

AN OVERVIEW OF THE YELLOW-CHECKED GIBBON (*NOMASCUS GABRIELLAE* THOMAS, 1909)

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Abstract

Primates play a considerable role in biomedical research. They are raised for medical research and to test new vaccines before being used for humans. The yellow-cheeked gibbon (*Nomascus gabriellae*) is an endemic mammal of Vietnam, included in the Vietnam Red Book 2007 and described in the IUCN Red Book 2009. Currently, the populations of yellow-cheeked gibbons distributed in the Indochina region have declined significantly and need to be preserved. This article aims to present an overview of research on the taxonomy, identification, reproduction, behaviour, ecology, distribution, population, and conservation status of this species. The overall results are intended to support the conservation of this rare endemic animal species and provide a reference in related biomedical research.

Keywords: biological characteristics, conservation, *Nomascus gabriellae*, primates, Yellow-cheeked gibbon

1. Introduction

Primates in Vietnam have many rare and endemic genetic resources. 22/23 Vietnamese primate species are described in the IUCN Red Book, 2006. All species are included in Decree 32/CP of 2006 and its appendices. CITES Appendix I and II (Dang Huy Huynh et al., 2010).

The yellow-cheeked gibbon (*Nomascus gabriellae*), also known as the Southern yellow-cheeked gibbon or the Southern tawny-cheeked gibbon, is a native gibbon species of Vietnam, Laos and Cambodia and has been included in the Vietnam Red Book 2007 and the list of species. They need to be protected by the forestry sector (Appendix IB of Decree 32/2006/ND-CP dated April 22, 2002, of the Government). Biomedical research on apes is typical of research on animal models that are close to humans, including folk medicine. Yellow-cheeked gibbons are found in dense evergreen and semi-evergreen forests (Geissman et al., 2000) and sometimes in other types, such as mixed bamboo and woody forests (Kenyon 2007; Ha et al., 2014).

In Vietnam, there was no population data for *N. gabriellae* in the 2000 gibbon status assessment (Geissmann et al., 2000). The main threats in Vietnam are hunting, livestock trade, habitat loss and degradation, and small and fragmented population (Rawson et al., 2010). Currently, most ape species are threatened or endangered, mainly due to the degradation or destruction of their forest environments. Besides, their meat is also supplied to the wildlife trading market. *Nomascus gabriellae* is hunted for meat and the pet trade, primarily to supply zoos. In Vietnam, the yellow-cheeked gibbon has been included in the Vietnam Red Book 2007 (EN-SĐVN, 2007); VU-IUCN, 2007), and the forestry sector's list of species in need of protection (Appendix IB Resolution Decision 32/2006/ND-CP dated April 22, 2002 of the Government).

Studying sex characteristics, age, reproductive status, season, effects of captivity, effects of diet, effects of daily care and human activities on Yellow-cheeked black gibbon to support the conservation of this rare endemic animal species and reference in biomedical research is essential.

2. Overall goals and strategies

2.1. Objective: The purpose of this review is to provide an overview of the taxonomy, identification, reproduction, behaviour, ecology, distribution, population and conservation status of the yellow-cheeked gibbon.

2.2. Evidence collection strategy: During the document collection process, the following terms “Yellow-cheeked gibbon”, “*Nomascus gabriellae*”, “primates”, and “rare animals” were used to search for evidence research articles in several databases such as Web of Science, PubMed, Scopus and Google Scholar.

3. Results

3.1 Classification

Phylum: Chordata

Class: Mammals (Mammalia)

Order: Primates (Primates)

Family: Gibbons (Hylobatidae)

Genus: *Nomascus*

Species: *Nomascus gabriellae*

Two-part nomenclature: *Nomascus gabriellae* (Thomas, 1909)

Name: Red-cheeked Gibbon, Buff-cheeked Gibbon or Southern Yellow-cheeked Crested Gibbon (Rawson et al., 2020).

