



Results of three surveys for Carpenter's Lar Gibbon *Hylobates lar carpenteri* in Chiang Mai Province, Northern Thailand



Waiying Thongbue, Saw Blaw Htoo, and Mark Grindley

Thailand Conservation Development Program Report No. 1

Chiang Mai, May 2014

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> Thailand Conservation and Development Program Report No. 1

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Cover photo: Gibbon survey team from Ban Khun Tae village. Credit: Waiying Thongbue /WISE Foundation (2012)

i. Abstract

The study reports the findings of the first surveys for *Hylobates lar carpenteri* in the Ob Luang-Doi Suthep forest complex in the west of the Ping River basin in northwest Thailand. The study was undertaken from January to March 2013 by a team of researchers from the Karen Environmental and Social Action Network (KESAN) and supported by the People Resources and Conservation Foundation (PRCF). The region had not previously been surveyed for gibbon, but previous telephone interviews with communities in the area suggested good populations, and suitable was known to persist.

Interviews and field surveys lead to estimates of gibbon numbers and status in three study sites, near the villages of Ban Huai Som Poi, Ban Khun Tae, and Ban Kun Win. These three study areas are located in the same region and the forests between them are believed to be degraded but fairly contiguous.

The area comprises fairly rugged hills and valleys on the edge of an upland plateau at about 1,500-1,600 meters. Forest is mostly wet hill evergreen, varying from slightly disturbed to undisturbed. Much of the forest is under local community management and direct threats to gibbons are very limited. The research included both primary and secondary data collection. Secondary data collection was mainly by interview with local people. Primary research used the auditory sampling technique, conducted from three field sites, which selected based on input from local communities.

Despite problems with data quality from the auditory surveys we can confirm the presence of Carpenter's Lar Gibbon (*Hylobates lar carpenteri*) in all three survey areas. Indeed, gibbons were heard from all listening posts and on almost all days and we deduce the species remains widespread in the area. Gibbons are not subject to direct persecution, and remaining habitat is not at particular risk from logging. The main threat therefore is agricultural expansion leading to forest fragmentation, and the multiple groups that seem to be present may already be genetically isolated. Addressing this problem through improved village-level land use planning, founded on improved awareness and community engagement, were identified as priority actions by the project team and will be the focus of follow-on activities.

Additional incidental records of birds, mammals, reptiles, and amphibians were also collected. In addition to biodiversity data, the surveys also increased capacity and interest among participating villages in gibbon conservation, which will greatly facilitate future actions to protect biodiversity at the sites.

ii. Acknowledgements

This report is the result of the project conducted by the Karen Environmental and Social Action Network (KESAN) for the Thailand Conservation and Development Program, which took place among the Karen people of the Chiang Mai province in Thailand. Gibbon Conservation Alliance (GCA) funded KESAN, a subgroup of the Wisdom of Ethnic Foundation WISE, with technical support provided by the People Resources and Conservation Fund (PRCF).

The project received substantial help from a conservation organization in the Chom Tong area (HNCC) and the Ban Khun Win Watershed Network (BKWWN), both of which have members from the villages in the study area. We would like to take this opportunity to thank all the participants who helped us with this research: Mr Withun Mahanopnatiprai, Mr Prachan Tanuratanachanchai, Mr Lek Maniratchayong, Mr Chaepaw Sawangratanachayong, Mr Supan Kiatasuwiyon, Mr Bee Praichiwin, Mr Sunan, Mr Sutat Tangjaijreunkul, Mr Tongin, Mr Leeleu Pongpanasawat, Mr La Manipinmon, Mr Thongsuk Praiwansiri, Mr Tipaw Chodo, Mr Duangkham, Mr Abeu Pasitong, Mr Watnasak Praisongsan, Mr Nopadon Tiangsong Kul, Mr Boonlert Narongsaksit, Mr Chataw Apiromtada, and Mr Rirat Kirisiprai.

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iv. Report Conventions

All geographical references are given as decimal degrees (lat/long, hddd.ddddo) on the WGS 84 datum.

All altitudes are in meters above sea level (masl).

Where non-English words or names are provided, they are indicated by the use of *italics*.

Scientific and common names for mammals come from Francis (2008). Those for birds are from Robson (2008). Those for reptiles are from Cox (1998).

Species threat status is taken from the IUCN Red List of endangered species, available at www.iucnredlist.org.

At the time of the survey, one USD was roughly equivalent to 31 Thai baht.

KESAN and Mark E Grindley/PRCF produced all maps unless otherwise stated.

v. Acronyms and Abbreviations

BKWWN	Ban Khun Win Watershed Network
DBH	Diameter at Breast Height
FS	Field Site
GCA	Gibbon Conservation Alliance
IUCN	World Conservation Union
KESAN	Karen Environmental and Social Action Network
WISE	Wisdom of Ethnic Foundation
HNCC	Highland Nature Conservation Chomthong
LP	Listening Post
PRCF	People Resources and Conservation Foundation
UNDP	United Nations Development Program
USD	United States Dollar
WCS	Wildlife Conservation Society
	•

IUCN Threat Status (highest to lowest);

- CR = Critically Endangered
- EN = Endangered
- VU = Vulnerable
- NT = Near Threatened
- LC = Least Concern

