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Cover: Wild group of Bornean white-bearded gibbons (*Hylobates albibarbis*) at the Mawas reserve, southern Kalimantan (Indonesia). The adult male Bejo (left) and the adult female Juminten (right) are resting while the dependent male infant Sutejo plays. Photo: Livia Haag. – *Wilde Weissbartgibbons (*Hylobates albibarbis*) im Mawas Schutzgebiet im Süden von Kalimantan (Indonesien). Das ausgewachsene Männchen Bejo (links) und das ausgewachsene Weibchen Juminten (rechts) ruhen, während das noch von der Mutter abhängige Männchen spielt.*

Instructions to Contributors

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

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

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

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

List cited references alphabetically at the end of the paper. Examples:

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

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

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

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

Die zitierte Literatur sollte am Ende des Manuskripts in alphabetischer Reihenfolge gelistet werden. Beispiele:

Papers in journals: **Zeitschriftenartikel:**

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

Books: **Bücher:**

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

Papers in edited books: **Arbeiten in editierten Büchern:**

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

Theses: **Dissertationen:**

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

Impressum

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Editorial

Dear Gibbon Friends

Initially, the Gibbon Journal served a hybrid function: It was the official publication of the Gibbon Conservation Alliance and thus contained the organisation's Annual Report. On the other hand, it also served as a journal for topics such as conservation biology and natural history of gibbons. Beginning with this year, the Annual Report and the Gibbon Journal are independent publications.

The Annual Report is mainly directed at members and sponsors of the Gibbon Conservation Alliance in order to keep them up-to-date concerning the organisation's activities. Our Annual Report is written in German, because we are based in Switzerland and most of our sponsors and members are native German speakers.

With the Gibbon Journal, on the other hand, we hope to communicate information on all aspects of gibbon natural history, to reach as many readers as possible as well as to increase the international media presence of gibbons. With this goal in mind, we started to accept manuscripts in English and German from issue two. All contributions include summaries in English and German. This will especially make the Gibbon Journal accessible to readers from the gibbon origin countries.

We hope that the Gibbon Journals and the Annual Report as introduced in this issue shall fulfil their separate functions more adequately.

I owe special thanks to everybody who helped proofreading this issue or parts thereof: Natasha Arora, Nicole Bischofberger, Annie Bissonnette, Roger Konrad, Matt Richardson, Sybille Traber, Andrea von Allmen.

With best regards,

Liebe Gibbon-Freunde

Bisher erfüllte das **Gibbon Journal** eine Art Hybridaufgabe: Es diente sowohl als offizielles Publikationsorgan der Gibbon Conservation Alliance und enthielt damit den Jahresbericht unserer jungen Gesellschaft, andererseits diente es auch als Zeitschrift zu Themen der Erhaltungsbiologie und Naturhistorie der Gibbons. Mit dieser Ausgabe wird der Jahresbericht erstmals vom Gibbon Journal entkoppelt.

Der Jahresbericht richtet sich an die Mitglieder und Gönner der Gibbon Conservation Alliance und hält sie über die Aktivitäten der Organisation auf dem Laufenden. Unser Jahresbericht wird er in deutscher Sprache verfasst, da wir unseren Geschäftssitz in der Schweiz haben, sind die meisten unserer Gönner und Mitglieder deutschsprachig sind.

Mit dem Gibbon Journal wollen wir dagegen Informationen über Gibbons verbreiten. Wir möchten möglichst viele Leser erreichen und die Medienpräsenz der Gibbons auf internationaler Ebene steigern. Zu diesem Zweck haben wir schon seit dem letzten Heft damit begonnen, sowohl deutsche wie englische Artikel zu veröffentlichen, und alle Beiträge sowohl mit deutschen als auch englischen Zusammenfassungen zu versehen. Damit wird das Gibbon Journal auch Lesern aus den Ursprungsländern der Gibbons zugänglich.

Ich hoffe, dass die Trennung in zwei verschiedene Veröffentlichungen dazu führen wird, dass der Jahresbericht und das Gibbon Journal in Zukunft ihre unterschiedlichen Funktionen noch besser erfüllen können.

Spezieller Dank gebührt allen, die beim Lektorat dieser Ausgabe geholfen haben: Natasha Arora, Nicole Bischofberger, Annie Bissonnette, Roger Konrad, Matt Richardson, Sybille Traber, Andrea von Allmen.

Mit herzlichen Grüssen,

Ihr

Thomas Geissmann

Zürich, im April 2007

Status reassessment of the gibbons: Results of the Asian Primate Red List Workshop 2006

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The status of East Asian primate taxa was reassessed for the IUCN Red List at a workshop held from September 8 - 12, 2006, in Phnom Penh, Cambodia. This paper presents the results for the gibbons or small apes, and summarizes the resulting new information on their taxonomy, geographic range, population size, major threats, conservation measures, and conservation status using IUCN Red List categories and criteria. A comparison of the new assessment with the previous ones of 2000 (or 2003 for two gibbon species) reveals that 10 of 16 species and 9 of 12 subspecies – i.e. 86% of all gibbon taxa – have become more endangered within the last three to six years by at least one category of threat, and 39% of all gibbon taxa by two categories.

Introduction

The World Conservation Union's Red List of Threatened Species (IUCN, 2006) presents a comprehensive review of the status of the world's fauna. In order to reflect the changing status of, and threats to, animal species and subspecies, this databank requires periodic re-evaluation. One of a number of information-gathering workshops was organized to reassess the Asian primates Red List. Held over the course of five days from September 8-12, 2006, in Phnom Penh, Cambodia in partnership with the IUCN/SSC Primate Specialist Group, the IUCN Global Mammal Assessment (GMA), and the Southeast Asia Mammal Databank Project of the Istituto di Ecologia Applicata of Rome University; the latter brought together experts on such diverse areas as taxonomy, distribution, threats on the ground, and conservation actions, in order to help review the data and conduct IUCN Red List assessments. The workshop built off of the extensive existing data on the region's primates, with the goal of bringing in new knowledge, expertise, and technology in the hope that this information will make a significant contribution to the conservation of Asian primates, as well as help set a benchmark in our knowledge of these taxa. The fully referenced results from the workshop will be made freely and publicly available on the web, in keeping with IUCN policy.

This paper summarizes the workshop's results for the gibbons or small apes. It should be noted that the new Asian Primate Red List data presented in this paper will not be official before it will be posted on the web by IUCN. The next Red List will come out in 2008, because submissions to the Red List are only made in February of each year (Jan Schipper, pers. comm.).

Assessors of the gibbon status reports

Noviar Andayani, Bill Bleisch, Warren Y. Brockelman, Thomas Geissmann, Nguyen Manh Ha, Long Yongcheng, Vincent Nijman, Ben Rawson, Matt Richardson, Jatna Supriatna, Carl Traeholt, Rob Timmins, Joe Walston, Danielle J. Whittaker, Jiang Xuelong, with additional contributions by Colin P. Groves, Saw Htun, Eric Meijaard, Sanjay Molur.

Species assessed and taxonomic notes

The gibbon species assessed and the countries in their distributional range are listed in Table 1. A total of 16 gibbon species are recognized here, of which three are divided into a total of 12 subspecies. The classification used largely follows Groves (2001), with the following taxonomic notes explaining any departures from that source or ongoing taxonomic uncertainties.

Hoolock hoolock and *H. leuconedys*: The previous generic name for hoolock gibbons, *Bunopithecus*, was changed by Mootnick and Groves (2005) to *Hoolock*, Haimoff *et al*., 1984. *Hoolock leuconedys* has traditionally been regarded as a subspecies of *H. hoolock*. It is recognized here as a full species based on distinct features in fur colouration described in Groves (1967, 1972).

Hylobates agilis: There is debate on the validity of subspecies. The general consensus seems to be that this species is monotypic, though some experts recognize two subspecies – *H. a. agilis* to the west, and *H. a. unko* to the east – which may possibly correspond with "mountain" and "lowland" forms. All this is not to be confused with the two main colour morphs found throughout the species' range, though in general the pale morph is more common in the Barisan Range of Sumatra, while the dark morph predominates in the eastern lowlands and in the Malay Peninsula (Marshall and Sugardjito, 1986).

Table 1. Taxonomy used in this assessment. – *Die in dieser Beurteilung verwendete Taxonomie.*

Species		Countries
Western hoolock gibbon	*Hoolock hoolock* (Harlan, 1834)	Bangladesh, China (not verified), India, Myanmar
Eastern hoolock gibbon	*Hoolock leuconedys* Groves, 1967	China (not proven), India, Myanmar
Agile gibbon	*Hylobates agilis* F. Cuvier, 1821	Indonesia, Malaysia, Thailand
Bornean white-bearded gibbon	*Hylobates albibarbis* Lyon, 1911	Indonesia
Kloss's gibbon	*Hylobates klossii* (Miller, 1903)	Indonesia
White-handed gibbon, Lar gibbon	*Hylobates lar* (Linnaeus, 1771)	China, Indonesia, Laos, Malaysia, Myanmar, Thailand
Subspecies:	*H. l. lar* (Linnaeus, 1771)	
	H. l. carpenteri Groves, 1968	
	H. l. entelloides I. Geoffroy, 1842	
	H. l. vestitus Miller, 1942	
	H. l. yunnanensis Ma and Wang, 1986	
Silvery gibbon, Javan gibbon	*Hylobates moloch* (Audebert, 1797)	Indonesia
Mueller's gibbon, Bornean gibbon, grey gibbon	*Hylobates muelleri* Martin, 1841	Brunei, Indonesia, Malaysia
Subspecies:	*H. m. muelleri* Martin, 1841	
	H. m. abbotti Kloss, 1929	
	H. m. funereus I. Geoffroy, 1850	
Pileated gibbon	*Hylobates pileatus* Gray, 1861	Cambodia, Laos, Thailand
Western black crested gibbon	*Nomascus concolor* (Harlan, 1826)	China, Laos, Vietnam
Subspecies:	*N. c. concolor* (Harlan, 1826)	
	N. c. furvogaster Man and Wang, 1986	
	N. c. jingdongensis Ma and Wang, 1986	
	N. c. lu Delacour, 1951	
Yellow-cheeked crested gibbon	*Nomascus gabriellae* Thomas, 1909	Cambodia, Laos, Vietnam
Hainan crested gibbon	*Nomascus hainanus* Thomas, 1892	China
Northern white-cheeked crested gibbon	*Nomascus leucogenys* Ogilby, 1840	China, Laos, Vietnam
Cao-Vit crested gibbon, Eastern black crested gibbon	*Nomascus nasutus* Künckel d'Herculais, 1884	China, Vietnam
Southern white-cheeked crested gibbon	*Nomascus siki* Delacour, 1951	Laos, Vietnam
Siamang	*Symphalangus syndactylus* (Raffles, 1821)	Malaysia, Indonesia, Thailand

Hylobates lar: The validity of *H. l. yunnanensis* as a subspecies is doubtful; it requires comparison with *H. l. carpenteri* (Groves and Geissmann, pers. comm.). The only geographically well-separated subspecies is *H. l. vestitus*, which is found on Sumatra.

Hylobates moloch: Though it has been suggested that there is evidence for two genetically distinct silvery gibbon populations (Andayani *et al.* 2001), leading to the subsequent recognition of two subspecies by several authors (Hilton-Taylor, 2000; IUCN, 2006; Supriatna, 2006; Supriatna and Wahyono, 2000), a recent review of the molecular evidence and a comparison of morphological and vocal data casts doubt on this claim (Geissmann *et al*., 2002a; Geissmann, unpublished data).

Nomascus concolor: All currently recognized subspecies of *N. concolor* were described based on small samples. The reported differences among these taxa are questionable, and further research may show *N. concolor* to be monotypic (Geissmann, 1989; Geissmann *et al*., 2000).

Nomascus gabriellae and *N. siki*: The distributional limits of these species are still unclear, especially with regard to each other. The identity of the crested gibbons occurring in a large area encompassing parts of central Vietnam, southern Laos and northeastern Cambodia is uncertain, as these differ in their song from both *N. gabriellae* in the south and *N. siki* in the north, but phenotypically resemble *N. gabriellae* (Geissmann *et al.*, 2000; Konrad and Geissmann, 2006; Geissmann, unpublished data). Here, gibbons that, at least phenotypically (i.e., fur colouration) look like *N. gabriellae* are included in this species. Phenotype information for the type locality of *N. siki* (Thua Luu, Thua Thien Hue Province, central Vietnam) is contradictory (Geissmann *et al*., 2000), but these gibbons are tentatively identified as *N. gabriellae* here. According to Delacour (1951) and (Groves 1972), *N. gabriellae* may possibly interbreed with *N. siki* in Saravane and Savannakhet, Laos (but see Geissmann *et al*., 2000, pp. 49 and 82).

Nomascus hainanus has been variously considered either as a species in its own right or as a subspecies of *N. concolor* or *N. nasutus*; it is here recognized as a distinct species based on differences in vocalizations and fur colouration (Geissmann, pers. comm.).

Nomascus nasutus has been variously considered either as a species in its own right (sometimes as conspecific with *N. hainanus*), or as a

subspecies of *N. concolor;* it is here recognized as a species distinct from *N. hainanus* and *N. concolor*, based on differences in vocalizations and fur colouration (Geissmann, unpublished results).

Geographic range

Reviews of the respective geographic ranges of most taxa can be found in earlier publications (Geissmann, 1995; Geissmann *et al*., 2000; Groves, 1972, 2001; Marshall and Sugardjito, 1986). Recent findings include:

Das *et al*. (2006) reported the discovery of a population of *Hoolock leuconedys* in Arunachal Pradesh, India, which has traditionally been considered to be part of the distribution area of *H. hoolock*. As a result, gibbon populations in south-eastern Tibet and Arunachal Pradesh east of Dibang and Lohiton to the west are yet to be determined.

In China, *Hylobates lar* is currently known only from Nangunhe Nature Reserve in the prefectury of Lincang, SW Yunnan (Geissmann *et al*., 2006).

Traditionally, the range of *Nomascus gabriellae* encompasses northeastern Cambodia south of Ratanakari Province, and southern Vietnam south of Bach Ma. The range is here augmented to include animals that, at least phenotypically (i.e., colouration), are *N. gabriellae*, extending as far north as Savannakhet in southern Laos and Thua Thien Hue Province (and possibly Quang Tri Province) in central Vietnam (Geissmann *et al*., 2000). Conversely, the range of *N. siki* here is taken to extend only as far south as Savannakhet in southern Laos and Quang Binh Province (and possibly Quang Tri Province) in central Vietnam (Geissmann *et al*., 2000).

Nomascus leucogenys was formerly present in southernmost Yunnan Province, China (Ma and Wang 1988). In the 1980s, a very small population still occurred in Xishuangbanna Prefecture in southernmost Yunnan, China, just across the border from Vietnam (Hu *et al*., 1989, 1990), but the species may no longer survive there (Bleisch, pers. comm.). In Vietnam it has been extirpated from several areas where it was previously recorded, and is now known only from a few localities in the northwest and north-central parts of this country (Geissmann *et al*., 2000; Nguyen Manh Ha *et al*., 2005).

The range of *N. nasutus* formerly extended over most of northeastern Vietnam east of the Red River. Gibbons of some undetermined species formerly lived in adjacent areas of southeastern China (Guangdong and Guangxi Provinces), but are thought to have almost completely disappeared from there during the 1950s (Chan *et al*., 2005; Geissmann *et al*., 2000). Today, the species is found in a small area of northeastern Vietnam and southeastern China northeast of the Red River, where it is restricted to the Phong Nam-Ngoc Khe mountains, Trung Khanh District, northern Cao Bang Province, and adjacent forest in Jingxi County, Guangxi (Bleisch, pers. comm.; Geissmann *et al*., 2002, 2003). It is possibly still extant in neighbouring Hoa Binh Province, Vietnam, as well, and there are unconfirmed reports from Kim Hy forest in Bac Kan Province (which has since been proposed as a nature reserve).

Nomascus hainanus is confined to the Bawangling Nature Reserve on the western side of the island of Hainan, China (Chan *et al*., 2005). Before the 1960s, the Hainan crested gibbon was widely distributed across the island, with an estimated population of over two thousand individuals (Liu *et al*., 1984).

Population

Table 2 summarizes the available population estimates for each species by country. Estimates older than 20 years were ignored. Global population estimates are currently available for only 6 (or 37.5%) of the 16 recognized gibbon species, meaning that for the remaining 10 (or 62.5%) they are not. For seven of the latter species the size of at least one subpopulation has been estimated, but for the remaining three no population estimates are available at all. Similarly, population size estimates are available for only 20 (or 53%) of 38 national populations, whereas the size of 18 of these populations (47%) remains unknown (Table 2).

Major threats

An assessment of 2003 (Geissmann, 2003) identified the following top four threats to gibbon survival: (1) Habitat loss and fragmentation; (2) Habitat degradation; (3) Hunting (for food, traditional "medicine," and sport); (4) Illegal trade (in pets and traditional "medicine").

As a result of the Red List assessment of 2006, the major threats for each gibbon population were assessed separately (Table 3). The conclusions, however, remain largely the same, although the order of the threats may vary among populations.

Conservation measures

All gibbons are listed under CITES Appendix I (CITES, 2007), precluding all international commercial trade in the species. Gibbon species are protected in most countries where they are found by national laws (e.g. China, India, Indonesia, Thailand, Vietnam).

All species have important populations in protected areas. Some, like *N. hainanus* in China or *H. lar* in Thailand, are entirely or almost entirely confined to protected areas; whereas large populations of species such as *H. klossii* or *H. moloch* occur outside of protected areas, while the only forest supporting *N. nasutus* is still not officially protected. Only one protected area exists in the range of *H. klossii* (Siberut National Park), and the second largest population of *H. moloch* (i.e. in the Dieng Mountains, central Java) is not in a protected area. In

the interest of preserving these species over the long term, additional areas will require some level of increased protection.

Table 2. Population estimates for each gibbon species, by country. – *Geschätzte Bestandesgrössen aller Gibbonarten für jedes Land im jeweiligen Verbreitungsgebiet*.

Species	Country	Population estimate[1]	References
Hoolock hoolock	Bangladesh	200-280	Islam *et al*., 2006; Molur *et al*., 2005
	China (SE Tibet)[2]	NA	
	India	2,400	Das *et al*., 2006[3]; Molur *et al*., 2005
Hoolock leuconedys	China	50-300	Lan, 1994; Tian *et al*., 1996; Zhang, 1998; Zhang *et al*., 2002
	India	170	Das *et al*., 2006
	Myanmar	10,000–50,000	Brockelman, pers. comm.
Hylobates agilis	Indonesia	NRA	
	Thailand	a few thousand	Brockelman, pers. comm.
Hylobates albibarbis	Indonesia (Kalimantan)	NRA	
Hylobates klossii	Indonesia	20,000–25,000	Whittaker, 2005b, 2006
Hylobates lar	China	10?	Geissmann *et al*., 2006; Guo and Wang, 1995; Lan and Wang, 2000
	Indonesia	NRA	
	Laos	NA	
	Malaysia	NRA	
	Myanmar	NA	
	Thailand	15,000–20,000	Brockelman, pers. comm.
Hylobates moloch	Indonesia	4,000–4,500	Nijman, 2004
Hylobates muelleri	Brunei, Indonesia, Malaysia	250,000–375,000	Meijaard and Nijman, unpublished data
Hylobates pileatus	Cambodia	>35,000	Traeholt *et al*., 2005
	Laos	NA	
	Thailand	12,000	Brockelman, pers. comm.
Nomascus concolor	Global	1,300–2,000	Brockelman, pers. comm.
	China	1,000–1,300	Jiang *et al*., 2006
	Laos	NA	
	Vietnam	<100	Geissmann *et al*., 2000
Nomascus gabriellae	Cambodia	20,000	Traeholt *et al*., 2005
	Laos	NA	
	Vietnam	NA	
Nomascus hainanus	China	18	Zhou Jiang, pers. comm.
Nomascus leucogenys	China	0?	Bleisch, pers. comm.
	Laos	NA	
	Vietnam	NA	
Nomascus nasutus	China	10	Tan Weifu, pers. comm.
	Vietnam	<40	Geissmann *et al*., 2002b, 2003; La Quang Trung and Trinh Dinh Hoang, 2004; Vu Ngoc Thanh *et al*., 2005
Nomascus siki	Laos	NA	
	Vietnam	NA	
Symphalangus syndactylus	Indonesia	NRA	
	Malaysia	NRA	
	Thailand	NRA	

[1] NA: no population estimate available, NRA: no recent population estimate available; estimates older than 20 years were ignored.

[2] The species identity of this taxon is not established

[3] A population of about 170 gibbons was recently allocated to *H. leuconedys* (Das *et al*., 2006) and is here subtracted from the population estimate for *H. hoolock* in NE India (Molur *et al*., 2005).

Table 3. Major threats to gibbon populations. – Hauptbedrohungen für den Fortbestand der Gibbonpopulationen.

Species	Major Threats	References
Hoolock hoolock	Habitat loss and fragmentation, hunting (food, traditional "medicine"). *China (Tibet)*: Hunting (food) (not established). *India*: Habitat loss (jhoom cultivation, harvesting of bamboo for paper mills, oil mining and exploration, and coal mining). *Myanmar*: Habitat loss (shifting cultivation, logging) and hunting	Bleisch, Brockelman, and Htun, pers. comm.; Choudhury, 1991, 2001; Das, pers. comm.; Gupta, 2005; Islam and Feeroz, 1992; Molur *et al*., 2005
Hoolock leuconedys	Habitat loss, hunting (food, traditional "medicine")	Brockelman and Htun, pers. comm.
Hylobates agilis	Habitat loss (coffee plantations, rubber plantations and other crops) and hunting for the habitat and pet trade	Brockelman, pers. comm.; Nijman, 2005; O'Brien *et al*., 2004
Hylobates albibarbis	Habitat loss (fires, illegal logging), pet trade	Nijman, pers. comm.
Hylobates klossii	Habitat loss (oil palm plantations, forest clearing), habitat degradation (logging, product extraction by local people), commercial hunting, illegal trade (pets)	Whittaker, 2005b, 2006
Hylobates lar	Hunting (food), illegal trade (pets), habitat loss (construction of roads through protected areas, shifting agriculture, commercial of palm oil plantations). *Northern Sumatra*: Ladia Galaskar (a network to link the west and east coasts of Aceh Province) means that much of the remaining forest is at risk	Brockelman, pers. comm.
Hylobates moloch	Habitat loss and habitat degradation (both of which have slowed down), illegal trade (unquantified)	Nijman, 2005
Hylobates muelleri	Habitat loss, illegal trade (pets), and [*interior Borneo*:] hunting (food)	Meijaard *et al*., 2005; Nijman, 2005
Hylobates pileatus	Habitat loss, hunting (food), illegal trade (pets). *Thailand*: most of the remaining habitat is now in protected areas, but hunting continues within these areas. *Cambodia*: main threat is habitat loss (logging, agriculture, hydro-electric development, and human settlement)	Duckworth *et al*., 1999; Traeholt *et al*., 2005
Nomascus concolor	Habitat loss and fragmentation, hunting	Geissmann *et al*., 2000; Jiang *et al*., 2006; Johnson *et al*., 2005; Le Trong Dat *et al*., 2000, 2001; Ngo Van Tri and Long, 2000; Tallents *et al*., 2000a, b, 2001a, b
Nomascus gabriellae	Vietnam: illegal trade (pets). *Laos*: hunting (food)	Duckworth *et al*., 1999; Geissmann *et al*., 2000
Nomascus hainanus	Hunting, habitat degradation (suboptimal habitat quality), small population size (inbreeding effects, poor mate-choice, and risks from human or natural disaster)	Chan *et al*., 2005; Geissmann, 2005, pers. comm.
Nomascus leucogenys	Habitat loss and fragmentation (agricultural encroachment into mountainous areas, fuel-wood and timber extraction, especially in China and Vietnam), hunting (food, traditional "medicine", cultural value)	Duckworth *et al*., 1999; Geissmann *et al*., 2000
Nomascus nasutus	Habitat loss (charcoal-making, cultivation, livestock grazing, firewood collection), habitat degradation, hunting, small population size (inbreeding effects, poor mate-choice, and risks from human or natural disaster)	Bleisch and Geissmann, pers. comm.; Geissmann *et al*., 2002b, 2003; La Quang Trung and Trinh Dinh Hoang, 2004
Nomascus siki	Habitat fragmentation (logging, agricultural encroachment, and [Vietnam] high human population density), hunting ("medicine", food), illegal trade (pets)	Duckworth *et al*., 1999; Geissmann *et al*., 2000; Nguyen Manh Ha *et al*., 2005
Symphalangus syndactylus	Habitat loss (logging, road development, conversion to agriculture or plantations), illegal trade (pets)	Nijman and O'Brien, pers. comm.; O'Brien *et al*., 2003, 2004

Unfortunately, in most protected areas laws against forest encroachment and poaching are not adequately enforced, and there is an urgent need for improved management, protection and patrolling, ideally involving community development aspects.

Several species are in need of taxonomic studies. In particular, *H. agilis* subspecies, *H. lar* subspecies (specifically *yunnanensis*), *N. gabriellae*, and *N. siki* require further investigation.

Surveys are recommended in several areas. For instance, in Myanmar there is a need to survey the *H. hoolock* areas west of Chindwin/Irrawady (now Ayerawady) River. Further survey work is needed to determine current population numbers of *H. lar* within protected areas across its range, and a priority area is southwest Yunnan, because it is unclear whether the species still survives in China. Field surveys throughout the range of *N. gabriellae*, *N. siki* and *N. leucogenys*, ideally including the collection of sound recordings, genetic data and photographic recordings, would help to determine the number of taxa involved and better define their distributional areas. Survey work outside the only known locality of *N. hainanus* (Bawangling Nature Resere) may help to find surviving individuals or groups not yet accounted for, especially in Diaoluoshan Nature

Reserve, Yinggelin Nature Reserve, and Jianfenglin Nature Reserve.

Red List Assessment

The IUCN Red List Categories and Criteria are intended to be an easily and widely understood system for classifying species at high risk of global extinction. The general aim of the system is to provide an explicit, objective framework for the classification of the broadest range of species according to their extinction risk. A representation of the relationships between the categories is shown in Fig. 1. In order to qualify for listing at a particular level of threat, a taxon needs to meet particular criteria and subcriteria. Summarizing them would go beyond the scope of this paper, but the current version of the Categories and Criteria (version 3.1) and guidelines for using them are described elsewhere (IUCN, 2001; Standards and Petitions Working Group, 2006).

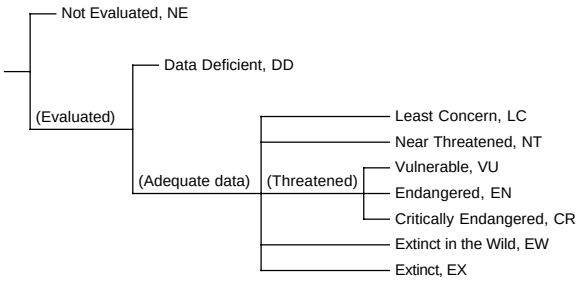

Fig. 1. Structure of the IUCN Red List categories (after IUCN, 2001). – *Beziehung zwischen den Kriterien zur Beurteilung des Bedrohungsgrades von Tieren der Roten Liste (nach IUCN, 2001)*.

A total of 28 gibbon taxa were evaluated (16 species, 12 subspecies). Four of these (*Hoolock leuconedys*, *Hylobates albibarbis*, *Nomascus siki*, and *N. hainanus*) had not been recognized as distinct species in earlier Red List assessments, but rather, as subspecies of *Hoolock hoolock*, *Hylobates agilis*, *Nomascus leucogenys*, and *N. nasutus*, respectively. Because two species (*H. agilis* and *H. moloch*) were recognized as monotypic in the new assessment, four subspecific taxa no longer required separate assessments.

Table 4 lists both the last Red List assessments for all gibbon taxa (carried out in 2001 or 2003, depending on species) (IUCN, 2006), and the new Red List assessments of September 2006. The last column in Table 4 identifies the changes that occurred between the latest and previous assessments.

The following species should be carefully monitored in the future:

(1) *Hylobates albibarbis* is hunted and collected for the wildlife trade and for human consumption where it occurs. A large part of its range is in peat swamp – an extremely threatened ecosystem. This species may qualify for CR in the future if rates of habitat change increase.

(2) *Nomascus gabriellae* is in need of close monitoring since, given predicted likely rates of both habitat loss and hunting in the future, it could well warrant listing in a higher category of threat.

(3) *Symphalangus syndactylus* has likely suffered 70-80% habitat loss of primary habitat within the last three generations (ca. 50 years) within its range, but fortunately is one of the most adaptable gibbon species to habitat change. Loss of habitat continues, however, and is compounded by impacts of road building and collection for the pet trade. Thus, this species could be considered CR due to historic habitat loss with more detailed information.

(4) The status of *Hylobates moloch* was considered EN in the previous assessment of 2000 (IUCN, 2006). The change in status from CR to EN reflects the availability of better information and does not suggest that the threats have decreased. There is concern about the legal status of the largest populations; therefore, the current status and persistent threats should be carefully monitored.

Table 5 summarizes a comparison between the most recent and previous Red List assessments. In the latest assessment, two of the 28 assessed gibbon taxa were placed into a lower threat category (the difference being one level in both cases), five taxa remained in the same threat category, 13 taxa were elevated in their threat category by one level, 11 taxa were elevated in their threat category by two levels, and for the remaining two taxa the assessments were not comparable because at least one of the latter was Data Deficient (DD). The most significant information revealed by this comparison is that 86% of all gibbon taxa have become more endangered within the last three to six years by at least one category, and 39% by two categories.

Table 4. Red List assessments for all gibbon taxa. – *Einschätzung des Bedrohungsgrades aller Gibbonarten und –unterarten für die Rote Liste.*

Last Red List assessment of 2000 and 2003 (IUCN, 2006)				**New Red List assessment of September 2006**			**Difference between assess-ments** [2]
Species / Subspecies	Assessment[1]		Year assessed	Species / Subspecies	Assessment[1]		
	Category	Criteria			Category	Criteria	
Bunopithecus hoolock hoolock	EN	A1cd	2000	*Hoolock hoolock*	EN	A2abcd+3bcd +4abcd	0
B. h. leuconedys	EN	A1cd	2000	*Hoolock leuconeyds*	VU	A4cd	–
Hylobates agilis	LR/nt		2000	*Hylobates agilis*	EN	A2cd	++
H. a. albibarbis	LR/nt		2000	*Hylobates albibarbis*	EN A4cd		++
Hylobates klossii	VU	A1c+2c, B1+2ac	2000	*Hylobates klossii*	EN A2cd		+
Hylobates lar	LR/nt		2000	*Hylobates lar*	EN A2cd		++
H. l. yunnan-ensis	CR	C2a, D	2000	*H. l. yunnan-ensis*	DD		NA
H. l. vestitus	LR/nt		2000	*H. l. vestitus*	EN		++
H. l. lar	LR/nt		2000	*H. l. lar*	EN		++
H. l. entelloides	LR/nt		2000	*H. l. entelloides*	VU	A2cd	+
H. l. carpenteri	LR/nt		2000	*H. l. carpenteri*	EN	A2cd	++
Hylobates moloch	CR	A1cd, C2a	2000	*Hylobates moloch*	EN	A2c	–
Hylobates muelleri	LR/nt		2000	*Hylobates muelleri*	EN	A2cd	++
H. m. muelleri	LR/nt		2000	*H. m. muelleri*	EN	A2cd	++
H. m. funereus	LR/nt		2000	*H. m. funereus*	EN	A4cd	++
H. m. abbotti	LR/nt		2000	*H. m. abbotti*	EN	A2cd	++
Hylobates pileatus	VU	A1cd+2cd	2000	*Hylobates pileatus*	EN	A4cd	+
Nomascus concolor	EN	A1cd, C2a	2000	*Nomascus concolor*	CR	A2cd	+
N. c. concolor	EN	A1cd, C2a	2000	*N. c. concolor*	CR	A2cd, C2a(i)	+
N. c. furvogaster	CR	A2cd, B2a	2000	*N. c. furvogaster*	CR	A2cd; C2a(i)	0
N. c. jingdong-ensis	CR	C2b	2000	*N. c. jingdong-ensis*	CR	A2cd; C2a(i)	0
N. c. lu	EN	A1c	2000	*N. c. lu*	CR	A2cd; C2a(i)	+
Nomascus gabriellae	VU	A1cd+2cd	2000	*Nomascus gabriellae*	EN	A4cd	+
Nomascus leucogenys leucogenys	EN	A1cd+2cd	2000	*Nomascus leucogenys*	CR	A2cd, A3cd	+
N. l. siki	DD		2000	*Nomascus siki*	EN	A2cd	NA
Nomascus nasutus nasutus	CR	C2a(i)b; D	2003	*Nomascus nasutus*	CR	A2acd; B1ab(iii,v); C2a(i,ii); D1	0
N. n. hainanus	CR	B1ab(iii,v); C2a(ii)b; D	2003	*Nomascus hainanus*	CR	A2acd; B1ab(iii,v); B2ab(iii,v); C2a(i,ii); D1	0
Symphalangus syndactylus	LR/nt		2000	*Symphalangus syndactylus*	EN	A2cb	++

[1] Abbreviations: CR Critically Endangered, DD Data Deficient, EN Endangered, LR/nt Low Risk/Near Threatened, VU Vulnerable. The category "Low Risk" was abandoned in 2003. For criteria and subcriteria on which the category assessment is based, see IUCN (2001) and Standards and Petitions Working Group (2006).

[2] Abbreviations: NA not applicable because at least one of the compared entries is data deficient (DD), 0 not change, + new assessment with higher threat category (difference 1 level), ++ new assessment with higher threat category (difference 2 levels), – new assessment with lower threat category (1 level)

Table 5. Summary comparison between the last Red List assessments for all gibbon taxa (carried out in 2001 or 2003, depending on species; IUCN, 2006) and the latest Red List assessments of September 2006. – *Aufsummierte Änderung des Bedrohungsgrades von Gibbonarten und –unterarten aufgrund der Einschätzungen für die Rote Liste aus den Jahren 2001 und 2003 (IUCN 2006) und der neuen Einschätzungen für die Rote Liste vom September 2006.*

Taxa	Change in threat category [1]					Total
	–	0	+	++	NA	
Species	2	3	5	5	1	16
Subspecies	0	2	3	6	1	12
Total	2	5	13	11	2	28

[1] Abbreviations: NA = not applicable because at least one of the compared entries is data deficient (DD), 0 = not change, + = new assessment with higher threat category (difference 1 level), ++ = new assessment with higher threat category (difference 2 levels), – = new assessment with lower threat category (1 level).

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References

Andayani, N., Morales, J. C., Forstner, M. R. J., Supriatna, J., and Melnick, D. J. (2001). Genetic variability in mtDNA of the silvery gibbon: Implications for the conservation of a critically endangered species. *Conservation Biology* **15**: 770-775.

Chan, B. P. L., Fellowes, J. R., Geissmann, T., and Zhang, J. (2005). *Hainan gibbon status survey and conservation action plan, version 1 (last updated November 2005)*. Kadoorie Farm & Botanic Garden Technical Report No. 3, Kadoorie Farm & Botanic Garden, Hong Kong, 32 pp. (Downloadable from www.gibbons.de)

Choudhury, A. (1991). Ecology of the hoolock gibbon (*Hylobates hoolock*), a lesser ape in the tropical forests of north-eastern India. *Journal of Tropical Ecology* **7**: 147-153.