3.2 Morphological characteristics

The yellow-cheeked black gibbon has thick and soft fur. The male is black; on both cheeks, there are two patches of light yellow hair; on the top of the head, there is a bunch of hair standing up like a crest; the hair on the chest is brown, not black. Females have fur that is not black; their back and thighs are light yellow, not grey or brown; they have a vertical tuft of dark fur on the top of their head; the fur around their face is usually yellow; the fur on their cheeks is usually straight outside. With long limbs without tails, body weight usually ranges from 6-10kg (Dang Huy Huynh et al., 2010). Gibbons have smaller body sizes than other great apes in the Hominidae family. The yellow-cheeked gibbon has a weight of about 7 to 11 kg and a body length of about 60 to 80 cm. The yellow-cheeked gibbon has two long front limbs and two shorter hind limbs. Big thumb, long nails, mainly used for grooming. The body is usually kept in an upright position. In *N. gabriellae*, males have brown facial patches that extend to the corners of the eyes. Compared to other gibbons, the females of the black-cheeked gibbon are small, with black edges on their ears (Geissmann and The Gibbon Network, 2005). The yellow-cheeked gibbon has silky, smooth fur that changes as the animal matures. The fur of a newborn yellow-cheeked gibbon is bright yellow, and after a few months it will turn black; As they mature, the plumage in females turns pale yellow (Geissmann and The Gibbon Network, 2005; Max Planck Institute for Evolutionary Anthropology, 2005; Nowak, 1999).

3.3 Reproduction

Similar to other gibbons, yellow-cheeked gibbons have a monogamous family-style reproductive system. Each family has 1 father, 1 mother and 0 to 4 children (Geissmann and Gibbon Network, 2005; Gibbon Conservation Center, 2005). Female gibbons can get pregnant for the first time around 7-8 years old, give birth once every two years, 1 baby at a time, with a gestation period of 7-8 months.

Females usually stay with the family until 6-8 years old, then separate to form a new family, looking for their own offspring to establish their new flock (Geissmann and Gibbon Network, 2005). Young golden-cheeked gibbons are cared for by both parents; the mother breastfeeds the young until 2 years of age, and the father is often responsible for protecting the immature offspring (Geissmann and Gibbon Network, 2005).

3.4. Longevity and behavior

Currently, Little research on yellow-cheeked gibbons have been conducted in the wild, so the longevity characteristics of this species in the wild are still unclear. In captivity, *N. gabriellae* can live up to 50 years (Gibbon Conservation Center, 2005). Yellow-cheeked gibbons only live in their family, mainly living in trees, active during the day. They communicate through visuals and complex howls. Yellow-cheeked gibbons have the habit of protecting their territory through performing collective family songs. Gibbons have very strong and dexterous front limbs, they use their hands to move, gather and groom. The yellow-cheeked gibbon can jump over 10 meters from branch to branch. High-speed manual movement helps them save energy. Gibbons use their legs to move on the ground or on tree branches and balance with their front limbs. They sleep in a sitting position with their family on a tree chosen as their home. They regularly engage in social grooming behavior to strengthen emotional bonds between family members (Geissmann and the Gibbon Network, 2005; Gibbon Conservation Center, 2005; Nowak, 1999). The territory of each family covers an area of about 20 to 50 hectares. Every morning, the whole family will sing vibrant and loud songs to protect against the intrusion of other apes, chasing non-family individuals out of their territory (Geissmann and Gibbon Network , 2005; Gibbon Conservation Center, 2005).

