

Hoolock gibbon and biodiversity survey and training in southern Rakhine Yoma, Myanmar: Preliminary report

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Myanmar Primate Conservation Program, BANCA, FFI, PRCF and Yangon University

Yangon, December 2008



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Cover: Western Hoolock Gibbon, *Hoolock hoolock*, adult female (Photo: Thomas Geissmann)

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Abstract

This is a report on a training course introducing the methodology to be used in the Hoolock Gibbon Status Review project (of the Myanmar Conservation Program), which was field tested on a short hoolock gibbon and biodiversity survey in southern Rakhine Yoma, south-west Myanmar. The survey served to fine-tune skills learned by course participants, and as a test run for the project which aims at assessing the status of the hoolock gibbons (genus *Hoolock*) in Myanmar. Although the country still holds large intact areas of prime gibbon habitat and is believed to support the largest remaining populations of hoolock gibbons, there is no significant data on the conservation status of the species in Myanmar. This first survey was carried out during the dry season (November 2008) in southern Rakhine Yoma. The study confirms the occurrence of hoolock gibbons in what appears to be the southernmost locality recorded so far, and supports their identification as Western Hoolock Gibbon (*Hoolock hoolock*). Hoolock gibbons were confirmed present in very low densities, and several possible explanations for this finding are discussed. However, the main reason for the low density is believed to be low habitat quality. As a further result of the survey, several mammal and bird species were confirmed for the first time for this region of Myanmar, and a potentially new fish species was observed.

Introduction

Hoolock gibbons

Hoolock gibbons (genus *Hoolock*) are distributed 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.

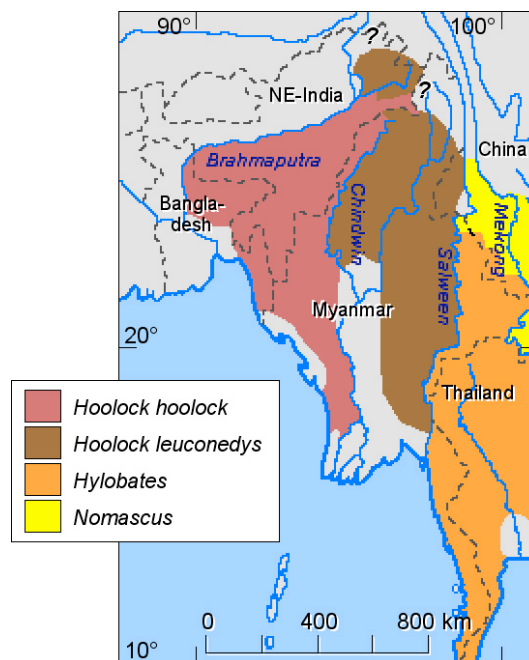


Fig. 1. Distribution of the hoolock gibbons (genus *Hoolock*) and gibbons of the genera *Hylobates* and *Nomascus* in adjacent areas.

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, 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 or variable population. Moreover, a population of *H. leuconedys* was discovered in Arunachal Pradesh, north-east India (Chetry *et al.*, 2008; Das *et al.*, 2006), which has traditionally been considered to be part of the distribution area of *H. hoolock*. As a result, gibbon populations in south-eastern Tibet are yet to be determined.

Of all gibbons, the range of the hoolock gibbons extends the farthest north and west, and it is the only genus of apes represented in the Indian sub-continent. Hoolocks are found in several types of habitats: tropical evergreen forest, the wetter tropical semi-evergreen forests, sub-tropical monsoon evergreen broadleaf forests, and sub-tropical evergreen broadleaf hill or mountain forests. They appear to be less common in deciduous forest and scrub forest, and absent from mangrove (Choudhury, 1996; Gittins and Tilson, 1984; Lan, 1994).

Although hoolock gibbons occur from the floodplains to the mountains, they appear to be more common at altitudes of 80-1500 m (Choudhury, 1996; Mukherjee, 1986). They have been recorded up to 2,550 m in Manipur, north-east India (Choudhury, 2001). In Myanmar, hoolocks also occur at higher altitudes. On the slopes of Mt. Victoria (Chin State, western Myanmar), they were observed at elevations of 2,100-2,300 m (King *et al.*, 1995). During the Vernay-Cutting expedition to north-eastern Myanmar, hoolocks were also observed in pine dominated forests at altitudes of up to 2,400-2,700 m (Anthony, 1941).

Previously found throughout the forests of its present range, deforestation and hunting have exterminated hoolock gibbons from much of their historical range. From an original ranging habitat of about 168,000 square kilometres, available habitat in 1987 was estimated at no more than 56,378 square kilometres, representing a 67 percent habitat loss (Feeroz and Islam, 1992).

Hoolock gibbons have experienced a drastic population decline. The 1971 and 1972 Zoological Survey of India census of primates estimated that the population of *H. hoolock* in Assam was between 78,000 to 80,000 individuals in north-east India (Chivers, 1977), whereas the present population there is estimated to be about 2,400 animals (Das *et al.*, 2006; Molur *et al.*, 2005). Other recent population estimates for *H. hoolock* include 200-280 individuals of *H. hoolock* in Bangladesh (Islam *et al.*, 2006; Molur *et al.*, 2005), whereas numbers for *H. leuconedys* include 50-300 individuals in China (Lan, 1994; Tian *et al.*, 1996; Zhang, 1998; Zhang *et al.*, 2002) and about 170 *H. leuconedys* in India (Das *et al.*, 2006).

Reasons for such decline have included rapid habitat loss and habitat fragmentation (shifting cultivation, logging), hunting (food, traditional “medicine”), lack of environmental awareness and education, and the absence of conservation measures (Feeroz and Islam, 1992; Geissmann, 2007). Habitat fragmentation forces gibbons to descend from trees to go across forest clearings, making them even more vulnerable to hunting and predation. Indeed, in some Indian locales, hoolocks are rare due to large scale hunting for food intense hunting of gibbons by local tribes is reported in Assam (Choudhury, 1991), and gibbon meat and bones are quite valuable as a tonic in some traditional Asian medicines. There is some evidence to suggest that hunting for the wildlife trade also occurs at extremely high levels in Myanmar (Rao *et al.*, 2002).

Myanmar is among the most biologically diverse countries in mainland Southeast Asia. In contrast to its neighbours, large areas (about 30%) of Myanmar are still forested, providing a unique opportunity to conserve biodiversity within protected areas (Rao *et al.*, 2002). At present, Myanmar potentially supports the largest remaining populations of either hoolock species. However, gibbons in Myanmar remain largely unstudied, and there are several thousand square kilometres of unsurveyed habitat. There are no population estimates of *H. hoolock* available. For *H. leuconedys*, a population census was conducted in Mahamyaing Wildlife Sanctuary (WS), Sagaing division (Brockelman, 2005; Gibbon Survey Team, 2005), and some surveys were conducted by Wildlife Conservation Society (WCS) in Hukaung Valley WS, Kachin state (Saw Htun, pers. comm. to TG, 2006). Based on vocal surveys, there are approximately two groups per square kilometre in Mahamyaing WS, with a total population of about 5,900 individual gibbons (Brockelman, 2005). Based on that result, the total population of *H. leuconedys* in Myanmar may be over 10,000 individuals, and perhaps up to 50,000 individuals (Brockelman, pers. comm., cited in Geissmann, 2007).

However, beyond the two surveys mentioned above and some presence/absence data from a few general biodiversity surveys in protected areas, no additional data on the status of hoolock gibbons in Myanmar exists. The species has been identified as a priority for conservation in Myanmar (Tordoff *et al.*, 2005), with the immediate priority being the conduct of a status review. A status review is deemed critical for identifying, prioritizing, and planning conservation interventions to enhance options for the long-term survival of the Myanmar population of hoolock gibbons.

Background to the project

The first Rakhine Yoma gibbon survey presented in this report is part of the Hoolock Gibbon Status Review project (of the Myanmar Conservation Program) implemented jointly by the People Resources and Conservation Foundation (PRCF), Fauna & Flora International (FFI), the Myanmar Biodiversity and Nature Conservation Association (BANCA) and the Zoology Department of the University of Yangon.

The project aims to assess the conservation status of the hoolock gibbon in Myanmar, while strengthening the capacity of the conservation movement in primate surveying, monitoring, and conservation. Globally, hoolock gibbon populations are dwindling due to forest clearance, disturbance, and hunting. Myanmar still holds significantly large and intact areas of prime habitat for hoolock gibbons, but there is no significant data on the conservation status of these apes.

A comprehensive review on the conservation status of the species will help identify, prioritize, and plan conservation interventions to boost options for the long-term conservation of hoolock gibbons. The proposed project will help initiate hoolock gibbon conservation efforts, by increasing the knowledge on the distribution and relative abundance of this species in Myanmar.

Through surveys and analysis of gibbon population status, the project will identify major threats to gibbon populations in Myanmar and raise awareness among stakeholders regarding conservation needs for the species. To ensure sustainability of project outcomes, specialists in the project will train counterpart staff from the local non-government 'Biodiversity and Nature Conservation Association' (BANCA) and the Zoology Department of Yangon University.

Materials and methods

A program and itinerary of this survey are listed in Table 1.

Table 1. Program of the training workshop and survey.