Choudhury, A. (2001). Primates in northeast India: An overview of their distribution and conservation status. *ENVIS Bulletin: Wildlife and Protected Areas (Non-human primates of India, A.K. Gupta, ed.)* **1**(1): 92-101.

CITES (2007): Convention on international trade in endangered species of wild fauna and flora: Appendices I, II and III, valid from 4 March 2007 (reprinted with corrections). International Environment House, Châtelaine, Geneva, Switzerland, 45 pp. Downloadable from www.cites.org/eng/app/index.shtml

Das, J., Biswas, J., Bhattacharjee, P. C., and Mohnot, S. M. (2006). First distribution records of the eastern hoolock gibbon (*Hoolock hoolock leuconedys*) from India. *Zoos' Print Journal* **21**(7): 2316-2320.

Delacour, J. (1951). La systématique des Gibbons Indochinois. *Mammalia* **15**: 118-123 (French text).

Duckworth, J. W., Salter, R. E., and Khounboline, K. (compilers) (1999). *Wildlife in Lao PDR: 1999 status report*, IUCN - The World Conservation Union / Wildlife Conservation Society / Centre for Protected Areas and Watershed Management, Vientiane, xiv+275 pp.

Geissmann, T. (1989). A female black gibbon, *Hylobates concolor* subspecies, from northeastern Vietnam. *International Journal of Primatology* **10**: 455-476.

Geissmann, T. (1995). Gibbon systematics and species identification. *International Zoo News* **42**: 467-501.

Geissmann, T. (compiler) (2003). Symposium on Gibbon Diversity and Conservation: Concluding resolution. *Asian Primates* **8**(3-4): 28-29.

Geissmann, T. (2005). Der Hainan-Schopfgibbon: Der bedrohteste Menschenaffe der Welt. *Gibbon Journal* **1**: 10-12 (German text, English summary). (Downloadable from www.gibbonconservation.org)

Geissmann, T., Dallmann, R., and Pastorini, J. (2002a). The Javan silvery gibbon (*Hylobates moloch*): Are there several subspecies? In *Caring for primates. Abstracts of the XIXth congress of the International Primatological Society, 4th-9th August, 2002, Beijing, China*, Mammalogical Society of China, Beijing, pp. 120.

Geissmann, T., La Quang Trung, Trinh Dinh Hoang, Dang Ngoc Can, Pham Duc Tien, and Vu Dinh Thong (2002b). *Report on an overall survey of the Cao Vit gibbon population (*Nomascus *sp. cf.* nasutus*) in Trung Khanh District, Cao Bang Province (second overall survey). Survey report*, Fauna & Flora International, Asia Pacific Programme, Hanoi, 8 pp.

Geissmann, T., Nguyen Xuan Dang, Lormée, N., and Momberg, F. (2000). *Vietnam primate conservation status review 2000 - Part 1: Gibbons (English edition)*, Fauna & Flora International, Indochina Programme, Hanoi, 130 pp. (Downloadable from www.gibbons.de)

Geissmann, T., La Quang Trung, Trinh Dinh Hoang, Vu Dinh Thong, Dang Ngoc Can, and Pham Duc Tien (2003). Rarest ape species rediscovered in Vietnam. *Asian Primates* **8**(3-4): 8-9.

Geissmann, T., Traber, S., and von Allmen, A. (2006). Das Nangunhe-Naturreservat, Provinz Yunnan, China: Ein Projektbericht [Nangunhe Nature Reserve, Yunnan Province, China: A project report]. *Gibbon Journal* **2**: 14-17 (German text, English summary). (Downloadable from www.gibbonconservation.org)

Groves, C. P. (1967). Geographic variation in the hoolock or white-browed gibbon (*Hylobates hoolock* Harlan 1834). *Folia Primatologica* **7**: 276-283.

Groves, C. P. (1972). Systematics and phylogeny of gibbons. In Rumbaugh, D. M. (ed.), *Gibbon and siamang, vol. 1*, Karger, Basel and New York, pp. 1-89.

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

Guo, G., and Wang, Z. (1995). Survey on the white-handed gibbon in Nangunhe Valley in China. *Chinese Primate Research and Conservation News* **4**(2): 7-9.

Gupta, A. K. (Ed.). (2005). *Conservation of hoolock gibbon (*Bunopithecus hoolock*) in Northeast India. A final report of Wildlife Institute of India and United States Fish and Wildlife Services collaborative project (No. 98210-2-G153)*, Wildlife Institute of India and United States Fish and Wildlife Services, 312 pp.

Hilton-Taylor C. (compiler) (2000). 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, UK, xviii + 61 pp. Downloaded on 10 November 2001.

Hu, Y., Xu, H. L., and Yang, D. (1989). [The studies on ecology in *Hylobates leucogenys*]. *Zoological Research* **10**(Supplement): 61-67 (Chinese text, English summary).

Hu, Y., Xu, H., and Yang, D. (1990). [Feeding ecology of the white-cheeked gibbon (*Hylobates concolor leucogenys*)]. *Acta Ecologica Sinica* **10**: 155-159 (Chinese text, English summary).

Islam, M. A., and Feeroz, M. M. (1992). Ecology of hoolock gibbon of Bangladesh. *Primates* **33**: 451-464.

Islam, M. A., Feeroz, M. M., Muzaffar, S. B., Kabir, M. M., and Begum, S. (2006). *Conservation of the hoolock gibbons (*Hoolock hoolock*) of Bangladesh: Population estimates, habitat suitability and management options*, United States Fish and Wildlife Service, 48 pp.

IUCN (2001). *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, U.K., ii+30 pp. Downloadable from www.iucn.org/themes/ssc/redlists/techdocs.htm

IUCN (2006). *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. Downloaded on 04 April 2007.

Jiang, X., Luo, Z., Zhao, S., Li, R., and Liu, C. (2006). Status and distribution pattern of black crested gibbon (*Nomascus concolor jingdongensis*) in Wuliang Mountains, Yunnan, China: Implication for conservation. *Primates* **47**: 264-271.

Johnson, A., Singh, S., Duangdala, M., and Hedemark, M. (2005). The western black crested gibbon *Nomascus concolor* in Laos: New records and conservation status. *Oryx* **39**(3): 311-317.

Konrad, R., and Geissmann, T. (2006). Vocal diversity and taxonomy of *Nomascus* in Cambodia. International Journal of Primatology **27**: 713-745.

La Quang Trung, and Trinh Dinh Hoang (2004). Status review of the Cao Vit black-crested gibbon (*Nomascus nasutus nasutus*) in Vietnam. In Nadler, T., Streicher, U., and Ha Thang Long (eds.), *Conservation of primates in Vietnam*, Frankfurt Zoological Society, Vietnam Primate Conservation Programme, Endangered Primate Rescue Center, Cuc Phuong National Park, Hanoi, pp. 90-94.

Lan, D. (1994). Progress of surveys of hoolock gibbon in Yunnan: Distribution, population size, habitat and conservation. *Chinese Primate Research and Conservation News* **3**(1): 8-10.

Lan, D., and Wang, Z. (2000). Wildlife conservation in Nanguanhe River Nature Reserve: A preliminary survey. *TigerPaper* **27**(1, January-March): 24-28.

Le Trong Dat, Le Quang Trung, and Trinh Dinh Hoang (2000). *Report on the survey of western black crested gibbon (*Nomascus concolor*) and the fauna in Nam Xay and Nam Xe communes, Van Ban District, Lao Cai Province*, Fauna & Flora International, Indochina Programme, Hanoi, 9 pp.

Le Trong Dat, Trinh Dinh Hoang, Tallents, L., and Luong Van Hao (2001). *Report on the third survey for western black crested gibbon* Nomascus concolor *and other animals in Che Tao commune, Mu Cang Chai District, Yen Bai Province*, Fauna & Flora International, Indochina Programme, Gibbon Conservation Project, Hanoi, 13 pp.

Liu, Z., Yu, S., and Yuan, X. (1984). [The resources of the Hainan black gibbon at its present situation]. *Chinese Wildlife* **1984**(6): 1-4 (Chinese text).

Ma, S., and Wang, Y. (1988). [The recent distribution, status and conservation of primates in China]. *Acta Theriologica Sinica* **8**: 250-260 (Chinese text, English summary).

Marshall, J. T., and Sugardjito, J. (1986). Gibbon systematics. In Swindler, D. R., and Erwin, J. (eds.), *Comparative primate biology, vol. 1: Systematics, evolution, and anatomy*, Alan R. Liss, New York, pp. 137-185.

Meijaard, E., Sheil, D., Nasi, R., Augeri, D., Rosenbaum, B., Iskandar, D., Setyawati, T., Lammertink, M., Rachmatika, I., Wong, A., Soehartono, T., Stanley, S., and O'Brien, T. (2005). *Life after logging: Reconciling wildlife conservation and production forestry in Indonesian Borneo*, CIFOR (Center for International Forestry Research), Jakarta. xxii+345 pp.

Molur, S., Walker, S., Islam, A., Miller, P., Srinivasulu, C., Nameer, P. O., Daniel, B. A., and Ravikumar, L. (Ed.). (2005). *Conservation of western hoolock gibbon (*Hoolock hoolock hoolock*) in India and Bangladesh*, Zoo Outreach Organisation / CBSG-South Asia, Coimbatore, India, 132 pp.

Mootnick, A., and Groves, C. P. (2005). A new generic name for the hoolock gibbon (Hylobatidae). *International Journal of Primatology* **26**: 971-976.

Ngo Van Tri, and Long, B. (2000). *A survey of the black gibbon* Hylobates concolor, *Harlan 1826, in Son La Province (North Vietnam), October - November, 1999*, Fauna & Flora International, Indochina Programme Office, Hanoi, 7 pp.

Nguyen Manh Ha, Thach Mai Hoang, Pham Trong Anh, Le Manh Hung, Nguyen Truong Son, Nguyen Van Dat, and Do Quang Huy (2005). *Status of white cheek-crested gibbon (*Nomascus leucogenys*) in North Central of Vietnam*, The Great Ape Conservation Fund, U.S. Fish and Wildlife Service and Central for Natural Resource and Environmental Studies (CRES), Vietnam National University, and Allwetterzoo Münster, Germany, Hanoi, v+59 pp.

Nijman, V. (2004). Conservation of the Javan gibbon *Hylobates moloch*: Population estimates, local extinctions, and conservation priorities. *The Raffles Bulletin of Zoology* **52**: 271-280.

Nijman, V. (2005). Hanging in the balance: An assessment of trade in orang-utans and gibbons on Kalimantan, Indonesia, TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia. viii+45 pp.

O'Brien, T. G., Kinnaird, M. F., Nurcahyo, A., Prasetyaningrum, M., and Iqbal, M. (2003). Fire, demography and the persistence of siamang (*Symphalangus syndactylus*: Hylobatidae) in a Sumatran rainforest. *Animal Conservation* **6**: 115-121.

O'Brien, T. G., Kinnaird, M. F., Nurcahyo, A., Iqbal, M., and Rusmanto, M. (2004). Abundance and distribution of sympatric gibbons in a threatened Sumatran rain forest. *International Journal of Primatology* **25**: 267-284.

Standards and Petitions Working Group (2006). *Guidelines for using the IUCN Red List categories and criteria. Version 6.2*. Prepared by the Standards and Petitions Working Group of the IUCN SSC Biodiversity Assessments Sub-Committee in December 2006. 60 pp. Downloadable from http://app.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf

Supriatna, J. (2006). Conservation Programs for the Endangered Javan Gibbon (*Hylobates moloch*). *Primate Conservation* **21**: 155-162.

Supriatna, J., and Wahyono, E. H. (2000). Panduan Lapangan Primata Indonesia [Field guide of Indonesian primates] (Indonesian text), Yayasan Obor Indonesia, Jakarta. xxii+334 pp.

Tallents, L., Le Trong Dat, La Quang Trung, and Trinh Dinh Hoang (2000a). *Survey for western black-crested gibbon (*Nomascus concolor*), Che Tao commune, Mu Cang Chai District, Yen Bai Province*, Fauna & Flora International, Indochina Programme, Gibbon Conservation Project, Hanoi, 10 pp.

Tallents, L., Le Trong Dat, La Quang Trung, and Trinh Dinh Hoang (2000b). *Report on the second survey for western black-crested gibbon in Che Tao forest*, Fauna & Flora International, Indochina Programme, Gibbon Conservation Project, Hanoi, 5 pp.

Tallents, L., Le Trong Dat, Luong Van Hao, La Quang Trung, and Trinh Dinh Hoang (2001a). *Muong La District, Son La Province, January 2001: A survey for western black crested gibbon in Nam Pam, Hua Trai and Ngoc Chien communes, Che Tao-Nam Pam forest. Survey report*, Fauna & Flora International, Indochina Programme Office, Hanoi, 14 pp.

Tallents, L., Le Trong Dat, Luong Van Hao, La Quang Trung, and Trinh Dinh Hoang (2001b). *A survey for western black crested gibbon in Nam Pam, Hua Trai and Ngoc Chien communes, Che Tao-Nam Pam forest, Muong La District, Son La Province, Januar 2001*, Fauna & Flora International Indochina, Gibbon Conservation Project, Hanoi, 14 pp.

Tian, B. P., Ji, W. Z., and Peng, Y. Z. (1996). The present status of living primates and experimental primates research in China. *Primate Report* **44**: 71-76.

Traeholt, C., Bonthoeun, R., Rawson, B., Samuth, M., Virak, C., and Sok Vuthin (2005). *Status review of pileated gibbon,* Hylobates pileatus *and yellow-cheeked crested gibbon,* Nomascus gabriellae, *in Cambodia*, FFI Cambodia Programme Office, Phnom Penh, 59 pp.

Vu Ngoc Thanh, Nguyen Xuan Dang, Nguyen Manh Ha, Luu Tuong Bach, and Hien, N. T. (2005). *Survey and assessent on population of cao vit gibbon (*Nomascus nasutus nasutus*) in Phong Nam-Ngoc Khe proposed species/habitat conservation area, Trung Khanh District, Cao Bang Province, with conservation recommendations*, Vietnam National University, Hanoi, 27 pp.

Whittaker, D. J. (2005). New population estimates for the endemic Kloss's gibbon *Hylobates klossii* on the Mentawai Islands, Indonesia. *Oryx* **39**: 458-461.

Whittaker, D. J. (2006). A conservation action plan for the Mentawai primates *Primate Conservation* **20**: 95-105.

Zhang, S.-Y. (1998). Current status and conservation strategies of primates in China. *Primate Conservation* **18**: 81-84.

Zhang, Y., Chen, L., Qu, W., and Coggins, C. (2002). The primates of China: Biogeography and conservation status. *Asian Primates* **8**(1-2): 20-22.

Zusammenfassung

Neubeurteilung des Bedrohungsstatus der Gibbons: Resultate des Workshops 2006 zur Roten Liste der asiatischen Primaten

Der Bedrohungsstatus asiatischer Primatenarten und –unterarten wurde für die Rote Liste bedrohter Tiere (IUCN) im Rahmen eines Workshops vom 8.–12. September 2006 in Phnom Penh, Kambodscha, neu beurteilt. Die vorliegende Veröffentlichung widmet sich speziell denjenigen Resultaten des Workshops, welche die Gibbons oder Kleinen Menschenaffen betreffen. In der hier verwendeten Systematik werden 16 Gibbonarten anerkannt, von denen drei in insgesamt 12 Unterarten aufgeteilt werden. Die vorgestellten Resultate umfassen die Themen Taxonomie der Gibbons, geographische Verbreitung, Populationsgrösse, Hauptbedrohungen, Schutzmassnahmen und Beurteilung des Bedrohungsstatus mittels der IUCN-Kategorien und -Kriterien für die Rote Liste. Für die Populationsgrössen (Tabelle 2) werden nur Schätzwerte verwendet, die jünger sind als 20 Jahre. Nur für 6 (37.5%) der 16 Gibbonarten ist ein Schätzwert für die Gesamtpopulation vorhanden. Von sieben der restlichen 10 Arten wurde zumindest die Bestandesgrösse einer Teilpopulation geschätzt, aber für drei Gibbonarten sind überhaupt keine Informationen zur Populationsgrösse vorhanden. Ähnlich verhält sich die Situation, wenn man die Gibbonpopulationen der einzelnen Arten für jedes Land separat betrachtet: Nur für 20 (53%) von 38 nationalen Gibbonpopulationen liegen Schätzwerte für die Bestandesgrösse vor, während die Grösse von 18 dieser Populationen (47%) unbekannt bleibt. Zu den vier Hauptbedrohungen für das Überleben der Gibbons gehören Lebensraumverlust und –fragmentation, Lebensraumverschlechterung, Jagd (Ernährung, "Medizin", Sport), und illegaler Handel (Haustiere, "Medizin"). Dabei kann die Rangordnung der einzelnen Bedrohungen von Gebiet zu Gebiet verschieden sein. Ein Vergleich des neu beurteilten Bedrohungsstatus der einzelnen Gibbonarten mit der letzten Beurteilung aus dem Jahr 2000 oder 2003 (je nach Gibbonart) zeigt, dass innerhalb der letzten drei bis sechs Jahre die Bedrohung bei 10 von 16 Arten und 9 von 12 Unterarten – also 86% aller Gibbonformen – um mindestens eine Kategorie zugenommen hat, bei 39% sogar um zwei Kategorien.

Menschenrechte für Gibbons? Versuche mit Menschenaffen

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Bei Primaten und ganz besonders bei Menschenaffen sind zahlreiche Fähigkeiten und Eigenschaften nachgewiesen worden, die man bis dahin als typisch „menschlich" angesehen hat. Aus diesem Wissen ergeben sich neue Fragen zum ethisch korrekten Umgang mit Menschenaffen. Ist es vor diesem Hintergrund zum Beispiel moralisch zulässig, mit Primaten Versuche anzustellen, bei denen sie Leid, Schmerz, Stress oder Angst empfinden könnten? In den letzten Jahren haben darum die ersten Länder Verbote für Versuche mit Menschenaffen erlassen. Mit wenigen Ausnahmen beschränken sich jedoch diese Verbote auf grosse Menschenaffen und stellen die Gibbons somit zu den übrigen Primaten. Im Folgenden möchten wir die moralische Sonderstellung der Menschenaffen erläutern und die rechtliche Regelung von Primatenversuchen in der Schweiz und in ausgewählten anderen Ländern aufzeigen. Wir beleuchten dabei speziell die Situation der Gibbons und zeigen, warum eine Grenzziehung durch die Gruppe der Menschenaffen hindurch unserer Meinung nach wenig Sinn macht.

Umdenken in Umgang mit Primaten

Viele Menschen fühlen sich mit gewissen Tierarten stärker verbunden als mit anderen. Zu diesen Tieren gehören nicht nur Haustiere wie Hund und Katze, sondern auch Wildtiere wie zum Beispiel Bären, Pinguine und ganz besonders auch die Primaten, unsere nächsten Verwandten im Tierreich. Beobachten wir Affen im Zoo oder in Dokumentarfilmen, sind wir fasziniert und verblüfft, wie viel von ihrem Verhalten uns bekannt vorkommt. Es fällt uns scheinbar leicht, uns in sie hinein zu versetzen. Diese intuitiv empfundene Ähnlichkeit zwischen Menschen und Affen wurde in den letzten Jahrzehnten durch zahlreiche Studien wissenschaftlich untermauert. So wurde gezeigt, dass Primaten über aussergewöhnliche kognitive, emotionale und soziale Fähigkeiten verfügen. Insbesondere bei den Menschenaffen und hier wiederum speziell bei den grossen Menschenaffen (Schimpansen, Bonobos, Gorillas, Orang-Utans) wurden Eigenschaften entdeckt, die man bis dahin ausschliesslich dem Menschen zugetraut hat, so zum Beispiel das gezielte Herstellen und Verwenden von Werkzeugen, die Weitergabe von erworbenen Fertigkeiten, die Fähigkeit Gesten einer Zeichensprache zu erlernen und in einem sinnvollen Kontext einzusetzen, vorausschauendes Planen und gezieltes Manipulieren und Täuschen von anderen (Boesch und Boesch, 1990; Byrne, 1995; De Luce and Wilder, 1983; Gardner *et al*., 1989; Russon, 2004; Savage-Rumbaugh *et al*., 1998; Sebeok and Umiker-Sebeok, 1980). Zudem gibt es starke Indizien für das Vorhandensein eines Selbstbewusstseins bei Menschenaffen (Anderson, 1994; Gallup *et al*., 2002; Inoue-Nakamura, 1997; Povinelli und Cant, 1995).

Aus diesem Wissen über die besonderen Fähigkeiten der Primaten ergeben sich jedoch weitreichende Fragen darüber, wie der Mensch mit seinen nächsten Verwandten umgehen soll. Ist es angesichts dieser Erkenntnisse moralisch zulässig, Primaten in Gefangenschaft zu halten oder mit ihnen Versuche anzustellen, bei denen sie Leid, Schmerz, Stress oder Angst empfinden könnten? Wenn ein Tier über eine ausgeprägte Wahrnehmung verfügt und seine Situation womöglich bewusst erlebt, dürfte es solche Belastungen vermutlich intensiver erleben und mehr darunter leiden. Die Antworten auf solche ethische Fragen bilden die Grundlage für die gesetzliche Regelung von experimenteller Forschung an Primaten.

Bei der rechtlichen Beurteilung von solchen Experimenten hat es in den letzten Jahren in verschiedenen Ländern Änderungen gegeben. Es ist interessant zu sehen, wie die Gibbons in dieser Hinsicht beurteilt werden. Zwar gehören sie biologisch klar zu den Menschenaffen (man unterscheidet jedoch innerhalb der Menschenaffen zwischen der oben erwähnten Gruppe der grossen Menschenaffen und der Gruppe der kleinen Menschenaffen bestehend aus mindestens 12 Arten von Gibbons). Andererseits ist die Tatsache, dass Gibbons Menschenaffen sind, jedoch wenig bekannt und wird in populären Veröffentlichungen über Menschenaffen oft nicht berücksichtigt. Ausserdem sind die Fähigkeiten der Gibbons weit weniger erforscht als diejenigen der anderen Menschenaffen (Anderson, 2006). Dies führt unter anderem dazu, dass die Gibbons in der Öffentlichkeit weniger Beachtung finden (Six, 2006).

Die Primaten: Ein ethischer Sonderfall

Beim Umgang mit Tieren allgemein, oder eben bei der ethischen Beurteilung der Forschung an Primaten im Speziellen, muss man sich mit der Frage befassen, welche Tierarten wir in den Kreis derer aufnehmen wollen, die moralisch zu berücksichtigen sind. Hier kann man natürlich ganz verschiedene Positionen vertreten. Das Spektrum reicht von der Auffassung, dass dieser Kreis dem Menschen allein vorenthalten sein sollte, bis hin zur Überzeugung, dass alle Lebewesen moralisch gleich viel zählen (Ritvo, 1985). Im Gegensatz zu dieser egalitären Idee würden wohl die allermeisten eine eher hierarchische Sichtweise vertreten, jedoch ohne absolute Position des Menschen. Danach verdienen zwar nicht alle Lebewesen den gleichen moralischen Respekt, aber man geht davon aus, dass Tieren, die über ähnlich komplexe Eigenschaften wie der Mensch verfügen, auch eine höhere moralische Bedeutung zukommt.

Insofern nehmen die Primaten – und unter ihnen speziell die grossen Menschenaffen – eine besondere Stellung ein. So wurde zum Beispiel gezeigt, dass Menschenaffen Artgenossen trösten, die das Ziel von Aggression waren, sich um alte oder kranke Gruppenmitglieder kümmern oder ihre Nahrung mit Artgenossen teilen (Boesch, 1991; Feistner und McGrew, 1989; Maestripieri *et al.*, 2002; de Waal, 1982; de Waal und Aureli, 1996).

Solche Verhaltensweisen legen nahe, dass grosse Menschenaffen über die Fähigkeit zur Vernunft und moralischem Handeln verfügen. Wenn man solche geistige Fähigkeiten mit dem Vorhandensein von (menschlicher) Würde verbindet, müsste man folglich grosse Menschenaffen wie nicht einwilligungsfähige Menschen behandeln. Forschung an nicht einwilligungsfähigen Menschen ist nur dann moralisch erlaubt, wenn diese selbst von der Forschung profitieren. Rein fremdnützige Forschung an ihnen ist nicht zulässig. Aus dem Wissen über die „menschlichen" Fähigkeiten der grossen Menschenaffen wurde die Forderung abgeleitet, dass bestimmte Grundrechte, die derzeit dem Menschen vorbehalten sind, auch den grossen Menschenaffen (engl. *great apes*) zugesprochen werden sollten. Dazu gehören das Recht auf Leben, der Schutz der individuellen Freiheit und das Verbot der Folter (*www.greatapeproject.org*). Die Resolution wird von namhaften Persönlichkeiten unterstützt und findet international zunehmend Beachtung.

Man kann sich nun die Frage stellen, ob es gerechtfertigt ist, nur gerade die grossen Menschenaffen auf einen höheren moralischen Sockel zu heben. Denn schliesslich scheint sich die Evolution bei der Entwicklung von komplexen geistigen Fähigkeiten nicht streng an die biologischen Verwandtschaftsverhältnisse gehalten zu haben. Nicht nur bei Primaten, sondern zum Beispiel auch bei Rabenvögeln und Delphinen wurde intelligentes Verhalten beobachtet. Und aus der Sicht der Gibbons kann man natürlich argumentieren, dass die Gibbons den grossen Menschenaffen und dem Menschen biologisch näher stehen als allen übrigen Primaten.

Die Initianten des Great Ape Project verschliessen sich zwar nicht der Idee, die Grundrechte auch auf andere Tierarten auszudehnen, sehen jedoch bei den grossen Menschenaffen den grössten Handlungsbedarf. Dies kommt aber wohl auch daher, dass die geistigen, emotionalen und sozialen Fähikeiten bei den grossen Menschenaffen mit Abstand am besten untersucht sind. Und es dürfte auch damit zu tun haben, dass gleichzeitig finanzielle Mittel vorhanden sind, um auf diese umfangreichen und beeindruckenden Erkenntnisse aufmerksam zu machen. Die kognitiven Fähigkeiten der Gibbons wurden bisher jedoch kaum untersucht. Es gibt gute Hinweise darauf, dass Gibbons sich im Spiegel selbst erkennen können (Fig. 1), was generell als Indiz für das Vorhandensein eines Selbstbewusstseins gilt (Ujhelyi *et al.*, 2000). Dieses Merkmal teilen Gibbons mit den grossen Menschenaffen und dem Menschen (Anderson, 1994; Gallup *et al.*, 2002; Inoue-Nakamura, 1997; Povinelli und Cant, 1995).

Primatenversuche in der Schweiz

Eingriffe und Handlungen, die für das Versuchstier eine Belastung bedeuten, sind in der Schweiz gemäss den Richtlinien des Bundesamtes für Veterinärwesen zwingend bewilligungspflichtig. Das heisst, die kantonale Tierversuchskommission sowie das kantonale Veterinäramt prüfen, ob der beantragte Versuch zulässig ist. Dies passiert anhand einer Güterabwägung, in der das menschliche Interesse an den zu erwartenden Forschungsresultaten gegen die Belastung der Tiere abgewogen wird. Das Resultat der Güterabwägung gibt darüber Auskunft, ob eine Belastung verhältnismässig und ein Versuch damit ethisch zulässig ist.

Im Jahr 2006 hat ein Experiment mit südamerikanischen Krallenäffchen an der Universität und der ETH Zürich für einiges Aufsehen in den Medien gesorgt (Anonymus, 2006a; Bachmann, 2006; Baumberger, 2006; RME, 2006; Rüegg, 2006). Im Versuch wurden Jungtiere in den frühen Lebenstagen zeitweilig von ihrer Mutter getrennt, um herauszufinden welche langfristigen Folgen eine solche Trennung für die Jungtiere hat. Aus den Untersuchungen erwartete man neue Erkenntnisse über die Entstehung von Depressionen beim Menschen. Die kantonalen Prüfungs- und Bewilligungsorgane haben den Versuch mit Auflagen gutgeheissen, was später von verschiedenen Seiten kritisiert wurde und zu einer Diskussion über die Zulässigkeit von Primatenversuchen führte.

Fig. 1. Dieser nördliche Weisswangen-Schopfgibbon (*Nomascus leucogenys*) inspiziert das Innere seiner Mundhöhle (links) und nimmt ungewöhnliche Posen ein, um Körperstellen im Spiegelbild zu betrachten, die er sonst nicht sehen kann. Photos: Maria Ujhelyi. – *This northern white-cheeked gibbon (N. leucogenys) examines the inside of his mouth in the mirror (left) and adopts unusual body positions (right). He is clearly interested in observing this in the reflection.*

Die Eidgenössische Kommission für Tierversuche (EKTV) und die Eidgenössische Ethikkommission für die Biotechnologie im Ausserhumanbereich (EKAH) haben daraufhin einen gemeinsamen Bericht über die ethische Zulässigkeit von Versuchen an Primaten verfasst und darin den erwähnten Versuch mit Krallenäffchen als Fallbeispiel behandelt (Anonymus, 2006b). Basierend auf dem vorhandenen Wissen über die speziellen Eigenschaften der Primaten und ethischen Grundüberlegungen zum experimentellen Umgang mit ihnen, gelangten die Kommissionen zu einer Reihe von Empfehlungen zuhanden des Bundesrates und der Bewilligunsbehörden. Eine dieser Empfehlungen besagt, dass belastende Versuche an grossen Menschenaffen explizit verboten werden sollen (obwohl heute in der Schweiz keine solchen Versuche durchgeführt werden). Begründet wird diese Forderung mit den erwiesenen „menschenähnlichen" geistigen, emotionalen und sozialen Fähigkeiten der grossen Menschenaffen und ihrer daraus resultierenden Sonderstellung. Gegenwärtig sind die Primaten gesetzlich allen anderen Tieren gleichgestellt und ihren Besonderheiten kann höchstens durch erhöhte Zurückhaltung in der Beurteilungspraxis durch die Bewilligungsinstanzen Rechnung getragen werden. Mit ihrer Forderung nach einem expliziten Verbot von Versuchen an grossen Menschenaffen ziehen die Kommissionen eine neue erweiterte Grenzlinie um den erlesenen Kreis der Wesen mit höherem moralischem Status.

So begrüssenswert diese Ausdehnung grundsätzlich sein mag, so unverständlich ist aus biologischer Sicht folgende Anmerkung im Bericht: „In Abgrenzung zu den grossen Menschenaffen werden die Gibbon-Affen gelegentlich als kleine Menschenaffen bezeichnet. Im Folgenden wird dieser Unterschied jedoch aussen vor gelassen; die Gibbons werden zu den übrigen Primaten gezählt." (Anonymus, 2006b, p. 21). Dies erstaunt insofern, als dass die Gibbons biologisch den grossen Menschenaffen näher stehen als allen übrigen Primaten, was taxonomisch dadurch ausgedrückt wird, dass sie in der Überfamilie menschenartigen Affen (Hominoidea) zusammengefasst sind. Aufgrund des aktuellen Wissens über Körperbau, Erbanlagen, Evolution, geistige Eigenschaften der Gibbons wären sie somit korrekterweise eben gerade nicht zu den übrigen Primaten zu zählen, sondern bei den Menschenaffen miteinzuschliessen.

Nach Aussage von Dr. Regula Vogel, Präsidentin der EKTV, wurde das Thema der Abgrenzung der grossen von den kleinen Menschenaffen anlässlich der Projektarbeit zum Bericht nicht eingehend diskutiert und es bestand nicht die Absicht, eine Abgrenzungsdiskussion zu führen oder zu veranlassen. Dem kann natürlich entgegen gehalten werden, dass durch eine so explizite Forderung für grosse Menschenaffen sehr wohl eine Abgrenzung vorgenommen wird, die es auch wert wäre diskutiert zu werden. Interessanterweise haben sich die Kommissionen gemäss Dr. Vogel der Unterscheidung des Great Ape Projects angeschlossen, einer Organisation, welche bereits in ihrer Namensgebung signalisiert, dass sie die Bedürfnisse der grossen Menschenaffen verfolgt. Vor diesem Hintergrund ist die Einteilung der Kommissionen nicht überraschend. Es stellt sich weiterhin, wie oben bereits erwähnt, die Frage nach der Richtigkeit einer Grenzziehung durch die Gruppe der Menschenaffen hindurch mit Ausklammerung der Gibbons. Ist es sinnvoll, nur denjenigen Arten eine moralische Sonderstellung zuzuschreiben, deren „menschenähnlichen" Leistungen umfassend dokumentiert sind? Oder müsste man nicht im Sinne der Plausibilität annehmen, dass anerkanntermassen nah verwandte Arten über ähnliche Anlagen und Eigenschaften verfügen, auch wenn sie nicht bei allen gleich gut untersucht sind?

Die Situation in anderen Ländern

Dass der Einbezug der Gibbons nur logisch und konsequent ist, wenn es darum geht, den Menschenaffen einen besonderen moralischen Status zu attestieren, zeigt das Beispiel unseres Nachbarlandes Österreich. Hier initiierte der Verein Gegen Tierfabriken VGT im Jahr 2002 eine Kampagne für ein generelles Verbot von Tierversuchen an Menschenaffen (Anonymus, 2005; persönliche Mitteilung Dr. Balluch, VGT). In der Petition des VGT und der Parlamentseingabe ging es nicht nur um die grossen Menschenaffen, sondern um alle Menschenaffen, also auch die Gibbons. Im Jahr 2004 stimmte das österreichische Parlament dann einstimmig einem Antrag zu, die Regierung zu bitten ein entsprechendes Verbotsgesetz zu erlassen. Die daraufhin veröffentlichte Regierungsvorlage beschränkte sich aber zunächst auf ein Versuchsverbot nur für die grossen Menschenaffen, also ohne Gibbons. Der VGT konnte jedoch erreichen, dass dem ursprünglichen Antrag Rechnung getragen wurde und – gemäss der anerkannten biologischen Einteilung – letztendlich alle Menschenaffen in das Gesetz aufgenommen wurden. Damit sind seit Beginn 2006 in Österreich alle Versuche (das heisst Eingriffe und Handlungen die das Wohlbefinden und die Unversehrtheit des Tieres beeinträchtigen) verboten, sofern sie nicht im Interesse des Tieres selbst sind.

Neben Österreich sind Experimente an Gibbons (und an allen anderen Menschenaffen) einzig noch in Schweden von Gesetzes wegen untersagt. Dort sind bereits seit dem Jahr 2003 nur noch Verhaltensstudien an Menschenaffen erlaubt. Damit nehmen Schweden und Österreich nicht nur in Europa sondern weltweit eine Vorreiterrolle ein, wenn es darum geht, bei der praktischen Umsetzung von Schutzbemühungen die Gibbons ebenfalls als Menschenaffen anzuerkennen und ihnen den gleichen Status zukommen zu lassen wie ihren grossen Verwandten.

