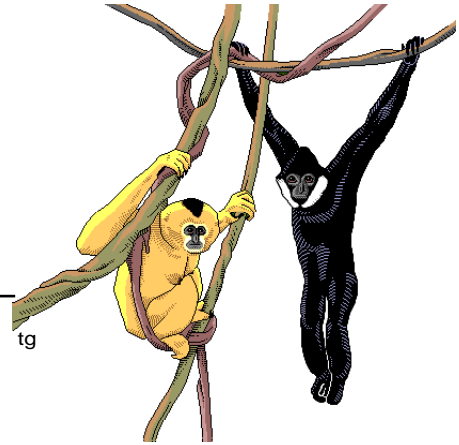


Thomas Geissmann
Institut für Zoologie
Tierärztliche Hochschule Hannover
Bünteweg 17
D – 30559 Hannover
Tel.: +49-511-953 84 31
Fax: +49-511-953 85 86
e-mail: thomas.geissmann@tiho-hannover.de
Website: www.gibbons.de



Symposium on Gibbon Diversity and Conservation

Abstracts

(as of 11 June 2002)

Dear Colleagues,

As announced last fall, I am organizing a symposium with the title “Gibbon Diversity and Conservation” at the 19th Congress of the International Primatological Society (Beijing, China, August 4-9, 2002).

I received an overwhelming total of 32 abstracts. An updated list of abstracts is presented below. As a result of the high number of participants, the symposium will last two full days.

I would like to thank everybody for their interesting contributions and I am looking forward to meeting you in Beijing.

Best wishes,

Thomas Geissmann.

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Territoriality and monogamy in hoolock gibbons

M. Farid Ahsan

Present address: EPSS/MESU, Environment Department, PO Box 67, Dubai, UAE, e-mail: mfaridahsan@yahoo.com

Permanent address: Department of Zoology, University of Chittagong, Chittagong 4331, Bangladesh, e-mail: mfahsan@ctgu.edu

Key Words: *Bunopithecus hoolock*, social behavior, Bangladesh

I collected data on territoriality and social structure of the hoolock gibbons (*Bunopithecus hoolock*). The gibbons were studied in the Lawachara area of the West Bhanugach Reserve Forest, Sylhet (Bangladesh). Data were collected between July 1989 and July 1990. Hoolock gibbons defend territories with fixed boundaries against neighbouring groups. Territorial disputes occur mainly over occupancy of food sources. The hoolock gibbon is monogamous. Monogamy appears to be maintained by adult mated females through exclusion of potentially reproductive other females, whereas adult males are opportunistically polygynous.

Hoolock gibbons in Bangladesh: Status and conservation issues

M. Farid Ahsan

Present address: EPSS/MESU, Environment Department, PO Box 67, Dubai, UAE, e-mail: mfaridahsan@yahoo.com

Permanent address: Department of Zoology, University of Chittagong, Chittagong 4331, Bangladesh, e-mail: mfahsan@ctgu.edu

Key Words: *Bunopithecus hoolock*, status, Bangladesh

The status and conservation issues of the hoolock gibbons of Bangladesh are discussed, based on primate field studies carried out since 1979. Different forested areas of the country were frequently surveyed from a conservation point of view. Habitat loss was identified as the main reason for dwindling gibbon population in Bangladesh. The major factors of habitat loss are discussed and several suggestions on how to conserve the gibbons and the biodiversity in the survey areas are presented.

Social behavior and social organization (and social traditions?) in white-handed gibbons

Thad Q. Bartlett

Department of Anthropology, The University of Texas at San Antonio, 6900 North Loop 1604 West, San Antonio, TX 78249, U.S.A., e-mail: tbartlett@utsa.edu

Key Words: *Hylobates*, social behavior, territoriality

Gibbons are broadly recognized as territorial in the classic sense of maintaining areas of exclusive use. As a result, it is commonly assumed that gibbon groups represent social isolates and that intra-group social interaction is rare and inter-group interactions are exclusively hostile. However, observations of white-handed gibbons in Khao Yai National Park, Thailand have demonstrated that inter-group encounters are not exclusively hostile and that the level of intra-group social activity is higher than previously estimated. These findings obligate a reconsideration of territoriality and social organization among gibbons.

From January 1994 to January 1995 the socio-ecology of two previously habituated gibbon social groups was studied as part of continuing research on white-handed gibbons (*Hylobates lar*) in Khao Yai National Park, Thailand. During full-day follows I recorded the occurrence of both intra- and inter-group social interactions. Affiliative social behavior was classified as wrestle play, chase play, grooming, and social contact. The overall rate of social behavior was 11% and varied considerably between months (range 3-20%). Rates of social activity were highest during the hot dry season when ripe fruit was most abundant. Grooming was the most common social activity in all age-sex classes except juveniles. All categories of social behavior were also recorded between individuals from neighboring groups. Young gibbons, in particular, regularly turned to other groups to find social partners.

I argue that affiliative social interactions between neighbors are indicative of a complex social system that can be described by a nested hierarchy. I hypothesize that at each level of this hierarchy the boundaries between groups are linked to aspects of the physical landscape and may be maintained through social traditions

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Behavioral diversity within Hylobatidae

Warren Y. Brockelman^{1,2} and Udomlux Suwanvecho²

¹ Center for Conservation Biology, ISTRD, Mahidol University, Salaya, Phutthamonthon, Nakhon Pathom 73170, Thailand, e-mail: wybrock@cscoms.com

² Department of Biology, Faculty of Science, Mahidol University, Rama VI Road, Bangkok 10400, Thailand

Key Words: adaptive radiation, Hylobatidae, territoriality

The gibbons comprise a family of 11 species of apes which started speciating at least 5 million years ago. This is ample time in which to have evolved behavioral and ecological differences among the species, yet all extant species appear to be characterized by small territorial groups, long term monogamous pairing, and loud songs which in most species are structured duets. This talk addresses three questions: (1) what behavioral variability exists among the species, (2) what is the range of variability within species, and (3) what has constrained the evolution of behavioral and ecological diversity within the family. Detailed observations of behavior and ecology exist for nearly all species, but long term observations of group formation and dynamics exist for only two: *Hylobates (Symphalangus) syndactylus* and *Hylobates lar*. The long term studies indicate that group composition and pair formation methods are more flexible than previously thought, but that long term monogamous pairing is the predominant, if not the sole, social pattern.

Gibbon species differ in details of vocal behavior, song pattern, diet, and perhaps group size, but a lack of knowledge of the range of variation within most species precludes an assessment of the significance of species differences. It is here argued that the relative lack of behavioral diversity within the family Hylobatidae is due to ecological and associated morphological constraints. Explaining how these constraints operate will require answers to the following questions: (1) why does the 'gibbon niche' require small group size and territorial behavior; (2) how have the gibbons' food resource requirements and territorial behavior prevented sympatry between the species (excepting the siamang), and hence largely restricted adaptive radiation within the family. More detailed and integrated studies of ranging, diet, foraging, and social behavior, especially competition, are needed to answer these questions.

