

# REDISCOVERY OF THE CRITICALLY ENDANGERED EASTERN BLACK CRESTED GIBBON *Nomascus nasutus* (HYLOBATIDAE) IN CHINA, WITH PRELIMINARY NOTES ON POPULATION SIZE, ECOLOGY AND CONSERVATION STATUS

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## ABSTRACT

The Critically Endangered Eastern Black Crested Gibbon *Nomascus nasutus* is rediscovered in China. Acoustic records and direct observation confirmed gibbon occurrence in the Bangliang Limestone Forest of Jingxi County in Guangxi Zhuang Autonomous Region of southwest China, along the Sino-Vietnam border. We recorded a total of 19 gibbon groups including three family groups plus a solitary male over a five-day survey; all groups had two females in adult pelage and carried infants, and at least one group was bigynous with both adult females carrying infants. Vocalizations were concentrated in the early hours from dawn till 07:00, especially immediately after sunrise (71% of total song bouts). The average length of a song bout was 22.4 minutes ( $n = 14$  song bouts), and a single song bout comprised up to 11 female great calls. The Bangliang Limestone Forest constitutes about one-third of a contiguous transboundary limestone forest block, and two of the three groups were observed traveling between China and Vietnam, making collaborative transboundary conservation imperative. Priority conservation actions to preserve this population should focus on (1) establishing a protected area in Bangliang Limestone Forest; (2) forming a close working relationship with Vietnamese counterparts; (3) strengthening the enforcement of forest and wildlife protection regulations inside the gibbon forest; and (4) restoring degraded areas inside and around the gibbon forest to accommodate expected population expansion. Very little is known about the ecology of this species; a better understanding of its life with studies on its social, breeding and feeding ecology should be a priority.

**Keywords:** *Nomascus nasutus*, Eastern Black Crested Gibbon, China, Guangxi, survey, population, ecology, vocalization, conservation.

## INTRODUCTION

The crested gibbons of the genus *Nomascus* are restricted to moist forest of Indochina, and are amongst the least studied of the Hylobatidae (Preuschoft *et al.*, 1984). Their taxonomy is still in a state of flux. From north to south they include the Western Black Crested Gibbon *N. concolor*; the *nasutus* group, east of the Red River; the Northern White-cheeked Gibbon *N. leucogenys*; Yellow-cheeked Gibbon *N. gabriellae*. A fifth taxon, known as the Southern White-cheeked Gibbon *N. leucogenys siki* (or *N. siki*), intermediate between *N. leucogenys* and *N. gabriellae* in both distribution and several morphological/vocal/molecular characters, has been suggested to be of hybrid origin (see discussions in Brandon-Jones *et al.*, 2004; Groves, 2004; Roos, 2004). The occurrence of possible additional taxa within the *leucogenys*-

*gabriellae* complex has recently been suggested (e.g. Konrad & Geissmann, 2006; Ruppell, 2007), but more work has to be done to resolve the confusion.

Indochina has a long history of human settlement and forest-based warfare; thus many range countries of *Nomascus* gibbons are subjected to intense pressures from habitat loss and poaching. As such, all recognized crested gibbon taxa are globally threatened. The status of the world's gibbon species was reassessed during a recent Asian Primate Red List workshop held in Cambodia (Geissmann, 2007); while *N. hainanus* and *N. nasutus* are unequivocally recognized as the two most threatened living apes (and both Critically Endangered), *N. concolor* and *N. leucogenys* are also categorized as Critically Endangered, and *N. gabriellae* as Endangered.