Date	Topic	Days
21-23 Nov	Training workshop in Yangon	3
24 Nov	Move from Yangon to Chaung Tha, Rakhine province	1
25 Nov	Walk to forest, select camp site, and establish listening posts	1
26-30 Nov	Field survey work, and interview work (29-30 Nov)	5
30 Nov – 1 Dec	Return from Chaung Tha, Rakhine province, to Yangon	1
2-5 Dec	Analyse results and write report	2
Total		13

Training

As an introduction to the Hoolock Gibbon Status Review project, a training workshop was held in Yangon on 21-23 Nov 2008 (Fig. 2). The participants included lecturers and students from Yangon University (13), Western Yangon University (2), Pyay University (1), Dawei University (1), local NGO staff from BANCA [Biodiversity and Nature Conservation Association] (3), and the Rakhine Coastal Association (1).



Fig. 2. Training workshop held at the beginning of the Hoolock Gibbon Status Review project in Yangon, 21 Nov 2008. Photo: Thomas Geissmann.

Training topics included:

- Introduction to this project, to FFI, and to PRCF (Frank Momberg, Mark Grindley)
- Introduction to conservation issues in Myanmar: Priority areas, species and threats (Dr. Htin Hla)
- Summary of Mahamyaing Wildlife Sanctuary Gibbon Survey WCS (Pwint Thu Aye)
- Distribution of long-tailed macaques in some areas of Myanmar (Dr. Aye Mi San)
- What are gibbons? Introduction to gibbon biology (Dr. Thomas Geissmann)
- Gibbon conservation issues (Dr. Thomas Geissmann)
- Status review method (Frank Momberg)
- Introduction to hoolock singing behaviour, with sound and video examples (Dr. Thomas Geissmann)
- Survey techniques for gibbons (Dr. Thomas Geissmann)

- Getting familiar with hoolock gibbons and selected key species at the Yangon Zoo (Dr. Thomas Geissmann)
- Introduction to compass and GPS handling (Mark Grindley)
- Interview techniques (Mark Grindley, Frank Momberg)
- Health and safety / first aid training (Dr. Htin Hla, Mark Grindley)

Additional training sessions in interview techniques and compass and GPS handling was provided during the field survey (Fig. 3), and a training session in plotting and triangulation gibbon song data and estimating gibbon group densities was held after the survey on 2 Dec 2008 in Yangon.



Fig. 3. A training session on interview techniques held at the field camp site on 28 Nov 2008. Photo: Mark Grindley.

Field survey area

Survey location

The first gibbon survey and training field work of this project was carried out during the dry season (last week of Nov 2008) in the southern Rakhine Mountain Range (Rakhine Yoma). Rakhine Yoma lies in the distribution range of the Western Hoolock Gibbon (*Hoolock hoolock*), inland of the Bay of Bengal, between the Myanmar-Bangladesh border and the Ayeyarwady River. The mountains of Rakhine Yoma are covered by patches of primary forest within a landscape dominated by secondary vegetation (largely bamboo) resulting from shifting cultivation. The survey area was located in a small mountain ridge facing the Bay of Bengal adjacent to Taing Kyo village and – further inland – Chung Tha village in Thandwe district, Gwa township in Rakhine division (Fig. 4).

Chung Tha village profile

Chung Tha village is located in Boak Pyin creek, about 3 km from the coast, about 1 km from the main road (coordinates: 17°50'40.3"N, 94°29'50.6"E). The village comprises 44 households (50 families), with a population of approximately 260 people. It is ethnic Chin, with premoniant religion being Christianity. The nearest forest is about 3 km away (0.5-1 hour walking) on the top of the Ngadanni Kyaw hills (50-500 meters elevation), which form the first ridge line parallel to the coast. A village interview was conducted with a small focus group to obtain basic socio-economic data related to farming, forest resource use and wildlife.

Forest ecosystems

The survey area ranges from 100-500 meters with secondary bamboo vegetation and patches of degraded forests on the western, seaward slopes and mostly contiguous lowland evergreen degraded forest on the mountain ridge and eastern slopes (Fig. 5). This forest block is separated from a larger forest block of evergreen and semi-evergreen forest on the central ridges of Rakhine Yoma to the east.

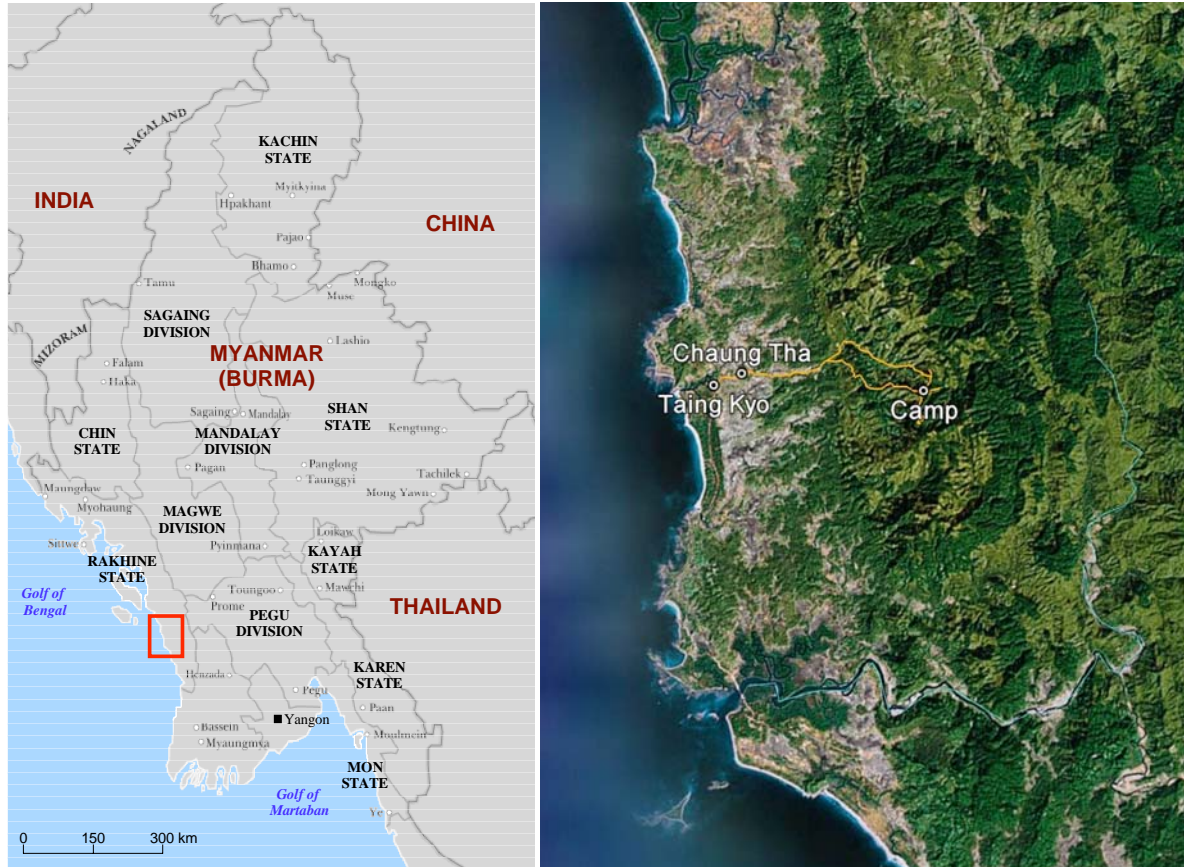


Fig. 4. Map of Myanmar showing location of field site (left), and overview of field site (right), showing the villages Taing Kyo and Chaung Tha, the camp site, and access routes (yellow). Width of right map is about 25 km.



Fig. 5. Views of the habitat of the survey area. The photo on the right shows a deforested patch in the upper left corner of the picture. Photos: Frank Momberg and Saw Moses.

Interview survey methods

Participatory rural appraisal (PRA) methods were used to obtain a village profile on livelihoods and natural resource management with an emphasis on forest use. The PRA was conducted with a small focus group from Chaung Tha village, including the village leader, the local church leader and an experienced hunter. The focus group discussion focused on farming, land tenure, forest utilization (timber and non-timber forest products), forest change, threats to forest and wildlife, human-wildlife conflicts, and local development initiatives. A forest and land use sketch map was produced, highlighting forest and farming areas, primate distribution, and hunting areas.

Additionally, expert interviews using semi-structured interviews were conducted with eight hunters to identify locations, time and numbers of primate sightings and primates heard, and identify the species based on described characteristics (size, tail presence/absence, tail length, fur colouration, marks, locomotion, feeding behaviour, and habitat). Additional topics included: threats to the species and their habitat, population status (rare/common) and trends, hunting methods (snaring/trapping, shooting, hunting with dogs), market prices and trade chains for each present primate species. Any hunted primates were recorded in detail (species, numbers, location, hunting method, market price).

Field survey

Participants in the field survey included:

Mi Mi Hlaing, Yu Yu Cho, Daw Ohmar Cho, Mg Kyaw Kyaw, Pwint Thu Aye, Saw Soe Aung, Mg Zay Lodi Aung, and Thet Naing Aung (Yangon University, Department of Zoology), May Myat Soe and Kyaw Thet Khang (local academic institutions in Rakhine State), Saw Moses and Ngwe Lwin (BANCA, Biodiversity and Nature Conservation Association).

Field survey techniques most suitable to estimate densities of gibbon populations are variants of the fixed point method, during which the loud morning songs of the gibbons are monitored from fixed listening points (Brockelman and Ali, 1987; Brockelman and Srikosamatara, 1993).

