of Assam (Chetry and Chetry, 2011). These discoveries opened up new perspectives on gibbon conservation in India.

### **Capacity building**

This phase was successful in improving awareness towards the conservation of hoolock gibbon and their habitat among the common masses beyond the scientific community to a great extent. The Gibbon Conservation Centre alone has reached 33,425 students through its education and awareness program. Forest Department staff, who were previously more concerned with charismatic wildlife such as tiger, rhino and elephant, have now developed a sense of responsibility for the conservation of the gibbon. The two books on the hoolock gibbon, which were developed as education materials, have been successful in increasing awareness among people from different backgrounds with Assam and other northeastern states towards the conservation of hoolock gibbon. Gibbon Conservation Centre took another noble step by providing two-week hoolock gibbon conservation training to the Forest Department field staff of Assam.

Along with Gibbon Conservation Centre, Aaranyak and Primate Conservation Centre, North-east, Wildlife Areas Development & Welfare Trust, the Zoo Outreach Organization also contributed towards the conservation of hoolock gibbon especially in capacity building through education and awareness to the educators in the 2007. ZOO for the first time conducted a Population and Habitat Viability Assess-

ment for western hoolock gibbons (Molur *et al.*, 2005).

In 2010, the Centre for Environment Education, Northeast also launched an education and awareness program for gibbon conservation.

### Suggestions for future activities

Despite the conservation efforts of the various, mainly non-governmental, organizations, the hoolock gibbon is not out of danger. Large-scale habitat destruction continues throughout the entire distribution range of the species in India. The Government of India has yet to consider seriously the conservation issues affecting the hoolock gibbon and other primate species. Even today, India does not have a national-level agenda for the country's only ape species. We are hopeful that an increasing number of in-depth studies and appropriate government policies will eventually enable us to conserve the hoolock gibbon in India. In order to make this possible, we propose to focus on the following conservation activities for the hoolock gibbon in India:

A. Initiate multi-dimensional conservation approaches, as practised in the Gibbon Wildlife Sanctuary, in other hoolock gibbon areas in India.

B. Further research in the following topics:

- Re-assessment of hoolock gibbon status
- Ecological study of the eastern hoolock gibbon
- Long-term study on population dynamics
- Habitat quality assessment
- Habitat mapping (GIS)
- Genetic study
- Parasitological study

C. Education and awareness:

- Initiate education and awareness for different target groups in gibbon habitat, especially in the protected areas
- Launch formal education programmes with effective modules in schools, colleges and universities
- Initiate informal education and awareness programmes in the villages of the fringe areas of gibbon habitat

D. Gibbon conservation training for Forest Department staff, teachers, students, NGO staff, and researchers

E. Advocacy:

- Lobbying for the inclusion of gibbons in the academic syllabus of schools, colleges, and universities
- Lobbying for the government of India to launch a "Project Gibbon" in line with existing tiger and elephant projects

### Acknowledgements

Our thanks go to colleagues from the Forest Department of Northeast India for providing us permission to conduct, and logistic support during, the fieldwork. We thank Prof. P. C. Bhattacharjee, Prof. S. M. Mohnot, and Dr. Arun Srivastava of the Indo-U.S. Primate Project for their guidance and support. We extend our sincere thanks to all the local forest officials and to our research team-mates (Dr. P. Sarkar, Dr. P. Bujarboruah, Dr. J. Bose, Dr. J. Biswas, Dr. J. Das, Mr. U. Phukan, Mr. G. Banik, Mr. R. Nath, Mr. N. Das, Mr. L. S. Darney, Mr. A. Das, Mr. D. Borah, M. S. S. G. Ahmed, Kumud Ghosh, Deban Borah). Special thanks go to my colleagues of Aaranyak and the Gibbon Conservation Centre, Assam. We also acknowledge the support of U.S. Fish and Wildlife Service.

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## Hoolock gibbon conservation in Bangladesh

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The western hoolock gibbon (*Hoolock hoolock*) is a globally threatened species, and in Bangladesh it is critically endangered. At present, the entire national population is estimated to be only around 350 individuals. These gibbons are restricted to very few viable habitats and are vulnerable to continuing habitat depletion. Many populations face severe habitat loss and fragmentation leading to population extirpation. The small populations (less than ten individuals) are particularly on the verge of extinction. This only ape of Bangladesh can thus be regarded as being in a crisis situation that needs an immediate conservation program for its lasting future. Carefully planned management, protection of habitats, management of people and their activities, legislation and its enforcement, and training of manpower to implement key actions are recommended.

### Introduction

Gibbons (Hylobatidae) are small apes distributed in South and Southeast Asia (Chivers, 2001). Currently, two species of hoolock gibbons are recognized; the western hoolock (*Hoolock hoolock*) and the eastern hoolock (*H. leuconedys*). The western hoolock gibbon occurs in Bangladesh, India and Myanmar, and the eastern hoolock gibbon in China, India, and Myanmar (Geissmann, 2007; Geissmann *et al.*, 2008; Walker *et al.*, 2009). An estimate of hoolock gibbons in Bangladesh reported a total of 300 individuals comprising 82 groups (Islam *et al.*, 2006, 2008), plus 50-100 individuals reported to occur in the remote, inaccessible areas of the Chittagong Hill Tracts (Walker *et al.*, 2009). The habitat of the western hoolock gibbon is strongly associated with contiguous canopy, broad-leaved, wet evergreen and semi-evergreen forests (Walker *et al.*, 2009). However, the species is threatened throughout its geographic range by population decline primarily due to habitat destruction (Chivers, 2001; Islam *et al.*, 2004, 2008; Molur *et al.*, 2005). In Bangladesh, the hoolock populations have decreased to only around 300 individuals from an estimate of over 3,000 individuals (Gittins and Akonda, 1982; Islam and Feeroz, 1992). Prediction indicates that all national hoolock populations will be extinct by the next 25-30 or so years given the current rate of habitat destruction (Molur *et al.*, 2005). At present, *H. hoolock* is categorized as Critically Endangered in the Red Book of Threatened Mammals of Bangladesh by the IUCN

Bangladesh (2000) and Endangered globally (IUCN, 2006).

Many aspects of hoolock gibbons are known from throughout its ranges over the last 30 or so years on population status and distribution (Gittins and Akonda, 1982; Islam *et al.*, 2006), ecology and habitat characteristics (Islam *et al.*, 2004, 2006, 2008; Muzaffar *et al.*, 2007), and outreach activities (Islam *et al.*, 2004, 2007). However, findings and recommendations of these research and activities were not adequately translated into conservation actions by the concerned authority. Although hoolock gibbons have been regarded as being in a crisis situation (Islam *et al.*, 2006, 2007), no carefully planned management activities are in place to arrest habitat loss and consequent further population decline. Under the given scenario, this analysis summarizes the current conservation status of hoolock gibbons and highlights future needs for continued and long-term survival of this critically endangered lesser ape in Bangladesh.

### Status and distribution

Very recent studies reported a total population close to 300 individuals comprising 82 groups in 37 field sites in the country (Islam *et al.*, 2006). In addition, there may be 50-100 individuals in the remote areas of the southeast hilly areas of Chittagong Hill Tracts, but this has not been confirmed due to inaccessibility of these sites (Islam *et al.*, 2006; Walker *et al.*, 2009). The Lawachara National Park and adjoint-



ing areas of West Bhanugach Reserve Forest in the northeast are known to support the largest and continuous population comprising of 59 gibbons in 16 groups (Islam *et al.*, 2004, 2006; Österberg, 2007).

However, the largest stronghold of gibbons comprising 84 individuals in 23 groups was recorded at Karnafuli in Kaptai (Fig. 1) in the southeastern region of the country (Islam *et al.*, 2006).

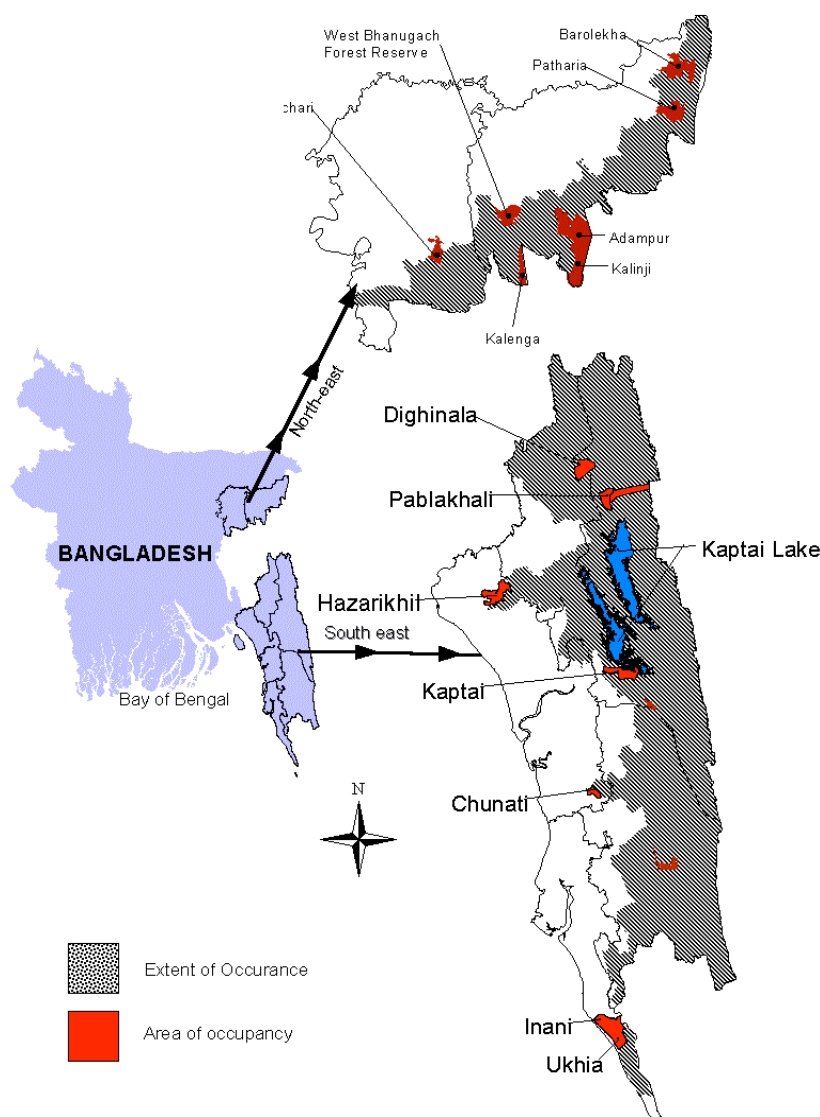


Fig. 1. Hoolock gibbon survey sites in Bangladesh.

The population trends of gibbons observed over recent years in Bangladesh and northeastern India indicated a very rapid decline in numbers (Walker *et al.*, 2009). In Bangladesh, hoolocks have declined from 3,000 (Gittins and Akonda, 1982) to 200 individuals in ten or so years (Feeroz and Islam, 1992). Eighteen of the 22 gibbon populations reported earlier (Feeroz and Islam, 1992) consisted of less than ten individuals. These isolated and fragmented populations cannot survive due to their small population size and pressure on their habitat (Molur *et al.*, 2005; Österberg, 2007). Isolated forest fragments holding a few gibbon groups of about one to four individuals each are insufficient for long-term survival (Molur *et al.*, 2005; Walker *et al.*, 2009). During the last 15 or so years, eight hoolock populations have been extirpated in Bangladesh, primarily due to habitat loss (Islam *et al.*, 2006; Molur *et al.*, 2005). There were

seven groups of hoolocks comprising 19 individuals in Chunati in the early nineties (Ahsan, 1984; Feeroz and Islam, 1992), but that local population had become extinct by 2005 (Molur *et al.*, 2005). Given the current effect of human impacts, a population and habitat viability model predicts about 95% decline of the gibbon population in Bangladesh over the next two decades (Molur *et al.*, 2005; Walker *et al.*, 2009).

The Wildlife Trust of Bangladesh is surveying the mammal species of the Chittagong Hill Tracts in the southeast of the country. Recently our team visited Kassalong Reserve Forest (N 23°34.436', E 92°94.664') which had not been explored extensively in earlier years because of insurgency and other problems. This field visit during the first week of November 2010 revealed the presence of ten gibbon groups with an estimated population size of between

40 and 50 individuals. We plan to survey this area more extensively in the near future. Recently we also visited Rema-Kalenga Wildlife Sanctuary in the northeast where we recorded four individuals. The previous record from this sanctuary was two solitary individuals. If we add these findings to our previous estimates, the total national population would consist of about 340-350 gibbons in 92 groups.

