

Volume 2 Number 1 2011

ISSN 1979-1631

# Asian Primates Journal

A Journal of the Southeast Asia, South Asia and China Sections of the IUCN/SSC Primate Specialist Group



SEAPA  
South East Asian  
Primatological  
Association

# Asian Primates Journal

A Journal of the Southeast Asia, South Asia and China Sections  
of the IUCN/SSC Primate Specialist Group

## EDITORS

### Ramesh Boonratana

Mahidol University International College, Thailand

### John R. Fellowes

Kadoorie Farm & Botanic Garden, China

### Christian Roos

IUCN-SSC PSG SE Asia (Regional Coordinator)/ German Primate Center, Germany

### Jatna Supriatna

IUCN-SSC PSG SE Asia (Regional Coordinator)/ University of Indonesia, Indonesia

## EDITORIAL ASSISTANTS

### George Amurao

Mahidol University International College, Thailand

### Rizki Ramadhan

University of Indonesia, Indonesia

### Wang Xiaochuan

Mahidol University International College, Thailand

## EDITORIAL BOARD

### Noviar Andayani

Wildlife Conservation Society, Indonesia/ University of Indonesia, Indonesia

### Mohamad Badrul

Universiti Kebangsaan Malaysia, Malaysia

### Warren Y. Brockelman

Mahidol University, Thailand

### Ardith A. Eudey

IUCN-SSC PSG, USA

### Birute M.F. Galdikas

Orangutan Foundation International, USA

### Colin Groves

Australian National University, Australia

### Ajith Kumar

National Centre of Biological Sciences, India

### Le Xuan Canh

Institute of Ecology and Biological Resources, Vietnam

### Long Yongcheng

IUCN-SSC PSG China (Regional Coordinator)/ The Nature Conservancy, China

### Russel A. Mittermeier

IUCN-SSC PSG (Chairman)/ Conservation International, USA

### Anna Nekaris

Oxford Brookes University, England

### Perry Ong

University of Philippines, Philippines

### Anthony B. Rylands

IUCN-SSC PSG (Deputy Chairman)/ Conservation International, USA

### Carel van Schaik

University of Zurich, Switzerland

### Myron Shekelle

National University of Singapore, Singapore

### Ian Singleton

Sumatran Orangutan Conservation Program, Indonesia

### Sarah Walker

IUCN-SSC PSG South Asia (Regional Coordinator)/ Zoo Outreach Organization, India

## LAYOUT

### Pratchaya Leelapratichayanont

Mahidol University International College, Thailand

## COVER PAGE

Adult male Tonkin Snub-nosed Monkey. Photo by Dong Thanh Hai

ASIAN PRIMATES JOURNAL is produced in collaboration with Conservation International, IUCN Species Survival Commission and SEAPA (South East Asian Primatological Association)



SEAPA  
South East Asian  
Primatological  
Association

# FOREWORD

At last – another issue! It has been far from plain sailing, but we are delighted to present another suite of primatological offerings from the region. Our expanded editor team and improved communications will hopefully speed things up next time, so keep those submissions coming.

We can't neatly encapsulate all the Asian primate conservation news since the last edition. Perhaps the biggest leaps in understanding are for the tarsiers, where closer examination in recent years has revealed some undiscovered species. The first Red List assessment for the Siau Island Tarsier *Tarsius tumpara*, only recently confirmed as distinct from the Endangered Sangihe Tarsier *T. sangirensis*, was completed in 2011. Alas it must be considered Critically Endangered, due to its steep recent decline and small remaining habitat. Another new species from central Sulawesi, Wallace's Tarsier *T. wallacei*, is Data Deficient and needs investigation. It's a good job there are plenty of you out there, doing what you can.

We would like to pay tribute to some key figures in the study and conservation of primates who died in 2011. John Crook, a pioneer in socio-ecology and one of the early field primatologists, who later became a distinguished scholar in Chan Buddhism, died in July aged 80. Annie Gautier-Hion, who devoted much of her life to studying the ecology and evolutionary biology of central African primates, died at 71 in November. Toshisada Nishida, who died in June at 70, did some of the earliest and most important field studies on chimpanzees, founding the Mahale field site in Tanzania. Finally Alan Mootnick, who died at 60 in November, was founder of the Gibbon Conservation Center in California, and a champion to the gibbons and siamangs. We salute the dedication, wisdom and inspirational legacy of each of these pioneers.

**Editors**

# OBSERVATIONS ON THE SEXUAL BEHAVIOUR AND BIRTH SEASONALITY OF PROBOSCIS MONKEY (*Nasalis larvatus*) ALONG THE LOWER KINABATANGAN RIVER, NORTHERN BORNEO

Ramesh Boonratana

Mahidol University International College, 999, Buddhamonthon 4 Road, Salaya, Nakhon Pathom 73170, Thailand.

E-mail: icramesh@mahidol.ac.th

## ABSTRACT

Sexual behaviour of Proboscis Monkey *Nasalis larvatus* was observed along the Lower Kinabatangan River in eastern Sabah, Bornean Malaysia, during a two-year field study. Eight sexual mounts and two non-sexual mounts in one-male groups were recorded using scan sampling and event sampling. All observed copulations comprised single mounts, with copulatory bouts averaging 25 seconds. The adult female was the solicitor when solicitations were observed with certainty. Sexual harassment by older infants and young juveniles of copulating pairs was also observed. *Nasalis larvatus* infants were observed almost throughout the study. No correlation could be established between birth dates and environmental parameters, although there appeared to be more births during the wet season.

**Keywords:** mating behaviour, sexual behaviour, sexual harassment

## INTRODUCTION

Proboscis Monkey *Nasalis larvatus* (Wurmb) is a large, sexually dimorphic, monotypic arboreal 'odd-nosed' colobine, endemic to the island of Borneo, where it is largely restricted to riverine, peat swamp, and mangrove forests of the coastal lowlands. The social structure of *N. larvatus* in the Lower Kinabatangan is flexible, comprising relatively stable one-male, all-male, and non-breeding groups. A non-breeding group refers to a loosely bonded predominantly male group with at least one female member (Boonratana, 1993, 2002). They further exhibit inter-group associations that show a secondary level of social organization, the band, with fission-fusion of stable one-male groups within bands (Boonratana, 1993, 2002).

A two-year field study was carried out on the ecology and behaviour of *N. larvatus* at Abai (N5°41', E118°22') and Sukau (N5°30', E118°17') located along the Kinabatangan River in eastern Sabah, Bornean Malaysia. Observations on the sexual behaviour of *N. larvatus* made during the study, carried out from January 1990 to December 1991, are described here. Data could not be collected in July 1990 when the author had viral fever, or in February 1991 due to unfavourable weather conditions.

The Lower Kinabatangan region (N5°20'-5°45', E117°40'-118°30') is generally flat with forests that had been subjected to different degrees of disturbance, with much of the area comprising a mosaic of open water, hills, limestone outcrops, settlements, plantations, and several ox-bow lakes at various stages of infilling (Boonratana, 1993, 2000). Overall, the region has a humid tropical climate whose annual rainfall averaged about 2,600 mm (wet months typically from October to February), and the mean diurnal temperatures from 22°C to 32°C (Scott, 1989). Being just 23 km apart, the climate seasonality was similar for both study sites. Mean temperatures did not vary much between months during the study. The mean monthly minimum for both 1990 and 1991 was 23.7°C, whereas the mean monthly maximum was 32.9°C for 1990, and 33.0°C for 1991 (Boonratana, 1993). The total rainfall was 1,816 mm for 1990, and 2,975 mm for 1991. It rained for a total of 159 days in 1990, and 183 days in 1991, or on average every other day. Dry months, with rainfall less than 50 mm, occurred in February and April 1990, and March 1991.

The principal vegetation at Abai was mangrove forest with extensive stands of *Nypa fruticans* Wurmb (Arecaceae) at the inland edge and the upper tidal limit of the estuaries, and riverine forest and lowland swamp forest beyond the influence of seawater, in the seasonally flood-prone zone. There were also patches of lowland dipterocarp forests on steep hills and flat ground. At Sukau, the vegetation in the flood-prone areas principally comprised riverine forest and freshwater swamp forest, peat swamp forest, and some open reed swamps. Meanwhile cocoa and oil palm plantations, and remnants of pristine lowland dipterocarp forest, logged-over swamp forest, and burnt lowland dipterocarp forest dominated in the flood-free zone. A full description of the botanical composition, structure, and phenology at Sukau and Abai during the study period is provided in Boonratana (1993, 2000).

## SEXUAL BEHAVIOUR OF PROBOSCIS MONKEY

No copulation was observed at the Abai study area. The habitat conditions (soft muddy substrate, entangled roots, and tidal inundations) at Abai did not allow observing any single group continuously throughout the day. Using event and scan sampling methods (Altmann, 1974), eight copulatory bouts in different one-male groups were recorded at Sukau throughout the study (Table 1).

For this study, scan samples encompassed all members of the group that could be recorded during a 2-minute period for every 15-minute time block from dawn to dusk on every full day follow. As it was possible to see more animals engaging in conspicuous activities (e.g. travelling) than in other inconspicuous activities (e.g. resting), the number of individuals recorded during each scan was weighted to reduce this bias. Each scan contributed only one point to the dataset, irrespective of how many animals were seen during the scan; all observations made during a scan were thus divided by the total number of observations made during that scan, giving the combined weightings for each scan as one (Kavanagh, 1977; Bennett, 1983; Boonratana, 1993).

Copulation in the focal one-male group, SU1, was recorded four times, twice during scan observations. Weighted scans showed that copulation made up only 0.1% of total scan observations at Sukau ( $n=4,966$ ). All copulations consisted of a single mount, ranging from 10 to 40 seconds and averaging 25 seconds. Murai (2006), at the same site, observed mostly single

mounts and some multiple mounts (up to six mounts per copulation), with the mounts averaging 27 seconds (ranging 7 to 58 seconds). At Tanjung Puting National Park, Yeager (1990) reported two instances of multiple mounts, one occurring in the context of harassment, and one during intergroup displays.

Typically in the present study, the adult female approached the adult male, presented her hindquarters in a quadrupedal position with slightly flexed legs and arms, and tail to one side. The male rested his feet on the supporting tree branch, grasped her midsection with his hands, and mounted and penetrated the female from the rear. This was followed by repeated thrusting movements by the male. During copulation, the female maintained a pouted face and pursed lips, and occasionally looked back at the male. A brief pause marked the end of the copulatory bout. The pair separated to at least a meter away after the male dismounted. After separation, both the male and female shuddered briefly. Similar observations were documented at Tanjung Puting National Park, with the exception that the male *N. larvatus* there often used a foot to clasp one of the female's hind limbs (Yeager, 1990).

In all five cases when solicitations were observed with certainty, the adult female was the solicitor. In Asian colobines, solicitations are considered almost always initiated by females (Kirkpatrick, 2007). In contrast, Murai (2006) at the same site observed that solicitation for copulation was initiated frequently by males and occasionally by females. At Tanjung Puting National Park, Yeager (1990) reported that females initiated six out of seven confirmed solicitations, and Gorzitze (1996) reported that copulations were solicited by the females in most instances. Likewise, female solicitations have also been reported for a captive *N. larvatus* group (Hollihn, 1973). Solicitations by the female in the Lower Kinabatangan, made during this study and Murai's (2006), usually began with a sexual gesture, which involved looking at the male with a pouted face, eyelids half closed, chin up and out, lips pursed forward, and occasionally shaking her head from side to side.

Although not observed in this study, Murai (2004a, 2004b, 2006) reported that sexual swelling was often visible in 77% of the mating females, with swelling most distinct in the mating subadult females. At Tanjung Puting National Park, Gorzitze (1996) reported observing reddening of the genitalia in pregnant females that lasted several days after birth of the infants.

Harassment of the mating pairs was seen five times but none were successful in stopping copula-

**Table 1.** Summary of *Nasalis larvatus* copulatory bouts observed at Sukau (n=8).

Date	Group	No. of mounts	Duration (seconds)	Harasser	Comments
21/05/90	?	1	15	Older infant	Agitated older infant bounced around the mating pair, then grabbed adult male's fur and screeched. Adult male barked at older infant but did not stop copulating.
31/08/90	SU1	1	35	Young juvenile	A young juvenile male pulled adult male's legs and rump, but did not succeed in interfering with the copulation.
28/10/90	?	1	12	Older infant	Older infant pulled the nose of the adult male, but did not stop the copulation.
14/03/91	SU1	1	12	None	Agitated older infant whimpered near the mating pair, but did not harass. Another adult female and older juvenile sat nearby and watched.
10/09/91	SU1	1	40	Young juvenile	Young juvenile pulled the nose of the adult male, but did not stop the copulation.
12/09/91	SU1	1	38	Two older infants	Two screeching older infants came towards the copulating pair. One climbed on the adult male's back, grabbed the adult male's chest and nose, but failed to stop the copulation. After copulation, the mating pair separated to about 0.5 m apart, and shuddered briefly.
18/09/91	?	1	40	None	About four minutes before copulation, adult males of a nearby predominantly male non-breeding group displayed by leaping from branch to branch.
10/11/91	SU5	1	10	None	The adult female of the mating pair was non-sexually mounted by another adult female for about two seconds before being sexually mounted by the adult male of the mating pair (see text).

tion. Older infants and young juveniles were the only age-sex classes observed harassing the mating pairs. Harassment included agitated movements, usually accompanied with 'screech' vocalizations near the mating pairs. Often the protagonists would climb the pair and grab the male's nose or other parts of his body (Table 1). Sexual harassment in *N. larvatus* was also reported at the same site (Murai, 2006), at Samunsam Wildlife Sanctuary (Bennett, 1988; Rajanathan & Bennett, 1990), and at Tanjung Puting National Park (Yeager, 1990).

Non-sexual mounts in *N. larvatus* were observed once at Abai and once at Sukau (Table 1). A non-sexual mount is defined as either homosexual or heterosexual mounting with no penile penetration. At Abai, during a play session, a young juvenile of indeterminate sex briefly mounted an older male infant. At Sukau, an adult female from SU5, another one-male group, bounced

from one tree branch to another and then started gesturing as described above. Another adult female of the same group, about four meters away on the same tree, then gestured similarly but did not bounce from branch to branch. The first female proceeded towards the second female and presented her hindquarters. The second female mounted the first, and began thrusting movements that lasted for two seconds. Both the females frequently looked at the resident male on another tree about 13 m away, from the moment the first female started gesturing. The first female proceeded, still gesturing towards the adult male and presented her hindquarters to him. He mounted her and began copulation that lasted for ten seconds.

Murai (2006) likewise observed non-sexual mounts at the same site, and these comprised female-female, female-juvenile/infant, juvenile-juvenile, and juvenile-infant pairs. Murai (2006) further reported observing

female-female mounts occurring shortly after solicitations toward males failed. Two instances of homosexual mounts in *N. larvatus* were observed at the Tanjung Puting National Park (Yeager, 1990). The first involved two adult females, with one of the females copulating with the resident male. In the second instance, an older juvenile mounted a young juvenile while they engaged in play wrestling. The function of non-sexual mounts in *N. larvatus* is still not clear. It could possibly be related to dominance (Altmann, 1962; Hall & DeVore, 1965). It could also be related to social bonding (Fedigan & Gouzoules, 1978; Reinhardt *et al.*, 1986). Conversely, it could assist in soliciting copulation, as in the mounting observed between two adult females. Non-sexual mounts likely have more than one function, apparently depending on the context of the act.

**BIRTH SEASONALITY OF PROBOSCIS MONKEY**

At birth *N. larvatus* have sparse, blackish hair and dark blue faces with snubby, upturned noses (Napier & Napier, 1967; Bennett, 1987; Bennett & Gombek, 1993). In this study young infants (up to two months old) were distinguished by their dark brown/black hair on the body and head and a dark coloured face, and older infants (two to four months old) were distin-

guished by their brown hair on the body and head but with at least some dark skin on their faces.

Young infants were present at Abai almost throughout the study, with peaks in number observed in September 1990, and to a lesser extent in January, June, and December 1991 (Fig. 1). The ratio of young infants to adult females was as high as 0.65, as observed in September 1990, while no young infants were observed in December 1990. This ratio was determined from the total number of young infants and adult females observed during monthly surveys carried out throughout the study. An August to November 1990 peak in births coincided with a wet period. The peaks in January and December 1991 similarly coincided with peak rains, and the one in June 1991 was during another wet period. No significant correlations, however, were detected between births and monthly rainfall (Spearman rank correlation,  $r_s = 0.17$ ,  $n=21$ ,  $p>0.05$ ). Nevertheless, birth peaks for 1991 were observed to coincide with the young leaf production of trees in Abai, and there was a positive correlation between young leaf production and rainfall ( $r_s=0.491$ ,  $n=21$ ,  $p<0.05$ ). There was also a significant positive correlation between fruit production and rainfall ( $r_s=0.513$ ,  $n=21$ ,  $p<0.05$ ), with the birth peaks coinciding with peak fruit production in January, September and December 1991. In addition, birth peaks in June and September 1991 were

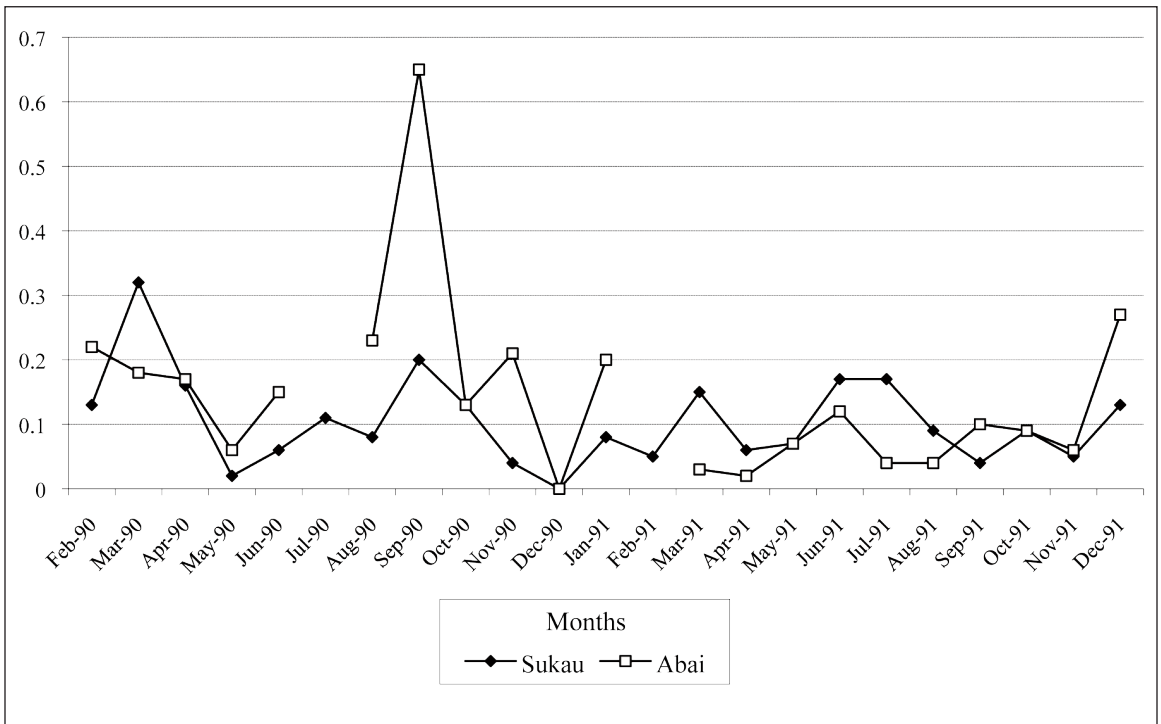


Fig. 1. Ratio of young infants per adult female observed each month.

observed to coincide with peaks in adult females' time spent feeding. This most likely relates to the costs of pregnancy and lactation (Clutton-Brock, 1977; Key & Ross, 1999; Dufour & Sauther, 2002).

