

## A brief survey for crested gibbons in Bach Ma National Park, central Vietnam

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We carried out a short survey for gibbons in the Bach Ma National Park (Thua Thien Hue Province) of central Vietnam. During eight survey days, eight different groups (including solitary males) were heard. All gibbons appeared to live in lowland evergreen forest at altitudes between 400 and 800 m, although the park area also includes forest areas at higher altitudes. Most gibbon songs (53%) started at dawn, between 05:00 and 06:00 hours. Our preliminary density estimate of about 1.3 groups/km<sup>2</sup> compares well with estimates of southern *Nomascus* populations and appears to be higher than at least some estimates from northern populations. We also carried out tape-recordings of the gibbons' songs. A comparative analysis of these recordings will be helpful in resolving the uncertainties about the taxonomic status of gibbons in central Vietnam and adjacent parts of Cambodia and Laos.

### Introduction

Bach Ma National Park of central Vietnam is not only located in a transition zone between the southern white-cheeked crested gibbon (*Nomascus siki*) to the north, and the yellow-cheeked crested gibbon (*N. gabriellae*) to the south (Geissmann, 1995; Geissmann *et al.*, 2000), but also in the vicinity of the type locality of *N. siki* (see Delacour, 1951). This makes the gibbons in the Bach Ma a particularly important key population in our comprehensive study on the vocal diversity and systematics of the crested gibbons (genus *Nomascus*). Therefore, we carried out a brief survey of the gibbons in Bach Ma National Park, in order to tape-record their calls, but also to collect some preliminary data on the status of the gibbon population in the park.

The most recent published surveys of crested gibbons in Bach Ma National Park date back to 1990/1 (Eames and Robson, 1993; Robson *et al.*, 1991). Although survey work has been conducted by the park staff since then, no results appear to have been published.

Gibbon populations throughout Vietnam are threatened by hunting and habitat loss, and unfortunately national parks are no exception. Therefore, long-term monitoring of the gibbons in Bach Ma is vital to ensure conservation measures are adequate.

The Bach Ma National Park is situated on the southern edge of Thua Thien Hue Province in central Vietnam, about 40 km south-east of the old imperial city of Hue (Fig. 1). The area of the park is located within the coordinates of 16°05'–16°15'N and 107°43'–107°53'E.



Fig. 1. Map showing the location of the Bach Ma National Park in Vietnam. – Die Karte zeigt die Lage des Bach Ma Nationalparks in Vietnam.

The national park was created in 1991 with the aim to conserve the only green transect left in Vietnam, stretching from the South China Sea to the border with Laos (Le Van Lan *et al.*, 2002). The misty mountain peak of Bach Ma is also a tourist attraction and the numbers of visitors to the park is steadily increasing with 15,000 visitors in 2001 (ICEM, 2001).

Bach Ma National Park is situated in the central Annamite Mountains and lies on a high mountain ridge that runs west-east from the Laotian border to the East Sea. This ridge interrupts the coastal plain of Vietnam, and, therefore, is believed to form a biogeographical boundary between the faunas and floras of northern and southern Vietnam. This ridge also affects the local climate at the national park, which is probably one of the wettest places in Vietnam: the mean annual rainfall at the summit of Mount Bach Ma is 7,977 mm (BirdLife International and MARD, 2004).

The topography of the national park is generally steep and rugged, with several peaks above 1,000 m, the highest of which is Mount Bach Ma at 1,448 m.

The park covers an area of about 220 km<sup>2</sup>, of which 51 km<sup>2</sup> have no forest cover. The forested area consists of 27 km<sup>2</sup> rich forest, 59 km<sup>2</sup> medium forest, 65 km<sup>2</sup> poor forest and 17 km<sup>2</sup> young forest (Van Ngoc Thinh *et al.*, 2001). As a result of human disturbance, no primary forest now remains in Bach Ma National Park, and the dominant habitats at the national park are scrub and grassland (Van Ngoc Thinh *et al.*, 2001).