### Threats and challenges

Threats to gibbons are diverse and pervasive. The principal threat to gibbons is habitat loss and fragmentation (Molur *et al.*, 2003; Islam *et al.*, 2004, 2006, 2007; Geissmann, 2007; Österberg, 2007). During a workshop held in Dhaka, Bangladesh, the Wildlife Trust of Bangladesh and Zoo Outreach Organization of India prioritized this threat as the most critical threat to hoolock gibbons in Bangladesh (Molur *et al.*, 2005). Other threats and challenges persistent throughout the gibbon ranges include the lack of environmental awareness and education, and the absence of conservation measures (Geissmann, 2007; Molur *et al.*, 2005; Walker *et al.*, 2009). In addition, the decline in forest quality (habitat deterioration) is another significant threat to hoolocks in Bangladesh. Isolated populations face an additional threat arising from intrinsic effects of small populations (Islam *et al.*, 2004, 2006; Walker *et al.*, 2009).

Hoolock gibbons have survived in Bangladesh in spite of acute deforestation pressure (Islam *et al.*, 2006; Molur *et al.*, 2005). Several populations have become extinct during the last 15 years (Islam *et al.*, 2006). Habitat destruction is the key cause of hoolock population decline in Bangladesh and India (Islam *et al.*, 2004; Molur *et al.*, 2005). Habitat loss and fragmentation occur mainly due to selective and illegal logging, firewood and timber collection, shifting cultivation, plantation of exotic tree species, habitat encroachment, and unplanned tourism (Ahsan 2000; Brindle, 2009; Islam *et al.*, 2006; Walker *et al.*, 2009; Molur *et al.*, 2003, 2005). In 2005-2006, for instance, an annual average of 1,188 trees were illegally logged in Lawachara National Park alone (Roy and DeCosse, 2006) which is one of the largest strongholds for hoolocks in the country. The root causes of habitat loss and fragmentation are the growing human population and their ever-growing demand for forest resources (Islam *et al.*, 2007; Österberg, 2007). This constant demand does not only originate from local people, but even bigger and more pervasive demand comes from illegal commercial entities for timber extraction (DeCosse and Huda, 2006; Roy and DeCosse, 2006).

Two essential key elements of suitable gibbon habitat are a closed canopy structure and a high diversity of fruiting trees. If these elements disappear from a forest, this may not necessarily reduce the area over which hoolocks can possibly be encountered (Islam *et al.*, 2004, 2006; Muzaffar *et al.*, 2007). However, disruption and detachment of closed canopy and elimination of edible fruiting trees may

result in a decline and disappearance of hoolocks from that habitat (Islam *et al.*, 2004, 2006; Muzaffar *et al.*, 2007). Several studies noted that the richness of edible plant species in a hoolock habitat is critical to the hoolocks' survival (Islam *et al.*, 2006; Muzaffar *et al.*, 2007). However, closed canopy areas, and density and number of trees per hectare have declined rapidly throughout the forested areas in the country (FAO, 2000). For example, Lawachara National Park has a total area of 1,250 ha of which only 800 ha are currently forested (BFD/MoEF, 2000; Muzaffar *et al.*, 2010).

Key challenges to gibbon conservation in Bangladesh include the lack of capacity and skills in the Forest Department, and the lack of awareness among the local communities living around gibbon habitats. The conservation of hoolocks ultimately lies in the hands of the Forest Department and the people that live off the hoolock habitats (Islam *et al.*, 2006). However, conservation measures for the protection of the hoolock habitats throughout the country are largely lacking or nonexistent. Inadequate protection and poor management systems of the hoolock habitats were identified as the major impediments for hoolock conservation (Ahsan, 2000). High levels of annual illegal logging occurring in Lawachara (Roy and DeCosse, 2006) and other forest lands in the country suggest a lack of commitment and understanding of the value of protected areas (Muzaffar *et al.*, 2010).

### Recommendations

Between 2001 and 2005, eight populations of hoolocks have been extirpated from Bangladesh and about 95% population decline is predicted over the next two decades (Islam *et al.*, 2006; Molur *et al.*, 2005; Walker *et al.*, 2009). Hoolock gibbons in Bangladesh can thus be regarded as being in a crisis situation, and their conservation will require carefully planned management of populations, protection of habitats, management of people and their activities, legislation and its enforcement, and the training of manpower to implement key actions (Islam *et al.*, 2006). An action plan to save this species is essential at the moment.

As habitat loss and destruction are the most important factors responsible for the decline of hoolock populations, a firm commitment from the government is urgently needed for habitat protection and restoration. Habitat loss must be arrested in terms of quantity and quality through multi-species plantations, checking for, and abolishment of, illegal felling, and other conservation measures. In addition, well-planned and long-term habitat restoration programs should be initiated immediately for degraded gibbon habitats. In tandem with an attitude change in the government, there is a need to improve habitats by planting a suitable combination of food trees. Furthermore, scientific monitoring of gibbon habitats and populations are recommended as a priority to identify

actions needed and to evaluate management outcomes for future improved conservation interventions. Previous efforts in awareness raising (Islam *et al.*, 2006) showed that people living in and around protected areas can be made to understand that the presence of certain wildlife species, such as hoolock gibbons, may indicate good quality habitat. Of the known populations, 17 have less than ten individuals and may not be viable due to their small population size and anthropogenic pressure on their habitats. Translocations of these small populations to larger, viable habitats through careful planned and standard guidelines are recommended.

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## The Myanmar Hoolock Gibbon Conservation Status Review: First results

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This report summarises results from 25 surveys conducted for the Myanmar Hoolock Gibbon Conservation Status Review Project between November 2008 and 2010. Myanmar holds large intact areas of prime gibbon habitat and is believed to support the majority of remaining hoolock gibbons, but, there is no up-to-date information on the species' conservation status in Myanmar. This project confirms the occurrence of gibbons in the larger areas of forest in five states and divisions. Habitat loss and degradation were recorded as the main threats and hunting was identified as a serious threat in some areas, whereas in other areas no threats were found.

### Introduction

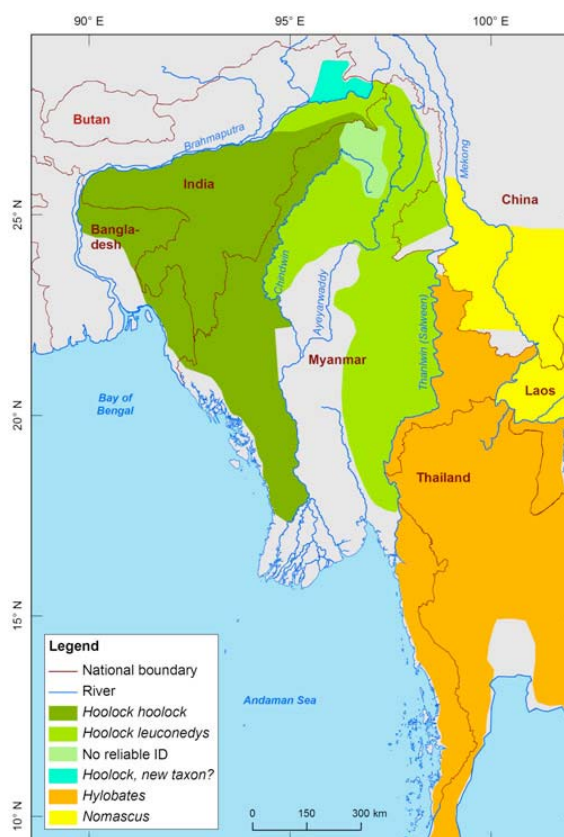
#### Myanmar

Myanmar is the largest country in mainland South-East Asia, with a land area of 680,000 km<sup>2</sup> and a coastline of 2,832 km. The country encompasses several mountain ranges in the west, north and east, while a large lowland plain occurs in the central part (Fig. 1). Over 9,600 plant species, around 360 species of reptiles, around 1,050 bird species and over 300 mammal species have been recorded. Among the latter are 15 species of non-human primate, including gibbons, leaf monkeys, macaques and slow lorises. All primates in Myanmar are threatened to some degree.

#### Hoolock gibbon distribution

Hoolock gibbons (genus *Hoolock*) occur in forested areas from eastern India and Bangladesh to Myanmar and southern China (Fig. 1). Geographically, these apes' natural range extends from east of the Brahmaputra River to west of the Salween River.

Currently, two species of hoolock gibbon are recognized, the western hoolock (*H. hoolock*) and the eastern hoolock (*H. leuconedys*) (Geissmann, 2007). The main distribution areas of both hoolock species are located in Myanmar. Their respective ranges are separated by the Chindwin River, which flows into the Irrawaddy (= Ayeyarwady) River (Groves, 1967, 1972). The boundary between the two species is uncertain in the Chindwin headwaters in the north, and possibly includes a zone of intermediates.



**Fig. 1.** The distribution of the hoolock gibbon (genus *Hoolock*) and gibbon of the genera *Hylobates* and *Nomascus* in Myanmar and adjacent areas.



## Hoolock Gibbon Conservation Status Review Project

This project is jointly implemented by the Biodiversity and Nature Conservation Association (BANCA), Fauna & Flora International (FFI) and the People Resources and Conservation Foundation (PRCF).

The project aims to assess the conservation status of the hoolock gibbons in Myanmar, while strengthening the capacity of the conservation movement in primate surveying, monitoring and conservation in Myanmar.

Three main objectives are (1) increase knowledge of the distribution and relative abundance of hoolock gibbons in Myanmar, (2) identify major threats to gibbons in Myanmar and (3) raise awareness among relevant stakeholders about gibbon conservation.

## Methods

### Activities

A training and capacity building workshop was conducted at the beginning of the project in 2008. The participants included lecturers and students from Yangon University, Western Yangon University, Pyay University and Dawei University, and local NGO staff from BANCA and Rakhine Coastal Association (RCA).

After the training workshop, field surveys were conducted in five states and divisions from December 2008 to May 2010. A workshop on the results of the conservation status review and on conservation action planning was held in May and June 2010.

### Priority survey sites

Priority areas for the field survey sites were selected based on the forest cover maps of Myanmar (Stibig, 2003, 2004). A total of 14 areas were chosen as targets for hoolock gibbon field surveys.

### Field surveys

A total of 25 field surveys were conducted from December 2008 to May 2010 in five states and divisions. Nine field surveys were conducted in the distribution area of the western hoolock gibbon, including Naga Land and areas along the Rakhine Mountain Range, and sixteen field surveys were conducted in the distribution area of the eastern hoolock gibbon, including areas in northern and southern Kachin State and in Kayin State (Geissmann et al., 2008, 2009, in prep.; Lwin et al., 2010a, b; ).

## Survey method

Field survey techniques most suitable to estimate densities of gibbons are variants of the Fixed Point Method, during which the loud morning songs of the gibbons are monitored simultaneously from four fixed listening points per site (Brockelman and Ali, 1987; Brockelman and Srikosamatara, 1993).

Listening posts were about 400 m apart and located on hilltops, in order to enable the survey participants to hear gibbons from as many directions as possible. Monitoring gibbon calls was carried out from dawn to noon for five consecutive days at each listening post.

Each listening post was manned by one to two surveyors. Time, direction, estimated distance, and type of all gibbon songs were recorded on a field form. Song types included (1) solo song bouts, (2) duets with just two participants, (3) duets with more than two participants, and (4) duets involving an unknown number of participants.

All information from each day were plotted and triangulated on graph paper. Density of gibbon groups was estimated based on the triangulated results.

Although songs of wild gibbons can often be heard over distances greater than 1 km, gibbons singing behind hills are often estimated to be further away than 1 km. Furthermore, different gibbon groups beyond 600 m from the listener are more difficult to be distinguished than groups singing at closer distances. As a result, gibbon densities were estimated using both a 0.6 km and a 1 km listening radius.

## Results

### Group densities

Group densities were estimated for 25 study areas. The lowest density was 0.13 group/km<sup>2</sup> and the highest density was 3.76 group/km<sup>2</sup> for western hoolock gibbon. The corresponding densities found for the eastern hoolock gibbon were 0.56 group/km<sup>2</sup> and 7.07 group/km<sup>2</sup>, respectively.

Preliminary estimates of gibbon group densities are summarized in Table 1.

### Threats to gibbons

The results of 25 field surveys confirmed that habitat loss and degradation caused by shifting cultivation and timber extraction are the main threats to both gibbon species (Table 2). Hunting for trade and subsistence was also recorded as a serious threat in seven study areas in the distribution area of eastern hoolock gibbon. In six study areas, no threat to gibbons was detected.

