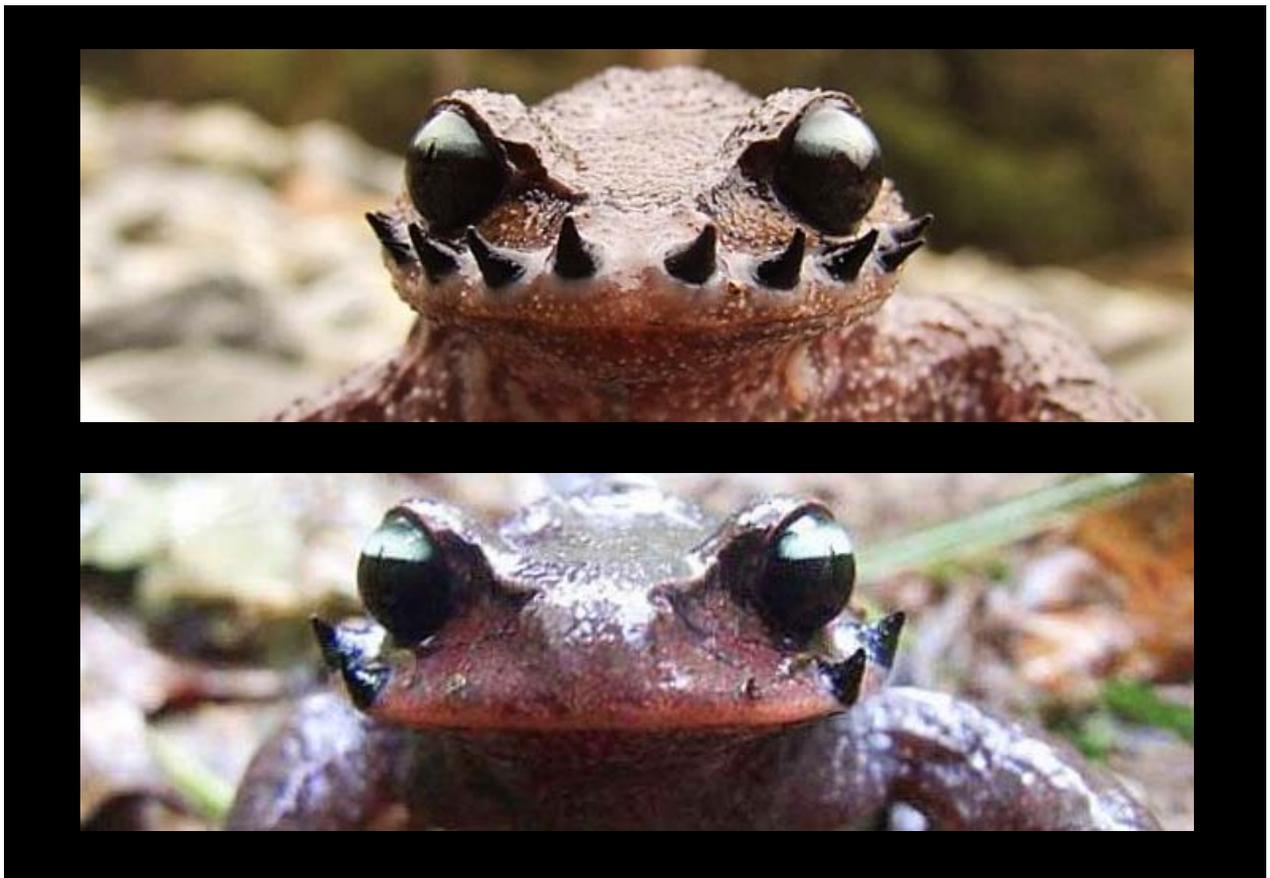




# Ecological Studies and Conservation Status Assessment on Two Endangered *Vibrissaphora* Toads in China



## Final Report

*August, 2007-August, 2008*

Mustache Toad Project Group

Southwest Forestry College

Written By Ben Han, Lianxian Han, Han Liu, Yueqiang Liu, Guangxu Huang



Project ID: 060107

Taxa: Amphibian

Country: China

Region: Asia

Team Leader: Ben Han

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Project Duration: August, 2007 – August, 2008