In order to facilitate comparison of results with those of the earlier gibbon surveys in Mahamyaing Wildlife Sanctuary, Sagaing division, Myanmar (Brockelman, 2005; Gibbon Survey Team, 2005), we adopted the same auditory survey method as far as possible.

At the study site, a camp was established at the following coordinates: 17°50'28.3"N, 94°32'05.4"E, elevation: 417 m (Fig. 6). Three listening points were selected from which gibbon calls were monitored during five consecutive mornings. The coordinates of the listening points and the survey hours spent at each of them are listed in Table 2. Only one listening point (LP3) proved to be unsuitable because of its location in a valley and was replaced by a new post (LP4) after one survey day.



Fig. 6. Establishing the camp site in the survey area, 25 Nov 2008. Photo: Thomas Geissmann.

Table 2. Listening post coordinates and survey time.

Listening post	Listening post coordinates and altitude [m]	Survey dates, Nov. 2008	Total hours spent at listening post
LP1	17°50'34.6"N, 94°32'10.3"E, 415 m	26-30 Nov	27.5 h (5.5+6+6+6+4 h)
LP2b	17°50'20.0"N, 94°32'03.1"E, 455m	26-30 Nov	27 h (5+6+6+6+4 h)
LP3	17°50'29.4"N, 94°32'14.9"E, 364 m	26 Nov	6 h
LP4	17°50'09.7"N, 94°32'05.2"E, 508 m	27-30 Nov	21 h (6+6+6+3 h)
Total			81.5 h

Listening posts were about 400-500 m apart and located on hilltops (Fig. 7) in order to enable the survey participants to hear gibbons from as many directions as possible. Surveyors had to leave the camp before dawn in order to arrive on the listening posts before 06:00 h (Fig. 8). Listening for gibbon songs was carried out daily from at least 06:00 to 11:30 h. Only on the last survey day (30 Nov 2008), survey time was shorter because the team had to travel back to Yangon on the same day.

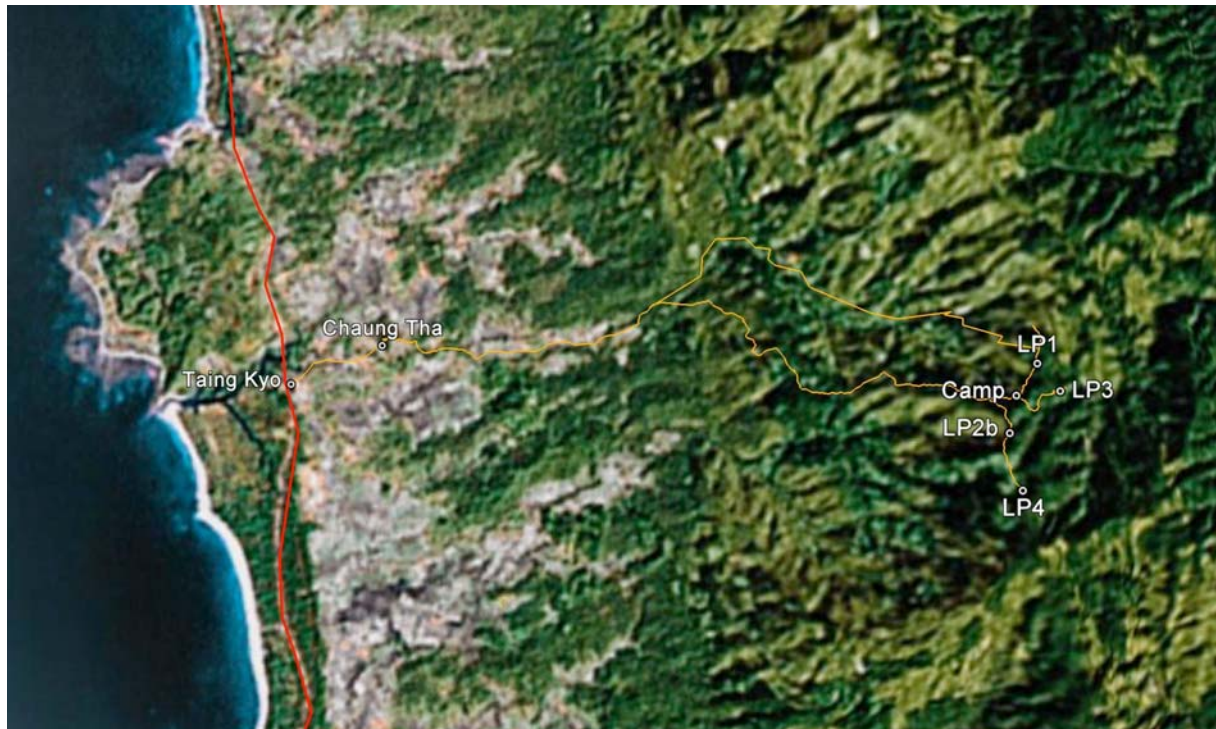


Fig. 7. Map of field site showing position of camp and listening posts (Source: GoogleEarth/Myanmar Primate Conservation Program).



Fig. 8. Camp site at 04:45 in the morning: the teams are preparing to walk to their respective listening posts, 27 Nov 2008. Photo: Thomas Geissmann.

Each listening post was manned by at least two surveyors. On the listening posts, watches of the surveyors were synchronized with the GMT of the GPS. Time, compass direction, estimated distance, and type of all gibbon songs were recorded on a field form. Compass bearing and distance estimates were checked by two surveyors. Song types included (1) solo song bouts, (2) duets with two singers, (3) duets with more than two singers, (4) duets with unknown number of singers. A template of the field form is presented in Appendix 1 of this report. Hoolock song bouts have an average duration of 15-20 min (Feeroz and Islam, 1992; Gittins and Tilson, 1984; Lan *et al.*, 1999; Tilson, 1979). If a song interval (silence) was longer than 5 minutes, the calls after the interval were recognised as a new song bout.

In addition to gibbon song data, surveyors also recorded direct observations of birds and mammals, other wildlife signs and evidence for hunting (hunters, gunshots, traps, snares), both at the listening posts and on the way to and from the posts each morning.

In addition to listening post surveys, various team members also carried out daily surveys for birds and other animals by walking slowly through the forest, and night surveys for nocturnal species using spotlights from about 19:30 to 22:00 hours.

Mapping and density determination

Times, directions and estimated distances of gibbon songs from each day were plotted and triangulated on graph papers. Density of gibbon groups was estimated based on the triangulated results. Temporal overlap in songs or song bouts produced within short intervals from different locations helped to identify different groups, and songs that mapped more than 500 m apart were also assumed to be by different groups. Comparing song times and estimated locations of singing gibbons recorded from different listening posts was used to identify song data referring to the same groups.

Although songs of wild gibbon can often be heard over distances well exceeding 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 a 0.6 km and a 1 km listening radius. The earlier gibbon survey in Mahamyang Wildlife Sanctuary, Sagaing division, Myanmar revealed that the 0.6 km radius consistently produced higher density estimates than the 1 km listening radius (Brockelman, 2005; Gibbon Survey Team, 2005).

Results 1: Interview survey

The following information on farming, forest resource use and wildlife in this section was collected during interviews conducted with inhabitants of the Chaung Tha village in the afternoon and evening of 29 Nov 2008 (Fig. 9). Chaung Tha is the closest village to the field survey area.



Fig. 9. Survey team members conducting interviews in Chaung Tha, 29 Nov 2008. Photo: Frank Momberg.

Farming system

Rice cultivation is the pre-dominant farming system with 12 families having paddy fields and 15 families upland 'swidden' fields (*taungya*). Four families practice both wet rice and upland rice cultivation (i.e. paddy and *taungya*). Wet rice is entirely rain-fed, with one crop cultivated annually. Swidden fields are farmed on a five to six year rotation.

Other agricultural cash crops and subsistence crops include chilli, peanuts, betel leaves, banana, sesame, beans, pumpkin, tomato, water melon, bitter leaves, eggplant, rosella leaves, and corn. Two farmers planted cashew trees this season for the first time. Paddy fields are privately owned, while no private or communal tenure exists for shifting cultivation land in Chaung Tha.

Forest land in the village is *de jure* owned by the state, but *de facto* an open access area due to a lack of boundary demarcation, management or enforcement. This access extends to the concept that even farmers from other villages may make use of unclaimed land or resources. Fifteen families have no farm land, while ten face hunger between August and September.

Livestock

Most villagers keep 1-2 cattle, 1-2 pigs and chicken. Only 2 families own 7-8 cows which are rented to other farmers for ploughing.

Forest resource use

Timber extraction: Most families participate in timber extraction during the rainy season July to September. Ten families rely on timber extraction throughout the year for income (mostly landless villagers). About 10 families from neighbouring Taing Kyo participate in timber extraction. Ironwood is cut in a distance of 30-60 minutes from the village, for *white wood* (less expensive, lighter coloured hardwoods as referred to by villagers) up to 3 hours from the village. Ironwood is becoming rare. Trees are usually cut with a DBH (diameter at breast height) of more than 30 cm. Fuelwood is collected from around the village for home consumption only, including by some residents of nearby coastal villages. Two families from Taing Kyo make charcoal year round near Chaung Tha village, from local wood supplies.