**Table 1.** Gibbon group density (mean  $\pm$  standard deviation)

Species	Number of sites	Gibbon group density/km <sup>2</sup>	
		Listening radius	
		600 m	1 km
<i>H. hoolock</i>	9	2.27 $\pm$ 1.44	1.55 $\pm$ 0.95
<i>H. leuconedys</i> (also including Mahamyaing WS, Brockelman <i>et al.</i> , 2005, 2009)	17	2.63 $\pm$ 1.76	2.05 $\pm$ 0.98
<i>Hoolock</i> sp., Hukaung valley (Saw Htun <i>et al.</i> , 2006)	13	2.15 $\pm$ 1.28	1.90 $\pm$ 0.91
Total	27	2.49 $\pm$ 1.61	1.88 $\pm$ 0.96

**Table 2.** Threats to gibbons

Species	Major threats			Minor threat	No threat
	Habitat fragmentation	Habitat degradation	Hunting	Hunting	
<i>H. hoolock</i> (9 sites)	8 (89%)	–	–	2 (22%)	1 (11%)
<i>H. leuconedys</i> (16 sites)	4 (25%)	4 (25%)	7 (43%)	–	5 (31%)

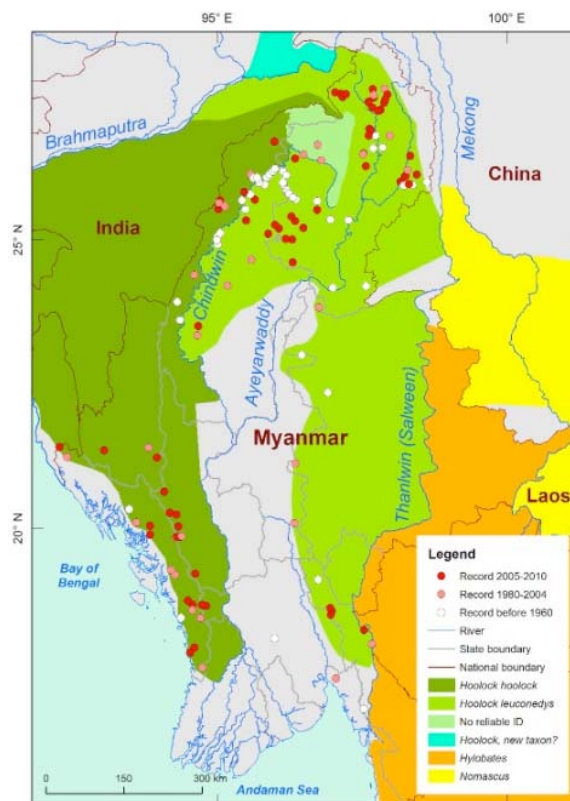
### Hoolock locality records

Gibbon survey data from Myanmar can be roughly grouped into three time periods: historical records (before 1960), modern records (1980-2004) and recent records (2005-2010). A total of 148 hoolock gibbon locality records were recorded in ten states and divisions. For the western hoolock gibbon, fifteen historical, 15 modern and 22 recent localities were recorded. For the eastern hoolock gibbon, the corresponding numbers were 35 historical, 12 modern and 44 recent localities. Only two modern and three recent localities were recorded for *Hoolock* sp. (Fig. 2).

Sixty-two (42%) of 148 localities were recorded from the status review project and 86 localities were recorded from the other sources.

### Action plan from the status review workshop

A hoolock gibbon status review workshop was held on 25 June 2010, during which actions for hoolock gibbon conservation, research and transboundary activities were planned. Planned activities for the hoolock gibbon conservation include conducting a national-level awareness program, reviewing the Myanmar protected species list, raising legal awareness among stakeholders and reviewing the protected area system to strengthen gibbon conservation. Planned research activities include conducting additional field surveys, conducting long-term behavioural research/ecology studies and establishing monitoring at selected sites. Planned transboundary conservation activities include improving cooperation with China.

**Fig. 2.** Hoolock gibbon locality records in Myanmar.

### Conclusions

Although hoolock gibbon surveys were conducted in some areas of Myanmar prior to the Hoolock Gibbon Conservation Status Review Project, this project is the first nationwide hoolock gibbon status review. During its course, 25 field surveys were conducted in five states and divisions covering most of the hoolock gibbons' main distribution areas.

This project estimates the density of hoolock gibbons in Myanmar and confirms the conservation status of these apes in Myanmar. A conservation action plan was also designated for future activities. More field surveys will be conducted in two protected areas and a site-based conservation program will be established at one protected area.

### Acknowledgements

We thank Arcus Foundation Great Apes Program, the United States Fish and Wildlife Service, Great Apes Conservation Fund, and Gibbon Conservation Alliance for financial support for this project. The use of US grant funds in Myanmar for this project is authorised by the US Treasury Department's Office of Foreign Assets Control.

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## Conservation status of the eastern hoolock gibbon (*Hoolock leuconedys*) in China

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We review the conservation status of eastern hoolock gibbon (*Hoolock leuconedys*) in China. Historically, this species was distributed in nine counties along the west bank of the Salween River in Yunnan Province, China. The species' range reduced to only three counties in 2009. Gibbon abundance declined by 50% or more at five sites since 1994 and gibbons were extirpated from nine other sites during the past two decades. Habitat destruction, degradation and fragmentation caused by commercial logging and agricultural encroachment were the main threats to hoolock gibbons living outside Gaoligongshan Nature Reserve in China. The forest inside Gaoligongshan Nature Reserve was suitably protected, however, illegal hunting still occurred inside the reserve.

### Distribution

The eastern hoolock gibbon (*Hoolock leuconedys*) is distributed in China, Myanmar and India east of the Chindwin River and west of the Salween River. Originally, the species was distributed in nine counties along the west bank of the Salween River in Yunnan, China: Lushui, Baoshan, Tengchong, Longling, Lianghe, Yingjiang, Longchuan, Luxi, and Ruili (Li and Lin, 1983; Tan, 1985; Yang *et al.*, 1985, 1987; Fooden *et al.*, 1987; Ma and Wang, 1986, 1988). More recently, the species' range reduced to only four counties: Baoshan, Tengchong, Yingjiang, and Longchuan, and the population was estimated to consist of 36-67 groups in the 1990s (Lan *et al.*, 1995). The most recent census, carried out between 2008 and 2009, recorded 40-43 groups and five solitary individuals in 17 forest patches in nine townships over three counties: Baoshan, Tengchong, and Yingjiang (Fig. 1). The total population in China is estimated to consist of less than 200 individuals (Fan *et al.*, 2011).

### Population trend

Gibbon abundance in Nankang, Bawan, Houqiao, Datang, and Sudian (locality names of townships or ranger stations) declined by 50% or more since 1994 (Lan *et al.*, 1995; Fan *et al.*, 2011). Furthermore, nine populations in Mankuang, Jietou, Dahaoping, Menglong, Xima, Jiucheng, Jiema, Husa, and Anding have been extirpated in the past two decades (Fan *et al.*, 2011). Two populations in Saige and Zizhi were newly reported by Fan *et al.* (2011).

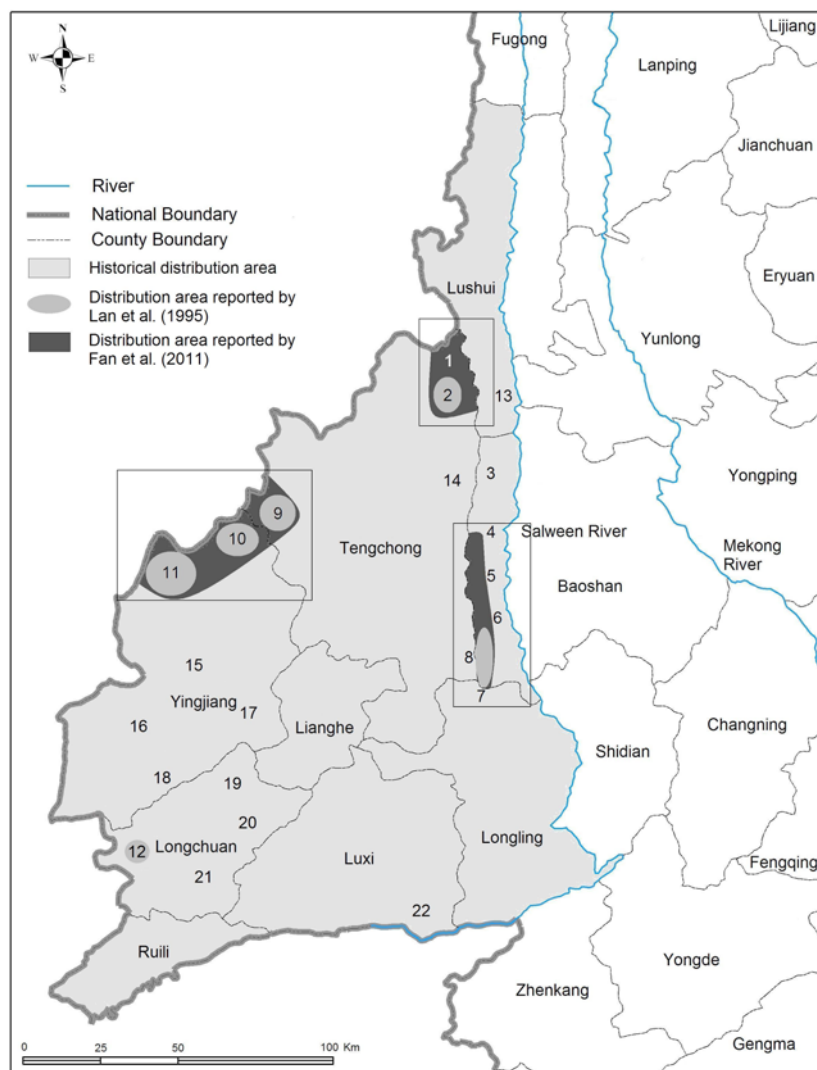
### Main threats

Habitat destruction, degradation and fragmentation caused by commercial logging (Fig. 2) and agricultural encroachment are the main threats to hoolock gibbons in China living outside Gaoligongshan Nature Reserve (Fan *et al.*, 2011). Commercial logging and road building for log transportation severely degrades and fragments the forest. As a result, the largest hoolock gibbon population in Mulonghe became extinct in 1994 and the Heinitang population declined dramatically. Five isolated small forest patches outside the reserve were found to support only one group each (Fan *et al.*, 2011).

Tsaoko cardamom (*Fructus tsaoko*) planting occurs at elevations between 1,800 and 2,200 m asl throughout the gibbon range outside Gaoligongshan Nature Reserve (Fig. 3). To plant cardamom, local people remove trees in the moist valleys to reduce the canopy density to 50-70%. They also clear out small trees and lianas. Cardamom plantations reduce gibbon food tree densities and are likely to increase the gibbons' foraging efforts as a result of the discontinuous canopy (Fan *et al.*, 2011). Cardamom plantation caused a dramatic decline of the hoolock population in Nankang. There are only one adult pair and a solitary female surviving in this site, and all infants of this adult pair died until intensive conservation activities were initiated in the area in 2008. Cardamom plantation also influences forest regeneration in the long term, because small trees are continually cleared.

In addition to cardamom plantations, local people in the area also practise rotational agriculture in Sudian (Fig. 4). They cut down primary forest each year, resulting in the destruction and fragmentation of gibbon habitat.





**Fig. 1.** Distribution of the eastern hoolock gibbon (*Hoolock leuconedys*) in Yunnan Province, China. Localities are: 1. Zizhi, 2. Datang, 3. Mangkuan, 4. Baihualin, 5. Saige, 6. Bawan, 7. Nankang, 8. Dahaoping, 9. Houqiao, 10. Zhina, 11. Sudian, 12. Husa, 13. Shangjiang, 14. Jietou, 15. Menglong, 16. Xima, 17. Jiucheng, 18. Jiema, 19. Fuguo, 20. Wangzishu, 21. Bangwa, 22. Zhongshan. The first eight localities are inside Gaoligongshan Nature Reserve.



**Fig. 2.** One group disappeared after commercial logging in Sudian.





**Fig. 3.** Tsaoko cardamom plantation under the forest canopy caused forest degradation of hoolock gibbon habitat in Heinintang.



**Fig. 4.** Rotation agriculture resulted in one group disappearance in Sudian.

Hunting is another important threat. Although management and patrolling of the area have greatly improved recently, some illegal hunting still occurs inside Gaoligongshan Nature Reserve. Gunshots were heard during the latest survey (Fan *et al.*, 2011). During a ten month study in Datang, one group with three individuals disappeared after four gunshots in one day (Fan, unpublished data). We presume that the population decline and extirpation of gibbons in Bawan, Jietou, and Dahaoping was caused by hunting, because the forests in these areas are still intact and presumed to be suitable for gibbons. Lisu people in Sudian and Heinintang traditionally do not kill

gibbons (Lan *et al.*, 1995; Fan *et al.*, 2011). As a result, small gibbon populations survive in small isolated forest patches of these areas (Fan *et al.*, 2011).