## Contributive Member List

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**Chytrid Fungus Testing Assistance:** *Jodi Rowley (Conservation International)*

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- (b) Leigongshan National Nature Reserve, Guizhou, China
- (c) Fanjingshan National Nature Reserve, Guizhou, China
- (d) Xiaoxi, Jiemuxi, and Badagongshan National Nature Reserve, Hunan, China (Three separate NNRs in Hunan Province)

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# Executive Summary

This report is submitted to the Conservation Leadership Programme. The CLP supported project Ecological Studies and Conservation Status Assessment on Two Endangered Vibrissaphora Toads in China by future conservationist award in 2007.

This final report, which describes the whole framework and introduces the content included in each part of the project. This report consists of three part, (1) preparation, (2) research, and (3) conservation. We had included the content as below: major research and conservation status assessment activities in the field, difficulties encountered during the project implementation and solutions, discoveries and highlights.

*Vibrissaphora boringiae* and *Vibrissaphora leishanensis* are two endemic amphibian species listed as endangered (EN) in the IUCN Red List, the common name for the species is “mustache toad”, because its black keratinized spines on the male ones during the breeding season. Two threatened species can only be found in south China, with each has a very limited distribution range and rapid declining population due to numerous negative factors.

This project was conducted its all major fieldwork and community education activities separately in two national nature reserves (Leigongshan National Nature Reserve and Fanjingshan National Nature Reserve), and additional quick survey in three national nature reserves in Hunan province (Xiaoxi National Nature Reserves, Jiemuxi National Nature Reserve and Badagongshan National Nature Reserve).

# Part A

## Preparation

### 1. Introduction

*Vibrissaphora*, alias mustache toad, known for its keratinized black spines during the breeding season, formerly were only discovered in China, and now its distribution range has been identified

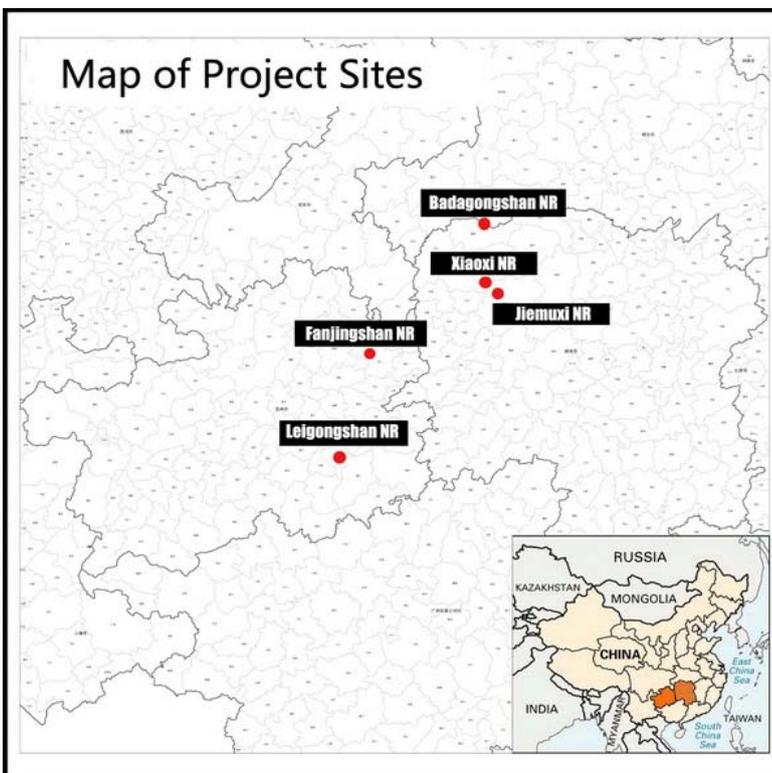


Figure 1. The general distribution map of all project sites in Guizhou and Hunan Province