DD = Data Deficient

vi. Field Site Summaries

Field Site Code	Survey Dates
FS1	29 Jan to 2 Feb 2013
Site Name	District, Province
Ban Huai Som Poi	Chom Tong, Chiang Mai Province
Site Location	Nearest Village
18°22'46.76"N, 98°31'21.83"E	Ban Huai Som Poi (18°22'34.79"N, 98°31'53.91"E)
Altitude	Prevailing Weather During Survey
1,504 m	Mostly cloudy with breeze, one day of rain, cold
Team Members	Guides/Key Respondents
Nai Lek, Nai Chae Paw, Nai Supan, Bee	Mr. Witoon and Mr. Prachan
Forest Status	Habitat
Tropical hill ever green Forest, under community care	Pristine and undisturbed primary forest. Good forest health. Plenty of giant trees, complex forest structure.
Biodiversity Values	Gibbon Population Density (est)
Wild boar, barking deer, palm civet, porcupine, squirrel	

Field Site code	Survey Dates
FS2	29 Jan to 2 Feb 2013
Site name	District, Province
Ban Khun Tae	Chom Tong, Chiang Mai Province
Site location	Nearest Village
18°23'25.12"N, 98°30'59.50"E	Ban Khun Tae (18°23'37.43"N, 98°30'13.55"E)
Altitude	Prevailing weather during survey
1,319 m	Mostly cloudy with breeze, one day of rain, very cold, frost in the morning
Team members	Guides/key respondents
Mr. Sunan Mr. Sutat, Mr. La, Mr. Thong Suk	Mr. Tong In and Mr. Ru Ru
Forest Status	Habitat
Tropical hill ever green Forest, under community care	Undisturbed forest similar to at FS#1
Biodiversity Values	Gibbon population density (est)
Similar to FS1	

Field Site code	Survey Dates
FS3	14 Mar 18 Mar 2013
Site Name	Division/State
Ban Kun Win	Mae Wang, Chiang Mai
Site Location	Nearest Village
18°44'33.64"N, 98°40'49.12"E	Ban Kun Win (18°44'37.13"N, 98°41'32.80"E)
Altitude	Prevailing Weather During Survey
1,251 m	Mostly cloudy
Team Members	Guides/Key Respondents
Mr. Tee Paw, Mr. Duang Kham, Mr. Suchat, Mr. Ah Bun, Mr. Nopadoh, Mr. Boon Lernt	Mr. Rirat and Mr. Jak Tong
Forest Status	Habitat
Similar to FS#1; Tropical hill ever green forest, under community care	A stream runs through, which makes it cooler than surrounding forests. Surrounded by deciduous forest
Biodiversity Values	Gibbon Population Density (est)
No significant large mammals	

1. Introduction

1.1 Background to the project

The Karen people have a saying – "Kaw yu pa thee t khu" – which can be translated as "When one gibbon dies in the forest, seven forests become silent". This demonstrates how the Karen believe that gibbons go hand in hand with forests, since large areas of forests become lonely without the sounds of the gibbon's call or other forest creatures.

Since humans and gibbons were once able to live in harmony with each other without encroaching onto each other's territory, Karen people have various beliefs and folklore involving gibbons. For example, killing or eating gibbons is prohibited, because it is believed that for doing so will bring disaster or suffering upon the poacher, their family or the community.

Gibbons don't tend to damage or destroy people's property. Yet in Karen areas of Myanmar and Thailand, it appears as though their populations are not increasing either. This raises several questions: Why are gibbon populations not increasing in the forest? Is there sufficient food for the needs of the gibbons? Is agricultural advancement destroying their population? Is it a part of the gibbon's nature that their breeding is not conducive for significant population increase? Could lack of population growth be due to poaching? Currently there are few answers to these questions in the Karen areas.

The survey area is within the range of one sub-species of the White-handed gibbon, *Hylobates lar carpenteri*. The status of this species is unknown, but a preliminary literature review (Mesher and Grindley C2011) and a subsequent telephone survey among 35 Thai-Karen villages in 2011 (KESAN 2012) indicated that the *carpenteri* gibbon is now primarily restricted to Karen areas of north-west Thailand and possibly eastern Shan State in Myanmar, though due to civil war this area is not possible to work in.

Karen communities in the range of the *carpenteri* gibbon in Thailand have already shown a strong interest in undertaking conservation projects, and have formed several organizations to do so. These include one of the groups participating in the surveys reported here, the WISE Foundation. Through technical and financial support, we helped these communities to add to the limited knowledge on the distribution and status of the *carpenteri* gibbon under a small, community-based project "Preliminary status review for *Hylobates lar carpenteri* in Thailand", funded by the Gibbon Conservation Alliance. The project aims and objectives are summarized in Box 1. This report details the results of Objective 3.

1.3 Survey sites

Given the limited available information, and the impossibility of working in the range of the *carpenteri* gibbon in Myanmar, the project was primarily interested in the locations of gibbon populations and their relative sizes among the Karen people in Thailand. Based on our preliminary literature review, interviews and telephone survey of 35 village leaders, Chiang Mai, and Mae Hong Son provinces were indicated to hold important vestigial gibbon numbers. However, although communities may be able to locate and report gibbons, we were not initially able to tell which gibbon groups had been reported by several communities, or how accurate the population estimates were. This study provides ground truthing for the initial study while building interest and capacity among several local civil society organizations and their members in gibbon conservation.

Box 1: Project aims and objectives

Aim

Improve information on the status of *Hylobates lar carpenteri* in northwest Thailand and identify at least one viable population and any necessary conservation interventions.