At Sukau, young infants were similarly present almost throughout the study (Fig. 1), with apparent peaks in births from February to April 1990 and from July to October 1990. The highest ratio of young infants to adult females was 0.32, in March 1990, while no young infants were observed in December 1990. Although not pronounced, peaks in births in 1991 were recorded from January to March and from June to December. Both birth peaks in 1991 began earlier than in 1990; the second birth season of 1991 was prolonged. In contrast to Abai, a birth peak coincided with the only peak in the adult females' feeding time, in December 1991. Other age-sex classes also fed more in this month. No correlation was observed between phenological patterns and rainfall for the same duration, or between the different plant parts eaten and rainfall.

In the Lower Kinabatangan, this study found that *N. larvatus* had birth peaks and the highest ratios of young infants to adult females, in February/March and September 1990, and in March, June/July, and December 1991. In contrast, Murai (2004a) at the same site reported no births in September 2000, or in February, July, and August 2001. Although seasonal weather conditions (Poirier, 1970; Melnick & Pearl, 1987; Struhsaker & Leland, 1987) and rainfall-induced food supply (Lindburg, 1987; Campbell, 2007) are reported to influence birth seasonality in some primates, and a birth peak in *N. larvatus* has been recorded near the end of the rainy season in March-May in Samunsam Wildlife Sanctuary (Rajanathan & Bennett, 1990), data currently available for *N. larvatus* in the Lower Kinabatangan are not sufficient to confirm such an influence. Furthermore, proximate mechanisms influencing birth seasonality might obscure normal patterns.

## ACKNOWLEDGMENTS

This study was funded by the Wildlife Conservation Society. John R. Fellowes kindly commented on the manuscript.

## REFERENCES

- Altmann, S.A. 1962. A field study of the sociobiology of rhesus monkeys, *Macaca mulatta*. *Annals of the New York Academy of Science* **102**: 338-435.
- Altmann, J. 1974. Observational study of behavior: sampling methods. *Behaviour* **49**: 227-267.
- Bennett, E.L. 1987. Big noses of Borneo. *Animal Kingdom (March/April)*: 9-15.
- Bennett, E.L. 1988. Cyrano of the Swamps. *BBC Wildlife* **6(2)**: 71-75
- Bennett, E.L. and Gombek, F. 1993. *Proboscis Monkeys of Borneo*. Borneo Natural History and Publications, KOKTAS, Kota Kinabalu, Malaysia.
- Boonratana, R. 1993. *The Ecology and Behaviour of the Proboscis Monkey (Nasalis larvatus) in the Lower Kinabatangan*, Sabah. PhD dissertation, Mahidol University, Bangkok, Thailand.
- Boonratana, R. 2002. Social organisation of proboscis monkeys (*Nasalis larvatus*) in the Lower Kinabatangan, Sabah, Malaysia. *Malaysian Nature Journal* **56(1)**: 57-75.
- Boonratana, R. 2003. Feeding ecology of proboscis monkeys (*Nasalis larvatus*) in the Lower Kinabatangan, Sabah, Malaysia. *Sabah Parks Nature Journal* **6**: 1-26.
- Campbell, C.J. 2007. Primate sexuality and reproduction. **In:** *Primates in Perspective*, C.J. Campbell, A. Fuentes, K.C. MacKinnon, M. Panger and S.K. Bearder (eds.), pp. 423-437. Oxford University Press, New York, USA.
- Clutton-Brock, T.H. 1977. Some aspects of intraspecific variation in feeding and ranging behaviour in primates. **In:** *Primate Ecology: Studies of Feeding and Ranging Behaviour in Lemurs, Monkey, and Apes*, T.H. Clutton-Brock (ed.), pp. 539-556. Academic Press, London, UK.
- Dufour, D.L. and Sauther, M.L. 2002. Comparative and evolutionary dimensions of the energetics of human pregnancy and lactation. *American Journal of Human Biology* **14(5)**: 584-602.
- Fedigan, L.M. and Gouzoules, H. 1978. The consort relationship in a troop of Japanese monkeys. **In:** *Recent Advances in Primatology, Volume I: Behaviour*, D. Chivers (ed.), pp. 493-495. Academic Press, London, UK.
- Goritzte, A.B. 1996. Birth-related behavior in wild proboscis monkeys (*Nasalis larvatus*). *Primates* **37(1)**:75-78.
- Hall, K.R.L. and DeVore, I. 1965. Baboon social behaviour. **In:** *Primate Behaviour*, I. DeVore (ed.), pp. 53-110. Holt Rhinehart and Winston, New York, USA.



- Hollih U. 1973. Remarks on the breeding and maintenance of colobus monkeys (*Colobus guereza*), proboscis monkeys (*Nasalis larvatus*), and douc langurs (*Pygathrix nemaeus*) in zoos. *International Zoo Yearbook* **13**:185-188.
- Key, C. and Ross, C. 1999. Sex differences in energy expenditure in non-human primates. *Proceedings of the Royal Society of London. Series B: Biological Sciences* **266**(1437): 2479-2485.
- Kirkpatrick, R.C. 2007. The Asian colobines: diversity among leaf-eating monkeys. **In:** *Primates in Perspective*, C.J. Campbell, A. Fuentes, K.C. MacKinnon, M. Panger and S.K. Bearder (eds.), pp. 186-199. Oxford University Press, New York, USA.
- Lindburg, D.G. 1987. Seasonality of reproduction in primates. **In:** *Comparative Primate Biology Volume 2B: Behavior, Cognition, and Motivation*, G. Mitchell and J. Erwin (eds.), pp. 167-218. Alan R. Liss, New York, USA.
- Melnick, D.J. and Pearl, M.C. 1987. Cercopithecines in multimale groups: genetic diversity and population structure. **In:** *Primate Societies*, B.B. Smuts, D.L. Cheney, R.M. Seyfarth, R.W. Wrangham and T.T. Struhsaker (eds.), pp. 121-134. University of Chicago Press, Chicago, USA.
- Murai, T. 2004a. *Social Structure and Mating Behavior of Proboscis Monkey Nasalis larvatus (Primates; Colobinae)*. PhD dissertation, Hokkaido University, Japan.
- Murai, T. 2004b. Social behaviors of all-male proboscis monkeys when joined by females. *Ecological Research* **19**(4):451-454.
- Murai, T. 2006. Mating behaviors of the proboscis monkey (*Nasalis larvatus*). *American Journal of Primatology* **68**(8): 832-837.
- Napier, J.R. and Napier, P.H. 1967. *A Handbook of Living Primates*. Academic Press, London, UK.
- Poirier, F.E. 1970. The Nilgiri langur (*Presbytis johnii*) of South India. **In:** *Primate Behaviour: Developments in Field and Laboratory Research*, L.A. Rosenblum (ed.), pp. 251-383. Academic Press, New York, USA.
- Rajanathan, R. and Bennett, E.L. 1990. Notes on the social behaviour of proboscis monkeys (*Nasalis larvatus*). *Malayan Nature Journal* **44**: 35-44.
- Reinhardt, V., Reinhardt, A., Bercovitch, F.B. and Goy, R.W. 1986. Does intermale mounting function as dominance demonstration in rhesus monkeys? *Folia Primatologica* **47**: 55-60.
- Struhsaker, T.T. and Leland, L. 1987. Colobines: infanticide by adult males. **In:** *Primate Societies*, B.B. Smuts, D.L. Cheney, R.M. Seyfarth, R.W. Wrangham and T.T. Struhsaker (eds.), pp. 281-324. University of Chicago Press, Chicago, USA.
- Yeager, C.P. 1990. Notes on the sexual behavior of the proboscis monkey (*Nasalis larvatus*). *American Journal of Primatology* **21**: 223-227.
-

# A FIRST OBSERVATION ON THE SEXUAL BEHAVIOUR OF THE CRITICALLY ENDANGERED TONKIN SNUB-NOSED MONKEY (*Rhinopithecus avunculus*) IN NA HANG NATURE RESERVE, VIETNAM

Thanh Hai Dong<sup>1</sup>, Susan Hua<sup>2</sup> and Ramesh Boonratana<sup>3\*</sup>

<sup>1</sup> School of Archaeology and Anthropology, Faculty of Arts, A.D Hope Building (Bldg. 14), The Australian National University, Canberra, ACT 0200, Australia. E-mail: donghaifuv@yahoo.com

<sup>2</sup> 20 Aspen Road, Latham, New York 12110, USA. E-mail: susan.huaconnell@gmail.com

<sup>3</sup> Mahidol University International College, 999, Buddhamonthon 4 Road, Salaya, Nakhon Pathom 73170, Thailand. E-mail: icramesh@mahidol.ac.th

\* Corresponding author

## ABSTRACT

A first observation of the sexual behaviour of Tonkin Snub-nosed Monkey *Rhinopithecus avunculus* was made during a long-term study on the behavioural ecology of the species in its natural habitats in northern Vietnam. The copulation comprised a single mount lasting 43 seconds, and was possibly initiated by the female.

**Keywords:** copulation, single mount

## INTRODUCTION

Tonkin Snub-nosed Monkey *Rhinopithecus avunculus* (Dollman) is a slender-bodied, sexually dimorphic, arboreal, critically endangered primate, endemic to northern Vietnam, where it is largely restricted to evergreen forests associated with steep karst limestone hills (Boonratana & Le, 1994, 1998). It belongs to the Colobinae subfamily and remains relatively unstudied in comparison with the other members of the “snub-nosed” group. The basic social unit of *R. avunculus* is a one-male unit, with extra males forming all-male groups (Boonratana & Le, 1994, 1998). The social structure of *R. avunculus* is flexible with different groups coming together exhibiting a secondary level of social organization – the band (Boonratana & Le, 1994, 1998).

A long-term study on the ecology and behaviour of *R. avunculus* was carried out in northern Vietnam in the Na Hang Nature Reserve (N22°16'-22°31' & E105°22'-105°29') and in Khau Ca Forest (N22°49'-22°52' & E105°05'-105°09'). The study in the Na Hang Nature Reserve was carried out from September 2004 to August 2005, and the study in the Khau Ca Forest was carried out from September 2005 to August 2006. This paper describes an observation made in the Na Hang Nature Reserve.

Primary forest in the Na Hang Nature Reserve is largely confined to the steep hills and mountains; other

parts of the reserve have been subjected to different degrees of disturbance. Given its extremely low population size, rarity, and relative shyness, few observations on the behaviour of *R. avunculus* have been made to date; consequently, there has been no published report on the sexual behaviour of *R. avunculus*. The following describes the first observation made during this study of this species' sexual behaviour.

## SEXUAL BEHAVIOUR OF TONKIN SNUB-NOSED MONKEY

On 3 May 2005, a single-mount sexual mount was observed in a one-male unit in the Tat Tra area of the Na Hang Nature Reserve. The group consisted of six individuals – one adult male, four adult females, and a juvenile of indeterminate sex. This group was initially spotted at 08:13 h when an adult female travelled quadrupedally along a tree branch at a height estimated to be between 12 and 15 m from the ground. The first adult female sat on the branch until two other adult females joined her a few seconds later. All three females, led by the first adult female, then climbed to a higher branch (of the same tree). Soon thereafter, they were joined by the juvenile, another adult female and the adult male, in that order, all along the same path.

Moments later, one of the adult females climbed down to a lower branch, stood on all four limbs and raised her tail above and to one side of her body. The adult male followed the adult female down and positioned himself behind her, rested his feet on the supporting branch, held her midsection with both his hands, mounted and then penetrated the female from the rear. Upon penetration, the male made repeated thrusting movements that lasted for 43 seconds. The adult male sat down on the supporting branch after dismounting, waved his right forelimb in front of his face, and briefly shook his head from side to side. After copulation, the adult female climbed down to a lower branch of the same tree, and entered a neighbouring tree.

The one-male unit detected the presence of the human observers two minutes later at 08:20 h. Although the observers continued watching the group until 09:10 h, no additional copulations were observed during this period.

It is not possible to draw any generalizations from observations of a single copulatory bout. In addition, other important behaviours usually associated with copulation could have been missed, given the short duration of the observation and the observers' limited range of view.

Nevertheless, the observation described above does suggest that the female initiated the mating behaviour. Studies on *R. roxellana* Milne-Edwards (Ren, 2000; Liang *et al.*, 2000; Ren *et al.*, 2000, 2003; Zhao *et al.*, 2005, 2008) and *R. bieti* Milne-Edwards (Cui & Xiao, 2004) showed that most of the mating behaviours were initiated by the females, which typically comprise the female approaching and soliciting the male by prostrating herself with her hindquarters pointing towards the male and the resident male then mounting the female if he accepts her solicitation.

## ACKNOWLEDGMENTS

The study was funded by the Australian National University, BP Conservation Programme, Wildlife Conservation Society, Zoological Society of San Diego, Margot Marsh Biodiversity Fund, Rufford Small Grant, and Primate Conservation, Inc.

## REFERENCES

- Boonratana, R. and Le, X.C. 1994. *A Report on the Ecology, Status and Conservation of the Tonkin Snub-nosed Monkey (Rhinopithecus avunculus) in Northern Vietnam*. Unpublished report, Wildlife Conservation Society/Institute of Ecology and Biological Resources, New York, USA and Hanoi, Vietnam.
- Boonratana, R. and Le, X.C. 1998. Preliminary observations on the ecology and behaviour of the Tonkin snub-nosed monkey (*Rhinopithecus [Presbyticus] avunculus*) in Northern Vietnam. In: *The Natural History of the Doucs and Snub-nosed Monkeys*, N.G. Jablonski (ed.), pp. 207-215. World Scientific Publishing Co. Ltd., Singapore.
- Cui, L.W. and Xiao, W. 2004. Sexual behavior in a one-male unit of *Rhinopithecus bieti* in captivity. *Zoo Biology* **23**: 545-550.
- Liang, B., Zhang, S. and Wang, L. 2000. Development of sexual morphology, physiology and behaviour in Sichuan golden monkeys, *Rhinopithecus roxellana*. *Folia Primatologica* **71**: 413-416.
- Ren, R.M. 2000. *Golden Monkey Society*. Beijing University Press, Beijing, China.
- Ren, R.M., Yan, K.H., Su, Y.J., Zhou, Y. and Li, J.J. 2000. *A Field Study of the Society of Rhinopithecus roxellanae*. Beijing University, Beijing, China.
- Ren, B.P., Zhang, S., Xia, S., Li, Q., Liang, B. and Lu, M. 2003. Annual reproductive behavior of *Rhinopithecus roxellana*. *International Journal of Primatology* **24**(3): 575-589.
- Zhao, D., Li, B., Li, Y. and Wada, K. 2005. Extra-unit sexual behaviour among wild Sichuan snub-nosed monkeys (*Rhinopithecus roxellana*) in the Qinling Mountains of China. *Folia Primatologica* **76**(3): 172-176.
- Zhao, D., Li, B., Groves, C.P. and Watanabe, K. 2008. Impact of male takeover on intra-unit sexual interactions and subsequent interbirth interval in wild *Rhinopithecus roxellana*. *Folia Primatologica* **79**(2): 93-102.

# FIRST SIGHTING OF BORNEAN ORANGUTAN TWINS IN THE WILD

Benoit Goossens<sup>1,2\*</sup> Mohd Daisah Kapar<sup>3</sup>, Suhailie Kahar<sup>4</sup>, and Marc Ancrenaz<sup>3</sup>

<sup>1</sup> Danau Girang Field Centre, c/o Sabah Wildlife Department, Wisma MUIS, 88100 Kota Kinabalu, Sabah, Malaysia. E-mail: goossensbr@cardiff.ac.uk

<sup>2</sup> Cardiff University, Cardiff School of Biosciences, Biomedical Sciences Building, Museum Avenue, Cardiff CF10 3AX, UK. E-mail: goossensbr@cardiff.ac.uk

<sup>3</sup> Kinabatangan Orangutan Conservation Project, PO Box 3109, 90734 Sandakan, Sabah, Malaysia. E-mail: marc.ancrenaz@yahoo.com

<sup>4</sup> Red Ape Encounters, PO Box 3109, 90734 Sandakan, Sabah, Malaysia.

\* Corresponding author

## ABSTRACT

Twinning is a rare event in great apes, and has never been reported in wild orangutans to date. In this paper, we report the first sighting of Bornean Orangutan (*Pongo pygmaeus*) twins in the wild. In October 2007, we observed a female Northeast Bornean Orangutan (*P. pygmaeus morio*) carrying two young twins aged four to six months old along the Kinabatangan River, Sabah, Malaysia. The same family unit (adult female and twins) was observed in November 2009, at the same location, indicating that the two offspring survived the first 2.5 years of their life. They appeared very healthy suggesting that the mother was able to care for two offspring over this period.