Currently, there are six *Vibrissaphora* species (Zheng, Li and Fu, 2008), or arguably there might be seven (Rao and Wilkinson, 2008), among which the five species, *Vibrissaphora liui*, *Vibrissaphora boringiae*, *Vibrissaphora leishanensis*, *Vibrissaphora ailaonica* and *Vibrissaphora promustache* are endemically distributed in southern China (Fei, 1999; Rao, 2006). *Vibrissaphora* tadpoles can only be found in limpid stony streams and the metamorphosis will occur before maturing to sub-adults until its third year (Fei and Ye, 1984; Li and Chen, 1988). Tadpoles have a strict requirement for habitat, as when transfer tadpoles to feculent water environment, it quickly inflicts the death of tadpoles (Zheng and Zeng, 2003). Snakes are identified to pose threat to the species and traces of predation on mature individuals by primates were observed during the breeding season (Chen et al, 1984). The last field study on mustache toads was conducted in 1987 (Tang, 1990).

Two species among the genus, *Vibrissaphora boringiae* and *Vibrissaphora leishanensis* are identified and listed as “Endangered (EN)” by the IUCN experts. The two species are suffering continuous and rapid declines in the number of mature individuals, which is apparently deteriorating its population sustainability and viability. The reasons to account for the shrinkage of adult population is assumed to be negative factors such as the neglect of breeding sites management, non-strict enforcement of wildlife law, general habitat degradation, reduction of proper breeding sites caused by drought and intensive human harvest pressure by local residents.

Two threatened *Vibrissaphora* species have separate breeding period, for *Vibrissaphora boringiae* the time begins in March and lasts to April, for *Vibrissaphora leishanensis* the breeding season starts from late October to November. Both of the breeding period will last for about 2-6 weeks long (Fei, 1999). Males would seek proper rocks in the running streams and construct suitable nests underneath these rocks during the breeding season, it is hard to observe such a behavior directly in the natural environment, recently the oviposition behavior of *Vibrissaphora boringiae* was reported but the observation was done in captivity status by transferring the couple and rocks into aquarium (Zheng and Fu, 2007). Females will leave immediately after laying eggs, but it is inferred that males may likely to stay for quite a long time at the same position in order to guard egg masses or attract more females for copulation (Fei and Ye, 1984; Chen et al, 1984; Tang, 1990). This breeding pattern made males and even females much more vulnerable to experienced human beings who harvest frogs for food. The function of keratinized black spines that only develop on the upper lip of the males during breeding season remains unknown so far. Otherwise, the species movement ability may be very limited. Since no radio telemetry and spool-and-line tracking had been done in the past, the individual movement range and sex difference in dispersal is not clear yet. Microhabitat selection by two species in breeding and non-breeding season thus is also in dimness. These weaknesses in ecological research have prevented proper strategy and management to its current habitat by related local authorities.

Furthermore, most of field research works were conducted during 1980s by former scientists. The present IUCN threat level of the species were basically assessed based on these early data. Conservation actions, status assessment and ecological research such as viability of tadpole populations, mark-recapture of adult population and population number estimation are needed and should be conducted as a management measure for population re-monitoring which about ten years later in 2007-2008 with the aim to help identifying if any variation occurs due to a global declining trend of many amphibian species. Also, considering increased human harvest activities since 1990, breeding success rate of two threatened *Vibrissaphora* species may be very low due to long period exposure to external predation until their tadpoles complete its metamorphosis in the third year. Hence, its entire population structure and viability might be disturbed as well. On the other side, although species have a relative wide distribution range, at each given site there is only a small number of population has been detected so far. Therefore, a quick survey is necessary to determine if there is any other new population of two threatened species in surrounding less-explored locations, areas and regions.

