FINAL PROJECT REPORT

Conservation of bat assemblages in Hanoi city, Vietnam

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CONTENTS

1. INTRODUCTION

Up to recent, Hanoi, the capital city of Vietnam, has experienced accelerated economic development that has resulted in rapid urbanization. However, the city has faced increasing environmental issues as a consequence of the poor and unscientific plans to develop its infrastructure, public transport, and industrial zones. In order to resolve the urban environmental issues in Hanoi, the local authorities have developed and implemented lots of urgent solutions that include a variety of method and management options but these efforts have not brought out the expected results. These issues, together with an extreme low of the local awareness on the environmental protection, particularly on the role of the urban nature conservation, have decreased the native fauna and flora and its native habitats and landscape of Hanoi. Therefore, to maintain this urban biodiversity and its habitats of the city with the hope to improve the life quality of the local residents, the urban planners and managers and local residents require conservation guidance based on sound ecological information. In response, a bat conservation program including a variety of activities has been conducted to address gaps in knowledge and strengthen urban nature conservation management in Hanoi.

Bats were chosen as the focus for research as they are one of the native mammalian groups that can exist in the urban environment, event in the high urbanized areas as the city centre of Hanoi. Bats play many important roles and provide many ecological services in ecology and can be used as bio indicators reflecting the status of wider biodiversity. Therefore, this program aimed to establish a program for conservation of urban bat populations in Hanoi city, northern Vietnam. To achieve this aim, the project will:

- Undertake field studies in a variety of habitats and seasons to determine the ecological requirements of bat species and populations inhabiting urban areas in Hanoi
- Develop research capacity and local conservation awareness by mentoring students in the research program and delivering a series of public seminars
- Promote wider awareness by publishing a series of academic papers and popular articles in local journals and mainstream media

According to above special purposes, the project achievements could be summarized as follow:

The project conservation research was successful taken place at the studied sites which were chosen along the gradient of urbanization in the “old Hanoi” and adjacent areas. Our findings showed that urban bat assemblage contains low level of species richness and its abundant was highly depended on the green spaces, water habitat distribution and insect abundant. In addition, some important ecological characters of bats in studied sites were also studied to assess the threats to them and subsequently to develop a long term program to conserve them and entire urban biodiversity.

The project capacity-building included a series of activities. Of which, a series of public seminar (mainly for children) were organized at the local to provide the basic knowledge of urban bat conservation and habitat management. Moreover, field and lab training were also conducted with the participation of graduating students from Faculty of Environmental Science, Hanoi University of Science (HUS) and post graduating students of Institute of Ecology and Biological Resources (IEBR).

Awareness raising campaigns has developed and distributed a variety of awareness materials such as brochures, calendars, T-shirts. These materials were designed to enhance the local understanding of the important of bats and other biodiversity in urban settings.

Publication: An academic paper generated from the project was presented at the national conference and other products were presented at the Asean Exhibition on Biodiversity**.**

2. **PROJECT ACTIVITIES:**

2.1. **Conservation research**

In august 2008, the Vietnamese government had decided to extend the boundaries of Hanoi, subsequently, the capital of Vietnam, covers nearly 334,500 ha, however, based on the purpose of the project, the study started to perform at different sites mainly in the "old Hanoi" area from mid-2009 and proved barely productive. Prior to our research, some initial surveys conducted by international and national scientists had suggested that some bat species used to occur in the city (see Appendix 1). However, at the time of the conducting this research, almost ancient habitats have recently been altered or destroyed by the spread of urbanization. Therefore, the findings of this project research reflexed current status of bat population existing in urban areas of the city. Based on previous data, this result would be used to assess the threats of the urbanization to native bat assemblage and then to use as baseline data to establish a long-tern program to maintain urban nature in Hanoi city. Preliminary results might be summarised as follows:

