

## NEW UPDATE INFORMATION ON SMALL MAMMALS CHECKLIST IN NGOC SON – NGO LUONG NATURE RESERVE, HOA BINH PROVINCE

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**Abstract:** We updated checklist on small mammals of Ngoc Son – Ngo Luong Nature Reserve (NS–NL NR), Hoa Binh province, lie in Pu Luong – Cuc Phuong limestone karst of the northern Vietnam. Based on the specimens in field survey combined with data from previous publications, 54 small mammal species in 10 families and 3 orders documented in this area. In which, *Sphaerias blanfordi*, *Cynopterus sphinx*, *Hipposideros gentilis*, *Hipposideros larvatus*, *Murina cyclotis* are common species in Bat fauna, *Leopodamys subanus*, *Maxomys surifer*, *Rattus tanezumi* are the popular species in Rodent fauna. However, illegal exploitation, hunting and human activities effect negative to the biodiversity values. Therefore, the conservation of biodiversity is required.

**Keywords:** Small mammals, checklist, limestone karst, Vietnam.

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### 1. INTRODUCTION

Ngoc Son – Ngo Luong Nature Reserve was established under the Decision No. 2714/QĐ–UB dated December 28, 2004 of the People's Committee of Hoa Binh Province. The area covers over 19,254 ha, stretching over 7 communes in 2 districts of Tan Lac and Lac Son (Ngoc Son – Ngo Luong Nature Reserve Management Board, 2010; Do A. T. et al., 2008). The nature reserves are located in the South–west of Hoa Binh province, has a border with Pu Luong Nature Reserve, Thanh Hoa province in north–west and Cuc Phuong National Park, Ninh Binh province in south–east (Do A. T et al., 2008). It forms part of the Pu Luong (Thanh Hoa) – Cuc Phuong (Ninh Binh) Limestone landscape, contribute to conserve the biodiversity in limestone ecosystem in northern of Vietnam (Pham Q. T., 2013). The limestone mountainous ecosystem is typical of the transitional area from Northwest Mountain to the Red River Delta. There are little is known about the biodiversity of Ngoc Son Ngo Luong Nature Reserve (BirdLife International & FIPI, 2001; FIPI, 2005). There

are eight major subformations belong to six formations in area, in which tropical evergreen seasonal lowland forest on limestone and tropical evergreen seasonal submontane forest on limestone are the largest area (Phung V. P. et al., 2014). About 235 higher vascular plants, of which 37 threatened plants species were recored (Nguyen Q. H. et al., 2012). 85 species belonging to 20 families, 3 orders, of which 23 species of threatened reptiles and amphibians were recorded (Thao A. T., 2015). Besides, this place is home of endangered mammals such as small carnivore and flying squirrel, especially the presence of a population of The Delacour's langur *Trachypithecus delacouri*, endemic to Vietnam (Daniel et al., 2011, Cano 2013, Le et al., 2008). This species also has been recorded in Pu Luong Nature Reserve and Cuc Phuong National Park (Birdlife, 2001). However, the study about the small mammal fauna is still limited. Some preliminary survey has been carried on here (Do T. & Duong A.T., 2003, Cano & Pham Q. T., 2010). Total 68 mammals were recorded, of which 40 species are listed in the Vietnam Red Book. Recently, there have been some updated studies on the fauna in Ngoc Son– Ngo Luong Nature Reserve (Phạm Q.T., 2013; Dong T.H., 2015). About 94 species of mammals belonging to 28 families and 9 orders were recorded, of which 46 species are endangered. However, the bat fauna was not covered by the study should be inherited from the previous literature. There are little study about small mammals, especially bat fauna is conducted in here. So in order to update and complete the small mammal fauna here, we conducted a survey to provide the most complete and up-to-date list of small mammals in this area, serving for biodiversity conservation.