Soweit wir wissen, verfügen Grossbritannien (seit 1997), die Niederlande (seit 2002) und Neuseeland (seit 1999) zwar über ein Verbot von Versuchen mit Menschenaffen; es ist jedoch auf die grossen Menschenaffen beschränkt. In verschiedenen Ländern sind derzeit Gesetzesänderungen in Diskussion, nicht zuletzt dank dem Engangement des Great Ape Projects und vieler weiterer Tierschutzorganisationen (Stumpe, 2007; Singer, 2006). Wie in der Schweiz werden aber leider oft – eben gerade abgestützt auf die Forderungen des Great Ape Projects – lediglich die grossen Menschenaffen für einen höheren moralischen Status in Betracht gezogen. Ein Beispiel dafür bietet sich gegenwärtig auch in der Europäischen Union (EU) dar: Das geltende EU-Recht (Tierversuchsrichtlinie 86/609) enthält kein Verbot von Tierversuchen an Menschenaffen. Es sieht nicht einmal ein Bewilligungssystem für solche Versuche vor. Nach Aussage von Frau Dr. Corina Gericke vom Verein Ärzte gegen Tierversuche Deutschland wird die Richtlinie 86/609 jedoch derzeit von der EU-Kommission überarbeitet. In einem ersten Vor-Entwurf ist ein Bewilligungssystem vorgesehen. Außerdem wird ein Verbot von Tierversuchen an Menschenaffen vorgeschlagen. Im erwähnten Vor-Entwurf ist jedoch nur von den "*great apes*" – das heisst den grossen Menschenaffen – die Rede. Es ist zu hoffen, dass nach dem Vorbild von Schweden und Österreich in weiteren Ländern erkannt wird, dass bei den Gibbons in Vergleich zu ihren grossen Verwandten zwar weniger über ihre geistigen, emotionalen und sozialen Fähigkeiten bekannt ist, jedoch aufgrund der nahen Verwandtschaft auch mit Gibbons ein ethischer Umgang vorgeschrieben sein sollte.

Nur die grossen oder alle Meschenaffen in der Gemeinschaft der Gleichen?

Unseres Wissens werden derzeit in Europa keine Versuche mit Gibbons durchgeführt. Es ist auch wenig wahrscheinlich, dass dies ausserhalb Europas in grösserem Umfang geschieht. Ähnlich wie grosse Menschenaffen weisen Gibbons relativ zu ihrer Körpergrösse lange Lebensphasen auf. So sind die Jungtiere mehrere Jahre vom Schutz der Eltern abhängig und erreichen die Geschlechtsreife meist erst in einem Alter von sechs Jahren. Gibbons vermehren sich also grundsätzlich nur langsam. Sie sind zudem relativ schwierig in Gefangenschaft zu halten, und zwar nicht in Grossgruppen sondern nur in kleinen Familiengruppen, in denen sich jeweils nur das adulte Paar fortpflanzt. Diese führt dazu, dass sich Gibbons in Gefangenschaft kaum in einer Überschussproduktion vermehren lassen. Dies macht sie für invasive Grossprojekte unattraktiv.

Wenn Primaten in Tierversuchen eingesetzt werden, sind es meistens leichter und schneller zu züchtende Arten wie Krallenäffchen, Totenkopfäffchen oder Makaken. In den meisten Fällen, in denen Menschenaffen für Tierversuche herangezogen wurden, handelte es sich um Schimpansen.

Man kann also momentan davon ausgehen, dass auch in Zukunft lediglich Verhaltensbeobachtungen an Gibbons durchgeführt werden, jedoch kaum Experimente. Da kann man sich natürlich fragen, ob es ein explizites Verbot von solchen Versuchen überhaupt braucht. Die Frage sollte jedoch breiter betrachtet werden. Schlussendlich ist ein gesetzlich vorgeschriebenes Verbot von Eingriffen in die Unversehrtheit anderer Geschöpfe ein Ausdruck davon, welchen moralischen Status wir diesen Geschöpfen anerkennen, beziehungsweise wen wir in die „Gemeinschaft der Gleichen" aufnehmen. Die Vorstellung darüber, wie gross die Gemeinschaft derer sein soll, die der Mensch nicht für seine Interessen benutzen darf, hat sich in den letzten Jahren stark verändert. Für immer mehr Leute gehören dazu auch unsere nächsten Verwandten im Tierreich, die Menschenaffen, oder gar alle Primaten. Sie attestieren den Primaten „menschliche" Rechte, weil wir gelernt haben, wie ähnlich diese Tiere uns in vielerlei Hinsicht sind. In Bezug auf Tierversuche liegt aber

eben gerade in dieser Ähnlichkeit ein moralischer Widerspruch. Einerseits werden Primaten in Versuchen eingesetzt, gerade weil sie uns so ähnlich sind, gleichzeitig geniessen sie aber bisher nicht den gleichen moralischen Schutz wie wir.

Interessant ist auch die Tatsache, dass ein Teil des Wissens über die weitreichenden Ähnlichkeiten zwischen Primaten und Menschen mit wissenschaftlichen Methoden erreicht wurde, die modernen ethischen Standards nicht mehr genügen würden. Verhindern wir also wichtige Forschung und die Gewinnung neuen Wissens, wenn wir neue ethische Richtlinien setzen und Versuche mit gewissen Tierarten verbieten? Dies hängt davon ab, ob ethisch vertretbare Methoden gefunden beziehungsweise angewendet werden. Gemäss dem Bericht der beiden eidgenössischen Kommissionen muss gegebenenfalls auf gewisse Erkenntnisse verzichtet werden, wenn diese nur auf ethisch unzulässigem Weg erreicht werden können.

Die Diskussionen über eine mögliche Ausdehnung des Kreises derer, die vom Dienst am Menschen durch einen besonderen moralischen Status ausgenommen sein sollen, haben vermutlich erst begonnen. Wo genau die neuen Grenzen gezogen werden, ist noch offen. Wenn man jedoch zum Schluss kommt, dass die Gruppe der Menschenaffen eine höhere moralische Stellung innehat als andere Tiere und darum einen besonderen Schutz verdient, dann macht es unserer Meinung nach wenig Sinn, dies nur auf die grossen Menschenaffen zu beschränken und die Gibbons auszuschliessen. Gibbons sind zweifelsohne Menschenaffen und auch unter den grossen Menschenaffen sind die verschiedenen herausragenden Fähigkeiten unterschiedlich stark ausgeprägt oder je nach Art bisher wenig untersucht. Die Gemeinschaft der „menschenähnlichen Affen“ ist scheinbar recht heterogen; das Verbindende ist jedoch nicht mehr zu übersehen.

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Literatur

Anderson, J. R. (1994). The monkey in the mirror: A strange conspecific. In Parker, S. T., Mitchell R. W., and Boccia, M. L. (eds.) *Self-awareness in animals and humans: Developmental perspectives*, Cambridge University Press, New York, pp. 315-329.

Anderson, J. R. (2006). Book review: Anne E. Russon, David R. Begun (eds). The evolution of thought: Evolutionary origins of great ape intelligence. Cambridge University Press, Cambridge, 2004. 384 pp. *Primates* **47**: 180-181.

Anonymus (2005). Bundesrat stimmte heute Menschenaffenversuchsverbot zu! *Verein Gegen Tierfabriken, News*, Wien, 21. Dezember 2005, www.vgt.at/presse/news/2005/news20051221.php

Anonymus (2006a). Zurückhaltung bei Tierversuchen mit Menschenaffen gefordert. Sonderstellung für Menschenaffen. *NZZ Online*, 22. Mai 2006, www.nzz.ch/2006/05/22/il/newzzENIM0R0Q-12.html

Anonymus (2006b). *Forschung an Primaten – eine ethische Bewertung*. Eidgenösische Kommission für Tierversuche (EKTV) und Eidgenössische Ethikkommission für die Biotechnologie im Ausserhumanbereich (EKAH), Bern. 24 pp. Erhältlich von www.ekah.ch/buwal/de/fachgebiete/fg_ekah/publikationen/broschueren/index.html

Bachmann, P. (2006). Leserbrief. *Schweizer Archiv für Neuroglogie und Psychiatrie* **157**(6): 300. Downloadable from www.sanp.ch

Baumberger, E. (2006). Keine Versuche mit Menschenaffen. *St. Galler Tagblatt*, 23. Mai 2006, www.tagblatt.ch/index.php?artikelxml=xxx&artikel_id=1192400&ressort=tagblattheute/schlagzeilen

Boesch, C. (1991). Teaching among wild chimpanzees. *Animal Behaviour* **41**: 530-532.

Boesch, C., and Boesch, H. (1990). Tool use and tool making in wild chimpanzees. *Folia Primatologica* **54**: 86-99.

Byrne, R. (1995). The thinking ape: The evolutionary origins of intelligence. Oxford University Press, Oxford, 280 pp.

De Luce, J., and Wilder, H. T. (eds.) (1983). *Language in primates: Perspectives and implications*. Springer-Verlag, New York and Berlin.

de Waal, F.B.M. (1982). Chimpanzee politics: Power and sex among apes. Jonathan Cape, London.

de Waal, F.B.M., and Aureli, F. (1996). Consolation, reconciliation, and a possible cognitive difference between macaques and chimpanzees. In Russon, A.E., Bard, K.A., and Parker, S.T. (eds), *Reaching into thought: The minds of the great apes*, Cambridge University Press, Cambridge, pp. 80-110.

Feistner, A. T. C., and McGrew, W. C. (1989). Food-sharing in primates: A critical review. In Seth P. K., and Seth S. (eds), *Perspectives in primate biology, vol. 3*, Today & Tomorrow’s Printers and Publishers, New Dehli, pp. 21-36.

Gallup, G. G. Jr., Anderson, J. R., and Shillito, D. J. (2002). The mirror test. In Bekoff, M., Allen, C., and Burghardt, G. M. (eds.) *The cognitive animal. Empirical and theoretical perspectives on animal cognition*. MIT Press, Cambridge, pp. 325-333.

Gardner, R. A., Gardner, B. T., and Van Cantfort, T. E. (eds.) (1989). *Teaching sign language to chimpanzees*. State University of New York Press, Albany.

Inoue-Nakamura, N. (1997). Mirror self-recognition in non-human primates. A phylogenetic approach. *Japanese Psychological Research* **39**: 266-275.

Maestripieri, D., Ross, S. K., and Megna, N. L. (2002). Mother infant interactions in western lowland gorillas (*Gorilla gorilla gorilla*): Spatial relationships, communication, and opportunities for social learning. *Journal of Comparative Psychology* **116**: 219-227.

Povinelli, D. J., and Cant, J. G. H. (1995). Arboreal clambering and the evolution of self-conception. *The Quarterly Review of Biology* **70:** 393-421.

Ritvo, H. (1985). Animal problems. Review of Harlan B. Miller and William H. Williams, eds., Ethics and Animals. Clifton, NJ: Humana Press, 1983. 416 pp. *Science, Technology, & Human Values* **10** (3): 87-91.

RME (2006). Wie umgehen mit Versuchen an Primaten? Ethik- und Tierversuchskommissionen präsentieren Bericht. *NZZ Online*, 23. Mai 2006, www.nzz.ch/2006/05/23/il/articleE5AC6.html

Rüegg, P. (2006). Neuer Bericht zu Primaten-versuchen. Ethiker fordern hohe Hürden. *ETH-Life (Webjournal)*, 23. Mai 2006, www.ethlife.ethz.ch/articles/tages/ethikundprimaten.html

Russon, A. E. (2004). Great ape cognitive systems. In Russon, A. E., and Begun, D. R. (eds.) *Evolution of thought: Evolutionary origins of great ape intelligence*, Cambridge University Press, Cambridge, pp. 76-100.

Savage-Rumbaugh, S., Shanker, S. G., and Taylor, T. J. (1998). *Apes, language, and the human mind*. Oxford University Press, Oxford.

Sebeok, T. A., and Umiker-Sebeok, J. (eds.) (1980). *Speaking of apes: A critical anthology of two-way communication with man*. Plenum Press, New York.

Singer, P. (2006). The great ape debate unfolds in europe. *The Japan Time Online*, 22. Mai 2006, http://search.japantimes.co.jp/cgi-bin/eo20060522a1.html

Six, A. (2006). Gibbons: Unsere völlig unterschätzten kleinen Brüder. *NZZ am Sonntag* **2006**(16. Juli): 58.

Stumpe, M. L. (2007). For immediate release. *Great Ape Project, News & Information*, 22. März 2007, www.greatapeproject.org/news.php

Ujhelyi, M., Merker, B., Buk, P., and Geissmann, T. (2000). Observations on the behavior of gibbons (*Hylobates leucogenys*, *H. gabriellae*, and *H. lar*) in the presence of mirrors. *Journal of Comparative Psychology* **114**: 253-262.

Summary

Human rights for gibbons? Experiments with apes

The close relatedness between humans and non-human primates in general and apes in particular is perceived by many people on an intuitive level, and has been supported in the last few decades by a wealth of scientific evidence. Many abilities, which have long been regarded as human exclusivities, have also been found in apes. These findings challenge the uniqueness of humans and raise the question of whether it remains morally acceptable to use primates in invasive experiments that risk to cause pain, stress and fear. If an individual has the mental ability to perceive its situation exactly (and possibly consciously), its suffering under experimental conditions is probably much more intense. There is strong evidence that apes possess self-awareness and have needs and interests that are particularly similar to those of humans. As a result, there is an increasing trend toward considering the knowledge of the outstanding and somewhat "human-like" mental, emotional and social abilities of apes in legal regulations of animal experiments, and some people claim that basic human rights (i.e. protection from torture) should be extended to the great apes (www.greatapeproject.org).

The facts that the mental abilities of great apes are by far the best known of all non-human primates (and probably any non-human species) and that funding has been available to raise public awareness of this knowledge probably play an important role in the increasing support for great apes. On the other hand, very little is known about the mental abilities of gibbons, and research on gibbon cognition is exceptionally rare. Our lack of knowledge on gibbon mental abilities should not lead to ignoring the wealth of biological data that clearly identify the gibbons as apes. Moreover, there is some evidence for self-recognition in gibbons, which is often considered an indication of self-awareness. In our view, it is questionable to restrict claims for special protection to the great apes while ignoring the small apes.

Unfortunately, this is exactly what recently adopted legal regulations do in several countries. A similar legal regulation also appears to be under way in Switzerland. In this country, no special regulations exist for the use of primates to date. In 2006, two federal commissions have published an ethical assessment of using primates in research. Besides ethical considerations related to the specificities of primates, they also state a number of postulations for the attention of regulatory authorities. They suggest exempting great apes from use in experiments but

explicitly exclude the gibbons from this moral circle and group them together with the monkeys.

Very similar considerations are also made in the current debate on new regulations for animal experiments in the European Union (EU). The United Kingdom, the Netherlands, and New Zealand have already banned experiments with great apes. To our knowledge, there are only two countries worldwide, namely Sweden and Austria, that have included the gibbons in such a ban, hence adopting the biologically unquestioned grouping of gibbons with the great apes.

Although gibbons are rarely used in laboratory experiments because their slow life history and their monogamous social structure makes it difficult to reproduce them in large quantities in captivity, these legal decisions in Sweden and Austria are still of ideological importance. The level of protection that a non-human species obtains in the law reflects its moral status in human society. We are not criticising an expansion of the moral circle to include great apes. In our view, however, a restriction of this protection to the great apes is largely driven by an imbalance in scientific knowledge and public awareness. This should not keep us from acknowledging the gibbons as true apes and from granting them the same legal protection.

Ex-situ conservation of the Javan silvery gibbon (*Hylobates moloch*)

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"The haunting and beautiful call of the female silvery gibbon still awakens a few small patches of the misty rainforests of West and Central Java. Unlike most gibbon species, her mate contributes little to the song but watches for intruders during the female's early morning recital" (Gates, 1995). Sadly, the call of the silvery gibbon could be silenced forever. The Silvery Gibbon Project is a registered environmental organisation based in Perth, Western Australia. Established in 1991, the project raises funds for the conservation of the endangered silvery gibbon (*Hylobates moloch*), a primate found only in the forests of Java. The following article discusses the plight of the silvery gibbon and some of the conservation efforts directed towards saving this unique creature. In particular, the Javan Gibbon Centre (JGC) which was established as a rescue and rehabilitation centre for rescued and confiscated silvery gibbons.

The silvery gibbon

The Javan or silvery gibbon (*Hylobates moloch*) (Fig. 1) is found only on the island of Java, Indonesia. Previously silvery gibbon habitat extended throughout the whole of the West Java and Banten provinces, through the western half of the Central Java provinces. Current populations are found only in Banten, West Java and the western half of Central Java. Unfortunately, like so many species today, the wild populations of the silvery gibbon are under threat due to habitat destruction and fragmentation from illegal logging, and encroachment from local human populations.

With a human population of 124 million in 2005, Java is the most populous island in the world; it is also one of the most densely populated regions on earth (Wikipedia, 2007). It is estimated that only 4% of the original native habitat is still available to the silvery gibbon (Benders-Hyde, 2002) due to habitat loss of and fragmentation. In addition to habitat loss, many gibbons are still lost each year to the illegal pet trade, when adult gibbons are slaughtered so that their babies can be sold in the markets as pets. It is estimated that as many as 300 silvery gibbons are held illegally in captivity, most frequently as pets (Supriatna *et al.*, 1994).

The situation for the silvery gibbon is dire. The species is listed on Appendix I of CITES, precluding all international commercial trade in the species, and is currently classified as Endangered based on data from 2006 (Geissmann, 2007).

Fig. 1. An adult silvery gibbon male at Perth Zoo, Australia. Photo: Karen Payne. – *Ein erwachsenes Silbergibbon-Männchen im Zoo von Perth (Australien).*

Since the first population surveys were carried out in 1978 by Kappeler (1984), numerous other studies have been performed to obtain estimates of the silvery gibbon populations in Java (Asquith, 1995; Asquith *et al.*, 1995; Nijman and van Balen, 1998; Djanubudiman *et al.*, 2004; Nijman, 2004). Population estimates vary from 400 to 5,000, though most estimate that between 2,000 and 4,000

individuals remain in the wild (Supriatna *et al*., 2001; Djanubudiman *et al.*, 2004, Nijman, 2004). Nijman (2006) suggests that although there are a relatively large number of gibbons existing in small populations in forest fragments, greater than 95% of the gibbons are believed to exist in populations of a hundred individuals or more. The largest of these populations are reported to be located in Mt. Halimun, Mt. Simpang, Mts. Dieng and Ujung Kulon. Nijman (2006) also reports that about one third of the total wild population of silvery gibbons inhabit forest areas outside of the protected area network.

The Javan Gibbon Centre

Following the 1994 Population and Habitat Viability Analysis (PHVA) workshop for the Javan gibbon and the subsequent 1997 international workshop on Javan Gibbon Rescue and Rehabilitation, a recommendation was made to the Government of Indonesia to establish a rescue and rehabilitation centre for the silvery gibbon. In November 2002, the Javan Gibbon Centre (JGC) was established as a rescue and rehabilitation centre for rescued and confiscated silvery gibbons. The Javan Gibbon Centre was the result of collaboration between Conservation International (CI), the Silvery Gibbon Project (SGP), Yayasan Penyelamatan Dan Rehabilitasi Owa Jawa, the Indonesian Ministry of Forestry and the University of Indonesia.

The Javan Gibbon Centre, located near Bodogol and close to the Gunung Gede Pangrango National Park, was established on 2.5 ha of land donated by a local ecotourism hotel. Facilities included a medical and quarantine building, individual and socialisation enclosures, office and a guard station. In late 2006, the centre was required to relocate to a new site, and is now located on a 15 ha site bordering the Gunung Gede Pangrango National Park (Fig. 2). Relocation of a number of the facilities to the new site has recently occurred, however a new veterinary clinic is yet to be built.

Development of the centre to its anticipated potential has not been as rapid as had been hoped, due largely to financial restraints. Currently the centre holds only six silvery gibbons (Fig. 3), and has had to turn away gibbons in the past due to space and staff constraints.

The Silvery Gibbon project is keen to see that the Javan Gibbon Centre develop significantly in the near future, with the hope that the centre will be able to accommodate up to 20 gibbons by the end of the year, and double this or more by the end of 2008. With a known 15 gibbons in struggling rescue facilities and even more held illegally as household pets, this number of gibbons is still only the tip of the iceberg.

Fig. 2. The new Javan Gibbon Centre site near Gunung Gede Pangrango National Park, Java. Photo: Karen Payne. – *Das Javan Gibbon Centre an seinem neuen Ort in der Nähe des Gunung Gede Pangrango Nationalparks in Westjava*.

In order to achieve this, however, further infrastructure urgently needs to be built on the new site to accommodate this amount of gibbons. Of critical importance is the construction of a number of good sized enclosures that will not only meet the physical needs of the gibbons but also allow the formation of pairs (Fig. 4). The construction and staffing of a basic veterinary clinic and quarantine facilities is also essential to allow health screening and monitoring of the gibbons.

Plans are already underway to secure funding for the construction of four more enclosures, however, more is urgently needed. Funding for the centre is currently being provided by the Silvery Gibbon Project, Conservation International and Sea World Busch Gardens.

The Javan Gibbon Centre hopes to contribute to the conservation of the silvery gibbon by:

- providing suitable accommodation for confiscated and rescued silvery gibbons.
- providing suitable facilities and expertise for the successful rehabilitation of pet gibbons allowing for normal social structure and breeding.
- securing suitable release sites and developing a successful reintroduction program.
- providing education programs and facilities to local people and visitors to the area.
- providing facilities for suitable research projects.

Other conservation efforts

It is recognised that the Javan Gibbon Centre on its own will not save this species. It is only a very small part of what needs to be done to prevent the imminent extinction of the silvery gibbon.

Fig. 3. Silvery gibbons Jeffrey (left) and Nancy (right) at the Javan Gibbon Centre will hopefully be paired once new enclosures are built. Photos: Karen Payne. – *Die beiden Silbergibbons Jeffrey (links) und Nancy (rechts) sollen zu einem Paar zusammengeführt werden, wenn ihre neuen Käfige fertiggestellt sind.*

Fig. 4. Site assessment for new enclosures at the Javan Gibbon Centre. Photo: Karen Payne. – *Auswahl der Standorte für neue Gibbongehege im Javan Gibbon Centre.*

Supriatna (2006) highlights the need to encourage government officers to take action in curbing illegal trade in gibbons, to double their efforts to patrol the existing parks, to create programs to monitor populations both in and outside protected areas, and to discourage trade by confiscating pets and placing them in a rehabilitation program.

Other vital steps in the conservation of this species include habitat protection and education of local people about the importance of conservation. Of these, habitat protection is seen as the most vital and urgent step and will have the greatest impact on improving the status of this species in the wild.

An education program and mobile education unit has been established at the Bodogol Conservation Education Centre in the Gunung Gede Pangrango National Park, and is reported to receive more than 5,000 visitors each year, mostly Indonesians. This program was set up with the aim of educating locals about the plight of the Javan gibbon and promoting an understanding of the link between conserving wildlife and the benefits to the people in securing their natural forests.

Captive populations of silvery gibbons are maintained in a number of institutions in the western world as well as within Indonesia. Breeding success in the past has been limited to only a small number of pairs, although breeding success does seem to be improving. In order to improve the gene pool of these captive gibbons, it has been recommended that the Indonesian zoos become more involved in breeding programs to ensure a long-term survival of the silvery gibbon. These captive populations also serve as an educational tool to highlight the need for the conservation of this species in the wild.

The Silvery Gibbon Project

The Silvery Gibbon Project is a non-government organisation (NGO) based in Perth, Western Australia. Established in 1991, we are a small group of volunteers that raise funds to be directed towards conservation of the silvery gibbon. The main project funded to date has been the Javan Gibbon Centre, with funds directed to the initial construction of the centre, building of enclosures, and providing funding for the operational costs. Recently funding has also assisted with the relocation of the centre to the new site. Members have also been able to provide advice on husbandry and veterinary management through experience from Perth Zoo, who currently holds a successful breeding population of this species.

Other projects funded by the Silvery Gibbon Project include funding for the mobile education unit at Bodogol, as well the building of gates and path at Gunung Halimun National Park.

In the future, the Silvery Gibbon Project hopes to expand its projects to also include habitat protection initiatives and the production of educational material for the centre. We also hope to broaden our conservation efforts to include financial support to other gibbon projects.

As part of this, an Indonesian Gibbon Workshop has been proposed with the aims of bringing together relevant people and projects working in the various aspects of gibbon conservation. It is hoped that this workshop, proposed clear directions for the future of gibbon conservation across Indonesia and south-east Asia and encourage co-operation and collaboration between the various agencies involved.

In addition, the Silvery Gibbon Project is currently supporting a fundraising tour for Kalaweit Gibbon Project, a gibbon rehabilitation project based in Borneo and Sumatra that houses in excess of 280 gibbons and siamangs. It is hoped that funds raised by this tour will be able to contribute to conservation efforts for the Kloss's Gibbon (*Hylobates klossii*) of the Indonesian Mentawai Islands.

The Silvery Gibbon Project is only a small group, with only around 100 members. However we hope that our efforts can help to contribute significantly to the conservation of the critically endangered silvery gibbon through raising awareness of the plight of this and other gibbon species, and through fundraising projects such as the current "Go Without For Gibbons".

Further information about the Silvery Gibbon Project can be found at our website www.silvery.org.au.

How can you help?

With a problem this big, it is often hard to see how one person can make a difference. But there are many things that you can do on a personal level that can help.

The "Go Without for Gibbons" campaign encourages people to forego a luxury once in a while and instead donate the money they would have spent on that item to The Silvery Gibbon Project. It is an example of how everyone of us can make a difference just by doing small things. It all adds up.

Other ways that people can help include:

- be aware of what you buy: don't purchase items made from Indonesian timber.
- don't promote the illegal pet trade by posing for photos with pet gibbons while travelling in Asia.
- lobby governments to protect and extend forested areas
- lobby governments to enforce illegal logging laws and confiscate pet gibbons
- spread the word
- donate money – in the end, conservation initiatives like this are fuelled by money and simply cannot progress without generous donations.

References

Asquith, N. M. (1995). Javan gibbon conservation: Why habitat protection is crucial. *Tropical Biodiversity* **3**: 63-65.

Asquith, N. M., Martarinza, and Sinaga, R. M. (1995). The Javan gibbon (*Hylobates moloch*): Status and conservation recommendations. *Tropical Biodiversity* **3**: 1-14.

Benders-Hyde, E. 2002. *Silvery gibbon*. Website: www.blueplanetbiomes.org/silvery_gibbon.htm. Accessed March 12 2007.

Djanubudiman, G., Arisona, J., Iqbal, M., Wibisono, F., Mulcahy, G., Indrawan, M., and Hidayat, R. M. (2004). *Current distribution and conservation priorities for the Javan gibbon (*Hylobates moloch*)*. Report to Great Ape Conservation Fund, U.S. Fish and Wildlife Service, Washington, DC, Indonesian Foundation for Advance of Biological Sciences, and Center for Biodiversity and Conservation Studies of University of Indonesia, Depok. 25 pp.

Gates, D. (1995). *The Silvery Gibbon Project – About the project*. www.silvery.org.au

Geissmann, T. (2007). Status reassessment of the gibbons: Results of the Asian Primate Red List Workshop 2006. *Gibbon Journal* **3**: 5-15.

IUCN (2006). *2006 IUCN Red List of Threatened Species*. IUCN – The World Conservation Union, Species Survival Commission (SSC), Gland, Switzerland and Cambridge, UK. Website: www.iucnredlist.org. Accessed 3 March 2007.

Kappeler, M. (1984). The gibbon in Java. In Preuschoft, H., Chivers, D. J., Brockelman, W. Y., and Creel, N. (eds.), *The lesser apes. Evolutionary and behavioural biology*, Edinburgh University Press, Edinburgh, pp. 19-31.

Nijman, V. (1995). Remarks on the occurrence of gibbons in central Java. *Primate Conservation* **16**: 66-67.

Nijman, V. (2004). Conservation of the Javan gibbon *Hylobates moloch*: Population estimates, local extinctions, and conservation priorities. *The Raffles Bulletin of Zoology* **52**(1): 271-280.

Nijman, V. (2006). *In-situ* and *ex-situ* status of the Javan gibbon and the role of zoos in conservation of the species. *Contributions to Zoology* **75**(3/4): 161-168.

Nijman, V., and Sozer, R. (1995). Recent observations of the grizzled leaf monkey (*Presbytis comata*) and extension of the range of the Javan gibbon (*Hylobates moloch*) in central Java. *Tropical Biodiversity* **3**(1): 45-48.

Nijman, V., and van Balen, S. (1998). A faunal survey of the Dieng Mountains, Central Java, Indonesia: Distribution and conservation of endemic primate taxa. *Oryx* **32**(2): 145-156.

Sugardjito, J., and Sinaga, M. H. (1999). Conservation status and population distribution of primates in Gunung Halimun National Park, West Java - Indonesia. In Supriatna, J., and Manullang, B. O. (eds.), *Proceedings of the international workshop on Javan gibbon (*Hylobates moloch*) rescue and rehabilitation*, Conservation International Indonesia Program, and Center for Biodiversity and Conservation Studies, University of Indonesia, Jakarta, pp. 6-12.

Supriatna, J. (2006). Conservation programs for the endangered Javan gibbon (*Hylobates moloch*). *Primate Conservation* **21**: 155-162.

Supriatna, J., Manansang, J., Tumbelaka, L., Andayani, N., Seal, U. S., and Byers, O. (eds.). (2001). *Conservation assessment and management plan for the primates of Indonesia. Briefing book.* IUCN/SSC Conservation Breeding Specialist Group (CBSG), Apple Valley, Minnesota. 838 pp.

Supriatna, J., and Manullang, B. O. (Ed.). (1999). *Proceedings of the international workshop on Javan gibbon (*Hylobates moloch*) rescue and rehabilitation*, Conservation International Indonesia Program, and Center for Biodiversity and Conservation Studies, University of Indonesia, Jakarta, pp. 60.

Supriatna, J., R. L. Tilson, K. J. Gurmaya, J. Manansang, W. Wardojo, A. Sriyanto, A. Teare, K. Castle and U. S. Seal (eds.). 1994. Javan Gibbon and Javan Langur: Population and Habitat Viability Analysis Report. IUCN/SSC Conservation Breeding Specialist Group (CBSG), Apple Valley, Minnesota. 112pp.

Wikipedia (2007). *Wikipedia – The free encyclopedia*. Website: http://en.wikipedia.org/wiki/Java. Accessed 15 March 2007.

Zusammenfassung

Ex-situ-Artenschutz beim javanischen Silbergibbon (*Hylobates moloch*)

"Noch immer erwachen ein paar wenige neblige Regenwaldregionen in West- und Zentraljava beim eindringlichen und schönen Gesang der weiblichen Silbergibbons. Anders als bei den meisten Gibbonarten steuert das Männchen wenig zum Gesang bei, sondern hält während des frühmorgenlichen Vortrags des Weibchens nach Eindringlingen Ausschau" (Gates, 1995). Leider könnte der Gesang des Silbergibbons bald für immer verstummen. Das *Silvery Gibbon Project* (SGP) ist eine eingetragene Organisation mit Sitz in Perth, Westaustralien. Das im Jahr 1991 gegründete Projekt sammelt Finanzmittel zum Schutz des bedrohten Silbergibbons (*Hylobates moloch*), einer Menschenaffenart, die nur in den Wäldern von Java vorkommt. Dieser Artikel diskutiert die Bedrohung der Silbergibbons and beschreibt einige der Schutzbemühungen, die zur Rettung dieser einzigartigen Tiere unternommen werden. Dazu gehört insbesondere die Gründung des Javan Gibbon Centre (JGC), einer Auffangstation für illegal in Gefangenschaft gehaltene Silbergibbons.

Gibbons in the smoke: Experiences of a field study on Bornean white-bearded gibbons (*Hylobates albibarbis*) in central Kalimantan (Indonesia)

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Bornean white-bearded gibbons (*Hylobates albibarbis*) and Bornean orangutans (*Pongo pygmaeus wurmbii*) both inhabit the peat swamp forests of Central Kalimantan. In order to conduct a comparative study on these two ape species, I observed a gibbon group and several orangutans in the summer of 2006. Living in a heavily logged peat swamp forest being exposed to thick smoke from forest burnings every year, the Asian apes do not only have to deal with ecological and social constraints, but also with the increasing threats caused by humans.

Introduction

Kalimantan, the Indonesian part of Borneo, belongs to Sundaland, one of the 25 designated bio-diversity hotspots on earth (Myers *et al*., 2000). Borneo provides habitat for 210 different mammal species, 48 of which are endemic to the island (Kapos and Caldecott, 2005). The Bornean white-bearded gibbon (*Hylobates albibarbis*) is found exclusively in Southwest Kalimantan between the rivers Kapuas and Barito (Brandon-Jones *et al*., 2004; Marshall and Sugardjito, 1986). 3,000 km^2 of white-bearded gibbon habitat fall under protection of the Mawas reserve. The Bornean Orangutan Survival Foundation (BOS) is active in this area to protect one of the last refuges of the Asian apes, conducting surveys to detect illegal logging, fires, hunting and pet-trade. Fire fights are organized in close collaboration with local people and in some previously logged parts of the reserve plant nurseries grow trees for reforestation (BOS, 2007).

Tuanan is a small village located well within the Mawas reserve. The Tuanan orangutan research station, located approximately 2 km upstream of the Kapuas in a heavily logged peat swamp forest was built in 2003 (Fig. 1). Research was conducted exclusively on orangutans until an Indonesian student habituated a gibbon group and conducted a study on seed dispersal between September 2004 and August 2005.

The Kejora gibbon group

Between February and September 2006 I travelled to Tuanan in order to conduct a comparative study on Bornean white-bearded gibbons and Bornean orangutans (*Pongo pygmaeus wurmbii*). When food becomes scarce, orangutans switch to an unusual diet and start to eat inner parts of bark, roots etc. (van Schaik, 2001). How do gibbons deal with periods of food scarcity?

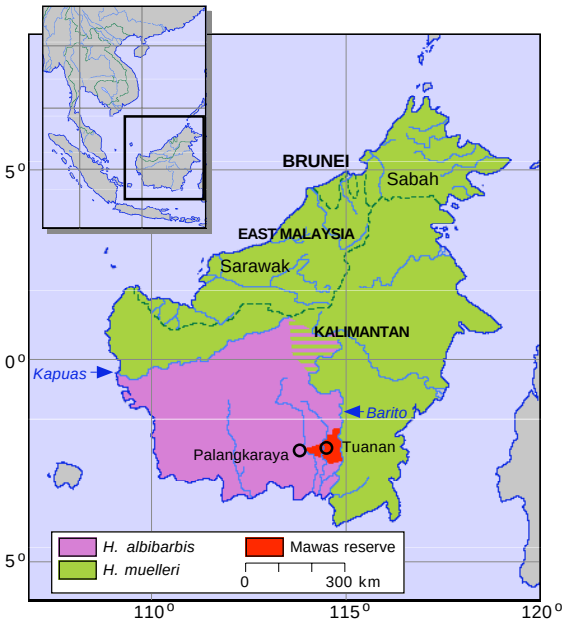

Fig. 1. Map of Borneo showing the distribution of the two gibbon species occurring on the island: *Hylobates albibarbis* and *H. muelleri*. The location of the Tuanan research station in the Mawas reserve, and Palangkaraya, the capital of Kalimantan are also shown. Inset map: South-east Asia.– *Die Karte zeigt das Verbreitungsgebiet der beiden Gibbonarten* H. albibarbis *und* H. muelleri *auf Borneo. Die Forschungs-station Tuanan im Mawas Schutzgebiet sowie Palangkaraya, die Hauptstadt von Kalimantan (dem indonesischen Teil von Borneo), sind ebenfalls eingezeichnet. Kleine Karte: Südostasien.*

To answer this question I entered the forest whenever possible, often together with my Indo-nesian counterpart. Our days started well before dawn when the first hoots from the gibbon male's solo song bouts reached camp. We expected some difficulties finding the group named Kejora (meaning Morning Star in Indonesian), which had been partially habituated during an earlier study, but following the

group rarely met our expectations. Morning after morning we tried to locate Bejo, the adult male of Kejora, during his morning solo song bouts. If we succeeded, he either brachiated away immediately or carried on singing for a while before he detected us and took flight. When we searched the forest for the rest of the day, we were sometimes lucky and a light swish of a tree gave away the presence of a gibbon. Following the incredibly fast fur balls was very difficult and we often lost them shortly after we had found them. After two month and countless hours in the forest, Bejo finally allowed us to become silent observers of the everyday miracles in a gibbons life. The adult female Juminten, the female juvenile Paimin, and the 1.5 year old male infant Sutejo, followed his example hesitantly (Fig. 2).