Urban bat diversity and distribution

Our results showed that bat assemblage in urban areas of Hanoi city (city centre and suburb) has extreme low level of species richness with 5 recorded species, *Cynopterus sphinx*, *Pipistrellus abramus*, *Scotophilus heathli, S. kuhli* and *Tylonycteris pachypus* belonging to 2 families (see Appendix 1**)**. The results generated from live trapping and observation, together with the detecting of echolocation calls of bats in different sites have indicated that *P. abramus* a small insectivorous bat can occur at all the studied sites and hence, has the widest distribution in the urban bat community. The fruit bat, *C. sphinx* consumes almost fruits and roosts mainly under palm leaves, therefore its distribution related closely to the fruit ability and the distribution of palm trees. Whereas *Scotophilus heathly* and *S. kuhli* are large insectivorous bats foraging at a high to medium altitude and confined to various open and semi-open habitats, therefore, this species was recorded only at studied sites in the city where contain many open spaces. Unlike the other species, *T. pachypus*, a small insectivorous bat, inhabit closely to the bamboo chain, hence it distribution was limited in the sites that found the bamboo chain along the dykes or in suburb of Hanoi city.

Urban bat's activities

Generally, our results indicated that levels of bat activity decrease along the gradient of the urban development. For example, at the sites in city centre where have high-density housing with high vehicle traffic and noise have low levels of bat activity compared to those activity levels recorded amongst low-density housing or sparsely built areas in the suburb. In the centre, the levels

of bat activities varied in different sites, depended upon the distribution of the fresh water resources, green coverage. Levels of bat activity have elevated at artificial light sources, where rich the night insect. Bat activity may also fluctuate in response to different environmental factors. For example, insectivorous bats (*S. heathli, S. kuhli, P. abramus* and *T. pachypus*) respond to daily or seasonal weather variation, and insect abundance. Our results showed that the activities of insectivorous bats in cold winter (from December to Match) were lower than those in the other cool and hot seasons. Especially, when the local temperature is lower than 15^0C, the level of bat's activities were extremely low. Whereas the highest abundant of the fruit bat, *C. sphinx* was found during the fruit season (litchi, longane) from May to August at the studied sites. This species could consume almost fruits in the litchi or longan garden, therefore, despite having a high value in reforestation; *C. sphinx* was listed as a pest in the fruit plantation areas. This species usually roosts at the leave of palm tree which were planted widely in the city centre, so that it is quite easily to observe in the daylight.

Bat reproduction

As disturbance during crucial reproductive periods (late pregnancy, lactation and weaning) threatens reproductive success, therefore, the reproductive phenology of urban bat species at studied sites was investigated. Results indicate that the timing of major reproductive events coincides among bat species. Reproduction of recorded bats spanned a period from April to August. The pick of pregnancy and lactation in all bat species were positively correlated with rainfall and temperature and food ability with weaning occurring during the mid-wet season (May-July).

2.2. Project Activities: Capacity building

During the project period 4 graduating students from Faculty of Environmental Science of Hanoi University of Science (HUS) and 01 Msc student of Institute of Ecology and Biological Resources (IEBR) have joined the project as project assistances. These volunteers have learnt a lot of experiences in field/lab work, networking, etc., which enhance their knowledge in bat studying and conservation.

- Mr. Nguyen Quang Tuan, Msc student of IEBR is developing his thesis proposal which focused on the using GIS to assess the diversity of small mammals in different habitats. Of which, bats will be focused as a model of his study.

- Other 4 graduating students are trying to improve their English with the hope to work for the national or NGO organizations who working in biological conservation or environmental protection after they graduate.

- Currently, the project investigator, Mr. Vuong Tan Tu, has received a 3 year scholarship from Vietnamese government to study PhD in France. With experiences and samples collected from

this project as well as other project, Tu has been accepted to do a PhD research entitled «**Biodiversité des chauves-souris (Mammalia, Chiroptera) de la Cordillère Annamitique et mise en évidence des taux d'endémicité at** Muséum national d'Histoire naturelle (MNHN), Département Systématique et Evolution UMR 7205 - Origine, Structure et Evolution de la Biodiversité.