3.5 Communication

Yellow-cheeked gibbons communicate mainly through their calls. They create songs with loud, repetitive sounds every early morning. Songs are family-specific, used to defend territory and call for mates (Geissmann and The Gibbon Network, 2005). Duet songs produced by mating pairs of golden-cheeked gibbons contain language-containing sounds that express gender-specific phrases and rhythms. Children in the family can sing along with their parents (Max Planck Institute for Evolutionary Anthropology, 2005). Unmated individuals have solo songs to call for mates. In addition, golden-cheeked gibbons communicate their sense of smell through secretions secreted from skin glands in the armpit, sternum and groin areas. Secretions will increase when the temperature is high and when the animal is excited. Another special type of communication in apes is tactile communication through grooming each other, playing together, and chasing each other. They also use intuitive visual communication signals, expressing emotions through body postures and facial expressions such as anger and affection (Gibbon Conservation Center, 2005; Nowak, 1999).

3.6. Ecological characteristics

Yellow-cheeked gibbons forage on tall trees, and their food consists of leaves, young shoots, fruits and insects, bird eggs, and young birds in nests. Black gibbons usually live in old forest habitats on high mountain tops, in old, dense forests, not in open or bamboo forests. Gibbons live in small groups like a family, consisting of an old male, 1-2 females and their children. A group has a separate residence area from other groups; sometimes, small groups break away from the herd to form new groups. They are active during the day and are most active in the early morning and evening, at noon and night, resting on treetops, often howling in the early morning (Dang Huy Huynh et al., 2010).

Although dry deciduous dipterocarp forests are present throughout their range, these gibbons do not appear to use them without associated semi-evergreen or evergreen forests (Rawson et al., 2009, Channa and Gray, 2009). Individuals mainly eat fruit and leaves (Traeholt et al., 2005), although a Cat Tien National Park study showed that their diet consisted of 38.6% figs and 43% berries other, 9.5% of mature leaves. and 8.9% flowers (Kenyon, 2007). Home range sizes range from 14.2 to 60.5 hectares, with an average of 41 hectares, but can vary depending on habitat, for example, from less than 30 hectares in evergreen forests to 100 hectares in bamboo forests cork in Cat Tien National Park

(Kenyon, 2007). This species is reportedly scarce above 1,500m elevation (Eames and Robson, 1993). However, recent studies show that *N. gabriellae* occurs at many altitudes, from about 100m (Cat Tien National Park) to higher than 2,287m (Chu Yang Sin National Park). Surveys at an altitude of 1,500m at Bidoup-Nui Ba National Park recorded a density of 0.29 groups/km² (Duc et al., 2015). Like other gibbons, the yellow-cheeked gibbon is diurnal, with an average song lasting 12 minutes and a lower frequency during the rainy season (Rawson, 2004, Kenyon, 2007). This species has a monogamous social structure consisting of adult and female pairs. The average group size is estimated at 3 - 5 individuals. Females migrate near, within, and around their breeding territory, but males migrate farther and more widely. Yellow-cheeked gibbons give birth to single babies, with a 17-22 months gap between two babies. This species plays a vital role in dispersing forest tree seeds (Hai et al., 2018).

3.7. Distribution and population

The yellow-cheeked gibbon is endemic to Cambodia (Chana and Gray, 2009; Traeholt et al., 2005) and Vietnam (Geissmann et al., 2000; Rawson et al., 2011). In Vietnam, this species is widely distributed in some areas of Dak Lak province and Lam Dong plateau (Geissmann et al., 2000). After 2000, gibbon surveys were conducted in many locations throughout the species' range and significant populations were found within and outside protected areas.

In protected areas (PAs), populations are estimated to have at least 150 groups and about 500 individuals in Cat Tien National Park (Kenyon, 2007; Rawson et al., 2011), 17 groups in Bi Doup-Nui Ba Mountain, part of Bidoup - Nui Ba National Park (Thinh et al., 2010), 124 groups in Bu Gia Map National Park (Duc et al., 2014), 78 groups in Phuoc Binh National Park (Duc et al., 2015), 54 groups in Hon Hon Nature Reserve Ba (Duc et al., 2015), and 166 groups in Chu Yang Sin National Park (Thinh et al., In press). Smaller populations are also found in Ta Dung Nature Reserves (Ha et al., 2014; Duc et al., 2010), and Dong Nai Nature Reserve. In addition to protected areas, the population is estimated at 86 groups in Quang Truc commune, Dak Nong province (Duc et al., 2014), 56 groups in Ninh Son State Forest Enterprise, about 66 groups in forest areas of Ninh Thuan province. and 52 groups in Son Thai - Giang Ly commune of Khanh Hoa province (Duc et al., 2015). This species has also been confirmed in some state-owned forestry farms, but no detailed population survey has been conducted (Rawson et al., 2011).