Wildlife extraction: Fifteen families are snaring wildlife during the rainy season. Main target species are Wild Pig and Red Muntjac. However, other mammals get trapped as well such as Sun Bear, Gaur, macaques, and Slow Loris. Hunters also reported regular snaring of an unidentified black cat with curled tail. The animal's Burmese name, *Kyaung Myee Kauk* means, literally, "cat with curly/curled tail". In the past also Sambar Deer were snared regularly, while now hunters rarely trap them. Hunters now only snare 50% of the Wild Pigs and Red Muntjac in comparison to 5 years ago. Two families hunt pangolins with dogs and one hunter from Taing Kyo village uses an air gun for hunting birds (Fig. 10). Few people (5-10) have crossbows. They hunt Red Muntjac, Phayre's Leaf Monkey and macaques. No shotguns are used in Chaung Tha and Taing Kyo villages.



Fig. 10. Asian Fairy Bluebird (*Irena puella*) hunted by airgun in the forest above Chaung Tha village, 29 Nov 2008. Photo: Frank Momberg.

Non-timber forest product collection: Most important NTFPs are bamboo poles, with 5-6 families harvesting poles full time for sale to Taing Kyo for house construction and for fish drying racks. Most villagers collect bamboo shoots during the rainy season and sell to the neighbouring coastal village of Taing Kyo. Other forest products for sale are medicinal plants (Pyin U, Paung Ma Ya Za), and mushrooms and firewood for local consumption. We asked village leaders to rank the economic importance of forest products. Results were as follows: 1. Timber, 2. Bamboo poles, 3. Wildlife, 4. Bamboo shoots, 5. Medicinal plants, 6. Rattan.

Other income from labour

Thirty families work as labour on fields, ten families work on fishing boats in the neighbouring village of Taing Kyo.

Wildlife conflicts

No wildlife-human conflicts are currently reported in Chaung Tha village. The last human-elephant conflict was recorded in 2000 when a single elephant raided crops. The last human-tiger conflict occurred in 1998 when a cow was killed by a tiger. Since then no signs of tigers have been reported from the village forests.

Development initiatives

There is limited initiatives to reduce poverty and no initiatives targeting sustainable resource use. Caritas has just started a micro-credit program, and the local catholic church is providing five hectares of land for poor families to farm on a 2 year rotational basis. UNICEF has financed public sanitation and water facilities.

Threats to forests/ habitat

The main threat to forest was the cyclone in 2005, followed by timber extraction over the last 20 years leading to increased forest degradation making the forest more vulnerable to windfall and fire. Shifting

cultivation has been a significant threat prior to 10 years ago when Chin farmers from Chaung Tha still practiced wide spread shifting cultivation, creating the current mosaic of forests and secondary bamboo re-growth. Now less people practice shifting cultivation, which is now largely limited to the seaward, western mountain slopes (Fig. 11).



Fig 11. Patches of former shifting cultivation on top (above) and on the western slopes (below) of the Ngadanni Kyaw hills. Photos: Thomas Geissmann.

Threats to wildlife

Interviews indicate the most significant threat to wildlife is snaring and hunting, which has already led to the extinction of some species (e.g. Tigers) while in other species such as ungulates and primates, populations have experienced a significant decline. Primates are hunted with cross-bows and macaques are occasionally snared. Hunters are reportedly not targeting gibbons any more. However, we were not able to verify this information. No signs of hunting or snaring were observed at the study site, with the exception of a snare laid by porters on the survey (and promptly dismantled), which was baited with chicken offal and presumably targeting small carnivores, and an Asian Fairy Bluebird killed by air rifle which was encountered on the return from the field survey (see above, Fig. 10). The second most serious threat to wildlife is said to be habitat fragmentation and degradation, which has been caused by previous commercial logging, and on-going community-based timber extraction and shifting cultivation.

Results 2: Field survey

Gibbons

Interview data

According to interview data, a gibbon group consisting of an adult pair with an infant had been observed in September and November 2008 near LP4. Gibbon calls had been heard in November 2008 near the waterfall creek near LP3, and in November 2008 near the A-Lal area. This would suggest that as many as three gibbon groups may occur in the survey area. Furthermore, a gibbon group consisting of 1-3 individuals was heard and observed in 2008 near the Ba-Wan river (Fig. 12). This locality may, however, be outside of the range of the listening posts.

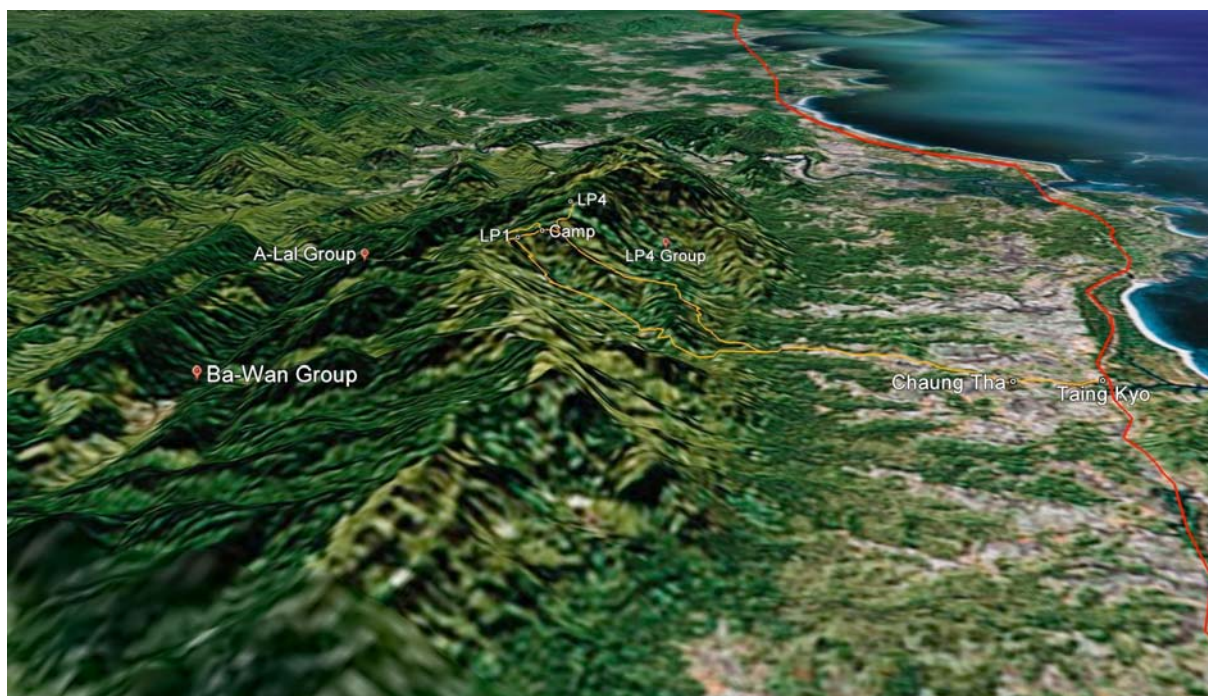


Fig 12. Oblique view of field site topography and gibbon records. Direction: Looking south-east (Source: GoogleEarth/Myanmar Primate Conservation Program).

Aural evidence

Only two gibbon songs were reliably heard during the five consecutive mornings spent on the listening posts: one solo song bout and one duet song bout. Both occurred at the same time (10:17-10:42) to the northeast of LP1, and both were heard from that LP only. The distance of the solo song was estimated to be about 900 m, the duet song was estimated to be further away than 1 km. One possible song was recorded on 27 Nov LP2 (06:48-07:00) from an eastern direction and a distance of more than 1 km, but the wind made it impossible to identify reliably whether a gibbon song was heard or not. In any case, calling rate was very low during this survey. The possible reasons for this are discussed further below.

Direct sightings

Two primates that may have been gibbons were encountered during this survey (30 Nov.) near LP4, but they fled through the canopy so quickly that no reliable identification was possible. On the following day, this area was carefully surveyed and a group of gibbons was encountered and observed during 15 minutes by one of us (SM). The group consisted of an adult pair with an infant carried by its mother. The infant was less than one year old, as it still exhibited the buff infant colouration. The white eye-brows of the male appeared to touch each other above the ridge of the nose, supporting an identification of the gibbon as Western Hoolock (*H. hoolock*).

As both the location and the composition of the group matched the information provided by two of the interviewees, this can be taken as an indicator of the reliability of the informants. Furthermore, this observation documented that at least one gibbon group was located in immediate vicinity of one of the listening posts. As the

group had not produced a song during the five consecutive survey days, this supports the interpretation that the calling activity was relatively low.

Density estimates

In the following estimates, the aural evidence and the direct sightings are combined.

No gibbon group song and only one solo song bout were heard from within a listening radius of 1 km, and no gibbon song at all from within a listening radius of 0.6 km. All songs were heard from LP1 only. As no gibbon song bout was heard from more than one listening post, no triangulation was possible. Because mated hoolock gibbons are not known to produce solo songs, the song we heard was produced, in all probability, by a solitary individual and not by a group.

The sighted gibbon group was located within the 0.6 km radius of LP4.

The resulting density estimates/km² for gibbon groups as well as gibbon individuals in the survey area are listed in Table 4. When calculating the area surveyed from each listening post, the areas of non-habitat have to be deducted. These included bamboo, grassland, cultivated areas, all resulting from shifting cultivation. We estimated that these areas amounted to 10% in LP1, 30% in LP2b and 20% in LP4. The amount of non-gibbon habitat in the listening area could have been determined more accurately if GIS technology had been available for this survey, which was, however, not the case.