As all *Vibrissaphora* species have a extremely strict requirements on habitats, and if there are no more actions to be taken, it is expected that their population number would reduce faster on the present level of human disturbance, and even much faster to reach extinction status than formerly predicted. An comprehensive project to collect more scientific data through fieldwork is thus urgently needed, and the outcomes will contribute to consolidate the knowledge about the species. To raise conservation awareness about the importance to preserve these endemic amphibian species through massive public education is critial to the sustainability of the species as well by the implementation of the project.

## 2. Conservation Issues

Table 1. Target Species

Common Name	Latin Name	IUCN rank
Emei Moustache Toad	<i>Vibrissaphora boringiae</i>	Endangered (EN)
Leishan Moustache Toad	<i>Vibrissaphora leishanensis</i>	Endangered (EN)



*Vibrissaphora boringiae*



*Vibrissaphora leishanensis*

Two threatened species, *Vibrissaphora boringiae* and *Vibrissaphora leishanensis* are undergoing a rapid population declines due to intrinsic and extrinsic factors. According to the previous evaluation by IUCN experts, *Vibrissaphora boringiae* is extremely rare to find at its type locality, which is Mt.Emeishan, Sichuan province. It is assumed that the species may nearly disappeared from many mountain streams in Mt. Emeishan. So far the current already-known distribution sites of the species are under protection by related nature reserve management bureau, but most of these sites are easy to access which made adult toads exposed to external threat such as human harvest. However, there is neither no significant conservation actions to be taken with specific goals to preserve endemic amphibian species at local level, nor management measures to reduce or stop human harvest on frogs by public awareness education. Nature reserve itself is also developing ecotourism with the expectation to gain more income, but the tourism development have largely ignored to highlight local wildlife species but only restricted to advertise simple hiking, landscape viewing and religious activities of Buddhism. Infrastructure were developing during the first IUCN

evaluation about species status, and now it may worsen the environment where the species inhabit in. Local residents are still harvesting frogs not only as food for human beings and poultry but also for some traditional medicine use.

According to IUCN Red List, conservation issues for two target species are identified and listed as below:

- (1) Habitat Loss and degradation by ongoing agricultural expansion, extraction of wood and other natural resources utilization, ongoing infrastructure development such as tourism and recreation, construction of dams, and other present or future causes;
- (2) Harvesting (hunting/gathering), ongoing disturbance by cultural/scientific/leisure activities, and ongoing subsistence use/local trade;
- (3) Intrinsic factors such as limited dispersal of adult and sub-adult individuals, low densities of both mature individuals and tadpole population, restricted range;
- (4) Policy-based actions such as legislation development and implementation at sub-national level is in place, but improvement needed;
- (5) Communication and community-based awareness education initiatives are needed;
- (6) Needed research actions are estimating population numbers, detecting new distribution range, and monitoring population trends
- (7) Habitat and site-based actions, such as Establishment and management of protected areas is in place but improvement needed, site maintenance and conservation and restoration if possible is also needed;
- (8) Identification of new protected areas is needed

### 3. Aims, Objectives and Outcomes

#### **Aim:**

To Initiate the first step in conservation of threatened *Vibrissaphora* species in related national nature reserves of southern China and make *Vibrissaphora* as flagship species for endemic amphibian conservation. To take scientific activities to address the issues which were suggested by the IUCN Red List, and contribute more consolidated knowledge about the species through collecting latest data for further assessment and actions. Design and implement proper conservation activities to raise public awareness among stakeholder groups with the aim to develop a long-term species-specific conservation strategy at local and sub-national level.