In Cambodia, populations of *N. gabriellae* have been relatively well documented (Channa and Gray, 2009). In the Seima Biodiversity Reserve, populations are estimated to range from 646-972 and 432-832 individuals, with densities ranging from 0.71 groups/km² to 0.74 groups/km² (Kidney et al., 2016). While previous surveys have suggested that Snoul and the South Lyr Wildlife Sanctuary have significant populations (Traeholt et al., 2005), habitat loss has been relatively rapid and continuous in recent years. This area suggests these populations may no longer be significant (Channa and Gray, 2009). Short surveys at the Lomphat and Prey Khieu Wildlife Sanctuary had no records of gibbons (Channa and Gray, 2009). Cao Thi Hong Nhung and colleagues (2021) used the Maxent research model to predict the distribution of yellow-cheeked gibbons. Results The authors have provided a complete set of distribution records for this species in the study area. Modeling shows that *N. gabriellae* is likely to occur in many areas of southern Laos, Cambodia and the Central Highlands of Viet (Cao Thi Hong Nhung et al., 2021).

3.8. Threats and conservation status

Nomascus gabriellae is hunted for meat and the pet trade, mainly to supply zoos. The main threats in Vietnam are hunting, livestock trade, habitat loss and degradation, and small and fragmented population (Rawson et al., 2011). The leading causes of these threats are the capture of young animals by maternal killing, capture for zoos and private exploitation, planned or unplanned forest conversion, developmental activities such as infrastructure, encroachment and illegal logging. Females and young animals are kept as pets in hotels and private areas such as zoos. Investigations and interviews with traders showed that at least 24-26 gibbons of this species were traded in the southern provinces originating from Lam Dong and Dong Nai provinces at the time of the investigation and may have been provided upon request (WCS, 2009). Of the 41 cases of gibbon possession reported to ENV

between 2005 and 2009, 32 cases came from the southern provinces (ENV, 2010). In Cambodia, hunting, logging and habitat loss, often due to economic land transfers, are significant threats to this species (Channa and Gray, 2009; Traeholt et al., 2005).

The threat of habitat loss is significant, historic and ongoing. According to current data from Global Forest Watch, since the beginning of this century, Vietnam has lost 16% of its forest cover., and if the current rate of forest cover loss continues, likely, nearly 60% of forest area by 2045. Cambodia has lost a complete 25% of its forest cover since the turn of the century, and if current rates of forest loss continue up to 70% of its forest cover could be lost by 2045.

In Vietnam, the yellow-cheeked gibbon has been included in the Vietnam Red Book 2007 (EN-SĐVN (2007); VU-IUCN (2007), and the forestry sector's list of species in need of protection (Appendix IB Resolution Decision 32/2006/ND-CP dated April 22, 2002 of the Government). Currently, this species is protected in conservation areas such as Bach Ma National Park (Thua Thien - Hue), Chu Mom Ray Nature Reserve (Kontum), Kon Ha Nung (Gia Lai), Ea So (Dak Lak), Da Lat Highlands, Yok Don National Park (Dak Lak), Cat Tien National Park in Lam Dong and Dong Nai provinces. In addition, several forests in the Central Highlands provinces are also being protected and moving towards establishing conservation areas to preserve this rare gibbon species (Dang Huy Huynh et al., 2010).