Objectives

- 1. Complete telephone survey in central Chiang Mai province, and expand it to Mae Hong Son and northern Tak provinces
- 2. Train WISE Foundation in the conduct of rapid gibbons surveys and threats assessment
- 3. Conduct at least three field surveys in areas previously identified as having significant numbers of gibbons in villages in Chiang Mai province
- 4. Identify one priority site and conduct participatory planning for conservation actions at the site

2. Materials and methods

2.1 Gibbon population data collection

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).

Listening posts were intended to be about 400-500 m apart and located on hilltops where possible, in order to enable the survey participants to hear gibbons from as many directions as possible. For several reasons this criteria was however not met for two posts, nor was it possible to establish five listening posts in each survey site. Problems with the research implementation and in the recording of data are noted in the Results section.

Surveyors had to leave the camp before dawn in order to arrive on the listening posts before 05:30 am. Listening for gibbon songs was carried out daily from at least 05:30 am to 10:30 am. Survey times were recorded for each listening post as per the standard field record form (Appendix 1).

Each listening post was manned by at least one surveyor, though two were used where possible. On the listening posts, times were recorded from GPS units to be synchronized. Time, compass direction, estimated distance, and (where possible) types of all gibbon songs were recorded on the same field form (Appendix 1). Two surveyors corroborated compass bearing and distance estimates where possible. 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. If a song interval (silence) was longer than 5 minutes, the calls after the interval were recognized as a new song bout.

During the day of each survey, weather conditions were also recorded on the field form. Finally, the information of other wildlife diversity of the area was recorded, mainly with the presence of the gibbon and the presence of other animals. The evidence of hunting and threat were also recorded.

2.2 Mapping and density determination

On completion of the survey, the times, directions and estimated distances of gibbon songs from each day were plotted and triangulated on graph paper. 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, several factors confuse estimates of even skilled researchers. For example, if the call comes from behind a physical feature it is possible that echo from surrounding hills will confuse the direction or the distance; groups may sound much farther away and in a different direction than reality. Also, if one group calls from close to the listener it may be difficult to locate more distant groups calling at the same time.

Furthermore, different gibbon groups beyond 600 m from the listener are more difficult to be distinguished than groups singing at closer distances. Indeed, earlier gibbon surveys in 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). As a result, gibbon densities reported here were estimated using both 0.6 km and a 1 km listening radii.

Average group size in *Hylobates lar* generally increases with latitude, with reported sizes in Thailand ranging from 3.2 animals in Phu Khieo Wildlife Sanctuary (Umponjan et al. 2007) and 3.7 from elsewhere in the center of the country, to 4.4 and 4.9 in northern Thailand (Brockelman and Geissmann 2008). In our analyses we assume an average group size of 4.65 individuals, which is the median of the two estimates from northern Thailand. However, where the survey team could directly observed or otherwise confidently determine the actual size of gibbon groups, we used the observed value.

2.3 Interview surveys

Interviews were conducted with village elders who were knowledgeable on gibbons in the area and on village folklore. The chosen seniors were asked to recall these stories. At least one key respondent was consulted per village. The benefit of these stories is for further discussion and for insight on past information that could help with the current understanding of local gibbon populations.

3. Survey details

3.1 Survey sites

The forest areas around three villages were selected for gibbon surveys based on the results of earlier telephone interview and their interest in participating, all within Chiang Mai province:

- Ban Hui Som Poi Moo 8 in the Tambol of Doi Kaew, in Ampeu Chom Tong. There are three listening posts along the Mae Tia River.
- Ban Khun Tae Moo 5, in Tambol Doi Kaew in Ampeu Chom Tong, also with three listening posts along the Mae Tae River.
- Ban Khun Win Moo 11 in Tambol Mae Win, Ampeu Mae Wang. It has a total of three listening points along the Mae Win River.

All three areas are the residential areas of Karen people as well as an ideal forest for gibbon habitats. The elevation in the region is between 1000-1600 meters above sea level, in the region of Doi Wat Hluang Khun Win, around Doi Da Jeu Kaw.

3.2 Survey itinerary

This project was conducted between October 2012 and May 2013. Initial telephone surveys were conducted in late 2012 and completed in 2013 (see separate project completion report), while field surveys were undertaken from the 29th of January to the 2nd of February 2013 for the study areas Ban Hui Som Poi and Ban Khun Tae, and between the 14th and 18th of March 2013 for Ban Khun Win Moo 11 (Table 1). Prior to the

field surveys, training sessions were held for the people who would go out and record the calls, as well as conservation groups and the heads of the villages. Information was provided on the reasons for this project, and any questions were answered. The training was also used to prioritize or select survey locations. Afterward training, two people from each village were assigned to each listening post, with four listening posts for each survey location. The teams then joined the research supervisors for five days of data collection in the field.

