

THE CONSERVATION STATUS OF BATS (MAMMALIA: CHIROPTERA) IN CAT BA NATIONAL PARK, NORTHERN VIETNAM

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Abstract. Prior to the present study, literature reviews revealed that 31 species of bats belonging to six families and 14 genera were identified in Cat Ba National Park in Northern Vietnam. However, the conservation status of many species remains unclear and is still subject to debate. Among the 31 species, 11 are common while the remainder have been rarely captured since 1942. At least two species, *Hipposideros alongensis* and *H. khaokhouayensis*, which are globally considered vulnerable, are very common in Cat Ba National Park. This paper provides an update on the current status of each species based on data from recent field surveys with reference to previous publications and the current IUCN Red List (iucnredlist.org). Results from the recent surveys included eight individuals provisionally identified as *Myotis* cf. *pilosus*. The taxonomic status of five species (*Aselliscus dongbacanus*, *Hipposideros gentilis*, *Hipposideros grandis*, *Miniopterus magnater*, *Murina harrisoni*) are updated following recent assessments. This information will inform future research and conservation actions.

Keywords: bat, Cat Ba, diversity, conservation.

1. Introduction

Cat Ba National Park (CBNP) is one of the best-known national parks in Vietnam for its outstanding karst island landscapes and biodiversity values. In fact, CBNP is a home to many species endemic to Vietnam including the Cat Ba hooded black leaf monkey (*Trachypithecus poliocephalus*) and the Ha Long leaf-nosed bat (*Hipposideros alongensis*) [1]. For bat species in the park, records have appeared in a series of documents since 1942 (Bourret R., 1942a; Bourret R., 1942b; Topál, 1975; Topál, 1993; Le Xuan Canh *et al.*, 1997; Furey *et al.*, 2002; Vu Dinh Thong *et al.*, 2007; Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008; Vu Dinh Thong *et al.*, 2008; Vu Dinh Thong, 2011; Vu Dinh Thong *et al.*, 2011; Abramov and Kruskop, 2012; Vu Dinh Thong,

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2012; Vu Dinh Thong *et al.*, 2012a, 2012b; Kruskop, 2013; Vu Dinh Thong, 2014; Vu Dinh Thong *et al.*, 2016) [2-20]. Some species were only known from a single record in the 20th century. Thus, the conservation status of many bat species in the park remains unclear. Since several caves and foraging sites for bats in CBNP have been disturbed or exploited by tourism and socio-economic developments, it is important to elucidate the current status of bats and develop conservation measures. This paper provides the first systematic assessment of the conservation status of each bat species based on data from recent field surveys and literature review, to inform further research and practical conservation action.

2. Contents

2.1. Materials and methods

A total of 52 documents including gray literature and publications containing records of bats from CBNP were reviewed. In addition, data from recent surveys for bats in CBNP carried out at caves and other ecosystems of the park including mangrove by Vu Dinh Thong *et al.* (2012a, 2012b), Vu Dinh Thong (2019) [16, 17, 19] were included. In these recent surveys, bats were captured and handled in the field following the guidelines approved by the American Society of Mammalogists (Sikes & ACUCASM, 2016) [20-22]. Three four-bank harp traps (Francis, 1989) [23] and three mist nets of various sizes (2.6 m [height], 3 - 9 m [length], mesh size: 16 mm × 16 mm) were employed to capture bats. The captured bats were removed carefully from the trap or net and placed individually in a cotton bag. Reproductive status and ages were assessed according to Racey (2009) and Brunet-Rossinni and Wilkinson (2009) [24, 25], respectively. Every captured bat was identified following Bates and Harrison (1997), Csorba (2003), Kruskop (2013), Vu Dinh Thong *et al.* (2012a, 2012b) and other publications relevant to the taxonomy of bats [5, 16, 17, 26, 27]. Echolocation calls were recorded over the field surveys using the PCTape recording system at a sampling rate of 480 kHz. Batman software was used to select high quality sound sequences which were then recorded. Recordings were also carried out in front of caves to obtain reference calls when bats were leaving their roosts. Recorded calls were analyzed using Selena software. The PCTape recording system, Batman and Selena were custom-made softwares created by Hans-Ulrich Schnitzler of the University of Tübingen, Germany. Based on the information obtained from the literature review and field surveys, the conservation status of each species is classified as "common", "uncommon" and "unconfirmed". "Common" is assigned to a species recorded during every field survey between 2010 and 2020, whereas "uncommon" is assigned to the species with only a single record or has not been recorded since 2010. "Unconfirmed" is reserved for species with either unclear or unconvincing records in previous publications.

2.2. Results and discussion

To date, 31 bat species belonging to six families and 14 genera are known from CBNP. Among them, 11 species are common, but 19 species are uncommon and one species is unconfirmed within the park (Table 1). The results from the recent surveys included eight unidentified individuals which are tentatively classified as *Myotis* cf.

pilosus. Their morphological characteristics are similar to those of *Myotis pilosus* but their body size is smaller than those described in previous publications. To identify/confirm their taxonomic status, selected wing membrane samples from these bats are being analysed for genetic data.