**Keywords:** *Pongo pygmaeus morio*, Borneo, Kinabatangan, reproduction, twinning

## INTRODUCTION

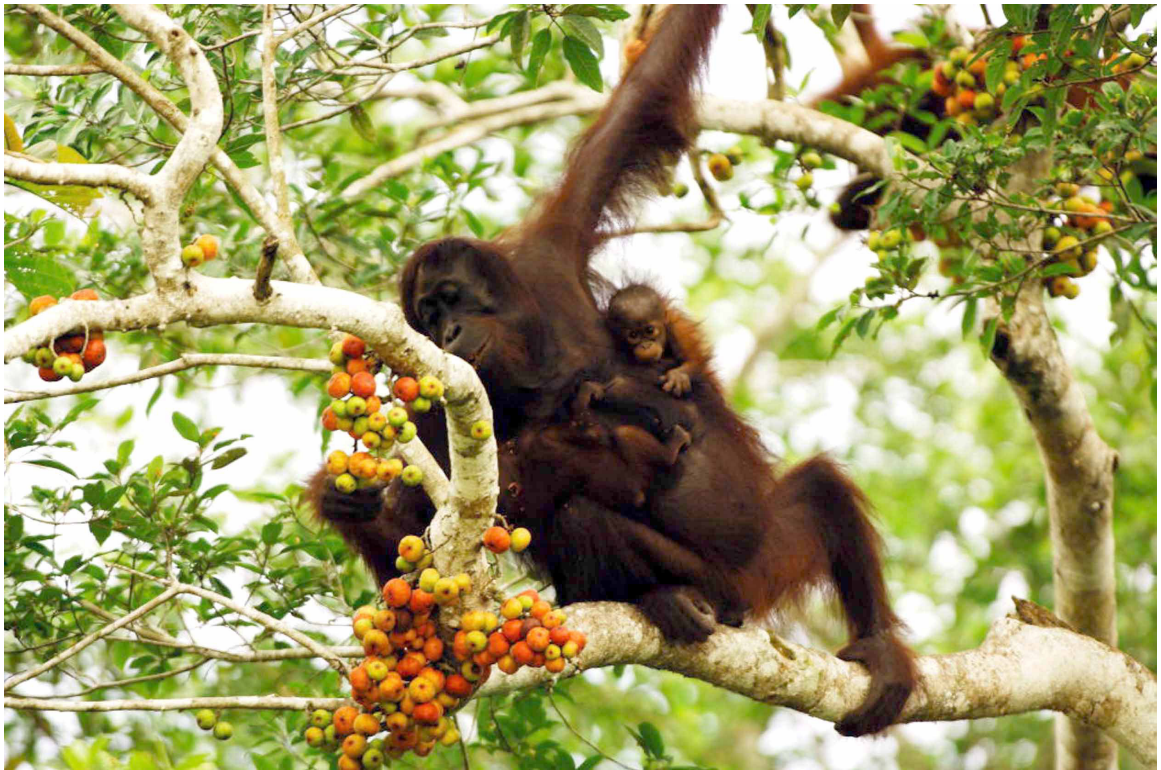
In captivity, twinning is a rare event with orangutan (*Pongo* spp.): from a sample of 626 orangutan pregnancies recorded in ISIS and the Orangutan Studybook between 1968 and 1985, Seal *et al.* (1985) reported 11 pairs of twins or 1.1% of the sample size (see also Geissmann, 1989 for a review). This rate is similar in other hominids (great apes and humans alike). The first-ever twin birth in captivity took place in 1968 at Woodland Park Zoo, in Seattle, Washington (Heinrichs & Dillingham, 1970), and the twins were still alive 40 years later (The Seattle Times 24 February 2008: [http://seattletimes.nwsourc.com/html/localnews/2004197844\\_orangs24m.html](http://seattletimes.nwsourc.com/html/localnews/2004197844_orangs24m.html)). In 1985, an orangutan gave birth to twins at the Audubon Zoo in New Orleans. More recently, in December 2003, non-identical orangutan twins were born at a wildlife park in Florida – the first recorded captive twin birth for almost 20 years. Taxonomic information is unavailable either for these captive-born twins or their parents. Furthermore, Bornean and Sumatran orangutans in American zoos were rather mixed at that time.

Only single infants have been observed with wild orangutans (Markham, 1995). In this paper, we report the first sighting of twins of Bornean Orangutan *Pongo*

*pygmaeus* (Linnaeus), and specifically of Northeast Bornean Orangutan *P. pygmaeus morio* (Owen) in the wild.

## METHODS

Observations were all from a boat while cruising along the Kinabatangan River in search of primates close to the study site of the Kinabatangan Orangutan Conservation Project (KOCP). The first observations were recorded by BG on 23 October 2007 and three days later by MDK on 26 October 2007. The orangutans were observed in a fig tree (*Ficus racemosa* L.) located on the edge of the river in Lot 1 of the Lower Kinabatangan Wildlife Sanctuary (LKWS: N5°33'01.44", E118°17'17.45"). Pictures were taken by Mr Jorge Camilo Valenzuela, a professional photographer, who was accompanying BG. This female and her twins have been subsequently reported to KOCP researchers on a regular basis by various sources (tourists, tour guides, villagers). On 15 November 2009, MDK and SK spotted at the same location the same adult female with a pair of young infants aged between 2.5 and 3 years old.



**Fig. 1.** Picture of a wild female Northeast Bornean Orangutan and her twins holding on to her chest (copyright: Jorge Camilo Valenzuela; courtesy: Benoit Goossens)

## RESULTS AND DISCUSSION

On the first day of sighting, BG observed a total of four orangutans in the same fig tree: one adult female with two babies of equal size clinging to her (see Fig. 1), accompanied by one adolescent (7 to 8 years old) only a few metres away from the trio. We assume that this adolescent was the older offspring of the same female (Goossens *et al.*, 2006). During the first two sightings, the twin babies were holding on tightly to both sides of the female's chest while the mother was feeding on figs or moving in the tree. The babies were observed suckling several times at this time. Based on photographs, we estimated the age of the twins to be between four and six months. Two years later, the same female was observed again with two juveniles of identical age (less than three years old). No other female was observed in the area, suggesting that the female was the mother of both of the two juveniles. The two juveniles were observed playing with each other, and interacting with the mother. They appeared very healthy.

This is the first reported sighting of orangutan twins in the wild. However, the absence of any records of orangutan twins in the wild does not mean that it has not happened before. It may be that orangutans in the

wild have had miscarriages when carrying twins, as recorded three times amongst nine sets of orangutan twins in captivity (Seal *et al.*, 1985). It is also possible that one of the twins often dies shortly after birth, as perinatal mortality is reported to be higher with primate twins compared to singletons (Bond & Block, 1982). Galdikas reported on her blog (<http://drbirute.com/2009/11/22/orangutan-twins-at-camp-leakey/>) that on 15 October 2009 an orangutan female gave birth at Camp Leakey in Tanjung Puting National Park, Central Indonesian Borneo, but one of the infants died shortly afterwards.

Moreover, holding two babies simultaneously may be challenging for the mother since mutual interference between the two newborn infants can alter their natural ventro-ventral clinging position. As reported in wild chimpanzees (Goodall, 1979), there is a risk of the babies losing their grip on the mother, and being killed as a result of falling, especially as orangutans are so highly arboreal. Difficulties in carrying twins seem only to last for a short time in most primate species, but can lead to the death or abandonment of one twin by the mother as reported in wild mountain gorillas (Watts & Huts, 1988). With a pair of twins observed in 2007,

and subsequently in 2009, it appears that this female had overcome this issue. On the other hand, the female must look for larger quantities of food to produce the extra milk necessary to feed the pair. In one pair of captive orangutan twins, one baby died four weeks after birth due to insufficient milk production by the mother, even though the female had easy access to food (Lang, 1973). Malnutrition and subsequent death of one twin was also observed in wild chimpanzees (Goodall, 1979). Here, the second observation of the mother and twins aged about three years old, appearing very healthy, show that this wild orangutan female had been able to produce enough milk to feed them for almost three years. During the last encounter, the twins were observed feeding directly on *Ficus* leaves, indicating that the weaning process had been initiated. Although we can confirm that the twins have survived their childhood stage, it is still not known whether they will survive until they become fully independent, which happens between six and nine years of age (Markham, 1995; Delgado & van Schaik, 2000).

#### ACKNOWLEDGMENTS

We thank the Economic Planning Unit for permission to conduct research in Sabah and the Sabah Wildlife Department and Dr Laurentius Ambu for permission to conduct research in the Lower Kinabatangan Wildlife Sanctuary. We also extend our thanks to our financial partners: Darwin Initiative for the Survival of Species (Grant no. 14/014, DEFRA, UK); zoos of Pittsburgh, Cleveland, Columbus, Philadelphia, Phoenix, Oregon, Saint Louis, Brevard, Houston, Woodland Park, Sea World & Bush Gardens, Chester, Apenheul, Beauval and La Palmyre; Abraham, World Women Work, Shared Earth, Margot Marsh and Arcus Foundations; USFWS Great Ape Conservation Fund, Australian Orang-utan Project, Orangutan Conservancy, Stichting BOS, Utah and North England Zoological Societies, and LEAP. We finally thank Jorge Camilo Valenzuela for kindly allowing us to use his photograph for scientific and educational purposes.

#### REFERENCES

- Bond, M.R. and Block, J.A. 1982. Growth and development of twin orangutans. *International Zoo Yearbook* **22**: 256-261.
- Delgado, R. and van Schaik, C.P. 2000. The behavioural ecology and conservation of the orangutan (*Pongo pygmaeus*): a tale of two islands. *Evolutionary Anthropology* **9**: 201-208.
- Geissmann, T. 1989. *Multiple Births in Catarrhine Monkeys and Apes: A Review*. II Sedicesimo, Firenze, Italy.
- Goodall, J. 1979. Life and death at Gombe. *National Geographic* **155**: 591-621.
- Goossens, B., Setchell, J.M., James, S.S., Funk, S.M., Chikhi, L., Abulani, A., Ancrenaz, M., Lackman-Ancrenaz, I. and Bruford, M.W. 2006. Philopatry and reproductive success in Bornean orangutans (*Pongo pygmaeus*). *Molecular Ecology* **15**: 2577-2588.
- Heinrichs, W.L. and Dillingham, L.A. 1970. Bornean orangutan twins born in captivity. *Folia Primatologica* **13**: 150-154.
- Lang, E.M. 1973. Zwillinge bei unsern Orangutans. *Zoilli* **31**: 14-15.
- Markham, R. 1995. Doing it naturally: reproduction in captive orangutans (*Pongo pygmaeus*). In: *The Neglected Ape*, R.D. Nadler, B.F.M. Galdikas, L.K. Sheeran and N. Rosen (eds.), pp. 273-278. Plenum Press, New York, USA.
- Seal, U., Flesness N. and Foose, T. 1985. Neonatal and infant mortality in captive-born great apes. In: *Clinical Management of Infant Great Apes*, C.E. Graham and J.A. Bowen (eds.), pp. 193-203. Alan R. Liss. Inc., New York, USA.
- Watts, D.P. and Huts, J. 1988. Twin birth in wild mountain gorillas. *Oryx* **22**: 5-6.

# THE PRECARIOUS STATUS OF THE WHITE-HANDED GIBBON *Hylobates lar* IN LAO PDR

Ramesh Boonratana<sup>1\*</sup>, J.W. Duckworth<sup>2</sup>, Phaivanh Phiapalath<sup>3</sup>, Jean-Francois Reumaux<sup>4</sup>, and Chaynoym Sisomphane<sup>5</sup>

<sup>1</sup> Mahidol University International College, Mahidol University, 999 Buddhamonthon 4 Road, Salaya, Nakhon Pathom 73170, Thailand. E-mail: icramesh@mahidol.ac.th

<sup>2</sup> PO Box 5573, Vientiane, Lao PDR. E-mail: willduckworthdprk@yahoo.com

<sup>3</sup> International Union for Conservation of Nature (IUCN), Ban Watchan, Fa Ngum Road, PO Box 4340, Vientiane, Lao PDR. E-mail: p.phiapalath@gmail.com

<sup>4</sup> PO Box 400, Houayxay, Bokeo, Lao PDR. E-mail: jfreumaux@yahoo.com

<sup>5</sup> Wildlife Section, Division of Forest Resource Conservation, Department of Forestry, Thatdam Road, PO Box 2932, Vientiane, Lao PDR. E-mail: chaynoym@yahoo.com

\* Corresponding author

## ABSTRACT

The White-handed Gibbon *Hylobates lar* is restricted within Lao PDR to the small portion of the north of the country that lies west of the Mekong River. The evidence-base includes one historical specimen of imprecise provenance, recent records of a few captives (of unknown origin), and a few recent field records. Only one national protected area (NPA), Nam Pouy NPA, lies within its Lao range, and the populations of the species now seem to be small and fragmented. Habitat degradation, conversion and fragmentation, and hunting, are all heavy in recently-surveyed areas, including the NPA. Without specific attention, national extinction is very likely, although the precise level of threat is unclear because so little information is available on its current status in the country.

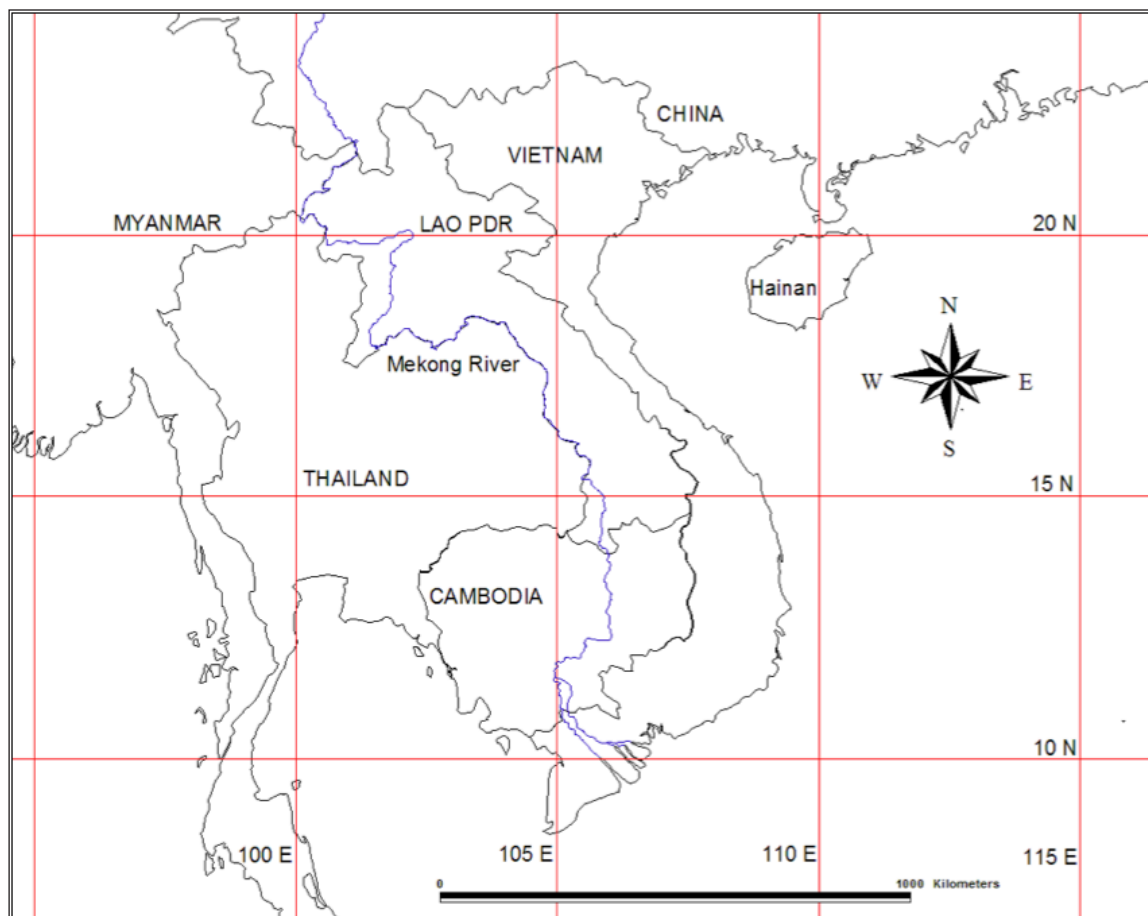
**Keywords:** conservation, distribution, geographic range, Mekong, threat status

## INTRODUCTION

Lao People's Democratic Republic (Lao PDR; Laos) is a landlocked country of 236,800 km<sup>2</sup> in Southeast Asia (Fig. 1), retaining, by regional standards, a relatively high proportion of natural and semi-natural habitats, and thus of high global conservation significance (e.g. Thewlis *et al.*, 1998). It supports among the highest numbers of gibbon species of any country, because it has a wide latitudinal range and straddles the Mekong. East of this river occur various species of *Nomascus* (with disagreement on exactly how many), and to the west occur White-handed Gibbon *Hylobates lar* (Linnaeus) in North Lao PDR and Pileated Gibbon *H. pileatus* (Gray) in South Lao PDR (Duckworth, 2008).

The distribution and status of *Nomascus* (as a genus) is relatively well-known in parts of the country, even though the lack of consensus on taxonomy prevents confident application of names to many populations (e.g. Duckworth *et al.*, 1995, 1999; Johnson *et al.*, 2005; Geissmann, 2007b; Brown, 2009; Robichaud *et al.*, 2010; Thinh *et al.*, 2010), whereas little information is available on the status of the two *Hylobates* species

(e.g. Boonratana, 1997; Round, 1998), and of *H. lar* in particular. This reflects two main factors: first, field survey effort in Lao PDR has been concentrated to the east of the Mekong (where most of Lao PDR lies), in the domain of *Nomascus*. Second, the *Nomascus* populations of Lao PDR are of outstanding global conservation significance: the genus occurs outside Lao PDR only in Vietnam and in small parts of China and Cambodia; all *Nomascus* taxa are highly threatened with global extinction (Geissmann, 2007a) and Lao PDR holds the largest populations of some of them (Duckworth, 2008). The two species of *Hylobates*, by contrast, remain locally common in other countries, and Lao populations are of much lower global significance. The Lao and global status is relatively well-known for Pileated Gibbon, which occurs otherwise in only Thailand and Cambodia (e.g. Traeholt *et al.*, 2005; Phoonjampa & Brockelman, 2008), but no good local or global overview is available for White-handed Gibbon status, perhaps because it has such a large global range (for a gibbon), spread over so many countries



**Fig. 1.** Map of Lao PDR showing parts of the country to the west and east of the Mekong River.

(Indonesia, Malaysia, Myanmar, Thailand and China, as well as Lao PDR; Groves, 2001).

To retain Lao PDR's full complement of gibbons, action may be urgently needed for White-handed Gibbon; there are suspicions that it is already extinct in China, in which it has, or had, only a small range (Gruter *et al.*, 2009). Lao PDR is omitted from the range of White-handed Gibbon by various global compilations (e.g. Groves, 2001; Mootnick, 2006), reflecting, presumably, the lack of undisputed Lao specimens. Moreover, the few reliable Lao records are scattered across internal project reports, and muddled by spurious claims of the species in the country. Information up to mid 2008 was collated in a status review of gibbons in Lao PDR (Duckworth, 2008), itself a grey-literature report of uncertain durability, existing only as a computer file on the Internet and a handful of custom printed paper copies.

Here, therefore, we present all information on White-handed Gibbon in Lao PDR that is traceable (up to June 2010), to highlight the poor information base

on the species, and the distinct possibility that national extinction is looming unless specific measures are taken to avert it.

## RECORDS

One White-handed Gibbon specimen collected before 1904 is believed to come from 'near Louangphabang' (e.g. de Pousargues in Pavie, 1904; Kloss, 1929). The specimen lacks authoritative information on origin (T. Geissmann *in litt.*, 1998), and the town of Louangphabang (N19°54', E102°09') lies east of the Mekong, and thus in the range of *Nomascus*, not *Hylobates* (Fig. 2). It has not been universally accepted as evidence of this gibbon in Lao PDR. However, although much of the Lao-Thai border consists of the Mekong, this stretch of the river lies entirely within Lao PDR, and it is c.100 km from the town to the nearest part of Thailand in a straight line (and much further using the Mekong for either upstream or downstream travel). Moreover, Louangphabang is not just a town but also a province extending both sides of the Mekong, reflect-



ing the former Royaume de Louangphabang (mapped in, e.g., Delacour & Greenway, 1940). Taking the given locality as merely meaning somewhere within the 'kingdom', it is perfectly plausible as the origin of the specimen.