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Date	Activity	Days
Before December 2012	Telephone survey	15
December 2012	Train surveyors from the three areas	1
December 2012	Coordinate Huibabah neighbourhood in Tambol Jaem Hluang, Ampeu Kalyawattana, Chiang Mai	2
26 January 2013	Hold a conference with leaders of conservation groups at Ampeu Chom Tong and leaders at the Khun Tae village	0.5
26 January, 2013	Meet and converse with villagers at Ban Hui Som Poi	0.5
29 January. 2013	Meet and converse for a second time with villagers at Ban Khun Tae	1
29 January – 2 February. 2013	Survey at Ban Hui Som Poi and Han Khun Tae	5
6 March, 2013	Prepare to meet with villagers of Ban Khun Win (part 1)	1
13 March, 2013	Meet with villagers of Ban Khun Win (part 2)	0.5
14 – 18 March, 2013	Conduct gibbon survey at Ban Khun Win	5
19 May, 2013	Follow up any remaining information at the field sites and conclude the survey	1
25-26 May, 2013	Follow up the remaining information at Ban Khun Tae	2
Total days		34.5

3.2 Site description

All three research areas have an elevation higher than 1000 meters above sea level. The forests are primary forests (called *Pwa Ka Keu Neu Pa* in the Karen language), with an average temperature of 20°C during the rainy season. Of the three sites, Ban Kun Tae is the coolest, such that some years there is fog in that area nears the stream bank. The cold temperatures reportedly sometime cause trees at the edge of the river to die. All three sites have tree species found in jungle, such as *Schima wallichii, Erythrina variegata* (Tiger Claw), White Champaca (*Michelia champaca*), wild mangos, forest palms, and various succulent plants. The primary forests in the study area have a variety of plant species, and prove to be very moist, showing significant mosses on tree trunks as well as orchids.

All three forests where the studies were conducted are under management by the participating communities. These have rules of conduct, which forbid the forests from being transformed into agricultural land or trespassing. The only exceptions made in the rules of conduct of the community forestry would be for growing medicinal herbs for the community or growing small gardens. However, there are strict rules, such as not cutting down trees or selling the orchids within these community forests.

All these aforementioned reasons show that these forests are a source of rich species biodiversity. The two forests in Ampeu Chom Tong where gibbon studies were conducted are within Ob Luang National Park, gazetted in 1991 and contiguous with Doi Inthanon National Park to the north (est. 1972). As for the Ban Khun Win forest area, it is currently not granted protected area status. However, it still receives protection from the community in the form of protest towards any land development in that area.

3.3 Survey team

The gibbon population surveys presented here were conducted by the research team at KESAN, a subgroup of the ethnic organization known as WISE Foundation. Their first work involved telephone surveys on Karen villages in the Chiang Mai and Mae Hong Son Regions (KESAN 2012). After their first level of information, they were better able to plan for the research, which was focused on the Chom Tong and Mae Wang. This was

followed by data collection training of the people interested in doing this research, mainly the GPS techniques and methods for listening post surveys.

The researchers used a map and defined the boundaries in which the optimal listening posts were located (Table 2). The listening posts were situated at the highest elevation possible where gibbons could be found in all three research locations. Local names for the posts are:

Listening post code	Listening post coordinates	Survey dates	Total hours spent at listening post
Field Site #1: Ban I	Huai Som Poi		
LP1.1	18°22'56.868"N, 98°31'33.193"E	29 Jan - 2 Feb	5h, 5h, 5h, 5h 5h
LP1.2	18°22'49.30"N, 98°31'38.90"E	29 Jan - 2 Feb	5h, 5h, 5h, 5h 5h
LP1.3	18°22'28.205"N, 98°31'7.951"E	29 Jan - 2 Feb	5h, 5h, 5h, 5h 5h
Field Site #2: Ban I	Khun Tae		
LP2.1	18°23'17.700"N, 98°31'8.500"E	29 Jan - 2 Feb	5h, 5h, 5h, 5h 5h
LP2.2	18°23'32.00"N, 98°31'15.00"E	29 Jan - 2 Feb	5h, 5h, 5h, 5h 5h
LP2.3	18°22'36.2"N, 98°30'23.6"E	29 Jan - 2 Feb	5h, 5h, 5h, 5h 5h
Field Site #3: Ban	Khun Win		
LP3.1	18°44'41.993"N, 98°41'1.800"E	14 - 18 Mar	5h, 5h, 5h, 5h 5h
LP3.2	18°43'33.893"N, 98°42'20.605"E	14 - 18 Mar	5h, 5h, 5h, 5h 5h
LP3.3	18°44'12.635"N, 98°40'36.618"E	14 - 18 Mar	5h, 5h, 5h, 5h 5h
LP3.4	18°44'56.530"N, 98°40'38.344"E	14 - 18 Mar	5h, 5h, 5h, 5h 5h
Total			250 h

 Table 2. Locations of listening posts, survey dates and hours on posts

- Ban Hui Som Poi: Baw Soh Oh Jo, Pi Chi Klaw Jo, and Sae Nu Ti Jo Koh
- Ban Khun Tae: Sae Mi Kae, Dah Jae Koh, and Peu Doh Lae
- Ban Khun Win: Seu Keu Chi Lu, Wad Hluang Khun Win, Wah Kru Dae, and Pi Da Ou Reu Jo

After defining the study area, two people were assigned each site to listen for the cries of the gibbons and to record the data over the course of five survey days.

3.4 Weather

During the study periods, Ban Hui Som Poi and Ban Khun Tae were experiencing the cold season and temperatures of around 25°C during the day, dropping to about 5°C at night. Prior to the study dates, we were told that heavy rainfall occurred at the Ban Khun Tae area, with unseasonal storms. These contributed to a cool climate during the studies at Ban Hui Som Poi and Ban Khun Tae. In the mornings, fogs descended into the area, and a breeze blew throughout the day. All sites remained cloudy but mostly free from rain during the surveys.