3.9. Role in the ecosystem

This species is little studied in the wild, so most recorded information is in captivity. *Nomascus gabriellae* is an altitude forager. Food is leaves, buds, fruits, flowers, insects, bird eggs, and young birds in nests (Geissmann and The Gibbon Network, 2005; Max Planck Institute for Evolutionary Anthropology, 2005). Because golden-cheeked gibbons eat fruit, they play an important role in dispersing seeds in the forest (Geissmann and Gibbon Network, 2005). Adult apes usually live high in the forest, so they are not attacked by predators. When moving to the understory of the forest canopy, yellow-cheeked gibbons can be prey for pythons, leopards, and some other carnivores (Geissmann and Gibbon Network, 2005).

4. Conclusion

The yellow-cheeked gibbon is threatened by habitat loss and hunting. The yellow-cheeked gibbon was included in the 2007 Vietnam Red Book in Vietnam. This species is rarely studied in the wild, and its biological characteristics are recorded mainly from captive breeding cases. No studies have been related to this species' physiological, biochemical, endocrine and pathological characteristics. The yellow-cheeked gibbon is not effectively protected, even in nature reserves and national parks.

References

- Amato, G., Wharton, D., Zainuddin, Z. Z. and Powell, J. R. (1995). Assessment of conservation units for the Sumatran rhinoceros. *Zoo Biology*, 14, 395-402.
- Bang, T.V. and Duc, H.M. (2015). *A Yun Pa Propose Natural Reserve: Initial data on primate fauna*. Proceeding of the 6th National Scientific Conference on Ecology and Biological Resources, Hanoi.
- Barnett, J.L., Hemsworth, P.H., Cronin, G.M., Newman, E.A., McCallum, T.H. (1991). Effects of design of individual cage-stalls on the behavior and physiological responses related to the welfare of pregnant pigs. *Applied Animal Behavior Science* 32, 23–34.
- Barrett GM, Shimizu K, Bardi M, Asaba S, Mori A. (2002). Endocrine correlates of rank, reproduction, and female-directed aggression in male Japanese macaques (*Macaca fuscata*). *Hormones and Behavior*, 42, 85-96.
- Barrett, G. M., K. Shimizu, M. Bardi, S. Asaba, and A. Mori. (2002). Endocrine correlates of rank, reproduction, and female-directed aggression in male Japanese macaques (*Macaca fuscata*). *Horm. Behav.*, 42, 85-96.
- Beehner, J. C., and P. L. Whitten. (2004). Modifications of a field method for fecal steroid analysis in baboons. *Physiol. Behav.*, 82, 269-277.