Most information on White-handed Gibbon in Lao PDR comes from Nam Pouy National Protected Area (= Nam Phoun NPA in Berk Müller *et al.*, 1995). Gibbons were clearly widely distributed in and around the NPA 20 years ago. Respondents in 14 of 16 villages questioned during 1989-1993 reported gibbons from their area (Salter, 1991; Duckworth *et al.*, 1999: Annex 5). A combined training-cum-survey by RB in mid-1997 did not cover most of the NPA but concluded on the available information that gibbons were already "possibly rare" (Boonratana, 1997: 18) and were threatened by hunting for food. Songs of gibbons (confirmed as

White-handed Gibbon, already very familiar to RB from experience in Thailand) were heard only towards the Lao-Thai border in the west of the northern region of the NPA, and in its remoter central core. An army patrol reportedly shot a gibbon during the third week of May 1997, apparently from the extreme northern part of the central region. Army personnel reported gibbons as common in the southwestern part of the NPA (Boonratana, 1997). No gibbons were recorded directly in a repeat visit in early 1998 (Boonratana, 1998); those mapped at various sites in the NPA (Boonratana, 1998: Fig. 4.1) were based on indirect reports (RB). K. Khounbolin & G. Baird (verbally to Duckworth, 2008) made several field trips around 2007 to the NPA, mainly investigating the status of Asian Elephant *Elephas maximus* Linnaeus. A picture of a dead adult gibbon, which had been killed in the NPA, was seen, but no

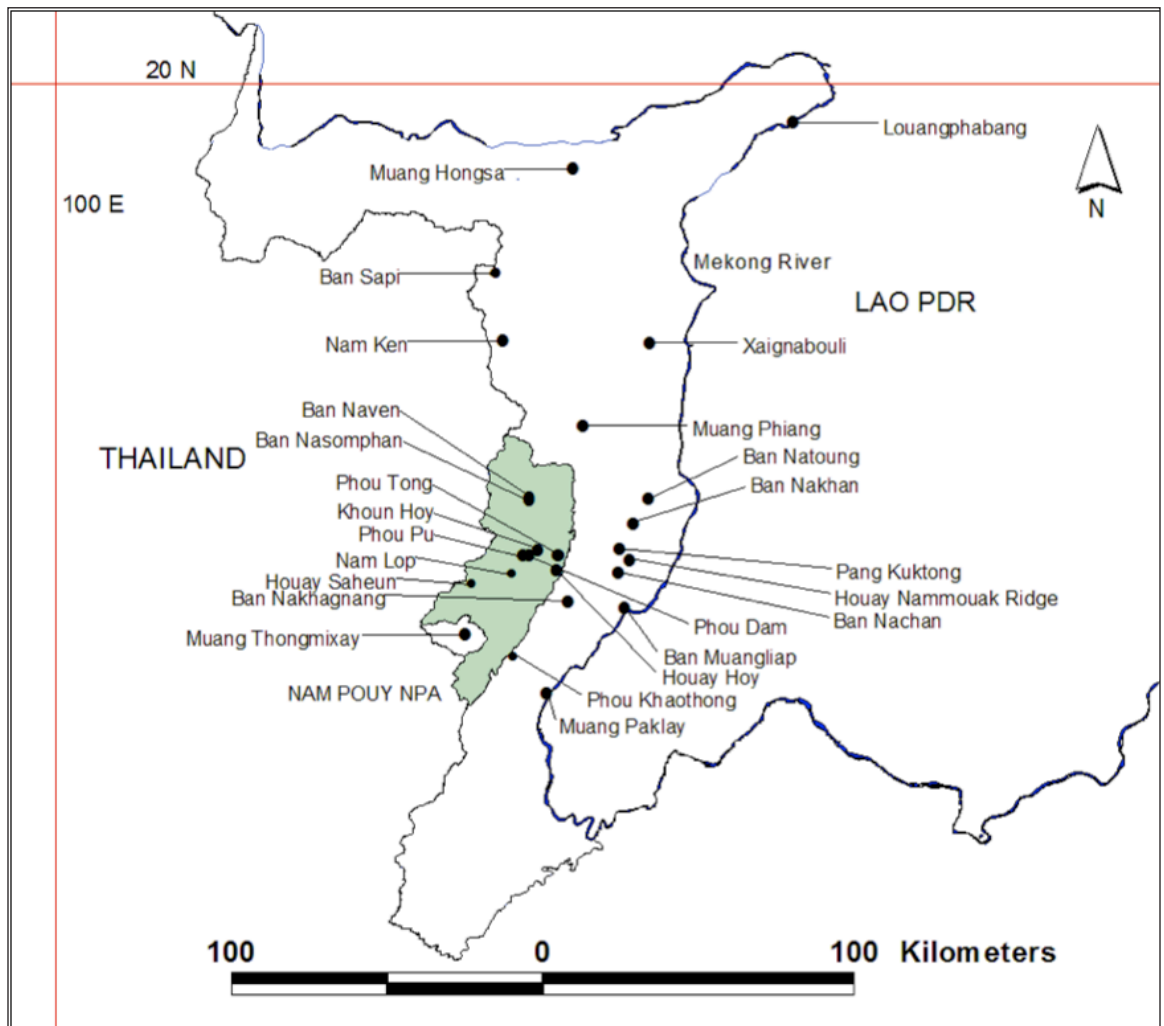


Fig. 2. Nam Pouy NPA and verified locations of places mentioned in text.

gibbons were found directly. Although the surveys visited some little-degraded semi-evergreen forest, they each lasted only one or a few days, and perhaps did not go far enough from villages to find gibbons: human activity was evident everywhere visited, and many areas were heavily cleared. On a short visit to parts of the NPA in May 2007 gibbons were heard on only one morning, when two groups of White-handed Gibbons were heard from the military road from the Nam (= river) Pouy southwest to Muang (= district of) Thongmixay; and the overall numbers were judged to be very low (J-FR). A young live White-handed Gibbon confiscated from hunters, who said it was from the NPA, was seen at the NPA road/guard post near Ban (= village of) Nakhagnang (N18°30', E101°29') on 17 March 2010 by JWD and CS; it was still present a couple of months later (Phiapalath & Vaisavanh, 2010).

Over 11-18 May 2010, Phiapalath & Vaisavanh (2010) visited Nam Pouy NPA, interviewing local people about gibbons. Areas where NPA staff and Boonratana (1998) reported gibbons were picked as survey areas; much of the NPA was not visited and in these parts the extent to which gibbons persist is unknown. Overall, the NPA's gibbon population seems to be very low and fragmented. Local reports of gibbons came from five main areas comprising the southern Phou (= mount) Tong (N18°38', E101°27'), Phou Dam (N18°38', E101°22'), Phou Pu (N18°38', E101°21'), the Houay (= stream) Saheun catchment (N18°33', E101°12'), Phou Khaothong (N18°22', E101°20') and Ban Naven (N18°48', E101°22'). However, there is some doubt with respect to the groups reported in the Ban Naven area, from the upper Houay Keo and other sites close to the Lao-Thai border. Local people believed there were only 1-2 groups left at each site. Villagers in Ban Nasomphan (N18°48', E101°22'), Ban Naven and Ban Thongmixay (N18°24', E101°10') reported that no gibbon songs had been heard in the last few years in areas formerly holding gibbons in northeastern Nam Pouy NPA (within Muang Phiang), the Nam Phoun Noy (N18°27', E101°05') area of Muang Thongmixay, and the area north of Ban Navan. The surveyors heard gibbon songs only once during the survey: a single singing session at Phou Pu on 14 May 2010; single mornings were spent listening for gibbons at Phou Dam, Phou Pu, the Houay Hang close to Phou Tong, the Houay Hoy (N18°35', E101°27') and the Nam Lop (N18°35', E101°19') in the Phou Pu area.

In 1991, eight of nine villages around the then potential Pasak Xaignabouli NPA reported the presence of gibbons in their area (Salter, 1991). This area was never

designated as an NPA, but some of these villages lie in areas which became part of Nam Pouy NPA, the declared area of which was much larger than the 1991 proposal. In a 665 km<sup>2</sup> area east of Nam Pouy NPA and spanning parts of Muang Phiang, Muang Xaignabouli and Muang Paklay, placed in the late 1990s into the Hipa Licence Area Division Three, restricted interviews in August-September 1999 yielded general statements that gibbons were no longer present in their areas; they were believed perhaps to persist a little north of the Nam Pouy (HFI, 1999).

Part of the Hipa Licence Area Division Three was incorporated in the Phou Phadam Production Forest Area (PFA), surveyed by JWD and CS over 18-30 March 2010. This designation is too recent for PFA management principles to have yet been introduced. Recent heavy felling was widespread in the Muang Phiang parts of the PFA, accompanied by conversion to cash-cropping (reportedly mainly sesame) and by evidently unrestrained hunting; both activities were illegal and their prevalence was attributed by long-term residents of the area to the ease of access to the forest on the extensive road network left by the former concessionaire. It is almost impossible to believe that any gibbons could have survived in this part of the PFA, and indeed people interviewed in three temporary settlements there all reported that gibbons had been present until ten years ago, but had been hunted out during the logging since then. The only suitable habitats visited in the PFA were around Pang Kuktong (N18°39', E101°38') and the Houay Nam-mouk ridge (N18°36'34", E101°40'03" - N18°36'07", E101°41'14"), in Muang Paklay; listening for gibbons was a major survey aim at both these sites. The villager-guide, from Ban Nachan (N18°35', E101°38'), knew both Pang Kuktong and the Houay Nam-mouk ridge well, and seemed generally knowledgeable about large mammals. He stated that the only gibbons surviving in the region were a few around the Houay Nam-mouk, and that luck was needed to hear them. Only one morning was spent there, and that after heavy overnight rain, known to depress gibbon song levels (Rawson, 2004). Moreover, two or more men with a hand-tractor and trailer were busy hunting for market and many gunshots were heard throughout the morning. Thus, while no gibbons were heard, this does not even weakly imply their absence from the area. The lack of records in five mornings at Pang Kuktong in excellent weather supported the guide's statements that gibbons had disappeared from there. Reports were received of gibbons persisting around two villages further north, in the eastern part of this PFA: Ban Nakh

**Table 1.** Captive White-handed Gibbon records from Lao PDR.

Site	Date	Type of location	Age	Remarks	Source
Louangphabang town	mid 1996	No information	No information		R. J. Timmins in Duckworth et al., 1999
Xaignabouli town	1998	Petrol station	Young		RB; Duckworth et al., 1999: Plate 13
Ben Keun Zoo	28 March 1999	Zoo	Adult	Reportedly in zoo for 3–4 yrs	T. Geissmann in litt., 2008
Wat Simouang, Vientiane town	27 & 29 March 1999	Wat (= temple)	Adult	Reportedly in wat for five yrs	T. Geissmann in litt., 2008

(N18°43', E101°40'; specifically Phou Houk and Phou Phakan) and Ban Natoung (N18°48', E101°43'; specifically Phou Moug, Phou Vieng near the Houay Hok, and Pha Toung). In May 2010 Phiapalath & Saisavanh (2010) were told by a resident of Ban Nakong that gibbons persist in the Ban Natoung-Ban Nakhan area, which he had visited several times in the last seven years, and one gibbon was reported to have been shot by loggers in 2009 there. East of the PFA, around Ban Muangliap (now called locally Ban Phaliap; N18°29', E101°39'), CS received village reports in late March 2010 that gibbons remained around Phou Kao Yoak, Phou Ye Noy, Phou Ye Nang, and Koun Houy.

Near Ban Sapi, Muang Xaignabouli, J-FR saw three wild White-handed Gibbons at c. N19°26'50", E101°16'12" during 18-20 May 2007, in an area where several others were heard. With a local guide, a total population of 18 individuals (four groups) was estimated within an area of 6 km<sup>2</sup>. Up to now these gibbons have been protected by a local taboo, but in the last 20 years have decreased from about 60 individuals perhaps because of the poor quality of the habitat: within the 6 km<sup>2</sup>, only 2-5% is secondary forest, and the rest is dominated by grass. Reports were received of other populations nearby, but these were not accurately located.

Outside Nam Pouy NPA, the selection of locations listed reflects the itineraries of those supplying records, not any real distribution pattern of this gibbon in Lao PDR. There are several clear statements of local extirpation, and these may typify much of the species' original range in Lao PDR. In Muang Hongsa (centred on N19°45', E101°30'), villagers reported that in the area of Napong and Nam Ken (N19°15', E101°18') gibbons had last been found in the early-mid 1970s (Bergmans, 1995). Hmong villagers in Ban Donmai,

c. 9 km east of Hongsa town, said in 2008 that there used to be gibbons further east near Ban Namseng, near to the Muang Chomphet border in old forest, but they had not been heard for many years (S. Ling *in litt.* to Duckworth, 2008). There are also various records of captive White-handed Gibbons in Lao PDR (Table 1), but none has meaningful information on their origins. Duckworth (2008) listed as provisional locations two second-hand reports for which subsequent verbal enquiry by PP suggests that the original identifications as gibbons, rather than monkeys of some form, were unreliable; these were from around Ban Phaxang (Muang Xaignabouli) and around Ban Phadeng (Muang Khop). These localities should be disregarded.

## DISCUSSION

The few positive identifications available corroborate the prediction of Geissmann (1995) that gibbons west of the Mekong in North Lao PDR (i.e. Xaignabouli Province, a small adjacent sliver of Bokeo Province, and Muang Chomphet of Louangphabang Province) are White-handed Gibbons, and there are no credible reports of this species east of the Mekong. However, incorrectly identified mammal listings pepper the grey literature of Lao PDR, particularly in commercial consultants' reports, as they probably do in all neighbouring countries. Gibbons have been particularly mis-treated in such reports and identifications to species level should be ignored except where there is specific evidence of competence on the part of the surveyors. Duckworth (2008), in an extensive trawl of available, and some not-so-available, literature, found numerous claims of White-handed and Pileated Gibbons east of the Mekong (spread from the far north to far south), as well as Agile Gibbon *H. agilis* F. Cuvier (multiple times, even though this Sundaic species occurs nowhere

near Lao PDR; Groves, 2001) and Black-cheeked Crested Gibbon *Nomascus concolor* (Harlan) across the country (evidently in many cases not through assumptions derived from the formerly widespread treatment of pale-cheeked crested gibbons as subspecies of *N. concolor*). Quite often in such reports, multiple species of gibbons were listed for one site, and a 2002 draft of the Nam Mang 3 hydropower project Environmental Impact Analysis and Outline Social Action Plan and Environmental Management Plan (by a European-run firm of "Environmental Impact Specialists" for the China International Water and Electric Corp.) outstripped all others by listing "Black Gibbon, White-cheeked Gibbon, Gibbons, White-handed Gibbon," all among the "mammal species reported or observed in the catchment (including reservoir) or inferred from known distributions," and yet the area under discussion lies entirely within Phou Khaokhoay NPA, an area well outside the range of the Black (= Black-cheeked Crested) Gibbon and White-handed Gibbon. These documents also claimed numerous other species highly implausible in the area and habitats of survey, and may simply reflect the limitations of showing picture-books to local people and asking them to point out which species are present. A basic presumption in these reports, that village interviews can be a short-cut wildlife survey method applicable by people of limited relevant experience, is fallacious; in fact to generate reliable species-specific results with them is even more demanding of specialised skills and extensive local experience than direct survey, because one not only has to know a lot about the wildlife, but about the local people and their customs as well (e.g. Baird, 2007).

It is impossible to predict the status of this gibbon in unsurveyed parts of North Lao PDR west of the Mekong. Tungitti-plakorn & Dearden (2002) found, in parts of northern Thailand, a fairly predictable sequence in which mammals disappeared from heavily hunted areas, with gibbons being among the early losses. This is likely to be true in Lao PDR as well, but cannot be used to assume that anywhere in the Lao range of the White-handed Gibbon with a severely depleted mammal community will automatically have lost the gibbon, because of the special status accorded to it by some communities, as at Ban Sapi.

The status of White-handed Gibbon in Lao PDR is probably perilous. Even in 1997, Boonratana (1997: 18) considered it "possibly rare" in Nam Pouy National Protected Area (NPA), the only NPA within its Lao range. The available information suggests it is likely to have declined steeply since then. Recent search effort has been very limited, and all that can be said is

that the species does persist in the country. Lao White-handed Gibbon populations outside Nam Pouy NPA have been little searched-for, and some large or at least readily-conservable populations might yet remain undocumented. Nam Pouy is an NPA, but is reportedly subject to heavy logging, which is presumably accompanied by heavy hunting. Phiapalath & Saisavanh (2010) found that the new road crossing the NPA from Ban Naven to Muang Thongmixay has allowed increased wildlife hunting in the area from both ends of the road. Long periods of continual forest-fires from year to year have resulted in habitat loss: forests in the northern Nam Pouy area are degraded almost to bare ground in places, with exceptions in the Phou Pu and Phou Dam areas where gibbons are still reported. The NPA undertakes some patrolling and active management but has human, technical and political resources insufficient for the scale of the tasks it faces. Outside Nam Pouy NPA, aside from the villagers' belief at Ban Sapi, there is presently no known active protection of White-handed Gibbon in Lao PDR.

The habitat used by White-handed Gibbons near Ban Sapi is at variance with frequent statements that gibbons require high-quality forest. However, hunting almost invariably accompanies logging in many countries, making it difficult to be sure of the reason for the general rarity of gibbons in many areas of heavily degraded forest. Habitat condition itself may not be so important, and Johns (1986: 690) even concluded that White-handed Gibbon in Malaysia showed "a remarkable degree of flexibility" in response to logging. A population of White-handed Gibbons in entirely fragmented and degraded, and largely deciduous, forest in northern Thailand was studied by Yimkao & Srikosamatara (2006), and the persistence around Ban Sapi is paralleled by various villages in Lao PDR where *Nomascus* gibbons survive surprisingly close to villages and/or in highly degraded forest, reflecting local restraints on hunting (Duckworth, 2008). In the face of rapid social changes, these local beliefs are generally weakening, and long-term protection of gibbons through them alone is unlikely.

Hunting, generally for food, with some use of animals as pets, has led to severe declines in gibbon populations in much of Lao PDR (Duckworth, 2008). All gibbons are afforded full protection under Lao wildlife law, and for White-handed Gibbon to survive in the country firmer enforcement of this law is essential. A number of conservation-related initiatives have recently started or are planned in Xaignabouli Province (in part reflecting the province's large Asian Elephant *Elephas maximus* population: K. Khounbolin verbally, 2010),

and the survival of White-handed Gibbon in Lao PDR will be more likely if gibbons are included in conservation measures for elephants or other umbrella species. Such plans should aim to reduce hunting pressure on gibbons and other species that are highly vulnerable and which cannot be sustainably exploited.

## ACKNOWLEDGEMENTS

Information for up to 2008 is extracted from Duckworth (2008), where can be found full acknowledgements for the process of record collation, funded by the ARCUS Foundation Great Apes Fund through Fauna & Flora International, overseen by Paul Insua-Cao, and assisted by Sisay Chounnavanh. Mike Baltzer (WWF Malaysia), Graham Baird (WWF Lao), Suphab Denphoukhao (Xaignabouli Province Agriculture and Forestry Office), Thomas Geissmann (Anthropological Institute, University Zürich-Irchel, Switzerland), Khamkhoun Khounboline (WWF Lao), Stuart Ling (VECO [Vredeseilanden] Rural Development Project, Bokeo province), and Vongdeuan Vongsihalath (National Land Management Authority) were particularly helpful with regard to information on status of White-handed Gibbon in Lao PDR. The 2010 visit to Phou Phadam PFA was under contract to the Government of Lao PDR - Government of Finland - World Bank *Sustainable Forestry For Rural Development* (Suford) project, and we thank Bounpone Sengthong and Chris Dickinson for coordination, the Division of Forest Resource Conservation (DFRC) of the Department of Forestry, the Xaignabouli Province Agriculture and Forestry Office (PAFO) and Phiang and Paklay District Agriculture and Forestry Offices (DAFOs) for support and authorisation, and Kongchay Sithisay (Xaignabouli PAFO), Thongsay Phanpeng (Paklay DAFO), Khammane Sonsoupad (Phiang DAFO), Chounlamany Sayyarath (DFRC) and Sisay Chounnavanh for field assistance. The May 2010 survey thanks the Xaignabouli PAFO and its Protected Area Management Division; Souphab Denphoukhao and Chandy Chanthavong, Head and Deputy Head of the Protected Area Management Division for Xaignabouli Province, and their motivated staff, in particular Khamphet; the efforts of the many villagers and soldiers who participated in the survey; and funding support from the US Embassy to Lao PDR and Fauna & Flora International (FFI) with in-kind contributions from IUCN Lao PDR and the DFRC. We also thank the anonymous reviewers for the comments to the earlier version of this manuscript.