Fig 2. Map showing location of the Field Sites in northern Thailand

4. Results: Gibbons

4.1 Interview results

According to interviews in four villages, there about 28 gibbon groups in the survey region, comprising around 81 individuals; seven groups around Htee Mu Plaw village, six groups around Baw Lay Der, eight groups around Shen Hta, and seven groups around the Pay Lay Pu.

These estimates give an average group size in the survey area of 2.9, which is lower than other estimates for *Hylobates lar* in northern Thailand – of 4.4 to 4.9 – but within the range for the species (Brockelman and Geissmann 2008).

Many respondents said that gibbons frequently come close to the villages and farm areas as they are not harmed by the villagers. If so, encounters might be relatively frequent, and estimates of group numbers could therefore be relatively reliable.

4.2 Aural evidence

Gibbon calls were heard on all days, from all listening posts except one (LP3.2 on day 4). In total, 123 records of individual gibbon song bouts were made; 37 from FS1, 35 from FS2 and 51 from FS3.

Of all the records, the earliest call was started at 06h20 (FS3, LP2, 13 March 2013) and the latest call finished at 10h35 (FS2, LP3, 31 Jan 2014).

In addition, during the travelling period from 8 to 9 April, the team heard three groups of gibbon calling from up to 1.5 km away at Htee Mu Klo Stream, west of Htee Mu Plaw Village. Also during the travel on 22 and 23 April, when coming back from the listening post to the villages, there were two groups of gibbon calls heard at the southern part of Khe Shor Ter Mountain.

4.3 Direct sightings

The only direct observation was made at Huai Som Poi LP 1.2, where the researchers observed one group of at least three individuals.

4.4 Density estimates

Despite gathering a sizable dataset of records, several methodological errors resulted that severely limit the value of the data. The reasons for the errors, and the lessons that might be learned from them, are discussed in the final section.

Unfortunately, many of the records were outside of the upper range for analysis (ie, estimated to be from over 1000m from the listening post), or were otherwise incomplete. Indeed this applied to 81 of the 123 records in total, or 66% (see Table 3). In addition, several of the listening posts were much further apart than normally considered ideal (ie, <500m apart), and thus in most cases it was not possible to confirm (or exclude) records based on overlapping listening ranges, as the usual aural survey methodology allows (see methodology section).

Field Site	Total number of records	(a) Over max listening radius (>1000)	(b) Records with a field missing	Number of usable records (total - (a) - (b))	Percentage of usable records
FS1	37	10	3	24	65%
FS2	35	20	10	5	14%
FS3	51	37	1	13	25%
Totals	123	67	14	42	34%

Table 3. Total number of records by site, with numbers of erroneous or unusable records

Of the three sites, FS1 (Ban Hui Som Poi) had the highest absolute (24) and relative (65%) number of usable records. These included seemingly reliable records from all three listening posts, although LP1 and LP2 were needlessly close together (260m) while LP3 was just over one kilometer from both of the others. However when plotted and analyzed, the records of calls from within 1000m of any listening post nonetheless indicate that two groups were recorded reliably by at least one post (and on more than one day), while two further groups can be inferred from multiple records on multiple days though from only one listening post (LP2 in this case). We therefore find evidence within the listening range of between two and four groups. This equates to between 9 to 19 individuals. Similar figures are provided in Table 4 for each listening site.

Table 4. Gibbon population estimates for each site, broken down by data quality

Field		Estima	ated gibbon numbers,	based on:	
Site Code	Row refers to ⁽¹⁾	Triangulated result	Multiple records from one LP	Single record from one LP	Totals
FS1	Groups	2	2	0	4

	Individuals	9.3	9.3	0	18.6
FS2	Groups	0	0	4	4
	Individuals	0	0	18.6	18.6
FS3	Groups	0	2	1	3
	Individuals	0	9.3	4.65	13.95

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⁽¹⁾ Using an average of 4.65 individuals per group; see Methodology section.

White-handed Gibbon Surveys, Chiang Mai Province, Thailand

The highest confirmed density groups were two groups within the listening area of FS1. This site was the furthest from permanent settlement, and from the easiest point of access into the forest.

However, due to multiple recording and reporting errors, this result cannot be reliably interpreted to mean that this site had the highest gibbon density of the three sites. Indeed all sites recorded multiple groups and there were overall 120 records made across three sites over 15 days of surveys.

It is a terrible disappointment that the data were not reliable enough to allow better comparison, but there still seems evidence to support the interview claims of good gibbon populations around these villages.

Due to the inadequacies in the data and the resulting low number of records that can be used for triangulation we have not attempted to estimate gibbon densities at any of the field sites.

Note: In the first draft of this report, the authors initially estimated a combined total of 18 to 21 groups present in the survey areas, within the 1 km listening radius. The teams also themselves estimated that these groups included between 55 and 69 individuals. Those estimates were based on the same data used here but following analysis with the teams conducted directly after the surveys. We now distrust these original estimates but they are provided here to provide an historical record.

4.5 Local beliefs

Local people report that gibbons call the most for a period of three days before and three days after the 'dark moon', over three days of the 'half moon' (both when waxing and waning), and over three days of the full moon. Villagers state that gibbons rarely call in the evening, and generally only call when they are "full" after eating. They also make sounds when they see some big animals or some things that scare them.

The gibbons reportedly sometimes call when one of their members dies, and the local people believe that the animals are conducting a "funeral ceremony". At this time, the gibbons all start into full song in unison, without the preliminary whoops usually observed with Hoolock song.