The above results ensure that the impact of the projects capacity-building works will continue and certainly some new bat project will be developed to improve national bat conservation and management.

2.3. Activities to strengthen local awareness

Due to resident hold the key to the success of urban nature conservation/management, the improvement in the resident's understanding of ecological patterns and processes in urban ecosystems is imperative. Therefore, in summer 2010 (June - August), a "Bat party" was designed for local resident, mainly for children to strengthen their knowledge of bat conservation and habitat management. This event contained a variety of activities such as game, film show, with aim to equip participants with some basic knowledge as follows:

- The role and vulnerability of urban ecosystems;
- The important of bat and other native biodiversity in urban setting;
- Principle and methodology for urban bat conservation and management and its implications for local habitat management;
- Practice and exchange their experience in their knowledge learnt from training event.

After this event, participants would be active propagators to spread the knowledge in bat conservation and some of them could become conservationists in future.

2.4. Wider awareness

During the project period, a range of activities has been taken place to raise wider awareness of the importance of urban bat and its implications for habitat management. These included conference/exhibition presentations, distribution of awareness materials, details for which are given below.

- An academic paper was presented at the Commemorative Conference to celebrate the 35th anniversary of Vietnam Academy of Science and Technology in Hanoi in October 2010.

- A collection of bat photos and poster generated from this project was presented at the Asean Exhibition was held in Hanoi in August 2010**.**

Together with this above event, a series of awareness materials including Rufford logo have been developed and delivered, detail as the table below:

#	Item	Quantity
1	Bats of Hanoi 2010 **Calendar** (A1, full colour)	200 units were made and delivered to local communities, schools
2	**Leaflet**: Bats of Hanoi: Full colour, six pages	1000 units were made and delivered to local communities, schools
3	**T-shirt**: Save Hanoi bats!	200 units distributed to community leaders and local children

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On-going works

In fact, the field research of project has finished in October 2010, however data analyses is still not complete. Currently, a set of DNA samples of recorded bats are analysing at MNHN in order to confirm the previous identification and submit to the Barcode of Life Data Systems (BOLD), if feasible. In addition, project team members are developing some manuscripts/reports based on the project achievements to submit to national journal/conference.

2.5. Report and Publication

With the data generated from the project, project member have completed or are developing some academic papers or reports to submit to national journal/conference/ mainstream media as listed below:

- Vuong Tan Tu, Vu Dinh Thong, Nguyen Canh Tien Trinh and Furey, N.M. 2010. *Echolocation calls of insectivorous bat (Pipistrellus abramus Temminck) recorded in urban areas of Hanoi, Vietnam*. National Conference to celebrate the 35th anniversary of Vietnam Academy of Science and Technology, Hanoi, Vietnam, 26 October, 2010 (in Vietnamese with English abstract).

- *Conservation of bat assemblages in Hanoi city*, Vietnam (poster and photos). Asean Exhibition on Biodiversity, 3-6 August, 2010, Hanoi, Vietnam

Additional manuscripts for which writing is in progress include:

- Nguyen Quang Tuan and Vuong Tan Tu, *Application of GIS to assess the effects of urban development to bat diversity in Hanoi city, Vietnam* (peer review in Vietnamese). Plan to submit to 4th National Conference on Ecology and Biological Resources will be held in Hanoi in 2011.

- Vuong Tan Tu, Nguyen Quang Tuan and Pham Duc Tien,.... Preliminary report on the bat fauna of Ba Vi National park. Report to Ba Vi National Park management board, (peer review) (in Vietnamese);

- Urban wildlife conservation: a revision of urban bat diversity. Press release submits to website of Vietnam Academy of Science and Technology (peer review).