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## Saving hoolock gibbon in Bangladesh, protecting forests, and conserving biodiversity through awareness building

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There are about 350 hoolock gibbons in Bangladesh spread across 36 sites that are fragmented and unconnected in the northeast and southeast. Only two sites have more than 30 individuals. The remainder contain mostly 2-5 individuals and are deemed genetically doomed. All known populations are under threat from habitat destruction. Better dissemination of knowledge through awareness programs may help generate public support to conserve this species. Making governments accountable to conventions they have signed, such as the Convention on Biological Diversity, may stimulate them to take a more serious approach to wildlife conservation. The Wildlife Trust of Bangladesh (WTB) has had considerable success with its awareness campaigns that have become an important part of all its projects. Schools, colleges, universities, local governments, local people and indigenous people have become involved in WTB's activities, resulting in greater awareness and stewardship of forests and nature. WTB has provided training and equipment for Forest Department officials, local leaders, local conservationists, etc. and hopes that they may continue to be engaged in conservation activities. The Trust also engages the Forest Department in habitat restoration through the planting of mixed species of trees in selected protected areas. The WTB group, in collaboration with Global Science Productions, has produced the first documentary on the hoolock gibbon in Bangladesh to help increase awareness and leverage funds. WTB's research has resulted in publications in peer-reviewed journals and has produced technical manuals (in English and Bengali) to help researchers, conservationists, and Forest Department staff to better document ecological variables in hoolock gibbon habitat.

### Introduction

Lack of awareness is a challenge for natural resource conservation in Bangladesh. Proper implementation of forest and biodiversity conservation related laws or conventions has not yet been established. Therefore, the degradation of forests is ongoing. Today, the country does not have viable protected areas or natural habitats. Moreover, information on the status of biodiversity, changing patterns and natural resources is very scarce and the current institutional arrangements for natural resource management are inadequate. Keeping these problems in mind, Wildlife Trust of Bangladesh (WTB) designed the conservation education program '*Save hoolock gibbons, protect forests, conserve biodiversity.*'

Bangladesh has only one ape species; the western hoolock gibbon (*Hoolock hoolock*). However, a lack of awareness, deforestation and human encroachment have combine to push this species to the verge of extinction in the country. The species is distributed across India, Bangladesh, Myanmar and

southern China, extending from the Brahmaputra River in the west to the Salween River in the east (Geissmann, 1995; Groves, 1967; Prater, 1980). At present, *H. hoolock* is categorized as Critically Endangered in the Red Book of Threatened Mammals of Bangladesh by IUCN Bangladesh (2000) and Endangered globally (IUCN, 2010). In Bangladesh, some forest fragments contain extremely small populations (less than five individuals) that are considered to be genetically doomed (Islam *et al.*, 2006, Muzaffar *et al.*, 2007). Attempts are being made to implement protection of remaining habitats and restore tree diversity and density.

Conservation education is a process of promoting awareness for the preservation of nature by using communication through interpretation in all forms to convey the desired message. Raising awareness through conservation education programs can increase participation by local people, foster positive attitudes towards nature, and promote natural resource conservation (Fitter, 1986; Jacobson, 1987; Sharpe, 1982). Moreover conservation education pro-



grams are generally resulting in greater awareness and stewardship of forests and nature as public discussion and participatory approaches are now frequently considered central elements in implementing conservation needs (Stewart, 2006) and in the management of protected areas (Barber, 2004; Martin *et al.*, 2000; Mulongoy and Chape, 2004). In our conservation education program we used the hoolock gibbon as a flagship species to raise awareness among children and adults (Fig. 1).



Fig. 1. Children attending the plantation program.

WTB has been assisting the Forest Department in the protection of nature and threatened species conservation. WTB, for the first time, made a baseline survey of this species and its habitats. Generally, the goals for conservation education programs typically include developing an awareness of, and concern about, the environment and its associated problems, and developing the knowledge, attitudes, motivations, and skills to work toward solutions of current problems and the prevention of new ones (Stapp and Cox, 1974). WTB's programs were mainly aimed to spark the enthusiasm of the participants and to inspire others to get involved in threatened species conservation. Based on the determination of needs at local, regional, or national levels, the goals were formulated as:

- to disseminate knowledge through awareness programs and educational materials, and to help generate public support;
- to educate children and adults about the importance of nature and natural resources using active learning;
- to increase the capacity and to engage Forest Department and local people in threatened species conservation; and
- to make the government accountable to conventions, and to stimulate a more serious approach to wildlife conservation.

### Materials and methods

Education materials used in the programs included a hoolock mask, hoolock placard and hoolock rakhi (friendship band) developed by Zoo Outreach Organization (ZOO), India and WTB, hoolock poster

by local experts and an attractive hoolock dress (t-shirts for boys and frocks for girls) designed by WTB. WTB, Bangladesh Forest Department, Wildlife Rescue Centre and the U.S. Fish and Wildlife Service developed billboards providing information about the hoolock gibbon and its conservation, and erected them in different protected areas and along roads. Two thousand hoolock T-shirts and 500 hoolock frocks were distributed among the local people (including the indigenous community) living in and around the hoolock gibbon areas in the northeast and southeast of Bangladesh. Additionally, 1,000 pamphlets and 2,000 posters summarizing the threats and conservation aspects of the hoolock gibbon were also distributed.

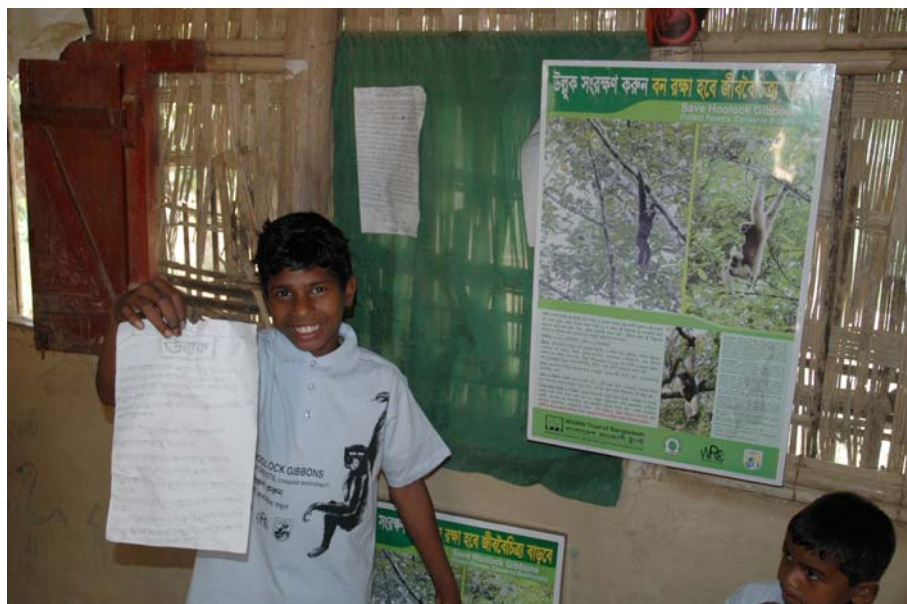


Fig. 2. Local people with the hoolock billboard.

Six large-sized billboards (Fig. 2) containing information on profile, threats and conservation needs of hoolock gibbon along with colour images of hoolock gibbons were erected at the following locations: one at Satchari National Park (NP), one on the highway outside the Satchari Park area, one at Lawachara NP, one near the Lawachara Forest Office, and two at Kaptai NP. Seventeen medium-sized billboards were erected at Bandarban, Dulahazra, Lama, Cox's Bazar, Inani, Ukhia and Teknaf. About 1,500 children were reached in different localities of Dhaka (the capital), Satchari, and Lawachara in the north-east, Kaptai, Chittagong, Bandarban, Dulahazra, Lama, Ramu, Cox's Bazar, Inani, Ukhia, and Teknaf in the southeast. Conservation lectures highlighting the plight of the hoolock gibbon were provided in about 50 schools, markets, societies and youth clubs in the areas mentioned above. Schoolchildren were provided with relevant educational materials and were engaged in interactive exercises to promote learning about hoolock gibbon conservation. We arranged training programs for schoolteachers and local conservationists who showed interest in arranging such programs in different areas.

A one-hour long hoolock documentary entitled 'Gibbons: The Forgotten Apes in Peril' was released and shown to viewers at the WTB auditorium at Cosmos Centre in Malibagh, Dhaka. WTB, Global Science Productions (GSP), Channel-I (local TV channel) and US Fish and Wildlife Service jointly produced the documentary. Over the duration of the

awareness programs, information about the hoolock populations, their threats and conservation needs was disseminated among the local people, general public, conservationists, scientists and politicians. WTB also arranged a national press conference during which national and international primatologists explained the need to conserve this species.



**Fig. 3.** Kanto Bhowmik was an indigenous boy of Satchari National Park who attended our programme. When we revisited the site later, we found him writing articles on hoolocks and sharing them with others. He inspired many of his friends.

Each event of the conservation education programs as well as the awareness raising campaigns was themed on 'active learning'. This method helped both children and adults to learn and retain what they have learned by practising it through interactive lessons with games, songs, creative activities and other mechanisms. The conservation education programs implemented by WTB concentrated mainly on making real changes in the minds and hearts of the participants they reached. Specific topics concerning conservation of hoolock and natural resources were aimed at bringing a positive change in the (1) knowledge, (2) attitudes, and (3) practices of the program participants.

### Evaluation assessments of effectiveness

Evaluations, by staff involved in program development, were conducted during the program planning, implementation (process) and post-project (product) stages, to ensure each step of our programs were carried out correctly. This involved discussing the strengths and weakness of our achievements during each of these three stages, to improve the subsequent stage.

Program assessment by external evaluators is also required for assessing the effectiveness of the conservation education programs (Jacobson, 1988b). Through sharing our program proceedings and reports

(from the participants) with funding bodies as well as with international conservation organizations such as WCS (New York) and ZOO (India), programme improvements can be made.

Following the hoolock conservation education programs, WTB conducted the same baseline survey and conservation education programs for other threatened species such as the bears of Bangladesh, indicating that our methodology was considered successful.

In order to judge the effectiveness of the programs, results in more quantitative or measurable outcomes are needed. Children who attended our programs are now planting trees for hoolock, some of them are writing articles on hoolock and biodiversity (Fig. 3), local schoolteachers are joining children to sing hoolock songs, and trainees of WTB's awareness raising programs are now serving as eco-guides in protected areas.

One of the Oxford Brookes University students, Ms Corrin LaCombe, joined our hoolock conservation education program. She modified and evaluated some of our events as a part of her masters thesis. However, a more systematic and long term evaluation of these programs is required.



## Conclusion

The communities living in or near the hoolock areas are now more conscious about the hoolock gibbon and other wild animals. They have started to accept hoolock as a gift of nature as it gives them a sense of pride when tourists visit their areas to see the hoolock. They started realizing how hoolock gibbons can help regenerate/expand forests. Some people now discourage others from cutting trees and disturbing these endangered animals. The children also share with their friends and other adults what they have learned. Thus they are spreading the spirit of conservation across the country. WTB and the Bangladesh Forest Department monitor post-awareness activities by visiting the places of past activities, and through communication with local people. The enhanced awareness, capacity and restoration will have to be maintained and improved to reach the long-term goal of achieving viable hoolock gibbon populations in Bangladesh.

## Acknowledgments

The authors are grateful to Dr Fred Bagley of USFWS, Ms Sally Walker and her team of Zoo Outreach Organization, India, Ms Nalini Mohan of Wildlife Conservation Society, New York, several local organizations in Bangladesh, and the Forest Department for their continuous support. We are grateful to Dr Stephen Browne of Fauna & Flora International for providing opportunities to present this programme at the 23rd Congress of the International Primatological Society in Kyoto, Japan.

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## Strategic plan for western hoolock gibbon conservation in Assam, India

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The western hoolock gibbon is an endangered primate, restricted to South-East Asia. The combination of being strictly arboreal and having a frugivorous diet makes the species very vulnerable to any negative changes to their habitat. In northeast India, habitat loss and fragmentation combined with hunting and the species' relatively low abundance are the major threats. For long-term conservation of the species, a comprehensive plan of action is required. A Strategic Planning workshop has been organized with concerned stakeholders to develop guidelines for the conservation of the western hoolock gibbon in Assam, India. Ten landscapes in Assam have been identified for long-term conservation of the species based on two criteria, habitat integrity and biological importance. A Gibbon Conservation Committee is being proposed to review overall gibbon research and conservation activities in the state and link them to better management of the habitats. Regular gibbon censuses, monitoring selected populations to identify trends, and a central gibbon database are the major recommendations, along with habitat improvement and improved connectivity between small fragments. Identification of isolated groups, characterization of fragmented forests, and development of a translocation program for meta-population management are additional parts of the plan. The development of separate education and outreach programs to address different sections of society were also emphasized in the strategic plan.