## 1. Background of the Eastern Black Crested Gibbon *Nomascus nasutus*

Classification of the *nasutus* group of crested gibbons has been problematic and dynamic (Fooden *et al.*, 1987; Geissmann, 1989; Geissmann *et al.*, 2000; Geissmann *et al.* 2003; Nadler, 2003; Brandon-Jones *et al.*, 2004; Groves, 2004; Roos, 2004). Contemporary primatologists agree there are at least two extant *nasutus* gibbon taxa. The Hainan Gibbon (*N. nasutus hainanus*) is endemic to the island of Hainan, with a single population of less than 20 individuals (Geissmann & Chan, 2004; Chan *et al.*, 2005; Wu *et al.*, 2005; Zhou *et al.*, 2005); and work in progress suggest it merits species status. This would mean the Eastern Black Crested Gibbon (*N. n. nasutus*), which ranged at least from southwest Guangxi Zhuang Autonomous Region (hereafter Guangxi Province) in China to northeast Vietnam (Dao, 1983; Fooden *et al.*, 1987; Geissmann *et al.*, 2000), would also be a distinct species. Experts participated in the 2006 Asian Primate Red List workshop already recognized the two as distinct species, namely *N. hainanus* and *N. nasutus*.

Gibbons were believed exterminated in Guangxi since the 1950s (Tan, 1985). In Vietnam it was also feared extinct until scientists from Fauna & Flora International (FFI) rediscovered a population in the limestone forest of Phong Nam-Ngoc Khe Communes in the northernmost Trung Khanh District, Cao Bang Province, northeast Vietnam along the border with Guangxi Province, China. At least five gibbon groups with 26 individuals were counted in a survey conducted in August 2002 (Geissmann *et al.*, 2002 & 2003), and 37 individuals in eight groups were recorded in September 2004 (Trinh Dinh Hoang, 2004).

The first author and colleagues visited Trung Khanh to study the gibbons in October 2005 (Chan & Ng, 2006), and observed that the gibbons occur very close to the China border. An investigation of the area's satellite maps indicated that the forest extends across the border into Jingxi County, Guangxi Province. Shortly afterwards we started interview surveys to search for possible gibbon occurrence around the area in China. In May 2006, we received reports from locals of the Bangliang-Daxing

Villages in Jingxi County that gibbons still exist in a limestone forest area. At around the same time, research groups from FFI-China and Guangxi University visited the site; while they were unable to observe the gibbons, the latter group heard the gibbon calls, but it was not clear whether the gibbons they heard were within Chinese territory. With enough reliable information at hand, we conducted a survey in September 2006 to collect first-hand field data.