## 2. MATERIAL AND METHODS

### Survey site and effort

Fieldworks were conducted in Ngoc Son – Ngo Luong during 10–20 January, 2009 and 1 – 12 June, 2019 by the Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology and Ha Noi Metropolitan University. This nature reserve is located in Tan Lac and Lac Son districts in the Southwestern of Hoa Binh Province, Vietnam stretching from 20°23' – 20°36' N and 105°07' – 105°30' E (Do A.T. et al., 2008). Total survey efforts are shown in Tab 1.

**Table 1.** Total survey efforts in Ngoc Son– Ngo Luong Nature Reserve

Trapline	Coordinates	Elevation	D.O	MN	H	M	S	C	N.O
Trapline 1A	20°24'51.81" N 105°18'39.92" E	316	4			576	160	80	4
Trapline 2A	20°24'32.22" N 105°20'37.39" E	201	4	1296					4
Trapline 3A Dai Cave	20°24'8.33" N 105°22'27.83" E	216	4	1296					4
Trapline 4A	20°25'13.26" N 105°22'36.7" E	485	4	672					4

Thon Chieng Cave									
Trapline 5A	20°26'39.97" N 105°15'39.61" E	233	4		72				4
Trapline 1B	20°24'24.75" N 105°22'14.67" E	292	4	240					4
Trapline 2B	20°27'28.3" N 105°30'8.95" E	500	2	672					2
Trapline 3B	20°23'30.76" N 105°12'4.34" E	300	2		36	288	80	40	2
Trapline 4B	20°23'53.94"N 105°10'56.65"E	320	1.5	672					1.5
Total			31.5	4.848	108	864	240	120	31.5

*Notes: D.O. – daytime observation (hours); MN – mist nets (m<sup>2</sup> / n / h); H – harp trap (m<sup>2</sup> / n / h); M – mole-traps (trap nights); S – Sherman traps; C – cage traps (trap nights); N.O. – nighttime observations (hours).*

### Methodology

Different methods were used to collect specimens to give the diversity of small mammal fauna in the study site. During the survey, we conducted day and night time excursions and using specialized trap methods for small mammals. A few types of traps were used:

- Three kinds of Sherman live-traps (3×3×10 cm; 5 × 5 × 18 cm; 7 × 7 × 30 cm) were used to catch medium-sized rodents and shrews. Tomahawk cage traps (20 × 20 × 60 cm) and local cage traps (15 × 15 × 25 cm) were used to large-sized rodents and squirrels. Baits for trapping must be odiferous enough to draw rodents into the traps from some distance, sticky enough to as here to the trap, and stable enough to keep from rotting. Baits were changed every day after checking the traps.

- Two types of mole-traps – Japanese hand-made traps and Talpex traps. Mole traps were set on the trails along small trails where mole tunnels were observed.

- Different types of mist nets (2 × 3 m, 5 × 3 m and 12 × 4 m) and harp trap (1.5 × 1.5 m) were used to live capture bats. The nets and traps were set to cross trails in the forest, over small ponds and streams in the forest or near forest edges, at openings at the forest edges and the entrances of caves.

The external body measurements: head and body length (HB), tail length (TL), hind foot length (HF), ear length (E) and weight (Wt) were taken by tapeline and digital caliper. For bats, forearm (FA) and tibia (Tib) lengths also were measured (Kruskop, 2013).

Detailed identification followed Csorba et al., 2003; Francis, 2019; Wilson & Reeder, 2005, Lunde & Nguyen, 2001.

The nomenclature of mammals follows Csorba et al., 2003, Wilson & Reeder, 2005; Lunde & Nguyen, 2001; Dang et al., 2008; unless otherwise stated.

We used Sorensen –Dice coefficient to estimate the similarity about bat fauna among Ngoc Son–Ngo Luong Nature Reserve and Pu Luong Nature Reserve and Cuc Phuong National Park. We used the following index:  $SI = 2c / (a+b)$ , where: c = number of species in both A và B sites; a = number of species in A site; B = number of species in B site (Shannon & Wiener, 1963).