Table 1. Conservation status of each species known from CBNP

Scientific name	Conservation status within CBNP	IUCN Red List	Previous publications
<i>Cynopterus sphinx</i>	Uncommon	LC	Abramov and Kruskop, 2012; Vu Dinh Thong, 2013; Vu Dinh Thong, 2014
<i>C. horsfieldi</i>	Uncommon	LC	Vu Dinh Thong, 2014
<i>Rousettus amplexicaudatus</i>	Uncommon	LC	Vu Dinh Thong, 2008; Abramov and Kruskop, 2012
<i>Rhinolophus marshalli</i>	Common	LC	Vu Dinh Thong and Furey, 2008; Vu Dinh Thong, 2012; Abramov and Kruskop, 2012;
<i>R. macrotis</i>	Uncommon	LC	Vu Dinh Thong and Furey, 2008; Vu Dinh Thong, 2014
<i>R. pearsonii</i>	Common	LC	Vu Dinh Thong and Furey, 2008; Abramov and Kruskop, 2012
<i>R. pusillus</i>	Uncommon	LC	Vu Dinh Thong and Furey, 2008; Vu Dinh Thong, 2014.
<i>R. cf. subbadius</i>	Unconfirmed	LC	Abramov and Kruskop, 2012
<i>R. affinis</i>	Uncommon	LC	Vu Dinh Thong and Furey, 2008; Vu Dinh Thong, 2014.
<i>Hipposideros grandis</i> *	Common	LC	Vu Dinh Thong and Furey, 2008; Vu Dinh Thong, 2011; Vu Dinh Thong, 2014.
<i>H. armiger</i>	Common	LC	Vu Dinh Thong and Furey, 2008
<i>H. griffini</i>	Uncommon	NT	Vu Dinh Thong, 2011; Vu Dinh Thong et al. 2012
<i>H. alongensis</i>	Common	VU	Vu Dinh Thong 2012; Vu Dinh Thong, 2013
<i>H. gentilis</i> *	Uncommon	LC	Vu Dinh Thong and Furey, 2008
<i>H. khaokhouayensis</i>	Common	VU	Vu Dinh Thong and Furey, 2008
<i>Aselliscus dongbacanus</i> *	Common	N/A	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008

<i>Coelops frithii</i>	Uncommon	NT	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>Taphozous melanopogon</i>	Common	LC	Vu Dinh Thong et al. 2016
<i>Myotis cf. pilosus**</i>	Common	N/A	Vu Dinh Thong et al. 2016
<i>Myotis siligorensis</i>	Common	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>M. muricola</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>Murina cyclotis</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>M. harrisoni*</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong et al., 2011;
<i>Harpiocephalus harpia</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>Scotophilus heathi</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>S. kuhli</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>Pipistrellus abramus</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>P. javanicus</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>P. tenuis</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>Hypsugo pulveratus</i>	Common	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008
<i>Miniopterus magnater*</i>	Uncommon	LC	Vu Dinh Thong, 2008; Vu Dinh Thong and Furey, 2008

Note: *Species were renamed following taxonomic assessment, ** Species new to Cat Ba National Park.

Of the species listed in the Table 1, the taxonomic status of five species (*Aselliscus dongbacanus*, *Hipposideros gentilis*, *Hipposideros grandis*, *Miniopterus magnater*, *Murina harrisoni*) is updated following recent assessments. In previous publications, these species were respectively listed as *Aselliscus stoliczkanus*, *Hipposideros pomona*, *Hipposideros larvatus*, *Miniopterus cf. fuliginosus*, *Murina tiensa* [2, 6, 10, 14]. An unconfirmed species, *Myotis cf. pilosus*, is new to Cat Ba National Park. Its taxonomic status will be confirmed using data from morphology, echolocation and genetics.

Remarkably, two species, *Hipposideros alongensis* and *H. khaokhouayensis*, which are globally considered vulnerable, are very common within CBNP. These two species have been recorded in almost all habitats throughout the park. Prior to 2017, *Hipposideros alongensis* was not listed in the IUCN Red List. With data from our study, the conservation status of the species has been assessed as Vulnerable (VU) in the IUCN Red

List since 2018 [28]. CBNP appears to be the most important area for conservation and further research on these two species. On the other hand, the numbers of bat species discovered in CBNP have increased impressively over the surveys. The taxonomic status of the eight unidentified individuals of the genus *Myotis* is still unconfirmed but they must be at least new to CBNP. The eight unidentified individuals distinctly differ from either *Myotis siligorensis* or *M. muricola* in measurements and other external characteristics. Further researches are required to confirm bat diversity in the park in the future.

3. Conclusions

Cat Ba National Park is home to at least 31 bat species belonging to 14 genera, 6 families. Among those, 11 species are common while 19 species are uncommon and one species is still unidentified. The park must be regarded as one of the most important area for bat research and conservation in Vietnam, particularly for conservation of globally threatened and endemic species.

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