## 2. Survey Area

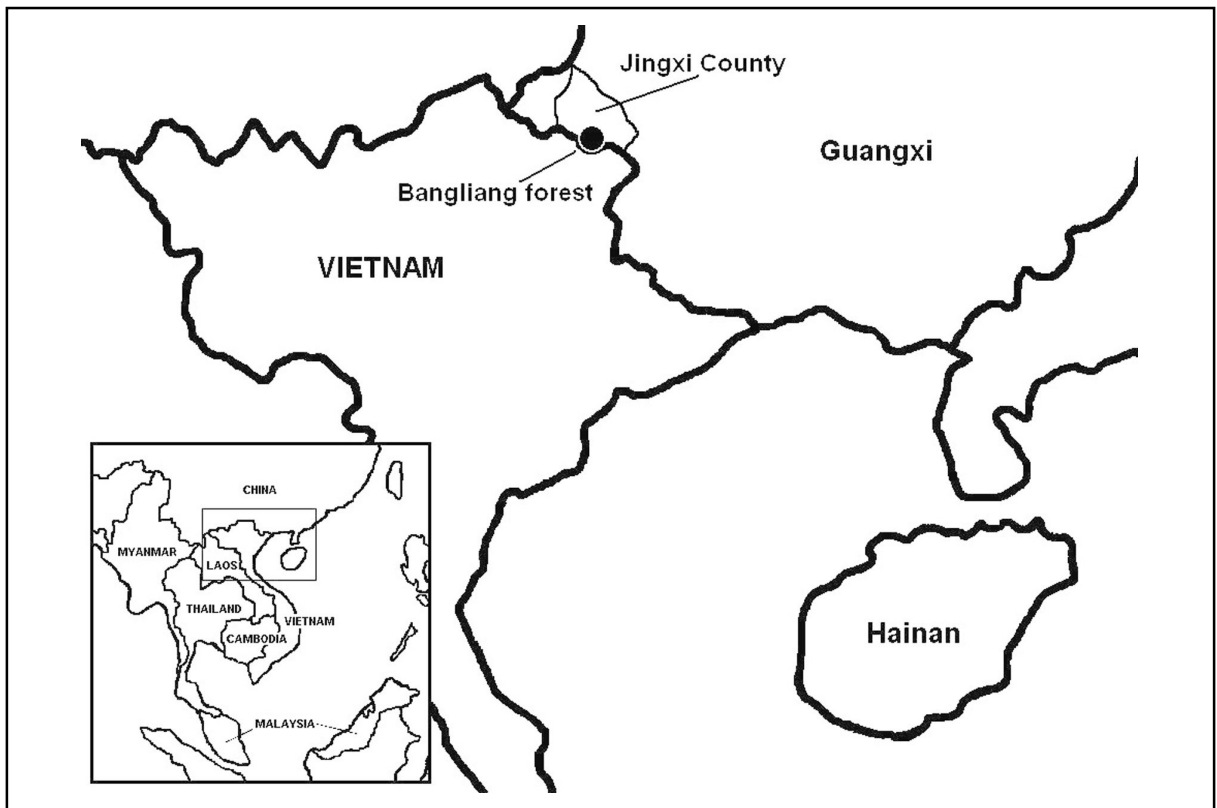
The Sino-Vietnam border area shared by Guangxi and the eastern part of Yunnan Province of China, and Cao Bang, Lang Son and Ha Giang Provinces of Vietnam, is dominated by karst limestone formations, which support one of the largest and most intact tropical karst mountain forest ecosystems in the world, but much of the forest in this area has been severely degraded by uncontrolled logging and agricultural encroachment, particularly in the 1980s-1990s. The zonal vegetation of the region is tropical limestone monsoon rainforest. About twenty years ago, the forest in southwest Guangxi was dominated by trees 25-35 m in height, dominant species including *Excentrodendron hsienmu*, *Cephalomappa sinensis*, *Garcinia paucinervis*, *Parashorea sinensis* and *Deutzianthus tonkinensis* (Su *et al.*, 1988). Vertical zonation of the plant community is not obvious due to the relatively low altitudinal range in the area. The region has a seasonal northern tropical monsoon climate with distinct wet (May to September) and dry (October to April) seasons. Annual mean temperature is c. 23°C, and the annual average rainfall is c. 1,500mm.

The survey area is the northern portion of a larger limestone forest complex shared by Jingxi County of Guangxi Province, China and Trung Khanh District of Cao Bang Province, Vietnam. The area has a picturesque karst landscape consisting of densely packed steep limestone outcrops interspersed with lowland depressions (called "Nong" or "Lung", by the same Long ethnic subgroup of the Zhuang minority in China and Vietnam, respectively), with an altitude range of c. 500-930 m asl. The forest block runs in a northwest-southeast direction, with two rivers acting as a natural boundary, merging where the forest ends in

Vietnam. The forest measures c. 12km at its longest and c. 4km at its widest, with a total area of c. 48km<sup>2</sup>; c. 18km<sup>2</sup> of it is within Chinese territory and the rest is on Vietnamese soil. Our survey area is surrounded by the Bangliang and Daxing Villages, to the west and east respectively (hereinafter Bangliang Limestone Forest; 22°55'N 106°30'E). Almost all valuable timber trees (e.g. *Excentrodendron hsienmu*) in the Bangliang Limestone Forest have been extracted and most other large trees were felled for charcoal production, therefore very little pristine forest remains. The current vegetation consists mainly of evergreen broadleaf forest with an average canopy height of less than 18m and a dbh of no more than 40cm, and climbing vines (e.g. *Tetrastigma planicaule* and *Gnetum hainanense*), sometimes covering extensive areas, are prominent elements in the area's flora. Fortunately, some of the gibbons' food plants (e.g. *Ficus* spp. and *Choerospondias axillaris*) are of little economic value, thus larger trees (up to 25m tall) can be found scattered around the area. Figure 1 illustrates the geographic location of the Bangliang Limestone Forest.