Interview respondents also stated that in the wild, an adult male would help the pregnant female to give birth by holding the stomach very tight. However, sometimes the older females also come to help. Sometime males help carry juveniles, although this is usually done by females.

5. Results: Other Species

5.1 Birds

During this study the research assistants recorded the calls of various bird species during the studies, and counted many species based on their calls. Traces of their leftover meals were found, and sometimes some birds were observed directly. A list of species records is provided in Table 5.

The birds in these areas are native species, rather than invasive or exotic species. These include the red whiskered bulbul (*Pycnonocus jocosus*), doves, parrots, pheasants, woodpeckers, and wild fowl. Karen names of common species are Hto Jikwi, Hto Kchoro, Hto Law, Hto Pawee, Hto Kleu, Hto Jibi, Hto Jisu, Hto Chawchae, Hto Pi, Hto Sawkaw, Hto Kawrawkawkae, and Hto Wakleu. These birds live primarily up in the tree canopies and enjoy the various fruits of the forest.

From the perspective of conservation, the only significant record is of Great Hornbill *Buceros bicornis*, which is regarded as Near Threatened.

5.2 Mammals

The only records of mammals were made from discarded food and other sign, and are listed in Table 6. Animals included wild pigs, barking deer, wild rabbits, rats, and squirrels. However, these animals were not observed during the field surveys; they reside in forest areas that are not too large. Some years, tiger tracks are found in the aforementioned conserved forests and what are assumed to be large carnivores kills some livestock in the village.

Family	Common name	Scientific name	Threat status
Phasianidae	Rufous-throated Partridge	Arborophila rufogularis	LC
	Red Junglefowl	Gallus gallus	LC
	Silver Pheasant	Lophura nycthemera	LC
	Grey Peacock-Pheasant	Polyplectron bicalcaratum	LC
Charadriiformes	Red-wattled Lapwing	Vanellus indicus	LC
Strigidae	Brown Wood-Owl	Strix leptogrammica	LC
Bucerotidae	Great Hornbill	Buceros bicornis	NT
Ramphastidae	Great Barbet	Megalaima virens	LC
	Blue-throated Barbet	Megalaima asiatica	LC
Columbidae	Barred Cuckoo-Dove	Macropygia unchall	LC
	Emerald dove	Chalcophaps indica	LC
	Thick-billed Green-Pigeon	Treron curvirostra	LC
	Mountain Imperial-Pigeon	Ducula badia	LC
Sittidae	Chestnut-vented Nuthatch	Sitta nagaensis	LC
Muscicapidae	Slaty-Backed Forktail	Enicurus schistaceus	LC
Timaliidae	Lesser Necklaced Laughingthrush	Garrulax monileger	LC

Table 5. Birds recorded in the survey

Table 6. Mammals recorded in the survey

Order	Family	Species			Evidence)		Threa
		Common name (Scientific name)	Visual	Aural	Faeces	Tracks	Inter- view	t status
Pholidota	Manidae	Pangolin <i>(Manis spp.)</i>				+	+	EN
Primates	Hylobatidae	Carpenter's Lar Gibbon (Hylobates lar carpenteri)	+				+	EN
Carnivora	Canidae	Dhole (Cuon alpinus)		+		+	+	EN
		Asiatic Jackal (Canis aureus)					+	LC
	Mustelidae	Yellow-throated Marten (Martes flavigula)	+				+	LC
		Hog Badger (<i>Arctonyx collaris)</i>				+	+	NT
	Viverridae	Binturong (Arctictis binturong)					+	VU
		Common Palm Civet (Paradoxurus hermaphroditus)					+	LC
		Masked Palm Civet					+	LC

		(Paguma larvata)					
	Felidae	Leopard <i>(Panthera pardus)</i>		+	+	+	NT
		Clouded Leopard (Neofelis nebulosa)				+	VU
Artiodactyla	Suidae	Eurasian Wild Pig <i>(Sus scrofa)</i>			+	+	LC
	Cervidae	Red Muntjac <i>(Muntiacus muntjac)</i>			+	+	LC
	Bovidae	Chinese Serow (Capricornis milneedwardsii)	+			+	NT
Rodentia	Sciuridae	Black Giant Squirrel (Ratufa bicolor)	+	+		+	NT
		Pallas's Squirrel (Callosciurus erythraeus)	+	+			LC
		Northern Treeshrew (Tupaia belangeri)	+	+			LC
	Histricidae	Malayan Porcupine (Hystrix brachyura)			+	+	LC
		Brush-tailed Porcupine (Atherurus macrourus)			+	+	LC

5.3 Reptiles

Only two species of reptile were recorded during the surveys, both of them turtles (Table 7). Most significant are interview records for Big-headed Turtle *Platysternon megacephalum*, which is currently considered to be globally Endangered (EN). Although interview records are often highly suspect, the unique physical characteristics of this species make mistaken identification seem unlikely.

Table 7.	Reptiles	recorded	during	the surveys
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Family	Species		Evidence		Threat
	Common name	Scientific name	Visual	Interview	Status
Testudinidae	Impressed Tortoise	Manouria impressa	+	+	VU
Platysternidae	Big-headed Turtle	Platysternon megacephalum		+	EN

5.4 Amphibians

Amphibians that were spotted included primarily frogs, the Karen names for which are Dae Nalae, Dae Chi, Dae PiHna, Dae KawKae, Dae Beu, Dae Lakleu, Dae Bila, and Dae Seu. Those three of which could be identified scientifically are listed in Table 8. None is of globally conservation significance, all being considered Least Concern.