### 3. RESULT AND DISCUSSION

In total, 40 specimens were captured in 2009, 2019. Collected specimens, direct observation in the field, the materials retrieved from local households, and combination of previously published records shows that there are 54 species belonging to 10 families and 10 orders. (Tab 2).

**Table 2.** Small mammals recorded in NS – NL Nature Reserve

No.	Scientific name	2013, 2015	2009, 2019
	<b>I. EULIPOTYPHIA Gregory, 1910</b>		
	<b>Erinaceidae</b>		
1	<i>Hylomys suillus</i> Müller, 1840		S (new recorded)
	<b>II. CHIROPTERA Blumbach, 1779</b>		
	<b>Pteropodidae Gray, 1821</b>		
2	<i>Cynopterus brachyotis</i> (Müller, 1838)	R	
3	<i>Cynopterus sphinx</i> (Vahl, 1797)	R	S
4	<i>Eonycteris spelaea</i> (Dobson, 1871)		S (new recorded)
5	<i>Rousettus amplexicaudatus</i> (E. Geoffroy, 1810)	R	
6	<i>Rousettus leschenaulti</i> (Desmarest, 1820)	R	
7	<i>Sphaerias blanfordi</i> (Thomas, 1891)		S (new recorded)
	<b>Megadermatidae H. Allen, 1864</b>		
8	<i>Lyroderma lyra</i> E. Geoffroy, 1810	R	
	<b>Hipposideridae Lydekker, 1891</b>		
9	<i>Aselliscus stoliczkanus</i> (Dobson, 1871)	R	
10	<i>Coelops frithii</i> Blyth, 1848	R	
11	<i>Hipposideros armiger</i> (Hodgson, 1835)	R	
12	<i>Hipposideros gentilis</i> K. Andersen, 1918	R	S
13	<i>Hipposideros larvatus</i> (Horsfield, 1823)	R	S
14	<i>Hipposideros lylei</i> Thomas, 1913	R	
15	<i>Hipposideros turpis</i> Bangs, 1901	R	

	<b>Rhinolophidae Gray, 1825</b>		
16	<i>Rhinolophus affinis</i> Horsfield, 1823	R	
17	<i>Rhinolophus pearsonii</i> Horsfield, 1851	R	
18	<i>Rhinolophus pusillus</i> Temminck, 1834		S (new recorded)
19	<i>Rhinolophus rex paradoxolophus</i> Bourret, 1951	R	
	<b>Emballonuridae Gervais, 1855</b>		
20	<i>Taphozous melanopogon</i> Temminck, 1841	R	
	<b>Vespertilionidae Gray, 1821</b>		
21	<i>Kerivoula picta</i> (Pallas, 1767)	R	
22	<i>Murina annamitica</i> Francis, Eger, 2012		S (new recorded)
23	<i>Murina cyclotis</i> Dobson, 1872		S (new recorded)
24	<i>Murina feae</i> (Thomas, 1891)		S (new recorded)
25	<i>Murina harrisoni</i> Csorba, Bates, 2005		S (new recorded)
26	<i>Murina huttoni</i> (Peters, 1872)		S (new recorded)
27	<i>Harpiocephalus harpia</i> (Temminck, 1840)		S (new recorded)
28	<i>Myotis chinensis</i> (Tomes, 1857)	R	
29	<i>Myotis</i> sp.		S (new recorded)
30	<i>Hypsugo pulveratus</i> (Peters, 1871)		S (new recorded)
31	<i>Ia io</i> Thomas, 1902	R	
32	<i>Scotomanes ornatus</i> (Blyth, 1851)	R	S
33	<i>Scotophilus heathii</i> Horsfield, 1831	R	
	<b>Miniopteridae Dosson, 1875</b>		
34	<i>Miniopterus fuliginosus</i> (Hodgson, 1835)	R	S
	<b>III. RODENTIA Bowdich, 1821</b>		
	<b>Sciuridae Fischer de Waldheim, 1817</b>		
35	<i>Ratufa bicolor</i> (Sparrman, 1778)	O	
36	<i>Belomys pearsonii</i> (Gray, 1842)	R	
37	<i>Hylopetes phayrei</i> (Blyth, 1859)	R	
38	<i>Petaurista philippensis</i> (Elliot, 1839)	S	
39	<i>Callosciurus erythraeus</i> (Pallas, 1779)	O	S
40	<i>Callosciurus inornatus</i> (Gray, 1867)	O	
41	<i>Dremomys pernyi</i> (Milne-Edwards, 1867)	R	
42	<i>Dremomys rufigenis</i> (Blanford, 1878)	R	
43	<i>Tamiops maritimus</i> (Bonhote, 1900)	O	
	<b>Muridae Illiger, 1811</b>		