- Brickle, N., Nguyen C., Ha Q.Q., Nguyen T.T.C. and Hoang V.S. (1998). The status and distribution of Green Peafowl, *Pavo muticus*, in Dak Lak province, Vietnam. BirdLife *International Vietnam Programme and IEBR*, Hanoi.
- Cao Thi Hong Nhung, Le Duc Minh, Nguyen Tuan Anh (2021). Modeling the distribution of the southern yellow-cheeked gibbon (*Nomascus gabriellae*) using maxent Vietnam *Journal of Science and Technology*, 59(5) 597-608
- Channa, P. and Gray, T. (2009). *The status and habitat of yellow-cheeked crested gibbon Nomascus gabriellae in Phnom Prich Wildlife Sanctuary, Mondulkiri*. WWF Greater Mekong.
- Clements, T., B. Rawson, E. Pollard, Nut M.H., and An D. (2008). *Long-term monitoring of black-shanked douc langur (Pygathrix nigripes) and yellow-cheeked crested gibbon (Nomascus gabriellae) in the Seima Biodiversity Conservation Area, Cambodia*. XXII Congress of the International Primatological Society Edinburgh, UK.
- Dang Huy Huynh, Pham Trong Anh, Le Xuan Canh, Nguyen Xuan Dang, Hoang Minh Khien and Dang Huy Phuong (2010). Wild animals - Mammalia Vietnam, morphology and ecological biology of some species, volume II, *Natural Science Publishing House and Technology*, Hanoi.
- Decree 32/2006/ND-CP, dated March 30, 2006 on the management of endangered and rare forest plants and animals.
- Decree No. 74/2010/ND-CP, dated July 12, 2010 of the Government on the direction and guidance of militia and self-defense forces and forest rangers in forest protection work.
- Duc, H. M., Bang, T.V. and Long, V. (2010). *Population status of the yellow-cheeked crested gibbon (Nomascus gabriellae) in Ta Dung Nature Reserve, Dak Nong Province, Vietnam*. In: auna & Flora International / Conservation International (ed.), 1-22. Hanoi.
- Duc, H.M, Bang, T.V., Tinh, M.X. and Thang, N.D. (2014). *Final Report on Fauna in Quang Truc Commune, Tuy Duc District, Dak Nong Province with the emphasis on population assessment of yellow-cheeked gibbon*. Technical report to Southern Institute of Ecology and Wildlife Conservation Society – Vietnam Programme.
- Duc, H.M., Bang, T.V. Covert, H.H. (2015). *Assessment of conservation status and strengthening conservation of Yellow-cheeked crested gibbon and other primates in Southeastern Slope of the Da Lat Plateau, Vietnam*. Final report to Southern Institute of Ecology and US Fish and Wildlife Service. Hochiminh City.
- Eames, J. and Robson, C. (1993). Threatened primates in southern Vietnam. *Oryx*, 27, 146-154.
- ENV (2010). *Gibbon cases 2005-2009*. ENV Wildlife Crime Unit Database, Education for Nature – Vietnam.
- FFI (2000). *Primate Field Survey Handbook*. Indochina Program, International Wildlife Organization, Hanoi, Vietnam.[English version].
- Forest Investigation and Planning Sub-Institute II (2004). *Scientific argument for reclassifying Bidoup-Nui Ba nature reserve into Bidoup-Nui Ba National Park*.
- Geissmann, T., Dang, N.X., Lormée, N. and Momberg F. (2000). Vietnam primate conservation status review 2000 - Part 1: Gibbons Status report. *Fauna and Flora International, Indochina Programme*, Hanoi, Vietnam.
- Geissmann, T., Nguyen Xuan Dang, Lormée, N. & Momberg, F. (2000). Assessment of the current status of primate conservation in Vietnam, Vietnam in 2000, Part 1: Gibbon species. *Indochina Program, International Wildlife Organization*, Hanoi, Vietnam.
- Groves C.P. (2001). *Primate Taxonomy*. Smithsonian Institution Press, Washington, DC, USA.
- Ha, N.M., Hoang, T.D., Nghia, T.D, Tuoc, D. and Dzung, L.V. (2014). *Habitat and animal survey in Nam Nung, Ta Dung nature reserves and the South-West and North-West area of Dak Nong province, with a focus on gibbon (Nomascus) and gaur (Bos gaurus)*. Trust Fund Forest, Vietnam/Dak Nong Forest Protection Department, Vietnam.
- Hai, B. T., Chen, J., McConkey, K. R., & Dayananda, S. K. (2018). Gibbons (*Nomascus gabriellae*) provide key seed dispersal for the Pacific walnut (*Dracontomelon dao*), in Asia's lowland tropical forest. *Acta Oecologica*, 88, 71-79.
- International Fund for Nature Protection - WWF Indochina program (2003). *Manual for biodiversity investigation and monitoring*. Transport Publishing House, Hanoi.