### Introduction

The western hoolock gibbon (*Hoolock hoolock*) is an endangered ape species, restricted to South-East Asia. Its strictly arboreal lifestyle and dominantly frugivorous diet, make the species particularly vulnerable to negative changes to their habitat. Habitat loss and fragmentation combined with hunting and the species' relatively low abundance have been identified as the major threats to the western hoolock in northeast India. In this paper, we present a comprehensive plan of action for long-term conservation of the species in Assam.

### Vision

To safeguard and conserve one element of India's unique natural heritage: the singing gibbons and their habitats, by promoting participatory conservation policies, legislations, and actions.

### Goals

- Rationalize the existing protected area network and improve protected area management;
- Develop a framework for wildlife conservation focusing on the gibbon as a flagship

species outside protected areas and promote ecologically responsible development;

- Restore degraded landscapes;
- Initiate meta-population management for stray and isolated populations;
- Promote a knowledge-based approach to conservation and an adaptive framework for wildlife management;
- Reduce existing anthropogenic pressures on natural resources;
- Promote local capacity, conservation education and awareness; and
- Involve of communities in conservation efforts.

### Multi-stakeholder workshop

A multi-stakeholder workshop was organised at Assam Forest School, Guwahati, Assam, India in November 2009, with participants including species specialists, state government staff responsible for implementation, and representatives from local NGOs.

A separate follow-up workshop is planned to include other stakeholders, including members of local communities, local politicians, private sector companies (tea, mining, oil and natural gas companies etc.).

### Conservation landscapes of Assam

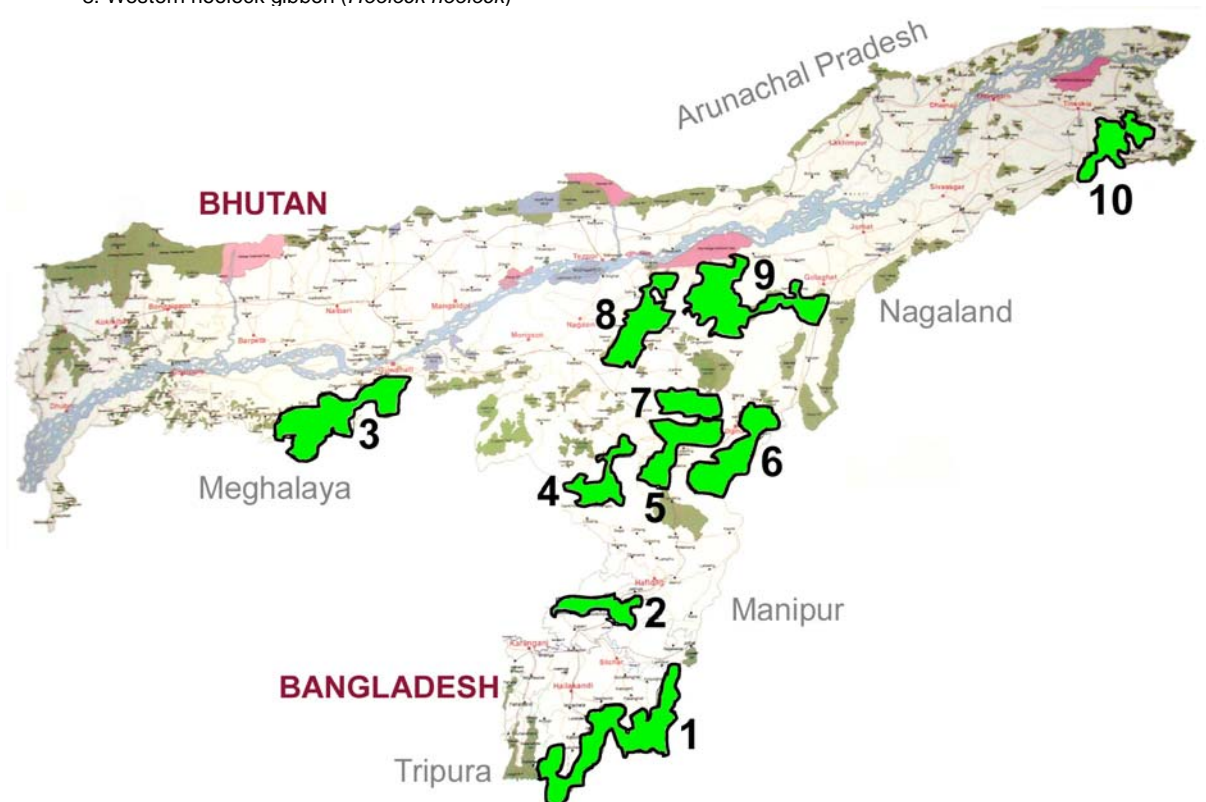
During the first workshop, ten important gibbon conservation landscapes were identified for Assam. They are listed in Table 1 and mapped in Fig. 1.

**Table 1.** List of identified conservation landscapes and information on primate diversity.

Conservation landscape	Area [km <sup>2</sup> ]	Primate species <sup>a)</sup>							
		1	2	3	4	5	6	7	8
1 Innerline – Kathakhal – Singha – Barak complex	1700	+	+	+	+	+	+	+	+
2 Barail WLS – Barail PRF – unclassified forest north of Barail WLS – North Cachar complex	450	+		+	+	+	+	+	+
3 Rani – Garbhanga – (Basistha to Moratola) Bogaikhas complex	350	+		+		+		+	+
4 Khurimming – Panimur – Amreng complex	186	+		+		+	+	+	+
5 Lumding RF	224	+		+		+	+	+	+
6 Dhansiri – Borlanfer – Daldoli complex	240	+		+		+	+	+	+
7 Marat Longri	450	+		+		+	+	+	+
5 Borjuri – Junthung – Western Mikir Hills – Doboka RF complex	350	+		+		+	+	+	+
9 Langlakso – Mikir Hills – Kalioni – North Karbi Anglong WLS – East Karbi Anglong WLS complex	1200	+		+		+	+	+	+
10 Joypur – Dirak – Upper Dehing complex	400	+		+		+	+	+	+

<sup>a)</sup> Primate species:

1. Bengal slow loris (*Nycticebus bengalensis*),
2. Phayre's leaf monkey (*Trachypithecus phayrei*),
3. Capped leaf monkey (*T. pileatus*),
4. Stump-tailed macaque (*Macaca arctoides*),
5. Assamese macaque (*M. assamensis*),
6. Northern pig-tailed macaque (*M. leonina*),
7. Rhesus macaque (*M. mulatta*),
8. Western hoolock gibbon (*Hoolock hoolock*)



**Fig. 1.** Forest map of Assam showing the identified conservation landscapes (1-10), as described in Table 1.

### List of abbreviations

CVSc:	College of Veterinary Sciences, Guwahati
FD:	Forest Department
GCC:	Gibbon Conservation Centre, Mariani
NGO:	Non-governmental organization
PCCF:	Principal chief conservator of forests
PRC:	Primate Research Centre, Guwahati
WWF:	World Wide Fund for Nature
WWT:	Wildlife Areas Development and Welfare Trust, Guwahati
ZOO:	Zoo Outreach Organization, India

### Strategic plan for western hoolock gibbon conservation in Assam, India

The following conservation strategies have been determined for western hoolock gibbons in Assam, India.

#### 1. Gibbon conservation committee

A committee has been proposed with the following structure:

Chairman	Forest Minister
Member Secretary	Principal Chief Conservator of Forests (Wildlife) cum Chief Wildlife Warden, Assam
Secretary	Conservator of Forests (Wildlife), Govt. of Assam
Members	All concerned gibbon area managers, experts from selected NGOs, honorary wildlife wardens of gibbon habitat areas, experts from Wildlife Institute of India, University, College of Veterinary Sciences
Activer/Facilitator	The Activer is selected by the committee. He will be the person who will guide the conservation initiative prescribed in the strategic plan for western hoolock gibbon conservation in Assam.

#### 2. Rapid assessment, identification and prioritization of hoolock gibbon landscapes

- By the Forest Department, supported by WWT, PRC, GCC, WWF
- Responsibilities: Not below the rank of Forest Range officers
- Developing the methodologies and training. Responsibility: WWT, PRC, GCC, WWF & FD.
- Training on gibbon census techniques will be imparted in all Assamese Divisions sup-

porting gibbons. Circle level Conservator of Forest shall take the initiative.

- Fund: Forest Department
- Training: Four training courses of one day each in Silchar (with the active support from WWT), Guwahati (with active support from PRC and WWT), Diphu (with support from WWF), and Jorhat (with support from GCC)

#### 3. Policy: Forest Rights Act 2006

- Before finalizing the 'Critical tiger habitat' and 'Critical wildlife habitat' no land to be handed over to anyone.
- Nodal agency should be the Forest Department along with the Tribal Affairs Department to implement the act policy.
- Forest Department is responsible in declaring the critical wildlife habitats.

#### 4. Central database on hoolock gibbon

- Habitat, maps, data, landscape information, etc. with the help of WWT, PRC, FD, and ZOO

#### 5. Conservation education and awareness

- Identification of target
- Eco-development along with the education
- In every strategy: Education and awareness separately
- Separate curricula for the students in hill area (juhm cultivation) and lowland area, short term and long term. It is not an awareness programme, but chapters on this topic are incorporated in the regular course of the school books. It is compulsory to read.
- Use the existing tools
- Responsibility: PRC, GCC, FD
- Support: ZOO

#### 6. Gibbon census every three years

- Survey in the areas under the Forest Department, non-forest lands
- Method: Combination of line transect and listening point survey
- Training in census technique: WWT, PRC, GCC (within one year). Book on census techniques in Assamese and English languages
- Responsibility: FD
- All other primates shall be included

#### 7. Mapping of the landscapes

- Habitat suitability mapping
- Change detection analysis
- Critical area mapping



- Responsibility: Assam Electronics Development Corporation Limited (AMTRON), Assam Remote Sensing and Application Centre (ARSAC)
- Time line: Habitat change analysis three months, critical area mapping one year

### 8. Conservation of gibbons outside forest areas

- Strategy for all non-forest lands: Rewards for saving trees and gibbons. Responsibility: FD
- Promote eco-tourism. Responsibility: FD
- Population census and monitoring. Responsibility: PRC
- Translocation of isolated gibbons to suitable habitats. Responsibility: FD
- Planning and resource support: PRC, ZOO
- Metapopulation management of fragmented population. Responsibility: FD
- Planning and resource support: PRC, ZOO
- Plantation. Responsibility: FD
- Habitat & population viability analysis. Responsibility: PRC, FD, ZOO, WWT, GCC

### 9. Research

- Population dynamics: PRC, Universities
- Selected population monitoring in each landscapes: PRC, WWT, Universities
- Food analysis: PRC, Universities
- Pathological study: College of Veterinary Sciences
- Genetic study: Laboratory for the Conservation of Endangered Species (LACONES), Aarnayak (a local NGO working for conservation of wildlife), PRC
- Threat analysis: FD, PRC, GCC
- Ecological study: Forest Department, Wildlife Institute of India, PRC, WWT
- Climate change adaptations: WWT, PRC, WWF

### 10. Monitoring

- Gibbon population
- Habitat
- Threats (at landscape and at local)
- Change in community perception
- Anthropogenic features
- Changes in policy, if any. Responsibility: FD
- Implementation strategies. Responsibility: Species activer. Time line: Continuous (every six months)

- Specific format while evaluating the health of the gibbon habitats. Responsibility: Wildlife Trust of India (WTI), AVC.
- Goal targets, actions

### 11. Socio economic development/ livelihood support training

- Poverty alleviation, eco-development for fringe population: Project Hoolock Gibbon
- Responsibility: FD, NGO's

### 12. Enforcement

- Enforcement: Proper and effective enforcement of all existing forest and wildlife related laws in the state by all concerned
- Environmental clearance: Permanent connections should be there every 60 meters in gibbon habitats while widening existing roads and laying new roads (Environmental Impact Assessment is obligatory as per Supreme Court directive)
- Responsibility: FD

### 13. Funding

Besides external funding Project Hoolock Gibbon has been proposed for constant support for the conservation of western hoolock gibbon from Government of India in the lines of Project Tiger, Project Elephant and Project Snow Leopard.