## METHODS

We conducted reconnaissance visits of the gibbon forest from June to August 2006, to understand gibbon ranging patterns and to determine the best observation posts. A full gibbon survey, with participants from Guangxi, Hainan and Guangdong provinces, was conducted between 11 and 15 September 2006, using primarily the fixed-point call-based method (e.g. Brockelman and Ali, 1987; Brockelman and Srikosamatara, 1993). Data collected during the morning auditory survey basically followed Geissmann *et al.* (2007). A total of 33 personnel were involved in the field survey; eight teams of two were posted at pre-selected vantage points on peaks or ridges roughly 500 m apart, and the type and timing of all gibbon vocalizations were recorded from predawn (i.e. c. 06:00) to 11:00 on five consecutive mornings. All eight teams had at least one member with prior experience (mainly with the closely related Hainan Gibbon) in surveying wild gibbons. An additional six teams, with basic training on identifying gibbons and their calls prior to the survey, conducted various biodiversity studies



**Figure 1.** Geographic location of the Bangliang Limestone Forest, Guangxi Province, China.

**Table 1.** Gibbon observation events in the present survey. Group composition: AM = Adult male; AF = Adult female; SJ = Subadult/juvenile; IN = Infant. Coordinates were recorded using hand-held GPS.

Date	Duration	Distance between observers and gibbons (m)	Group composition (number in each age-sex class)	Coordinates
11-Sept	17:45-17:49	300	AM(1), AF(1), SJ(2), IN(2)	--
12-Sept	10:06-10:26	200	AM(1), AF(1),IN(1)	22°55'23.0" N, 106°29'52.9" E
12-Sept	10:11-11:13	400	AM(1), AF(1), SJ(2)	22°55'43.8" N, 106°30'16.3" E
13-Sept	08:06-08:28	150	AM?(1)	22°55'15.4" N, 106°30'47.9" E
14-Sept	06:45-07:01	150	AM(1), AF(2), SJ(3), IN(2)	22°55'48.3" N, 106°30'11.7" E
14-Sept	07:02-07:24	800	AM(1), AF(2), SJ(3), IN(2)	22°55'46.3" N, 106°30'13.8" E
14-Sept	07:15-07:45	200	AM(1), AF(2), SJ(3), IN(1)	22°55'15.4" N, 106°30'47.9" E
14-Sept	15:30-16:20	70	AM(1), AF(2), SJ(3), IN(2)	22°56'02.6" N, 106°30'15.4" E
15-Sept	08:30-08:43	300	AM(1), AF(2), SJ(3), IN(2)	22°56'02.6" N, 106°30'15.4" E
15-Sept	10:05-10:21	50	AM(1), AF(2), SJ(3), IN(1)	22°55'14.6" N, 106°30'49.3" E

in the same vicinity, covering a larger distance within the forest each morning, and they collected gibbon sighting/vocal data whenever gibbons were detected. All team members also conducted fieldwork each afternoon within the gibbon forest during the survey period, and therefore our survey covered the full active hours of gibbons. A one-day training, based on materials collected during the Trung Khanh visit by the first author, on gibbon recognition and vocalization was delivered to all participants, and standardized record sheets provided prior to the survey to ensure accuracy of data collected. Minimum population size was estimated by triangulation of vocalization data and confirmed with direct observations. Behavioral data was collected by the more experienced team members during morning fixed-point survey or opportunistic encounters.