- IUCN Vietnam (2003). *Assessment of conservation and development areas in four countries in the lower Mekong region*. Vietnam's national report on conservation and development areas. Labor and Social Publishing House, Hanoi.
- Joint Circular No. 98/2010/TTLT-BQP-BNNPTNT dated July 19, 2010 between the Ministry of National Defense and the Ministry of Agriculture and Rural Development.
- Kenyon, M. (2007). *The ecology of the golden-cheeked crested gibbon (Nomascus gabriellae) in Cat Tien National Park, Vietnam*. PhD Thesis, Anatomy School. University of Cambridge, Cambridge.
- Kidney, D., Rawson, B.M., Borchers, D.L., Stevenson, B.C., Marques, T.A. and Thomas, L. (2016). An efficient acoustic density estimation method with human detectors applied to gibbons in Cambodia. *PLoS ONE*, 11(5).
- Konrad, R. and Geissmann, T. (2006). Vocal diversity and taxonomy of *Nomascus* in Cambodia. *International Journal of Primatology*, 27, 713-745.
- Le Trong Dat (2009). *Survey of Western Black Crested Gibbon (Nomascus concolor) in Hoang Lien – Van Ban Nature Reserve, Van Ban district, Lao Cai Province, Vietnam (including other Wildlife records)*. Fauna & Flora International Vietnam programme, *Unpublished Report*, Hanoi.
- Ministry of Natural Resources and Environment (2005). Report on Vietnam's Environmental Development in 2005, *Biodiversity*, Hanoi.
- Pham Nhat, Do Tuoc, Tran Quoc Bao, Pham Mong Giao, Vu Ngoc Thanh and Le Xuan Canh (1998). Distribution and status of primates in Vietnam. *Proceedings of the workshop on action plan for conservation of primates in Vietnam*, Hanoi.
- Project ALA/VIE/94/24, Vietnam - Netherlands Research Program (VNRP) (2002). *Proceedings of the International Conference Buffer Zones of Vietnam's Natural Reserves*. Agriculture Publishing House, Hanoi.
- Rawson, B.M. (2004). Vocalisation patterns in the yellow-cheeked crested gibbon (*Nomascus gabriellae*). In: T. Nadler, U. Streicher and H.T. Long (eds), *Conservation of Primates in Vietnam*, pp. 130-136. Hanoi: Haki Publishing.
- Rawson, B.M. (2010). The status of Cambodian Primates. In: T. Nadler, B.M. Rawson and Van Ngoc Think (eds), *Conservation of Primates in Indochina*, pp. 17-26. Frankfurt Zoological Society and Conservation International, Hanoi, Viet Nam.
- Rawson, B.M., Clements, T. and Hor, N.M. (2009). Status and Conservation of Yellow-Cheeked Crested Gibbons (*Nomascus gabriellae*) in the Seima Biodiversity Conservation Area, Mondulkiri Province, Cambodia. In: S. Lappan and D.J. Whittaker (eds), *The Gibbons, Developments in Primatology: Progress and Prospects*.
- Rawson, B.M., Hoang, M.D., Roos, C., Van, N.T. & Nguyen, M.H. (2020). *Nomascus gabriellae*. *The IUCN Red List of Threatened Species 2020*
- Rawson, B.M., Insua-Cao, P., Ha, N.M., Think, V.N., Duc, H.M., Mahood, S., Geissmann, T. and Roos, C. (2011). *The Conservation Status of Gibbons in Vietnam*. Fauna & Flora International/Conservation International, Hanoi, Vietnam.
- Think, V.N. and Craik, R. (2009). *A Rapid Survey of Yellow-Cheeked Crested Gibbon and Bird Species in Da Chais Commune*. Bi Doup-Nui Ba National Park with a view to developing an ecotourism programme in the area.
- Think, V.N., Rawson, B., Hallam, C., Kenyon, T., Nadler, T., Walter, L. and Roos, C. (2010). Phylogeny and distribution of crested gibbon (genus *Nomascus*) based on mitochondrial cytochrome b gene sequence data. *American Journal of Primatology*, 72, 1047-1054.
- Traeholt, C., Bonthoeun, R., Rawson, B., Samuth, M., Virak, C. and Sok Vuthin. (2005). *Status review of pileated gibbon, Hylobates pileatus, and yellow-cheeked crested gibbon, Nomascus gabriellae, in Cambodia*. FFI Cambodia Programme Office, Phnom Penh, Cambodia.