Family	Species		Evidence		Threat
	Common name	Scientific name	Visual	Interview	Status
Megophryidae	n/a	Leptobrachium chapaense	+	+	LC
Ranidae	n/a	Amolops marmoratus	+	+	LC
	Large-headed Frog	Limnonectes kuhlii	+	+	LC

Table 8. Amphibians recorded during the surveys

6. Description of villages and agricultural systems

The following is based on the results of village interviews and focus group consultations, combined with the personal knowledge of the authors.

6.1 Livelihoods

Agriculture: There are minor differences in the occupations of the Ban Hui Som Po and Ban Khun Tae villages since both areas have a history of monoculture (cabbage and shallots). They have been producing cash crops since 30 years ago, when a Thai-Norway project introduced agriculture as an alternative to opium. The emphasis of the agricultural industry in these areas is to sell these crops. As such, the agricultural land has been extensively used as public land. As for Ban Khun Win, the population is much smaller that doesn't have much infrastructure compared to the previous two villages. Their agricultural practices depend very much on the forest, such as collecting wild honey, vegetables from the forest, and tea plantations to sell. All three villages grow rice on terraces for household use and sale.

Fruit trees/perennials: Ban Hui Som Po and Han Khun Tae have fruit trees that are viable for sale such as persimmon, avocado, and coffee. Ban Khun Win has *Zanthozylum limonella* (a spice), which is grown in the forest, as well as tea. The kinds of fruits found in all three villages include jackfruit trees, lemon, lychee, longan, and a variety of bamboo.

Livestock: In all three villages, breeding cows was more common than breeding buffalos since buffalos have a slower reproductive cycle. There are also water restrictions which make buffalos harder to rear, and consequently the villagers have more incentive to breed cows. Regardless, the number of both animals is significantly lower compared to past years, primarily because as agricultural land has expanded it has reduced the land available for breeding animals. Another livestock issue is a shortage of workers, since the new generations seek higher education and leave the caring of the livestock to the parents. This results sometimes in the livestock destroying neighboring agriculture. These animals have to be dispersed, which will lead to long term issues of decreased population size.

Forest uses/Timber extraction: Forests in the three survey regions are distributed into various types by the villagers under local and national-level arrangements. Conserved forest areas are where the villagers are prohibited from transforming into agriculture, or from causing destruction in any way. The forest floor is used for animal breeding or building houses. This forest area is restricted from being sold outside of the community. For these reasons it is common to see conserved forests surrounding the villages, or set aside for restricted use.

Hunting: In the conserved forests, animals are protected from hunting. Hunting is only allowed in designated zones, as defined by the villagers, which has resulted in an increase in the number of small animals compared to the past. However there are still hunters that continue to hunt despite the prohibition. According to local custom, perpetrators are punished if they are caught, with the severity dependent on the species hunted. This has also helped increase the amount of small animals in the forest.

Other species: Within the forests there are a variety of other species that have a purpose for people. Those which can be harvested and eaten include bark mushrooms, button mushrooms, stalked mushrooms and various other vegetables and young stems, as well as herbs.

Other forms of income: The villagers of all three areas have agricultural professions. After the riceplanting season, the commercial vegetation needs to be grown, which requires a lot of intensive labor. Some villagers leave the village for a few months to do temporary work such as manual labor, shop keeping, and working at gas stations or restaurants in other towns. During the rice-harvesting season, they return to help harvest.

Conflicts with wildlife: Compared to the past, a conflict with wildlife is very minimal. Issues include wild dogs killing several baby cows of the farmers, and on some occasions wild carnivores destroy young cattle.

Development initiatives: Ban Hui Som Poi and Ban Khun Tae have a longer history of development: nearly 40 years. Development has been initiated by Buddhist and Christian projects, which help support staff development and children's education. There have been government funded and internationally funded projects to develop the economy by building roads, improving the water supply, ensuring public peace, developing education and safety. At the moment, Ban Khun Win has had NGOs' support for nearly 20 years. Their emphasis is on developing self-reliance. They don't have a budget for extensive activities, but public schools are a means for children to get various opportunities. Ban Khun Win is significantly more rural than Ban Hui Som Poi and Ban Khun Tae.

Threats to wildlife: Since the villagers in all three study areas have strict regulations on forest animal conservation, the populations of wild animals are able to increase in number. However since the land area isn't large enough for certain species to exist peacefully, and weapons such as guns have been introduced and roads have made the forests more accessible, outsiders pose a threat to wildlife that the locals wouldn't hunt such as gibbons and the great hornbills. The hunting and killing of these certain animals affect the food chains of the forest permanently. The lack of crop rotation means some animal species can't live peacefully: forests that grow from crop rotations are safer than open forests, which people can enter more easily. Also, the food of certain animals disappears once the hunting grounds for those animals regenerates into forest, eg, rabbits decrease in population once the forest becomes denser.

6.2 History and folklore

The following represents Karen folklore attitudes towards gibbons in the survey areas.

Called "ther yu pwa" by the Karen, the gibbon has a special and meaningful place in the forest. The gibbon's presence in the forest brings not only physical and aesthetic beauty of diversity, but also spirituality to the people whose life is closely intertwined with the forest and natural resources. Its call, antics, and agility in the forest canopy bring life and joy to anyone who happens to chance upon this wonderful mammal. Its death brings anguish to the whole place and the seven ridges and seven valleys in the local area reverberate in mourning for the great loss.