RESULTS

During the survey period, the weather was cool (nighttime temperature down to 13°C) but sunny. The time of dawn was around 06:15, and time of sunrise was around 06:30. A total of 14 song bouts were heard (excluding the uncertain and extremely brief solo male calls), and gibbons were observed directly on ten occasions (Table 1). Based on locations of observation/vocalization, overlapping song bouts, and group composition, three groups, including one group with eight individuals, one group with seven, and a group consisting of a pair and their single infant, plus a solitary male, could be confirmed, making a total of 19 individual gibbons (Table 2).

1. Vocalizations

A male solo song from far away (>1km) was heard for eight minutes between 17:20 and

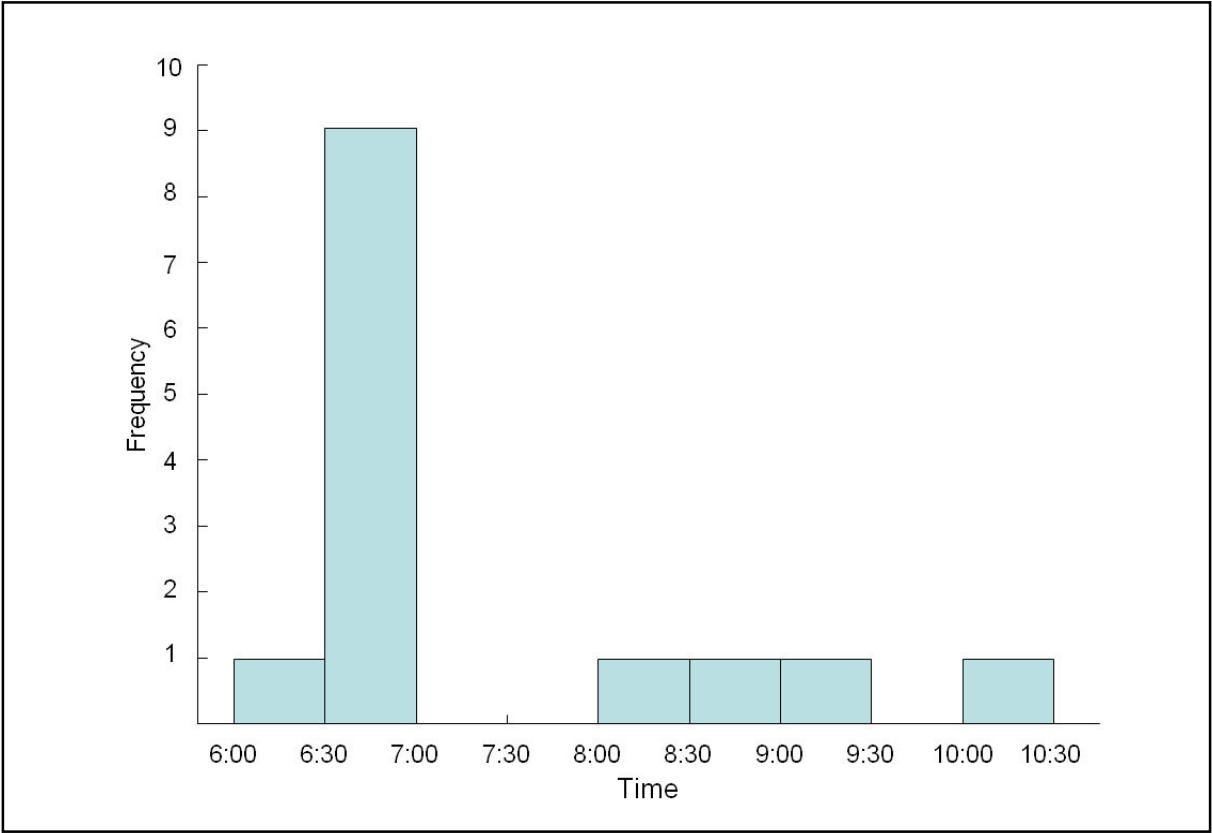
**Table 2.** Gibbon group composition recorded in the present survey.