Kalaweit Gibbons Conservation Project in Kalimantan, Indonesia

Aurelien Brule (Chanee)

Etho-Passion Society, Jl Pinus No 14, Palangka Raya, Central Kalimantan, Indonesia, e-mail: kalaweit@hotmail.com

Key Words: gibbons, rehabilitation, Indonesia

The Island of Borneo harbours an enormous variety of animal and plant species. Among the life forms found here are many primates of which two are anthropoids. The first and best known is the orang-utan (*Pongo pygmaeus*). The second, also threatened, is the gibbon. Two gibbon species occur on Borneo: the agile gibbon (*Hylobates agilis*) and the Mueller's gibbon (*Hylobates muelleri*). Etho-Passion (EP), a French society of conservation, have created the first Kalimantan gibbon conservation program: the Kalaweit Program. This program was started on 29 September 1999 with the signature of the Memorandum of Understanding between EP and the Ministry of Forestry and Estate Crops of the Republic of Indonesia. The program receives infant animals whose mothers have been killed, with the aim of avoiding the same fate for them. The rehabilitation center (Kalaweit Station) is situated in the virgin jungle of the Bukit Baka Bukit Raya National Park (181,090 ha). The gibbons' return to the wild will be a process covering several years. The Kalaweit Program shall include rehabilitation, research, socialization/information (in collaboration with several radio / TV stations), education, and technical assistance for to help the local government in the protection of the Bukit Baka Bukit Raya National Park.

Feeding habits of hoolock gibbons in the Gibbon Wildlife Sanctuary, Assam (India)

Pranab Bujarbarua¹ and S.K. Sarma²

¹ Plant Ecology Lab., Department of Botany, Gauhati University, Guwahati; P.O. Gauhati University; 781 014 Assam (India), e-mail: pranab_bujarbarua@rediffmail.com

² Plant Ecology Lab., Department of Botany, Gauhati University, Guwahati; P.O. Gauhati University; 781 014 Assam (India).

Key Words: food habits, hoolock gibbon, gibbon wildlife sanctuary

We carried out a study on the feeding habits of the primates of Gibbon Wildlife Sanctuary in Assam (India) during 1998-1999. The sanctuary harbours 7 species of non-human primates within an area of 1915.6 hectares. A total of 288 hours observation on the hoolock gibbons (*Bunopithecus hoolock*) of the sanctuary revealed that they spend 25.17% and 33.79% of their daily activity feeding during the wet and the dry season, respectively. Fruits formed 72.97% of the gibbon diet during the wet season, whereas the gibbons ate mostly leaves (young and mature) during the dry season. Besides, the gibbons also ate minor amounts of flower buds, flowers, leaf petioles, moss, algae, lichen and insects. A total number of 21 plant species belonging to 13 families and 18 genera were used as food by the gibbons of the sanctuary. Intra- and interspecific interactions were also observed during our study. Interspecific interactions involving gibbons and capped langurs were observed at food sources used by both primate species. Our study documents that leaves form a major part of the diet of hoolock gibbons of the sanctuary during the dry season, although most gibbons are usually considered to be frugivorous animals.

Biogeography of gibbons: Congruence testing with other South-east Asian primates

Helen J. Chatterjee

Grant Museum of Zoology, Department of Biology, Darwin Building, University College London, Gower Street, London, WC1E 6BT, U.K., e-mail: h.chatterjee@ucl.ac.uk

Key Words: biogeography, component analysis, congruence testing

Phylogenetic and biogeographic relationships among gibbons are investigated, and compared with macaques. Congruence between the two analyses is tested to reconstruct a model of the pattern of radiation of gibbons in South East Asia.

Multiple gene data for eleven gibbon species representing the four gibbon genera (*Nomascus*, *Symphalangus*, *Bunopithecus* and *Hylobates*) are used to reconstruct phylogenetic interrelationships. Published data, derived from the European Bioinformatic Institute's EMBL database, are analysed using maximum likelihood, parsimony and bootstrapping methods. The following genes are employed: cytochrome *b*, 12S and 16S RNA and D4. For comparison, multiple gene data (cytochrome *b*, NADH, SRY, NRAMP1, and TSPY) for sixteen species of macaque are analysed using the same methods. For each phylogenetic analysis the multiple gene data are combined to derive two consensus phylogenetic trees; one for gibbons, and one for macaques. A molecular clock is employed to provide an estimate of the date of the gibbon and macaque radiations.

The consensus phylogenetic trees for gibbons and macaques are used in biogeographic analyses to reconstruct the pattern of radiation leading to the present day distributions. Taxon area cladograms are created using distribution data in association with the consensus trees derived from the molecular analyses. Four methods of biogeographic reconstruction are employed: ancestral area analysis using irreversible parsimony, ancestral area analysis using reversible parsimony, dispersal-vicariance analysis (DIVA) and component analysis. AA and DIVA analyses are used to reconstruct patterns of radiation for gibbons and macaques. Results of the analyses are compared. Component analysis is implemented to test the congruence between the gibbon and macaque taxon area cladograms. Results of the biogeographic analyses are compared and combined with the estimates of the timing of radiations to reconstruct a model of the pattern of radiation of gibbons and macaques. The various forms of cladistic biogeography are also appraised.

Assessing the viability of rehabilitation and reintroduction of ex-captive gibbons (*Hylobates agilis albibarbis* and *Hylobates muelleri* ssp.) in Indonesian Borneo

Susan M. Cheyne

Wildlife Research Group, Department of Anatomy, University of Cambridge, Downing Street, Cambridge CB2 3DY, U.K., e-mail: fael_inis@hotmail.com

Field address: Kalaweit Care Centre, Jl. Pinus No. 14, Palangka Raya, Kalteng, Indonesia.

Key Words: gibbons, rehabilitation, Indonesia

The past 30 years have seen vast resources/research time focusing on rehabilitation/reintroduction of orang-utans throughout their home range. Until now, all similar efforts to rehabilitate ex-captive gibbons have been educated guesswork, accompanied up by little or no pre-release assessment of the suitability of the individuals involved, or follow-up monitoring. The only report on a gibbon rehabilitation project in Thailand states that all releases failed, probably due to the poor quality relationships between the released adults. Most releases from this project have been based on subjective impression and not objective scientific data. Until this issue is addressed, many released gibbons will continue to perish, having contributed nothing to the survival potential of the species.

A study was initiated in March 2002 to begin systematic behavioural assessment of ex-captive gibbons being rehabilitated at the Kalaweit Programme, Central Kalimantan. Upon arrival at Kalaweit, all gibbons are placed in quarantine cages to undergo medical testing: for TB (anti TB IgG), HepBsAb, HepBsAg, anti-HSV1 and anti-HSV2 antibodies. Gibbons are housed alone until results are known. Healthy gibbons are transported to the rehabilitation site located in the Bukit Baka/Bukit Raya National Park. Only mature subadults and adults are considered for release.

Initial findings on feeding and social behaviour, and activity patterns of the ex-captives are presented, with comparisons to wild populations. The validity of the results as tools for identifying if (a) an individual is suitable for rehabilitation and (b) a pair is suitable for release, are appraised. Also presented are future research plans and how the preliminary data is being used to plan future releases and pair compatible individuals at Kalaweit.