Considering the limited time available for this survey, these estimates are tentative.

Table 4. Gibbon group and individual density estimates for the survey area.

Listening post ¹	Listening radius			
	0.6 km		1.0 km	
	Groups	Individuals	Groups	Individuals
LP1	0	0	0	1
LP2b	0	0	0	0
LP4	1	3	1	3
Total Gibbons	1	3	1	4
Density / km ²	0.37	1.11	0.13	0.53

¹ Listening post LP3 is not included as it was in use during only one survey morning.

In an earlier study for the hoolock gibbons in Mahamyaing Wildlife Sanctuary, Sagaing division (Brockelman, 2005; Gibbon Survey Team, 2005), gibbon density estimates were, on average, 2.3 groups/km² for the 0.6-km listening radius, and 1.8 groups/km² for the larger 1-km radius. These density estimates are roughly one order of magnitude larger than those determined in the study (0.37 and 0.13 groups/km², respectively).

Gibbon calling rate is the main factor used for the calculation of gibbon density. Gibbon groups living in areas with high population densities sing more often than groups in low density areas. The population density of gibbons in the study appears to be very low, to judge by the low numbers of gibbons encountered during surveys (see above). The low calling rate observed during this survey (as described above) could, however, have several additional causes:

(1) Low quality of the habitat may not support higher gibbon densities in the survey area, which in turn would keep calling rates low. In several parts of the survey area, the canopy was open, and the forest was fragmented or interspersed with large patches of bamboo. In these areas, the habitat was certainly not optimal for gibbons. Causes for suboptimal habitat quality in the survey area are believed to include selective logging and local shifting cultivation, but also damages to the forest resulting from the cyclone of 2005 (and likely other tropical storms before and after 2005). Many wind-thrown trees were encountered in and around the survey site. Human induced damages to habitat quality probably have the larger impact in gibbon density, because it is unlikely that the gibbon would have been highly decimated only three years after a cyclone.

(2) Gibbon calling rate fluctuates seasonally, with more calls being produced during high fruit availability in the wet season and fewer calls being produced during the dry season. The survey was conducted during the dry season.

(3) High hunting pressure may have selected against calling gibbons, as hunters use the calls to locate and approach the gibbons. There is no evidence for gibbons being hunted in recent years, but gibbons may have been hunted in earlier years, which would explain the low density of gibbons encountered during the survey (see below).

(4) Gibbons rarely sing during certain weather conditions (rain, wind, cold temperatures). There was no rain and the weather was warm ($\geq 20^{\circ}\text{C}$) during the survey. During two early mornings, it was relatively windy, but in

both cases, the wind disappeared around 08:30, so that the gibbons would have had enough of favourable weather conditions for singing.

Other mammals

Table 3 provides a list of the mammals encountered during the survey or reported to occur in the survey area by the interviewees. Eight of the 24 taxa listed have not previously been recorded in south-west Myanmar, according to the distribution maps provided in Francis (2008). These include all of the squirrel species observed during this survey (Figs. 13-14). It appeared that the distribution of mammals in Myanmar in Francis (2008) did not take into consideration unpublished field reports from Myanmar, which makes it possible that the findings on range extension may have been documented previously.

Of particular interest is an as yet unidentified dog-sized black cat with curled tail called *Kyaung Myee Kauk*. According to informants, the animal is snared about three times per year, although this could not be corroborated.



Fig. 13. Variable Squirrels (*Callosciurus finlaysonii*) were common in the study area. Most individuals observed during the survey had reddish fur with a white tail-tip, as shown in this photograph, only some individuals were lacking a the white tip. Photo: Thomas Geissmann.



Fig. 14. Irrawaddy Squirrel (*Callosciurus pygerythrus*). Photo: Thomas Geissmann.

Table 3. Mammals recorded during the survey. * denotes a species that has not been recorded previously in south-western Myanmar (Rakhine province), according to Francis (2008).

Order	Family	Species	Evidence					IUCN status	
			Visual	Aural	Feces	Tracks	Inter-view		
Pholidota	Manidae	Sunda Pangolin (<i>Manis javanica</i>)					+	EN	
Scandentia	Tupaiaidae	Northern Treeshrew (<i>Tupaia belangeri</i>)	+						
Chiroptera	unid. genera	unid. species	+						
Primates	Loridae	Northern Slow Loris (<i>Nycticebus bengalensis</i>)					¹	VU	
	Cercopithecidae	Northern Pig-tailed Macaque (<i>Macaca leonina</i>)					+	VU	
		Rhesus Macaque (<i>M. mulatta</i>)	*				²		
		Long-tailed Macaque (<i>M. fascicularis</i>)					³		
		Phayre's Leaf Monkey (<i>Trachypithecus phayrei</i>)					⁴	EN	
Hylobatidae	Western Hoolock (<i>Hoolock hoolock</i>)	+	+			⁵	EN		
Carnivora	Canidae	Dhole (<i>Cuon alpinus</i>)					+	NT	
	Ursidae	Sunbear (<i>Helarctos malayanus</i>)					⁶	EN	
	Felidae	Tiger (<i>Panthera tigris</i>)	*				⁷	EN	
Black cat? (local: Kyaung Myee Kau)		*				⁸			
Proboscidea	Elephantidae	Asian Elephant (<i>Elephas maximus</i>)					⁹	EN	
Artiodactyla	Suidae	Eurasian Wild Pig (<i>Sus scrofa</i>)				+	+		
		Red Muntjac (<i>Muntiacus muntjak</i>)		+			+		
	Cervidae	Sambar (<i>Rusa unicolor</i>)					¹⁰	NT	
	Bovidae	Gaur (<i>Bos frontalis</i>)			+	+	+	VU	
		Water Buffalo (<i>Bubalus bubalis</i>)	*			+	+	EN	
Rodentia	Sciuridae	Black Giant Squirrel (<i>Ratufa bicolor</i>)	*	+					NT
		Variable Squirrel (<i>Callosciurus finlaysonii</i>) ¹¹	*	+	+				
		Irrawaddy Squirrel (<i>C. pygerythrus</i>)	*	+					
		Blackish tree squirrel with white tail-tip, maybe a variant of the variable squirrel	*	+					
	Muridae	Indet sp.		+					

¹ Snared in rainy season 2008² Could also be *M. assamensis*, as the two species are very similar and the interview data does not allow to tell the species apart. They are identified here as *M. mulatta* because the known distribution range of that species is closer to the survey area. Snared in 2004 and 2005.³ Outside survey area, in mangrove forest close to village, observed catching fish, crab, and clam⁴ Infant in yellow coat caught on 22 Nov 2008, sold to trader in Tiang Kyo. Group of about 5-6 regularly seen near LP4 of this survey, one individual cross-bowed in 2005. Also reported from northeast of village in A-Lal mountain, contiguous with survey forest⁵ Group of 1 pair with infant seen in Sept. 2008 and in Nov. 2008 near LP4. Gibbon calls were heard in Nov 2008 near the waterfall creek near LP3, and in Nov. 2008 near A-Lal mountain range. One group (1-3 individuals) was heard and seen in 2008 near Ba-Wan river, possibly outside of the survey area.⁶ Snared in rainy season 2008⁷ Last seen 1998⁸ Regularly snared about 3 times per year⁹ One individual seen crop-raiding 2002, species occasionally seen before cyclone 2005¹⁰ Previously abundant, now rare¹¹ Red fur, two forms seen: most with white tip of tail, some without white tip

Birds

A total of 145 bird species were recorded during this survey (Fig. 15). They are listed in Appendices 2 and 3 of this report. The following four of these were not previously recorded in south-west Myanmar, according to Robson (2005):

- White-throated Needletail (*Hirundapus caudacutus*)
- Chinese Sparrow Hawk (*Accipiter soloensis*)
- Pale Blue Flycatcher (*Cyornis unicolor*)
- Slaty-blue Flycatcher (*Ficedula tricolor*)

One species recorded, the Great Hornbill (*Buceros bicornis*), is listed as “Near Threatened” by IUCN global threat status.

As only five observation days were spent in the field it can be assumed that significantly more species occur in this forest. Several of the observed bird species such as the Great Hornbill (*Buceros bicornis*), Wreathed Hornbill (*Aceros undulatus*), Abbot’s Babbler (*Malaconcincla abbotti*), or Chestnut-headed Tesia (*Tesia castaneocoronata*) typically inhabit primary forest, it can be assumed therefore that many more species of birds and mammals occur in the less disturbed forest blocks in this region.



Fig. 15. The Little Spiderhunter (*Arachnothera longirostra*) was one of the most typical bird species in the survey area. Here it is seen feeding on nectar from banana flowers. Photo: Thomas Geissmann.

Other animals

Due to time constraints, we did not attempt systematic surveys of other orders besides mammals and birds. However, a catfish species was repeatedly encountered in the small creek near LP3, and one young individual (Fig. 16) was observed to travel several meters across a dry pebble bed to another puddle of water. Several larger specimens were collected for scientific examination later during the survey (Fig. 17). They may represent a previously unknown catfish species (Pwint Thu Aye, pers. comm.).



Fig. 16. After travelling several meters across dry land, this young catfish inspects a new part of the creek near LP3. Photo: Thomas Geissmann.