	Group composition				Total no.
	Adult males	Adult females	Subadults/Juveniles	Infants	
Group A	1	2	3	1	7
Group B	1	1	--	1	3
Group C	1	2	3	2	8
Total no.	3	5	6	4	18

17:28 on 10 September 2006, but the timing was outside *Nomascus gibbons'* normal calling hours and the listeners were uncertain due to the long distance. There was a solitary male emitting an extremely brief solo call on two days (11 and 14 September), lasting for only one minute each time. These records are not included for the following analysis.

A total of 14 song bouts were heard during the survey period. The gibbon groups produced morning songs on all days during the study period. We heard all three groups plus the solo male call on 14 September 2006, and only Group A was heard on 15 September. Daily song bout frequency ranged from one to four song bouts (12 September) per day. Vocalization started just after dawn; the earliest song bout started at 06:28 on 15 September, and the last one at 10:06 on 12 September, with a peak during the first 30 minutes after sunrise (71.4% of total song bouts,  $n = 14$ ). Figure 2 illustrates the frequency distribution of the start time of vocalization for *Nomascus nasutus* in Guangxi.

On some occasions, the male started a solo but the female was reluctant to contribute, and it took the adult male of Group A 14 minutes to induce the female to begin a great call on 14 September 2007. In comparison with the Hainan Gibbon, with which the survey team has much experience, the Eastern Black Crested Gibbons' elaborate song appears to be longer. Duet song bouts lasted for 22.4 minutes on average ( $n = 14$  song bouts), and varied from 9 minutes (Group C at 06:58-07:07 on 11 September) to 38 minutes (Group B at 09:12-09:50 on 12 September). The song duration is much longer than those documented for the *Nomascus "siki"* of Bach Ma National Park, which averaged seven minutes (Geissmann *et al.*, 2007), and those of Phong Nha-Ke Bang National Park, which averaged c. 13 minutes (Ruppell, 2007). Females participated in the duet more frequently in comparison to the Hainan Gibbon (Bosco Chan, unpubl. data), with a maximum of 11 great-call phrases recorded during a single song bout of Group C, on 12 September 2006 between 06:50-07:11.



**Figure 2.** Frequency distribution of the start time of vocalization for *Nomascus n. nasutus* in Guangxi Province, China ( $n = 14$  song bouts). First arrow at bottom is the average time of dawn, second arrow the average time of sunrise.

As with other gibbons, e.g. the Hainan Gibbons (Bosco Chan, unpubl. data) and the Javan Gibbons (Haag, 2007), the whole family participated in a song with much shaking of branches and brachiating during the female great calls. This activity was video-taped during our survey.

## 2. Movement Pattern

Gibbon groups traveled between China and Vietnam, at least for Group A and Group C. On 14 September, Group C was observed by two different observation teams moving from China towards Vietnam in the early morning after their first vocalization of the day (06:45 by the first team, then 07:02 by the second team). The gibbon group moved out of sight from 07:24, but returned from Vietnam via the same route at 15:30 on the same day, feeding on a fruiting *Choerospondias axillaris*, and possibly spent the night on nearby sleeping trees. The same group was observed again at the same spot in the following morning at 08:30. Although Group A was only sighted from one observation post close to the international border inside Chinese territory, the same observation team heard it from as close as 200m (on 11 and 13 September) to as far as over 1km on the intervening date, which means the group is most likely to have a home range which transverses international boundary, but it cannot be confirmed due to the complex topography of its home range, and the uncertainty of where the actual international border lies. Our data suggest there are two peaks for feeding activity; one in the early morning after the first morning song, and another from 15:30 probably until the time they retreat into their sleeping trees.