I suggest that several factors in the individual's life history may be involved in the differences between the gibbons' performances in the rehabilitation process.

Paternal care in a family of white-handed gibbons (*Hylobates lar*)

Zsófia Clemens¹, Mária Ujhelyi² and Björn Merker³

¹ Institute of Behavioural Sciences, Semmelweis University, Budapest, Hungary, e-mail: clemenszsofia@hotmail.com

² Institute of Behavioural Sciences, Semmelweis University, Budapest, Hungary, e-mail: bjorn.merker@kmh.se

³ Center for Research in Music Education, The Royal University College of Music, Stockholm, Sweden, e-mail: ujhmar@net.sote.hu

Key Words: *Hylobates lar*, paternal care, parental investment

Among the small apes, only siamang males are known to display extensive paternal caretaking behaviour. Here we report on paternal behaviour observed in a white-handed gibbon (*Hylobates lar*) family at the Debrecen Zoo (Hungary). The animals were observed and filmed for 4 hours, every 6 weeks, throughout one year. Behavioural measures taken from the films for the analysis were as follows: types and duration of social parent-offspring interactions; and the initiator of all dyadic social interactions. In order to get further information about parental motivations, two types of interventions were introduced: 1. preferential feeding to check patterns of food sharing; 2. alternating separation of the group members.

During the study period we observed sustained biparental care. The male was highly interested in the infant and spent a substantial amount of time in dyadic interactions with it. Although the male's interactions with the infant included most elements of maternal care, the pattern of dealing with the infant (type of care, time budget, and initiating interactions) showed marked gender differences and changes in time span. While the comfort-giving behaviours (carrying, defending) were largely carried out by the female, behaviours requiring more tolerance (such as playing and food sharing) were displayed by the father.

Because some field observations and our unpublished study on siamangs also support the presence of similar preferential maternal and paternal roles, we suggest that a tendency toward role differentiation is present in small apes which deserves further research.

Distribution and conservation of hoolock gibbons in Assam (India)

Jayanta Das^{1,2}, P.C. Bhattacharjee¹ and S.M. Mohnot²

¹ Animal Ecology and Wildlife Biology Lab., Department of Zoology, Gauhati University, Guwahati-781014, Assam, India, e-mail: gibbonconservation@yahoo.com

² Primate Research Centre, 396, 3rd 'C' Road, Sardarpura, Jodhpur 342003, India, e-mail: prcindia@sify.com

Key Words: *Bunopithecus hoolock*, status, India

The distribution in relation to time and space is the core to the evaluation of the species status. But a wider distribution range does not necessarily qualify better success and survival possibilities. Detailed surveys were carried out in 110 forests in 16 forest divisions of Assam during 1995-1997. The state Assam with a geographic area of 78,438 km² has 5 National Parks, 14 Wildlife Sanctuaries and several Reserve Forests (17,422 km²), Proposed Reserve Forests (2,815 km²), Unclassed State Forests (5,894 km²). Protected areas in Assam cover only 2.63% of the total geographic area of the state, and hoolock gibbons (*Bunopithecus hoolock*) are found in only 1.03% of the protected areas. An area of 6,405 km² has been estimated as hoolock habitat. Hoolock gibbons were recorded from 5 Protected Areas and from 62 other forests of all surveyed forests. Most protected areas are either grasslands or too small to support a viable population. The major threat for hoolock gibbons in Assam is habitat loss, followed by hunting and improper implementation of Wildlife Protection Acts and Laws. Thirty candidate priority areas and 6 conservation landscapes have been identified for future hoolock gibbon conservation in Assam.

This survey was supported by the grant agreement no. INT / FWS-22.

Effect of habitat destruction on behaviour and ecology of hoolock gibbons

Jayanta Das^{1,2} and P.C. Bhattacharjee¹

¹ Animal Ecology and Wildlife Biology Lab., Department of Zoology, Gauhati University, Guwahati-781014, Assam, India, e-mail: gibbonconservation@yahoo.com

² Primate Research Centre, 396, 3rd 'C' Road, Sardarpura, Jodhpur 342003, India, e-mail: prcindia@sify.com

Key Words: *Bunopithecus hoolock*, ecology, India

The survival of frugivorous, brachiator species like gibbons mostly depends on the continuous availability of sufficiently rich food sources throughout the year. During an extensive field study from October 1998 to December 2000, two groups of hoolock gibbons (*Bunopithecus hoolock*) were observed, one in undisturbed (Namdapha National Park) and one disturbed habitat (Borajan Reserved Forest). A major difference in the activity patterns was observed between the two habitats: In the disturbed habitat, gibbons spent less time feeding (42.78% versus 54.28%), grooming (0.94% versus 2.32%, and singing (0.63% versus 1.60%); whereas they spent more time resting (46.17% versus 33.64%), travelling (6.17% versus 5.59%) and monitoring (2.96% versus 2.14%). The distribution and abundance of the food resources in different seasons is thought to represent the major guiding factor for allocating time in various activities in different habitats. These differences in the major activities have serious long-term consequences for the survival of hoolock gibbons.

This study was supported by the grant agreement no. INT / FWS-22.

Hoolock gibbons (*Bunopithecus hoolock*) of Bangladesh: Status, distribution and conservation

Mohammed M. Feeroz

Department of Zoology, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh, e-mail: feeroz@juniv.edu

Key Words: *Bunopithecus hoolock*, conservation, Bangladesh

Among the nine species of primates of Bangladesh, hoolock gibbon *Bunopithecus hoolock* is the only lesser apes found in the evergreen and semi-evergreen forests of north-east and south-east of the country. Group size of *B. hoolock* varied from 2 to 5 (mean = 3.03, $sd \pm 0.82$, $n = 34$), population density varying from 0.5 to 1.3 gibbons/km² (mean = 0.8 gibbons/km²). This species is found in monogamous families comprising of one adult male and one adult female with their offspring. This species is sympatric with three other primate species in most of its habitat. The population of this species is declining in all other areas except the West Bhanugach Forest Reserve. This forest reserve supports nearly 30% hoolock gibbon groups of the country. Rapid degradation of the forest due to increased population pressure, highway construction, expansion of agricultural field, betel cultivation, unlimited fuel wood extraction and cattle grazing are the major constant threats for the survival of this species in Bangladesh. There is no existing laws for the protection of this species or no area has been declared as gibbon sanctuary in the country.