## REFERENCES

- Baird, I.G. 2007 (for 2006). Conducting rapid biology-based assessments using local ecological knowledge. *Natural History Bulletin of the Siam Society* **54**: 167-175.
- Bergmans, W. 1995. On mammals from the People's Democratic Republic of Laos, mainly from Sekong Province and Hongsa special zone. *Zeitschrift für Säugetierkunde* **60**: 286-306.
- Berkmüller, K., Evans, T., Timmins, R. and Vene Vongphet. 1995. Recent advances in nature conservation in the Lao PDR. *Oryx* **29**: 253-260.
- Boonratana, R. 1997. *Field Training in Wildlife Techniques and Large Mammal Survey at Nam Phui National Biodiversity Conservation Area, Lao PDR*. IUCN/LSFP, Vientiane, Lao PDR.
- Boonratana, R. 1998. *Field Management of Nam Poui and Phou Xang He National Biodiversity Conservation Areas*. IUCN/LSFP, Vientiane, Lao PDR.
- Brown, J. 2009. Status of the western black crested gibbon (*Nomascus concolor*) in the Nam Ha National Protected Area, Lao PDR. *Gibbon Journal* **5**: 28-35.
- Delacour, J. and Greenway, J.C. 1940. Ville expédition ornithologique en Indochine française: itinéraire. *L'Oiseau et la Revue française d'Ornithologie* **10**: 3-24.
- Duckworth, J.W. 2008. *Preliminary Gibbon Status Review for Lao PDR 2008*. Fauna & Flora International, Hanoi, Vietnam. (Internet only: [www.fauna-flora.org/gibbons.php](http://www.fauna-flora.org/gibbons.php)).
- Duckworth, J.W., Timmins, R.J., Anderson, G.Q.A., Thewlis, R.M., Nemeth, E., Evans, T.D., Dvorak, M. and Cozza, K.E.A. 1995. Notes on the status and conservation of the gibbon *Hylobates (Nomascus) gabriellae* in Laos. *Tropical Biodiversity* **3**: 15-27.
- Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. *Wildlife in Lao PDR: 1999 Status Report*. IUCN/WCS/CPAWM, Vientiane, Lao PDR.
- Geissmann, T. 1995. Gibbon systematics and identification. *International Zoo News* **42**: 467-501.
- Geissmann, T. 2007a. Status reassessment of the gibbons: results of the Asian Primates Red List Workshop 2006. *Gibbon Journal* **3**: 5-15.
- Geissmann, T. 2007b. First field data on the Laotian black crested gibbon of the Nam Kan area of Laos. *Gibbon Journal* **3**: 56-65.
- Groves C.P. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington D.C., USA.

- Grueter, C.C., Jiang, X., Konrad, R., Fan, P., Guan, Z. and Geissmann, T. 2009. Are *Hylobates lar* extirpated from China? *International Journal of Primatology* **30**: 553-567.
- HFI (Hipa Forest Industries) 1999. *Preliminary Environmental Impact Statement for Proposed Timber Harvesting Activities in the Hipa Licence Area, Divisions Three and Seven*, Lao PDR. Hipa Forest Industries, Vientiane, Lao PDR. (unpublished draft prepared by M.C. Baltzer).
- Johns, A.D. 1986. Effects of selective logging on the behavioural ecology of West Malaysian primates. *Ecology* **67**: 684-694.
- Johnson, A., Singh, S., Duangdala, M. and Hedemark, M. 2005. The western black crested gibbon in Laos: new records and conservation status. *Oryx* **39**: 311-317.
- Kloss, C.B. 1929. Some remarks on the gibbons with the description of a new sub-species. *Proceedings of the Zoological Society of London* '1929' (8): 113-127.
- Mootnick, A.R. 2006. Gibbon (Hylobatidae) species identification recommended for rescue or breeding centers. *Primate Conservation* **21**: 103-138.
- Pavie, A. 1904. *Recherches sur l'Histoire Naturelle de l'Indochine Orientale. Mission Pavie en Indochine. III. Études Diverses*. Leroux, Paris, France.
- Phiapalath, P. and Saisavanh, V. 2010. *Gibbon Surveys: Nam Phui National Protected Area and Dong Khanthung Provincial Protected Area*. Unpublished report, IUCN, Vientiane, Lao PDR.
- Phoonjampa, R. and Brockelman, W.Y. 2008. Survey of pileated gibbon *Hylobates pileatus* in Thailand: populations threatened by hunting and habitat degradation. *Oryx* **42**: 600-606.
- Rawson, B.M. 2004. Vocalisation patterns in the yellow-cheeked crested gibbon (*Nomascus gabriellae*). In: *Conservation of Primates in Vietnam*, T. Nadler, U. Streicher and Ha Thang Long (eds.), pp. 130-136. Frankfurt Zoological Society, Hanoi, Vietnam.
- Robichaud, W.G., Insua-Cao, P., Sisomphane, C. and Chounnavanh, S. 2010. *A Scoping Mission to Nam Kan National Protected Area, Lao PDR*. Fauna & Flora International, Vientiane, Lao PDR. (available from internet: [www.fauna-flora.org/gibbons.php](http://www.fauna-flora.org/gibbons.php)).
- Round, P.D. 1998. *Wildlife, Habitats and Priorities for Conservation in Dong Khanthung Proposed National Biodiversity Conservation Area, Champasak Province, Lao PDR*. WCS/CPAWM, Vientiane, Lao PDR.
- Salter, R.E. 1991. *Notes on Reconnaissance Surveys of Proposed Protected Areas, 26-31 March 1991*. IUCN/Lao-Swedish Forestry Programme, Vientiane, Lao PDR.
- Thewlis, R.M., Timmins, R.J., Evans, T.D. and Duckworth, J.W. 1998. The conservation status of birds in Laos: a review of key species. *Bird Conservation International* **8** (supplement): 1-159.
- Thinh, V.N., Rawson, B., Hallam, C., Kenyon, M., Nandler, T., Walter, L. and Roos, C. 2010. Phylogeny and distribution of crested gibbons (genus *Nomascus*) based on mitochondrial cytochrome b gene sequence data. *American Journal of Primatology* **72**: 1047-1054.
- Traeholt, C., Bonthoeun, R., Rawson, B., Samuth, B.M., Virak, C. and Vuthin, S. 2005. *Status Review of Pileated Gibbon, Hylobates pileatus, and Yellow-cheeked Crested Gibbon, Nomascus gabriellae, in Cambodia*. Fauna & Flora International, Phnom Penh, Cambodia.
- Tungittiaplakorn, W. and Dearden, P. 2002. Hunting and wildlife use in some Hmong communities in northern Thailand. *Natural History Bulletin of the Siam Society* **50**: 57-73.
- Yimkao, P. and Srikosamatara, S. 2006. Ecology and site-based conservation of the white-handed gibbon (*Hylobates lar* L.) in human-use forests in Mae Hong Son province, northern Thailand. *Natural History Bulletin of the Siam Society* **54**: 109-138.

# A SUMMARY OF THE CONSERVATION STATUS, TAXONOMIC ASSIGNMENT AND DISTRIBUTION OF THE INDOCHINESE SILVERED LANGUR *Trachypithecus germaini* (*sensu lato*) IN CAMBODIA

Jessica E. Moody<sup>1\*</sup>, An Dara<sup>2</sup>, Camille N. Z. Coudrat<sup>3</sup>, Tom Evans<sup>4</sup>, Tom Gray<sup>5</sup>, Matt Maltby<sup>6</sup>, Men Soriyun<sup>7</sup>, Nut Meng Hor<sup>7</sup>, Hannah O'Kelly<sup>4</sup>, Pech Bunnat<sup>8</sup>, Phan Channa<sup>5</sup>, Edward Pollard<sup>4</sup>, Hugo J. Rainey<sup>4</sup>, Benjamin M. Rawson<sup>9</sup>, Rours Vann<sup>8</sup>, Song Chansocheat<sup>2</sup>, Tan Setha<sup>7</sup>, and Thong Sokha<sup>8</sup>

<sup>1</sup> Department of Mammalogy, Wildlife Conservation Society/Bronx Zoo, 2300 Southern Boulevard, Bronx, New York 10460, USA. E-mail: jmoody@wcs.org

<sup>2</sup> General Department Administration for Nature Conservation and Protection, Ministry of Environment, Phnom Penh, Cambodia. E-mail: daraan@gmail.com; E-mail: s.chansocheat@gmail.com

<sup>3</sup> Department of Anthropology and Geography, Oxford Brookes University, Headington Campus, Gypsy Lane, OX3 0BP, Oxford, UK. E-mail: camillecoudrat@gmail.com

<sup>4</sup> Global Conservation Program, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, New York 10460, USA. E-mail: tevans@wcs.org

<sup>5</sup> Greater Mekong Cambodia Country Program, World Wide Fund for Nature, Phnom Penh, Cambodia. E-mail: tomnegray@hotmail.com; E-mail: phanchannal@yahoo.com

<sup>6</sup> Cambodia Programme, Fauna and Flora International, Phnom Penh, Cambodia. E-mail: matt.maltby ffi@gmail.com

<sup>7</sup> Department of Wildlife and Biodiversity, Forestry Administration, Phnom Penh, Cambodia. E-mail: n.menghor@gmail.com

<sup>8</sup> Cambodia Program, Wildlife Conservation Society, PO Box 1620, Phnom Penh, Cambodia. E-mail: p.bunnat@gmail.com; E-mail: roursvann@gmail.com

<sup>9</sup> Greater Mekong Program, Conservation International, Hanoi, Vietnam. E-mail: b.rawson@conservation.org

\* Corresponding author

## ABSTRACT

Nine of the ten primate species known to occur in Cambodia are globally Threatened due to habitat loss/fragmentation and direct persecution. One of these, the Indochinese Silvered Langur, *Trachypithecus germaini* (*sensu lato*), has only recently gained the attention of conservationists, having formerly been considered conspecific with the Sundaic Silvered Langur, *T. cristatus*. *Trachypithecus cristatus*, broadly defined, was a widespread species listed as Data Deficient in earlier IUCN Red List assessments. According to more recent assessments, the Sundaic taxa, *T. cristatus* and *T. auratus*, are known to range from peninsular Malaysia throughout the Indonesian archipelago, while *T. germaini* occurs in a much smaller range in south-eastern Thailand, Cambodia, southern and central Lao PDR, and south and central Vietnam. This short paper summarizes existing published information (and some unpublished observations from the authors) on the habitat, distribution, and conservation status of *T. germaini* in Cambodia, which is undoubtedly the global stronghold. We call for increased conservation action for this species in Cambodia, primarily within the context of existing protected area management programs. We also highlight a number of factors that confound assessments of its status and recommend areas for further research.

**Keywords:** taxonomy, habitat, *Trachypithecus margarita*

## INTRODUCTION

Following the end of armed conflict in Cambodia, beginning in the early 1990s, wildlife conservation initiatives began to take place. These started modestly, mainly in the form of survey work (Timmins & Soriyun, 1998; Daltry & Momberg, 2000; Long *et al.*, 2000; Seng, 2001; Timmins & Ou, 2001; Walston *et al.*, 2001; Kong & Tan, 2002). As the forests of Cambodia became safer, more areas of the country were surveyed and protected area management became established (Boonratana, 1999; Davidson, 2006; Bezuijen *et al.*, 2007; Eames, 2007). To date, most significant larger blocks of forest have been surveyed to some extent, and many protected areas declared (Pollard *et al.*, 2007; Rainey *et al.*, 2009; Rawson, 2010; Royan, 2010; Coudrat *et al.*, 2011). Conservation efforts within these reserves have helped to reduce threats to wildlife from human pressures, particularly hunting and habitat loss (Timmins & Ou, 2001; Pollard *et al.*, 2007; Coudrat, 2009; Rainey *et al.*, 2009; Rawson *et al.*, 2009).

Nine of the ten primate species that are known to occur in Cambodia are globally Threatened (IUCN 2011). One of these species, the Indochinese Silvered Langur *Trachypithecus germaini* (Milne-Edwards), has yet to be the focus of any direct conservation action. There is no synthesis concerning the geographic range, distribution, abundance, and ecological characteristics for this species throughout its range, which hampers the ability to develop and implement effective conservation strategies both within and outside of Cambodia (Nadler *et al.*, 2003, 2005; Brandon-Jones *et al.*, 2004; Bezuijen *et al.*, 2007; Pollard *et al.*, 2007; Rainey *et al.*, 2009; Gray *et al.*, 2010; Timmins *et al.*, 2011). Currently, *T. germaini* is classified by the IUCN Red List as Endangered A2cd (Nadler *et al.*, 2008), which implies a past decrease in population size of more than 50% over three generations (estimated to be 36 years). The apparent paucity of recent records, especially in areas outside of Cambodia, and the relative rate of forest conversion, hunting, and wildlife trade in this region (Sodhi *et al.*, 2004) suggests that this species has undergone very significant declines in population size and area of occupied habitat. Recent genetic analyses suggest a species split into *T. germaini* (*sensu stricto*) and *T. margarita* (Elliot) (Nadler *et al.*, 2003, 2005; Roos *et al.*, 2008), which is not currently recognized as a valid taxon by the IUCN Red List pending further taxonomic work (Nadler *et al.*, 2008). For the purposes of this report, all Indochinese Silvered Langur populations will be referred to as *T. germaini* (*sensu lato*).

A synthesis of information on the distribution, abundance, and taxonomic limits of *T. germaini* is urgently needed in order to assess its conservation status in Cambodia. As much of the available information about Silvered Langurs is in survey reports and other informally published formats, it is not readily accessible outside of Cambodia. This paper collates much of the available recent information to provide a more accurate picture of the status and distribution of this species in Cambodia. A more comprehensive analysis is also being prepared which will contain more specific details, photographs, an analysis of historical sources, and expanded supporting data for the statements made herein.

## TAXONOMY

The taxonomic position of Indochinese Silvered Langur populations remains under debate. Recent genetic analyses recommend treating the Indochinese form as two species: *T. germaini* (*sensu stricto*) or Indochinese Silvered Langur (Groves, 2001), and *T. margarita* or Annamese Silvered Langur (Nadler *et al.*, 2005, 2007; Roos *et al.*, 2007, 2008). More evidence is needed to confirm this hypothesis as the existing genetic data include only four samples from Cambodia (two of which are of unknown origin), and no samples from Lao PDR (Nadler *et al.*, 2005; Roos *et al.*, 2008; Tan *et al.*, 2008). Furthermore, phylogenies were reconstructed using only mitochondrial DNA, which may not accurately describe genetic structure within and among populations, particularly for species characterized by a female-philopatric social organization which is typical among the Asian colobines (Melnick & Hoelzer, 1993; Oates & Davies, 1996; Collins & Dubach, 2000; Ballard & Whitlock; 2004; Kirkpatrick, 2007).

The Mekong River, which delineates the eastern or western boundary for several primate species, is speculated to be the taxonomic boundary between *T. germaini* to the west, and *T. margarita* to the east, by Nadler *et al.* (2005, 2007). However, we suggest that the Mekong seems inherently unlikely to be a particularly strong barrier to gene flow, since Silvered Langurs are often found in riverine and coastal forests throughout their range (Daltry & Momberg, 2000; Long *et al.*, 2000; Kong & Tan, 2002; Pollard *et al.*, 2007; Royan, 2010; Timmins *et al.*, 2011) and occupy many of the Mekong channel islands in northern Cambodia (Bezuijen *et al.*, 2007), suggesting a strong ability to cross this particular piece of water. Detailed field observations by the authors of the current review on both sides of the Mekong show that morphological differences in monkeys between these two land areas are less con-



sistent than implied by Nadler *et al.* (2005) and the purported species-level characters may in some cases be attributable to intraspecific variation. This raises further doubts about the taxonomic limits of the two taxa and prevents ready assessment of their distribution. Until this is resolved, field records such as those summarized below cannot sensibly be assigned to either of these two putative taxa.

**DISTRIBUTION AND ABUNDANCE IN CAMBODIA**

Recent field records of the Indochinese Silvered Langur from survey areas throughout Cambodia during the period 1999-2010 are presented in Table 1 and Fig. 1. There are believed to be numerous additional grey literature sources, historical sources, and unpublished records of this species in Cambodia not yet obtained, and so the distribution presented is likely incomplete. Nonetheless, the sources cited do indicate the main features of the status of this species in Cambodia.

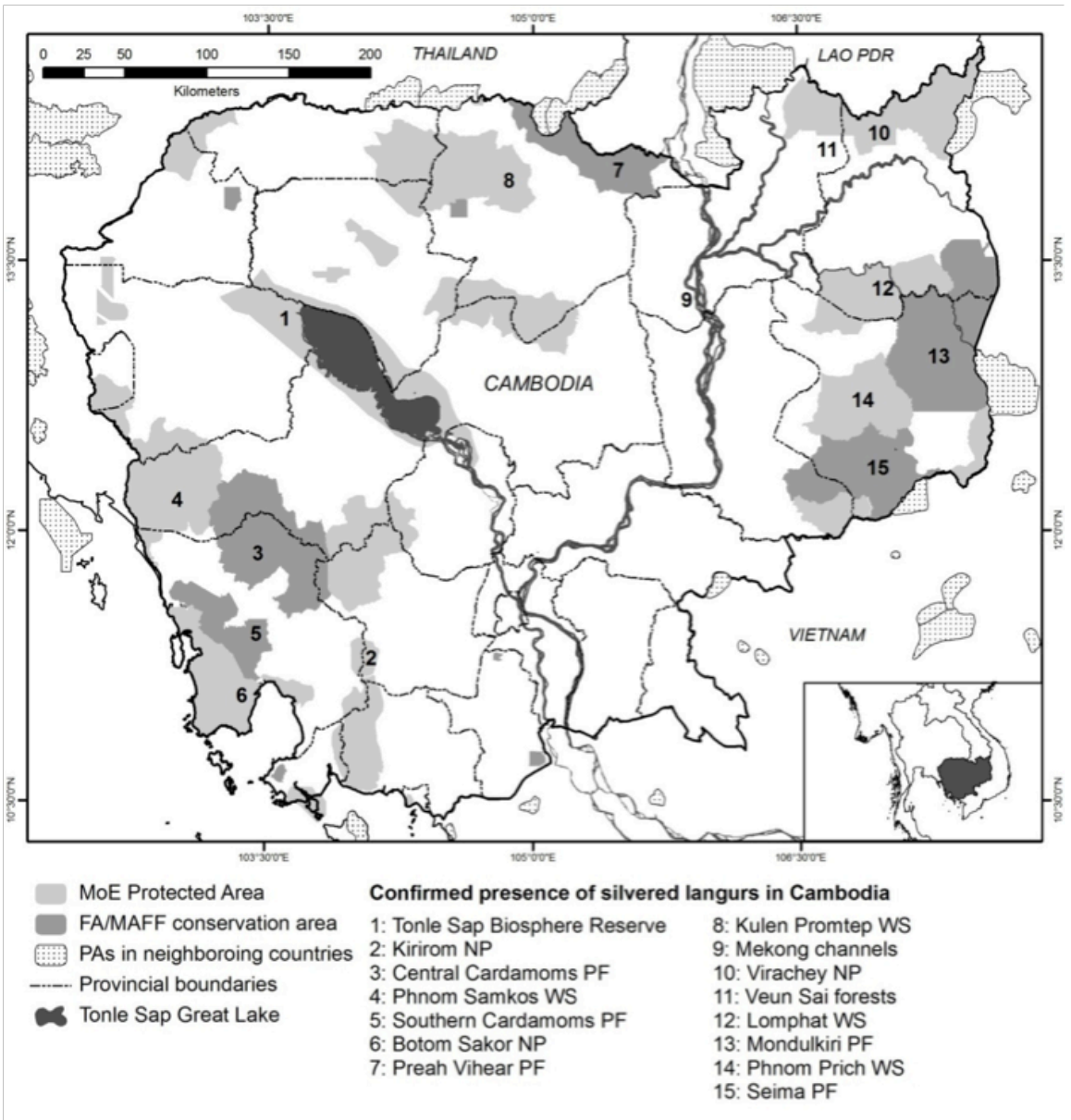


Fig. 1. Map of Cambodia highlighting all protected areas noted in Table 1 with confirmed presence of *Trachypithecus germaini*.