Local people do not hunt the gibbons due to a belief that hunting them will bring them and their family bad luck. Villagers are told at a young age that hunting or eating the gibbons would bring discord into the community. When outsiders who don't share these beliefs and hunt or kill the gibbons, and then are seen to experience unfortunate situations, reinforce the local villagers' beliefs.

Locals believe that if one gibbon dies, seven forests will become silent. This is to say that gibbons have a very important role in adding vitality to the forests, and that their absence is significantly noticed.

Karens have a folklore that all monkeys used to be human siblings that went into the forest to look for food. One turned into a monkey that eats all food regardless of who it belongs to, the other became a gibbon that would not eat people's food.

7. Threats and opportunities for gibbon conservation

7.1 Direct threats

In Karen people's belief, it is forbidden to kill gibbons as a means of direct conservation. Although other traditions developed with the Karens, they still hold strong to the prohibition. There are opportunities for other tribes to hunt animals, which roam, around the forest, but these are not frequent. Threats towards gibbons by the Karen people are rare.

7.2 Indirect threats

Some indirect threats include hunting and killing done by outsiders, which was more common in the past. Aside from that, the changes in the forest structure also affect the food availability of the gibbons. Areas of the forest that were disturbed by fires affect gibbons, but usually not fatally since they are not very intense.

7.3 Deforestation

All three study areas, regardless of whether the locals have a profession in agriculture or not, the use of land for farming causes a strong distinction between the conserved forest and the community use forest. Some of the plantations may be interspersed in the community use forest area such that there is sufficient land for the gibbons to live in too. Forest destruction here isn't as severe as in other places. The forest around the community is still an ideal forest for community use, and is complete and healthy and surrounds the base of the mountain. This ensures the protection of the conserved forest, in addition to the active care from the villagers. According to villagers, the forestland around Ban Khun Win lies within a national forest area, and may in future be included within the proposed Ob Khan NP, though local residents are currently contesting this. The exact status of the forest or plans for protected area status cannot be confirmed at this time.

7.4 Opportunities

It is very valuable that the Karen people have a strong belief in not killing gibbons. Aside from this, their lifestyle is in accordance with forest conservation already. This is evidence that there are opportunities to preserve the lives of gibbons while living in harmony with them. By encouraging the ancestral beliefs to be retold and spread in the community and in the education systems and learning materials, there will be a better understanding of how to live alongside gibbons in the future. This offers the opportunity that gibbons could become a flagship for the conservation of other forms of natural resources such as other wildlife and flora that are threatened today.

8. Discussion

8.1 Problems with gibbon data quality

There were multiple errors and problems with the field data recorded by the survey teams that were discovered during peer review of the original report by the current third author. These include:

- Very long periods recorded for song bouts, which suggests the protocol was not followed correctly (ie, breaks of more than five minutes indicate separate bouts)
- Multiple records from an estimated distance of over 1000m (these were excluded from the analysis)
- Multiple records with fields missing, including time, distance and/or bearing

It has not been possible as yet to discuss these errors with the field team, but more thorough training and better supervision presumably could have avoided them for novice survey team members. The low number of usable records is a double tragedy because not only are results inconclusive, but it also means the effort of the field teams and the local counterparts were largely to no purpose.

However, the diminished results are still of value for conservation of this little-known subspecies, and for biodiversity conservation in the survey villages.

8.2 Overall status of biodiversity in the study area

In total, 20 species of mammal were recorded from the survey area, mostly from interviews. However there is good evidence for the presence of Globally Endangered Pangolin (*Manis* sp) and Dhole (*Cuon Alpinus*) and less strong evidence for the Globally Vulnerable Binturong (*Arctictis binturong*) and Clouded Leopard (*Neofelis nebulosa*).

The project also recorded numerous bird species although the sites contained nothing remarkable aside from Great Hornbill (*Buceros bicornis*), which is regarded as Near Threatened and could be regarded as a flagship for protection of mature forest. Along with gibbons, the species is among the few that can disperse the largest tree seeds and therefore has an important role in forest ecology.

The survey confirms the presence of Carpenter's Lar Gibbon (*Hylobates lar carpenteri*) in all three survey areas. Although density estimates were not possible due to poor data, gibbons were heard from all listening posts and on almost all days. We deduce that gibbons are still widespread in the area, and furthermore are not subject to direct persecution, and that remaining habitat is not at particular risk from logging. The main threat therefore is agricultural expansion leading to forest fragmentation, and the multiple groups that seem to be present may already be genetically isolated. Addressing this problem through improved village-level land use planning, founded on improved awareness and community engagement, were identified as priority actions by the project team and will be the focus of follow-on activities.

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10. Appendices

Appendix 1: Field form (Call Record sheet, English version)

Observers		Date		
Time arrive L	.P	Time lea	ve LP	
LP position /	alt			
Call records				
Start Time	End Time	Bearing (°)	Distance (m)	Туре*

Time	Sun	Cloud	Rain	Breeze	Wind
06:00					
15					
30					
45					
07:00					
15					
30					
45					
08:00					
15					
30					
45					
09:00					
15					
30					
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15					
30					
45					
11:00					
15					
30					
45					
12:00					
15					
30	-				
45				-	