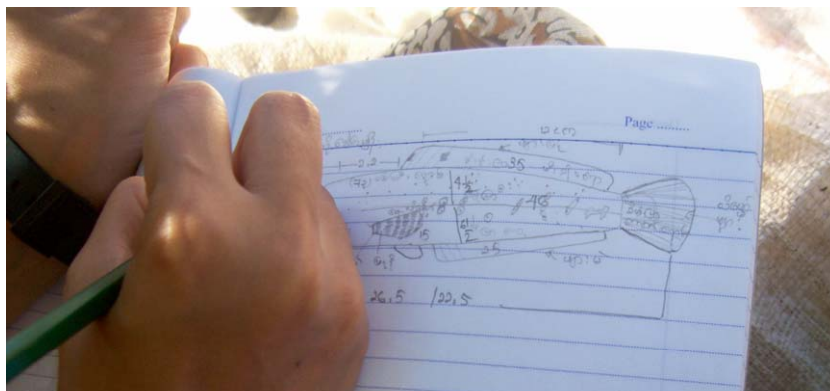


Fig. 17. A captured larger specimen of the same (and possibly new) catfish species is examined in the camp by Pwint Thu Aye. Photos: Saw Moses.

Conclusions

The study confirms the presence of gibbons in the southern Rakhine Yoma. There are some historical records of hoolock gibbons from Rakhine state (Anderson, 1881, Blyth, 1875, Tickell, 1859a,b). Blyth (1875) gives both Sandoway (18°27'N, 94°23'E) and Akyab (20°08'N, 92°54'E) as localities. Based on this evidence, Groves (1972, p. 66) concluded that “there seems thus no reason to doubt that this species extends further south than the Chin Hills; but how far south, and what subspecies it belongs to, are doubtful.” Since then, the occurrence of hoolock gibbons in Rakhine state has been confirmed during tiger surveys of 1999-2002 (Lynam 2003, p. 57). The author specifies the following sites: Northern Rakhine (21°05'-21°22'N, 92°21'-92°29'E), and Rakhine Elephant Range (18°01'-18°59'N, 94°36'-94°45'E). The study site (around 17°50'N, 94°32'E) appears to be the southernmost record for hoolock gibbons, so far, and supports their identification as Western Hoolock Gibbon (*Hoolock hoolock*).

The survey confirms that forest habitat in our study area in the southern part of the Ngadanni Kyaw Hills of southern Rakhine Yoma is severely degraded and fragmented. Main threats to the survival of the hoolock gibbon is habitat loss and fragmentation and habitat degradation, while hunting poses a serious threat to wildlife in general. The main hunting method used is snaring, which does not target strictly arboreal primates such as gibbons. Crossbows, however, are used to hunt primates, but hunters from Chaung Tha village claim not to target gibbons. Nevertheless we cannot exclude that hunting with crossbows and occasional shotguns poses a serious threat to gibbons in southern Rakhine Yoma. Additional hunter interview surveys in other villages need to be conducted to confirm and quantify hunting pressure to gibbons in southern Rakhine Yoma.

Gibbon densities in the survey area are very low (0.13-0.37 groups/km²), and for this reason the site was not an ideal training location. Observations and interview results suggest the main reason for low densities is poor habitat suitability due to degradation, which corresponds with findings in the hoolock regions of Bangladesh and north-east India.

Overall, the goal of a training course to introduce and practice gibbon survey methods was achieved, and a competent field team has now been established. Further surveys under this project will expand the picture of the threats and status of Hoolock gibbon in Myanmar, and help identify priorities for conservation interventions.

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Appendix 2. Birds recorded during the survey

An asterisk (*) denotes those three species that have not been recorded previously in south-western Myanmar (Rakhine province), according to Robson (2005).

Family	Species		Evidence ¹		* IUCN status ²	
			Visual	Aural		
Phasianidae	Red Junglefowl	<i>Gallus gallus</i>		+		
Picidae	Greater Flameback	<i>Chrysocolaptes lucidus</i>	+	+		
	Bay Woodpecker	<i>Blythipicus pyrrhotis</i>	+			
	Heart-spotted Woodpecker	<i>Hemicircus canente</i>	+			
Megalaimidae	Blue-throated Barbet	<i>Megalaima asiatica</i>	+	+		
	Blue-eared Barbet	<i>Megalaima australis</i>	+	+		
	Coppersmith Barbet	<i>Megalaima haemacephala</i>	+			
	Lineated Barbet	<i>Megalaima lineata</i>		+		
Bucerotidae	Oriental Pied Hornbill	<i>Anthracoceros albirostris</i>	+			
	Great Hornbill	<i>Buceros bicornis</i>	+		NT	
	Wreathed Hornbill	<i>Aceros undulatus</i>	+			
Upupidae	Common Hoopoe	<i>Upupa epops</i>	(+)			
Trogonidae	Red-headed Trogon	<i>Harpactes erythrocephalus</i>	+	+		
Coraciidae	Indian Roller	<i>Coracias benghalensis</i>	(+)			
Alcedinidae	Common Kingfisher	<i>Alcedo atthis</i>	+			
Halcyonidae	Black-capped Kingfisher	<i>Halcyon pileata</i>	+			
	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	(+)			
Meropidae	Green Bee-eater	<i>Merops orientalis</i>	++			
	Blue-tailed Bee-eater	<i>Merops philippinus</i>	+			
Cuculidae	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	+			
	Asian Koel	<i>Eudynamis scolopacea</i>		+		
	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	+			
Centropadidae	Greater Coucal	<i>Centropus sinensis</i>	+			
Psittacidae	Vernal Hanging Parrot	<i>Loriculus vernalis</i>	+			
	Red-breasted Parakeet	<i>Psittacula alexandri</i>	++			
Apodidae	Himalayan Swiftlet	<i>Collocalia brevirostris</i>	+			
	White-throated Needletail	<i>Hirundapus caudacutus</i>	+		*	
	Brown-backed Needletail	<i>Hirundapus giganteus</i>	+			
	House Swift	<i>Apus affinis</i>	+			
	Fork-tailed Swift	<i>Apus pacificus</i>	+			
	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	(+)			
Tytonidae	Barn Owl	<i>Tyto alba</i>		+		
Strigidae	Collared Scops Owl	<i>Otus bakkamoena</i>		+		
	Mountain Scops Owl	<i>Otus spilocephalus</i>		+		
	Collared Owlet	<i>Glaucidium brodiei</i>		+		
	Asian Barred Owlet	<i>Glaucidium cuculoides</i>		+		
Columbidae	Rock Pigeon	<i>Columba livia</i>	(+)			
	Spotted Dove	<i>Streptopelia chinensis</i>	++			
	Eurasian Collared Dove	<i>Streptopelia decaocto</i>	(+)			
	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	+			
	Red Collared Dove	<i>Streptopelia tranquebarica</i>	(+)			
	Emerald Dove	<i>Chalcophaps indica</i>	+			
	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	+			
Scolopacidae	Common Sandpiper	<i>Actitis hypoleucos</i>	(+)			
Charadriidae	Red-wattled Lapwing	<i>Vanellus indicus</i>	(+)			
Accipitridae	Oriental Honey-Buzzard	<i>Pernis ptilorhynchus</i>	+			
	Black Kite	<i>Milvus migrans</i>	+			
	Brahminy Kite	<i>Haliastur indus</i>	+			
	Crested Serpent Eagle	<i>Spilornis cheela</i>	+			
	Shikra	<i>Accipiter badius</i>	+			
	Chinese Sparrow Hawk	<i>Accipiter soloensis</i>	+		*	
	Common Buzzard	<i>Buteo buteo</i>	+			
	Mountain Hawk Eagle	<i>Spizaetus nipalensis</i>	+			
	Falconidae	Common Kestrel	<i>Falco tinnunculus</i>	+		

² NT = Near Threatened

Appendix 2 (ctd.)