The Kejora group inhabits a home range around camp with an estimated size of 47 ha (Fig. 3). This compares well with average home range sizes of 28 ha and 45 ha that were determined at Gunung Palung and the Sabangau catchment areas, respectively (Buckley *et al*., 2006; Mitani, 1990).

A regular observation day started around 04:30 and ended around 15:00 hours when the gibbons broke into a run before entering a sleeping tree, a behaviour that has been described as an anti-predator strategy (Reichard, 1998). In these situations it was often impossible to keep up with the group. Only after all individuals were sufficiently habituated we had the opportunity to see the adult female with her infant or the adult male in a sleeping tree. Gibbons usually choose high trees (Gittins, 1982; Reichard, 1998), which are revisited irregularly over long periods (Reichard, 1998). Only a few sleeping trees of the Kejora group are known (Fig. 3) and all of them were used between July and August 2006.

a

b

c

Fig. 2. The members of the Kejora gibbon group. (a) The juvenile female Paimin (top), the adult female Juminten, and the dependent male infant Sutejo are resting together. (b) The adult male Bejo is feeding on figs. (c) The juvenile female Paimin feeds on shoots and young leaves of a liana species. Photos: Livia Haag. –

Die Mitglieder der Kejora Gibbongruppe: (a) Das weibliche Jungtier Paimin (zuoberst), das ausgewachsene Weibchen Juminten und das noch von der Mutter abhängige männliche Jungtier Sutejo ruhen sich zusammen aus. (b) Das ausgewachsene Männchen Bejo frisst an Feigen. (c) Das weibliche Jungtier Paimin frisst Sprosse und junge Blätter einer Liane.

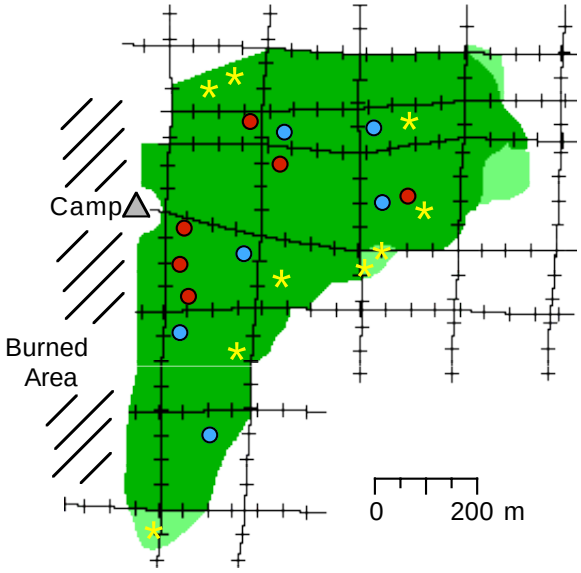

Fig. 3. The home range of the Kejora group (green) borders on an area that has been burned in 2003. Blue dots represent sleeping trees of the adult female, red dots of the adult male respectively. Yellow stars mark the regions of territorial encounters between April and September 2006. Light green regions were not visited regularly by the gibbons (less than five times during the study period). – *Das Streifgebiet der Kejora-Gruppe (grüne Fläche) grenzt an ein Gebiet, welches im Jahr 2003 abbrannte. Blaue Punkte bezeichnen Schlafbäume des erwachsenen Weibchens, rote Punkte jene des erwachsenen Männchens. Gelbe Sterne bezeichnen Orte, an denen Konflikte mit Nachbargruppen beobachtet wurden. Hellgrün sind Regionen, welche von den Gibbons während der Studienzeit weniger als fünf Mal besucht wurden.*

Surprisingly, 58% of the sleeping trees were used more then once (up to three times). White-handed gibbons (*H. lar*) of the Khao Yai National Park in Thailand were reported to reuse only 18–30% of their sleeping trees (Reichard, 1998: results from several groups). In contrast, the high revisitation rate in Tuanan may be explained by low predation pressure or by a very restricted number of suitable sleeping trees in the home range due to the heavy logging in Tuanan's recent past.

Gibbon songs

The adult male Bejo produced morning solo song bouts in 76.6% of 64 observation days. A male of a study group of *H. agilis* on the Malay Peninsula was found to sing on 67% of 177 study days (Gittins, 1984), and in Gunung Palung males of *H. albibarbis* sang on 77% of 124 study days (Mitani, 1988), which is roughly similar to the value for the Kejora group.

The start time for most male solo song bouts is around dawn (average start time 04:50 hours), with a peak in the time slot between 05:00 and 05:30 hours (n = 43 song bouts) (Fig. 4).

Bejo's solo song bouts often helped us in locating the Kejora group in the early morning. Most solo song bouts were produced while the male was still in the sleeping tree. Sometimes the male of the neighbouring group sang less then 50 meters away from a well-known sleeping tree of the Kejora group. This created some confusion when we tried to locate our study group, and only after several months our increasing familiarity with Bejo's song led us reliably to the correct singing post. Previous work (Dallmann and Geissmann, 2001a, b; Geissmann *et al.*, 2005; Haimoff and Gittins, 1985; Haimoff and Tilson, 1985) suggests that gibbons exhibit slight individual differences in their songs.

In addition to male solo song bouts, mated pairs also produced duet song bouts. Duet song bouts of the Kejora group (n = 19) occurred on 29% of the 64 observation days, which appears to be less often then in other studies (e.g. Gittins, 1984: in 66% of all days). The whole family participated in the duet song bouts of the Kejora group. It was always spectacular to see them jumping around and shaking branches during the climax of the female's great call phrase. The juvenile female joined her mother during this most distinctive part of the duet, and the infant made its contribution by screaming.

As a rule, duet song bouts occurred later in the morning than the male solo song bouts, usually after the group's first feeding bout, with a peak in the time slot of 07:00 to 07:30 hours. One exceptionally late duet song bout at 13:00 hours took place in the context of a territorial encounter. As shown in Fig. 4, there is virtually no overlap in the distribution of the starting times of male solo song bouts and duet song bouts.

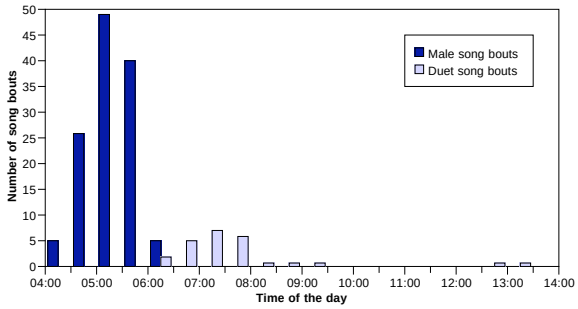

Fig. 4. Frequency distribution of the start time of song bouts by the Kejora group. Male solo song bouts (n = 43) start usually before dawn (average start time 04:50 hours), whereas duet song bouts (n = 19) start later in the morning. – *Häufigkeitsverteilung der Startzeit von Gibbon-gesängen der Kejora-Gruppe. Das Männchen beginnt seine Solo-Gesänge meist um die Zeit der Morgendämmerung (durchschnittliche Startzeit 04:50 Uhr), während Duettgesänge meist später am Morgen gesungen werden.*

Male solo song bouts were of longer duration than duet song bouts (median value 30 min versus 13 min). The difference is statistically significant (Mann-Whitney *U* test; $U = 118.0$, $p < 0.0001$). This

is also the rule in other species of the genus *Hylobates* (Geissmann, 2002).

Some highlights of gibbon follow days

One day, when my focal animal, the juvenile female Paimin, was sitting quietly on a branch, I suddenly heard some crackling and rustling noises. We were surrounded by red langurs (*Presbytis rubicunda*). As the monkey group entered a tall tree to feed on leaves, Paimin followed. The juvenile gibbon started to run up and down the tree, chasing red langurs back and forth. For more than an hour, she was playing, chasing and screaming, and even touching, red langur juveniles (Fig. 5). Brief inter-specific play episodes in gibbons involving pig-tail macaques (*Macaca nemestrina*) have been reported by Reichard (1998). Although pig-tail macaques also live in the home range of the Kejora group, encounters were not frequent, and interactions were never observed. Further playful contacts with other animal species included chasing of squirrels and birds, and slapping common palm civets or orangutan infants.

Fig. 5. Inter-specific social play between a Bornean white-bearded gibbon (*Hylobates albibarbis*) and a red langur (*Presbytis rubicunda*). Photo: Livia Haag. – *Soziales Spielen zwischen zwei Affenarten: einem Weissbartgibbon und einem Maronen-langur.*

Not only were encounters with other species spectacular to watch, but so were encounters with gibbons from neighbouring groups. When the adult male hung head down in a tall tree giving soft sounds and breaking dead twigs, another gibbon group was never far. Vocalizations produced during disputes were described as conflict whistles (Gittins, 1979) and sound like chirps from a little bird. Territorial encounters occur frequently along the territorial boundary (Fig. 3). Gittins recorded such disputes every second day in an agile gibbon group (*H. agilis*) on the Malay peninsula. Far less frequent are encounters with single individuals, most likely subadults that disperse from their native group. A solitary male met the Kejora group three times in core regions of their territory. After the adult male of Kejora chased the intruder shortly, he was mainly watching while the adult female fought him to the ground for more then 2.5 hours, only taking breaks to nurse the infant or copulate with her partner (Fig. 6). During the last observed encounter, at the end of the study, the lone male sat within 10 meters of Bejo without provoking any reaction.

Fig. 6. A solitary male encountered within the territory of the Kejora group was fought to the ground over several hours by the adult female of the group. Photo: Livia Haag. – *Dieses solitäre Gibbonmännchen wurde von der Kejora-Gruppe in ihrem Territorium angetroffen und vom erwachsenen Weibchen der Gruppe über mehrere Stunden immer wieder auf den Boden gejagt.*

Threats

In mid-August 2006, forest burnings started their vast destruction. What was first a faint familiar smell of a bonfire quickly became a thick layer of smog that veiled the sun and burned in our eyes and throats (Fig. 7).

Two seasons occur in Central Kalimantan, a rainy season and a dry season. In 2006, it had not rained since the end of June and by August the peat was dried out completely.

Forests in Indonesia burn every year. In 2003 a fire was set right in front of the Tuanan research station. The territory of the Kejora group now borders on this burned area (Fig. 7). It is very likely that this group once inhabited parts of the forest that are now reduced to grass and bush land.

Fig. 7. This former peat swamp forest bordering on the Tuanan research area was burned down in 2003. In 2006, when this photo was taken, forest fires from all over Kalimantan veiled the area in thick smoke again. Photo: Livia Haag. – *Dieses ehemalige Sumpfwald-Habitat, welches an das Forschungs-gebiet in Tuanan angrenzt, wurde im Jahr 2003 niedergebrannt. Auch im Jahr 2006, als dieses Bild entstand, waren Waldbrände über ganz Kalimantan verteilt und hüllten das Gebiet in dichten Rauch.*

Fires induce the biggest destruction during el Niño years. El Niño events are oscillations of the ocean-atmosphere system in the tropical Pacific causing elongated dry seasons in much of Indonesia. Because of large-scale land use on the islands of Borneo and Sumatra especially, el Niño became increasingly associated with massive forests fires that spread a choking haze and economic concerns across Southeast Asia (mongabay.com, 2007). The fires of 1997/98, before 2006 the most extreme fires, released an estimated 2.67 billion tons of carbon dioxide into the atmosphere (mongabay.com, 2006). In the el Niño year 2006 increased agricultural burnings resulted in massive forest destruction. This resulted in the highest deforestation rate (more than 30,000 km^2) ever recorded in Indonesia (mongabay.com, 2007). The incredible amount of smoke produced by Indonesian forest fires even provoked complaints from surrounding nations (Kessler, 2006). When the first rain in late November redeemed Kalimantan from the smoke, almost 10,000 km^2 of forest had been destroyed in this part of Borneo alone (Klute, 2007).

Most of the fires are deliberately set and soon get out of control. According to Nellemann *et al.* (2007), "the driving forces to set forest fires are not impoverished farmers, but what appears to be well-organized companies with heavy machinery and strong international links to the global market". Currently, the main reason for forest clearings is the oil palm industry. Palm oil is found in one of ten supermarket products (e.g. toothpaste, lipstick etc.) and is a main source of bio-fuel (Nellemann *et al.*, 2007). Especially controversial is the fact that bio-fuel is produced to reduce CO_2 emission caused by conventional energy sources. Peat is a huge reservoir of CO_2 that has built up over thousands of years. When peat swamp forests catch fire, the trees and the peat burn, releasing far more CO_2 then can be saved through the use of palm oil as bio-fuel (Nellemann *et al.*, 2007). At the moment, 65,000 km^2 of land are cropped with oil palms in Indonesia. Indonesia and Malaysia together account for 83% of the global palm oil production (Klute, 2007; Nellemann *et al.*, 2007). Since fires can only be stopped with huge effort, most of the deliberately set fires get out of control and far more land is cleared than used for plantations afterwards. Since it is easier and cheaper to burn forest than grass and bush land, vast areas of forest that have been cleared in previous years are not cropped and lie idle.

Clearings for palm oil plantations are the primary cause of permanent rain forest loss in Kalimantan and sadly, 50% of all recorded burnt areas in 2002/04 lie in nature reserves (Nellemann *et al.*, 2007).

BOS tries to provide protection for the Mawas reserve by the help of a "debt-for-nature-swap". Companies that produce more CO_2 than allowed can invest in the protection of rainforest to settle their debts (Wiesmayr, 2003). This sheds some light on the smoky sky.

It is well known that in addition to fires, logging destroys or degrades valuable habitat for forest-living species. The Tuanan research station is situated in a heavily logged swamp forest (Fig. 8). The logging trails are still visible and few large trees are left. Through logging the diversity of forest trees declines, since wood with a high economic value vanishes. Only a few species that grow into large trees are left, either because their wood is not suitable for construction business or it does not float and is therefore difficult to transport (personal comment from former loggers). In some studies, gibbons were reported to be quite tolerant of partial logging, whereas other authors found marked decreases of 20% to over 60% in gibbon density between logged and primary forest (Buckley *et al.*, 2006; Meijaard *et al.*, 2005). These declines are believed to result of reductions in food availability.

Fig. 8. The peat swamp forest in the Tuanan research area has been heavily logged in the recent past. Photo: Livia Haag. – *Der Sumpfwald im Tuanan-Forschungsgebiet wurde in den letzten Jahren stark ausgeholzt.*

Sadly, illegal logging is not a threat of the past. Along the Kapuas logging camps still border the river. Many local people are employed by big logging companies. Without exception all current Tuanan research assistants earned their money in the past by cutting down trees for timber, pulp, paper and plywood.

As described by Nijman (2005, 2006), gibbons in Kalimantan do not only suffer from habitat destruction, but also from pet trade and hunting.

For all these reasons the Bornean white-bearded gibbon (*H. albibarbis*) is listed by IUCN as lower risk: near threatened (Eudey *et al.*, 2000). However, during the Asian Primate Red List workshop held in Phnom Penh, Cambodia in September 2006, the status of this gibbon was reassessed and considered Endangered (Geissmann, pers. comm.). A large part of the white-bearded gibbon's range is in peat swamp – an extremely threatened ecosystem. If rates of habitat change should increase, this gibbon may soon qualify for Critically Endangered. Therefore we should go to any length to protect the last habitats of the Bornean white-bearded gibbon and monitor this species carefully in the future.

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I would like to thank LIPI and the Indonesian government for granting me a research permit and UNAS and MAWAS for the invaluable help with all the paperwork. I am grateful to Carel van Schaik, who made my journey possible and to all the people that shared their time with me in the rainforest, in particular Meredith Bastian and Laura Damerius who also gave helpful comments on this article. I appreciate the careful editing of by Thomas Geissmann and thank him for drawing the maps.

References

BOS (2007). BOS Mawas conservation program. http://www.orangutan.or.id/bos.php?cat=program&subcat=mawas (downloaded February 2007).

Brandon-Jones, D., Eudey, A. A., Geissmann, T., Groves, C. P., Melnick, D. J., Morales, J. C., Shekelle, M., and Stewart, C.-B. (2004). Asian primate classification. *International Journal of Primatology* **25**: 97-164.

Buckley, C., Nekaris, K. A. I., and Husson, S. J. (2006). Survey of *Hylobates agilis albibarbis* in a logged peat-swamp forest: Sabangau catchment, Central Kalimantan. *Primates* **47**: 327-335.

Dallmann, R., and Geissmann, T. (2001a). Individuality in the female songs of wild silvery gibbons (*Hylobates moloch*) on Java, Indonesia. *Contributions to Zoology* **70**: 41-50.

Dallmann, R., and Geissmann, T. (2001b). Different levels of variability in the female song of wild silvery gibbons (*Hylobates moloch*). *Behaviour* **138**: 629-648.

Eudey, A. and Members of the Primate Specialist Group. (2000). *Hylobates agilis* ssp. *albibarbis*. In: IUCN 2006. *2006 IUCN Red List of Threatened Species.* <www.iucnredlist.org>. (downloaded on 18 February 2007).

Geissmann, T. (2002). Duet-splitting and the evolution of gibbon songs. *Biological Reviews* **77**: 57-76.

Geissmann, T., Bohlen-Eyring, S., and Heuck, A. (2005). The male song of the Javan silvery gibbon (*Hylobates moloch*). *Contributions to Zoology* **74**: 1-25.

Gittins, S. P. (1979). The behaviour and ecology of the agile gibbon (*Hylobates agilis*). Unpublished PhD thesis, University of Cambridge. 315 pp.

Gittins, S. P. (1982). Feeding and ranging in the agile gibbon. *Folia Primatologica* **38**: 39-71

Gittins, S. P. (1984). The vocal repertoire and song of the agile gibbon. In Preuschoft, H., Chivers, D. J., Brockelman, W. Y., and Creel, N. (eds.), *The lesser apes. Evolutionary and behavioural biology*, Edinburgh University Press, Edinburgh, pp. 354-375.

Haimoff, E. H. and Gittins, S. P. (1985). Individuality in the songs of wild agile gibbons (*Hylobates agilis*) of peninsular Malaysia. *American Journal of Primatology* **8**: 239-247.

Haimoff, E. H., and Tilson, R. L. (1985). Individuality in the female songs of wild Kloss' gibbons (*Hylobates klossii*) on Siberut Island, Indonesia. *Folia Primatologica* **44**: 129-137.

Kapos, V., and Caldecott, J. (2005). Great ape habitats: tropical moist forests of the Old World. In Caldecott, J., and Miles, L. (eds.), *The world atlas of great apes and their conservation*. Prepared at the UNEP World Conservation Monitoring Centre. University of California Press, Berkeley, pp. 31-42.

Kessler, M. (2006). Rauch trübt Himmel und politisches Klima in Südostasien. *Tages Anzeiger* 2006 (Donnerstag, 19. Oktober): p. 6

Klute, M. (2007). Löst eure Energieprobleme nicht auf unsere Kosten. *Regenwald Report* **2007**(1): 10-15. Downloadable from www.regenwald.org

Marshall, J. T., and Sugardjito, J. (1986). Gibbon systematics. In Swindler, D. R., and Erwin, J. (eds.), *Comparative primate biology, vol. 1: Systematics, evolution, and anatomy*, Alan R. Liss, New York, pp. 137-185.

Meijaard, E., Sheil, D., Nasi, R., Augeri, D., Rosenbaum, B., Iskandar, D., Setyawati, T., Lammertink, M., Rachmatika, I., Wong, A., Soehartono, T., Stanley, S., and O'Brien, T. (2005). *Life after logging: Reconciling wildlife conservation and production forestry in Indonesian Borneo*, CIFOR (Center for International Forestry Research), Jakarta. xxii+345 pp. Donwloadable from www.cifor. cgiar.org

Mitani, J. C. (1988). Male gibbon (*Hylobates agilis*) singing behavior: Natural history, song variations and function. *Ethology* **79**: 177-194.

Mitani, J. C. (1990). Demography of agile gibbons (*Hylobates agilis*). *International Journal of Primatology* **11**: 411-424.

mongabay.com (2006): Forest fires result from government failure in Indonesia. *mongabay.com editorial* October 15, 2006. http://news.mongabay.com/2006/1015-indonesia.html (downloaded February 2007).

mongabay.com (2007): 2006 Indonesian forest fires worst since 1998: Fires in Indonesia were worsened by el Niño says NASA. *mongabay.com*, March 1, 2007. http://news.mongabay.com/2007/0301-nasa.html (downloaded March 2007).

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., and Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature* **403**: 853-858.

Nellemann, C., Miles, L., Kaltenborn, B.P., Virtue, M., and Ahlenius, H. (eds.) (2007). *The last stand of the orangutan – State of emergency: Illegal logging, fire and palm oil in Indonesia's national parks*. United Nations Environment Programme, GRID-Arendal, Norway. 50 pp. Downloadable from www.grida.no

Nijman, V. (2005). Hanging in the balance: An assessment of trade in orang-utans and gibbons on Kalimantan, Indonesia, TRAFFIC Southeast Asia, Petaling Jaya, Selangor, Malaysia. viii+45 pp. Downloadable from www.traffic.org/publications/pubs_tsea.html

Nijman, V. (2006). Trade in Bornean gibbons. *Gibbon Journal* **2**: 33-36.

Reichard, U. (1998). Sleeping sites, sleeping places, and presleep behavior of gibbons (*Hylobates lar*). *American Journal of Primatology* **46**: 35-62.

van Schaik, C. P. (2001). Securing a future for the wild orangutan. In Chicago Zoological Society (ed.), *The apes: Challenges for the 21st century. Brookfield Zoo, May 10-13, 2000, Conference Proceedings*, Chicago Zoological Society, Brookfield, Illinois, U.S.A., pp. 29-35. Downloadable from www.brookfieldzoo.org/content0.asp?pageID=774

Wiesmayr, M. (2003). Rehabilitation und Wiederauswilderung von Orang-Utans in Borneo, mit Dr. Willie Smits, Gründer der internationalen Balikpapan Orangutan Survival Foundation (BOS-Foundation), in der Botschaft Indonesiens in Berlin, 8. März 2003. *Infodienst Indonesien und Osttimor* **19** (Februar/März 2003). http://home.snafu.de/watchin/Infodienst19.htm (downloaded February 2007).

Zusammenfassung

Gibbons im Rauch: Erfahrungen aus einer Freilandstudie an borneanischen Weissbartgibbons (*Hylobates albibaris*) in Zentral-Kalimantan (Indonesien)

Schwarzhandgibbons (*Hylobates albibaris*) und Orang-Utans (*Pongo pygmaeus wurmbii*) leben in den Sumpfwäldern von Kalimantan, dem indonesischen Teil der Insel Borneo. Zwischen Februar und September 2006 wurde eine vergleichende Studie dieser Menschenaffenarten anhand von Beobachtungen an einer Gibbongruppe und mehreren Orang-Utans durchgeführt. Menschliche Aktivitäten verändern zunehmend den Lebensraum dieser Waldbewohner und zwingen sie zu Anpassungen. So lebt die untersuchte Gibbongruppe in einem stark ausgeholzten Waldteil, welcher an eine bereits vollständig abgebrannte Fläche grenzt. Zusätzlich werden jedes Jahr die Wälder und ihre Bewohner in dicken Rauch gehüllt, weil riesige Flächen Regenwald durch Brandrodungen für Palmölplantagen urbar gemacht werden.

The vanishing ape of Bangladesh: A report from the hoolock gibbon's last stronghold in the country

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This paper describes the results of a brief field study on hoolock gibbons in Lawachara National Park, Bangladesh. The study was carried out during the monsoon season of 2006 and was focusing on the effects forest fragmentation have on the hoolock gibbons. The field work consisted of two separate but mutually supportive parts; one being behavioural observations of two gibbon groups and the other being a gibbon census of Lawachara National Park and adjacent areas of the West-Bhanugach Reserve Forest. This study was able to provide some evidence of the gibbons' adaptation abilities. It appears that the apes are able to adjust to moderate disturbances and to living in proximity with humans, as long as they have food sources, a canopy height of 10 m or more, and a dense canopy cover in at least a part of their territory. A total of 17 gibbon groups including 62 individuals were found in this population that stretches beyond the borders of the national park, with one group being isolated from the main population. Forest fragmentation and isolation of gibbon groups may pose a problem to the gibbons' future in the study area.

Introduction

Bangladesh is one of the poorest and most densely populated countries on earth and yet a lot of wildlife still survives in forest fragments here. Ten species of primates can be found in the country today, one of which is the western hoolock gibbon (*Hoolock hoolock*). Due to severe reduction of the species's numbers in both India and Bangladesh during the past decades and because of fragmentation of the remaining habitats, the western hoolock has recently been added to the IUCN/SSC Primate Specialist Group's list of the 25 most endangered primates 2006-2008. The total world population of this species is estimated to be lower than one thousand (Molur *et al*., 2005; Kakati, 2004), of which Bangladesh has 200–300 individuals spread out in 22 small, isolated populations. To our knowledge, at least eight populations of gibbons in Bangladesh have gone extinct in the last 15 years due to clear cutting of their forest habitat (Molur *et al*., 2005).

Lawachara National Park (Fig. 1) is likely to support the only population of hoolock gibbons in the country that might be viable into the next century (Molur *et al*., 2005). This paper describes my MSc fieldwork in Lawachara National Park during three monsoon months in 2006, which included behavioural observations of two gibbon groups and a gibbon census of Lawachara National Park and adjacent areas in West-Bhanugach reserve forest.

Fig. 1. Map showing the location of the Lawachara National Park (red dot) in Bangladesh. Inset map: location of the survey area in South-east Asia, and distribution of hoolock gibbons (red area). – *Die Karte zeigt die Lage des Lawachara Nationalparks in Bangla Desh. Kleine Karte: Lage der untersuchten Region in Südostasien und Verbreitungsgebiet der Hulocks (rote Fläche)*.

Methods

Upon my arrival at Zia International Airport in Dhaka, I was picked up by one of Professor Anwarul Islam's students from the Zoological Department at Dhaka University. The friendly people I met there made sure I was well looked after during my acclimatisation to the Bangladeshi temperatures.

On the second day I met with Philip J. DeCosse at the Forest Department's Nishorgo headquarters, and after this I was taken out to my field site in Sylhet division. Despite all the arrangements Professor Islam had made for me to stay in the forest rest house, it was believed that I would be more safely accommodated in Nishorgo Support Project's training centre, 10 km away, in the city of Srimangal. The room offered to me was lovely and unexpectedly luxurious, but the distance to the forest caused some problems in the early morning hours. I had hoped to be in the forest at dawn when the gibbons left their sleeping sites, but not even my wonderful field guide, Shyamol Deb Barma, could find us reliable transport for before 06:00 a.m., so this plan had to be dismissed, and my daily field observations usually started after 07:00 hrs.

Two weeks of *ad libitum* behavioural recording of the two gibbon groups was initially conducted in May, to familiarise myself with the forest and to fine-tune my observation methods. From mid-May until mid-June and again in July 2006, observations investigating the link between behaviour and different habitat variables were the main focus of study. Observations were carried out using the instantaneous scan sampling method with a sample interval of 15 minutes (Martin and Bateson, 1993). Each morning of behavioural observations, one group was tracked until located and then followed for as many hours as possible. As far as weather and other practicalities allowed, the same group was followed on at least two consecutive days to discover any travel or behavioural patterns.

A total of 955 scans were conducted over 22 observation days and more than 80 hours were spent in visual contact with the two study groups; 1/3 of the time was spent following Group A and 2/3 of the time following Group B. The reason for the difference was that Group A was much less habituated than Group B, they were more difficult to find in the mornings and to follow continuously for many hours. For both groups, more than 85% of the observation scans were obtained between 08:00 and 14:00 hours.

The population census was conducted throughout the main research period, but mainly on clear days in June when many gibbon groups were heard singing. Because of the relatively small size and elongated shape of the forest, I conducted a total count of the gibbons, relying on visual identification of each group. Through discussions with local villagers, my field assistant was able to provide me with valuable information about the possible presence of gibbon groups along the forest boundaries. The gibbons were most easily located when singing, and this positioning process was aided by the fact that song bouts of hoolock gibbon are very contagious, so that the duet song of one group often triggers its neighbours to start singing as well (Brockelman and Ali, 1987). The number of groups could thus be estimated based on auditory evidence for later GPS positioning and identification. Where neighbouring groups had the same number of family members, both groups were located at least twice and particular notice was paid to the adult female and her interactions with the youngest offspring, as this is considered to be a constant in the group structure.

Lawachara National Park

Lawachara National Park is located in the South of West-Bhanugach reserve forest. It was declared a national park in 1996 and covers an area of 12.5 km^2 (Nishorgo Support Project, 2006). The forest gives an impression of being evergreen, even though most of the tall trees are deciduous and only the smaller trees are evergreen (Ahsan, 1994). Most of the forest was felled in the 1920's and has subsequently been replanted block by block with different tree species by the Forest Department (Feeroz, 1999). Lawachara is traversed by a road and a railway. Furthermore, two villages of the Khasia ethnic group are located inside the park and the forest is extensively used for resource extraction by the local people (Fig. 2). To the North, Lawachara National Park borders Chautali and Kalachara forest areas, the two latter together comprising 14.9 km^2 (Feeroz, 1999). These areas are under even more intensive human usage and have accordingly lost most of their high forest (Fig. 3).

Fig. 2. Local people are depending on the forest for timber, fuel wood, extraction of other forest resources, cultivation land, cattle grazing land etc. Photo: Petra Österberg. – *Anwohner versorgen sich mit Bau- und Brennholz und anderen Produkten aus dem Wald und nutzen den Wald unter anderem als Anbaufläche und Weideland.*

Fig. 3. Outside of the national park boundaries, the rest of the forest reserve often lacks canopy cover due to illegal logging, and only small isolated patches with suitable primate habitat remain. Photo: Petra Österberg. – *Ausserhalb der Nationalpark-grenzen fehlt dem Schutzwald als Folge von illegalem Holzschlag oft ein zusammen-hängendes Kronendach, und nur wenige Waldstücke verbleiben, die sich als Habitat für Affen eignen*.

The first two weeks I spent customising myself with the forest, and particularly with the two areas where my study groups were expected to be found. During this season, leaches were abundant in the forest and we felt we were being eaten alive by them. After some experimenting with different remedies we found that tobacco powder on our shoes drove off the leeches efficiently – at least until it got washed off in the rain.

To both my field guide's and my great excitement, we were able to localise gibbons from the very first day in the forest. We also encountered at least a few of the other diurnal primate species, including northern pig-tailed macaques (*Macaca leonina*), rhesus macaques (*M. mulatta*), Phayre's langurs (*Trachypithecus phayrei*), and capped langurs (*T. pileata durga*), on a daily basis. This easy spotting was aided by the onset of the fruiting season and the subsequent congregation of primates in the centre of the forest. During other times of the year the rhesus macaques are known to raid crops on the forest boundaries (Feeroz, 1999) and some primates, not including the gibbons (Gittins, 1982; Raemaekers, 1980), are believed to expand their home ranges in search of food during the lean season (Waser, 1987) which makes them more difficult to locate.

Normally it would take much longer to habituate wild gibbons than three months I spent in the field. (e.g. Chivers, 1974), but the gibbons in Lawachara are remarkably tolerant to observers. This tolerance is believed to have developed as a result of the high human presence in the forest, as well as the low hunting pressure. The majority of Bangladeshi people are Muslim and would not eat primate meat (Ahsan, 2001), although hunting for primates amongst tribal people has occasionally been reported (Molur *et al.*, 2005). In short, the monsoon season is a great time to see different primates in Lawachara!

The study groups

Two groups were chosen for the study based on previous work in the area by Md Shahriar Mahmud. The intention was to study two families with phenologically different home-ranges and a suspected variance in disturbance factors. Group A inhabits a rectangular area between the railway and the asphalt road that was planted with *Tectona grandis* around 80 years ago, but where the natural vegetation now is dominant. Group B clearly inhabits the poorer habitat, which is partly a plantation of *Artocarpus chaplasha*. It extends from the forest boundary to the rest house in the middle of the forest and the railway from the opposite side of territory A. It also crosses the busy main walking trail through the national park. Table 1 summarizes some characteristics of the two groups' territories.

Table 1. Comparison of the territories of two study groups. – *Vergleich der Territorien der beiden untersuchten Gibbongruppen.*

Territory	Group A	Group B
Size (ha)	41.0	32.5
Tree density (trees/ha)	253.7	192.1
Plantation year (Feeroz, 1999)	1920's–1930's	1950's
> 10% of species composition	*Tectona grandis* 13%, *Artocarpus chaplasha* 12%	*Artocarpus chaplasha* 13%
% trees higher than 15 m	53%	49%
% forest with canopy cover >50%	46%	42%
Human dis-turbance	Road with traffic, electric line, illegal logging	Forest boundary / settlements, walking trail / gas pipeline, illegal logging, visitors

My two study groups A and B consisted of four and five family members, respectively. Both groups had two adult sized males and, to judge by the behaviours of all the group members, the second males were probably the mature sons of the adult couples. As it turned out, the subadult in Group B in particular was not well tolerated by the other male, presumably his father, and he thus often followed his family from a distance. During one occasion he was observed in a prolonged play-chase with a group of capped langurs. Studies of other species have found that lonely, adolescent primate males sometimes actively seek social comfort in the company of other primates (Tutin, 1999; Waser, 1987).

Group B (Fig. 4) encountered humans many times each day, and their response was often to sit still, resting on branches. The gibbons in Group A, on the other hand, which were living in the less disturbed area with fewer human trespassers were considerably more flighty and suspicious in their response to us.

We consistently approached both groups in the same way, letting the animals know we were there but remaining partly hidden from view, crouching down behind vegetation. This allowed me to satisfyingly collect data on the gibbons' use of vegetation and substrate. Although both groups seemed to stop paying us any attention soon during the study, they may still have been affected by our presence (Williamson and Feistner, 2003).

Quite expectedly, the gibbons spent most time higher than 10 m in the canopy, and they were never seen to descend to the ground. During rest, play and grooming sessions, the gibbons preferred having a canopy covering at least 50% of the sky above their heads. Group B, which was living in the more disturbed habitat and which was more tolerant of humans seemed to have a higher selection for denser cover during these activities (Table 2). The presence of an infant in this group might have influenced the vegetation preferences.