## 3. Inter-group Interaction

It was interesting to observe neighboring gibbon groups interact when singing. Groups A and C have their territory boundaries in a lowland depression and when one group started calling, the other, if present in the same general area, would start singing soon and both groups approached each other while continuing to sing. On one occasion, Group C started singing close to their common boundary, and when Group A heard its neighbor singing close to its territory it started to sing from the other side of

the mountain and the whole group quickly climbed over the mountain, approaching Group C to a minimum distance of c.200 m. When Group C finished the song bout, Group A did not remain at the conflict zone for long and swiftly moved uphill, disappearing back to the other side of the mountain, where the group might have resumed feeding.

## 4. Sympatric Animals

At our study site a total of four primate species were present; we also observed the Rhesus Monkey *Macaca mulatta* and the Assam Macaque *Macaca assamensis* in the wild during our survey, and local people reported that the Francois's Leaf Monkey *Trachypithecus francoisi* also occurs in the region, but only on outcrops with cliffs and caves. Although some of the observation posts were situated in areas with such landscape features, we were unable to locate the leaf monkeys during our short survey. The survey team also recorded the Maritime Striped Squirrel *Tamiops maritimus*, Red-bellied Squirrel *Callosciurus erythraeus*, Black Giant Squirrel *Ratufa bicolor* and the Masked Palm Civet *Paguma larvata*, as well as droppings of a flying squirrel on tree branches. In addition, villagers reported the presence of Asian Palm Civet *Paradoxurus hermaphroditus* and a second species of flying squirrel. All the above are frugivorous/herbivorous and may compete with the gibbons for food. Two large mammalian predators, the Asiatic Black Bear *Ursus thibetanus* and the Leopard *Panthera pardus*, are reported to be present. Presence of the Asiatic Black Bear was confirmed by the survey team, with evidence of fresh claw marks and feeding signs. At the predawn period on 13 September 2006, one of our teams heard a big animal traveling on trees and breaking branches. A group of Rhesus Monkeys was seen with the first light from the source of the sound and the local guide suggested that it was a leopard hunting the troop of macaques.

## DISCUSSION

Based exclusively on interview results and remains of skins from animals reported to be hunted locally, gibbons were said to occur along the Sino-Vietnam border of Guangxi's Longzhou, Daxin, Jingxi and Napo counties in

the fairly recent past (e.g. up to the 1950s) (Tan, 1985; Zhang, 1997). As far as we are aware, however, there has been no definitive field-based scientific record of wild-living gibbons from Guangxi in modern times, and the source of the original claim (see Tan, 1985, followed by Fooden *et al.*, 1987 and subsequent workers) appears not substantiated. Our result is thus of considerable value to ascertain the distribution of gibbons in this province, making Guangxi the fourth province in China (after Hainan, Yunnan and Tibet) supporting extant gibbon populations. However, there is ambiguity in exactly where the international border lies at the local scale, and it is possible that our survey data includes some gibbon groups/individuals from Vietnam. This is, however, not the highest concern, as the gibbons are living on the international border and failure to protect the gibbons and their habitat from either side of the tiny forest block will effectively jeopardize the population as a whole.

Our survey covered an area of c. 6km<sup>2</sup>, and we found three groups of 18 individuals. Using a very crude calculation we estimated a density of 0.5 gibbon groups/km<sup>2</sup> within the existing habitat, which has been under considerable human disturbance. Our survey timing seems to have been very appropriate to survey for gibbons (at least for this species), as the gibbon groups were observed and produced morning songs on all days during the study period, and they were encountered opportunistically several times during afternoon transect walks, suggesting September may be a high-activity month for the gibbons. Unfortunately, because of the brevity of survey time, local topography and dense vegetation, we were unable to identify many of the gibbons' food plants, but they were seen feeding on fruits of *Ficus* spp., *Choerospondias axillaris* and various climbing vines. During our visit to Trung Khanh, we observed the gibbons feeding on the fruits of *Caryota urens* and *Bridelia fordii*.