Family	Species		Evidence ¹		* IUCN status	
			Visual	Aural		
Ardeidae	Little Egret	<i>Egretta garzetta</i>	(+)			
	Great Egret	<i>Casmerodius albus</i>	(+)			
	Cattle Egret	<i>Bubulcus ibis</i>	(++)			
	Indian Pond Heron	<i>Ardeola grayii</i>	(+)			
	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>		(+)		
Irenidae	Asian Fairy Bluebird	<i>Irena puella</i>	++			
	Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>	+			
	Blue-winged Leafbird	<i>Chloropsis cochinchinensis</i>	+			
Laniidae	Brown Shrike	<i>Lanius cristatus</i>	+			
	Grey-backed Shrike	<i>Lanius tephronotus</i>	+			
Corvidae	Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	+			
	Large-billed Crow	<i>Corvus macrorhynchos</i>	+			
	Ashy Woodswallow	<i>Artamus fuscus</i>	(+)			
	Black-naped Oriole	<i>Oriolus chinensis</i>	+			
	Black-hooded Oriole	<i>Oriolus xanthornus</i>	+			
	Black-winged Cuckooshrike	<i>Coracina melaschistos</i>	+			
	Scarlet Minivet	<i>Pericrocotus flammeus</i>	+			
	Bar-winged Flycatcher-Shrike	<i>Hemipus picatus</i>	+			
	Bronzed Drongo	<i>Dicrurus aeneus</i>	+			
	Crow-billed Drongo	<i>Dicrurus annectans</i>	+			
	Spangled Drongo	<i>Dicrurus hottentottus</i>	+			
	Ashy Drongo	<i>Dicrurus leucophaeus</i>	+			
	Black Drongo	<i>Dicrurus macrocercus</i>	(+)			
	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	+			
	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>	+			
	Black-naped Monarch	<i>Hypothymis azurea</i>	++			
	Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>	+			
	Common Woodshrike	<i>Tephrodornis pondicerianus</i>	+			
	Muscicapidae	Blue Rock Thrush	<i>Monticola solitarius</i>	(+)		
		Blue Whistling Thrush	<i>Myophonus caeruleus</i>	+		
Asian Brown Flycatcher		<i>Muscicapa dauurica</i>	+			
Red-throated Flycatcher		<i>Ficedula parva</i>	+			
Slaty-blue Flycatcher		<i>Ficedula tricolor</i>	+		*	
Verditer Flycatcher		<i>Eumyias thalassina</i>	+			
Blue-throated Flycatcher		<i>Cyornis rubeculoides</i>	++			
Pale Blue Flycatcher		<i>Cyornis unicolor</i>	+		*	
Grey-headed Canary Flycatcher		<i>Culicicypa ceylonensis</i>	++			
White-rumped Shama		<i>Copsychus malabaricus</i>	+			
Oriental Magpie Robin		<i>Copsychus saularis</i>	+			
Black-backed Forktail		<i>Enicurus immaculatus</i>	+			
Pied Bushchat		<i>Saxicola caprata</i>	(+)			
Sturnidae	Siberian Stonechat	<i>Saxicola maura</i>	+			
	Vinous-breasted Starling	<i>Sturnus burmannicus</i>	+			
	Asian Pied Starling	<i>Sturnus contra</i>	(+)			
	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	+			
	Jungle Myna	<i>Acridotheres fuscus</i>	+			
	Common Myna	<i>Acridotheres tristis</i>	(+)			
	Hill Myna	<i>Gracula religiosa</i>	+	+		
Paridae	Great Tit	<i>Parus major</i>	+			
	Sultan Tit	<i>Melanochlora sultanea</i>	+			
Hirundinidae	Red-rumped Swallow	<i>Hirundo daurica</i>				
	Barn Swallow	<i>Hirundo rustica</i>	(+)			
	Pacific Swallow	<i>Hirundo tahitica</i>	+			
	Nepal House Martin	<i>Delichon nipalensis</i>	+			

Appendix 2 (ctd.)

Family	Species		Evidence ¹		* IUCN status
			Visual	Aural	
Pycnonotidae	Streak-eared Bulbul	<i>Pycnonotus blanfordi</i>	+		
	Red-vented Bulbul	<i>Pycnonotus cafer</i>	+		
	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	+		
	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	+		
	Olive Bulbul	<i>Iole virescens</i>	+		
Cisticolidae	Zitting Cisticola	<i>Cisticola juncidis</i>	(+)		
Zosteropidae	Oriental White-eye	<i>Zosterops palpebrosus</i>	+		
Sylviidae	Chestnut-headed Tesia	<i>Tesia castaneocoronata</i>	+		
	Dark-necked Tailorbird	<i>Orthotomus atrogularis</i>	+		
	Common Tailorbird	<i>Orthotomus sutorius</i>	+		
	White-tailed Leaf Warbler	<i>Phylloscopus davisoni</i>	+		
	Dusky Warbler	<i>Phylloscopus fuscatus</i>	+		
	Yellow-browed Warbler	<i>Phylloscopus inornatus</i>	+		
	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	+	+	
	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	+	+	
	Abbott's Babbler	<i>Malacocincla abbotti</i>	+		
	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	+	+	
	Large Scimitar Babbler	<i>Pomatorhinus hypoleucos</i>	+		
	Golden Babbler	<i>Stachyris chrysaea</i>	+		
	Grey-throated Babbler	<i>Stachyris nigriceps</i>	+		
	Rufous-capped Babbler	<i>Stachyris ruficeps</i>	+		
	Rufous-fronted Babbler	<i>Stachyris rufifrons</i>	+		
	Striped Tit Babbler	<i>Macronous gularis</i>	++		
	Nepal Fulvetta	<i>Alcippe nipalensis</i>	+		
	Brown-cheeked Fulvetta	<i>Alcippe poioicephala</i>	+	+	
	White-bellied Erpornic	<i>Erpornis zantholeuca</i>	+		
	Nectariniidae	Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>	+	
Orange-bellied Flowerpecker		<i>Dicaeum trigonostigma</i>	+		
Copper-throated Sunbird		<i>Nectarinia calcostetha</i>	(+)		
Crimson Sunbird		<i>Aethopyga siparaja</i>	+		
Little Spiderhunter		<i>Arachnothera longirostra</i>	++		
Passeridae	House Sparrow	<i>Passer domesticus</i>	(+)		
	Russet Sparrow	<i>Passer rutilans</i>	+		
	Yellow Wagtail	<i>Motacilla flava</i>	+		
	Baya Weaver	<i>Ploceus philippinus</i>	Nests +		
	Scaly-breasted Munia	<i>Lonchura punctulata</i>	+		
	White-rumped Munia	<i>Lonchura striata</i>	+		

¹ Evidence:

+ present (seen, heard, nests)

++ common (> 30 individuals recorded)

(+ / ++) only present in open habitat, only seen or heard during first and/or last survey day on the way between Taing Kyo village and camp site in open cultivation area (paddy fields, gardens, scrub) on the coastal plain and/or the shifting cultivation in the foothill zone.

² NT = Near Threatened

Appendix 3. Daily bird records during the survey

Family	Species		Date and location ¹					
			25 Nov X	26 Nov LP3	27 Nov LP4	28 Nov LP3	29 Nov LP3	30 Nov LP4+X
Phasianidae	Red Junglefowl	<i>Gallus gallus</i>		Aural				
Picidae	Greater Flameback	<i>Chrysocolaptes lucidus</i>				Aural	1	
	Bay Woodpecker	<i>Blythipicus pyrrhotis</i>				1		
	Heart-spotted Woodpecker	<i>Hemicircus canente</i>					1	
Megalaimidae	Blue-throated Barbet	<i>Megalaima asiatica</i>	Aural	Aural	1			
	Blue-eared Barbet	<i>Megalaima australis</i>		Aural	1			
	Coppersmith Barbet	<i>Megalaima haemacephala</i>	1					1
	Lineated Barbet	<i>Megalaima lineata</i>	Aural					Aural
Bucerotidae	Oriental Pied Hornbill	<i>Anthracoceros albirostris</i>				2		
	Great Hornbill	<i>Buceros bicornis</i>		2				
	Wreathed Hornbill	<i>Aceros undulatus</i>				1+		
Upupidae	Common Hoopoe	<i>Upupa epops</i>	1					
Trogonidae	Red-headed Trogon	<i>Harpactes erythrocephalus</i>			Aural	1		
Coraciidae	Indian Roller	<i>Coracias benghalensis</i>	6					6
Alcedinidae	Common Kingfisher	<i>Alcedo atthis</i>					1	
Halcyonidae	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	1					2
	Black-capped Kingfisher	<i>Halcyon pileata</i>						1
Meropidae	Green Bee-eater	<i>Merops orientalis</i>	5	7	5	6	7	17
	Blue-tailed Bee-eater	<i>Merops philippinus</i>	5					4
Cuculidae	Plaintive Cuckoo	<i>Cacomantis merulinus</i>	1					
	Asian Koel	<i>Eudynamys scolopacea</i>						Aural
	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>					1	
Centropadidae	Greater Coucal	<i>Centropus sinensis</i>						1
Psittacidae	Vernal Hanging Parrot	<i>Loriculus vernalis</i>	1	5	4	3	3	4
	Red-breasted Parakeet	<i>Psittacula alexandri</i>	20					100
Apodidae	Himalayan Swiftlet	<i>Collocalia brevirostris</i>	2	3	2	1	2	3
	White-throated Needletail	<i>Hirundapus caudacutus</i>		3			8	
	Brown-backed Needletail	<i>Hirundapus giganteus</i>		1<				
	Asian Palm Swift	<i>Cypsiurus balasiensis</i>	5					5
	House Swift	<i>Apus affinis</i>	8	3	4	4	5	4
	Fork-tailed Swift	<i>Apus pacificus</i>		7		6	4	
Tytonidae	Barn Owl	<i>Tyto alba</i>	Aural					
Strigidae	Collared Scops Owl	<i>Otus bakkamoena</i>	Aural				Aural	
	Mountain Scops Owl	<i>Otus spilocephalus</i>		Aural				Aural
	Collared Owlet	<i>Glaucidium brodiei</i>		Aural	Aural			
	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	Aural	Aural	Aural	Aural	Aural	Aural
Columbidae	Rock Pigeon	<i>Columba livia</i>	5					
	Spotted Dove	<i>Streptopelia chinensis</i>	20					20
	Eurasian Collared Dove	<i>Streptopelia decaocto</i>						13
	Oriental Turtle Dove	<i>Streptopelia orientalis</i>	4					4
	Red Collared Dove	<i>Streptopelia tranquebarica</i>						13
	Emerald Dove	<i>Chalcophaps indica</i>	2	3	1	2	2	2
	Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>					10+	
Scolopacidae	Common Sandpiper	<i>Actitis hypoleucos</i>	1					
Charadriidae	Red-wattled Lapwing	<i>Vanellus indicus</i>	1					
Accipitridae	Oriental Honey-Buzzard	<i>Pernis ptilorhyncus</i>	1			1		1
	Black Kite	<i>Milvus migrans</i>	1					1
	Brahminy Kite	<i>Haliastur indus</i>						1
	Crested Serpent Eagle	<i>Spiornis cheela</i>	1			1		1
	Shikra	<i>Accipiter badius</i>						1
	Chinese Sparrow Hawk	<i>Accipites soloensis</i>						1
	Common Buzzard	<i>Buteo buteo</i>				1	1	1
	Mountain Hawk Eagle	<i>Spizaetus nipalensis</i>				1	1	
Falconidae	Common Kestrel	<i>Falco tinnunculus</i>						1
Ardeidae	Little Egret	<i>Egretta garzetta</i>	8+					11+
	Great Egret	<i>Casmerodius albus</i>	3+					3+
	Cattle Egret	<i>Bubulcus ibis</i>	20+					20+
	Indian Pond Heron	<i>Ardeola grayii</i>	3					2
	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Aural					
Irenidae	Asian Fairy Bluebird	<i>Irena puella</i>	2	11	9	5	4	8
	Blue-winged Leafbird	<i>Chloropsis cochinchinensis</i>		4	1		4	3
	Golden-fronted Leafbird	<i>Chloropsis aurifrons</i>					1+	