Yet, the Bach Ma area has long been noted for its rich biodiversity (BirdLife International and MARD, 2004). One reason is that, within a relatively small area, the area supports a wide range of habitat types, from coastal lagoons to montane forest. Additionally, Bach Ma is situated at a biogeographical boundary between northern and southern Vietnam, and between the Annamite Mountains and the coastal plain. Bach Ma National Park has also been identified as one of the Vietnamese regions that support important populations of primates that are of national importance (Van Ngoc Thinh *et al.*, 2006), such as the crested gibbons and red-shanked douc langurs (*Pygathrix nemaeus*) and an unidentified crested gibbon (*Nomascus* sp.) (Robson *et al.*, 1991). However, the current status of many of these species at the national park is unclear.

### Materials and methods

Our survey was carried out during eight days between 5 and 12 April 2001. The survey itinerary is shown in Table 1.

The auditory survey technique was employed to assess the gibbon population size (see Brockelman and Ali, 1987, for details). The survey team split into two pairs, stationed roughly 500 m apart, in order to accurately locate the calling groups by mapping the

angle and estimated distance to groups from two known locations.

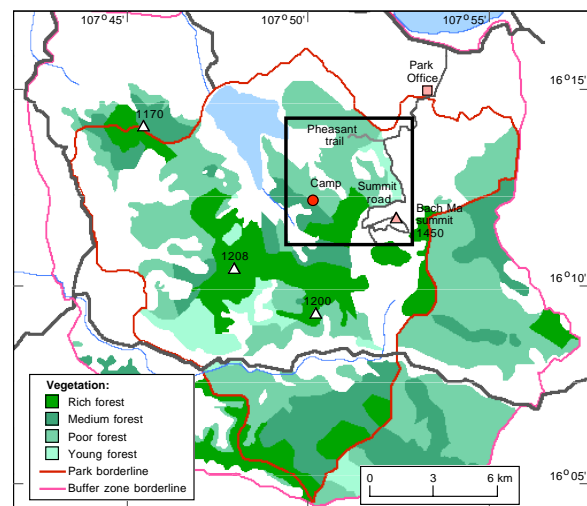
**Table 1.** Survey itinerary. – *Ablauf der Feldstudie.*

Date	Activity
5 April	Survey along the road to the summit (km 9 and 10)
6 + 7 April	Survey along the Pheasant Trail
8 + 9 April	Survey along the road (km 13 and 14)
10 + 11 April	Survey in camp area
12 April	Survey along the road (km 14) in rain

Surveys began at 05:00 and ended at 11:00 hours, in order to be in position during the peak singing time of the gibbons. The location of observation posts was determined by a combination of knowledge of the position of groups from previous surveys, and terrain; ideally, listening posts were located on a ridge from which several valleys could be surveyed at once.

Because workers on the summit road insisted that gibbons in Bach Ma frequently call in the evening, we also carried out two surveys in the evening hours between 15:00 and 18:00 hours.

Most observation posts were located on the road from the park office to Bach Ma summit. Two mornings near the beginning of the survey were spent on the “Pheasant Trail”, and two mornings near the beginning of the survey were spent in the area of our forest camp (16°12.6'N, 107°50.8'E), located on the ridge trail leading down from the summit road at kilometre 14 (Fig. 2).



**Fig. 2.** Map of the Bach Ma National Park. The black frame indicates the survey area. Forest types after Van Ngoc Thinh *et al.* (2002). – *Karte des Bach Ma Nationalparks und Lage des Untersuchungsgebietes (schwarzer Rahmen). Waldtypen nach Van Ngoc Thinh et al. (2002).*

The following information was recorded: Time of arrival at, and departure from, the observation post; time of dawn as judged from when the observer could see the green of leaves; local time of sunrise (i.e. the time at which the sun was visible over the horizon); Gibbon song bouts: start and end time of song bouts, number of males and great-calling individuals, compass bearing and estimated distance to group, and visual information on group location when the terrain was visible from the observation post.

Song bouts were recorded using two sets of tape-recorders for future analysis of song characteristics: (1) Sony WM-D6C tape-recorder equipped with a JVC MZ-707 directional microphone; (2) Sony TC-D5M tape-recorder equipped with a Sennheiser ME80 (+K3U) directional microphone.