Gibbons: In the shadow of the great apes

Thomas Geissmann

Institute of Zoology, Tierärztliche Hochschule, Bünteweg 17, 30559 Hannover, Germany, e-mail: thomas.geissmann@gibbons.de

Key Words: species loss, vanishing apes, conservation bias

In an ever increasing way, media and scientists alike have succeeded in making us aware of the plight of the great apes, while at the same time ignoring the gibbons or small apes. We are being taught that the great apes are "neglected apes", "forgotten apes" or "vanishing apes" (book titles on great apes), and that our first conservation priority among primates should be directed at these species. A simple review of research and publication activities documents that not the great apes, but the small apes are the true neglected or forgotten apes. Similarly, a review of the population numbers suffices to show that conservation priorities should be directed at small apes. Even the most endangered species of great apes (*Pongo abelii*) still has populations of more than 10,000 individuals in the wild. In contrast, there are at least three gibbon species (e.g. *Nomascus concolor*, *N. sp. cf. nasutus*, *Hylobates moloch*) with less than 3,000 individuals. Population sizes of several gibbon species have not been estimated since the early 1980's or are "data deficient." Whereas research on, and conservation activities directed at, the great apes are supported by a strong lobby, gibbons tend to be overlooked whenever media, scientists, funding agencies and conservation agencies are referring to apes. Gibbons are largely ignored in current debates about ape conservation (bush meat, world heritage status for great apes, etc.). The long-standing tradition to favor great apes, or to ignore the small apes, has in recent years contributed to divert from the increasingly critical status of many gibbon populations and may result in the loss of several ape species. In order to survive, the small apes need to get out of the shadow of the great apes and obtain an equivalent share of attention from conservation agencies, scientists and media alike.

The Javan silvery gibbon (*Hylobates moloch*): Are there several subspecies?

Thomas Geissmann¹, Robert Dallmann² and Jennifer Pastorini³

¹ Institute of Zoology, Tierärztliche Hochschule, Bünteweg 17, 30559 Hannover, Germany, e-mail: thomas.geissmann@gibbons.de

² Institute of Zoology, Tierärztliche Hochschule, Bünteweg 17, 30559 Hannover, Germany, e-mail: robert@dallmanns.de

³ Anthropologisches Institut, Universität Zürich, Winterthurerstrasse 190, 8057 Zürich, Switzerland, e-mail: jenny@aim.unizh.ch

Key Words: systematics, rehabilitation program, conservation

Although Sody (1949) described Central Javan gibbons as a distinct subspecies (*Hylobates lar pongoalsoni*), this was not confirmed by subsequent taxonomists, and Javan gibbons (*Hylobates moloch*) are traditionally being regarded as monotypic. Recently, DNA sequence data from the control region of Javan zoo and pet gibbons were reported to suggest the presence of two genetically differentiated lineages representing different management units that should be managed separately (Supriatna *et al.* 1999; Andayani *et al.* 2001). As a result, it was concluded that pet animals from both areas cannot be pooled for a rehabilitation program and that genetic screening should be applied before sending any pets to such a program (Supriatna & Manullang 1999). Some authors accept this as evidence for the presence of two gibbon subspecies on Java (Supriatna & Wahyono 2000), and this view has also been adopted by the IUCN Red List.

We critically examine all available evidence relevant for the systematics of this species. Our analysis of fur coloration of the majority of museum skins from known Javan localities does not support the recognition of two distinct populations. A detailed analysis of gibbon song vocalizations recorded from all major wild populations of *H. moloch* weakly supports the recognition of two clades, but the boundary between them is located much more to the east than the boundary reported to exist between the molecular clades. A re-analysis of the published DNA sequences produces up to six genetically distinct clades. In addition, genetic divergences within each clade reach the range for between clade comparisons. Based on the available evidence, recognition of two subspecies is not warranted. This finding has direct implications for any programs directed at breeding and rehabilitating Javan silvery gibbons.

Where nomenclature is a stumbling block: The *Bunopithecus* problem

Colin Groves

School of Archaeology & Anthropology, Australian National University, Canberra, ACT 0200, Australia, e-mail: colin.groves@anu.edu.au

Key Words: hylobatidae, hoolock gibbon, *Bunopithecus*

The 14 or so species of gibbons (Hylobatidae) have, until recently, been placed in a single genus, *Hylobates*, with four subgenera. The hoolock gibbon is called *Hylobates (Bunopithecus) hoolock* under this scheme. It has been argued by Geissmann and others that the four subgenera would be better ranked as full genera, and this seems appropriate for many reasons – in particular, the genetic distances between them, at least as far as mtDNA is concerned, are greater than that between *Homo* and *Pan*. But generic names have a high profile in a way which subgeneric names do not, and if we are to raise the subgenera to genera we must examine whether the names are appropriate.

The name *Bunopithecus* is based on a fossil jaw fragment, with two molars, from the Middle Pleistocene site of Yanjinggou (Yenchingkou), in Sichuan, China. The name has been used for the hoolock because the molars are said to show the features by which those of the hoolock differ from other gibbons. Close examination shows that the fossil actually stands outside the range of morphology of modern gibbons; probably the genus *Bunopithecus* is valid, but refers only to the fossil species, *B. sericus*. A new generic name must be coined for the hoolock.

Status of hoolock gibbons in India: Conservation issues and concerns

Atul K. Gupta

Department of Population Management, Capture & Rehabilitation, Wildlife Institute of India, PO Box 18, Chandrabani, Dehradun 248 006, Uttaranchal, India, e-mail: akg@wii.gov.in

Key Words: *Bunopithecus hoolock*, status, India

The hoolock gibbon (*Bunopithecus hoolock*), the only ape species in India, is the western most of the nine species of lesser apes of Southeast Asia. Its distribution is restricted to the monsoon and evergreen rain forests of northeast India south of Brahmaputra River, Southern Yunnan and Myanmar up to the river Chindwin. Although, it is categorized as endangered by IUCN and listed in Schedule I of the Wildlife (Protection) Act, 1972 of India. Present knowledge of gibbon ecology and population estimate comes only from few studies. Lowland tropical rain forests in northeast India, the major gibbon habitats, are the most species-rich of the terrestrial ecosystems. These lowland forests, however, are now present in form of fragments of varying size, shape, and succession stages mainly due to agricultural expansion, illegal encroachment, shifting cultivation, establishment of tea and coffee estates, illegal logging, poaching and hunting, and diversion of forest land for developmental projects as faulty land-use policies.

The gibbons' frugivorous diet, high territoriality, and adaptation for brachiation easily make them the most threatened species in those areas where habitat loss and fragmentation have been intense. Fragmentation of the habitat may result in reduced availability of their preferred food-fruit and their highly territorial nature or 'spatial inflexibility' may prevent them from exploiting food resources in adjoining areas. Further, their brachiatory locomotion makes their movement impossible in habitats without canopy contiguity. The population size of monogamous gibbons having small family size and low reproductive output can not exceed beyond a small maximum even if environmental conditions improve. The ideal conservation measures may include both short-and long-term measures including check on fragmentation, poaching and illegal hunting for ethnic medicines, and conservation education to create awareness on the conservation of gibbons.