44	<i>Bandicota indica</i> (Bechstein, 1800)	S, R	
45	<i>Berylmys bowersi</i> (Anderson, 1879)	S, R	S
46	<i>Chiropodomys gliroides</i> Blyth, 1856	S, R	
47	<i>Leopoldamys sabanus</i> (Thomas, 1887)	S, R	S
48	<i>Maxomys surifer</i> (Miller, 1900)	S, R	S
49	<i>Mus musculus</i> Linnaeus, 1758	S, R	
50	<i>Mus pahari</i> Thomas, 1916	S, R	S
51	<i>Rattus andamanensis</i> (Blyth, 1860)	S, R	
52	<i>Rattus argentiventer</i> (Robinson, Kloss, 1916)	S, R	
53	<i>Rattus nitidus</i> (Hodgson, 1845)	R	
54	<i>Rattus tanezumi</i> Temminck, 1844	S, R	S

Notes: S: specimens; O: observation; R: references

In the species composition, the Chiroptera and Rodentia orders are recorded the most species richness with 33 and 20 species respectively. In bat fauna, Vespertilionidae family is the most species diverse with 14 species, next to Hipposideridae family with 7 species. Based on survey effort time, *Hipposideros gentilis*, *Sphaerias blanfordi*, *Cynopterus sphinx* and *Hipposideros larvatus* were some most common species with the highest catch frequency. 10 specimens *Cynopterus sphinx* were captured and released including 3 males and 7 females, only two male and female kept as voucher specimens. In addition, some dominant vespertilionidae were also found such as *Murina cyclotis*, *Hypsugo pulveratus*. Some cave such as Dai Cave, Thon Chieng Cave are home to some populations such as *Hipposideros gentilis*, *Hipposideros larvatus*.



*Murina feae*



*Hipposideros cineraceus*



*Eonycteris spelaea*



*Hypsugo pulveratus*

**Fig 1.** Flying photo of some recorded bats in NS – NL NR (Sources: Dr. Nguyen Vu Khoi – WAR )

In the rodent fauna, the Muridae family is most richness with 11 species. *Maxomys surifer*, *Rattus tanezumi* and *Leopodamys sabanus* species were trapped with the highest catch frequency. In the field survey, 5 specimens of *Maxomys surifer*, *Rattus tanezumi* species and 4 specimens of *Leopodamys sabanus* were collected in limestone mountainous in elevation 300 – 450m otherwise other rodents such as *Mus pahari*, *Berylmys bowersi* trapped 1–2 specimens. Besides, we recorded 1 specimen *Hylomys suillus* species belong Eulipotyphla order, collected along streams. Compared with the previous study on the bat fauna of Pham T.T. et al., 2013 and Dong T.H. et al., 2015, This survey was new recorded *Hylomys suillus* species belong to Eulipotyphla order, 2 species *Eonycteris spelaea* and *Sphaerias blanfordi* in Pteropodidae family, 1 species in Rhinolophidae and 8 species in Vespertilionidae (Tab 3, Fig 1).