Appendix 3 (ctd.)

Family	Species	Date and location ¹						
		25 Nov X	26 Nov LP3	27 Nov LP4	28 Nov LP3	29 Nov LP3	30 Nov LP4+X	
Laniidae	Brown Shrike	<i>Lanius cristatus</i>	1					
	Grey-backed Shrike	<i>Lanius tephronotus</i>	1					
Corvidae	Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	1+					
	Large-billed Crow	<i>Corvus macrorhynchos</i>	4+					3+
	Ashy Woodswallow	<i>Artamus fuscus</i>	3					2
	Black-naped Oriole	<i>Oriolus chinensis</i>		1	1		1	
	Black-hooded Oriole	<i>Oriolus xanthornus</i>			1			
	Black-winged Cuckooshrike	<i>Coracina melaschistos</i>				1		
	Scarlet Minivet	<i>Pericrocotus flammeus</i>		6			5	
	Bar-winged Flycatcher-Shrike	<i>Hemipus picatus</i>				5		3
	Crow-billed Drongo	<i>Dicrurus annectans</i>			1			1
	Bronzed Drongo	<i>Dicrurus aeneus</i>				2	2	
	Spangled Drongo	<i>Dicrurus hottentottus</i>	1+	1+	1+	1+	1+	2+
	Ashy Drongo	<i>Dicrurus leucophaeus</i>	4	3	3	3	4	4
	Black Drongo	<i>Dicrurus macrocercus</i>	6					5
	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>		1			2	
	Lesser Racket-tailed Drongo	<i>Dicrurus remifer</i>		2		3	1	
	Black-naped Monarch	<i>Hypothymis azurea</i>	5	4	5	6	5	5
	Asian Paradise-flycatcher	<i>Terpsiphone paradisi</i>		1	2	1	2	1
	Common Woodshrike	<i>Tephrodornis pondicerianus</i>				11		
Muscicapidae	Blue Rock Thrush	<i>Monticola solitarius</i>	1					1
	Blue Whistling Thrush	<i>Myophonus caeruleus</i>	1					
	Asian Brown Flycatcher	<i>Muscicapa dauurica</i>			1		1	1
	Slaty-blue Flycatcher	<i>Ficedula tricolor</i>		1	1		1	
	Red-throated Flycatcher	<i>Ficedula parva</i>				1	1	1
	Verditer Flycatcher	<i>Eumyias thalassina</i>		1	1	1	1	1
	Blue-throated Flycatcher	<i>Cyornis rubeculoides</i>	7+	5+	5+	7+	6+	5+
	Pale Blue Flycatcher	<i>Cyornis unicolor</i>				1	1	
	Grey-headed Canary Flycatcher	<i>Culicicapape ceylonensis</i>	10+	10+	10+	10+	10+	10+
	Oriental Magpie Robin	<i>Copsychus saularis</i>	2					2
	White-rumped Shama	<i>Copsychus malabaricus</i>	2	1	2	3	2	1
	Black-backed Forktail	<i>Enicurus immaculatus</i>		1		2	3	
	Pied Bushchat	<i>Saxicola caprata</i>						1
	Siberian Stonechat	<i>Saxicola maura</i>	1					1
Sturnidae	Vinous-breasted Starling	<i>Sturnus burmannicus</i>	5					4+
	Asian Pied Starling	<i>Sturnus contra</i>	1+					2+
	Chestnut-tailed Starling	<i>Sturnus malabaricus</i>		3			3	1
	Common Myna	<i>Acridotheres tristis</i>	11+					15+
	Jungle Myna	<i>Acridotheres fuscus</i>	2					3+
	Hill Myna	<i>Gracula religiosa</i>	Aural	Aural	Aural	Aural	Aural	4+
Paridae	Great Tit	<i>Parus major</i>						1
	Sultan Tit	<i>Melanochlora sultanea</i>			4		3	2
Hirundinidae	Red-rumped Swallow	<i>Hirundo daurica</i>						4+
	Barn Swallow	<i>Hirundo rustica</i>	4+					
	Pacific Swallow	<i>Hirundo tahitica</i>	22		1			2
Pycnonotidae	Nepal House Martin	<i>Delichon nipalensis</i>		3			3	
	Streak-eared Bulbul	<i>Pycnonotus blanfordi</i>	1					1
	Red-vented Bulbul	<i>Pycnonotus cafer</i>	3	2	1	2	2	7
	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	7	5				7
	Black-crested Bulbul	<i>Pycnonotus melanicterus</i>	6	3				6
	Olive Bulbul	<i>Iole virescens</i>	7	6	8	9	11	18
Cisticolidae	Zitting Cisticola	<i>Cisticola juncidis</i>	1					
Zosteropidae	Oriental White-eye	<i>Zosterops palpebrosus</i>		4				
Sylviidae	Chestnut-headed Tesia	<i>Tesia castaneocoronata</i>		1		1		
	Dark-necked Tailorbird	<i>Orthotomus atrogularis</i>				3+		2
	Common Tailorbird	<i>Orthotomus sutorius</i>	2	3	2	1	2	3
	White-tailed Leaf Warbler	<i>Phylloscopus davisoni</i>				1	1	
	Dusky Warbler	<i>Phylloscopus fuscatus</i>						1
	Yellow-browed Warbler	<i>Phylloscopus inornatus</i>	3+	4+	2+	2+	2+	2+
	White-crested Laughingthrush	<i>Garrulax leucolophus</i>	6	Aural	Aural	Aural	Aural	Aural
	Greater Necklaced Laughingthrush	<i>Garrulax pectoralis</i>	3	Aural	Aural	Aural	Aural	Aural
	Abbott's Babbler	<i>Malacocincla abbotti</i>		1				
	Puff-throated Babbler	<i>Pellorneum ruficeps</i>	Aural	Aural	3	Aural	Aural	Aural
	Large Scimitar Babbler	<i>Pomatorhinus hypoleucos</i>			1+			
	Golden Babbler	<i>Stachyris chrysaesa</i>	1					
	Grey-throated Babbler	<i>Stachyris nigriceps</i>		6	3	4	4	1

Appendix 3 (ctd.)

Family	Species	Date and location ¹						
		25 Nov X	26 Nov LP3	27 Nov LP4	28 Nov LP3	29 Nov LP3	30 Nov LP4+X	
Sylviidae (ctd.)	Rufous-capped Babbler	<i>Stachyris ruficeps</i>	1					
	Rufous-fronted Babbler	<i>Stachyris rufifrons</i>	1			1	1	
	Striped Tit Babbler	<i>Macronous gularis</i>	8+	7+	8+	9+	8+	8+
	Nepal Fulvetta	<i>Alcippe nipalensis</i>				6	6	
	Brown-cheeked Fulvetta	<i>Alcippe poioicephala</i>	Aural	7	6	5	4	6
	White-bellied Erpornic	<i>Erpornic zantholeuca</i>			4		4	
Nectariniidae	Scarlet-backed Flowerpecker	<i>Dicaeum cruentatum</i>	1				1	
	Orange-bellied Flowerpecker	<i>Dicaeum trigonostigma</i>				1		
	Copper-throated Sunbird	<i>Nectarinia calcostetha</i>	1				2	
	Crimson Sunbird	<i>Aethopyga siparaja</i>		2	1	1	2	1
Passeridae	Little Spiderhunter	<i>Arachnothera longirostra</i>	10+	11+	10+	10+	10+	
	House Sparrow	<i>Passer domesticus</i>	2+				3+	
	Russet Sparrow	<i>Passer rutilans</i>	10+				10+	
	Yellow Wagtail	<i>Motacilla flava</i>	5				10	
	Baya Weaver	<i>Ploceus philippinus</i>	Nest				Nest	
	Scaly-breasted Munia	<i>Lonchura punctulata</i>	3				11	
	White-rumped Munia	<i>Lonchura striata</i>	4				4	

¹ X = On the way to camp from Chaung Tha village (includes bird records on forest edges and mixed open cultivation, degraded forest fragments, secondary bamboo regrowth).