Distribution and conservation of the western black crested gibbon (*Nomascus concolor*) in Wuliang mountain, Yunnan province, China

Jiang Xuelong and Wang Yingxiang

Kunming Institute of Zoology, Chinese Academy of Science, Kunming 650223, China, e-mail: jiangxl@mail.kiz.ac.cn

Key Words: *Nomascus concolor*, status, China

Wuliang mountain was declared a provincial reserve in 1986 and was upgraded to a national reserve in 2000. It is located in central Yunnan, China, between the Mekong and Black rivers, and includes parts of three counties (Jingdong, Zhengyuan, and Nanjian). Ecology, behaviour and conservation of the western black crested gibbon (*Nomascus concolor*) have been studied there since 1985. The gibbon of Wuliang mountain was described as a distinct subspecies (*N. c. jingdongensis*) in 1986. Previous estimates of its population size differed widely (51-300 groups).

We present new results of a detailed survey of this population and its distribution, conducted by five teams from November 4, 2001, to January 6, 2002. Two teams surveyed the eastern slope and two teams the western slope in Jingdong and Zhengyuan, and one team surveyed the Nanjian sector. Groups were identified and located by their characteristic loud calls and direct sightings. We recorded ninety-seven gibbon groups in Wuliang. They inhabit semi-humid evergreen broad-leaved forest and mid-montane humid evergreen broad-leaved forest at elevations of 1800-2660 meters. Gibbons are more abundant in the southern part, with more groups occurring on the eastern than on the western slope. Previous reports suggested that the population was isolated in 38 forest patches ranging from 70-2500 ha in 1995.

Our current surveys show that habitat fragmentation is less severe than reported before. The population is thinly spread, however, because some neighbouring groups are separated by distances of 3-4 kilometers. The low population density is now the main concern for the conservation of this endemic subspecies. Our study also demonstrates that hunting and deforestation are still resulting in the extirpation of groups and habitat loss in some areas. In addition, road and power-line constructions are increasing the fragmentation of the population.

Community consensus on protecting Vietnam's last black gibbons

Mai Dang Khoa, James Hardcastle and Frank Momberg

Fauna & Flora International – Indochina Programme, IPO Box 78, 104B Pho Hue, Hanoi, Vietnam, e-mail: ffi@fpt.vn

Key Words: *Nomascus*, conservation strategy, Vietnam

Primate conservation initiatives in Vietnam largely fail to address a lack of law enforcement, a lack of conservation awareness, and a lack of land-use planning that takes into account the need for biodiversity conservation. Top-down approaches in protected area gazettement have alienated local communities.

Fauna & Flora International's (FFI) discovery of 39 groups of western black crested gibbons (*Nomascus concolor*) in Che Tao forest, North Vietnam, reconfirmed their continued existence in the country for the first time since the 1960's. To date a minimum of 91 individuals are confirmed in Che Tao – without doubt the largest population of the species in Vietnam, yet critically threatened by habitat fragmentation and hunting pressures.

In response, FFI initiated a strategy and action plan for the community and district authorities to take on protection activities themselves. This 'evolved' into a community-based project. Under the banner of long-term protection for gibbons in Che Tao, the project has instilled a clear-cut sense of ownership amongst both local people and district departments, to harness local capacity for conservation, and to demote FFI's role to facilitator.

Key interventions include awareness raising, household-level gibbon hunting ban agreements, community 'forest stewardship councils' to take on forest management responsibilities, and a land use mapping exercise to incorporate local resource needs into the protection strategy.

Building on the participatory approach and local consensus, the area will be gazetted as a 'Gibbon Sanctuary'. This gazettement is based on three tenets: of community co-management; of community access to resources; and local recruitment of forest rangers. Forest stewardship councils will be the foundation for the local management board of the Sanctuary.

FFI will continue to support Che Tao with an aim to build up local capacity to continue to develop a solid programme that supports conservation of gibbons, their habitat and local resource needs.

Intergroup interactions and the role of calling among siamangs

Margaret Kinnaird, Timothy O'Brien, Anton Nurcahyo and Maya Prasetyaningrum

Wildlife Conservation Society, P. O. Box 311, Bogor, 16003, Indonesia, e-mail: wcs-ip@indo.net.id

Key Words: siamang, territoriality, calling

We examine siamang calling in the context of territorial defense and describe intergroup interactions among four habituated groups in a southern Sumatran rainforest. At least three groups were followed simultaneously five days per month for one year. We recorded day range, feeding trees, frequency, location and direction of calls and counter calls, and context in which intergroup interactions occurred. Groups defended territories ranging from 14.8-26.7 hectares but territories overlapped by as much as 32%. Groups called and engaged in counter calling with neighbors more often from territory boundaries than from the center of territories. Groups directed calls and counter calls in an outward direction four times more than toward territory centers. Number of fruiting trees in a siamang territory had significant effects on frequency of monthly calling. Counter calling occurred more often when inter-group distances were ≤ 50 m and in the proximity of fruiting trees. Counter calling was more strongly influenced by number of fruiting trees than calling alone, suggesting that neighbors call and counter call more often as territories become more valuable. Percent of fruit in the diet however had no significant effect on rates of calling or counter calling, suggesting that the defensibility of fruit resources is more important than availability alone. The majority of intergroup interactions (inter-group distances ≤ 100 m) occurred in or in the proximity of fruiting trees and resulted in neutral outcomes with both groups retreating from the conflict. The smallest group with the smallest but richest territory was involved in the most intergroup interactions, and lost most frequently when there was a decisive outcome. Calling appears to be effective for territorial defense but when calling fails to mediate conflict, group size may be important. Territorial defense remains the most parsimonious explanation for evolution of calling in siamangs.

Survival rates in captive lar gibbons (*Hylobates lar*) and siamangs (*Symphalangus syndactylus*)

Christina Klein¹ and Lori K. Sheeran²

¹ International Center for Gibbon Studies, POB 800249, Santa Clarita, CA 91830, U.S.A., e-mail: gibbon1@earthlink.net

² Department of Anthropology, POB 6846, CSUF, Fullerton, CA 92834-6846, U.S.A., e-mail: lsheeran@fullerton.edu

Key Words: survival rates, parental investment, gibbons

Aspects of a species' natural history, such as predation and diet, impact on life history traits such as life span and maturation and mortality rates. We often lack data from wild populations to enable exploration of relationships between life history events and natural history, but captive populations often provide a large database from which demographic information can be gleaned. Allman *et al.* (1998)¹ used studbook and other data to explore primate mortality in terms of the caregiving roles of adults. They hypothesized that the sex that is the primary caregiver should have higher survival rates. They found that female chimpanzees, spider monkeys, orangutans, lar gibbons, gorillas, and humans had a survival advantage over males. Male siamangs and Goeldi's, owl, and titi monkeys had higher survival rates than did their female counterparts, which they argued is a consequence of these males' expanded caregiving roles. Using studbook data, we focused on lar gibbons and siamangs to further explore Allman's hypothesis and conclusions. For both species, we tested the null hypothesis that males and females have the same mortality rates. Because mortality differences may become apparent or more pronounced at particular life stages, we ran logistic regressions on four reproductive age groups spanning 8 to 20+ years. We also compared the overall mortality rates of siamangs and lar gibbons. For both species, we found that male and female mortality rates are the same. However, in all four reproductive age groups, siamangs of both sexes have a survivorship advantage over lar gibbons of both sexes. Our data do not support Allman's hypothesis that sex differences in caregiving roles yield differences in survival rates of the two sexes. Instead, we suggest that the siamang's survival advantage is related to other aspects of its natural history, such as increased folivory.