Outline:

1. Introduction
2. Project justification
3. Project objectives
4. Project areas
5. Broad management principles
  - 5.1. Management approach
  - 5.2. Management initiatives
  - 5.3. Strategy for reaching out
  - 5.4. Research
6. Indicative activities under project
7. Administration
8. Financial implications
9. Conclusion
10. Time-lines
11. Annexure

### Acknowledgements

We thank all the stakeholders who participated in the workshop, and the donors for their continued support of the gibbon research, conservation and education work in Assam. We are grateful to Dr Thomas Geissmann for his help in drafting the manuscript.

## Photo Gallery

While editing the articles for this issue of the *Gibbon Journal*, I invited authors to send photographs of wild hoolock gibbons that were suitable to be used for this issue's cover. The authors surprised me by sending so many really beautiful photographs that I found it difficult to single one out for the cover.

Because I felt that readers might enjoy seeing more of these outstanding gibbon photographs, I inserted this section showcasing a selection of pictures that did not make it on the cover.

Thomas Geissmann



**Fig. 1.** Western hoolock (*Hoolock hoolock*), adult male, Lawachara National Park, Bangladesh, 15 March 2011. Photo: Samiul Mohsanin.

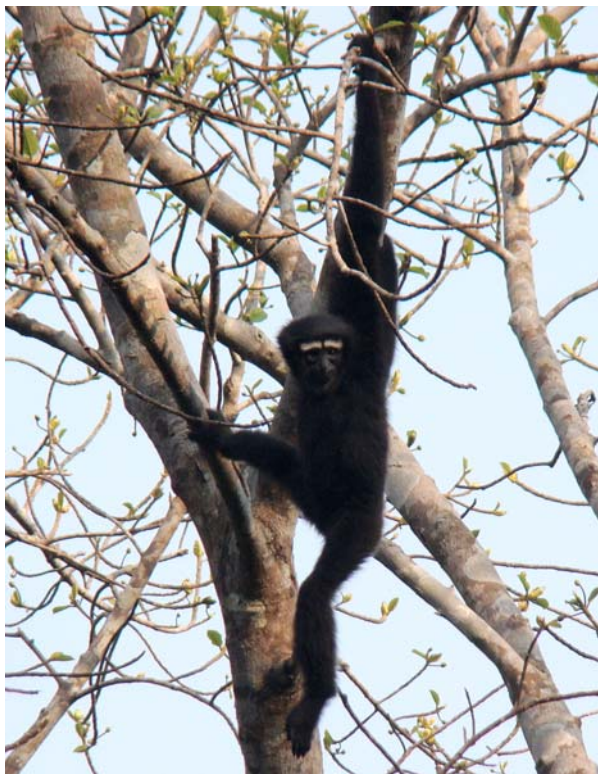


**Fig. 2.** Western hoolock (*H. hoolock*), adult female carrying infant, Lawachara National Park, Bangladesh, 15 March 2011. Photo: Samiul Mohsanin.



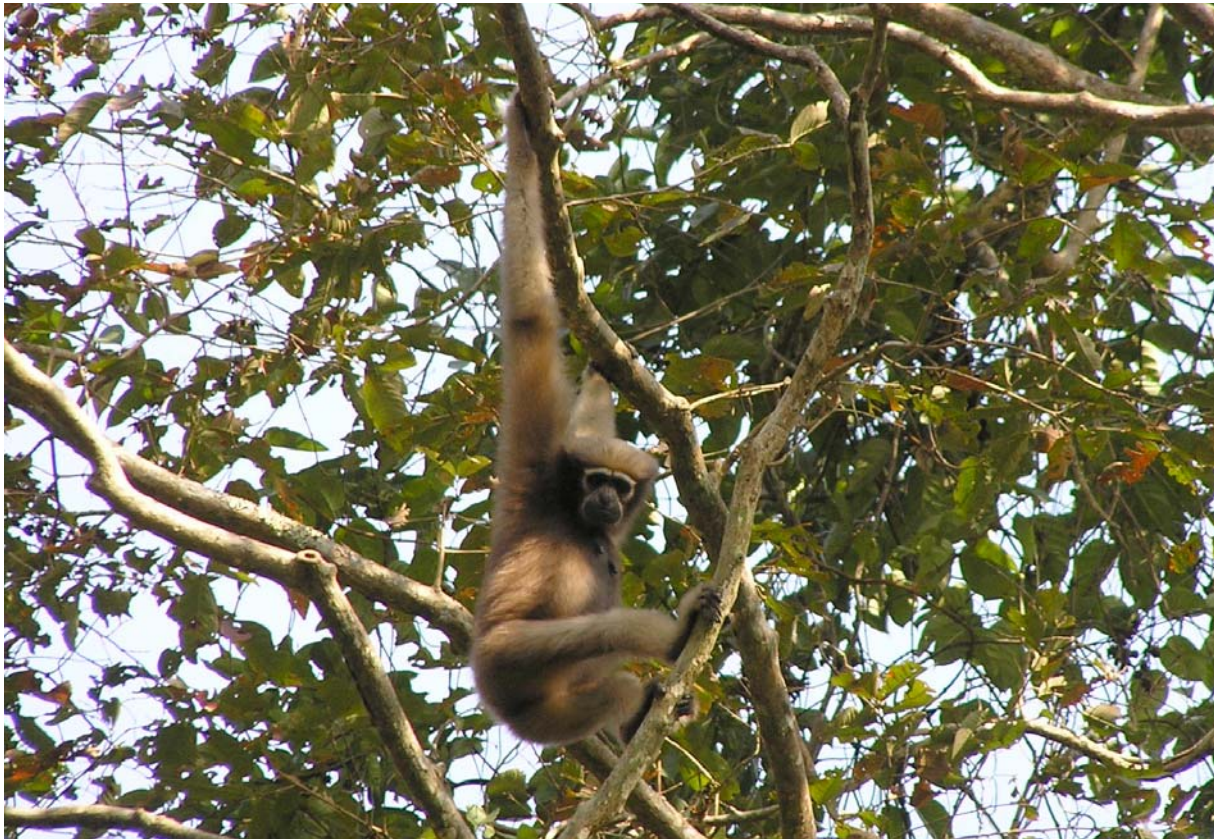


**Fig. 3.** Western hoolock (*H. hoolock*), adult female carrying infant, Lawachara National Park, Bangladesh, 15 March 2011. Photo: Samiul Mohsanin.

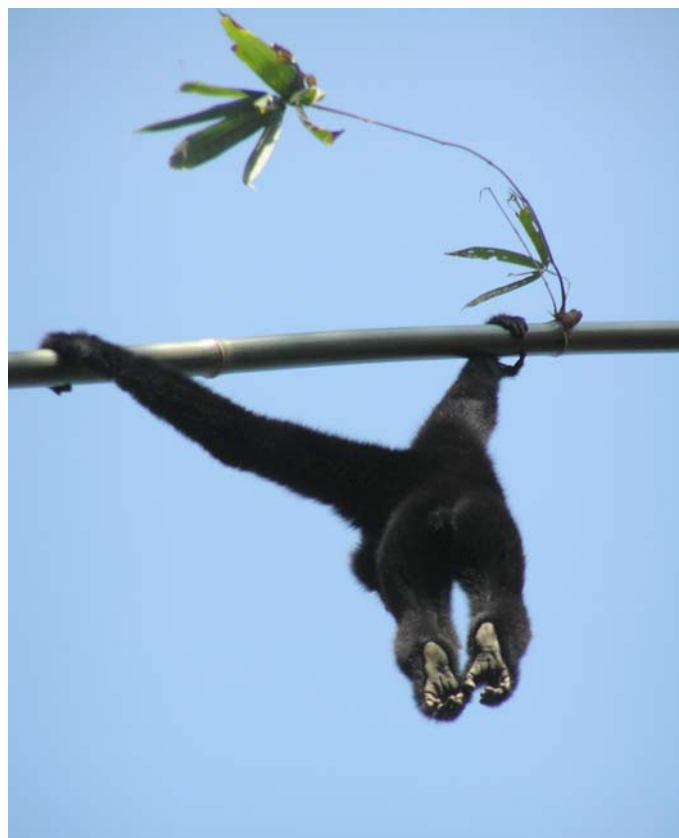


**Fig. 4.** Western hoolock (*H. hoolock*), subadult male (left) and adult female carrying infant (right), Lawachara National Park, Bangladesh, 17 March 2011. Photos: M. Abdul Aziz.



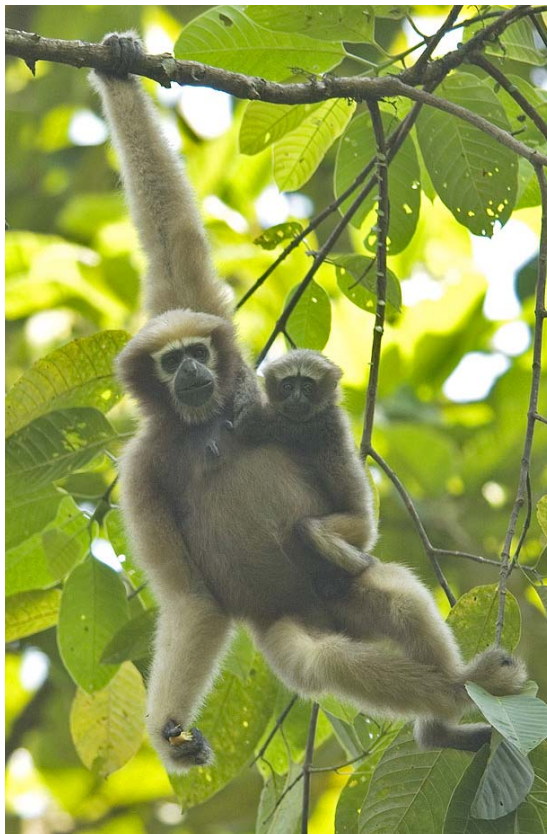


**Fig. 5.** Western hoolock (*H. hoolock*), adult female, Gibbon Wildlife Sanctuary, Jorhat District, Assam, India, 13 March 2007. Photo: Dilip Chetry.

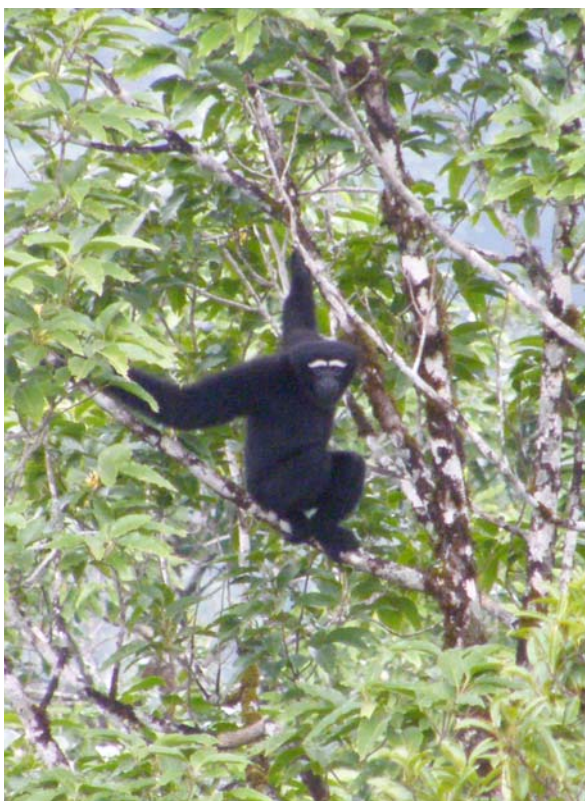


**Fig. 6.** Western hoolock (*H. hoolock*), adult male, Barikuri Area, Tinsukia District, Assam, India, 29 Jan. 2006. Photo: Dilip Chetry.