The records comprise a high proportion of the major forest areas covered by wildlife surveys during this period. Distribution ranges from the Cardamom Mountains in the southwest, through the flooded forests of the Tonle Sap Great Lake, along a section of the Mekong River and across the Northern and Eastern Plains landscapes. The Northern Plains comprise sites 7, 8 and surrounding areas on Fig. 1 (essentially Preah Vihear Province and physiographically similar areas of adjacent provinces) whilst the Eastern Plains comprise sites 12-15 and adjacent areas on Fig. 1 (essentially Monduliri Province and physiographically similar areas of adjacent provinces).

### HABITAT USE

In Cambodia, Indochinese Silvered Langurs have been observed in a number of lowland habitats. Probably the greater part of their occupied range is in the Northern and Eastern Plains amongst deciduous dipterocarp forest in evergreen or semi-evergreen forest, mixed-deciduous patches, or riparian strips at around 60-250 m (Pollard *et al.*, 2007; Rainey *et al.*, 2009; authors' pers. obs.). In those areas of the country with higher hill ranges and extensive semi-evergreen and evergreen forests, notably the far northeast, the Monduliri Plateau and the Cardamom range of the southwest, there is an indication that the species is more restricted to riparian areas, and apparently absent over large areas, even in the lowlands (Daltry & Momberg, 2000; Long *et al.*, 2000; Kong & Tan, 2002; Pollard *et al.*, 2007; Royan, 2010; authors' pers. obs.). Along the coast, the species has been recorded from riparian vegetation along river stretches under tidal influence, although not true mangrove vegetation communities *per se* (R. J. Timmins *in litt.*). They also occur in extensive seasonally flooded forest of the Mekong and Tonle Sap floodplains (Davidson, 2006; Bezuijen *et al.*, 2007). The upper altitudinal limit of the species in Cambodia is not known although we are unaware of any records above 450 m.

### CONSERVATION STATUS

Densities are not yet known for any site, but the survey reports cited in Table 1 give a crude guide to relative abundance. Anecdotal evidence suggests that several of the sites support notably high encounter rates (Coudrat, 2009; Rainey *et al.*, 2009) as compared to areas outside of Cambodia. This combination of high densities and large areas of available habitat are in sharp contrast to the current situation in Lao and Vietnam (Nadler *et al.*, 2007; Hoang Minh Duc *et al.*,

2010; Le Khac Quyet *et al.*, 2010; Nadler, 2010; Rawson, 2010; Timmins *et al.*, 2011) and strongly suggests that Cambodia is the global stronghold of the species. The status of the species in Thailand remains unclear.

The main areas with high encounter rates over large landscapes are the deciduous/evergreen forest mosaics of the Northern and Eastern Plains, and at a few sites they can even be described as common, suggesting that these areas in particular may represent a species' stronghold. Given the great extent of suitable habitat in these two landscapes, they likely support the most important populations within Cambodia, and hence globally. A high encounter rate was also recorded over a relatively small survey area in Phnom Samkos Wildlife Sanctuary (Coudrat *et al.*, 2011) suggesting the need for additional surveys to evaluate it as a priority area for the conservation of *T. germaini*.

Threats to the populations in Cambodia are not well studied, although all Cambodian primates are facing severe pressures from habitat loss and hunting (Bezuijen *et al.*, 2007; Pollard *et al.*, 2007; Coudrat, 2009; Rainey *et al.*, 2009; Rawson, 2009, 2010; Rawson *et al.*, 2009; Rawson, 2010; Gray *et al.*, 2010). Deforestation is evidently a threat in the preferred habitats of this species, including large-scale conversion to plantations, small-holder farming, and potentially the construction of dams. Denser forest formations near waterbodies are especially favoured for clearance due to their higher agricultural potential. The extent to which this species is hunted in Cambodia remains poorly known, but there is a generally high hunting pressure on primates for bushmeat wherever they occur and many easily accessible areas of apparently suitable Silvered Langur habitat are not occupied by the monkeys, or are occupied at unnaturally low densities, suggesting these populations have been hunted out. It is not currently reported to have high value as a pet or for medicine (in contrast to *Nycticebus*: for example Nekaris *et al.* [2010]) but the regional market for primate gelatine is strong (R.J. Timmins *in litt.*) and might lead to increased demand in the future. Occasional live specimens have been observed in trade as pets (T. Evans & C. Coudrat, pers. obs.) but this is not believed to be a serious threat. There are also reports that Silvered Langurs may be trapped as 'by-catch' during the collection of Long-tailed Macaques *Macaca fascicularis* or the biomedical trade (WCS data). Given the ease with which langur populations have been depleted in neighbouring countries, and given the significant markets for harvesting of primates, including the gelatine market in Vietnam and China, Silvered Langurs could be extirpated from Cambodia within

**Table 1.** Protected areas in Cambodia with confirmed presence of *Trachypithecus germaini*.

Areas with confirmed presence of <i>Trachypithecus germaini</i> *	Status	Selected references
Tonle Sap Biosphere Reserve	Recorded in Prek Toal and Beung Tonle Chmar core areas	Davidson, 2006
Kirirom NP	Found 'strictly in close proximity to water'; 'patchily distributed'	Kong & Tan, 2002
Central Cardamoms PF	One record from Areng River	Daltry & Momberg, 2000
Samkos WS	Observation and hunted specimen; all observations in lowland evergreen forest	Daltry & Momberg, 2000; Coudrat, 2009; Coudrat et al., 2011
Southern Cardamoms PF	-	FFI field data per M. Maltby
Botum-Sakor NP	Encountered along rivers; reported as 'low density'	Royan, 2010
Preah Vihear PF	Widespread and often encountered in dense forest	Rainey et al., 2009; Moody (pers. obs.), WCS data
Kulen Promtep WS	Reportedly more abundant in dense forest than Long-tailed Macaque, which is itself common in riparian forest	WCS data, Rours Vann (pers. obs.)
Mekong Channels (Kratie to Stung Treng Towns)	Restricted to the more remote stretches, and encounter rates relatively low compared with some other sites.	Bezuijen et al., 2007
Virachey NP	Photo of a hunted animal which shows eye-rings	WWF data
Veun Sai forests	Camera trap photos	B. Rawson (pers. obs.)
Lomphat WS	-	Earnes, 2007
Mondulkiri PF	'very common' with groups of up to 50 individuals observed, in riparian corridors in deciduous dipterocarp and semi-evergreen forest (T. Gray pers. obs.)	Long et al., 2000, several authors (pers. obs.).
Phnom Prich WS	present in riparian and evergreen forest	Timmins & Ou, 2001
Seima PF	Most frequently encountered in riparian forest corridors in deciduous dipterocarp forest but also one record from evergreen forest on the margins of a large natural grassland	Pollard et al., 2007; Walston et al., 2001

\*PF = protected forest; WS = wildlife sanctuary; NP = national park

the century if threats are not controlled (Sodhi *et al.*, 2004; Schipper *et al.*, 2008). Although current threats to the species have been kept largely at bay within some key protected areas, this cannot be taken for granted in the future as this depends upon continued local capacity-building and effective management and law enforcement within these areas, and significant further declines outside protected areas seem inevitable. Given the status of *T. germaini* in other range countries, and the increasing threats within Cambodia, continued support for conservation initiatives within Cambodian protected areas is vital to the long-term survival of the species.

## CONCLUSION

From an examination of readily available published and grey literature records, we suggest that Cambodia retains the largest and healthiest populations of the Indochinese Silvered Langur. However, threats are also apparently high in Cambodia and we recommend action of two kinds.

The most important is to increase conservation attention for this species. This can perhaps best be achieved through increased efforts at the main protected areas in the species' range, most of which lie in Cambodia and many of which already have significant government and external support but all of which face severe pressures. In Cambodia, at least, there is no evidence that this species is especially targeted for trade and so broad measures to reduce habitat loss and bushmeat hunting at these sites should benefit this species as well as many others, as long as they are designed appropriately.

We also note that the design of optimal conservation measures for the Indochinese Silvered Langur should include reliable distributional, ecological, morphological, and genetic data throughout its range. In particular, conservation priorities may need to be revised if two species are confirmed to occur. Genetic analyses should be expanded to include multiple markers as well as autosomal and Y chromosome DNA in order to account for dispersal systems that may not be reflected by mitochondrial DNA alone (Tan *et al.*, 2008), and should attempt to correlate genetic differences with consistent morphological traits, taking account of variability within populations. Most importantly, an improved understanding of the ecology and habitat use of the Indochinese Silvered Langur and an assessment of the threats to its survival are critical to developing better management strategies.

## ACKNOWLEDGEMENTS

We thank the Forestry Administration in the Ministry of Agriculture, Fisheries and Forestry, and the General Department Administration for Nature Conservation and Protection of the Ministry of Environment for their partnership in conservation in Cambodia. We thank Eleanor Briggs for her long-term support for conservation in Cambodia. We also thank Robert Timmins for extensive comments on the manuscript, anonymous reviewers, and the many other donors who supported the work referred to here, and listed in the cited survey reports.

## REFERENCES

- Ballard, J.W.O. and Whitlock, M.C. 2004. The incomplete natural history of mitochondria. *Molecular Ecology* **13**: 729-744.
- Bezuijen, M.R., Timmins, R. and Seng, T. 2007. *Biological Surveys of the Mekong River Kratie and Stung Treng Towns, Northeast Cambodia, 2006-2007*. WWF Greater Mekong-Cambodia Country Programme, Phnom Penh, Cambodia.
- Boonratana, R. 1999. A preliminary wildlife survey in the Cardamom Mountains region of Southwestern Cambodia. In: *Conservation Status of the Cardamom Mountains in Southwestern Cambodia: Preliminary Studies*. F. Momberg and H. Weiler (eds.), pp. 12-28. Fauna & Flora International: Indochina Programme, Hanoi, Vietnam.
- Brandon-Jones, D. 2004. A taxonomic revision of the langurs and leaf monkeys (Primates: Colobinae) of South Asia. *Zoos' Print Journal* **19**: 1552-1594.
- 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.
- Collins, A.C. and Dubach, J.M. 2000. Phylogenetic relationships of spider monkeys (*Ateles*) based on mitochondrial DNA variation. *International Journal of Primatology* **21**: 381-420.
- Coudrat, C. 2009. *A Multidisciplinary Approach to Primate Conservation in Cambodia: Survey and Habitat Description in Samkos Wildlife Sanctuary, Western Cardamom Mountains, and Education Project on Primate Pet Trade*. PhD dissertation, Oxford Brookes University, Oxford, UK.

- Coudrat, C.N.Z., Rogers, L. and Nekaris, K.A.I. 2011. Abundance of primates reveals Samkos Wildlife Sanctuary, Cardamom Mountains, Cambodia as a priority area for their conservation. *Oryx* **45**: 427-434.
- Daltry, J.C. and Momberg, F. 2000. *Cardamom Mountains Biodiversity Survey, 2000*. Fauna & Flora International, Cambridge, UK.
- Davidson, P.J. 2006. *The Biodiversity of the Tonle Sap Biosphere Reserve 2005 Status Review*. Wildlife Conservation Society, Phnom Penh, Cambodia.
- Eames, J.C., Nguyen Duc Tu, Le Trong Trai, Dang Ngoc Can, Ngo Van Tri, Hoang Duc Dat, Thai Ngoc Tri and Nguyen Thi Thu He. 2004. *Draft Final Biodiversity Report for Yok Don National Park, Dak Lac Province*. PARC, FPD, UNOPS. UNDP, Scott Wilson Asia-Pacific Ltd, Hanoi, Vietnam.
- Eames, J. 2007. *A Rapid Evaluation of Lomphat Sanctuary*. Birdlife International, Indochina Programme, Phnom Penh, Cambodia.
- Gray, T.N.E., Phan, C. and Long, B. 2010. Modelling species distribution at multiple spatial scales: gibbon habitat preferences in a fragmented landscape. *Animal Conservation* **13**: 324-332.
- Groves, C.P. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC, USA.
- Hoang Minh Duc, Tran Van Bang, Covert, H.H., Luu Hong Truong and Tran Quoc Toan. 2010. Conservation status of primates in Ta Kou Nature Reserve. **In: Conservation of Primates in Indochina**, T. Nadler, B.M. Rawson and Van Ngoc Thinh (eds.), pp. 91-98. Frankfurt Zoological Society and Conservation International, Hanoi, Vietnam.
- IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 23 August 2011.
- Kirkpatrick, R.C. 2007. The Asian colobines: diversity among leaf-eating monkeys. **In: Primates in Perspective**, C.J. Campbell, A. Fuentes, K.C. Mackinnon, S.K. Bearder and R.M. Stumpf (eds.), pp. 186-200. Oxford University Press, Oxford, UK.
- Kong Kim Sreng and Tan Setha. 2002. *A Wildlife Survey of Kirirom National Park, Cambodia*. Wildlife Conservation Society, Phnom Penh, Cambodia.
- Le Khac Quyet and Nguyen Vu Khoi. 2010. Preliminary survey on primates in Phu Quoc National Park, Kien Giang Province, Vietnam. **In: Conservation of Primates in Indochina**, T. Nadler, B.M. Rawson and Van Ngoc Thinh (eds.), pp. 99-106. Frankfurt Zoological Society and Conservation International, Hanoi, Vietnam.
- Long, B., Swan, S. and Kry Masphal. 2000. *Biological Surveys in Northeast Mondulhiri, Cambodia. April 2000*. Fauna & Flora International, Indochina Programme and the Wildlife Protection Office, Hanoi, Vietnam and Phnom Penh, Cambodia.
- Melnick, D.J. and Hoelzer, G.A. 1993. What is mtDNA good for in the study of primate evolution? *Evolutionary Anthropology* **2**: 2-10.
- Moody, J. 2007. *The Taxonomic Classification and Systematics of the Southeast Asian Silvered Langurs (Trachypithecus cristatus)*. Master's thesis, Hunter College, City University of New York, USA.
- Nadler, T. 2010. Status of Vietnamese primates - complements and revisions. **In: Conservation of Primates in Indochina**, T. Nadler, B.M. Rawson and Van Ngoc Thinh (eds.), pp. 3-16. Frankfurt Zoological Society and Conservation International, Hanoi, Vietnam.
- Nadler, T., Momberg, F., Dang, F. and Lormee, N. 2003. *Leaf Monkeys: Vietnam Primate Conservation Status Review 2002, Part 2*. Fauna and Flora International, Asia Pacific Programme Office, Hanoi, Vietnam.
- Nadler, T., Timmins, R.J. and Richardson, M. 2008. *Trachypithecus germaini*. **In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.1.** <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 23 August 2011.
- Nadler, T. Walter, L. and Roos, C. 2005. Molecular evolution, systematics, and distribution of the taxa within the silvered langur species group (*Trachypithecus [cristatus]*) in Southeast Asia. *Der Zoologische Garten (N.F.)* **75**: 238-247.
- Nadler, T., Vu Ngoc Thanh and Streicher, U. 2007. Conservation status of Vietnamese primates. *Vietnamese Journal of Primatology* **1**(1): 7-26.
- Nekaris, K.A.I., Shepherd, C.R., Starr, C.R. and Nijman, V. 2010. Exploring cultural drivers for wildlife trade via an ethnoprimateological approach: a case study of slender and slow lorises (*Loris* and *Nycticebus*) in South and Southeast Asia. *American Journal of Primatology* **72**: 877-886.
- Oates, J.F. and Davies, A.G. 1994. *Colobine Monkeys: Their Ecology, Behavior, and Evolution*. Cambridge University Press, Cambridge, UK.
- Pollard, E., Clements, T., Hor, N.M. and Ko, S. 2007. *Status and Conservation of Globally Threatened Primates in the Seima Biodiversity Conservation Area*,

- Cambodia. Wildlife Conservation Society - Cambodia Program, Phnom Penh, Cambodia.
- Rainey, H., Clements, T., Setha, T., Sokha, T., Vann, R. and Tyson, M. 2009. *Large Mammal Surveys in Preah Vihear Protected Forest, Cambodia 2006-2009*. Wildlife Conservation Society, Phnom Penh, Cambodia.
- Rawson, B.M. 2009. *The Socio-ecology of the Black-shanked Douc (Pygathrix nigripes) in Monduliri Province, Cambodia*. PhD dissertation, The Australian National University, Canberra, Australia.
- Rawson, B.M., Clements, T. and Nut Meng Hor. 2009. Status and conservation of yellow-cheeked crested gibbons in Seima Biodiversity Conservation Area, Monduliri Province, Cambodia. **In:** *The Gibbons: New Perspectives on Small Ape Socioecology and Population Biology*, S. Lappan and D.M. Whittaker (eds.), pp. 387-408. Springer, New York, USA.
- Rawson, B.M. 2010. The status of Cambodian primates. **In:** *Conservation of Primates in Indochina*, T. Nadler, B.M. Rawson and Van Ngoc Thinh (eds.), pp. 17-25. Frankfurt Zoological Society and Conservation International, Hanoi, Vietnam.
- Roos, C. 2004. Molecular evolution and systematics of Vietnamese primates. **In:** *Conservation of Primates in Vietnam*, T. Nadler, U. Streicher and Ha Thong Long (eds.), pp. 23-28. Frankfurt Zoological Society, Hanoi, Vietnam.
- Roos, C., Vu Ngoc Thanh, Walter, L. and Nadler, T. 2007. Molecular systematics of Indochinese primates. *Vietnamese Journal of Primatology* **1**(1): 41-53.
- Roos, C., Nadler, T. and Walter, L. 2008. Mitochondrial phylogeny, taxonomy and biogeography of the silvered langur species group (*Trachypithecus cristatus*). *Molecular Phylogenetics and Evolution* **47**: 629-636.
- Royan, A. 2010. Significant mammal records from Botum-Sakor National Park, Southwest Cambodia. *Cambodian Journal of Natural History* **1**: 22-26.
- Schipper, J., Chanson, J.S., Chiozza, F., Cox, N.A., Hoffmann, M., *et al.*, 2008. The status of the world's land and marine mammals: diversity, threat, and knowledge. *Science* **322**: 225-230.
- Seng Teak. 2001. *Surveys of Tigers and Other Large Mammals in Virachey National Park (2000-2001)*. WWF Cambodia Conservation Program, Phnom Penh, Cambodia.
- Sodhi, N.S., Koh, L.P., Brook, B.W. and Ng, P.K. 2004. Southeast Asian biodiversity: an impending disaster. *Trends in Ecology & Evolution* **19**: 654-660.
- Tan, S.H.D., Ali, F., Kutty, A.N. and Meier, R. 2008. The need for specifying species concepts: how many species of silvered langurs (*Trachypithecus cristatus* group) should be recognized? *Molecular Phylogenetics and Evolution* **49**: 688-689.
- Timmins, R.T. and Soriyun, M. 1998. *A Wildlife Survey of the Tonle San and Tonle Srepok River Basins in Northeastern Cambodia*. Fauna & Flora International: Indochina Programme/Wild Life Protection Office, Department of Forestry, Hanoi, Vietnam and Phnom Penh, Cambodia.
- Timmins, R.J. and Ou Ratanak, 2001. *The Importance of Phnom Prich Wildlife Sanctuary and Adjacent Areas for the Conservation of Tigers and Other Key Species*. WWF Cambodia Conservation Program, Phnom Penh, Cambodia.
- Timmins R.J., Steinmetz, R., Poulsen, M.K., Evans, T.D., Duckworth, J.W. and Boonratana, R. 2011. The Indochinese silvered leaf monkey *Trachypithecus germaini* (*sensu lato*) in Lao PDR. *Primate Conservation* **26**: 1-12.
- Walston, J., Davidson, P. and Soriyun, M. 2001. *A Wildlife Survey of Southern Monduliri Province, Cambodia*. Wildlife Conservation Society, Phnom Penh, Cambodia.