¹ Allman, J.; Rosin, A.; Kumar, R. & Hasenstaub, A. 1998: Parenting and survival in anthropoid primates: Caretakers live longer. *Proceedings National Academy of Sciences* 95(12): 6866-6888.

Multi-male siamang groups: Polyandry and cooperation in a Sumatran gibbon

Susan Lappan

New York Consortium for Evolutionary Primatology, Department of Anthropology, New York University,
25 Waverly Place, New York, NY 10003, U.S.A., e-mail: sl232@nyu.edu

Key Words: siamang, polyandry, mating system

Most early studies of hylobatid socioecology (e.g. Carpenter 1944; Chivers 1974) emphasized gibbon monogamy, characterized by long-term pair-bonds between adult males and females, cooperative territorial defense, and the gradual peripheralization and emigration of offspring as they reached maturity. However, more recently, extra-pair copulation (Reichard & Sommers 1997; Palombit 1994), transfer of immatures between groups (Oka & Takenaka 2001), and even possible cases of social polygyny (Jiang *et al.* 1999; Bleisch & Nan 1990) have been reported in gibbons. These observations demonstrate that gibbons display a much wider diversity of social and mating strategies than previously understood. At the WCS/ PHKA Way Canguk Research Station in southern Sumatra, the long-term retention of multiple adult-sized males in siamang groups is relatively common. This presentation reports new observations of polyandrous mating within three multi-male siamang groups, and discusses potential benefits of polyandry for siamang males. A possible relationship between population density and siamang social and mating strategies is proposed.

Siamangs are unusual among gibbons in that males have been reported to provide extensive care for infants, especially during the second year of infant life, in the form of infant carrying. In this study, infant carrying by all adult-sized males (and some immature males) in polyandrous groups was observed, although the frequency of infant carrying varied between males, both within and between groups. While data on the relationship between the number of males in a group and infant survival are not currently available, helping by "extra" males may provide an important benefit to dominant males. Tolerance of extra males within the group may also function to reduce the loss of paternity to extra-group males.

Social communication by the use of gestures and facial expressions within families of siamangs (*Symphalangus syndactylus*) in zoological gardens

Katja Liebal¹ and Michael Tomasello²

¹ Max-Planck-Institute for Evolutionary Anthropology, Inselstraße 22, 04103 Leipzig, Germany, e-mail: liebal@eva.mpg.de

² Max-Planck-Institute for Evolutionary Anthropology, Inselstraße 22, 04103 Leipzig, Germany, e-mail: tomas@eva.mpg.de

Key Words: intentional signals, recipient's state of attention, flexible use of signals

The vast majority of work on primate communication has concerned vocalizations, but just as important are their gestures and facial expressions, which have been studied in only a few primate species, mostly in macaques and chimpanzees. Almost nothing is known about the use of those signals in lesser apes (Hylobatidae) and the influence of social or ecological factors on the communication of those primates.

In the present study social communication using intentional signals was investigated in captive siamang groups (*Symphalangus syndactylus*). The goal was 1) to describe the signal repertoire (tactile, visual gestures, actions and facial expressions), 2) to focus on gender, sex and age differences and 3) to investigate the use of signals in terms of flexibility (context, attentional state of recipient).

Fourteen individuals of four groups each consisting of an adult pair and two or three offspring were observed in two different zoos.

During 138 hours of observation, 34 different signals containing 14 tactile and 10 visual gestures, 6 actions as well as 4 facial expressions were observed. Tactile gestures and facial expressions were observed most often. Differences between groups concerning the number and frequency of used signals were caused above all by the social constellation of the family or housing conditions. Although most of the signals were common in all individuals, some signals were only used by a particular age class. There was also an influence of age in context with the use of the signals depending on the state of the recipient. Adult siamangs performed visual signals exclusively toward an attending recipient, whereas infants used this signal category also toward a not attending individual. Differences between the repertoire of genders were less distinct.

Summarizing the signal repertoire of siamangs can be described as variable and multifaceted range of different signals, which underlies the influence of different social and ecological parameters.

Long-term field data, emerging perspectives, and human influences: The importance of integration in hylobatid conservation

Nicholas Malone¹ and Agustin Fuentes^{1,2}

¹ Department of Anthropology, University of Oregon, Eugene, OR 97403-1218, U.S.A., e-mail: nmalone@darkwing.uoregon.edu

² Department of Anthropology, Notre Dame University, Notre Dame, Indiana 46556-5639, U.S.A., e-mail: agustin.fuentes@cwu.edu

Key Words: captive management, rehabilitation, gibbon conservation

Intraspecific behavioral flexibility, as well as behavioral variability among closely related species, is becoming increasingly evident within the Order Primates. Additionally, many primate species are either considered endangered or critically endangered. Efforts to conserve and protect endangered nonhuman primates are influenced by the ways in which we view species diversity and behavioral variability, and also by how well conservationists understand human cultural, economic, and social interconnections.

Given certain complexities within the family Hylobatidae, including, but not limited to, the occurrence of naturally occurring hybridization, effective conservation of these organisms must include consideration of both long-term field observations and human cultural and scientific influences. In light of an emerging perspective of hylobatid social organization based on recent data from long-term studies of free-living populations (Brockelman *et al.* 1998; Palombit 1995) and the re-examination of existing data sets (Fuentes 2000), approaches to the rehabilitation and captive management of hylobatids should be re-evaluated. Management strategies of displaced hylobatids should also be developed in conjunction with the overall conservation goals for the species in question. For example, hylobatid breeding and public display may need to be in tight accordance with integrated conservation priorities.

We present a synthesis of data from monitoring efforts of the illegal pet-trade, a behavioral study of displaced hylobatids, and theoretical developments in hylobatid social organization. This effort emphasizes the complexities of hylobatid conservation in source countries, as well as establishes a model for the assessment of human cultural impacts. A primary goal of this paper is to provide guidance for and stress the importance of future examinations of human and hylobatid interconnections in Southeast Asia.

The importance of stress reduction when housing gibbons in a captive setting

Alan R. Mootnick

International Center for Gibbon Studies, P.O. Box 800249, Santa Clarita, CA 91380, U.S.A., e-mail: gibboncenter@earthlink.net

Key Words: captive management, enclosure design, stress management

Gibbons (Hylobatidae) naturally live in the upper canopy, are generally observed in a monogamous family unit, and are known for their territorial defense. When housing gibbons in captivity, many factors need to be taken into consideration in order to reduce their stress levels. It is not recommended to house more than one adult of the same sex in an enclosure. It is important to create visual barriers between enclosures to prevent hostile displays among gibbons. Hostile presenting between enclosures, or housing gibbons in small enclosures could cause self-mutilation, abortion, infant neglect, displaced aggression on infants, offspring to be peripheralized at an earlier age, or suppression of the immune system. It is important to gradually introduce gibbons to each other, especially if one of the gibbons is imprinted on humans. When housing immature gibbons without their parents, they should not be housed with a dominate or older gibbon who could hurt them. The removal of an offspring from its family can stress the parents or other offspring. There is the potential for a gibbon to be an inadequate parent if it did not observe parental care of siblings. Humans should not be allowed to torment gibbons, and predators should be prevented from being in close proximity to gibbon enclosures. Having a barking dog encircle an enclosure has caused some gibbons to spend up to 3 weeks looking for the dog throughout each day. Noise or machinery near gibbon enclosures could increase the chance of aborting. The use of large machinery higher than a gibbon enclosure could cause gibbons to abort. When removing gibbons from their enclosure, the best method for each situation should be taken into consideration in order to reduce their stress levels. If these suggestions are utilized when housing gibbons, they will live a much longer and healthier life.