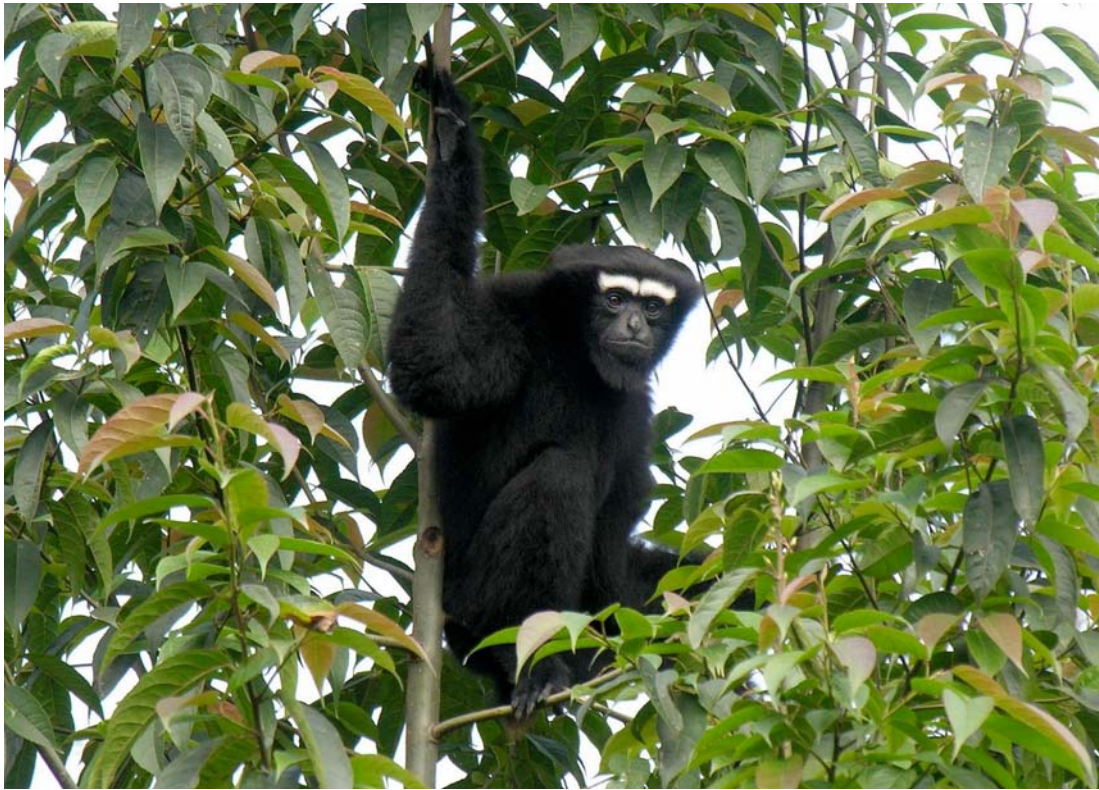


**Fig. 7.** Western hoolock (*H. hoolock*), adult female carrying infant, Borajan Wildlife Sanctuary, Tinsukia District, Assam, India, 14 June 2008. Photo: Dhritiman Mukherjee.

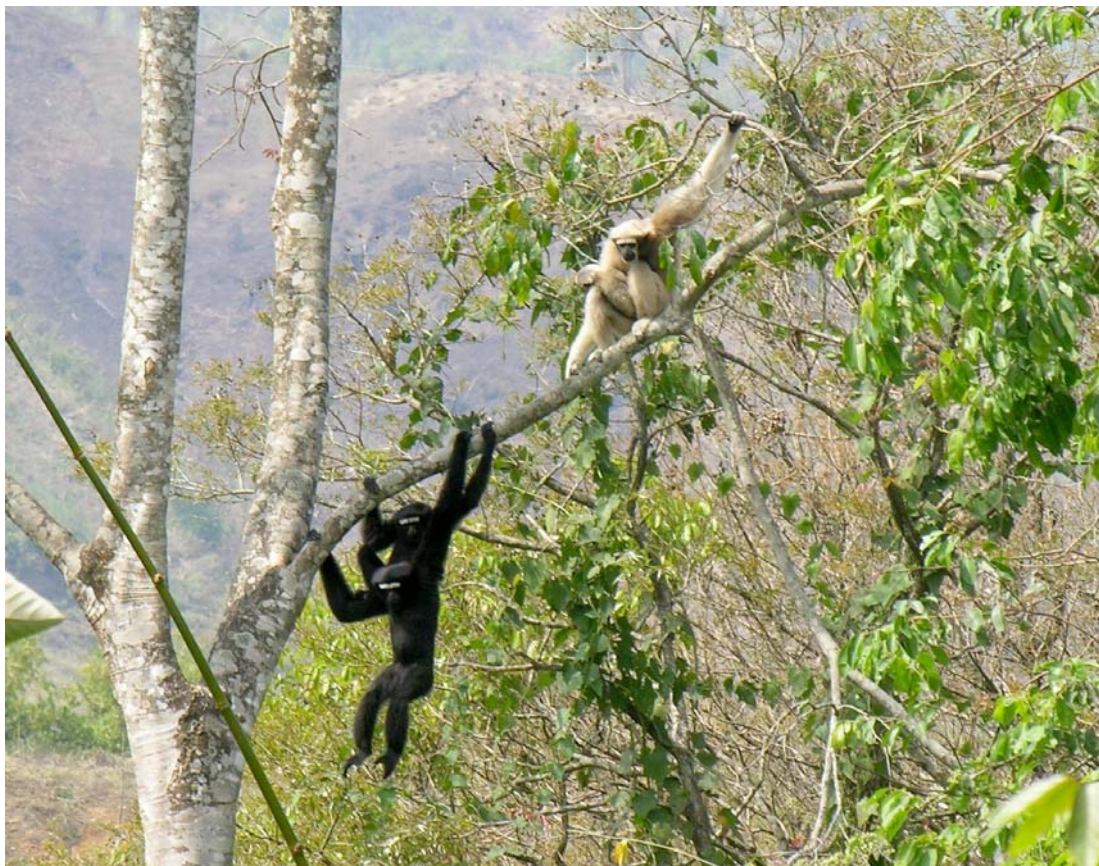


**Fig. 8.** Western hoolock (*H. hoolock*), adult male (left), and female carrying infant (right), Rakhine Yoma, Magway Division, Myanmar, 24 April and 14 May 2009, respectively. Photos: Ngwe Lwin.



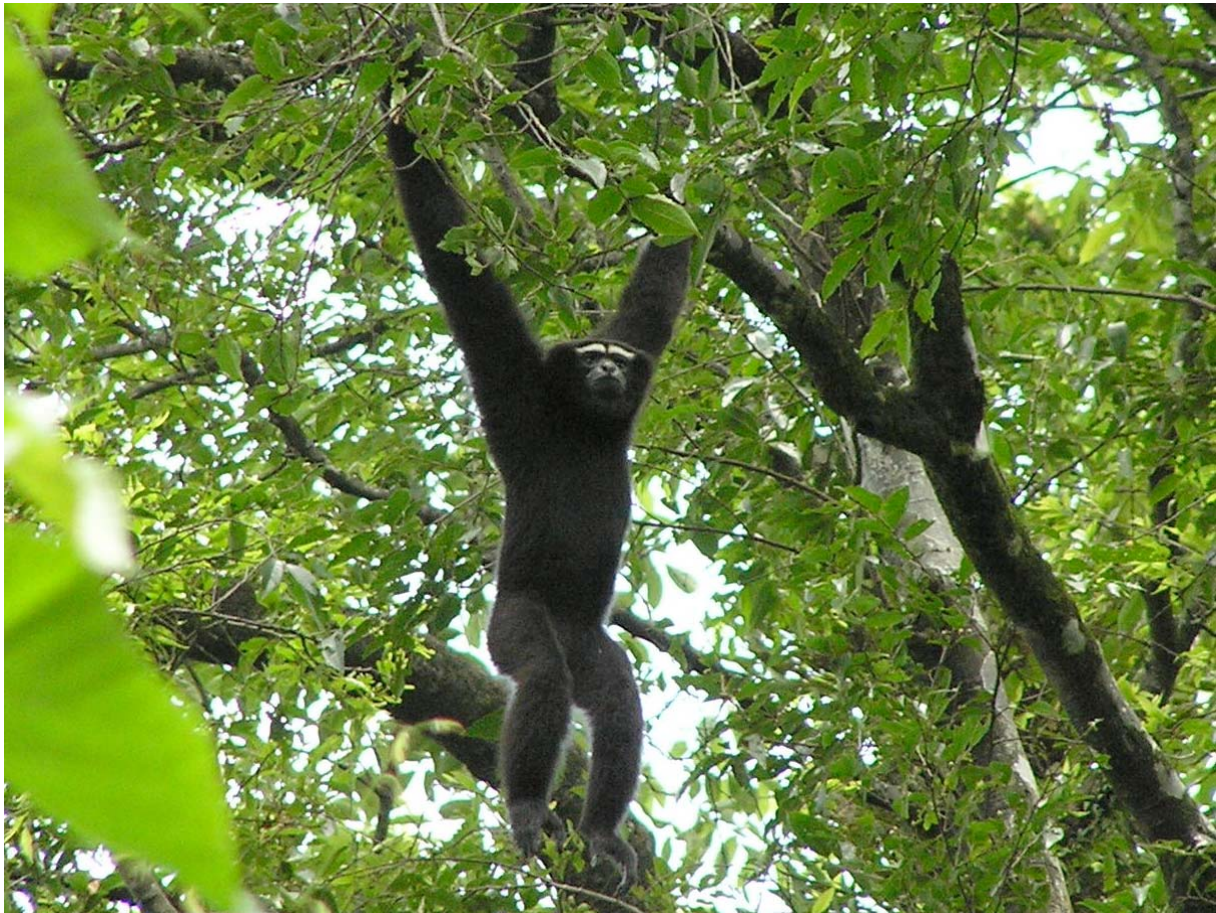


**Fig. 9.** Eastern hoolock (*Hoolock leuconedys*), adult male, Mehao Wildlife Sanctuary, Lower Dibang Valley District, Arunachal Pradesh, India, 6 April 2009. Photo: Jihosuo Biswas.

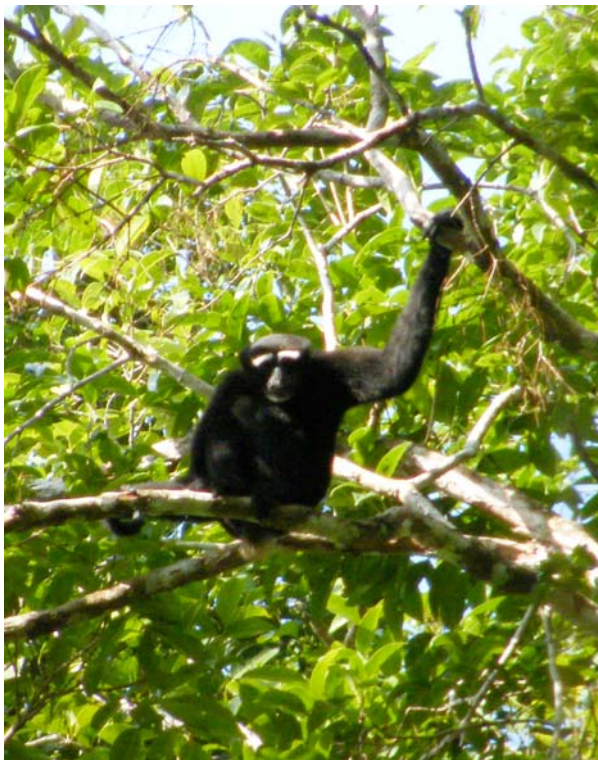


**Fig. 10.** Eastern hoolock (*H. leuconedys*), family group with destroyed habitat visible in the background, Mehao Wildlife Sanctuary, Lower Dibang Valley District, Arunachal Pradesh, India, 6 April 2009. Photo: Jihosuo Biswas.