The survey calculated the similarity of bat fauna between Ngoc Son– Ngo Luong NR, Pu Luong NR and Cuc Phuong National Park, located limestone karst in northern Vietnam. Compare with research of Vu Dinh Thong 2004, the Sorensen – Dice coefficient between Cuc Phuong NP and Pu Luong NR is the highest, about 0.47. Ngoc Son – Ngo Luong NR has a higher similarity with Cuc Phuong NP than Pu Luong NR, SI is around 0.29. Out of total 58 species of bats recorded in 3 regions, there are 9 species distributed in all 3 regions, mainly focusing on some common and dominant species such as *Murina cyclotis*, *Hipposideros larvatus*, *Cynopterus sphinx*.

**Table 3.** Comparing bat fauna recorded in Ngoc Son– Ngo Luong NR, Pu Luong NR and Cuc Phuong NP

		Cuc Phuong NP	Pu Luong NR	Ngoc Son– Ngo Luong NR
1	<i>Rousettus leschenaulti</i>	X	(X)	X
2	<i>Rousettus amplexicaudatus</i>	X		X
3	<i>Eonycteris spelaea</i>	X	X	X
4	<i>Cynopterus brachyotis</i>	X		X
5	<i>Cynopterus sphinx</i>	X	(X)	X
6	<i>Sphaerias blanfordi</i>			X
7	<i>Macroglossus minimus</i>	X		
8	<i>Megaderma spasma</i>	X		
9	<i>Lyroderma lyra</i>			X
10	<i>Aselliscus stoliczkanus</i>	X	X	X
11	<i>Hipposideros armiger</i>	X		X
12	<i>Hipposideros bicolor</i>	X	X	
13	<i>Hipposideros cineraceus</i>		X	
14	<i>Hipposideros fulvus</i>		X	
15	<i>Hipposideros gentili</i>			X

16	<i>Hipposideros larvatus</i>	X	X	X
17	<i>Hipposideros lylei</i>	X		X
18	<i>Hipposideros turpis</i>		X	X
19	<i>Coelops frithii</i>	X		X
20	<i>Rhinolophus affinis</i>	X	X	X
21	<i>Rhinolophus macrotis</i>		X	
22	<i>Rhinolophus malayanus</i>		X	
23	<i>Rhinolophus marshalli</i>	X		
24	<i>Rhinolophus pearsonii</i>	X	X	X
25	<i>Rhinolophus pusillus</i>	X		X
26	<i>Rhinolophus rex paradoxolophus</i>	X		X
27	<i>Rhinolophus rouxii</i>	X	X	
28	<i>[Rhinolophus subbadius]</i>		X	
29	<i>Rhinolophus thomasi</i>	X	X	
30	<i>Taphozous melanopogon</i>	X		X
31	<i>Kerivoula hardwickii</i>	X	X	
32	<i>Kerivoula picta</i>			X
33	<i>Murina aurata</i>		X	
34	<i>Murina tubinaris</i>		X	X
35	<i>Murina cyclotis</i>	X	X	X
36	<i>Murina anamitica</i>			X
37	<i>Murina feae</i>			X
38	<i>Murina harrisoni</i>			X
39	<i>Murina huttoni</i>			X
40	<i>Myotis chinensis</i>	X		X
41	<i>Myotis siligorensis</i>	X	X	
42	<i>Myotis ater</i>	X		
43	<i>Myotis daubentonii</i>	X		
44	<i>Myotis formosus</i>	X		
45	<i>Pipistrellus ceylonicus</i>		X	
46	<i>Pipistrellus paterculus</i>	X		
47	<i>Pipistrellus javanicus</i>	X	(X)	
48	<i>Pipistrellus coromandra</i>	X		
49	<i>Pipistrellus tenuis</i>	X	X	
50	<i>Pipistrellus cadornae</i>	X		
51	<i>Hypsugo pulveratus</i>	X		X
52	<i>Tylonycteris pachypus</i>	X		
53	<i>Ia io</i>	X		X
54	<i>Scotomanes ornatus</i>	X		X
55	<i>Scotophilus heathii</i>	X		X
56	<i>Miniopterus schreibersi</i>	X		