Fig. 4. Core members of Group B: (above) juvenile male being groomed by his father; (below) adult female and infant. The group also included a second, more peripheral male (not shown here) which may have been an adolescent son of the breeding pair. Photos: Sirajul Hossain. – *Die Hauptmitglieder der untersuchten Gibbonfamilie "Gruppe B": (oben) das junge Männchen wird von seinem Vater gegroomt; (unten) das erwachsene Weibchen mit seinem noch abhängigen Kind. Zur Gruppe gehörte noch ein zweites, ausgewachsenes Männchen (hier nicht gezeigt), welches sich am Rand der Gruppe aufhielt. Dabei könnte es sich um einen Sohn dieses Paares gehandelt haben.*

Table 2. The percent of the observations of each behaviour spent under the 4 categories of canopy cover, for two study groups of gibbons. – *Verteilung verschiedener Verhaltensweisen der untersuchten Gibbons auf Waldstücke mit unterschiedlichem Deckungsgrad der Kronendecke (vier Kategorien).*

Behaviour variables	Gibbon group	Number of observations	Canopy cover category			
			No cover	<50 % covered	50–99% covered	Complete cover
Rest	A	69	1.4	26.1	68.1	4.3
	B	318	0.6	24.2	65.4	9.7
Travel	A	44	4.4	53.3	42.2	–
	B	113	4.5	44.6	50.9	–
Feed	A	41	1.3	44.3	54.4	–
	B	128	–	25.2	70.9	3.9
Vigilance	A	16	–	50	50.0	–
	B	8	–	37.5	62.5	–
Social	A	50	–	77.6	18.4	4.1
	B	128	–	30.6	61.3	8.1
Subtypes of Social:						
Social rest	A	2	–	100.0	–	–
	B	22	–	9.1	90.9	–
Play	A	16	–	50.0	50.0	–
	B	51	–	29.4	58.8	11.8
Groom	A	13	–	69.2	15.4	15.4
	B	18	–	22.2	55.6	22.2
Singing	A	19	–	100.0	–	–
	B	37	–	48.6	51.4	–

Table 3. Composition of the gibbon groups in West-Bhanugach Reserve Forest[(1)] – *Zusammensetzungen der Gibbongruppen im West-Bhanugach Waldreservat*

Group	Sex and age classes							Total number of indiviuals
	Adult male	Adult female	Sub-adult	Ado-lescent	Juvenile	Infant (dark coat)	Infant (light coat)	
Lawachara NP								
A	1	1	1		1			4
B	1	1	1		1		1	5
C	1	1	1		1		1	5
D	1	1			1			3
E	1	1		1	1			4
F	1	1		1	1			4
G	1	1		1*	1	1		5
H	1	1			1			3
I	1	1						2
J	1	1	1	1	1			5
K	1	1						2
L	1	1		1	1			4
M	1	1			1			3
N	1	1						2
Kalachara								
O	1	1				1		3
Chautali								
P	1	1		1			1	4
Q	1	1		1	1			4
Total	17	17	4	7	12	2	3	62

[(1)] Age classes: * = f emale. Adult males have black fur and a large genital tassle, adult females have buff fur. Subadults have the appearance of an adult individual and stay on the periphery of their natal groups. Adolescents are adult sized, but still difficult to sex and behaviourally well integrated in the family and tolerated by the parents. Juveniles are smaller than adults, but not carried by their mother when travelling. Infants are smaller than adults and still carried by their mother. Infants younger than about 15 months exhibit a buff neonatal coat, older infants are dark (Ahsan, 1994).

Census

Fifty-nine hoolock gibbons in 16 families were found in a continuous population stretching beyond the boundaries of the national park (Fig. 5). This is a number considerably larger than any previous estimate for Lawachara, thus leaving the question open to whether an influx from forest pockets from surrounding areas has been possible in recent years.

An additional group (Group O, consisting of three individuals) was completely isolated from the remaining population in a small forested fragment surrounded by villages and paddy-fields (Fig. 5).

According to the villagers, the gibbon male had come walking across the fields, about six years ago, to join with the lone female in the fragment.

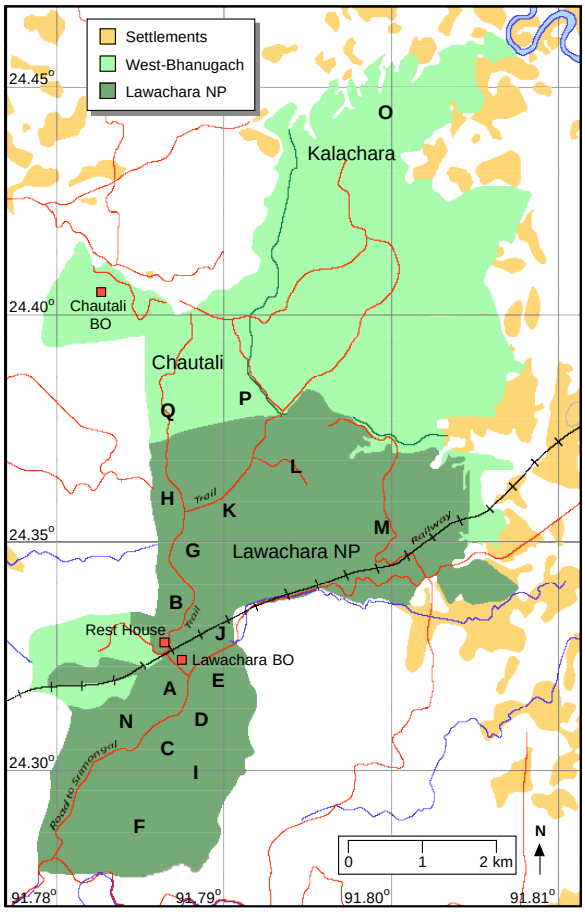

Fig. 5. Map showing the locations of the 17 gibbon groups (A-O) found in Lawachara National Park and adjacent West-Bhanugach Reserve Forest. Note the isolated location of Group O. – *Verteilung der 17 Gibbongruppen (A-O) im Lawachara Nationalpark und angrenzenden Waldreservat von West-Bhanugach. Die Isolation der Gruppe O ist auffällig.*

My census found a total of 17 gibbon groups (including 62 individuals) in the whole forest area. The average group size in West-Bhanugach is 3.7 individuals (range 2-5 individuals). The group compositions are listed in Table 3.

Conservation education

During the course of my fieldwork I made acquaintance with Bangladeshi nature and wildlife photographer Sirajul Hossain. It was decided that he would join me on a few days of behavioural observations of study Group B. During these days he managed to get amazing shots of the gibbon family, some of which are shown in this paper. After seeing the photographs, we started to plan an awareness raising exhibition to give people a chance to see the apes up close and to inform the public about the threats facing this beautiful primate.

The idea started rolling and picked up speed along the way and within a couple of weeks we had booked the National Museum Gallery in Dhaka for a four day exhibition, written Newspaper articles, invited the media for a press conference and prepared information booklets for distribution at the event. The opening day, just three days prior to my departure from Bangladesh, became a huge success with several TV interviews and great Newspaper coverage (Fig. 6).

Fig. 6. Visitors at the exhibition "The vanishing Ape" at the National Museum Gallery in Dhaka. Photo: Petra Österberg. – *Besucher der Ausstellung "Die verschwindenden Menschenaffen" in der Gallerie des Nationalmuseums in Dhaka*.

In the days following the event, most daily papers in Bangladesh published photographs of the hoolock gibbons and informed their readers about the rapid loss of habitat that threatens the species. I was overwhelmed by the interest the Bangladeshi people showed in the plight of the gibbons and very happy to think that my small MSc project may have made an impact in the habitat country.

Looking into the future

A good ten months after I first set my feet on Bangladeshi ground, I often find myself wondering if the sub-adult male in Group B has been able to leave his family and where he has gone to. Is he going to find a suitable female in this limited population? My census had not been able to confirm the sexes of all adolescent individuals, but the majority of identified young individuals appeared to be males. Is there going to be space in Lawachara for this sub-adult to raise his own family in the future? And how will the future look for the isolated group in the forest pocket? With a growing juvenile to feed, they seemed doomed on that little island in the middle of the paddy-fields.

Fig. 7. Adult male in a fig tree (left) and adult female carrying her infant (right), both of Group B. Lawachara is a great place to see the hoolock gibbons. Tourists should not forget to pay the visitor fee to the national park and to hire a local guide so that the people can benefit from forest conservation. Photos: Sirajul Hossain. – *Das erwachsene Männchen der Gruppe B sitzt in einem Feigenbaum (rechts); das Weibchen derselben Gruppe trägt sein Kind mit sich herum (links). Der Lawachara Nationalpark ist ein guter Ort, um wilde Gibbons zu sehen. Touristen sollten bei ihrem Besuch nicht vergessen, dem Nationalpark eine Besuchergebühr zu bezahlen und vor Ort einen Führer anzuheuern, damit die lokale Bevölkerung vom Schutz der Waldgebiete profitieren kann.*

Unfortunately there is no easy way for a poor country to deal with conservation issues when the expanding human population has ever growing needs. However, the results of the Nishorgo program's work for local community involvement and their efforts to create alternative livelihoods for people living around the forests, are giving some hope for the future of the hoolock gibbon in Bangladesh (Fig. 7). Nishorgo's ambitious plans include a very much needed conversion of monocultures within the park to natural vegetation that can support primates (Nishorgo Support Project, 2006). The primates of Lawachara are better off than elsewhere in the country…

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I would like to thank the Chief Conservator of Forest, Forest Department of Bangladesh for giving me the permission to conduct my fieldwork in Lawachara. I thank Professor Anwarul Islam for his help, my supervisor Nancy Priston at Oxford-Brookes for all her advice, and my fantastic field guide Shyamol Deb Barma for his help and his good company. I would also like to thank Sirajul Hossain for letting me use his photographs in this paper. My fieldwork was kindly sponsored by The Primate Society of Great Britain and the Born Free Foundation for which I am profoundly grateful. I am grateful to Thomas Geissmann for reading and commenting on this manuscript. However, my most sincere gratitude goes to the gibbons that let me share their lives for a short time.

References

Ahsan, M. F. (1994). Ecology of the hoolock gibbon (Hylobates hoolock) in Bangladesh, Ph.D. thesis, University of Cambridge, 437 pp.

Ahsan, F. (2001). Socio-ecology of the hoolock gibbon (*Hylobates hoolock*) in two forests of Bangladesh. In Chicago Zoological Society (ed.), *The apes: Challenges for the 21st century. Brookfield Zoo, May 10-13, 2000, Conference Proceedings*, Chicago Zoological Society, Brookfield, Illinois, U.S.A., pp. 286-299.

Brockelman, W. Y., and Ali, R. (1987). Methods of surveying and sampling forest primate populations. In Marsh, C. W., and Mittermeier, R. A. (eds.), *Primate conservation in the tropical rain forest*, Alan R. Liss, Inc., New York, pp. 23-62.

Chivers, D. J. (1974). *The siamang in Malaya – A field study of a primate in tropical rain forest* (Contributions to primatology vol. 4), Karger, Basel and New York, 135 pp.

Feeroz, M. M. (1999). *The ecology and behaviour of the pig-tailed macaque (*Macaca nemestrina leonina*) in Bangladesh*. Ph.D. dissertation, University of Cambridge.

Gittins, S.P. (1982). Feeding and ranging in the agile gibbon. *Folia Primatologica* **38**: 39-71.

Kakati, K. (2004). *Impact on forest fragmentation on the hoolock gibbon in Assam, India*, Ph.D. thesis, University of Cambridge Wildlife Research Group, Department of Anatomy, University of Cambridge, and Wolfson College, Cambridge, vii+212 pp.

Martin, P., and Bateson, P. (1993). *Measuring behaviour. An introductory guide, 2nd edition*, Cambridge University Press, Cambridge, 222 pp.

Molur, S., Walker, S., Islam, A., Miller, P., Srinivasulu, C., Nameer, P. O., Daniel, B. A., and Ravikumar, L. (eds.) (2005). *Conservation of western hoolock gibbon (*Hoolock hoolock hoolock*) in India and Bangladesh*. Zoo Outreach Organisation / CBSG-South Asia, Coimbatore, India, 132 pp.

Nishorgo Support Project (2006). *Management plans for Lawachara National Park.* Nishorgo Support Project, Forest Department, Ministry of Environment and Forests, Government of Bangladesh, Dhaka, 155 pp. Downloadable from: www.nishorgo.org/reference_center.asp

Raemaekers, J. (1980). Causes of variation between Months in the distance travelled daily by gibbons. *Folia Primatologica* **34**: 46-60.

Tutin, C. E. G. (1999). Fragmented living: behavioural ecology of primates in a forest fragment in the Lopé Reserve, Gabon. *Primates* **40**: 249-265.

Waser, P. M. (1987). Interactions among primate species. In Smuts, B. B., Cheney, D. L., Seyfarth, R. M., Wrangham, R. W., and Struhsaker, T. T. (eds.), *Primate societies*, University of Chicago Press, Chicago and London, pp. 210-226.

Williamson, E. A., and Feistner, A. T. C. (2003). Habituating primates: processes, techniques, variables and ethics. In Setchell, J. M, and Curtis, D. J. (eds.), *Field and laboratory methods in primatology*, Cambridge University Press, Cambridge, pp. 25-39.

Zusammenfassung

Das Verschwinden der Menschenaffen von Bangla Desh – Ein Bericht aus einem der letzten Lebensräume der Hulocks in diesem Land

Diese Arbeit beschreibt die Resultate einer kurzen Feldstudie an den Hulocks (*Hoolock hoolock*) des Lawachara Nationalparks von Bangla Desh. Die Studie wurde während der Monsun-Monate des Jahres 2006 durchgeführt, mit dem Ziel, den Einfluss der Waldzerstückelung auf die Hulocks zu untersuchen. Die Feldarbeit bestand aus zwei sich gegenseitig ergänzenden Teilen: Im ersten Teil wurden Verhaltensbeobachtungen an zwei Gibbongruppen durchgeführt, die in unterschiedlich fragmentiertem Wald lebten, im zweiten Teil wurde eine Bestandeserhebung der Gibbons des Lawachara Nationalparks und dem angrenzenden Waldreservat von West-Bhanugach durchgeführt. Die Hulocks scheinen eine gewisse Anpassungsfähigkeit aufzuweisen, indem sie einen relativ hohen Grad an menschlicher Störung vertragen und in unmittelbarer Nachbarschaft mit menschlichen Siedlungen leben können, so lange sie genügend Futterquellen haben, die Bäume mindestens 10 m hoch sind und mindestens ein Teil ihres Territoriums ein geschlossenes Kronendach aufweist. Während der Bestandesaufnahme wurden total 17 Gibbongruppen mit insgesamt 62 Individuen gefunden. Diese Gibbonpopulation dehnt sich über die Grenzen des Nationalparks in die angrenzenden Waldgebiete aus, und eine Gruppe lebte völlig von den anderen Gibbons isoliert. Waldzerstückelung und die damit einhergehende Isolation einzelner Gruppen dürften in einigen Teilen des Untersuchungsgebietes eine Bedrohung für den Fortbestand der Gibbons darstellen.

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 goups/km^2 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^2, of which 51 km^2 have no forest cover. The forested area consists of 27 km^2 rich forest, 59 km^2 medium forest, 65 km^2 poor forest and 17 km^2 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).

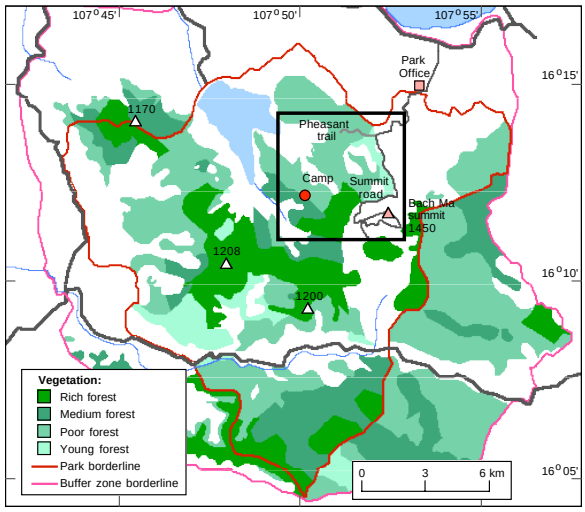

Fig. 2. Map of the Bach Ma National Park. The black frame indicates the survey area. Forest types after Van Ngoc Thinh *et al.* (2002). – *Karte des Bach Ma Nationalparks und Lage des Untersuchungsgebietes (schwarzer Rahmen). Waldtypen nach Van Ngoc Thinh et al. (2002).*

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 Thinh *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.*

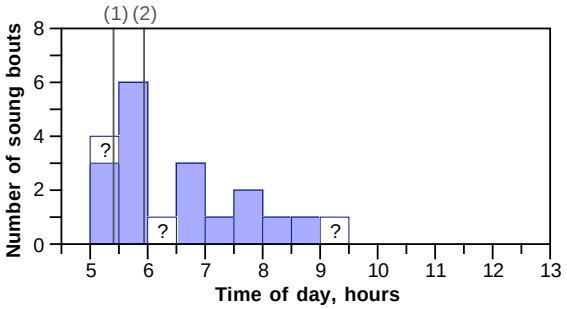

Fig. 4. Frequency distribution of the start time of gibbon song bouts (n = 17). Question marks indicate three possible additional song bouts that were not heard reliably. (1) dawn (average: 05:22 hours), (2) sunrise (average: 05:56 hours) – *Häufigkeitsverteilung der Startzeit von Gibbongesängen (n = 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 funktionstüchtig 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^2 and we heard eight gibbon groups (including solo singing males). Based on this data, we estimate a density of about 1.3 goups/km^2. 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^2 (n = 15), with an average of 1.47 groups/km^2 (Traeholt *et al.*, 2005). These estimates appear to be higher that 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^2 (review in Chan *et al.*, 2005), with a mean of 0.6 groups/km^2 (n = 4 reports). Density of *N. hainanus* was estimated as 0.50-0.57 groups/km^2 (Zhang *et al.*, 1995). Only *N. concolor* at Che Tao, northern Vietnam, may exhibit higher group densities of 1.6 groups/km^2 (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^2, 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.).

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We would thank Mr. Huynh Van Keo, Director of Bach Ma National Park, for allowing us to carry out this survey. Our thanks also go to Mr. Nguyen Vu Linh for his help in arranging the logistics of the survey, and to the park Forest Protection Department rangers for the help and information they provided. We would also like to acknowledge the assistance of the local people and tourism staff of the park. This survey was part of FFI Indochina's Gibbon Conservation Project, and as such was funded by the Walt Disney Foundation. We are grateful to Julia Ruppell for reading and commenting on our manuscript.

References

BirdLife International and MARD (2004). *Sourcebook of existing and proposed protected areas in Vietnam: Second edition*, BirdLife International in Indochina and MARD. Downloadable from www.birdlifeindochina.org/source_book

Bleisch, W. V., and Chen, N. (1991). Ecology and behavior of wild black-crested gibbons (*Hylobates concolor*) in China with a reconsideration of evidence for polygyny. *Primates* **32**: 539-548.

Bleisch, W. V., and Jiang, X. (2000). *Action plan for conservation of the gibbons of the Wuliang Mountains*, Sino-Dutch Forest Conservation and Community Development Project, Kunming, Yunnan, China.

Brockelman, W. Y., and Ali, R. (1987). Methods of surveying and sampling forest primate populations. In Marsh, C. W., and Mittermeier, R. A. (eds.), *Primate conservation in the tropical rain forest*, Alan R. Liss, Inc., New York, pp. 23-62.

Chan, B. P. L., Fellowes, J. R., Geissmann, T., and Zhang, J. (2005). *Hainan gibbon status survey and conservation action plan, version 1 (last updated November 2005)*. Kadoorie Farm & Botanic Garden Technical Report No. 3, Kadoorie Farm & Botanic Garden, Hong Kong, 32 pp. Downloadable from www.gibbons.de

Delacour, J. (1951). La systématique des Gibbons Indochinois. *Mammalia* **15**: 118-123 (French text).

Eames, J. C., and Robson, C. R. (1993). Threatened primates in southern Vietnam. *Oryx* **27**: 146-154.

Geissmann, T. (1993). *Evolution of communication in gibbons (Hylobatidae)*, Ph.D. thesis, Anthropological Institute, Philosoph. Faculty II, Zürich University, 374 pp. Downloadable from www.gibbons.de

Geissmann, T. (1995). Gibbon systematics and species identification. *International Zoo News* **42**: 467-501.

Geissmann, T., Nguyen Xuan Dang, Lormée, N., and Momberg, F. (2000). *Vietnam primate conservation status review 2000 - Part 1: Gibbons (English edition)*, Fauna & Flora International, Indochina Programme, Hanoi, 130 pp. (Downloadable from www.gibbons.de)

Gilmour, D. A., and Nguyen Van San (1999). *Buffer zone management in Vietnam*, IUCN Vietnam, Hanoi.

ICEM [International Centre for Environmental Management] (2003). Field study: Vietnam. Thua Thien Hue Province. In: ICEM (ed.), *Field Studies: Economic benefits of protected areas. Lower Mekong Protected Areas and Development Review*, Indooroopilly, Queensland, Australia, pp. 103-142. Downloadable from www.mekong-protected-areas.org/vietnam/field.htm

Konrad, R., and Geissmann, T. (2006). Vocal diversity and taxonomy of *Nomascus* in Cambodia. *International Journal of Primatology* **27**: 713-745.

Le Van Lan, Ziegler, S., and Grever, T. (2002). *Utilization of forest products and environmental services in Bach Ma National Park, Vietnam*, Protected Areas and Development, 9 pp. Downloadable from www.mekong-protected-areas.org/vietnam

Robson, C. R., Eames, J. C., Newman, M., Nguyen Cu, and Truong Van La (1991). *Vietnam forest project: Forest bird surveys in Vietnam 1989/90, final report*, International Council for Bird Preservation, Cambridge, 71 pp.

Roznov, V. V., Nikolski, A. A., and Kuznetsov, G. V. (1986). [Vocal activity of gibbons on the Tainguen-Plateau]. In Sokolov, V. E. (ed.), [*Fauna and ecology of mammals and birds in Vietnam*], Academy of Sciences of the USSR, Institute for Evolutionary Morphology and Ecology of Animals "A.N. Severcov", Nauka, Moscow, pp. 23-30 (Russian text).

Tallents, L., Le Trong Dat, La Quang Trung, and Trinh Dinh Hoang (2000). *Report on the second survey for western black-crested gibbon in Che Tao forest*, Fauna & Flora International, Indochina Programme, Gibbon Conservation Project, Hanoi, 5 pp.

Traeholt, C., Bonthoeun, R., Rawson, B., Samuth, M., Virak, C., and Sok Vuthin (2005). *Status review of pileated gibbon,* Hylobates pileatus *and yellow-cheeked crested gibbon,* Nomascus gabriellae, *in Cambodia*, FFI Cambodia Programme Office, Phnom Penh, 59 pp.

Van Ngoc Thin, Le Quoc Khanh, and Do Thouc (2002). *The tiger (*Panthera tigris*) ecology in Bach Ma National Park*, Bach Ma National Park, Vietnam, Phu Loc, 46 pp.

Van Ngoc Thinh, Vu Ngoc Thanh, Do Tuoc, Minh Hoang, Le Trong Dat, Nguyen Manh Ha, FPD Hue, and Dickinson, C. (2006). *An assessment of the mammal fauna of the Green Corridor forest landscape, Thua Thien Hue Province, Vietnam*. Technical Report No 6: Green Corridor Project, WWF Greater Mekong & Vietnam Country Programme and FPD Thua Thien Hue Province, Vietnam, 42 pp. Downloadable from www.huegreencorridor.org

Zhang, Y., Quan, G., Yang, D., Liu, Z., and Sheeran, L. (1995). Population parameters of the black gibbon in China. In Xia, W., and Zhang, Y. (eds.), *Chinese primate research and conservation*, China Forestry Publishing House, Beijing, pp. 203-220.

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^2. 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 Südlaos 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 Ostkambodscha). 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.

The gibbons of Phong Nha–Ke Bang National Park in Vietnam

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The white-cheeked gibbons at Phong Nha–Ke Bang National Park in Vietnam have not been studied previously. In July of 2006 I visited the park for a project on the vocal diversity and systematics of crested gibbons (genus *Nomascus*). During a survey covering about 15 km^2 of the whole park (858 km^2), I was able to hear 13 groups of gibbons and make sound-recordings of ten of these groups. Gibbons from this area are generally identified as southern white-cheeked crested gibbons (*Nomascus siki*), but their calls differ from more southern populations (for instance those of the Bach Ma National Park) that are usually believed to be of the same taxon. This finding suggests that two different species or subspecies are involved and that the systematics of the crested gibbons is in urgent need of revision.

The Phong Nha–Ke Bang NP

Phong Nha–Ke Bang National Park is located in north-central Vietnam (Fig. 1). It is located in central Vietnam, about 500 km south of the capital, Hanoi, within the Quang Binh Province at the narrowest part of Vietnam. The western boundary of the park forms part of the Lao-Vietnamese border. The geographical coordinates of the park 17°20'–17°48'N and 105°46'–106°24'E are contained within the Bo Trach and Minh Hoa Districts of Quang Binh Province in western Vietnam.

The karst formation of Phong Nha–Ke Bang National Park (Fig. 2) has evolved since the Palaeozoic (400 million years ago) and so is the oldest major karst area in Asia (Pham Khang, 1985). Subject to extensive tectonic changes, the park's karst landscape is particularly complex with many geomorphic features of significance. The vast area, extending to the border of Laos, contains magnificent formations including 65 km of caves and underground rivers.

The Phong Nha Nature Reserve (50 km^2) was declared on 9 August 1986 and was extended to 411 km^2 by 1991, with an approved management plan. On 19 May 2000 this was changed to establish the Phong Nha–Ke Bang National Park. The core area of the park covers 858 km^2 and is surrounded by a buffer zone of 1,889 km^2 (UNEP-WCMC, 2003). The altitude ranges from 100 to over 1,000 m a.s.l., but the core area is mostly above 500 m (Hermann and Pagel, 2000). The climate is tropical, hot and humid. The park is now the fifth UNESCO World heritage site recognized in Vietnam (Unesco.org, 2003). Most of the 41 existing world heritage sites containing karst are in temperate regions. None of these can be compared with Phong Nha–Ke Bang as they have very dissimilar geologic, climatic and biotic conditions.

Fig. 1. Map showing the location of the Phong Nha–Ke Bang and Bach Ma National Parks in Vietnam. – *Die Karte zeigt die Lage der Phong Nha–Ke Bang und Bach Ma Nationalparks in Vietnam.*

The park is also an important tourist attraction, with Phong Nha Cave being the principal visitor site. Visitor numbers are rapidly increasing. In 1999 there

were 80,500 domestic visitors and 900 international visitors (UNEP-WCMC, 2003).

A total of 568 vertebrate species have been recorded in Phong Nha–Ke Bang NP, comprising 113 mammals, 81 reptiles and amphibians, 302 birds, and 72 fish species (UNEP-WCMC, 2003). In recent years, several new species of reptiles (two gecko and one snake species) were discovered here by a group of Vietnamese and German biologists (Ziegler, 2005; Vogt *et al.*, 2006). The area is of high conservation value as one of the largest areas of intact forest habitat remaining in Vietnam (Timmins *et al*., 1999).

Phong Nha–Ke Bang is also one of the remaining areas in Vietnam which still supports gibbons (Geissmann *et al*., 2000; Herrmann and Pagel, 2000). However, no systematic gibbon surveys have been carried out in this forest, so far.

Fig. 2. Karst landscape of the Phong Nha–Ke Bang area. Photo: Julia Ruppell. – *Karstlandschaft in der Region von Phong Nha–Ke Bang.*

Vietnam is situated in Southeast Asia, between Cambodia in the south-west, Laos in the west, China in the north, and the South China Sea to the east. It supports several gibbon species all of which are crested gibbons (genus *Nomascus*). The gibbons in central Vietnam are of particular interest. They have traditionally been identified as southern white-cheeked crested gibbons (*N. siki* or *N. leucogenys siki*). Recent research suggests the more than one taxon may be included under this name and that that central Vietnam is part of a larger area where the "identity" of the gibbons is uncertain (Geissmann *et al*., 2000; Konrad and Geissmann, 2006). Gibbon calls (usually termed songs) exhibit species-specific characteristics and can be used to assess phylogenetic relationships among the species and among populations (Dallmann and Geissmann, in prep.; Geissmann, 2002a, b; Konrad and Geissmann, 2006; Keith *et al*., in prep.).

This study was part of an on-going project on the vocal diversity and systematics of crested gibbons (genus *Nomascus*) undertaken by the Gibbon Research Lab. at Zurich University, Switzerland. The goal of my study was to tape-record the songs of the gibbons in Phong Nha–Khe Bang NP in order to learn more about their affinities (through comparison with recordings collected at other localities), and to obtain preliminary information on the population density of these gibbons. This report deals with the assessment of the current distribution and status of the poorly known gibbons in this national park which was obtained during my research.

Surveying the gibbons

The locations of gibbon groups, and the density and size of a gibbon population can be estimated based on their vocalizations. The gibbon population size in the park has not been estimated before. Because no detailed gibbon surveys had been previously carried out in the area where I conducted my data collection, I generally had no knowledge of the gibbon density and the distribution of individuals, groups and territories. Local people and park staff provided a good source of information and were consulted as to whether gibbons had been heard in the area in recent times. Once at a locality in the field, a camp and listening post were set up. If gibbons were heard, the listening post was moved in the direction of the gibbon group during subsequent mornings, in order to obtain clearer recordings. Once a good set of recordings for a group was collected, I attempted to locate a different group in the same locality. Because gibbons live in small family groups and because mated crested gibbons normally produce duet songs but not solo songs, a group can be defined when a male and female duet is recorded for one location. Each duet that was heard on a given day was recorded and the direction of the group song was noted using a GPS and compass. This process ensures that the number of gibbon groups heard each day can be differentiated from each other during data analysis.

The trek to find gibbons began with several days of travel from Hanoi to Quang Binh Province and Dong Hoi city. From Dong Hoi city my assistant and I travelled by taxi to Phong Nha the town through which you can enter the park. After several days of travel I finally arrived in Phong Nha–Ke Bang. We met with the national park staff in order to arrange permits for entering and camping in the park. I was assigned two rangers who were to stay with me and my assistant during my stay in the park. Although they spoke no English, they were quite helpful in pointing me in the direction of the "vuon" (gibbon). A main service road cuts through Phong Nha–Ke Bang National Park. The gibbon presence in Phong Nha–Ke Bang had been reported to be between km 40 and km 52 on this road. Therefore I focused on these areas for locating gibbons.

I first began looking for gibbons starting from "Post km 40", a small ranger station deep in the park (Fig. 3). Amazingly a gibbon was seen on our first day within the park. High up in the trees branches were shaking irregularly and I thought this could not be due to wind. For a second or two a male white-

cheeked gibbon was visible and then disappeared into the canopy. We tried to stay on his trail and the same male was seen again nearby one hour later. Unfortunately, I did not see another gibbon after this encounter, as they are extremely fast and elusive creatures.

Fig. 3. "Post km 40", a small ranger station deep in the park. Photo: Julia Ruppell. – *"Post km 40", eine kleine Ranger-Station tief im Innern des Parks*.

During the following mornings we climbed from the road up to various peaks in order to be in an optimal position to detect gibbon songs. Every morning, we began hiking in the darkness of 04:00 hr, in order to arrive on our listening posts before dawn, when the gibbons start to sing. As there were no trails, our path was obstructed by saw palmettos which were so sharp they would slice your skin open on contact. The only way up the steep karst peaks was through an almost vertical climb using branches and roots like ladder rungs (Fig. 4). Insects were buzzing in our faces and seemed to be getting into our clothes. My assistants blazed the trail with machetes clearing the brush and saw palmettos. I got used to leeches and insect bites which were unavoidable deep in the forest.

Fig. 4. Blazing a trail in very steep karst terrain. Photo: Julia Ruppell. – *Abstieg von einem Hörposten durch den steilen Karstwald*.

On the first morning it took us an hour to reach our chosen listening post. I immediately set up my recording equipment and told everyone to be silent. That first morning, four groups were heard from the listening post. The groups were heard coming from four different directions. Gibbon song was all around us, and it was the most beautiful music I ever heard.

During this study (16 to 25 July 2006), we monitored gibbon song activity from listening posts on five different hilltops along the road between km 40 and km 52, trying to locate and record as many gibbons as possible. The listening posts had an average altitude of 56 m (SD = 6 m, range 510-690 m). Every day, we arrived on our chosen listening post between 04:00 and 04:30 hrs and stayed there until 11:30 hr. During afternoons, we made survey walks in the forest. During ten consecutive days of monitoring, a total of 31 song bouts were recorded. I heard an average (± standard deviation) of 3.1±1.0 songs per day (range 2-5 song bouts; n = 10 days). Gibbons often started a few minutes before sunrise (i.e. 05:26 hr local time), and 80% of all songs started between 05:00 and 05:30 (Fig. 5). No song started earlier than 04:58 hr and no songs were heard that started after 05:53 hr. Song bouts had an average duration of 13.2±2.8 minutes (range 6–18 minutes; n = 24 song bouts).

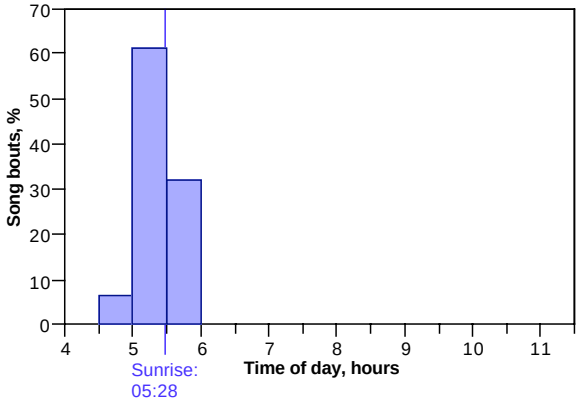

Fig. 5. Frequency distribution of the starting time of gibbon song bouts in Phong Nha–Ke Bang NP. – *Häufigkeitsverteilung der Startzeit von Gibbongesängen im Phong Nha–Ke Bang Nationalpark.*

Songs of ten groups were effectively tape-recorded. At least three other groups were heard between km 40 and km 52, but they were too far away to be tape-recorded. Therefore my estimate for the area between km 40 and km 52 is that there are at least 13 groups (30+ individuals) living in this area.

Assuming that a gibbon song carries about 1 km in the forest, an area of roughly 3 km^2 could be monitored with one listening post and about 15 km^2 with five listening posts that are separated at least 2 km from each other. This very tentative method suggests that gibbon density was about 0.7 groups/km^2. This is a very conservative estimate, however, as each listening post was used only for two

consecutive days on average. An average gibbon group may not sing every day and remain silent for up to five consecutive days. Therefore, it is likely that some groups in the survey area remained undetected during this short study.

There are various other places where gibbons have been reported to have been heard within the park during the 1990's (reviewed in Geissmann *et al*, 2000). However, there has been little recent evidence since the 2000 publication to suggest that gibbons are found in other areas. A troop of red-shanked douc langurs (*Pygathrix nemaeus*) were the only other primate species that we saw. Several other primate species are reported to exist in the park such as the Hatinh langur (*Trachypithecus laotum hatinhensis*), rhesus macaques (*Macaca mulatta*), stump-tailed macaques (*M. arctoides*), and the Bengal slow loris (*Nyticebus bengalensis*) (Dang *et al*., 1998).

Discussion

Beginning my trip, I had no idea what I would find. I knew there was a possibility of searching for days and hearing no gibbons. Earlier surveys carried out in Phong Nha Ke-Bang NP during the 1990s (summarized in Geissmann *et al*., 2000) only heard few (one to four) gibbon groups at the surveyed localities. My finding that the gibbons still survive in Phong Nha–Ke Bang at more substantial densities (at least in my survey area) can be regarded as good news.