Effect of forest fire disturbance on the demography of siamang (*Symphalangus syndactylus*) in a Sumatran rainforest

Timothy O'Brien, Margaret Kinnaird, Maya Prasetyaningrum, Anton Nurcahyo and Muhammad Iqbal

Wildlife Conservation Society, P. O. Box 311, Bogor 16003, Indonesia, e-mail: wcs-ip@indo.net.id

Key Words: siamang, demography, habitat disturbance

Few studies have attempted to quantify the effects of severe habitat disturbance on primate population dynamics, and data on the demography of lesser apes is almost non-existent. We examined demographic characteristics of a siamang (*Symphalangus syndactylus*) population (n=38 groups, 130 group-years) from 1998 through 2001 in a southern Sumatran forest recently disturbed by fires. The population was located in a national park and not subject to hunting or logging disturbance.

Groups adjacent to the burn area were smaller (3.2 vs. 4.0 individuals, $P=0.039$), produced fewer infants and juveniles (25.7% vs. 37.4%), and possessed smaller home ranges than groups in unburned forest habitat. Interbirth intervals were slightly longer for burn area groups (2.8 vs. 2.5 years), suggesting that females in the burned area may be nutritionally stressed. Most important, infant and juvenile survival was significantly lower among the burn area groups during the first four years of life. The probability of an infant surviving to the subadult stage is 0.22 for burn area groups and 0.62 for groups in better habitat. Compared to groups in unburned forest, groups in burned forest had access to less than 50% as many large *Ficus* spp. and *Dracontomelum dao* trees, the two main fruits in siamang diets. We show that groups adjacent to burned forest occupy poor quality habitat with fewer food sources, and we believe the reduced foraging time and increased resting time associated with habitat disturbance results in the lower productivity and higher mortality of young animals.

The gibbons in Vietnam: Distribution and conservation status

Pham Nhat

Faculty of Forest Resources & Environment Management, Forestry University of Vietnam, Xuanmai, Hanoi, Vietnam, e-mail: nhathuv@hn.vnn.vn

Key Words: *Nomascus*, status, Vietnam

At least 5 subspecies of gibbons are found in Vietnam, including *Nomascus concolor concolor*, *Nomascus* sp. cf. *nasutus*, *Nomascus leucogenys leucogenys*, *Nomascus leucogenys siki*, and *Nomascus gabriellae*. This paper provides information on their former and present distribution and their conservation status. The most recent studies show that the distribution areas of all subspecies have been narrowing due to habitat loss. All taxa are threatened to become extinct. Some solutions for conserving of these animals in the wild will be discussed.

Preliminary observations on wild yellow-cheeked crested gibbons (*Nomascus gabriellae*) in eastern Cambodia

Benjamin Rawson

School of Archaeology & Anthropology, The Faculties, Australian National University, Canberra ACT 0200, Australia, e-mail: ben.rawson@anu.edu.au

Key Words: *Nomascus gabriellae*, Cambodia, ecology

Samling logging concession is located in southern Mondulkiri province, Cambodia and covers some 457,000 hectares. Amongst other primate species present here is the yellow-cheeked crested gibbon (*Nomascus gabriellae*), listed as 'Vulnerable' by the IUCN Red List of Threatened Species. Found in southern Vietnam, southern Laos and eastern Cambodia, no long-term study of this species has been conducted. To rectify this a study has been initiated as of May 2002 in the Samling logging concession on the ecology and behaviour of the species. Initial findings on the species ranging, feeding and social behaviour, and activity patterns are presented here along with the potential threats to populations within the concession from hunting and habitat disturbance.

Mirror self-recognition in gibbons (*Hylobatidae*)

Tanya A. Romaniuk

P.O. Box 1375, Agoura Hills, California 91376-1375, U.S.A., e-mail: tromaniuk@earthlink.net

Key Words: self-recognition, mirror images, facial paint-marking technique

The capacity for self-recognition is one indicator of a sense of self, and humans were once considered to be unique in the capability of forming a self-concept (Gallup 1977). However, chimpanzees (*Pan paniscus*) and orangutans (*Pongo pygmaeus*) have been observed using mirrors to explore body parts and facial paint-markings that were otherwise not visible to them, thereby indicating the capacity to recognize their own reflections (Gallup 1970; Suarez & Gallup 1981; Povinelli *et al.* 1993). Monkeys appear to lack this ability (Lethmate & Dürcker 1973; Gallup 1977).

In the present study, the reactions of 16 gibbons (representing four species and three genera of *Hylobatidae*) to their mirror images were observed in order to determine whether age, sex, species, type of housing, and type of rearing differences in mirror-responsiveness exist. The facial paint-marking technique was used on eight of these gibbons in order to determine whether self-recognition is a feature exclusive to the great apes and humans, or whether it is a general characteristic of all apes and humans.

Results indicated that gibbons do respond to mirrors. They look into the mirror and they exhibit social, contingent, and exploratory behaviors. However, the gibbons that were given the facial paint-mark test failed to show conclusive evidence of self-recognition. Ten white-handed gibbons (*Hylobates lar*), three agile gibbons (*Hylobates agilis*), and one gibbon-siamang hybrid have previously failed the paint-mark test (Hyatt 1998; Lethmate & Dürcker 1973). However, one previous study (Ujhelyi *et al.* 2000) reported that a juvenile siamang (*Symphalangus syndactylus*) did exhibit a mirror-guided, mark-directed response to his facial paint-mark. Although all gibbons do not display mirror-guided, mark-directed behavior indicative of mirror self-recognition, they do respond to the mirror, indicating some understanding of themselves within their environment.

Status review of black crested gibbons (*Nomascus concolor* and *Nomascus* sp. cf. *nasutus*) in Vietnam

La Quang Trung¹, Trinh Dinh Hoang¹, Barney Long² and Thomas Geissmann³

¹ Fauna & Flora International – Indochina Programme, IPO Box 78, 104B Pho Hue, Hanoi, Vietnam, e-mail: ffi@fpt.vn

² WWF Indochina Programme Office, 53 Tran Phu, Hanoi, Hanoi, Vietnam, e-mail: barneylong@cwcom.net

³ Institute of Zoology, Tierärztliche Hochschule Hannover, Bünteweg 17, 30559 Hannover, Germany, e-mail: thomas.geissmann@gibbons.de

Key Words: *Nomascus*, status, Vietnam

The status of the crested gibbons (genus *Nomascus*) in Vietnam is poorly known. No surveys in recent times have reliably recorded the presence of the two northern species, the western black crested gibbon *Nomascus concolor* and the eastern black crested gibbon *N.* sp. cf. *nasutus*. Since 1999, FFI-Indochina (Fauna & Flora – Indochina Programme) have been conducting numerous primate-focused surveys to assess the status of these species and identify priority sites for their conservation.