## Results

Eight different groups were heard (including solitary individuals). Most groups contained one adult male, and one to three great-call-singing individuals. The great-call-singers of each group presumably include adult females and immature group members of either sex (e.g. Geissmann, 1993). Songs of one group were too far away to determine whether great-calls occurred in the song or not. Two solitary males were heard repeatedly. Minimum group sizes, based on the number of calling individuals, are listed in Table 2. No direct observations of gibbons were possible during this short study.

All gibbon groups we heard appeared to be located at altitudes between 400 and 800 m (Fig. 3). Six groups were located in what was classified as rich or medium forest by Ngoc Tinh *et al.* (2001), and two groups in poor forest.

In seven days, a total of 17 song bouts were heard by two observer teams. We heard one to four groups per day and one to five songs per days. Single great calls were not included in the count. Three

additional song bouts may have occurred but were not heard reliably. The earliest song bout started at 05:22 hours, the last one at 08:44 hours, and a majority 53% of all songs started before 06:00 hours (Fig. 4). Median song duration was 7 minutes (range 1-12 minutes).

All days, except the last one, were sunny with occasional intervals of heavy fog (Fig. 5a, b). Gibbons were not heard to sing in the fog. Heavy rain during the morning of the last survey day made it impossible to hear any gibbon calls (Fig. 5c).

Other primates recorded included one group of about 20 bear macaques (*Macaca arctoides*) which passed near our camp.

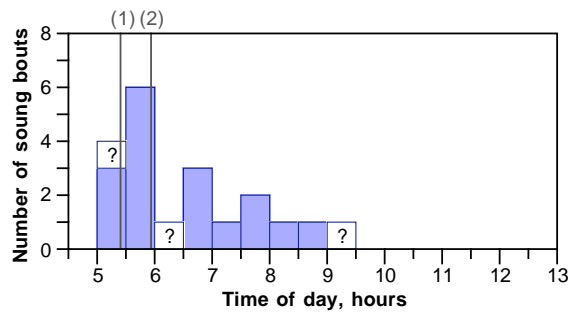
In the camp area, we also discovered two rusty metal objects that were obviously relics from the Vietnam war. One of them appeared to be part of an illumination shell, the other may have been a fragment of a larger shell (Fig. 6).

**Table 2.** Minimum gibbon group size, based on the number of audible singers. – *Mindestgrösse der gehörten Gibbongruppen, basierend auf der Zahl der singenden Tiere.*

Group number	Adult males	Minimum number of great-calling individuals	Minimum group size	Number of songs (song days)
1	1	0	1	3 (3)
2	1	2	3	3 (2)
3	1	3	4	4 (3)
4	1	2+	3+	2 (2)
5	1	2	3	1 (1)
6	1	0	1	2 (1)
7	1	?	1?	1 (1)
8	1	2	3	1 (1)
Total (minimum)	8	5	19	17 (7)



**Fig. 3.** View from the summit road to the north. Gibbon territories extend up to the crest in the left foreground and down in the valley behind it (left half of the photo), but no gibbons were heard from the cone shaped hill in the centre. The arc-shaped bay of Phu Loc is visible in the background, right half of the photo. Photo: Thomas Geissmann. – *Ausblick nach Norden, von der Strasse, die auf den Bach Ma Gipfel führt. Gibbon-Territorien erstrecken sich bis auf den Hügelkamm, der links vorne ins Bild ragt, sowie ins Tal dahinter (linke Bildhälfte), aber keine Gibbons wurden von dem kegelförmigen Berg in der Mitte gehört. Die Berge von Bach Ma erstrecken sich fast bis zur Küste. Im Hintergrund rechts ist die bogenförmige Bucht von Phu Loc zu sehen.*



**Fig. 4.** Frequency distribution of the start time of gibbon song bouts ( $n = 17$ ). Question marks indicate three possible additional song bouts that were not heard reliably. (1) dawn (average: 05:22 hours), (2) sunrise (average: 05:56 hours) – Häufigkeitsverteilung der Startzeit von Gibbongesängen ( $n = 17$ ) im Bach Ma Nationalpark. Fragezeichen kennzeichnen drei weitere mögliche Gesänge, die aber nicht verlässlich gehört wurden. (1) Dämmerung (Durchschnitt: 05:22 Uhr); (2) Sonnenaufgang (Durchschnitt: 05:56 Uhr).