# ON THE APPARENT OCCURRENCE OF HOSE'S SURILI *Presbytis hosei* IN SIMILAJAU NATIONAL PARK, SARAWAK, MALAYSIA

J.W. Duckworth<sup>1\*</sup>, Anthony C. Sebastian<sup>2</sup>, R.N. Kelsh<sup>3</sup> and Douglas Brandon-Jones<sup>4</sup>

<sup>1</sup> 3 Camerton Close, Saltford, Bristol BS31 3BT, UK. E-mail: willduckworthdprk@yahoo.com

<sup>2</sup> Aonyx Consultancy, P.O. Box A1195, Kenyalang Park, 93824 Kuching, Sarawak, Malaysia. E-mail: aonyxenvironmental@gmail.com

<sup>3</sup> Dept of Biology & Biochemistry, University of Bath, Claverton Down, Bath BA2 7AY, UK. E-mail: bssrnk@bath.ac.uk

<sup>4</sup> 22 Karenia Street, Bray Park, QLD 4500, Australia. E-mail: douglas@quadrumania.net

\* Corresponding author

## ABSTRACT

The polytypic Hose's Surili *Presbytis hosei*, endemic to Borneo, is categorised as Vulnerable by the IUCN Red List of Threatened Species. Mostly, recent sources recognise *P. h. everetti* (previously considered a junior synonym of *P. h. hosei*), leaving the nominotypical subspecies with only a small known range within which no surviving populations are confirmed. Similajau National Park, coastal Sarawak, has been speculated to hold *P. h. hosei* (*sensu stricto*). If *P. hosei* occurs there, it must be rare: the most intensive survey to date (1995) failed to locate it. Descriptions of apparent *P. hosei* observed in the park in 1986, 2002 and 2005 (once in each year) do not fully accord with those of *P. h. hosei*, *P. h. everetti*, any other named form, or with one another. These animals cannot confidently be identified. Some surilis in the park might be subspecifically intermediate between Sarawak Surili *P. chrysomelas chrysomelas* (the most common colobine in the park) and *P. c. cruciger*. Whatever they are, if still extant in the park they are probably extremely threatened there. The lack of a healthy (if any) population in Similajau National Park of *P. h. hosei* (*s.s.*), which is so poorly known that its typical morphology is partly inferred, means that searches for it are urgently required in Brunei.

**Keywords:** conservation status, geographic range, *Presbytis chrysomelas*, *Presbytis hosei hosei*, taxonomic uncertainty

## INTRODUCTION

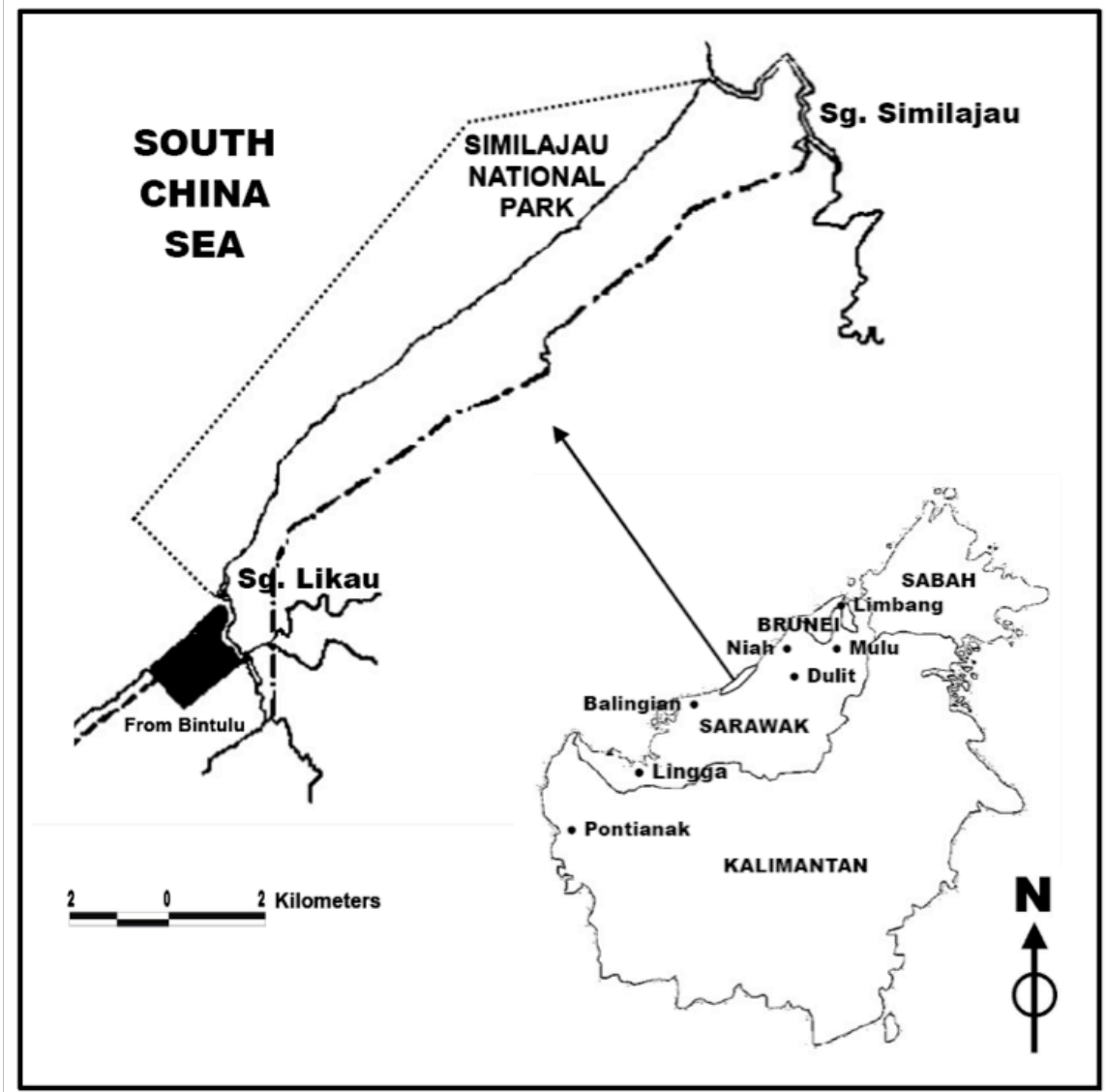
Categorised as Vulnerable by the *IUCN Red List of Threatened Species* (Nijman *et al.*, 2008a), Hose's Surili (= Hose's Langur, Grey Leaf Monkey) *Presbytis hosei* (Thomas) is one of several primate species endemic to Borneo. Recent authors have not followed Brandon-Jones (1997) in considering it conspecific with Javan Surili *P. comata* Desmarest. It is invariably considered polytypic, and Groves (2001) suspected that it might best be divided into three species, a stance supported by subsequent craniometric analysis (Meijaard & Groves, 2004), and followed by Nijman (2010). Brandon-Jones (1997), Groves (2001, 2005) and Brandon-Jones *et al.* (2004) recognised *P. h. everetti* (Thomas), although previous authors in recent decades (notably Payne *et al.* [1985]: the chief reference used during the surveys providing the observations described here) had invariably treated it as a synonym of *P. h. hosei* (Thomas) as did the later Nijman (2010), although

without discussing why. Brandon-Jones (1997) noted that the subspecies *P. h. everetti*, from inland eastern Sarawak, Brunei, west Sabah and northern Kalimantan, is undoubtedly sexually dichromatic, while the nominotypical subspecies *P. h. hosei* (as he defined it, confirmed only from the type locality of Niah, Sarawak) is reputedly sexually monochromatic. Brandon-Jones (1997, 2006) knew of no records of *P. h. hosei* (*sensu stricto*) for decades, speculating that it might be extinct but that, if it survives, Similajau National Park (= NP) in Sarawak, and Brunei might be the most likely places, on geographical grounds, to find it.

This note therefore details records of apparent *P. hosei* from Similajau NP. This park (N3°22-31', E113°10-18') covers 90 km<sup>2</sup> of forest along the Sarawak coast, mostly as a narrow strip, and c. 131 km<sup>2</sup> of adjacent sea. In 1986 it was contiguous with thousands of square kilometres of little-degraded lowland evergreen

forest. By 1995 it had been largely isolated through logging, and by 2005 it was almost entirely surrounded by oil palm plantation and had in parts itself been heavily logged. Much of the park is mixed dipterocarp forest, transitional with *kerangas* (forest on soil too poor to support a rice crop) over large areas, particularly closer to the coast. Some areas, both tidal and freshwater, resemble swamp forest. Most of the park is below 50 m altitude, and much is on almost level terrain; the highest point is at only 113 m. The records came from general bird and large mammal surveys, using mainly direct observation, of the park in 1986 (6 August - 16

September; Duckworth & Kelsh, 1988; Duckworth, 1995), 1995 (4-28 September; Duckworth, 1997), 2002 (9-17 July; Jefferies & Sebastian, 2003) and 2005 (unpublished observation of JWD during 5-27 April). Throughout the text, comparison is made to the various figures in Payne *et al.* (1985) of colobines, not assuming that they are perfectly accurate, but to act as a point of reference for precision in describing the observed animals' appearance. While comparison of the observations against particular specimens would be preferable, these pictures were available to all observers during the surveys. All pertinent morphological



**Fig. 1.** Similajau National Park, and other Bornean localities mentioned in the text. Sg. = Sungai (River). The black area southwest of the Sungai Likau is a recent extension to the park, the original southern boundary of which was the Sungai Likau. The seaward boundary of the park is shown by the dotted line and the landward by the dashed line.



information from each sighting is given here; that it is rather scanty reflects the brevity of the views and, in 1986, the community-level novelty of the entire Southeast Asian fauna to the surveyors. The taxonomy of Southeast Asian colobines is unstable, particularly for Bornean surlis. Taxonomy and nomenclature here follow Groves (2001). The park and other Bornean localities mentioned in the text are shown in Fig. 1.

These surveys showed the common colobine of the park's forests to be Sarawak Surlil *P. chrysomelas chrysomelas* (Müller) (called Banded Langur *P. melalophos chrysomelas* by Payne *et al.* [1985], and *P. femoralis chrysomelas* by Brandon-Jones *et al.* [2004]), itself of major conservation significance: the taxon is presently considered Critically Endangered by the IUCN Red List of Threatened Species (Nijman *et al.*, 2008b). Although Medway (1977: 66) stated that "northwards *P. m. chrysomelas* extends to central Sarawak where it meets *P. m. cruciger*", Payne *et al.* (1985) omitted from their distribution map records of *P. c. chrysomelas* from Balingian (Pocock, 1935: 909-911) and Similajau NP (Aken, 1982). *Presbytis chrysomelas* was observed many times (involving several groups at two sites) in 1986 (Duckworth & Kelsh, 1988), on ten days (involving at least five groups at three sites) in 1995 (Duckworth, 1997), more regularly and at more spots than any other colobine in 2002 (ACS), and four times in 2005 (with four further sightings of colobines unresolved to species; JWD). In 1995, 2002 and 2005, the animals were studied particularly carefully because of an inconclusive 1986 sighting of *P. hosei* in the park. Most sightings in all years were of animals typical of *P. chrysomelas chrysomelas*.

### **OBSERVATIONS OF APPARENT *P. hosei* IN SIMILAJAU NATIONAL PARK**

During the late afternoon of 24 April 2005, JWD observed a troop of six or more surlis for about a minute about 1 km inland along the Batu Ancau trail, in the south of the park. It contained animals differing greatly from typical *P. c. chrysomelas*. Only two individuals were seen well; they had bright pink facial skin with bold black (or blackish) bands across the cheek-skin (similar in size and oblique orientation to those in the illustrations of *P. hosei* in Payne *et al.* [1985]), dark (but not charcoal) grey upperparts, and strikingly bright clean white-looking underparts. The facial skin colour-pattern and ventral pelage colour were both well outside the range of variation shown by other surlis seen in the park in 2005. The best-seen individual was much smaller than adult size (but showed no trace of infant colour). The same facial skin colour-pattern and ventral

pelage colour features were confirmed on at least one full-grown animal. Four or more other animals in association were seen in quick succession as the troop moved. In the brief views obtained, none appeared inconsistent with the two clearly visible individuals, having upperparts paler than those of *P. chrysomelas*, (Müller) and at least some white on the underparts. Field notes focused on facial skin and ventral features as these differed noticeably from those of local *P. chrysomelas*. Had the extensive white head pelage of *P. h. hosei* and *P. h. everetti* (Payne *et al.*, 1985 [where *P. h. everetti* was considered a synonym of *P. h. hosei*]; Brandon-Jones, 1997) been present, this marked difference from local *P. chrysomelas* would have been noted. The head pelage was presumably of a grey tone like that of the upperparts, or at most resembled in palor the illustration in Payne *et al.* (1985) of *P. h. sabana*.

These animals were about 50 yards from a first-detected group of surlis on which observation (unfortunately) concentrated. On being flushed, the two groups moved off in opposite directions. One of the first-seen groups had fleshy grey facial skin with readily visible, dark, horizontal cheek-bars, charcoal pelage and dirty-looking pale grey-white underparts. At least one other had the dark face typical of *P. chrysomelas* in the park. This and several others had dark pelage resembling that of *P. chrysomelas* in the park. An uncertainly identified animal seen along the park's 'Loop Trail' (starting from the Sungai Likau) on 11 April 2005 had blackish pelage with a whitish blaze across the chest as well as between the hindlegs and around the tail-base, and obvious dark cheek-bands. Much of its facial skin looked pink, but the precise tone was difficult to judge because the observation was against the light.

On 9 July 2002, ACS watched two apparent *P. hosei* for 10 minutes along the Loop Trail. They were in the tall larger-boled forests on the hilly part of the park, towards the inland boundary. Clean white cheek fur was seen clearly on one individual. The second animal faced away from the observer but even from almost directly behind, white cheeks could be seen puffed out on either side of the head. Clean white on the cheeks extended up the sides of the head, but not to the extent that is depicted for *P. h. hosei* (including *P. h. everetti*) in Payne *et al.* (1985). The extent (although not the colour) of white on the head of the individual best observed was more like that source's illustration of the pale area in *P. h. sabana* than of white in *P. h. hosei*. Black 'war-paint' bands on the face were clearly observed on the head-on individual. When first observed in the canopy, it was the pale-faced appearance that

first caught ACS's eye: the pink skin was very bright. The dark pelage (which was paler ventrally than dorsally) was clearly a lighter shade of grey than the charcoal-colour of *P. chrysomelas*.

In 1986, a group of six apparent *P. hosei* was seen in intergrade *kerangas*-mixed dipterocarp forest near the Sungai (= River) Similajau (the northern boundary of the park), and other sightings of less visible animals elsewhere in the park in that year may also have been of this species (Duckworth & Kelsh, 1988). On 10 September, RNK observed the animals head-on at ranges down to 40 m. The face was pale pinkish-white with oblique black bands across the cheeks. The head-fur was greyish, like the illustration of *P. h. sabana* (Thomas) in Payne *et al.* (1985). The underparts were whitish, as were the insides of the limbs and, probably, the base of the tail. The 'machine-gun' call resembled that of *P. chrysomelas*. It was not noted how many animals showed well enough to allow these characters to be assessed, and it cannot be ruled out that there might have been variation in, for example, head pelage.

On the 1995 survey, no animals strongly suggesting *P. hosei* were seen. The only animal with its face visible in a surili troop near the Sungai Likau (in the south of the park) had some ill-defined flesh-pink skin on the face (eyelids, bridge of nose and cheek-skin immediately beside the nose) (R.J. Wilkinson *in litt.*, 1995). Surilis seen around the Sungai Likau that year also varied in pelage darkness, particularly on the tail. Some animals in one troop had almost black tails, while others had so many pale hairs that from a distance the tail seemed almost white. This is probably within the range of the taxon's natural variation: one paratype of *P. chrysomelas* collected by P.-M. Diard and labelled as from near Pontianak is predominantly albinistic (Brandon-Jones, 1999). Mitchell (1977) reported that in Gunung (= Mount) Mulu NP, *P. hosei* often has white flecks on its tail; one had a 100-mm white tail-tip.

## DISCUSSION

Sarawak Museum male (probably adult, but skull not traced) 086/28 is the only known study specimen of the Similajau area *P. c. chrysomelas* population, albeit somewhat paler ventrally than were most of those observed in the field during 1986-2005. Collected (number B.2) on 22 January 1953, apparently by 'Nyandoh', its label is printed: 'Loke Wan Tho: Tom Harrison Collection'. Its field notes state: "old jungle; on top of a tree; pairs". The hair behind the facial midline has a V-shaped parting. The occipital crest is about 50 mm in length; the nuchal hairs are mainly

backwardly compressed. The groin, lower abdomen, inside of the limbs, underside of the tail almost to its tip, midline of the lower chest (almost coalescing with the abdomen), most of the mammary area, and a patch below the chin are yellowish white. The upper chest and sides of the neck are pale brown. Intermediate in tone between these colours, the lips, especially the upper one, are sprinkled with blackish hairs. The dorsal tail base is brown, as are the lower chest (other than its midline) and upper abdomen, darkening laterally and towards the abdominal midline. The pelage is otherwise blackish brown (DB-J).