The survey area is well within the distribution area of what is currently known as the southern white-cheeked crested gibbon (*Nomascus siki*). Although the white cheek patches of the one male I sighted supports such an identification, the call characteristics of the gibbon songs I heard differ from those recorded by Thomas Geissmann at Bach Ma NP, i.e. from a forest area located further to the south (Fig. 1) and very close to the type locality of *N. siki* (Konrad and Geissmann, 2006; Tallents *et al*., 2001). This conflicting evidence documents that the systematics of the crested gibbons requires further study.

The gibbons in Phong Nha–Ke Bang live in very steep forests of relatively high altitude (Fig. 6). This terrain is virtually un-farmable, which probably is the reason why this forest is still standing and why the gibbons are still there, in contrast to many other localities, where gibbons used to occur (Geissmann *et al*., 2000).

We simply do not know how large the gibbon population is, and a huge part of the forest remains to be surveyed.

As a result of this project I am determined to go back to Phong Nha–Ke Bang in order to conduct a more accurate survey of the individuals that exist there. Research and conservation in the region such as the establishment of the Vietnam project of the Cologne Zoo engages in the protection and conservation of the biodiversity of the park (Herrmann and Pagel, 2000; Ziegler, 2004; Ziegler and Herrmann, 2000). A reintroduction program for endangered langurs into the park has been initiated. The project has also been successful in supporting the rangers and forest guards of the national park. However, the protection section of the park lacks funds, equipment and motivation. Consequently, the rangers who are employed by the park rarely patrol the forest in order to prevent illegal logging and hunting.

Currently, the biggest threat to biodiversity at Phong Nha–Ke Bang is hunting, which is widespread at the site and represents a particular threat to populations of primates (Cao Van Sung and Le Quy An, 1998; Herrmann and Pagel, 2000; UNEP-WCMC, 2003). Levels of hunting are high in response to demand from the wildlife trade. In addition to hunting, illegal timber extraction is a major threat to biodiversity, and again occurs largely in response to commercial demand (Cao Van Sung and Le Quy An, 1998). In addition there are villages within the park where hunting is not monitored. While the human population density is low inside the park, its natural resources are under great pressure from the expanding surrounding population. A highway which is currently being constructed through the core area of the park may result in increased rates of habitat loss and disturbance to key species, especially globally threatened primates. Another potential threat to the natural properties of the park is the rapid expansion in visitor numbers and the tourism-related infrastructure (UNEP-WCMC, 2003).

Fig. 6. View from the top of the karst mountains, showing one of the few forests where gibbons still occur in Vietnam. Photo: Julia Ruppell. – *Aussicht von einem Karstberg auf einen der wenigen Wälder in Vietnam, in denen Gibbons noch überleben.*

Lastly, almost nothing is known on the gibbons in the park. Distribution, density and population size of the gibbons at Phong Nha–Ke Bang are unknown and no directed conservation efforts are being performed in the park for gibbons at this time.

The site I used to record gibbons has great potential for a long-term demographic and ecological study of gibbons and other arboreal animals for a variety of reasons: many individuals were recorded within a 12 km area, a trail system could easily be

implemented and mapped, and lastly Phong Nha–Ke Bang is officially protected as a national park. I hope to make use of the established infrastructure in order to continue research on the little known white-cheeked gibbon. In summary, much of the gibbon news I have reported here is sobering but I would say the situation in not hopeless. There are still gibbons surviving in the wild of Vietnam and with our help they may endure to keep on singing their beautiful morning songs.

Acknowledgements

Flora and Fauna International Hanoi helped me to get a working visa in Vietnam and assisted in getting permits for Quang Binh Province and Phong Nha Ke Bang National Park which I am extremely grateful for. Specifically I thank Paul Insua-Cao and Trinh Thanh Long of FFI for their time and care assisting me to make this project possible. I am grateful to my research assistant and translator Ngoc Qunyh Nguyen for assisting with the field aspects of the project. Lastly I thank my advisors Dr. Natalie Vasey and Dr. Thomas Geissmann for their support of my study.

References

Cao Van Sung and Le Quy An (eds.) (1998). Environment and bioresources of Vietnam: present situation and solutions. The Gioi Publishers, Hanoi.

Dallmann, R., and Geissmann, T. (in prep.). Individual and geographical variability in the songs of wild silvery gibbons (Hylobates moloch) on Java, Indonesia. In Lappan, S. M., Whittacker, D., and Geissmann, T. (eds.), Wild gibbon populations: New perspectives on small ape socioecology and population biology. Kluwer, New York. Manuscript under review.

Geissmann, T. (2002a). Duet-splitting and the evolution of gibbon songs. Biological Reviews **77**: 57-76.

Geissmann, T. (2002b). Taxonomy and evolution of gibbons. In Soligo, C., Anzenberger, G., and Martin, R. D. (eds.), Anthropology and primatology into the third millennium: The Centenary Congress of the Zürich Anthropological Institute (Evolutionary Anthropology Vol. 11, Supplement 1), Wiley-Liss, New York, pp. 28-31.

Geissmann, T., Nguyen Xuan Dang, Lormée, N., and Momberg, F. (2000). Vietnam primate conservation status review 2000 – Part 1: Gibbons (English edition). Fauna & Flora International, Indochina Programme, Hanoi, 130 pp. (Downloadable from www.gibbons.de)

Herrmann, H. W., and Pagel, T. (2000). Phong Nha–Ke Bang – Das Regenwaldschutzprojekt des Kölner Zoos in Vietnam. Zeitschrift des Kölner Zoo **43** (2): 79-88.

Keith, S. A., Waller, M. S., and Geissmann, T. (in prep.). Vocal diversity of Kloss's gibbons (*Hylobates klossii*) in the Mentawai Islands, Indonesia. In Lappan, S. M., Whittacker, D., and Geissmann, T. (eds.), Wild gibbon populations: New perspectives on small ape socioecology and population biology. Kluwer, New York. Manuscript under review.

Konrad, R., and Geissmann, T. (2006). Vocal diversity and taxonomy of Nomascus in Cambodia. International Journal of Primatology **27**: 713-745.

Nguyen Xuan Dang, Pham Nhat, Pham Trong Anh, Hendrichsen, D. (1998). Results of surveys on mammal fauna in Phong Nha–Ke Bang area, Quang Binh, Vietnam: July 1 – August 21, 1998. Report to the Fauna & Flora International Indochina Programme, Hanoi.

Pham Khang (1985). The development of karst landscapes in Vietnam. Acta Geologica Polonica 35 (3-4): 305-319.

Tallents, L., Geissmann, T., Trinh Dinh Hoang, and La Quang Trung (2001). Survey for crested gibbons (genus Nomascus) in Bach Ma National Park, Viet Nam, April 2001. Survey report, Fauna & Flora International, Indochina Programme Office, Hanoi, 5 pp.

Timmins, R. J., Do Tuoc, Trinh Viet Cuong, and Hendrichsen, D. K. (1999). A preliminary assessment of the conservation importance and conservation priorities of the Phong Nha–Ke Bang prposed national park, Quang Binh Province, Vietnam. Fauna and Flora International, Indochina Programme, Hanoi, 81 pp.

UNEP-WCMC (2003). World heritage sites: Protected areas and world heritage. Country: Vietnam. Name Phong Nha–Ke Bang National Park. Date April 2001, March 2003. http://www.unep-wcmc.org/sites/wh/Phong_nha.html

Unesco.org (2003). Phong Nha–Ke Bang National Park. Update: 3 July 2003. http://whc.unesco.org/sites/951rev.htm

Vogt, M., Forster, B., Pagel, T., and Ziegler, T. (2006). Neues vom Naturschutzprojekt des Kölner Zoos in Vietnam. Zeitschrift des Kölner Zoo **49** (1): 35-49.

Ziegler, T. (2004). Erforschung der Artenvielfalt im Vietnamprojekt des Kölner Zoos: Die Amphibien und Reptilien von Phong Nha–Ke Bang. Zeitschrift des Kölner Zoo **47** (4): 147-171.

Ziegler, T., and Herrmann, H.-W. (2000). Preliminary list of the herpetofauna of the Phong Nha–Ke Bang area in Quang Binh Province, Vietnam. Biogeographica, Paris **76** (2): 49-62.

Zusammenfassung

Die Gibbons des Phong Nha–Ke Bang Nationalparks in Vietnam

Die Weisswangen-Schopfgibbons des Phong Nha–Ke Bang Nationalpark im westlichen Zentralvietnam wurden bisher nie untersucht. Im Rahmen eines grösseren Projekts zur stimmlichen Diversität und Systematik der Schopfgibbons (Gattung *Nomascus*), habe ich im Juli 2006 den Park besucht. Während einer Bestandeserhebung der Gibbons, die eine Fläche von etwa 15 km^2 des gesamten Nationalparks abdeckte (858 km^2), konnte ich die Gesänge von 13 Gibbongruppen hören und Tonaufnahmen von zehn Gruppen durchführen. Die Gibbons aus diesem Gebiet werden allgemein als südliche Weisswangen-Schopfgibbons (*Nomascus siki*) identifiziert, aber ihre Rufe unterscheiden sich deutlich von denen weiter südlich (zum Beispiel im Bach Ma Nationalpark) lebender Gibbons, die normalerweise ebenfalls dieser Unterart zugeordnet werden. Dies legt die Vermutung nahe, dass es sich eventuell um zwei verschiedene Arten oder Unterarten handelt und belegt, dass die Systematik der Schopfgibbons dringender Revision bedarf.

First field data on the Laotian black crested gibbon (*Nomascus concolor lu*) of the Nam Kan area of Laos

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The enigmatic Laotian black crested gibbon (*Nomascus concolor lu*) has not been studied since its discovery in 1939, and its distribution area in northwestern Laos is a biogeographic anomaly. I carried out a gibbon survey in the Nam Kan Valley of Bokeo Province (northwestern Laos), confirming the continued occurrence of this gibbon in Nam Kan. The study site appears to be situated very close to the original type locality. During a four-week study I collected preliminary data on vocal behaviour, population density, group composition, conservation status and systematic affinities of this gibbon. In addition, interviews with the area's inhabitants revealed that Nam Kan Valley appears to be one of the very few places where gibbons are not hunted by the local ethnic group, which gives some hope for their continued survival.

Introduction

The Laotian black crested gibbon is one of the few gibbon populations that remains entirely unstudied in the wild. In January 1939, black crested gibbons (*Nomascus concolor*) were discovered during a French-American collecting expedition to Ban Nam-Khueng (20°25'N, 100°14'E, northwest Laos). A dozen individuals were collected, which were subsequently described as a new subspecies (*N. c. lu*) by Delacour (1951). Unfortunately, a re-examination of most of the available museum specimens by Geissmann (1989) suggested that the features distinguishing this form from *N. c. concolor*, as reported by Delacour, were not reliable, and the systematical distinctiveness of *N. c. lu* must be regarded as questionable (Geissmann, 1995). This was further supported when the remaining museum specimens were also examined (Geissmann *et al.*, 2000, and Geissmann, unpublished data).

Darker fur colouration, which was originally considered to be distinctive for females of *lu*, turned out to be based on inclusion of subadult females which have not completely finished their colour change from juvenile black to adult yellow. Fully adult females do not exhibit these characteristics. Males of *N. c. lu* have also been reported to exhibit a silvery-black line between eye and ear (Delacour, 1951). This characteristic does not occur in all specimens of *N. c. lu*, however, and moreover also occurs from time to time in other crested gibbons. Therefore, this characteristic does not appear to be of diagnostic value for identification of this taxon (Geissmann, 1989).

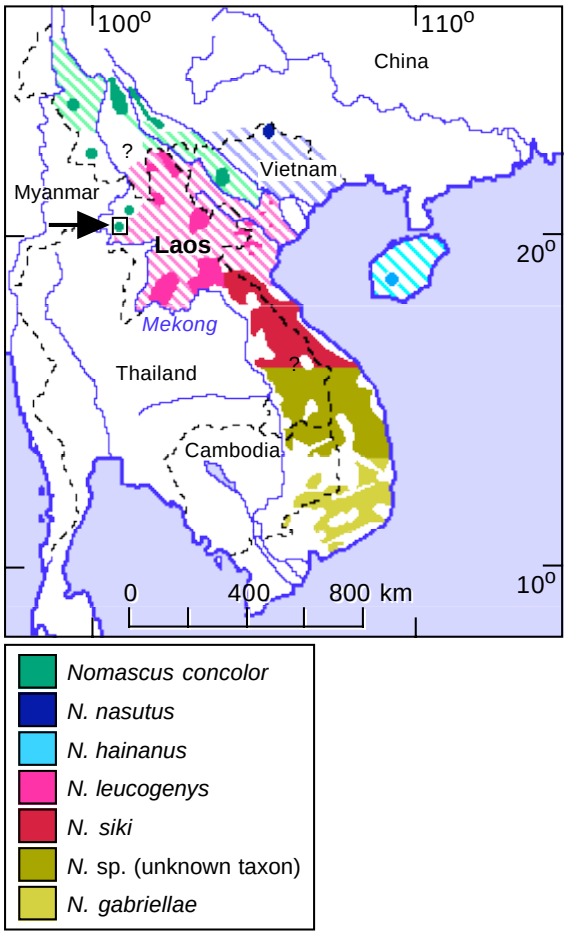

Fig. 1. Map showing Indochina and the distribution of the crested gibbons (genus *Nomascus*). The arrow indicates the location of the Nam Kan PPA – *Die Karte zeigt Indochina und die Verbreitung der Schopfgibbons (Gattung* Nomasus*). Der Pfeil zeigt die Lage des Nam Kan Provinz-Schutzgebietes (PPA).*

Regardless of whether the Laotian black crested gibbon is a distinct taxon or not, it certainly remains one of the most enigmatic of gibbon populations. In addition to its completely unknown status in the wild and questionable taxonomic status, these gibbons also exhibit an unusual, geographically isolated distribution. It is situated as an enclave within the distribution of the white-cheeked crested gibbon (*N. leucogenys*), some 100 km away from the nearest populations of *N. concolor* in northwest Vietnam and the Chinese Yunnan Province (Fig. 1). The distribution of the Laotian black crested gibbon appears to be restricted to a relatively small area near the east bank of the Mekong River, the opposite side of which marks the beginning of the distribution area of the white-handed gibbon (*Hylobates lar*), a representative of an entirely different gibbon genus.

After the type series of the Laotian black crested gibbon was collected in 1939, only very little information on this population became available. The position of the locality within the infamous "golden triangle" between Myanmar, Laos and Thailand made field research impossible for many years. Indeed, for a long time it was unknown whether gibbons still occurred in the area at all, until members of the French ecotourism project Forespace (J.-F. Reumaux, pers. comm. 1998) reported having seen some in the Nam Kan Provincial Protected Area (PPA) in Bokeo Province (northwest Laos). More recently, a few additional groups were discovered during surveys in the Nam Ha National Protected Area (NPA) in Luang Namtha Province, to the northeast of Nam Kan (Johnson *et al.*, 2005). Because the Nam Kan area is relatively close to the type locality of *N. c. lu*, I decided to carry out a brief survey to identify the gibbons, record their calls, and collect data on their status and biology.

The location of the common distribution boundary between *N. concolor* and *N. leucogenys* in Laos is unknown. Because rivers often act as distribution barriers for gibbon populations (e.g. Marshall and Sugardjito, 1986), I also carried out a rapid survey along the lower run of the Nam Tha River. This tributary to the Mekong River south of Nam Kan PPA is one possible candidate for the boundary between the two *Nomascus* species.

Material and Methods

The Nam Kan PPA (Fig. 2) covers an area of 775 km^2 at altitudes ranging from 440 to 1468 metres. Its limits were defined by a Department of Forestry study in 1993 (Forespace, 1999). The Bokeo Agriculture and Forestry Office has requested that the Nam Kan PPA be considered as a National Protected Area; but this area has not been selected to date. It is not clear what protective role the province presently plays in the Nam Kan Provincial Protected Area (WCS, 2003).

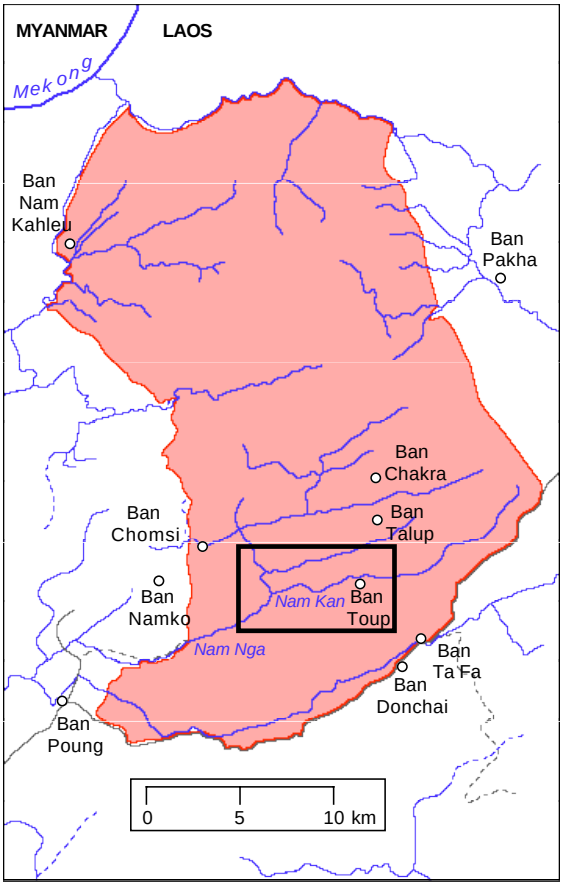

Fig. 2. Map showing the Nam Kan Provincial Protected Area (red area). The black rectangle indicates the study area in the Nam Kan Valley. – *Karte des Nam Kan Provinz-Schutzgebietes (rote Fläche). Das schwarze Viereck bezeichnet das Untersuchungsgebiet im Tal des Nam Kan Flusses.*

The reserve's southern access at Ban Donchai city is situated 48 km eastnortheast of Huay Xai (Houayxay), the capital of Bokeo Province.

This survey covers the central part of the Nam Kan Valley in the southern half of the reserve (Fig. 3). Ban Toup is the main village of this valley and belongs to the Hmong ethnic group. Field data were collected during 14 full survey days in March 1999. The area was surveyed from east to west as follows: 6–9 March west of Ban Toup village (= Ban Champa, Camp 1, 20°28.42'N, 100°48.02'E), 10–13 March around Ban Lao Xor village (Camp 2, 20°28.42'N, 100°47.17'E), and 14–19 March at the Forespace resort (Camp 3, 20°27.70'N, 100°45.03'E) (see also Forespace, 1999).

Laos is a monsoon country, with a rainy season from May to September and a dry one from October to April (Forespace, 1999). During the survey, the minimum nighttime temperature (mean±SD) was 13.3±2.0°C (range 11-17°C, n = 13) and the maximum daytime temperature was 31.8±2.1°C (range 28-35°C, n = 12); while the minimum daytime air humidity was 23.4±18.1% (range 0-43%, n = 12) and the maximum during the night 99.6±0.9% (range 97-100%, n = 13).

Fig. 3. The Nam Kan River near Camp 3. Photo: Thomas Geissmann. – *Der Nam Kan Fluss in der Nähe von Camp 3.*

The auditory survey technique was employed to assess the gibbon population size (modified from Brockelman and Ali, 1987). In addition to eight days of single listening point surveys, the survey team split into two pairs on six days, stationed at neighbouring listening points, in order to locate the calling groups by mapping the compass bearing and estimated distance to groups from two known locations. A total of eight listening points, stationed roughly 0.5-2 km apart, were used in order to locate the calling groups (Fig.8). Each listening point was used on 1 to 5 days (mean = 2.6, SD = 1.5).

Surveys began at 05:00 hours, in order to be in position during the peak singing time of the gibbons, and variably ended between 11:00 and 14:00 hours. In addition, several surveys were carried out in the afternoons until 17:00, although no gibbons were observed or heard then. Listening posts were located on hills or ridges from which several valleys could be acoustically surveyed at once.

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 recognize the green colour of leaves near the forest floor; local time of sunrise (i.e. the time at which the sun was visible over the horizon); gibbon calls. In terms of vocal behaviour, start and end time of calling bouts were recorded, as were the number of males and great calling individuals, the compass bearing and estimated distance to group, and visual information on group location when the terrain was visible from the observation post.

In addition to this work, a rapid survey along the Nam Tha River was carried out on 21-23 March 1999. Interviews were carried out at Ban Paktha (20°06.6'N, 100°35.7'E), a village located where the Nam Tha joins the Mekong, about 27 km southeast of Huay Xai (Houayxay), and in two villages upstream of the Nam Tha: Ban Don Savan (20°07.9'N, 100°38.9'E), and Ban Pakhat (20°08.8'N, 100°43.1'E), located some 6 km and 13 km northeast of Ban Paktha, respectively. From Ban Pakhat, I followed the little Nam Hat tributary upstream to the southeast and conducted further interviews in four villages on the left bank, up to 25 km southeast of Ban Paktha. Villages visited included Ban Xai Savan (20°06.1'N, 100°48.5'E), Ban Xai Oudom (20°05.7'N, 100°48.9'E), Ban Punxay (20°05.3'N, 100°49.2'E), and Ban Thin Keo (20°04.8'N, 100°49.6'E). Interview questions included: 1. "Do you know gibbons?" 2. "What do they look like?" 3. "Where do they live?" 4. "When did you last see or hear gibbons?"

Calling bouts were recorded on two sets of tape recorders: (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.

Tape recordings were digitized with a sampling rate of 22 kHz and a sample size of 16 bits. I generated sonograms (time vs. frequency displays) of the sound material via the Canary version 1.2.4 software (Cornell Laboratory of Ornithology) on a Macintosh PowerBook G4. The latter were computed by Fast Fourier Transformation (FFT). The FFT size of the sonograms was 4096 points with a time resolution of 128 points, overlap of 87.5%, frequency resolution of 5.38 Hz, and frame length of 4,096 points (Charif *et al.*, 1995).

Results from the Nam Kan survey

Gibbon habitat in the survey area mainly occurred at altitudes above 550 m (Figs. 4 and 5). Lower parts of the valley were mostly deforested (Fig. 6), or covered with secondary forest, or – in the westernmost part of the survey area – consisted of selectively logged forest.

Fig. 4. Inside the forest near Listening Post 2 (left), and near Camp 3, the only place in the survey area where some remnants of the primary forest remained below 550 m (right). Photos: Thomas Geissmann. – *Das Waldesinnere beim Hörposten 2 (links) und in der Nähe von Camp 3, dem einzigen Ort des Untersuchungsgebietes an dem noch Reste des Primärwaldes unterhalb von 550 m gefunden wurden.*

Fig. 5. Crown layer of the forest near Listening Post 5 (left), and near Listening Post 6 (right). Photos: Thomas Geissmann. – *Kronenregion des Waldes beim Hörposten 5 (links) und beim Hörposten 6.*

Fig. 6. Lower parts of the Nam Kan Valley are mostly deforested or covered with secondary forest, as shown at Camp 2 near Ban Lao Xor (left). Some secondary forest between Camp 2 and Camp 3 was freshly cut (right). Photos: Thomas Geissmann. – *Tiefliegende Gebiete des Nam Kan Tales waren zumeist entwalded oder trugen Sekundärwald wie die Gegend bei Camp 2 in der Nähe von Ban Lao Xor (links). Der Sekundärwald zwischen Camp 2 und 3 war stellenweise frisch gerodet worden (rechts).*

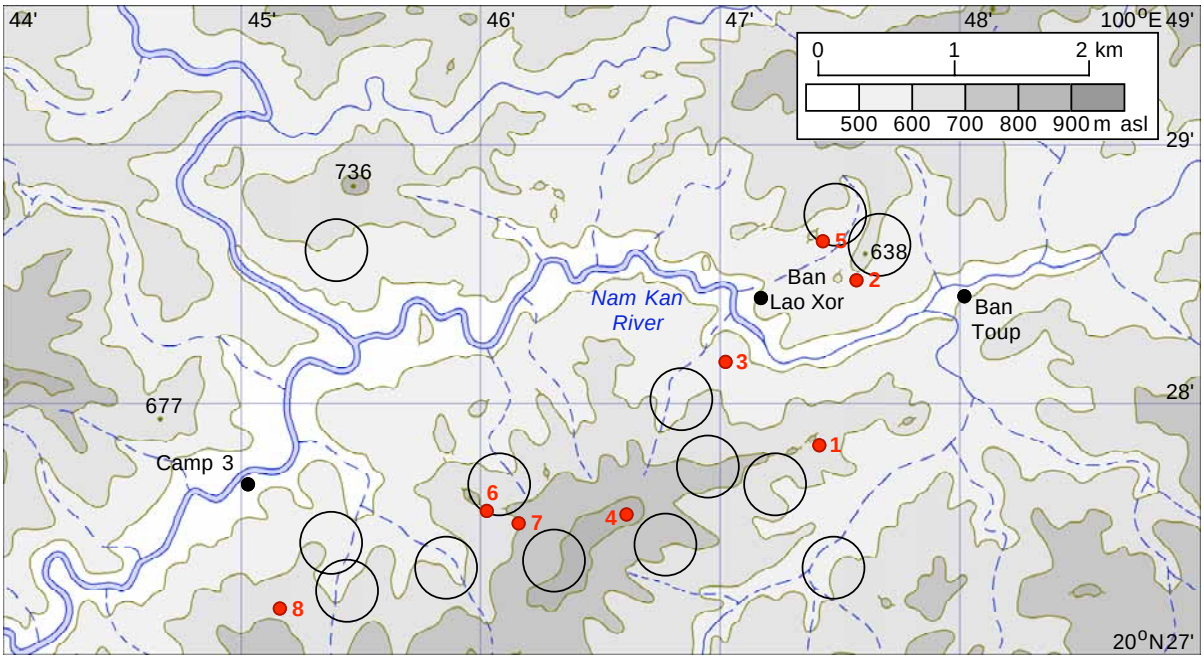

Fig. 7. Map of the survey area. Red dots (numbered 1 through 8) indicate the location of listening posts used during this study; open circles indicate the approximate distribution of gibbon groups heard during the survey. – *Karte des Untersuchungsgebietes im Nam Kan Tal. Rote Punkte (nummeriert von 1 bis 8) bezeichnen die Hörposten, von denen aus die Gibbongesänge überwacht wurden, und die Kreise zeigen die ungefähre Verteilung der gehörten Gibbongruppen.*

During our survey in the Nam Kan PPA we heard a total of 62 gibbon song bouts (counting only those heard during full days in the forest, i.e. 14 days). Based on location of singing groups and temporal overlap between song bouts, we estimate that we heard at least 13 distinct gibbon groups (Fig. 7). On average (±SD), we heard a total of 4.4±1.7 bouts per day (range 1-7, n = 14) and 4.0±1.6 bouts per listening point (range 1-7, n = 14).

As we acoustically surveyed an area of roughly 6 km^2, gibbon density can be tentatively estimated as 2.2 groups/km^2.

Two gibbon groups were directly observed during the survey, both near camp 3. One group contained three individuals (an adult pair and one black infant), the other four individuals (an adult pair, one juvenile, and one black infant). Both groups fled immediately upon noticing the observers. As forest is only left on steeper hills and few paths were available inside the forest, following the gibbons was difficult. Yet, one of the latter two groups, after having been twice relocated by us, was subsequently followed during a 20-minute period. Group compositions observed during this study, as well as compositions reported by our guides during this survey, are listed in Table 1 and suggest an average group size of 3.6–3.8 individuals (standard deviation 1.1–1.4 individuals). Based on this estimated group size, gibbon population density in the Nam Kan Valley can be tentatively inferred to be around 8–8.4 individuals/km^2.

Table 1. Gibbon group compositions in the Nam Kan Valley. Observers were not confident about the presence of the individual in parenthesis. – *Zusammensetzung von beobachteten Gibbongruppen im Nam Kan Tal. Über die Präsenz des Individuums in Klammern waren sich die Beobachter nicht sicher.*

Group No.	Composition				Total
	Adult male	Adult female	Juve-nile	Infant	
Direct observation during this study					
1	1	1	1	1	4
2	1	1		1	3
Reported by guides					
3	1(+1)	2	2		5(+1)
4	1	2	1	2	4
3	1	1			2
Total	5(+1)	7	4	4	18(+1)

The distribution of gibbon calls across the day is shown in Fig. 8. The gibbons exhibited a preferred calling time right after dawn, with 64.5% of all song bouts (40 out of 62) produced between 06:00 and 07:00 hours. On average, the first song bout per day started at 06:26±00:15 hours (range 06:14-07:02, n = 15, while the last song bout per day started at 08:37±02:24 hours (range 06:30-12:32 hours, n = 14).

Song bouts had an average duration of 11.7 minutes (standard deviation 4.4 min., range 2-28 min., n = 59 song bouts).

Fully developed male song contributions of both *N. concolor* and *N. leucogenys* consist of single booms produced during inflation of a throat sac, as well as staccato and multi-modulated phrases; whereas female song contributions are great-call phrases (e.g. Geissmann *et al*., 2000). *Nomascus concolor* and *N. leucogenys* differ in several species-specific song characteristics, as described by Geissmann *et al*. (2000). The most notable of these differences are listed in Table 2.

Representative sonagrams of *N. concolor* song excerpts from Nam Kan PPA are shown in Fig. 9, together with sonagrams of homologous song sections from Laotian *N. leucogenys*. As can be seen in the sonagrams, the gibbon songs recorded in the Nam Kan study area correspond to *N. concolor* in each of the characteristics listed in Table 2 and differ from those of *N. leucogenys*.

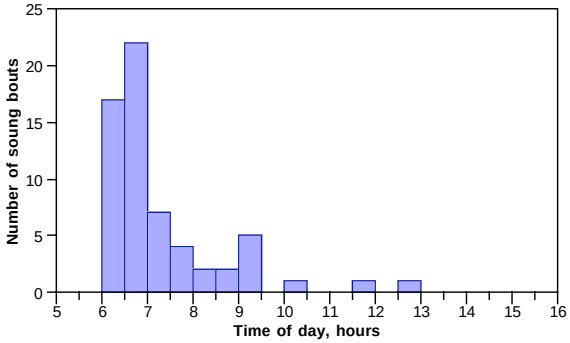

Fig. 8. Frequency distribution of the starting time of gibbon song bouts (n = 62) in the Nam Kan Valley. – *Häufigkeitsverteilung der Startzeit von Gibbongesängen (n = 62) im Nam Kan Tal.*

In addition to gibbons, northern pig-tailed macaques (*Macaca leonina*) were encountered repeatedly, but in all probability, these sightings represented just two groups, one near Camp 2, the other one near Camp 3.

Interviews with members of the local ethnic group (Hmong) in the study area revealed that there is a taboo against hunting gibbons. According to the interviewees, this taboo was introduced only as late as 1975. The village head of Ban Toup (the father of one of the interviewees) reportedly introduced the taboo in a special ceremony and declared it as binding for the whole community. When asked about the reasons for introducing this measure, I was told that – unlike some monkeys – gibbons were basically harmless and "nice" animals because they were not raiding crops and because they were singing in the morning.

Table 2. Distinctive song characteristics of *N. concolor* and *N. leucogenys* (extracted from Geissmann *et al*., 2000). – *Gesangsmerkmale, die zwischen Schwarzen Schopfgibbons (*N. concolor*) und nördlichen Weisswangen-Schopfgibbons (*N. leucogenys*) unterscheiden (nach Geissmann et al., 2000)*.

Song element	Song phenotype	
	N. concolor	*N. leucogenys*
(1) Number of great-call notes:	≤ 10 notes	> 10 notes
(2) Note shape in great-call climax:	First descending, then ascending frequency (v shaped)	Ascending frequency only
(3) First note in fully expressed multi-modulated phrases:	Ascending frequency	First part of stable frequency, then rapid down-up-sweep

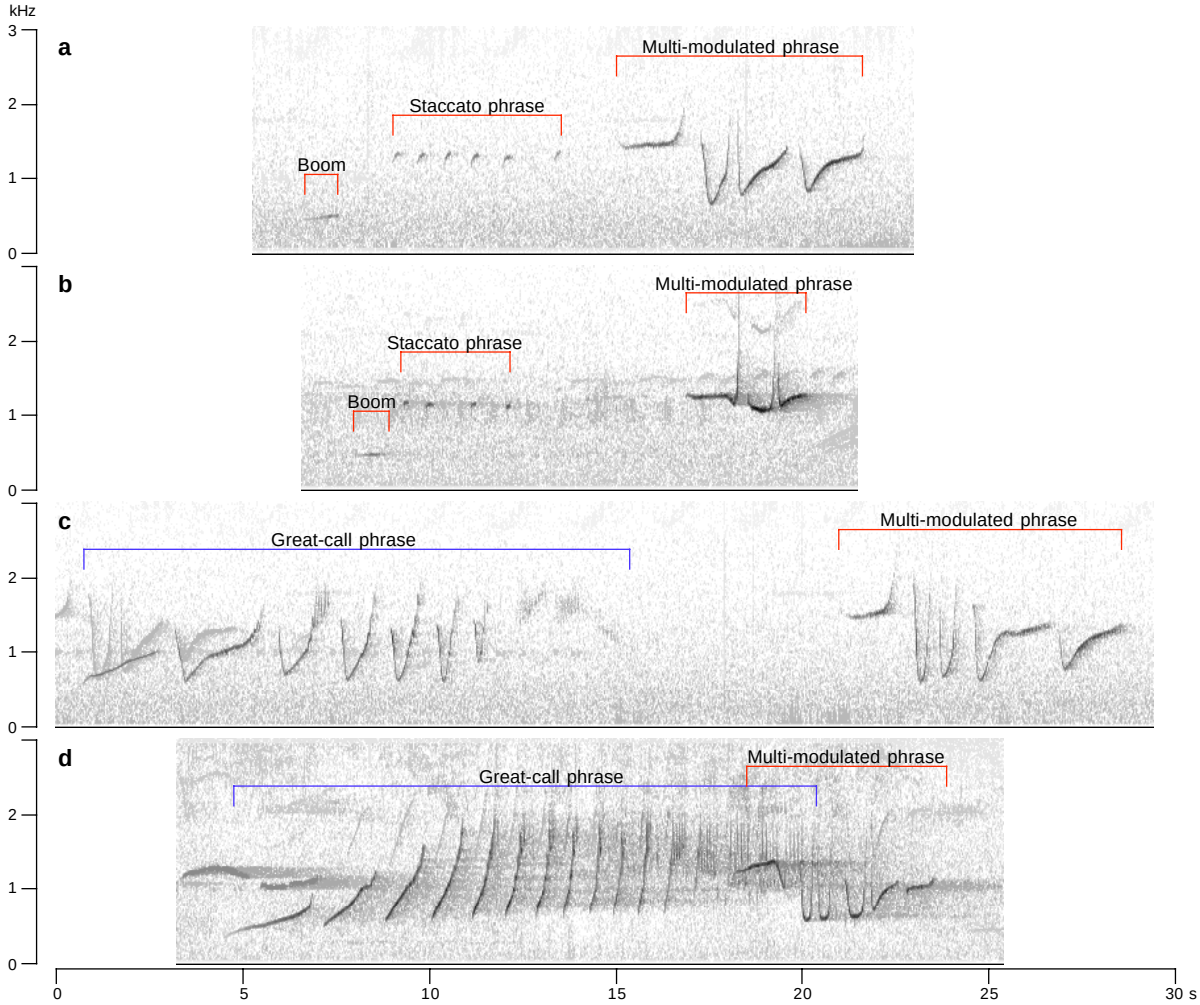

Fig. 9. Comparison of representative song sections between *N. concolor* from the Nam Kan Valley in Bokeo Province (northwest Laos, this study) and *N leucogenys* from Houaphanh Province (northeast Laos, recordings by Pete Davidson). (a *N. concolor* male song segment, (b) homologous *N. leucogenys* male song segment from Nam Xam NBCA, (c) *N. concolor* duet segment, (d) homologous *N. leucogenys* duet segment from Phou Louey NBCA. Red brackets indicate male song elements, blue brackets indicate female song elements. – *Vergleich repräsentativer Gesangsausschnitte der Schwarzen Schopfgibbons (N. concolor) aus dem Nam Kan Tal der Provinz Bokeo (Nordwest-Laos, vorliegende Studie) mit homologen Gesangsausschnitten Nördlicher Weiss-wangen-Schopfgibbons der Provinz Houaphanh (Nordost-Laos, Aufnahmen von Pete Davidson). (a)* N. concolor*, Gesangssegment eines Männchens, (b) homologes Segment eines Mänchens von* N. leucogenys *aus dem Schutzgebiet Nam Xam, (c)* N. concolor*, Duettsequenz, (d) homologe Duettsequenz von* N. leucogenys *aus dem Schutzgebiet Phou Louey. Rote Klammern bezeichnen männliche Gesangs-elemente, blaue bezeichnen weibliche Elemente*.