## Discussion

All gibbon groups we heard appeared to occur in lowland evergreen forest at altitudes between 400 and 800 m, although the park area covers altitudes from 40-1450 m a.s.l. and forest also occurs at altitudes higher than 800 m. Forest above an elevation of 900 m was identified as montane evergreen forest (Gilmour and Nguyen Van San, 1999).

Crested gibbons (genus *Nomascus*) are known to occur at higher altitudes. *Nomascus concolor* for instance, is known to occur at elevations of 1900-2900 m a.s.l. in Yunnan Province, China (Bleisch and Chen, 1991; Bleisch and Jiang, 2000). Other crested gibbons like *N. nasutus*, *N. leucogenys* and *N. gabriellae* have all been reported to occur at altitudes of well above 1000 m (see review in Geissmann *et al.*, 2000), although they seem to prefer lower forest if available. Our findings suggest that gibbons in Bach Ma prefer lower altitude forest.

Although local people insisted that gibbons in Bach Ma also exhibit a second preferred calling time in the evening hours, we heard no gibbons after 09:30 hours. What our informants identified as gibbon calls in the evening were, in all probability, calls of the crested Argus pheasant (*Rheinardia ocellata*). This bird is very common in Bach Ma National Park, and its calls exhibit a bimodal frequency distribution with elevated calling frequency both in the early morning and early evening hours.



**Fig. 5.** (a, b) Phases with heavy fog were common during our survey. (c) Because of heavy rain we did not hear any gibbons during the last survey day. Photos: Thomas Geissmann. – (a, b) Phasen mit dichtem Nebel waren häufig während unserer Studie. (c) Heftiger Regen am letzten Tag der Studie machte es unmöglich, Gibbongesänge zu hören.



**Fig. 6.** Relics of the Vietnam war are still to be found in the forest of the Bach Ma NP. The left item apparently was part of an illumination shell, the pyrotechnic content of which was still functional when we found it. The scale is 15 cm. Photo: Thomas Geissmann. – *Noch immer finden sich Überreste aus dem Vietnamkrieg im Wald des Bach Ma Nationalparks. Die Hülse links war offensichtlich Teil eines Beleuchtungsgeschosses, dessen Inhalt noch funktionsfähig war, als wir sie fanden. Der Massstab unten im Bild misst 15 cm.*

Although we did not find these pheasant calls very similar to those of the crested gibbons, they can be confounded. This is also confirmed by the very first field study on calls of gibbons in Vietnam (Roznov *et al.*, 1986). Examination of the published sonagrams and the original tape-recordings revealed that the early study unfortunately did not examine gibbon calls but consists of a detailed analysis of the calls of crested Argus pheasants (Geissmann, unpublished data).

During our survey, we monitored a forested area of about 6 km<sup>2</sup> and we heard eight gibbon groups (including solo singing males). Based on this data, we estimate a density of about 1.3 groups/km<sup>2</sup>. Because of the short duration of our study, this is a very preliminary estimate, but it is very similar to estimated population densities of *N. gabriellae* and *N. siki* in eastern Cambodia which range from 0.0 to 3.73 groups/km<sup>2</sup> (n = 15), with an average of 1.47 groups/km<sup>2</sup> (Traeholt *et al.*, 2005). These estimates appear to be higher than those of crested gibbons from more northern latitudes. Density estimates for *N. concolor* in Yunnan Province range from 0.43 to 0.82 groups/km<sup>2</sup> (review in Chan *et al.*, 2005), with a mean of 0.6 groups/km<sup>2</sup> (n = 4 reports). Density of *N. hainanus* was estimated as 0.50-0.57 groups/km<sup>2</sup> (Zhang *et al.*, 1995). Only *N. concolor* at Che Tao, northern Vietnam, may exhibit higher group densities of 1.6 groups/km<sup>2</sup> (Tallents *et al.*, 2000). Several hypotheses could explain this general trend. It is possible that the northern *Nomascus* species are more heavily thinned out as a result of particularly severe hunting pressure or habitat degradation, or these species may need larger territories because the more

seasonal climate may cause food sources to be less common during dry seasons.