3. FINANCIAL SUMMARY

During the project period (June 2009 to October 2010), total expenditure approximately £10600 GBP. Together with £5970, a grant of Rufford Foundations, the additional £4630 was provided by IEBR, Hanoi University and Ideawild (USA). The table below summarised how the Rufford grant was used for the project (all items are GBP)

Project expenditure	Total (GBP)
Personnel	
Project Investigator	1125
2 Partners	1050
Local assistance	1200
Subtotal	**3375**
Consumables	
Chemicals	80
Personal field equipment	490
Field consumables (tarpaulin, utensils, groundsheets, batteries)	160
Subtotal	**730**
Travel	
Car hire	360
Miscellaneous travel expenses	310
Subtotal	**670**
Miscellaneous expenses	
Administrative cost	140
Stationary	120
Communications	165
Subtotal	**425**
Public Seminars	
Awareness leaflets (1000 units)	150
Calendar (200 units)	170
Conservation t-shirts (200 units)	210
Bat party expense	240
Subtotal	**770**
TOTAL	**5970**

Literature Cited

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Jones, G., Jacobs, D. A., Kunz, T. H., Willig, M. R., Racey, P. A. 2009. Carpe noctem: the importance of bats as bio-indicators. Endangered Species Research. doi: 10.3354/esr00182

Neil M. Furey, Iain J. Mackie and Paul A. Racey 2010. Bat diversity in Vietnamese limestone karst areas and the implications of forest degradation. Biodiversity and Conservation. Volume 19 (7), 1821-1838, DOI: 10.1007/s10531-010-9806-0

APPENDIX

Appendix 1 : Checklist of bat species occurred at Hanoi city and adjacent territories

#	Scientific Name	Site / Habitat		
		City centre (old Hanoi)	Suburb (Dong Anh and Tu Liem districts)	Ba Vi National Park area
I.	**Pteropodidae**			
1	*Cynopterus sphinx* (Vahl, 1797)	1	1,2,3	
2	*Rousettus leschenaulti* (Desmarest, 1820)	3		
II.	**Rhinolophidae**			
3	*Rhinolophus affinis* Horsfield, 1823			1
4	*Rhinolophus pusillus* Temminck, 1834			1,3
5	*Rhinolophus pearsoni* Horsfield, 1851			3
	Rhinolophus stheno			3
6	**Hipposideridae**			
	Aselliscus stoliezkanus (Dobson, 1871)			1
III.	Hipposideros pomona K. Andersen, 1918			1,3
7	Hipposideros cineraceus Blyth, 1853			1,3
8	**Vespertilionidae**			
IV.	Myotis horsfieldii (Temminck, 1840)			
9	Pipistrellus abramus Temminck, 1840	2,3	3	
10	Pipistrellus tenuis (Temminck, 1840)	2		
11	Scotomanes ornatus (Blyth, 1851)			2
12	Scotophilus heathi Horsfield, 1831		2,3	
13	Scotophilus kuhli Leach, 1821		2,3	
14	Murina cyclotis Dobson, 1872			3
15	Tylonycteris pachypus (Temminck, 1840)		3	
V	Molossidae			
16	Chaerephon plicata (Buchanan, 1800)			2

1 – Recorded bat species in Hanoi by Topal and Csorba during the period 1988 – 1999;
2 - Recorded bat species in Hanoi by Kuznetsov et al and Borissenko et al during 1990s;
3 – Bat species recorded during this study.

Appendix 2 Abstracts of paper was presented at the National Conference to celebrate the 35th anniversary of Vietnam Academy of Science and Technology, Hanoi, Vietnam, 26 October, 2010.