57	<i>Miniopterus australis</i>	X		
58	<i>Miniopterus fuliginosus</i>			X
	<b>Total</b>	<b>40</b>	<b>24</b>	<b>32</b>

### Conservation information in Ngoc Son – Ngo Luong NR

From previous studies by Pham Thanh Tung 2013 and Dong Thanh Hai 2015, illegal logging is still the direct cause of biodiversity decline in the limestone landscape in southwestern Hoa Binh province. Large areas of shrubland as a result of over-harvesting, firewood, and grazing have been documented in a number of studies. (Pham T. T. et al., 2013; Phung V. P. et al., 2014). Besides, hunting still occurs in some communes in nature reserve, usually in the dry season, November, December. It is conducted by local ethnic people and neighborhoods nearby serving mainly food needs also business needs (Cano et al., 2013). The rangers also collaborated with local authorities confiscated guns and traps. Among small mammals, some species in Sciuridae family such as *Callosciurus erythraeus*, *Dremomys rufigenis* are subjects are regularly hunted for food and trade value. Besides, some squirrels, considered to be threatened in Vietnam Red Data Book as *Ratufa bicolor*, *Hylopetes alboniger*, *Petaurista philippensis*, are also frequently hunted (Vietnam Red Data Book, 2007).

Moreover, due to the increasing demand for wildlife consumption, local people are more likely to trap mammals for trading. In addition, they also trap animals for their daily food when they stay a long time in the forest for product exploitation. One of the forest products, orchids, is highly demanded and intensively exploited from forests. Moreover, wildlife trading is becoming more and more difficult to control because these activities are prohibited by laws, then local people and traders often make deals illegally. So, it is necessary to carry out frequent patrolling and monitoring programs to control the hunting activities of local people. These programs should be coordinated with other authorities such as commune policies and local forest protection forces. Communication and education activities on forest protection should continue to be updated and disseminated to local people, restaurant owners, and wildlife traders in several areas. Legal regulations and punishment should be strengthened for nature protection.

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## **THÔNG TIN CẬP NHẬT VỀ KHU HỆ THÚ NHỎ TẠI KHU BẢO TỒN THIÊN NHIÊN NGỌC SƠN – NGỒ LUÔNG, TỈNH HOÀ BÌNH**

**Tóm tắt:** Điều tra bổ sung và cập nhật thành phần các loài thú nhỏ phân bố tại Khu bảo tồn thiên nhiên Ngọc Sơn – Ngổ Luông (KBTTN–NSNL), tỉnh Hòa Bình. KBTTN–NSNL nằm trong quần thể núi đá vôi Pù Luông – Cúc Phương của miền Bắc Việt Nam. Dựa trên các mẫu vật khảo sát thực địa kết hợp với các công bố trước đây, tổng số 54 loài thú nhỏ thuộc 10 họ và 3 bộ đã được ghi nhận ở khu vực này. Trong đó, *Sphaerias blanfordi*, *Cynopterus sphinx*, *Hipposideros gentilis*, *Hipposideros larvatus*, *Murina cyclotis* là những loài phổ biến trong khu hệ Dơi; *Leopodamys subanus*, *Maxomys surife*, *Rattus tanezumi* là những loài đặc trưng trong khu hệ Gặm nhấm. Tuy nhiên, dưới tác động của tình trạng khai thác bất hợp pháp, săn bắn và các hoạt động của con người đã và đang gây ảnh hưởng tiêu cực đến các giá trị đa dạng sinh học. Vì vậy, việc bảo tồn đa dạng sinh học vấn đề cấp bách hiện nay.

**Từ khoá:** Hệ thú nhỏ, danh sách, núi đá vôi, Việt Nam.