Before concluding that another surili taxon occurs at Similajau NP, allowance must be made for the extensive variation in *Presbytis chrysomelas*, as discussed in Napier (1985: 41) and Groves (2001: 278). Some otherwise morphologically typical Similajau NP *P. chrysomelas* showed atypical features, notably grey to pinkish facial skin (producing contrasting dark cheek bands [although their orientation was not noted]) and paler underparts. Pocock (1935: 911) found marked tonal variation in the grey throat colour of two specimens from Balingian (N2°55', E112°32'), 100 km southwest of Similajau NP. In the Sarawak Museum, Banks (1931: 105) had "a peculiar male from Lingga [N1°21', E111°10'] (No. 5.216) [now accessed as SMK.086/21] in which the bases of the hairs instead of being black or blackish brown are rust coloured on the shoulders, down to the elbows, and on the thighs and flanks so that only the extremities of the hairs are black. If turned aside they disclose rust coloured markings faintly suggestive of what is presently generally called *P. chrysomelas cruciger* (Thomas); the hairs on the rump have only a little rust colour just at the base and there are few of these. The tail is dark brown at the base and more grizzled brownish at the extremity; the crest is very well marked but yellowish white in front with a white patch behind each ear".

Those surilis seen in Similajau NP in 1986, 2002 and 2005 and described above were even more strikingly different from typical *P. c. chrysomelas*. In sum, from the descriptions above: all had bright pale pink facial skin with well-defined oblique dark cheek bands; where specified (in 2002 and 2005), the upperparts were paler grey than *P. c. chrysomelas*; and (1986 and 2005, unconfirmed in 2002) the underparts were considerably whiter. Compared with external variation in museum series of surilis, the unusual ones were consistent enough on the three different occasions to comprise probably only one odd form. Only the animals seen in 2002 displayed the clean white cheek

pelage, restricted in *P. hosei* to *P. h. hosei* and *P. h. everetti*. Animals in 1986 were explicitly noted to have grey sides to the head (resembling *P. h. sabana*).

The combination of grey (as described in 2002 and 2005), rather than charcoal-grey, upperparts with whitish underparts fits only *P. hosei*. *Presbytis hosei* occurs across a wide altitudinal range including in lowland forest (Nijman, 2010), and Similajau NP is only 60 km southwest of Niah (N3°52', E113°44'), the type and only confirmed locality of *P. h. hosei*, so its presence in the park is plausible. Brandon-Jones (1997) mapped many localities for *P. h. everetti*, of which the closest to Similajau NP was Gunung Dulit (N3°21', E114°11'), only 90 km due east of it.

Just before or immediately after completing eruption of the permanent dentition, subadult females of *P. h. everetti* acquire a head pelage colour distinctly darker than that of males and juvenile females, which they retain throughout adulthood (well illustrated in Payne *et al.* [1985], as *P. h. hosei*). Brandon-Jones (1997) reinstated *P. h. everetti* because both Hose (1893) and Banks (1931) declared that animals in the lowlands (where lies the type locality of *P. h. hosei*, s.s.) lacked this distinct adult female head pelage. Although neither provided a mature adult female lowland specimen, the implication is that adult females of *P. h. hosei* (the coastal population) retain the juvenile (and male) colour and that *P. h. everetti* (the inland population) is therefore recognisable as a taxon distinct from *P. h. hosei*. The excessive yellowish head pelage of two females from Limbang (N4°45', E115°00'), Sarawak, Malaysia (Brandon-Jones, 1997), suggesting they are subspecifically intermediate (Brandon-Jones, 1999), reinforces this conclusion. Given the few apparent *P. hosei* individuals observed in Similajau NP, the absence there of sexual dichromatism cannot be confirmed, but is suggested by the lack of any noted difference between adults and juveniles.

Both sexes of both *P. h. hosei* and *P. h. everetti* have much luxuriant 'clean' white head pelage. The reported lack of such pelage in Similajau NP animals seen in 1986 and 2005 accords better with *P. h. sabana*. And although the 2002 animals showed clean white lateral head pelage (not shown by *P. h. sabana*; DB-J, pers. obs.), its extent fitted that of the contrastingly paler grey pelage shown by *P. h. sabana* (as illustrated in Payne *et al.* 1985), not the extent shown by *P. h. hosei* or *P. h. everetti*. These similarities to *P. h. sabana* may simply be convergent, because *P. h. sabana* is the northeastern subspecies of *P. hosei*. Its nearest confirmed locality is almost 400 km away from Similajau

NP, in southern Sabah, separated by the entire range of *P. h. hosei* and *P. h. everetti* (Brandon-Jones, 1997). Southeast of *P. h. everetti* in eastern Borneo lives *P. h. canicrus* Miller, which, like *P. h. sabana*, lacks bright white pelage on the head (Brandon-Jones, 1997). This subspecies has dark facial skin down to the ear-mouth line. The 1986 and 2005 Similajau NP animals therefore are not this subspecies.

Based on known range, the unidentified Similajau NP surili would be most likely to be *P. h. hosei*, but what is believed to be a characteristic feature of this taxon, the luxuriant white lateral head pelage, was not present on some of the best-seen animals. Conceivably, but improbably, a surili taxon new to science might be endemic to Similajau NP and its immediate environs. A perhaps more plausible alternative to this tiny-range hypothesis can equally accommodate the apparent physical irregularities of the sighted animals. It is that when reporting *P. h. everetti* absent from the lowlands, Hose's (1893) observations pertained to animals north of Niah and that Niah represents the western limit of what would therefore be called *P. h. hosei* (with *P. h. everetti* as a synonym), or that his holotype was mislabelled and actually came from further east. This would mean there are no known study specimens of the sexually monochromatic coastal population: the animal discussed as *P. h. hosei* by Brandon-Jones (1997). This potential subspecies could occur from Similajau NP to western Brunei and be more distinct from what is presently called *P. h. everetti* than is Brandon-Jones's (1997) concept of *P. h. hosei*. There is also the possibility of hybridisation between *P. chrysomelas* and *P. hosei*, especially as other sighted animals approximating *P. chrysomelas* in appearance had some skin and pelage features of *P. hosei*. The available evidence is too fragmentary or contradictory to discriminate convincingly between these possibilities.

All primates seen in 1986 were shy, reflecting the heavy hunting in the then unstaffed and unmanaged park. In both 1995 and particularly 2005, colobines were shyer than were Long-tailed Macaques *Macaca fascicularis* (Raffles) and Bornean Gibbons *Hylobates muelleri* Martin, both of which could (in contrast to 1986) be readily observed almost whenever encountered. Although some surilis could be watched closely and for prolonged periods in 1995, this was not universal. Such confiding behaviour was never observed in 2005 (although gibbons and macaques remained relatively unconcerned by close human presence): those seen well were not aware of the observer; and on noticing him departed promptly and fled far enough to be

out of view. That the surilis were so much shyer than the gibbons or macaques suggests the possibility of targeted hunting, as can occur elsewhere (e.g. Nijman, 2005, 2010). In any case, the current status of these surilis in Similajau NP cannot be considered secure. Therefore, it is important to identify the taxon present and, depending on the answer, there may be a very high priority to clarify its conservation needs, followed by conservation interventions (if it still survives) to prevent its loss. Given that one taxon of Hose's Surili is sexually dichromatic whereas the others are not, particular attention should be paid to assessing the precise appearance of head pelage of as many animals as possible in each troop. Concerning *P. h. hosei* (s.s.), Brandon-Jones's (2006) other hope for its survival, Brunei, is probably the best place to seek the taxon, if it is not already extinct.

### ACKNOWLEDGEMENTS

The 1986 survey was possible only through the help of many people and institutions as gratefully thanked in Duckworth & Kelsh (1988). The 1995 and 2005 visits were made with the kind assistance and encouragement of, respectively, the Sarawak National Parks and Wildlife Office and the Sarawak Forestry Corporation, who are particularly thanked. Mike Chong assisted with the 2002 survey. The observations of Mike Evans, Simon Irwin, Rob Tizard and Roger Wilkinson in 1995 helped illuminate the appearance of surilis in Similajau NP. Stephanie Phan kindly prepared the map.

### REFERENCES

- Aken, K.M. 1982. *A Wildlife Survey of Similajau National Park*. Unpublished report to the National Parks and Wildlife Office, Sarawak Forest Department, Kuching, Sarawak, Malaysia.
- Banks, E. 1931. A popular account of the mammals of Borneo. *Journal of the Malayan Branch of the Royal Asiatic Society* **9**(2): 1-139.
- Brandon-Jones, D. 1997. The zoogeography of sexual dichromatism in the Bornean grizzled sureli, *Presbytis comata* (Desmarest, 1822). *Sarawak Museum Journal* **50**(71): 177-200.
- Brandon-Jones, D. 1999. *A Revision of the Surelis, Genus Presbytis Eschscholtz, 1821 (sensu stricto)* (Mammalia: Cercopithecidae). PhD dissertation, University of London, UK.
- Brandon-Jones, D. 2006. Miller's grizzled surili *Presbytis hosei canicrus* Miller, 1934. In: 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. (eds.), *Primates in Peril: the world's 25 most endangered primates 2004-2006*, p. 11. *Primate Conservation* **20**: 1-28.
- 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.
- Duckworth, J.W. 1995. Mammal records from Similajau National Park. *Sarawak Museum Journal* **48**: 157-161.
- Duckworth, J.W. 1997. Mammals in Similajau National Park, Sarawak, in 1995. *Sarawak Museum Journal* **51**: 171-192.
- Duckworth, J.W. and Kelsh, R.N. 1988. *A Bird Inventory of Similajau National Park*. International Council for Bird Preservation (Study Report 31), Cambridge, U.K.
- Groves, C.P. 2001. *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC, USA.
- Groves, C.P. 2005. Order Primates. In: *Mammal Species of the World*, 3rd edition, D.E. Wilson and D.M. Reeder (eds.), pp. 111-184. Johns Hopkins University Press, Baltimore, USA.
- Hose, C. 1893. *A Descriptive Account of the Mammals of Borneo*. Edward Abbott, Diss, Norfolk, U.K.
- Jefferies, B. and Sebastian, A. 2003. *Site Conservation Management Plan for Similajau National Park*. Sarawak Forest Department, Kuching, Sarawak, Malaysia.
- Medway, Lord 1977. *Mammals of Borneo: Field Keys and an Annotated Checklist*. Malaysian branch of the Royal Asiatic Society (monograph 7), Kuala Lumpur, Malaysia.
- Meijaard, E. and Groves, C.P. 2004. The biogeographic evolution and phylogeny of the genus *Presbytis*. *Primate Report* **68**: 71-90.
- Mitchell, A. W. 1977. *Royal Geographical Society Mulu (Sarawak) Expedition: Preliminary Results of a Primate Survey in the Gunung Mulu National Park, July-September 1977*. Unpublished report.
- Napier, P. H. 1985. *Catalogue of Primates in the British Museum (Natural History) and Elsewhere in the British Isles. Part III: Family Cercopithecidae, Subfamily Colobinae*. British Museum (Natural History), London, UK.

- Nijman, V. 2005. Decline of the endemic Hose's langur *Presbytis hosei* in Kayan Mentarang National Park, east Borneo. *Oryx* **39**: 223-226.
- Nijman, V. 2010. Ecology and conservation of the Hose's langur group (Colobinae: *Presbytis hosei*, *P. canicrus*, *P. sabana*): a review. **In:** *Behavior, Ecology and Conservation of Indonesian Primates: Progress and Prospects in Primatology*, S. Gursky-Doyen and J. Supriatna (eds.), pp. 269-284. Springer Science+Business Media LLC, New York, USA.
- Nijman, V., Meijaard, E. and Hon, J. 2008a. *Presbytis hosei*. **In:** IUCN 2010. *IUCN Red List of Threatened Species*, Version 2010.4. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 23 February 2011.
- Nijman, V., Hon, J. and Richardson, M. 2008b. *Presbytis chrysomelas*. **In:** IUCN 2010. *IUCN Red List of Threatened Species*, Version 2010.4. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 23 February 2011.
- Payne, J., Francis, C.M. and Phillipps, K. 1985. *A Field Guide to the Mammals of Borneo*. Sabah Society with World Wildlife Fund Malaysia, Kota Kinabalu and Kuala Lumpur, Malaysia.
- 
-



# Instructions to Contributors

## Scope

This journal aims to provide information relating to conservation of the primates of Asia. We welcome manuscripts on any relevant subject, including taxonomy and genetics, biogeography and distribution, ecology and behaviour, active threats and primate-human interactions. Submissions may include full articles, short articles and book reviews.

## Submissions

Manuscripts and all editorial correspondence should be directed to Dr Ramesh Boonratana (rbz@loxinfo.co.th). Manuscripts are to be submitted to the journal on the understanding that they have not been published previously and are not being considered for publication elsewhere. The corresponding author is responsible for ensuring that the submitted manuscript has been seen and approved by all co-contributors, and the covering letter accompanying it should be signed to this effect. It is also the responsibility of the contributor to ensure that manuscripts emanating from a particular institution are submitted with the approval of the necessary authority. The editors retain the right to modify the style and the length of a contribution and to decide the time of publication; they will endeavour to communicate any changes to the contributors. The full name and address of each contributor should be included. Please avoid the use of unexplained abbreviations and acronyms.

## Contributions

Manuscripts should be submitted in English. Manuscripts must be in electronic format in MS-Word or a compatible program, double-spaced and left-justified. The first page should include a concise title, an abridged title for a running header (no more than 50 characters), up to seven keywords not found in the title, full names and addresses of all authors, current addresses if different, e-mail addresses, and indication to whom queries and proofs should be sent. In-text citations should use comma and ampersand and follow first chronological, then alphabetical, sequence: (Matsuzawa & MacKinnon, 1980; Marsh, 1998; Matsuzawa, 1998a, 1998b). All pages including tables should be numbered. Footnotes should be avoided.

**Full articles** will be sent out for peer-review and should contain significant new findings. They should not exceed about 20 pages in length (double-spaced), including references. Please include an abstract of no more than 200 words, placing the work in conservation context and summarising what it has contributed, and subheadings (e.g. Introduction, Methods, Results, Discussion, Acknowledgements, References) as appropriate.

## Taxonomy

Scientific nomenclature should be used at first mention of any species or subspecies. Nomenclature should include taxonomic authority (at first mention) as currently recognised by IUCN, e.g. Northern Pigtailed Macaque *Macaca leonina* (Blyth) (see [www.iucnredlist.org](http://www.iucnredlist.org)). Authors are referred to The Plant List ([www.theplantlist.org](http://www.theplantlist.org)) for up-to-date plant nomenclature.

## Numbers

Measurements should always be metric, or where this is inappropriate, the metric equivalents given in parentheses. Time should be designated in the 24-hour system (as e.g. 17:30 h) and date in the European system (e.g. 7 December 2011). Summary statistics should include measures of both central tendency and dispersion where appropriate, e.g. means and standard deviations (SD). Reports of all statistical tests should include the name of the statistical test, the name and value of the test statistic, the degrees of freedom, the probability value used to determine significance and the authors' interpretation. Probabilities should be reported as exact values if not significant, otherwise rounded off to either  $P < 0.05$ ,  $0.01$  or  $0.001$ .

## Figures, maps and tables

Articles may include photographs, high-quality figures, high-quality maps and tables. Please keep these to a minimum. We stress the importance of providing maps which are *publishable*, with clear explanation of features shown, scale and orientation. Please number tables and figures (as Table 1, Fig. 1 etc.) and provide clear concise captions.

## References

Examples of house style may be found in the latest volume of this journal. Please refer to these examples when listing references:

### Journal article

Bynum, E.L., Kohlhaas, A.K. and Pramono, A.H. 1999. Conservation status of Sulawesi macaques. *Tropical Biodiversity* **6**: 123-144.

### Chapter in book

Hohmann, G.M. and Fruth, B. 1995. Loud calls in great apes: sex differences and social correlates. **In:** *Current Topics in Primate Vocal Communication*, E. Zimmerman, J.D. Newman and U. Juergens (eds.), pp. 161-184. Plenum Press, New York, USA.

### Book

Niemitz, C. 1984. *The Biology of Tarsiers*. Gustav Fischer, Stuttgart, Germany.

### Thesis/Dissertation

Barrett, E. 1984. *The Ecology of some Nocturnal, Arboreal Mammals in the Rainforests of Peninsular Malaysia*. PhD dissertation, Cambridge University, UK.

### Report

Eudey, A.A. 1987. *Action Plan for Asian Primate Conservation: 1987-1991*. IUCN/SSC (Species Survival Commission) Primate Specialist Group, Gland, Switzerland.

### Electronic Database

Nadler, T., Timmins, R.J. and Richardson, M. 2008. *Trachypithecus germaini*. **In:** IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 1 June 2012.

# *Asian Primates Journal*

A Journal of the Southeast Asia, South Asia and China Sections of the IUCN/SSC  
Primate Specialist Group

Volume 2

Number 1

2011

**FOREWORD** 1

---

## **ARTICLES**

OBSERVATIONS ON THE SEXUAL BEHAVIOUR AND BIRTH SEASONALITY OF PROBOSCIS  
MONKEY (*Nasalis larvatus*) ALONG THE LOWER KINABATANGAN RIVER, NORTHERN  
BORNEO

Ramesh Boonratana 2

---

A FIRST OBSERVATION ON THE SEXUAL BEHAVIOUR OF THE CRITICALLY ENDANGERED  
TONKIN SNUB-NOSED MONKEY (*Rhinopithecus avunculus*) IN NA HANG NATURE RESERVE,  
VIETNAM

Thanh Hai Dong, Susan Hua and Ramesh Boonratana 8

---

FIRST SIGHTING OF BORNEAN ORANGUTAN TWINS IN THE WILD

Benoit Goossens, Mohd Daisah Kapar, Suhailie Kahar and Marc Ancrenaz 10

---

THE PRECARIOUS STATUS OF THE WHITE-HANDED GIBBON *Hylobates lar* IN LAO PDR  
Ramesh Boonratana, J.W. Duckworth, Phaivanh Phiapalath, Jean-Francois Reumaux and  
Chaynoy Sisomphone 13

---

A SUMMARY OF THE CONSERVATION STATUS, TAXONOMIC ASSIGNMENT, AND  
DISTRIBUTION OF THE INDOCHINESE SILVERED LANGUR, *Trachypithecus germaini*  
(*sensu lato*), IN CAMBODIA

Jessica E. Moody, An Dara, Camille N.Z. Coudrat, Tom Evans, Tom Gray, Matt Maltby, Men  
Soriyun, Nut Meng Hor, Hannah O'Kelly, Pech Bunnat, Phan Channa, Edward Pollard, Hugo  
J. Rainey, Benjamin M. Rawson, Rours Vann, Song Chansocheat, Tan Setha, and Thong  
Sokha 21

---

ON THE APPARENT OCCURRENCE OF HOSE'S SURILI *Presbytis hosei* IN SIMILAJAU  
NATIONAL PARK, SARAWAK, MALAYSIA

J.W. Duckworth, Anthony C. Sebastian, R.N. Kelsh and Douglas Brandon-Jones 29

---