ECHOLOCATION CALLS OF INSECTIVOROUS BAT (Pipistrellus abramus Temminck) RECORDED IN URBAN AREAS OF HANOI, VIETNAM

Vuong Tan Tu, Vu Dinh Thong, Nguyen Canh Tien Trinh and Neil M. Furey

Abstract

Up to recent, the spread of urban development in Vietnam has degraded and altered native habitats; however, urban areas retain some capacities to support many native fauna and flora. Of which, bats, one of the native mammalian group, form an important portion of the city's biodiversity and provide many economic and ecological values still can exist in this special environment. In spite of the fact that urban bats have adapted to the urban environment, these species are vulnerable to the disturbance of urban development, however, our knowledge on the Vietnamese urban bats is extremely low due to almost Vietnamese bat researchers are traditionally interested in studying on bats in natural habitats than that in urban habitats. Therefore, the need to conduct a conservation research to enhance our knowledge on urban bats in Vietnam is an urgent issue. To fill in these gaps, during period from May 2009 to May 2010, a bat research that sponsored by the Rufford Small Grant for Nature Conservation (UK), were conducted in Hanoi. According to obtained data, this paper presents on the echolocation calls and some ecological characters of Pipistrellus abramus, a very common bat species in urban areas of Hanoi. As the result of this study, P. abramus emits the FM signals to search and forage its preys. This species also prefer foraging in near water bodies and street lights than in other habitats. Notwithstanding, these habitats have been degraded and polluted as the consequence of the urban development and therefore further researches are required to assess the threats to urban nature to imply for its habitat conservation and management in Vietnam.

Appendix 3 Photo-documentation

Live mist-nesting

Echolocation recording in the field

Live harp-trapping

Extracting a bat from mist net in the field

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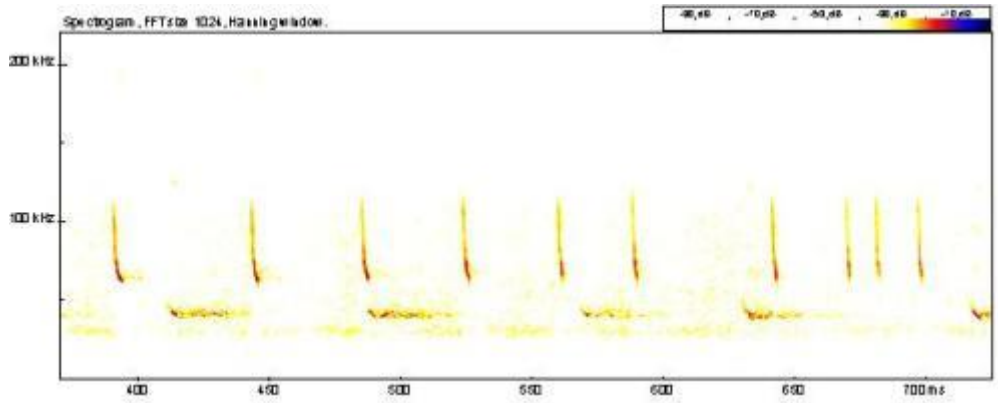
Bat root inventory at Bavi National Park

Extracting a live bat from flap net in the field

Appendix 3 (continued): Bat species collection

The roost of Cynopterus sphinx



Spectrogram of echolocation calls of echolocating bats (*Tylonycteris pachypus*)


A prégnant bat (T. pachypus)

Appendix 3: Capacity-building and awareness raising

Field identification training event for graduating students from Hanoi University

Mr. Pham Van Kien, project assistance at Asean Exhibition on Biodiversity

Showing how to record bat echolocation calls

Local children are fun with live trapping

Local children with awareness T-shirt joined summer festival

Project member presented a live bat for the local kids

Mr. Nguyen Quang Tuan – project assistance (Msc student in IEBR) attended to the Asean Exhibition on Biodiversity

Mr. Vuong Tan Tu, PI (second on left) with children at Asean Exhibition on Biodiversity

The project's photos and poster were selected as major collection of the Institute of Ecology and Biological Resources (IEBR) presented at the Asean Exhibition on Biodiversity

Appendix 3: Some awareness material generated from the project

Appendix 3: Some profiles of studied sites at Hanoi city

A small portion of Bach Thao park

The releasing of pollutants to local environment

A calm pattern in West lake in Hanoi city

The polluted roads exist frequently in Hanoi

The new road attached with green coverage

The clearance of attached trees for wider road

Thu Le park

To Lich, a river inner city, is highly polluted