## Conservation

Prior to our discovery, the Bangliang Limestone Forest was not considered a priority site for conservation, although the national logging ban on natural forest and rifle confiscation campaign appear to have curbed rampant

forest clearance and poaching. In fact it is still not a legally protected area and a formal management structure is still lacking, in spite of regular patrolling to combat illegal activities by the county authorities. During our survey, hunting did not seem to be a major issue as game animals such as civets, macaques and squirrels were still regularly seen, as were large predators such as the Asiatic Black Bear and (possibly) Leopard. In addition, we did not find any signs of hunting activity.

On the other hand, removal of large trees, mainly for illegal charcoal production, must be immediately stopped because the abundant food sources these few remaining large trees provide is vital for the continued survival of the gibbons. The gibbons at Bangliang appear to be breeding well and the population should increase should the gibbons and their habitat be saved from further human disturbances. This leads to another problem which must be tackled with some immediate actions, because of the time it takes to be effective; the size of suitable forest in the Bangliang Limestone Forest is limited and less than 10km<sup>2</sup> is currently of good enough quality to support gibbons - by our crude estimation, enough to support no more than five groups. The rest, at the periphery of the forest core surrounded by villages, is poor-quality shrubland subjected to regular human disturbances. Even within the small patch of good forest many of the lowland depressions have been severely logged, either as raw material of charcoal or as fuel for charcoal burning, and a rather large depression deep inside the gibbon range is currently under cultivation as maize fields. Straight after the five-day survey, part of our survey team did a reconnaissance visit in adjacent areas of limestone forest, which turned out to be interspersed by extensive fields, hundreds of households, village roads and a few highways, and the hillsides are at their most degraded stage (what limestone scientists term "rock desertification"). Because of the geology and landscape, karst habitats are fragile ecosystems and particularly susceptible to degradation. Forest restoration in these degraded areas, as well as better protection of the peripheral buffer zone, are thus important if the gibbons' future population is not to be limited by habitat

availability. Much can be learned in this regard from the reforestation experience around the Hainan Gibbon habitat at Bawangling, Hainan Island, which is a collaborative project of KFBG and Bawangling National Nature Reserve (Fellowes *et al.*, this volume).

In addition to the immediate surroundings of Bangliang, there are ten protected areas along the Sino-Vietnam border in Guangxi Province (Chunxiu, Defu, Diding, Dizhou, Encheng, Gulongshan, Laohutiao, Nonggang, Qinglongshan and Xialei), and eight of them (all except Defu and Diding) cover similar limestone ecosystems (although it is doubtful the Eastern Black Crested Gibbon is a limestone specialist). Most of these reserves are small and isolated from each other, and there is an urgent need to step up protection of these reserves and ensure habitat continuity between them. Bangliang Limestone Forest constitutes about one-third of a contiguous transboundary limestone forest block, and two of the three groups were observed traveling between China and Vietnam, making collaborative transboundary conservation imperative. It should be borne in mind that the thriving gibbon population on the Vietnamese side is "locked in" by the two branches of a large river flowing from China southwards into Vietnam, which effectively prevent the gibbons from expanding further into Vietnam. Thus the population, should it increase, could expand only into China, making the restoration of habitat there more crucial. Very little is known about the ecology of this species; for instance no formal study has been conducted on its feeding ecology, and we do not even have a food plant checklist for such a critically endangered species. A better understanding of its life, with studies on its ecology and social, breeding and foraging behavior should be a priority. Chan & Ng (2006) provided a preliminary checklist of its (potential) food plant species based on a quick survey at Trung Khanh, and work is in progress to more thoroughly describe the species' habitat characteristics and potential food plants based on botanical studies in both China and Vietnam (Ng & Chan, in prep.).

Priority conservation actions to preserve the apparently healthy population of the Eastern Black Crested Gibbon should focus on (1)

establishing a protected area in Bangliang Limestone Forest in the immediate future; (2) forming a close working relationship with Vietnamese counterparts, both at government and NGO levels; (3) strengthening the enforcement of forest and wildlife protection regulations in the gibbon forest and its buffer zone; and (4) restoring degraded areas inside and around the gibbon forest to accommodate expected population expansion.

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