Robson *et al.* (1991) recorded gibbons calling from nine locations in Bach Ma National Park. Their northern-most two groups were not detected during our survey and may have disappeared or remained silent when we were surveying the area. These two groups were located in what was identified as poor quality forest in the maps provided by Van Ngoc Thinh *et al.* (2001). The northernmost two we heard also appear to live in poor forest. All other gibbon groups were located in rich or medium quality forest.

Although an earlier survey carried out by the Park Forest Protection Department in the year 2000 recorded only five groups in the park (Van Ngoc Thinh, personal communication), we found eight groups during our short survey. Considering that we only surveyed less than 10% of the park's strict protection area of 71 km<sup>2</sup>, and our survey had a duration of only seven days (excluding the rainy day), there may well be more gibbons living in Bach Ma than the eight groups recorded by us, even if forest areas above 900 m are discounted.

The identity of the gibbons of Bach Ma National Park is still not fully resolved. Following our survey, the calls we tape-recorded were compared with gibbon calls from various more southern localities in Cambodia, southern Laos and Vietnam, suggesting gibbons in north-eastern Cambodia, southern Laos and in Quang Nam Province (Vietnam) produce the same song type as the gibbons of Bach Ma. In contrast, the yellow-cheeked gibbons (*N. gabriellae*) in southern Cambodia produce a distinct song type (Konrad and Geissmann, 2006; Geissmann, unpublished). In a next step, we will compare the calls of these gibbons to those from areas north of Bach Ma (Ruppell and Geissmann, in prep.).

### Acknowledgements

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## Zusammenfassung

### **Eine Kurzstudie an den Schopfgibbons im Bach Ma Nationalpark von Zentral-Vietnam**

Dies ist ein Bericht über eine kurze Studie an den Schopfgibbons (Gattung *Nomascus*) im Bach Ma Nationalpark (Provinz Thua Thien Hue) in Zentral-Vietnam. Es ging darum, erste Daten über den Bestand der Gibbons in diesem Park zu erheben sowie Tonaufnahmen ihrer Gesänge anzufertigen. Das Bach Ma Gebiet ist Teil des zentral-annamitischen Gebirgszuges, welcher sich quer durch das Land von der laotischen Grenze bis zur Küste erstreckt und Höhen von 1400 m erreicht. Dieser Gebirgszug wird als wichtige biogeographische Barriere betrachtet und nimmt damit eine Schlüsselstelle ein bei dem Versuch, die unklare Systematik der Schopfgibbons aus dem zentralen Indochina zu untersuchen. Dabei spielt der Vergleich der Gibbongesänge eine wichtige Rolle.

Während acht Tagen hörten wir mindestens acht verschiedene Gibbongruppen (einschliesslich zweier einzelner Männchen). Alle gehörten Gibbons hielten sich im immergrünen Tieflandwald in Höhen

zwischen 400 und 800 m auf, obwohl der Bach Ma Nationalpark auch höher gelegenen Wald umfasst. Von den 18 gehörten Gibbongesängen begannen die meisten (53%) während oder kurz nach der Dämmerung, zwischen 05:00 und 06:00 Uhr. Für unser Untersuchungsgebiet bestimmten wir eine grobe Populationsdichte von etwa 1.3 Gibbongruppen/km<sup>2</sup>. Dieser Schätzwert gleicht publizierten Werten für Populationen aus dem südlichen Teil des Verbreitungsgebietes der Schopfgibbons, während nördliche Populationen zumindest als Trend niedrigere Dichten aufzuweisen scheinen.

Die Gesänge der Gibbons im Bach Ma Nationalpark stimmen mit denen aus der Nachbarprovinz Quang Nam überein, sowie mit Gesängen aus Süd-laos und Nordostkambodscha – alles Gebiete, die südlich von Bach Ma liegen. Sie unterscheiden sich deutlich von den Gesängen der Gelbwangen-Schopfgibbons (*N. gabriellae*), die noch weiter südlich beheimatet sind (Südvietnam, südliches Ost-kambodscha). Um die Systematik dieser Gibbons zu klären, sollen ihre Rufe in zukünftigen Studien mit denen von Schopfgibbons verglichen werden, die nördlich von Bach Ma verbreitet sind.