Our field surveys revealed the Che Tao – Nam Pam forests (between Yen Bai and Son La provinces) and the forests of Van Ban district (Lao Cai province) as the only known sites in Vietnam where the occurrence of the western black crested gibbon has been confirmed. The population in Che Tao – Nam Pam consists of at least 40 groups and 111 individuals. In Van Ban district, 14 groups have been identified, but some of them are isolated from the main core of surviving groups.

In January 2002 we were finally able to locate the first confirmed population of *Nomascus* sp. cf. *nasutus* in Vietnam since the 1960's. This population was discovered in Trung Khanh district (Cao Bang province) and consists of about 8 individuals totally (two groups and a single male). Even if vocal and DNA analyses should indicate that the Eastern black crested gibbon in Vietnam and the Chinese Hainan gibbon are the same species, the estimated global population of the species amounts to only about 32 individuals, meaning that this gibbon is the world's most endangered primate species.

The results of our surveys highlight the critical status of these Vietnamese apes due to hunting and habitat loss. Both species are on the brink of extinction in Vietnam and, without species-focused conservation efforts, will become extirpated in the next one to ten years.

Cognitive differences among small apes based on their behaviour in the presence of mirrors

Maria Ujhelyi and Zsolia Clemens

Semmelweis University, Institute of Behavioural Sciences, Hungary, e-mail: ujhmar@net.sote.hu

Key Words: self-recognition, mirror images, gibbons

In recent years, we have carried out long term mirror experiments using 11 gibbon individuals from three genera (*Hylobates* 5, *Nomascus* spp. 2, *Symphalangus syndactylus* 4 individuals). Animals differed in the amount of interest, activity level, and types of investigative, exploratory and social behaviors exhibited in relation to the mirror image and its uses. In order to obtain further information about the nature of the individual differences, tests involving localizing hidden objects via their mirror reflections were conducted. For this purpose, the mirror was mounted outside the cage, and boxes serving as potential hiding places were affixed to the cage bars facing toward the mirror. The subjects had no previous experience with the setup and received no training.

In this situation, several individuals tried to retrieve the hidden object (visible only through the mirror) by reaching toward the mirror, that is toward the "virtual" location of the object, while others reached toward the open side of the real box. These animals appeared to realize that the object visible in the mirror really had another location, implying that they had incorporated a not directly visible part of the surroundings into their mapping of it. Only such a mental rearrangement of space can help explain their ability to retrieve the hidden object, which they did on the first attempt, that is, without trial and error.

Differences found in the hidden object situations match the different levels of mirror competence exhibited by the animals in the earlier studies. We have previously suggested that species, gender and a variety of factors in the individual's life history may be involved in the wide range of differences between the gibbons' performances in the presence of mirrors. The relative importance of these factors, and the causes of possible species differences are still unknown.

The survey project for captive gibbons in Taiwan and South-east Asia

Ci-Wen Yang¹, Hou-Chun Chen¹, Po-Chung Chang¹ and Kuang-Yu Hu²

¹ Taipei Zoo, Taiwan, 30 Sec.2 Hsin Kuang Road, Taipei, Taiwan, R.O.C., e-mail: dwx10@zoo.gov.tw

² National Defense Medical College, Taipei Taiwan.R.O.C., e-mail: kyhu@ndmctsgh.edu.tw

Key Words: gibbon identification, DNA, vocal

In 1993, the Taipei Zoo surveyed the gibbons in Taiwan and located 77 *Hylobates lar*, 3 *H. moloch*, 3 *H. muelleri*, 8 *H. pileatus*, 2 *Bunopithecus hoolock*, 11 *Nomascus* spp., and 3 *Symphalangus syndactylus*, totaling 166 gibbons. During that survey, the local government did not have accurate means to identify gibbon species.

The Taipei Zoo cooperated with the National Defense Medical College of R.O.C. to initiate the project "Phylogenetic analysis of gibbons at Taipei Zoo" in August, 1999. During that project, we collected hairs and blood for DNA analysis. The molecular indicated that 30 gibbons at the Taipei Zoo were 4 *Hylobates agilis*, 17 *H. lar*, 4 *H. muelleri*, 1 *Nomascus leucogenys*, 2 *N. gabriellae*, 1 *Symphalangus syndactylus*, and one gibbon with ambivalent sequence data. In addition, 1 gibbon housed outside the Taipei Zoo was 1 *H. muelleri*, and 2 captive gibbons at Shanghai Zoological Park were 2 *N. leucogenys*.

During a survey in 2000, we collected hairs and blood for molecular analysis and obtained photographs of gibbon fur coloration from additional zoos and conservation centers in Taiwan. In 2001, Alan Mootnick assisted a morphological survey of the gibbons housed at the Taipei Zoo and zoos in the northern region. Our surveys include 111 captive gibbons in Taiwan.

During surveys in 2002, we will tape-record song bouts of the gibbons housed in Taiwan; these will be identified by Thomas Geissmann in Germany. In cooperation with zoos in Indonesia, Malaysia, Singapore and Thailand, we have begun surveying the captive gibbons of the South East Asian Zoos Association (SEAZA). The Taipei Zoo plans to establish a comprehensive database of the captive gibbon populations in South-east Asia including molecular data, vocal data and fur coloration data. This data base could serve as an important tool for ex-situ gibbon conservation.

The population distribution and abundance of siamangs (*Symphalangus syndactylus*) and agile gibbons (*Hylobates agilis*) in west central Sumatra

Achmad Yanuar¹, David J. Chivers¹ and Jito Sugardjito²

¹ Wildlife Research Group, Department of Anatomy, University of Cambridge, Downing Street CB2 3DY, Cambridge, U.K., e-mail: ay343@yahoo.com

² Fauna and Flora International-Indonesia Program, Jl. Bangbarung Raya, Blok III, Kaveling 11, Bantar Jati, Bogor, Indonesia

Key Words: siamang, sympatry, habitat types

Two species of gibbons, the siamang (*Symphalangus syndactylus*) and the agile gibbon (*Hylobates agilis*), occur sympatrically in and around the mountaineous forests of the Barisan ridge in Kerinci-Seblat National Park (KSNP), west central Sumatra. Data on density, distribution, group size and biomass of the two hylobatids are analysed and discussed. The line-transect method was chosen and non-parametric statistics were used in calculations and analysis.

Hylobates agilis can be observed in three habitat types (lowland, hill dipterocarp and sub-montane forests), but is more common on the east side of the Barisan ridge in KSNP. Higher group densities for *H. agilis* were found in hill dipterocarp forest, and for *S. syndactylus* in montane and lowland forest.