Results from the Nam Tha and Nam Ha survey

In the hope of obtaining information on the location of the common distribution boundary between *N. concolor* and *N. leucogenys*, a rapid survey along the lower run of the Nam Tha River (a tributary to the Mekong River south of Nam Kan PPA and 27 km southeast of Huay Xai [Houayxay]) was also carried out (Fig. 10). The forest along the river was found to have largely gone or to be so strongly degraded that it is extremely unlikely that any gibbons survive in that area (Fig. 11).

Interviews with numerous people in villages up to several kilometres away from the river revealed that gibbons apparently became extinct in the area about 30-40 years ago. Only older men (mostly former hunters) remembered gibbons, and only one man reported personally hunting them, having shot one gibbon of a group of four individuals as recently as 6–7 years ago. The locality (Ban Hanly) he reported for that gibbon group was situated so far upstream that I was not able to travel there during the time available for this study.

Based on details of the descriptions of gibbons obtained during these interviews, it was often possible to assess the reliability of the interview data. When asked about the cheek colouration of the black gibbon individuals, both white and black cheeks were confirmed for localities on either side of the Nam Tha River. This contradictory information makes it impossible to determine whether the Nam Tha River

was the distribution boundary between black crested and white-cheeked crested gibbons in the past.

Fig. 10. The Mekong River at Ban Paktha, about 27 km downstream from Huay Xai, the capital of Bokeo Province. In the dry season, the river is not very broad here. The mouth of the Nam Tha River can be seen in the foreground. Photo: Thomas Geissmann. – *Der Mekong Fluss bei Ban Paktha, ewa 27 km flussabwärts von Huay Xai, der Hauptstadt der Provinz Bokeo. Während der Trockenzeit ist der Fluss hier nicht sehr breit. Im Vordergrund erkennt man die Einmündung des Nam Tha.*

Discussion

On average, 4.4 song bouts per day were heard in the Nam Kan Valley. This value is higher than the numbers recorded during some other surveys of crested gibbons in China and Vietnam (range: 2.1–3.1 songs/day; Chan *et al*., 2006; Geissmann *et al*., 2007; Ruppell, 2007), except for data on *H. c. concolor* in the Ailao Mountains of Yunnan Province, China (6.0 songs per day, Geissmann, unpublished data 1990). A tentative density estimate of 2.2 gibbon groups/km^2 in the Nam Kan Valley is also higher than density estimates for *N. concolor* in Yunnan Province (range 0.43–0.82 groups/km^2, review in Chan *et al*., 2005) and *N. concolor* at Che Tao, northern Vietnam (1.6 groups/km^2 (Tallents *et al*., 2000). The density estimate for the Nam Kan Valley is also higher than estimates for *N. hainanus* (0.50-0.57 groups/km^2, Zhang *et al*., 1995), *N.* cf. *siki* in central Vietnam (0.7–1.3 goups/km^2, Geissmann *et al*., 2007; Ruppell, 2007). Only some estimates for *N. gabriellae* and *N. siki* in eastern Cambodia are higher (range 0.0–3.73 groups/km^2, average of 1.47 groups/km^2, Traeholt *et al*., 2005).

In general, density estimates for crested gibbons should be regarded with caution, however, because many of them (including the one resulting from this study) are based on very short surveys. As a trend, the results of this study suggest that the survey area supports a relatively high density of gibbons, and may be an indicator of a relatively undisturbed gibbon population.

The Nam Kan PPA of Bokeo Province is not part of the national protected area system (Duckworth *et al*. 1999). The people living in the survey area of the Nam Kan Valley reported that they have not hunted gibbons since 1975 owing to a local taboo. This may have contributed considerably not only to the ongoing survival of the gibbons in that area, but also to their apparently high estimated density. This hunting taboo does not appear to be the result of official conservation measures, which – according to my personal experience in various Indochinese forests – are often ignored by forest-living ethnic groups. Unfortunately, the Nam Kan area is in a region of human immigration (Duckworth *et al*., 1999), and as new settlers are unlikely to share the beliefs, it is unclear how effective local hunting taboos will continue to be in protecting this species.

Fig. 11. The areas visited along the Nam Tha River (left) and its tributary, the Nam Hat River (right) were largely deforested or supported only traces of secondary forest in the best case. Photos: Thomas Geissmann. – *Die besuchten Gebiete entlang des Nam Tha Flusses (links) und seines Zuflusses, des Nam Hat (rechts) waren weitgehend entwaldet oder wiesen im besten Fall noch Spuren von Sekundärwald auf.*

As this outlying population is currently assigned subspecific rank (as *N. c. lu*), it has a high conservation priority. Its very limited distribution puts the subspecies at risk, and the small and shrinking overall range of the species, together with its gravely threatened status in Vietnam and China (Geissmann, 2007; Geissmann *et al.*, 2000) means that the Bokeo population is of high international importance. The only other modern record of *N. concolor* from Laos stems from the Nam Ha National Protected Area (NPA) in Luang Namtha Province, northeast of our study area. Although this area is part of the national protected area system, gibbons there were heard on only five of 12 survey days and only about five different groups were heard in total (Johnson *et al.*, 2005). This suggests that Nam Ha NPA supports a lower gibbon population density than in Nam Kan PPA, and further underlines the importance of the Nam Kan gibbon population.

Crested gibbons (the '*concolor*' group, genus *Nomascus*) present one of the most challenging taxonomic issues for South-east Asian large mammals, with little consensus on their relationships and how many species are involved (Duckworth *et al*. 1999). More to the point, it is unclear if the black crested gibbon inhabiting northwest Laos, currently recognized as *N. concolor lu*, is in fact a valid subspecies, as the supposed morphological difference may be due to other sources of variation (see Introduction). Previous assessments of the affinities of this gibbon population were based on fur colouration characteristics. The song structure of the gibbons from Nam Kan does not exhibit any conspicuous differences from that of other populations of *N. concolor* (i.e. *N. c. concolor*, *N. c. jingdongensis*, and *N. c. furvogaster* from China and Vietnam; Geissmann *et al*., 2000 and unpublished data), but markedly differs from that of *N. leucogenys*.

Contradictory information was obtained during my interviews in the lower Nam Tha River area (south of Nam Kan PPA), making it impossible to determine whether this river was the distribution boundary between black crested and white-cheeked crested gibbons in the past. Similar interview results were also obtained during a study carried out in the Nam Ha National Protected Area (NPA) in Luang Namtha Province, adjacent to Bokeo Province (Johnson *et al*., 2004, 2005). These interview results do not necessarily suggest that the two gibbon species are or were sympatric anywhere in Laos. More likely, the interviewees were familiar with only one gibbon species, but the immense variability of intermediate fur colouration patterns that crested gibbons exhibit during their ontogeny (Geissmann, 1993, 2003) may make interview data on gibbon fur coloration less reliable, especially in areas where gibbons are very rare or have become extinct several decades ago. Interview data may not be reliable to determine which of the two gibbon species is, or was, present in an area.

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References

Brockelman, W. Y., and Ali, R. (1987). Methods of surveying and sampling forest primate populations. In Marsh, C. W., and Mittermeier, R. A. (eds.), *Primate conservation in the tropical rain forest*, Alan R. Liss, Inc., New York, pp. 23-62.

Chan, B. P. L., Fellowes, J. R., Geissmann, T., and Zhang, J. (2005). *Hainan gibbon status survey and conservation action plan, version 1 (last updated November 2005)*. Kadoorie Farm & Botanic Garden Technical Report No. 3, Kadoorie Farm & Botanic Garden, Hong Kong, 32 pp.

Charif RA, Mitchell S, Clark CW. 1995. Canary 1.2 user's manual. New York: Cornell Laboratory of Ornithology, Ithaca, 229 pp.

Delacour, J. (1951). La systématique des Gibbons Indochinois. *Mammalia* **15**: 118-123 (French text).

Duckworth, J. W., Salter, R. E., and Khounboline, K. (compilers) (1999). *Wildlife in Lao PDR: 1999 status report*, IUCN - The World Conservation Union / Wildlife Conservation Society / Centre for Protected Areas and Watershed Management, Vientiane, xiv+275 pp.

Forespace (1999). *Through the eye of the gibbon. Wildlife conservation & tree-top ecotourism with the hill tribes of northern Laos. Nam Kan Protected Area, Bokeo, Laos, Version 1.0* (Multimedia CD-ROM), Ministry of Information & Culture, Hoei Sei.

Geissmann, T. (1989). A female black gibbon, *Hylobates concolor* subspecies, from northeastern Vietnam. *International Journal of Primatology* **10**: 455-476.

Geissmann, T. (1993). *Evolution of communication in gibbons (Hylobatidae)*, Ph.D. thesis, Anthropological Institute, Philosoph. Faculty II, Zürich University, 374 pp. (Downloadable from www.gibbons.de)

Geissmann, T. (1995): Gibbon systematics and species identification. *International Zoo News* **42**: 467-501.

Geissmann, T. (2003). *Vergleichende Primatologie*, Springer Verlag, Heidelberg & New York, xii+357 pp.

Geissmann, T. (2007). Status reassessment of the gibbons: Results of the Asian Primate Red List Workshop 2006. *Gibbon Journal* **3**: 5-15.

Geissmann, T., Nguyen Xuan Dang, Lormée, N., and Momberg, F. (2000). *Vietnam primate conservation status review 2000 – Part 1: Gibbons (English edition)*. Fauna & Flora International, Indochina Programme, Hanoi, 130 pp. (Downloadable from www.gibbons.de)

Geissmann, T., Trinh Dinh Hoang, La Quang Trung, and Tallents, L. (2007). A brief survey for crested gibbons in Bach Ma National Park, central Vietnam. *Gibbon Journal* **3**: 43-49.

Johnson, A., Singh, S., and Duangdala, M. (2004). A preliminary survey for the black-cheeked crested gibbon (*Nomascus concolor*) in the Nam Ha national protection area, northern Lao PDR. In Nadler, T., Streicher, U., and Ha Thang Long (eds.), *Conservation of primates in Vietnam*, Frankfurt Zoological Society, Vietnam Primate Conservation Programme, Endangered Primate Rescue Center, Cuc Phuong National Park, Hanoi, pp. 117-118.

Johnson, A., Singh, S., Duangdala, M., and Hedemark, M. (2005). The western black crested gibbon *Nomascus concolor* in Laos: New records and conservation status. *Oryx* **39**(3, July): 311-317.

Ruppell, J. (2007). The gibbons of Phong Nha–Ke Bang National Park in Vietnam. *Gibbon Journal* **3**: 50-55.

Tallents, L., Le Trong Dat, La Quang Trung, and Trinh Dinh Hoang (2000). *Report on the second survey for western black-crested gibbon in Che Tao forest*, Fauna & Flora International, Indochina Programme, Gibbon Conservation Project, Hanoi, 5 pp.

Traeholt, C., Bonthoeun, R., Rawson, B., Samuth, M., Virak, C., and Sok Vuthin (2005). *Status review of pileated gibbon, Hylobates pileatus and yellow-cheeked crested gibbon, Nomascus gabriellae, in Cambodia*, FFI Cambodia Programme Office, Phnom Penh, 59 pp.

WCS (2003). *Biodiversity profile for Luang Namtha Province, final version, November 20 2003*. Report produced for Science, Technology and Environment Agency and UNDP for the Lao PDR. Biodiversity Country Report by the WCS Lao program, 60 pp. (Downloadable from www.directoryofngos.org/project.cfm?id=58)

Zhang, Y., Quan, G., Yang, D., Liu, Z., and Sheeran, L. (1995). Population parameters of the black gibbon in China. In Xia, W., and Zhang, Y. (eds.), *Chinese primate research and conservation*, China Forestry Publishing House, Beijing, pp. 203-220.

Zusammenfassung

Erste Freilanddaten vom Laotischen Schwarzen Schopfgibbon (*Nomascus concolor lu*) des Nam Kan Gebietes in Laos

Der rätselhafte Laotische Schwarze Schopfgibbon (*Nomascus concolor lu*) blieb seit seiner Entdeckung im Jahre 1939 im Freiland kaum untersucht. Sein Verbreitungsgebiet stellt eine biogeographische Anomalie dar: Es liegt wie eine Enklave im sonst von Weisswangen-Schopfgibbons (*N. leucogenys*) bewohnten Nordlaos, mehrere 100 km entfernt vom nächsten Vorkommen Schwarzer Schopfgibbons (*N. concolor*) in der chinesischen Provinz Yunnan. Während einer Expedition in das Nam Kan Tal der Provinz Bokeo (Nordwest-Laos) während der Trockenzeit konnte ich bestätigen, dass die Schwarzen Schopfgibbons dort immer noch vorkommen. Das Gebiet liegt innerhalb des Nam Kan Provinz-Schutzgebietes und scheint sich relativ nahe bei der Typuslokalität dieser Gibbonform zu befinden. Diese Studie präsentiert erste Daten zu Rufverhalten, Populationsdichte, Gruppenzusammensetzung, Bedrohungsstatus und systematischer Verwandtschaft dieser Gibbons.

Der für Gibbons geeignete Lebensraum im Untersuchungsgebiet liegt vorwiegend auf Hängen von über 550 m, während der Wald im Talboden weitgehend gerodet oder stark ausgeholzt ist. Während 14 Tagen wurden 62 Gibbongesänge gehört (im Durchschnitt 4.4 Gesänge pro Tag), von denen die Mehrheit (65%) zwischen 06:00 und 07:00 Uhr und alle zwischen 06:00 and 13:00 Uhr begannen. Fünf beobachtete Gruppen bestanden aus 2 bis 5 oder 6 Individuen (Durchschnitt 3.6–3.8). Die Gesänge stammten von 13 verschiedenen Gibbongruppen, und die geschätzte Populationsdichte im untersuchten Gebiet betrug grob 2.2 Gruppen/km^2 oder 8–8.4 Individuen/km^2. Interviews mit Bewohnern des Nam Kan Tales ergaben, dass die dortigen Gibbons seit 1975 unter einem Jagdtabu stehen. Dies dürfte zur relativ hohen Gibbondichte in diesem Gebiet beigetragen haben und gibt Anlass zur Hoffnung für die Zukunft dieser Gibbons. Die Gesänge aus dem Nam Kan Tal gleichen denen anderer Schwarzer Schopfgibbons aus China und Vietnam, unterscheiden sich aber stark von denen der Nördlichen Weisswangen-Schopfgibbons (*N. leucogenys*).

Eine zusätzliche Expedition wurde in das weiter südlich gelegene Tal des Flusses Nam Tha durchgeführt, um zu untersuchen, ob dieser Fluss die gemeinsame Grenze zwischen *N. concolor* und *N. leucogneys* darstellen könnte. Die Gegend erwies sich aber als weitgehend entwaldet. Interviews in verschiedenen Dörfern ergaben, dass die Gibbons dort vor etwa 30-40 Jahren ausgestorben waren. Des Weiteren fielen die Interviewdaten zu widersprüchlich aus, als dass sich daraus nachträglich die Gibbonart hätte bestimmen lassen, die früher in den Wädern beidseits desNam Tha gelebt hatte.

Tooth eruption in two agile gibbons (*Hylobates agilis*)

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Although the eruption stage of teeth is often used for a quick assessment of maturation in mammals, little is known about tooth-eruption in gibbons in general and specifically about the eruption of permanent teeth. In this study, we present longitudinal data on tooth-eruption in two captive agile gibbons (*Hylobates agilis*). The eruption of the deciduous dentition started around the age of one week, and was completed around the age of five months. This result was similar to findings of earlier studies on other gibbon species. The eruption of permanent teeth started at the age of 1.4 years and was completed at the age of around 6.6 years. There were individual differences between subjects both in the age at which certain teeth erupted and in the sequence of their eruption. A comparison with data on other primates suggests that ages of individual teeth eruptions in agile gibbons were similar to those of Japanese macaques, but occurred earlier than in chimpanzees and humans. As our gibbon sample is very small, observations on additional individuals are required in order to assess the generality of this result.

Introduction

The value of tooth eruption data is now well established for the comparisons of growth rate and life history of primate species (Smith *et al*., 1994; Swindler, 2002). Smith *et al.* (1994) compiled comprehensive data on the ages of eruption of all teeth for a wide array of primates and pointed out the glaring deficiency of data on gibbons (Hylobatidae). Our present knowledge of tooth eruption in gibbons can be summarized as follows.

Published information on deciduous tooth eruption encompasses 14 individuals, but several reports provide fragmentary data only (Badham, 1967; Ibscher, 1967, p. 56; Keith, 1931, p. 57; Robinson, 1925; Schultz, 1944, p. 41). The few cases that are described in more detail include a hybrid gibbon (*Hylobates lar* x *H. moloch*) and a siamang (*Symphalangus syndactylus*) at the San Diego Zoo (Rumbaugh, 1967a, 1967b), and seven white-handed gibbons (*H. lar*) and one crested gibbon (*Nomascus leucogenys*) at the Takarazuka Zoological and Botanical Gardens (Araki *et al*., 1989). These two studies suggested that the eruption of the deciduous dentition in gibbons starts soon after birth and is completed at the age of about six months. Intervals of dentition checks were unspecified in all previous studies, making it impossible to assess the accuracy of reported ages at which eruptions occurred. The number of the available samples is too small to determine whether there are differences among gibbon genera or species.

There does not appear to be any published information on the ages of permanent tooth eruption in gibbons. Based on their evaluation of earlier reports (Keith, 1931; Schultz, 1933, 1935, 1956), Smith *et al*. (1994) suggested that the first molar erupts around the age of 1.75 years and the dentition was complete at the age of about 7.5 years, but noted that this result was highly tentative, because the exact age of most gibbon specimens used in these studies was unknown.

As suggested by the above, there is a great need for data on dental eruption in gibbons of exactly known age. For this purpose, we monitored the ages of each tooth eruption as well as eruption sequence in two captive-born agile gibbons (*H. agilis*).

Animals and methods

Subjects were two male agile gibbons at the Primate Research Institute of Kyoto University (KUPRI), Japan. They were full brothers, named Tsuyoshi and Raja (Fig. 1).

Tsuyoshi was born on 9th June, 1998. His mother showed various improper behaviours toward her baby, the biggest problem being that she refused to suckle. As a result, nursery rearing began eight days after birth. Tsuyoshi was fed baby formula ten times per day in the early phase of rearing, and thereafter gradually weaned at the age of two years. Various foods were then fed at least three times per day, including fruits, vegetables, eggs, meal worms, nuts, and monkey chow. Tsuyoshi was thus raised by the authors and other KUPRI staff. At the same time, daily meetings with adult gibbons, including Tsuyoshi's biological mother were scheduled to facilitate his social development as a gibbon. When Tsuyoshi was one year of age, his younger brother Raja was born. Since then, the two have been reared together. At 2.5-years-old, Tsuyoshi was returned to his mother's cage. She showed receptive behaviours to him, such as grooming and playing. He lived with her until her death, at which time he was six years old. He has not suffered from any major illness, and has remained very healthy up to the present.

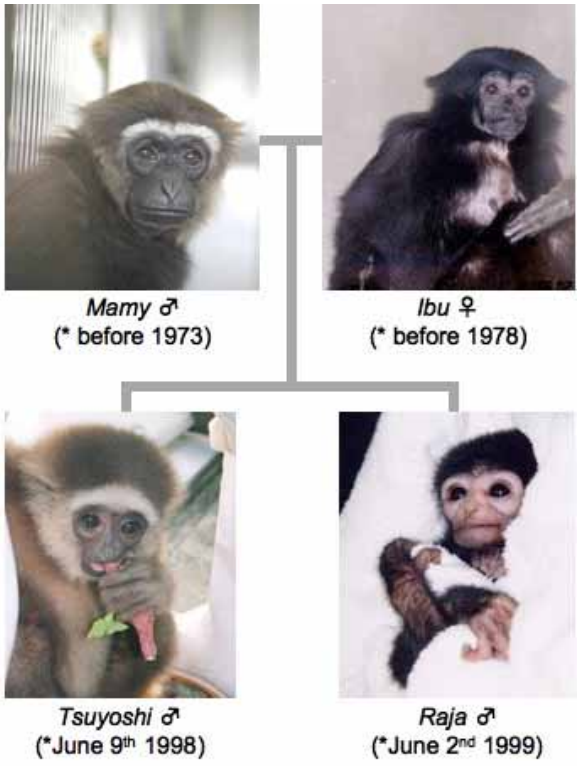

Fig. 1. Agile gibbons (and their date of birth) at the Primate Research Institute of Kyoto University (KUPRI). The subjects of this study, Tsuyoshi and Raja, were sons of the same pair. – *Die Schwarzhandgibbons und ihre Geburtsdaten am Primatenforschungsinstitut der Universität Kyoto (KUPRI). Die beiden Studientiere Tsuyoshi and Raja waren Söhne desselben Paares*.

Raja was born on 2nd June, 1999 (Fig. 2). His history was very similar to Tsuyoshi's. He was moved to nursery rearing at the age of 12 days. He was raised with Tsuyoshi from the start, and lived with his biological mother from the age of 1.5 to 5 years. One important difference was that Raja was severely bitten by his father at the age of 96 days. The injury on his left forearm was sutured and treated by veterinary staff (Fig. 3), and eventually healed. He also suffered from external piles soon after the injury described above. After getting over these disorders, he grew up in good health.

Study period for this article was from June 17th 1998 to August 27th 2005. Subjects were observed about five hours per day during the study period by the first author. This was a version of the Participant observation (Spradley, 1980; Matsuzawa, 2006), as the authors participated in the everyday activities of the subjects. Daily records on the gibbons were kept in a notebook, in cooperation with other caretakers and researchers. Dentitions were checked virtually every day when the subjects opened their mouths. Opportunities for this were common during the gibbons' daily activity, for instance when they were laughing, yawning, eating, or biting (Fig. 4). However, the upper molars were often relatively difficult to see.

Tooth eruption was defined as projection of any portion of tooth through gums, referred to as "standard gingival emergence" (Smith *et al.*, 1994). As the minimum unit, age in days after birth was used here. Ages recorded were converted to the larger units according to need (1 month = 30.4375 days, 1 year = 365.25 days). The tooth arrangements were depicted in pattern diagrams, filling in the age and order of eruption of each tooth in turn.

Tooth names were abbreviated as follows. Deciduous teeth were written in lowercase letters, and permanent teeth in CAPITALS. Tooth type was expressed by the initial letter: i or I = incisor, m or M = molar, c or C = canine, P = premolar. The number following the letter identified the position of the tooth; for example, i1=central incisor.

Fig. 2. Raja clinging to his mother Ibu soon after birth. Photo: N. Maeda. – *Raja klammert sich an seine Mutter kurz nach seiner Geburt*.

Fig. 3. Raja three days after being bitten by his father. The left forearm is swollen; the injury had to be sutured. – *Raja drei Tage nachdem er von seinem Vater gebissen wurde. Der linke Unterarm ist geschwollen und die Bisswunde musste genäht werden*.

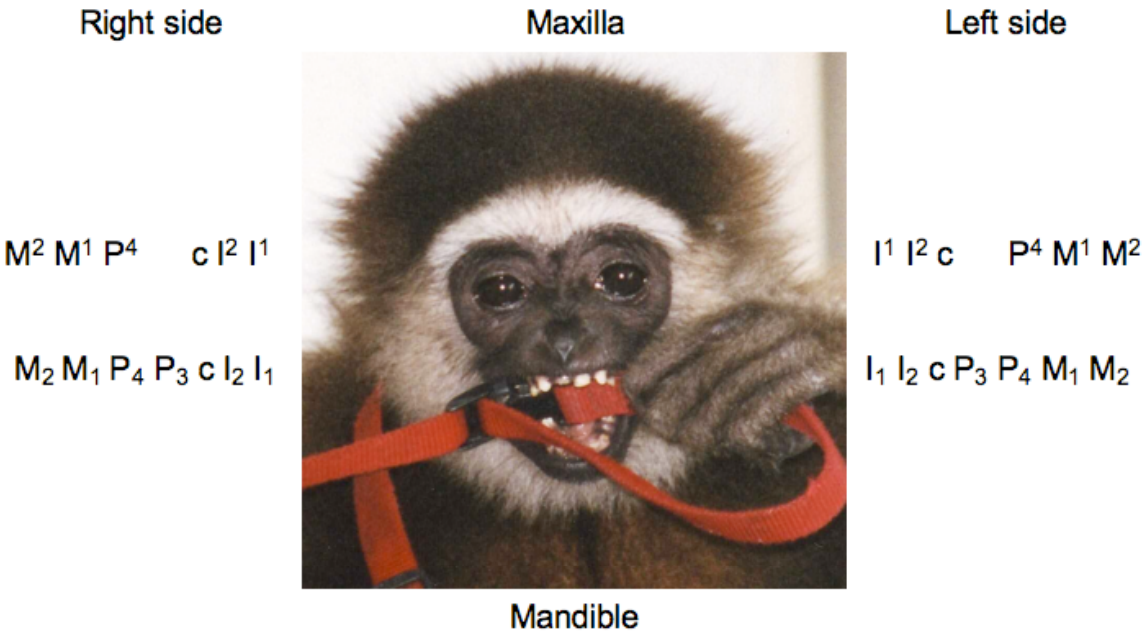

Fig. 4. The gibbons' dentitions were monitored by inspecting their mouths during daily activity. This photo was taken when Tsuyoshi was 1,512 days old. The shorthand description of his dentition on that day is also shown in the figure (see text for abbreviations). He fractured his right upper I1. Tips of his lower P3 are just projecting through the gums. – *Die Bezahnung der Gibbons wurde während ihrer täglichen Aktivitäten kontrolliert. Auf diesem Bild ist Tsuyoshi 1'512 Tage alt. Die Kurzbezeichnung seiner rechten, linken, oberen und unteren Zähne sind neben dem Bild angegeben. Die Spitzen seiner unteren Prämolaren P3 befinden sich im Durchbruch*.

Table 1. Sequence of tooth eruption in gibbons.[1] – *Reihenfolge des Zahndurchbruchs bei Gibbons*.

Reference		Sequence of eruption	
		Deciduous teeth	Permanent teeth
Schultz (1944)		i1 - i2 - m1 - c - m2	M1 - I1 - I2 - M2 - P3 & P4 - C - M3
Uchikoshi & Matsuzawa (this study)	Tsuyoshi	i1 - i2 - m1 - c - m2	M1 - I1 - I2 & M2 - P4 - P3 - C & M3
	Raja	i1 - i2 - m1 - c & m2	M1 - I1 & I2 & M2 - P3 & P4 - M3 & C

[1] Tooth types were listed from left to right in the sequence of their eruption. Abbreviations for tooth types, deciduous teeth: i1 = central incisor, i2 = lateral incisor, c = canine, m1=first molar, m2 = second molar; permanent teeth: M1 = first molar, I1 = central incisor, I2 = lateral incisor, M2 = second molar, P3 = first premolar, P4 = second premolar, C = canine, M3 = third molar.

Results

Deciduous Teeth

Results are described separately for Tsuyoshi and Raja.

When Tsuyoshi was separated from his mother at the age of 8 days, 4 central incisors and 2 lower lateral incisors had already erupted. Other teeth erupted in the sequence shown in Fig. 5, and the deciduous dentition was completed by the age of 134 days (or 4 months).

In the case of Raja, the first teeth erupted at the age of 13 days, slightly later than in the case of his brother (Fig. 5). The projection of the last tooth occurred at the age of 206 days (or 6 months), which was 2 months later than in Tsuyoshi.

The age at eruption of each tooth in each gibbon is specified in Fig. 5, and the sequence of tooth eruption is summarized in Table 1.

Comparison with previous gibbon studies

Combining data from earlier work with those from the present study, ages at which each tooth erupted and those of completion are listed in Table 2. There were individual differences in ages of each eruption; minimum range was 8 days in the case of central incisor eruption, and maximum range was over 101 days in canine eruption. Completion and eruption of the 2nd molar in Tsuyoshi occurred earlier than in other gibbon individuals (Raja, Gabrielle, Sarah, Con-chan). Tsuyoshi completed his deciduous dentition at the age of 134 days, representing the earliest recorded case. Conversely, completion and eruption of four tooth types occurred later in Raja than in other individuals. Raja completed his dentition at the age of 206 days, and this was representing the slowest recorded case. Tsuyoshi and Raja were not particularly similar to each other in their tooth eruption patterns, in spite of their close relatedness.

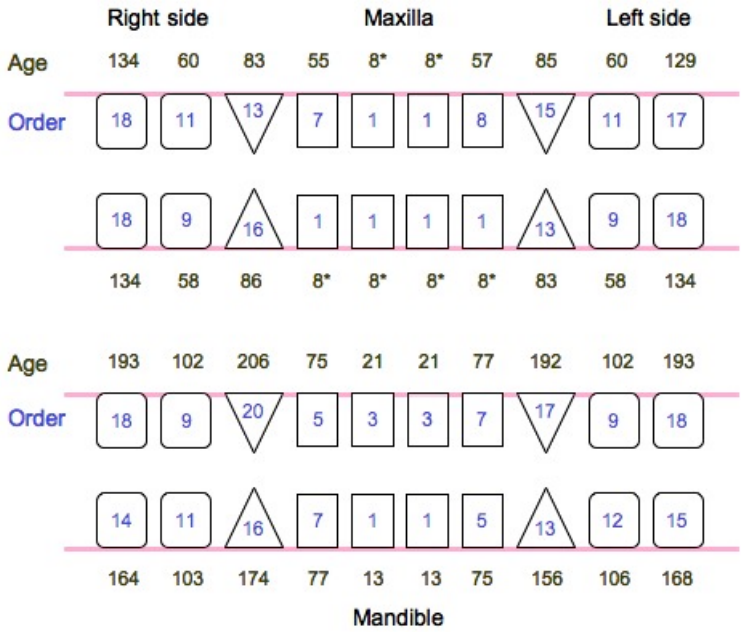

Fig. 5. Deciduous tooth eruption in Tsuyoshi (above) and Raja (below). This diagram shows the dentition from an anterior view. The pink horizontal line represents the gum line. Teeth symbols include rectangles for incisors, triangles for canines, and rounded rectangles for molars. Ages in days of each tooth eruption were indicated in the gum area of each teeth row. Tooth eruptions in several teeth may have occurred slightly earlier than we first detected them (judging by the amount of tooth projection). These teeth are identified by an asterisk. Sequences of eruption are written inside the teeth symbols in blue. – *Durchbruch der Milchzähne bei Tsuyoshi (oben) und Raja (unten). Das Diagram zeigt das Gebiss in Frontalansicht. Die waagrechten rosa Linien stellen das Zahnfleisch dar. Quadrate stehen für Schneidezähne, Dreiecke für Eckzähne und gerundete Quadrate für Molaren. Die Zahlen im Bereich des Zahnfleisches sind das Alter bei Durchbruch des betreffenden Zahnes. Aufgrund des Durchbruchsstadiums könnte der Durchbruch mancher Zähne begonnen haben, bevor wir ihn entdeckten. Solche Zähne sind mit Stern gekennzeichnet. Die Reihenfolge des Durchbruchs wird durch die blauen Zahlen innerhalb der Zahnsymbole Sequences angegeben*.

Table 2. Comparison of the ages in days at which each deciduous tooth erupted in various gibbons.[1] – *Alter in Tagen beim Durchbruch der einzelnen Zähne für verschiedene Gibbons.*

Reference	Taxon	Individual	Tooth					Comple-
			i1	i2	c	m1	m2	tion
Rumbaugh (1967a, b)	*S. syndactylus*	Sarah	10	by 48	–	–	–	by 180
Rumbaugh (1967a, b)	*H. lar* x *H. moloch*	Gabrielle	–	by 34	by 55	by 48	by 151	by 158
Araki *et al.* (1989)	*H. lar*	mean±SD[2]	6±1.4	26±17.5	96±25.0	60±16.9	141±20.0	169±13.6
Araki *et al.* (1989)	*N. leucogenys*	Con-chan	5	5	87	68	169	190
Uchikoshi & Matsuzawa (this study)	*H. agilis*	Tsuyoshi	by 8	by 8	83	58	129	134
	H. agilis	Raja	13	75	156	102	164	206
Range			5-13	5-75	by 55-156	by 48-102	129-169	134-206

[1] The age of the earliest eruption is shown.

[2] The number of individuals varies (maximum number: 7).

As suggested by the data compiled in Table 2, the eruption of the deciduous teeth in gibbons appears to begin at the age of around one week and to end at the age of about five months.

Sequences of tooth eruption in subjects were compared with the "typical sequence in gibbons" proposed by Schultz (1944), which was based on his examination of 22 infantile gibbon skulls. In Tsuyoshi, the sequence of tooth type eruption was [i1 i2 m1 c m2], identical to that reported by Schultz. In Raja, however, the last tooth to erupt was an upper canine, not an m2.