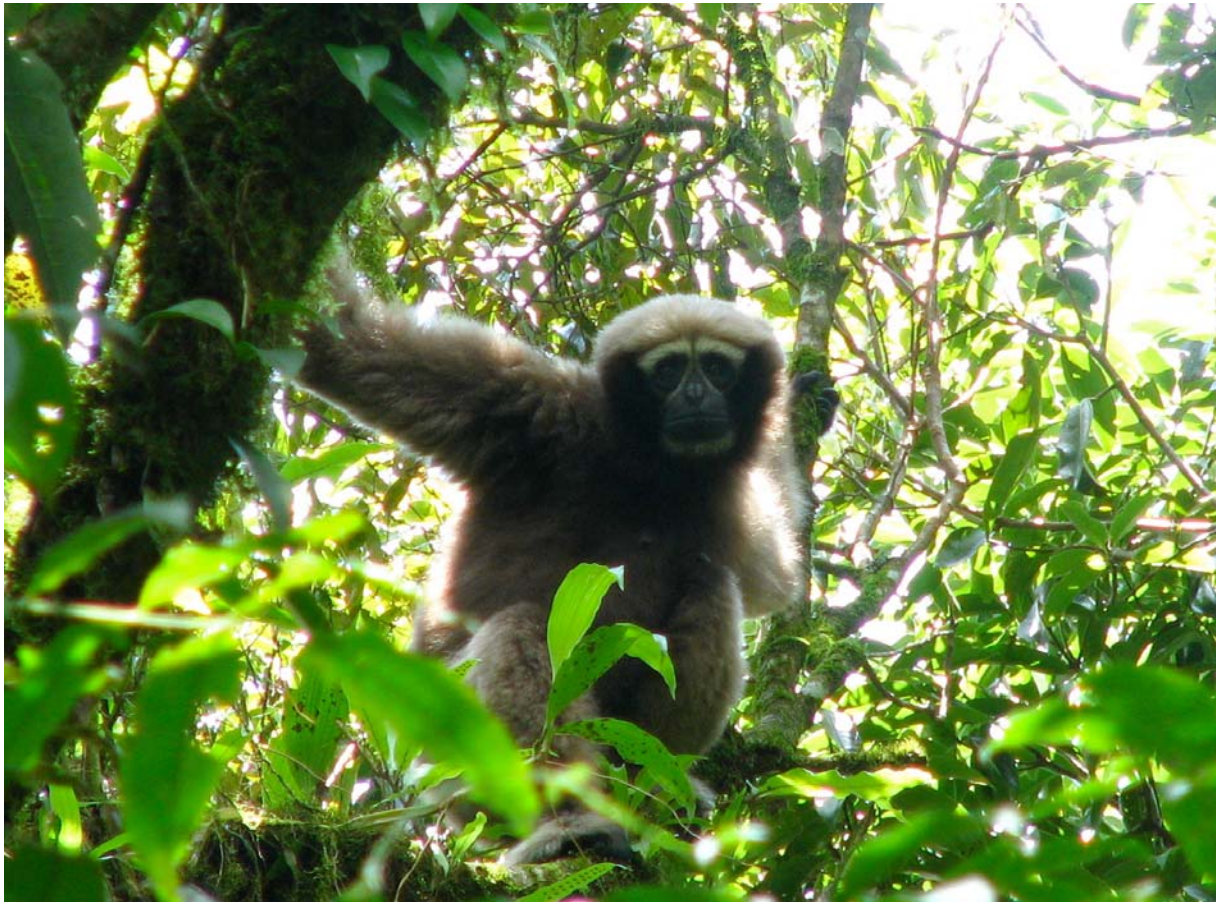


**Fig. 11.** Eastern hoolock (*H. leuconedys*), adult male, Turung Reserve Forest, Lohit District, Arunachal Pradesh, India, 16 Feb. 2006. Photo: Dilip Chetry.

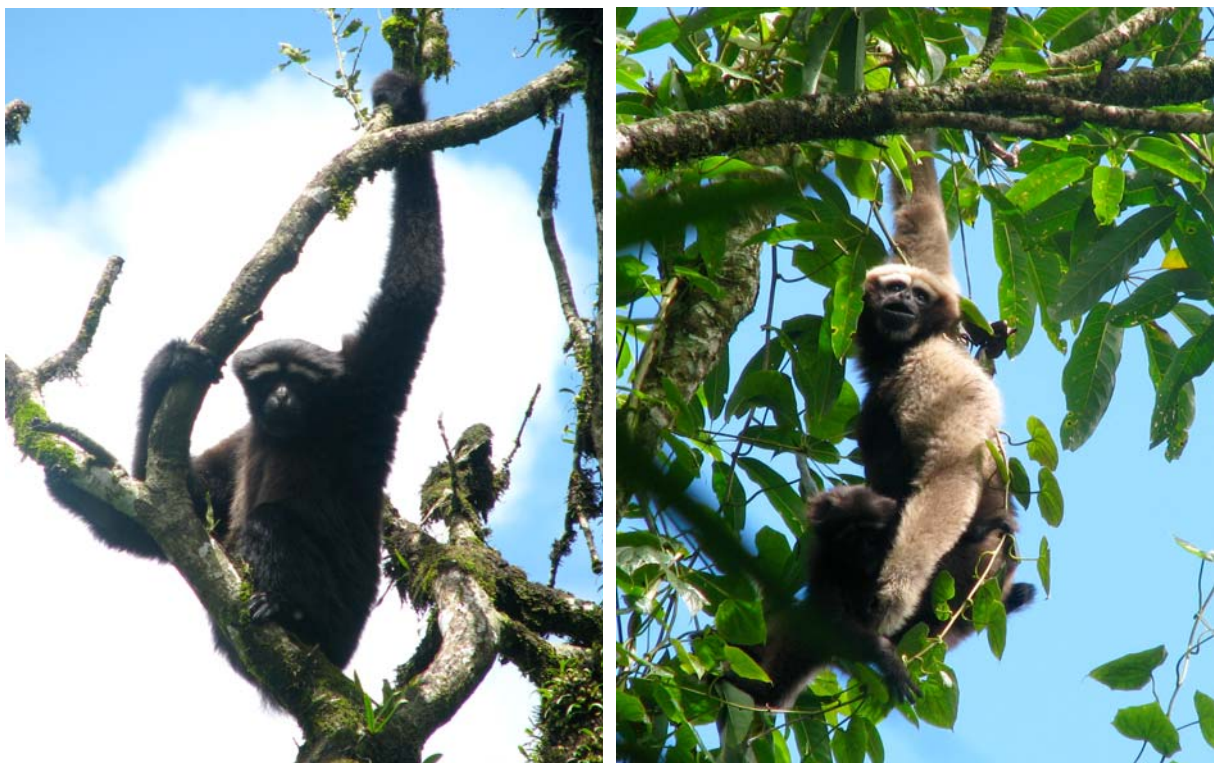


**Fig. 12.** Eastern hoolock (*H. leuconedys*). Left: Adult male, Ohnyan mountain range, Indawgyi Wildlife Sanctuary, Mohnyin District, Kachin State, Myanmar, 18 Jan. 2010. Photo: Ngwe Lwin. Right: Female carrying infant, Nantnint area, south of Indawgyi lake, Hkamti District, Sagaing Division, Myanmar, 10 Jan. 2010. Photo: Thet Naing Aung.



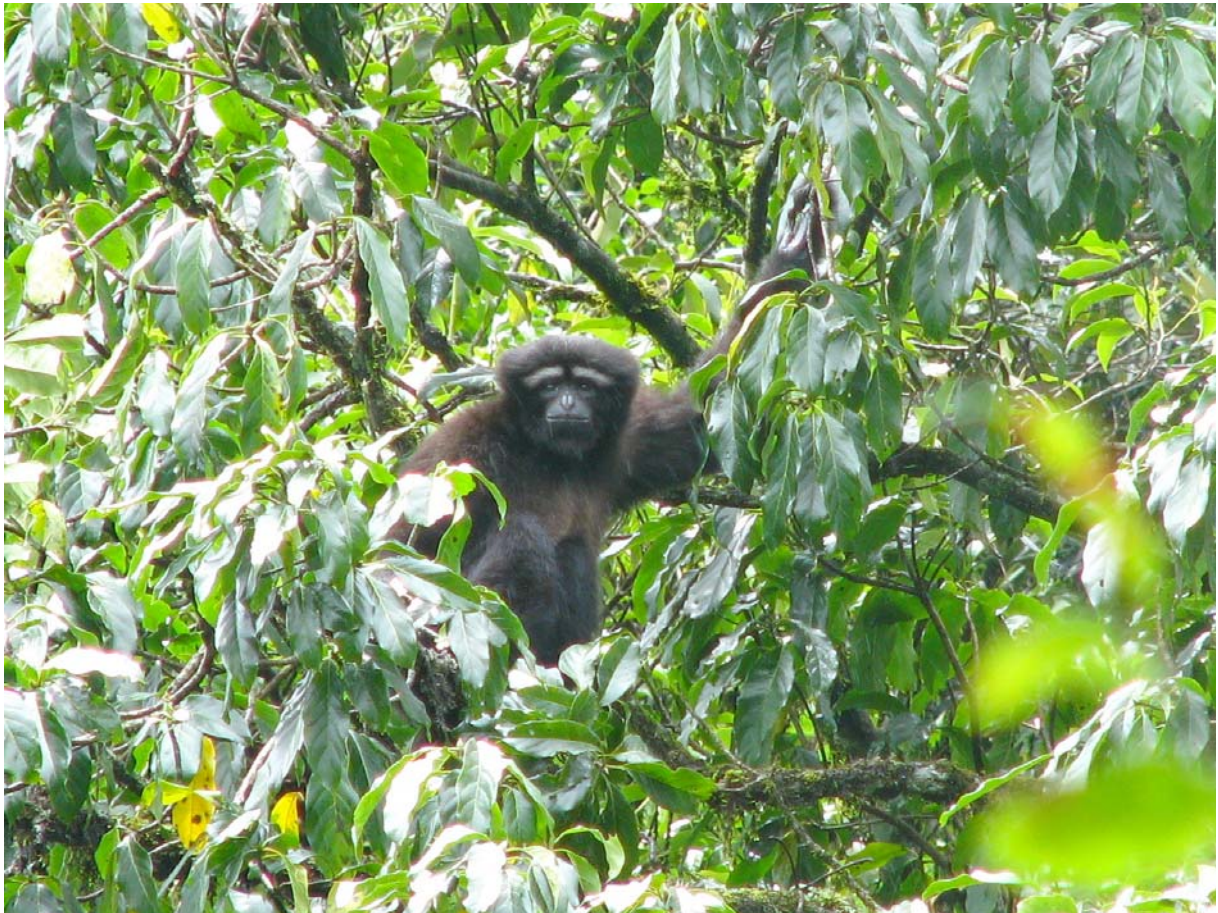


**Fig. 13.** Eastern hoolock (*H. leuconedys*), adult female, Gaoligongshan Nature Reserve, Yunnan Province, China, 27 July 2010. Photo: Fan Peng-Fei.



**Fig. 14.** Eastern hoolock (*H. leuconedys*), adult Male (left), and adult female carrying infant (right), Gaoligongshan Nature Reserve, Yunnan Province, China, 4 Aug. 2010. Photos: Fan Peng-Fei.





**Fig. 15.** Eastern hoolock (*H. leuconedys*), adult male in the rain, Gaoligongshan Nature Reserve, Yunnan Province, China, 5 Aug. 2010. Photo: Fan Peng-Fei.

## What is the Gibbon Conservation Alliance?

### Gibbon Conservation Alliance



#### Goals

The **Gibbon Conservation Alliance** (GCA) supports the active conservation of gibbons, promotes research on their natural history, and raises awareness on gibbons and their plight. The **GCA** is a non-profit organisation. The **GCA** always welcomes help and funds to continue its important work.

#### Main Activities

- Publication of the Gibbon Journal and the Annual Report of the **Gibbon Conservation Alliance**
- Maintenance of a Website providing information on the **Gibbon Conservation Alliance** and its activities
- Raising funds to support gibbon conservation projects
- Promoting awareness of gibbons and the need to make efforts towards their conservation, as well as providing research results on gibbons. This can be carried out through lectures, publications, website, etc.

#### Organisation

The **Gibbon Conservation Alliance** is a non-governmental organisation based in Zurich/Switzerland. Established in 2004, the **Gibbon Conservation Alliance** comprises a small group of volunteers that raises funds for the conservation of gibbons.

#### How Can I Become a Member?

By becoming a member or by making a donation, you are helping us raise awareness for, and realize, gibbon conservation projects. An electronic application is possible via our Website ([www.gibbonconservation.org](http://www.gibbonconservation.org)). An application form can also be found on the last page of this publication. Additional application forms and information can be obtained from the following address: **Gibbon Conservation Alliance**, Anthropological Institute, University Zurich-Irchel, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland; E-mail: [info@gibbonconservation.org](mailto:info@gibbonconservation.org)

#### Annual Membership Fees and Donations

Single member:	CHF 30.–
Students:	CHF 20.–
Bank address:	Raiffeisenbank Zürich, Limmatquai 68, CH-8001 Zürich, Switzerland

#### *Payments from Switzerland:*

Post account:	87-71996-7
Account Nr.:	6929305
Bankclearing/Bankleitzahl:	81487

#### *Payments from other countries:*

SWIFT-Code:	RAIFCH22
IBAN:	CH32 8148 7000 0069 2930 5

## How can I help the gibbons?

### Application

In order to apply to the **Gibbon Conservation Alliance** for membership, please fill out this form and send it to: **Gibbon Conservation Alliance**, Anthropological Institute, University Zurich-Irchel, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland. Please note that entries marked with a \* are mandatory.

**Annual membership fees:** Regular Member CHF 30.–, Students CHF 20.–

Title \*

☐

Mr

☐

Ms

Family name \*

First name \*

Affiliation

Street / Nr. \*

Zip code / City \*

Country

Phone number

E-mail

Remarks

**Thank you for helping us save the gibbons!**