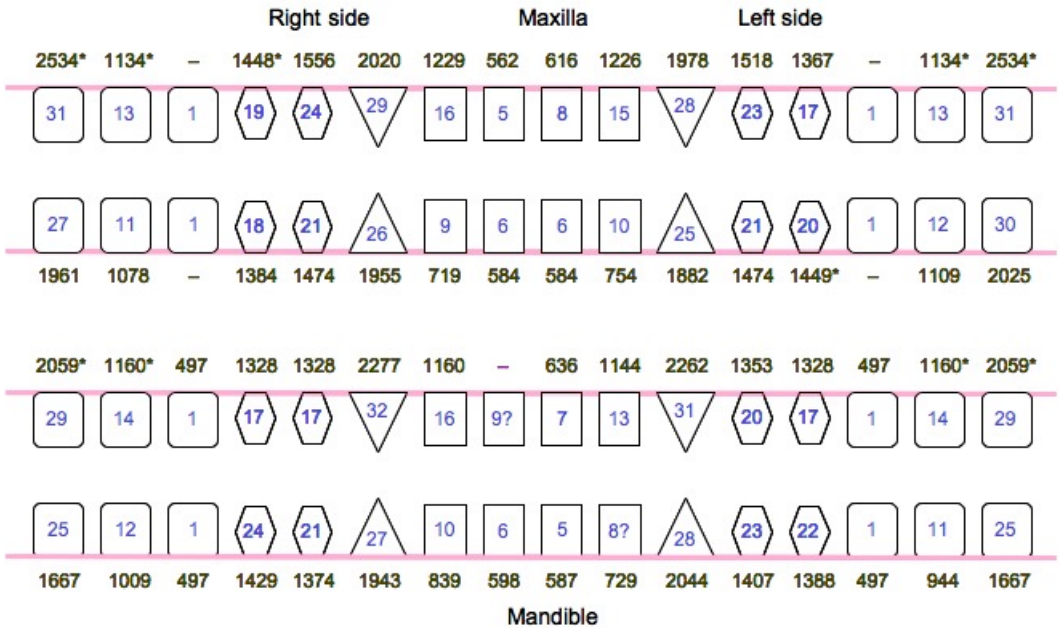

Fig. 6. Permanent tooth eruption in Tsuyoshi (above) and Raja (below). Symbols as for the deciduous teeth (Fig. 5), but hexagons are added to identify premolars. The ages at which the 1st molars in Tsuyoshi, and the upper right central incisor in Raja erupted, were not recorded. Tooth eruptions in several teeth may have occurred slightly earlier than we first detected them (judging by the amount of tooth projection). These teeth are identified by an asterisk. – *Durchbruch der Dauerzähne bei Tsuyoshi (oben) und Raja (unten). Die Zahnsymbole sind dieselben wie in Fig. 5; zusätzlich stehen Sechsecke für Prämolaren. Das Alter, bei dem die ersten Molaren von Tsuyoshi und der erste Schneidezahl oben rechts von Raja durchgebrochen sind, wurden nicht erfasst.*

Permanent teeth

In Tsuyoshi, we missed the eruption of the first permanent tooth. The reason for this loss of data was that it occurred early beyond the authors' expectation. At the age of 562 days (or 1.5-years-old), a central incisor erupted. At that point, all 1st molars had already projected (Fig. 6). By the age of 2,534 days (or 6.9-years-old), all permanent teeth had erupted.

In Raja, the first permanent teeth appeared at the age of 497 days (or 1.4-years-old); all 1st molars projected simultaneously (Fig. 6). Raja completed his dentition at the age of 2,277 days (or 6.2-years-old); earlier than in Tsuyoshi, unlike in the case of deciduous teeth completion.

Sequences of eruption for each tooth in the two subjects are shown in Fig. 6, summed up by tooth type in Table 1. There were differences between subjects in the order of eruption. For example, the last erupted tooth in Tsuyoshi was the upper 3rd molar, whereas it was a canine in Raja.

Comparison with earlier gibbon studies

Smith *et al.* (1994) suggested that the first molar erupts at the age of about 1.75 years, and the dentition is complete at the age of about 7.5 years. These stages occurred slightly earlier in our study gibbons. Schultz (1944) described the typical sequence based on observation of 118 immature, mostly wild-shot *H. lar* (Table 1). Whilst our subjects followed Schultz's order roughly, they differed from it in several points. After the permanent 1st molars, orders in the two subjects were somewhat irregular.

Discussion

Basic data on tooth eruption were collected by observing two agile gibbons for 7 years. Ages of deciduous tooth eruption in the subjects were comparable to two earlier studies (Rumbaugh, 1967a, b; Araki *et al.*, 1989), though there were individual differences (Table. 2). Combining our data with this earlier work suggested that gibbons seem to erupt deciduous teeth from around 1 week of age to around 5month of age (Table 2). However, later completions were reported in two other articles. Ibscher (1967) observed a female hybrid gibbon (*H. pileatus* x *H. lar*), whose deciduous dentition was completed at the age of 8 months. Badham (1967) mentioned that a male pileated gibbon (*H. pileatus*) of 7 months had 16 teeth other than four molars. Later ages of completion in these two individuals could have been caused by several reasons. Firstly, differences in methods of observation: the gibbon studied by Ibscher was reared by her mother, which may have made checking her dental development more difficult than in the nursery-reared gibbons of this and other studies (Araki *et al.*, 1989; Rumbaugh, 1967a, b). The pileated gibbon studied by Badham had experienced improper care from his mother, and had been removed from her at the age of 5.5 months. As the infant's body weight at the age of 7 months was 0.9 kg, it was much lighter than other gibbons of the

genus *Hylobates* that weighed more than 1.4 kg at about the same age (Tsuyoshi, Raja, and Gabrielle). This suggests that the pileated gibbon of the study may have developed later or more slowly than usual. In order to determine standard body weights of immature gibbons for each age, however, larger samples are still required.

Ages of permanent tooth eruption were revealed by the present study. Based on data from two subjects, it seems that permanent teeth in agile gibbons start to erupt at the age of 1.4 years, and complete at the age of about 6.6 years. More cases are doubtless needed to confirm the generality of this result. Accumulation of data will make it possible to investigate existence or non-existence of differences among gibbon genera or species.

The sequences of tooth eruption differ among the taxa in various ways. The first permanent tooth to erupt in all primates is the first molar; however, the last tooth to erupt is extremely variable; it may the 3rd molar, a canine, or even a premolar (Swindler, 2002). Schultz (1944) described the typical eruption sequence for gibbons based on a cross-sectional examination of 22 infantile skulls and 118 juvenile specimens of several species but mostly *H. lar*. Although the eruption sequence of our agile gibbons resembles the one published by Schultz, there are some differences (Table 2). And although the two agile gibbons were full brothers, their dental eruption patterns also differed in several respects, suggesting the occurrence of "emergence sequence polymorphisms" such as those reported for chimpanzees (Conroy and Mahoney, 1991).

A preliminary comparison of the age at the earliest eruption of each tooth type for four primate species is shown in Fig. 7. Samples were humans (mean ages, 239 individuals for deciduous teeth and 3075 males for permanent teeth), chimpanzees (mean ages, 58 individuals for deciduous teeth and 8 males for permanent teeth), Japanese macaques (median ages, 76 individuals for deciduous dentition and 59 males for permanent dentition) and agile gibbons (mean ages of two males). The figure suggests that ages of tooth eruption in agile gibbons are similar to those of Japanese macaques, whereas the same teeth erupt later in chimpanzees and later again in humans. This finding appears to be consistent with the results of morphological formation of gibbon teeth (Dirks, 1998). Probably, teeth erupt earlier in gibbons than in chimpanzees because gibbons exhibit a much lower body weight of only about one 8th of chimpanzees (Geissmann, 1993; Leigh and Shea, 1995; Rowe, 1996). In previous studies, the mean age of tooth eruption is strongly related to size, measured as mean adult body weight (Smith *et al.*, 1994). There must be many other factors which contribute to differences in life history traits; such as metabolic rate, brain weight, diet, age-specific mortality, infant care strategy, social system, phylogeny, etc. (Allman *et al.*, 1998; Dirks, 2003; Kappeler and Pereira, 2003).

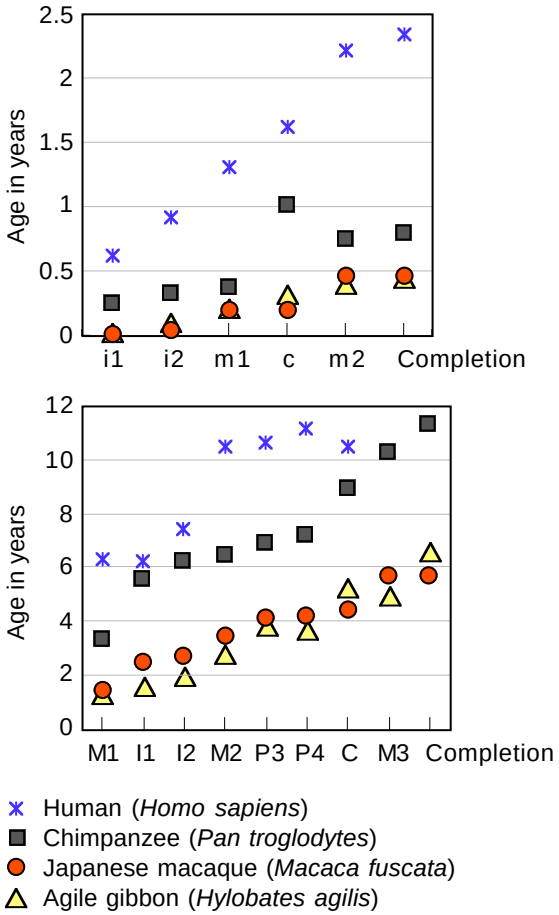

Fig. 7. Age at the earliest eruption of each tooth type for four primate species. Graph of deciduous teeth above, and that of permanent teeth below. Data for species other than gibbons are from Smith *et al.* (1994). – *Alter des frühesten Durchbruchs für jeden Zahntyp bei vier Primatenarten. Obere Graphik: Milchbezahnung; untere Graphik: Dauerbezahnung. Die Daten für die Nicht-Gibbons stammen von Smith et al. (1994)*.

Probably, features of gibbon development will become clear not only from tooth data, but also from considering the relationship between teeth and other domains, such as endocrine, morphological, cognitive and behavioural development. Comprehensive analysis of gibbon development is the next challenge, comparing data from multiple domains in the same subjects (Myowa-Yamakoshi and Tomonaga, 2001; Suzuki *et al.*, 2003). In contrast to tooth eruption, most behaviours appeared later in our subjects than in Japanese macaques, and earlier than in chimpanzees (Uchikoshi and Matsuzawa, 2002, and unpublished data; a similar view on gibbon behavioural development was suggested by Berkson, 1966). Speed differences between the growth of teeth and behavioural changes during early development might be a key feature of gibbons, assuming heterochrony (defined as a developmental change in the timing of events; see Gould, 1977).

Above, we discussed features of tooth eruption in agile gibbons, based on data from only two

subjects. Further information will clarify the standard values; we therefore hope to see reports by researchers who have similar data in the future. Maybe, such data already exists, in unpublished form, in zoos, rehabilitation centres and sanctuaries. It is also possible that relevant work has been published in non-English language journals, and thus we are unaware of it. Since the observation of tooth eruption through daily interaction is completely non-invasive, it dose not have welfare implications. Not only from a scientific perspective but also from a bioethical view-point, we can broadly recommend tooth observation. Accumulation of knowledge on hylobatid tooth eruption will help age estimation for individuals who were brought into captivity before adulthood, thereby contributing to the progress of gibbon conservation and welfare.

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References

Allman, J., Rosin, A., Kumar, R., and Hasenstaub, A. (1998). Parenting and survival in anthropoid primates: Caretakers live longer. *Proceedings of the National Academy of Sciences of the United States of the America* **95**: 6866-6869.

Araki, K., Samekawa, T., Furukawa, N., Mochizuki, Y., and Nishi, H. (1989). [Breeding and hand-rearing the white-handed gibbon, *Hylobates lar*, and the *concolor* gibbon, *Hylobates concolor* at Takarazuka zoological and botanical gardens]. *Journal of the Japanese Association of Zoological Gardens and Aquariums* **31**(2): 41-46 (Japanese text).

Badham, M. (1967). A note on breeding the pileated gibbon (*Hylobates lar pileatus*) at Twycross Zoo. *International Zoo Yearbook* **7**: 92-93.

Berkson, G. (1966). Development of an infant in a captive gibbon group. *Journal of Genetic Psychology* **108**: 311-325.

Conroy, G. C., and Mahoney, C. J. (1991). Mixed longitudinal study on dental emergence in the chimpanzees, *Pan troglodytes* (Primates, Pongidae). *American Journal of Physical Anthropology* **86**: 243-254.

Dirks, W. (1998). Histological reconstruction of dental development and age at death in a juvenile gibbon (*Hylobates lar*). *Journal of Human Evolution* **35**: 411-425.

Dirks, W. (2003). Effects of diet on dental development in four species of catarrhine primates. *American Journal of Primatology* **61**: 29-40.

Geissmann, T. (1993). *Evolution of communication in gibbons (Hylobatidae)*, Ph.D. thesis, Anthropological Institute, Philosoph. Faculty II, Zürich University, 374 pp. (Downloadable from www.gibbons.de)

Gould, S. J. (1977). *Ontogeny and phylogeny*. Harvard University Press, Cambridge, MA, 501 pp.

Ibscher, L. (1967). Geburt und frühe Entwicklung zweier Gibbons (*Hylobates lar* L.). *Folia Primatologica* **5**: 43-69.

Kappeler, P. M., and Pereira, M. E. (Eds.) (2003). *Primate life histories and socioecology*. The University of Chicago Press, Chicago.

Keith, A. (1931). *New discoveries relating to the antiquity of man*. Williams & Norgate, London, 512 pp.

Matsuzawa, T. (2006). Sociocognitive development in chimpanzees: A synthesis of laboratory work and fieldwork. In Matsuzasa, T., Tomonaga, M., and Tanaka, M. (eds.), *Cognitive development in chimpanzees.*Springer Verlag, Tokyo, pp. 13-20.

Myowa-Yamakoshi, M., and Tomonaga, M. (2001). Development of face recognition in an infant gibbon (*Hylobates agilis*). *Infant Behavior & Development* **24**: 215-227.

Leigh, S. R., and Shea, B. T. (1995). Ontogeny and the evolution of adult body size dimorphisms in apes. *American Journal of Primatology* **36**: 37-60.

Robinson, S. M. (1925). Birth of a white-handed gibbon (*Hylobates lar*) in captivity. *Journal of the Bombay Natural History Society* **30**: 456-458.

Rowe, N. (1996). *The pictorial guide to the living primates*, Pogonias Press, East Hampton, New York, viii+263 pp.

Rumbaugh, D. M. (1967a). Alvilla – San Diego Zoo's captive-born gorilla. *International Zoo Yearbook* **7**: 98-107.

Rumbaugh, D. M. (1967b). The siamang infant, Sarah… its growth and development. *Zoonooz (San Diego)* **40**(3): 12-18.

Schultz, A. H. (1933). Observations on the growth, classification and evolutionary specialization of gibbons and siamangs. *Human Biology* **5**: 212-255, and 385-428.

Schultz, A. H. (1935). Eruption and decay of the permanent teeth in primates. *American Journal of Physical Anthropology* **19**: 489-581.

Schultz, A. H. (1944). Age changes and variability in gibbons. A morphological study on a population sample of a man-like ape. *American Journal of Physical Anthropology* **2** (n.s.): 1-129.

Schultz, A. H. (1956). Postembryonic age changes. In Hofer, H., Schultz, A. H., and Starck, D. (eds.), *Primatologia. Handbuch der Primatenkunde, vol. 1: Systematik, Phylogenie, Ontogenie*, Karger, Basel and New York, pp. 887-964.

Smith, B. H., Crummett, T. L., and Brandt, K. L. (1994). Ages of eruption of primate teeth: a compendium for aging individuals and comparing life histories. *Yearbook of Physical Anthropology* **37**: 177-231.

Spradley, J. P. (1980). Participant observation. Thomson Learning Academic Resource Center, Stanford, 208 pp.

Suzuki, J., Kato, A., Maeda, N., Hashimoto, C., Uchikosi, M., Mizutani, T., Doke, C., and Matsuzawa, T. (2003). Plasma insulin-like growth factor-1, testosterone and morphological changes in the growth of captive agile gibbons (*Hylobates agilis*) from birth to adolescence. *Primates* **44**: 273-280.

Swindler, D. R. (2002). *Primate dentition. An introduction to the teeth of non-human primates.* Cambridge University Press, Cambridge, xvii+308 pp.

Uchikoshi, M., and Matsuzawa, T. (2002). Behavioral development of agile gibbons: The first four years after the birth. *Japanese Psychological Review* **45**(4): 483-499 (Japanese text, English abstract).

Zusammenfassung

Der Zahndurchbruch bei Schwarzhandgibbons (*Hylobates agilis*)

Obwohl Stadien des Zahndurchbruchs normalerweise zur raschen Beurteilung des Entwicklungszustandes und zur Altersschätzung von Säugetieren verwendet wird, ist nur wenig über den zeitlichen Verlauf des Zahndruchbruchs und insbesondere des Zahnwechsels bei Gibbons bekannt. In dieser Studie präsentieren wir Langzeitdaten zum Zahndurchbruch und –wechsel von zwei in Gefangenschaft geborenen Schwarzandgibbons (*Hylobates agilis*). Der Durchbruch der Milchzähne begann etwa im Alter von einer Woche und war im Alter von etwa fünf Monaten abgeschlossen. Dieses Resultat ähnelt den Befunden von früheren Studein an anderen Gibbonarten. Der Durchbruch der Dauerzähne begann im Alter von 1.4 Jahren und war mit 6.6 Jahren abgeschlossen. Obwohl die beiden untersuchten Gibbons Brüder waren, unterschieden sie sich sowohl im Alter, mit welchem einzelne Zähne durchbrachen, als auch in der genauen Reihenfolge des Durchbruchs einzelner Zähne. Dabei dürfte es sich um die ersten veröffentlichten Beobachtungen zum Durchbruch der Dauerzähne bei Gibbons von genau bekanntem Alter handeln. Ein Vergleich mit Daten von anderen Primaten zeigt, dass die einzelnen Zähne bei den untersuchten Gibbons ungefähr im selben Alter durchbrechen wie bei Rotgesichtsmakaken (*Macaca fuscata*), aber deutlich früher als bei Schimpansen (*Pan troglodytes*) und Menschen. Unsere Gibbon-Stichprobe ist jedoch noch sehr klein, und Beobachtungen an weiteren Individuen sind nötig, um die Allgemeingültigkeit unserer Schlussfolgerungen zu beurteilen.

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Theses

Dooley, H. (2006). *Social behaviour in gibbon groups of gibbons (*Hylobates leucogenys *and* Hylobates moloch*) at Perth Zoo*, Honour's thesis, School of Anatomy and Human Biology, University of Western Australia, viii+57 pp.

Österberg, P. (2006). *Habitat requirements and the effects of forest fragmentation on the western hoolock gibbon (*Hoolock hoolock hoolock*) in Lawachara National Park, Bangladesh*, M.Sc. thesis in Primate Conservation, Oxford Brookes University, U.K., viii+71 pp.

Vereecke, E. (2006). *The functional morphology and bipedal locomotion of* Hylobates lar *and its implication for the evolution of bipedalism in hominins*, Ph.D. thesis, Universiteit Antwerpen, Falculteit Wetenschappen, Biologie, Belgium, 308 pp.

Books and special publications

Chan, B. P. L., and Ng, S.-C. (2006). *Report of a rapid biodiversity assessment at Trung Khanh Proposed Nature Reserve, Cao Bang Province, northeast Vietnam, 20 to 24 October 2005. Kadoorie Farm & Botanic Garden Technical Report No. 4*, Kadoorie Farm & Botanic Garden, Hong Kong, ii+17 pp.

Hossain, S., and Österberg, P. (2006). *The vanishing ape. Endangered hoolocks of Lawachara*, Dhaka, Bangladesh, 14 pp.

Islam, M. A., Feeroz, M. M., Muzaffar, S. B., Kabir, M. M., and Begum, S. (2006). *Conservation of the hoolock gibbons (*Hoolock hoolock*) of Bangladesh: Population estimates, habitat suitability and management options*, United States Fish and Wildlife Service, 48 pp.

Lynam, A. J., Round, P. D., and Brockelman, W. Y. (2006). *Status of birds and large mammals in Thailand's Dong Phayayen – Khao Yai Forest Complex*, Biodiversity Research and Training (BRT) Program and Wildlife Conservation Society, Bangkok, 245 pp.

Nishorgo Support Project (2006). *Management plans for Lawachara National Park*, Nishorgo Support Project, Forest Department, Ministry of Environment & Forests, Government of Bangladesh, Dhaka, 155 pp.

Journal articles and book chapters

Amherd, D., and Ziltener, A. (2006). *Interaktionen zwischen Familienmitgliedern bei Gibbons*, Projektbericht, Blockkurs BIO 201: Methoden der Primatenethologie, Juni 2006, Anthropologisches Institut, Universität Zürich, 16 pp.

Anderson, J. R. (2006). Book review: Anne E. Russon, David R. Begun (eds). The evolution of thought: Evolutionary origins of great ape intelligence. Cambridge University Press, Cambridge, 2004. 384pp. *Primates* **47**: 180-181.

Anonymous (2006). 15 Endangered Gibbons Found in SW. China. *Xinhua News Agency, May 31, 2006, www.china.org.cn/english/scitech/169972.htm*.

Anonymous (2006). Chinese scientists find 15 world-endangered gibbons. *www.chinaview.cn, May 30, 2006, http://news.xinhuanet.com/english/2006-05/30/content_4621962.htm*.

Anonymous (2006). Ein Mädchen für die Kappengibbons. *20 Minuten* **2006**(Donnerstag, 22. Juni 2006, Zürich #118): 3.

Anonymous (2006). Major obesity gene is 'lost in the shuffle': genome evolution in lower apes erased a 'fat gene'. *Downloaded on April 02, 2006, from: www.sciencedaily.com/releases/2006/04/060401105634.htm*
www.biologynews.net/archives/2006/04/01/major_obesity_gene_is_lost_in_the_shuffle.html
http://news.biocompare.com/newsstory.asp?id=128221
www.eurekalert.org/pub_releases/2006-03/cshl-mog031606.p*hp*

Bleisch, W. V., Nadler, T., Zhang, Y., and Insua-Cao, P. (2006). Prioritization of conservation action for primates of Indochina and south China. In, *Conservation and utilization of primate resources. China Fusui International Primatological Symposium, March 29-31, 2006*, Fusui, China, pp. 1 (Abstract only).

Bouhallier, J., and Berge, C. (2006). Analyse morphologique et fonctionnelle du pelvis des primates Catarrhiniens: conséquences pour l'obstétrique (Morphological and functional analysis of the pelvis in catarrhines: consequences for obstetrics). *Comptes Rendus Palevol* **5**(3-4): 551-560.

Buckley, C., Nekaris, K. A. I., and Husson, S. J. (2006). Survey of *Hylobates agilis albibarbis* in a logged peat-swamp forest: Sabangau catchment, Central Kalimantan. *Primates* **47**: 327-335.

Carlson, K. J., and Patel, B. A. (2006). Habitual use of the primate forelimb is reflected in the material properties of subchondral bone in the distal radius. *Journal of Anatomy* **208**: 659-670.

Chatterjee, H. J. (2006). Phylogeny and biogeography of gibbons: A dispersal-vicariance analysis. *International Journal of Primatology* **27**: 699-712.

Cheyne, S. M. (2006). Wildlife reintroduction: Considerations of habitat quality at the release site. *BMC Ecology* **6**(5): 8 pp.

Cheyne, S. M. (2006). Unusual behaviour of captive-raised gibbons: implications for welfare. *Primates* **47**: 322-326.

Cheyne, S. M., and Chivers, D. J. (2006). Sexual swellings of female gibbons. *Folia Primatologica* **77**(5): 345-352.

Choudhury, A. (2006). The distribution and status of hoolock gibbon, *Hoolock hoolock*, in Manipur, Meghalaya, Mizoram, and Nagaland in Northeast India. *Primate Conservation* **20**: 79-87.

Clarke, E., Reichard, U. H., and Zuberbühler, K. (2006). The syntax and meaning of wild gibbon songs. *PLoS ONE* **1**(1): e73.

Cunningham, C. L., Anderson, J. R., and Mootnick, A. R. (2006). Object manipulation to obtain a food reward in hoolock gibbons, *Bunopithecus hoolock*. *Animal Behaviour* **71**: 621-629.

Dam, S. N. (2006). A short study on wild hoolock gibbons (*Hoolock hoolock*) in Assam and Bangladesh. *Gibbon Journal* **2**: 40-47.

Das, J., Biswas, J., Bhattacharjee, P. C., and Mohnot, S. M. (2006). First distribution records of the eastern hoolock gibbon (*Hoolock hoolock leuconedys*) from India. *Zoos' Print Journal* **21**(7): 2316-2320.

Delgado, R. A. (2006). Sexual selection in the loud calls of male primates: Signal content and function. *International Journal of Primatology* **27**: 5-25.

Fan, P.-f., Jiang, X.-l., Liu, C.-m., and Luo, W.-s. (2006). Polygynous mating system and behavioural reason of black crested gibbon (*Nomascus concolor jingdongensis*) at Dazhaizi, Mt. Wuliang, Yunnan, China. *Zoological Research* **27**(2): 216-220.

Geissmann, T. (2006). Schutz des Hainan-Schopfgibbons, des seltensten Menschenaffen der Welt: Ein Projektbericht [Conservation of the Hainan black crested gibbon, the most endangered ape species: A project report]. *Gibbon Journal* **2**: 11-13 (German text, English summary).

Geissmann, T. (2006). Forschungsbesprechung: Hulocks erhalten einen neuen Gattungsnamen [Research Review: Hoolocks get a new genus name]. *Gibbon Journal* **2**: 37-39 (German text, English summary).

Geissmann, T., and Nijman, V. (2006). Calling in wild silvery gibbons (*Hylobates moloch*) in Java (Indonesia): Behavior, phylogeny, and conservation. *American Journal of Primatology* **68**: 1-19.

Geissmann, T., Nijman, V., and Dallmann, R. (2006). The fate of diurnal primates in southern Sumatra. *Gibbon Journal* **2**: 18-24.

Geissmann, T., Traber, S., and von Allmen, A. (2006). Das Nangunhe-Naturreservat, Provinz Yunnan, China: Ein Projektbericht [Nangunhe Nature Reserve, Yunnan Province, China: A project report]. *Gibbon Journal* **2**: 14-17 (German text, English summary).

Hong, K.-W., Hibino, E., Takenaka, O., Hayasaka, I., Murayama, Y., Ito, S., and Inoue-Murayama, M. (2006). Comparison of androgen receptor CAG and GGN repeat length polymorphism in humans and apes. *Primates* **47**: 248-254.

Horton, K. E., and Caldwell, C. A. (2006). Visual co-orientation and expectations about attentional orientation in pileated gibbons (*Hylobates pileatus*). *Behavioural Processes* **72**(1): 65-73.

Insua-Cao, P. (2006). FFI's community patrol group model for protecting critically endangered primates in northern Vietnam. In, *Conservation and utilization of primate resources. China Fusui International Primatological Symposium, March 29-31, 2006*, Fusui, China, pp. 17-18 (Abstract only).

Isler, K., Payne, R. C., Günther, M. M., Thorpe, S. K. S., Li, Y., Savage, R., and Crompton, R. H. (2006). Inertial properties of hominoid limb segments. *Journal of Anatomy* **209**: 201-218.

Jiang, X., Luo, Z., Zhao, S., Li, R., and Liu, C. (2006). Status and distribution pattern of black crested gibbon (*Nomascus concolor jingdong-ensis*) in Wuliang Mountains, Yunnan, China: Implication for conservation. *Primates* **47**: 264-271.

Kramer, K. (2006). Tiere: Wechsellied der Zaunkönige. *Der Spiegel* **2006**(6, 6. Februar): 138-139.

Keith, S. A. (2006). Conservation status of the Kloss's gibbon (*Hylobates klossii*) in the Mentawai Islands, Indonesia. *Gibbon Journal* **2**: 29-32.

Konrad, R., and Geissmann, T. (2006). Vocal diversity and taxonomy of *Nomascus* in Cambodia. *International Journal of Primatology* **27**: 713-745.

Koppe, T., Röhrer-Ertl, O., Breier, S., and Wallner, C.-P. (2006). Maxillary sinus atelectasis in a wild born gibbon (*Hylobates moloch*). *Primates* **47**: 140-144.

Lee, J.-W., and Kim, H.-S. (2006). Endogenous retrovirus HERV-I LTR family in primates: Sequences, phylogeny, and evolution. *Archives of Virology* **151**: 1651-1658.

Lin, J.-y., Mo, L.-j., Zhuang, X.-y., Chen, Q., Chen, S.-h., and Zhang, J.-f. (2006). Niche breadth and overlap of the feeding plants in the forest communities as habitats for *Nomascus hainanus*. *Journal of South China Agricultural University* **27**(4): 52-57 (Chinese text).

Masali, M., and Micheletti Cremasco, M. (2006). Hoc alterum auditus organi ossiculum est: Ear ossicles in physical anthropology. *Human Evolution* **21**: 1-17.

Mittermeier, R. A., Valladares-Pádua, C., Rylands, A. B., Eudey, A. A., Butynski, T. M., Ganzhorn, J. U., Kormos, R., Aguiar, J. M., and Walker, S. (2006). Primates in peril: The world's 25 most endangered primates, 2004-2006. *Primate Conservation* **20**: 1-28.

Mootnick, A. R. (2006). Gibbon (Hylobatidae) species identification recommended for rescue or breeding centers. *Primate Conservation* **21**: 103-138.

Mootnick, A. R., Baker, E., Nadler, R. D., and Merker, B. (2006). Hostile presenting in captive gibbons. *International Journal of Primatology* **27**: 809-825.

Nakayama, K., and Ishida, T. (2006). Alu-mediated 100-kb deletion in the primate genome: The loss of the agouti signaling protein gene in the lesser apes. *Genome Research* **16**: 485-490.

Ni, Q.-y., and Ma, S.-l. (2006). Population and distribution of the black crested gibbons in southern and southeastern Yunnan. *Zoological Research* **27**(1): 34-40.

Nijman, V. (2006). Trade in Bornean gibbons. *Gibbon Journal* **2**: 33-36.

Nijman, V. (2006). *In-situ* and *ex-situ* status of the Javan gibbon and the role of zoos in conservation of the species. *Contributions to Zoology* **75**(3/4): 161-168.

Oliveira, N. M., Farrell, K. B., and Eiden, M. V. (2006). In vitro characterization of a koala retrovirus. *Journal of Virology* **80**(6): 3104-3107.

Österberg, P. (2006). Habitat requirements and the effects of forest fragmentation on the western hoolock gibbon (*Hoolock hoolock*) in Bangladesh. *Canopy (MSc in Primate Conservation Newsletter, Oxford Brookes University)* **4**(2, Spring 2006): 11.

Payne, R. C., Crompton, R. H., Isler, K., Savage, R., Vereecke, E. E., Günther, M. M., Thorpe, S. K. S., and D'Août, K. (2006). Morphological analysis of the hindlimb in apes and humans. I. Muscle architecture. *Journal of Anatomy* **208**: 709-724.

Payne, R. C., Crompton, R. H., Isler, K., Savage, R., Vereecke, E. E., Günther, M. M., Thorpe, S. K. S., and D'Août, K. (2006). Morphological analysis of the hindlimb in apes and humans. II. Moment arms. *Journal of Anatomy* **208**: 725-742.

Phakdeewirot, P., Payungporn, S., Chutinimitkul, S., Theamboonlers, A., and Poovorawan, Y. (2006). Prevalence and molecular characterization of the polymerase gene of gibbon lymphocryptovirus. *Journal of Medical Primatology* **35**: 136-143.

Pilbrow, V. (2006). Lingual incisor traits in modern hominoids and an assessment of their utility for fossil hominoid taxonomy. *American Journal of Physical Anthropology* **129**: 323-338.

Roos, C., and Nadler, T. (2006). Molecular evolution and systematics of Indochinese primates. In *Conservation and utilization of primate resources. China Fusui International Primatological Symposium, March 29-31, 2006*, Fusui, China, pp. 23 (Abstract only).

Scheumann, M., and Call, J. (2006). Sumatran orangutans and a yellow-cheeked crested gibbon know what is where. *International Journal of Primatology* **27**: 575-602.

Shanee, S., and Shanee, N. (2006). Successful gibbon rehabilitation in Thailand. *Canopy (MSc in Primate Conservation Newsletter, Oxford Brookes University)* **4**(2, Spring 2006): 15.

Six, A. (2006). Gibbons: Unsere völlig unterschätzten kleinen Brüder. *NZZ am Sonntag* **2006**(16. Juli): 58.

Srivastava, A. (2006). Conservation of threatened primates of Northeast India. *Primate Conservation* **20**: 107-113.

Such, R., and Fröhlich, D. (2006). Altes Paar mit jungem Glück. *Manati (Zeitschrift des Tiergartens Nürnberg)* **21**(1, 1 April 2006): 11-12.

Supriatna, J. (2006). Conservation programs for the endangered Javan gibbon (*Hylobates moloch*). *Primate Conservation* **21**: 155-162.

Thorén, S., Lindenfors, P., and Kappeler, P. M. (2006). Phylogenetic analyses of dimorphism in primates: Evidence for stronger selection on canine size than on body size. *American Journal of Physical Anthropology* **130**: 50-59.

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

Vereecke, E. E., D'Août, K., and Aerts, P. (2006). Locomotor versatility in the white-handed gibbon (*Hylobates lar*): A spatiotemporal analysis of the bipedal, tripedal, and quadrupedal gaits. *Journal of Human Evolution* **50**: 552-567.

Vereecke, E. E., D'Août, K., and Aerts, P. (2006). The dynamics of hylobatid bipedalism: evidence for an energy-saving mechanism? *Journal of Experimental Biology* **209**: 2829-2838.

von Allmen, A. (2006). Soziale Kommunikation bei Schopfgibbons (Gattung *Nomascus*) in zoologischen Gärten. *Gibbon Journal* **2**: 48-49 (German text).

Voisin, J.-L. (2006). Clavicle, a neglected bone: Morphology and relation to arm movements and shoulder architecture in primates. *Anatomical Record, Part A* **288A**: 944-953.

Waller, M. S. (2006). Rain and Kloss's gibbons: A travelogue from the Mentawai islands in Indonesia. *Gibbon Journal* **2**: 25-28.

Whittaker, D. J. (2006). A conservation action plan for the Mentawai primates *Primate Conservation* **20**: 95-105.

Congresses and Workshops

3. Annual Meeting of the Gibbon Conservation Alliance

28 April 2007, Tierpark Goldau, Zug, Switzerland

E-mail: info@gibbonconservation.org

Website: www.gibbonconservation.org

18' Congresso Associazione Primatologica Italiana (API)

16–18 May 2007, Calci (Pisa), Italy

E-mail: calciapi2007@yahoo.it

Website: www.unipv.it/webbio/api/api.htm

30th Annual Meeting of the American Society of Primatologists

20–23 June 2007, Wake Forest University School of Medicine in Winston-Salem, NC, U.S.A.

Website: www.asp.org/meetings/index.html

2nd Congress of the European Federation for Primatology

3–7 September 2007, Charles University in Prague, Faculty of Education Prague, Czech Republic

E-mail: marina.vancatova@seznam.cz

Website: www.pedf.cuni.cz/kbio/efp

20ème Colloque de la Société Francophone de Primatologie

Topic: "Primates: Histoires d'évolutions"

22–24 October 2007, Muséum National d'Histoire Naturelle (MNHN), Paris, France

Website: http://www-sfdp.u-strasbg.fr

22nd Kongress of the International Primatological Society

3–8 August 2008, Edinburgh International Conference Centre, Edinburgh, Scotland

E-mail: meetings@psgb.org

Website: www.ips2008.co.uk

What is the Gibbon Conservation Alliance?

Gibbon Conservation Alliance

Goals

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

Main Activities

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

Organisation

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

How Can I Become a Member?

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

Annual Membership Fees and Donations

Single member:	CHF 30.–
Students:	CHF 20.–
Bank address:	Raiffeisenbank Zürich, Limmatquai 68, CH–8001 Zürich, Switzerland
Payments from Switzerland:	
Post account:	87-71996-7
Account Nr.:	6929305
Bankclearing/Bankleitzahl:	81487
Payments from other countries:	
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IBAN:	CH32 8148 7000 0069 2930 5

How can I help the Gibbons?

Application

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

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

Title *		Mr		Ms
Family name *				
First name *				
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Zip code / City *				
Country				
Phone number				
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Remarks				

Thank you for helping us save the gibbons!