## Objectives:

- (a) Survey and evaluate distribution range of two endangered *Vibrissaphora* species at currently known and unexplored sites, assess conservation status in two provinces of southern China (Guizhou and Hunan province);
- (b) Investigate tadpole population age structure based on the procedures of capture, measurement and release protocol, assess tadpole density and rate of survival;
- (c) Investigate mating system, observe oviposition behavior and copulation pattern through methods like individual tagging, sound recording and play back;
- (d) Estimate adult population numbers by capture-release, call counting, setting drift fences and bucket traps; Collating latest data with formerly collected data before 1990s;
- (e) Determine activity rate and sex difference in movement range during breeding season by using methods such as spool-and-line tracking and radio telemetry;
- (f) Analyze external threat factors such as human harvest frequency and possible chytrid fungus occurrence;
- (g) Produce a suitable conservation strategy to ensure breeding success of at least the minimum viable population against human harvest;
- (h) Teach and train local nature reserve rangers and staff of effective long-term population monitoring knowledge, skills and techniques, and gain experience through participative fieldwork;
- (i) Conduct community-based education program to raise local conservation awareness about the importance and urgency to preserve endemic amphibians and its habitats in the trend of global amphibian declines, and mitigate human harvest pressure;
- (j) Draw public attention from more people through exposure to popular science magazines at national level;
- (k) Build collaborative partnership between key agencies such as nature reserves and related research institutions;

## Outcomes:

The success of the project will be measured based on the set objectives, and depends on the key outputs listed below, each arising from a series of targeted activities and achievements indicators.

1. Production of species distribution map within the nature reserve and other surveyed areas;
2. Production of current conservation status assessment and suggested strategy;
3. Production of formal data collection protocols and latest data set of tadpole population age structure, density, and rate of survival to promote further monitoring by local rangers;
4. Production of records and descriptions about mating system and copulation pattern during the

breeding season;

5. Production of population data of adult individuals for comparison with former collected data and future monitoring;
6. Production of data set about activity rate and movement range during the breeding season for site-specific protection
7. Detection of Chytrid fungus occurrence or not;
8. In-situ conservation by identification of breeding streams, caution boards setting and establishment of enclosures to against human harvest;
9. Enhanced management measures and monitoring plan by local rangers;
10. Produce species distribution map at major project sites based on the field survey;
11. The rise of public conservation awareness and the reduction in human harvest frequency through education programs in schools and local communities, magazine exposure, and other exhibitions;

## 4. Team Members

### Ben Han (Male, Age 23)



Ben has a B.A. degree in English from Southwest Forestry College, he is project leader and coordinator, skilled in recording, sound analysis, radio telemetry and community education. Ben has some field experience in bird watching and a increasing interest in endemic amphibian species conservation issues. His role in the project is preparation of proposal, application, project presentation, budgeting and subsequent coordination and managerial work. He mainly participated into

the fieldwork such as tadpole distribution survey, estimation of adult population, skin sampling and telemetry tracking. He also designed education materials for community-based education program in Leigongshan NNR and Fanjingshan NNR.

### Fuping Sun (Male, Age 26)

Sun got his a B.S. degree in Wildlife Conservation and Management from Southwest Forestry College. Previously, Sun worked in the Zoo of Chongqing City as a technician who was responsible for wildlife nutrient and food supply. Now he works as a staff in the department of conservation biology at SWFC, he has strong interests in wildlife research and birding. His role in the project is to perform survey in primary data collecting work such as tadpole density, age structure, skin sampling, telemetry tracking and many other fieldworks. Sun contributed a lot as one of major co-participants in the fieldwork at Leigongshan National Nature Reserve.



### Han Liu (Female, Age 25)



Liu is pursuing her M.Sc. degree in Wildlife Conservation and Management at Southwest Forestry College. Liu is a major co-participant of fieldwork conducted in Leigongshan NNR. Liu also plays an important role in community-based education program. Liu has participated into many field surveys in Yunnan province and gained a wide experience in research on birds and amphibians. Liu has complemented her knowledge about amphibian species through this project and mastered the

skills of telemetry tracking techniques and how to collect and analyze population data.

### Zhongrong Wu (Female, Age 32)

Wu has a B.Sc. degree in Wildlife Conservation and Management from Southwest Forestry College and previously worked in the Zoo of Guiyang City, Guizhou province. Wu began to pursue her M.Sc. education in SWFC since 2005, and will go back to work in the Zoo again after graduation.

Wu's role in the project is coordinator that to assist with field survey and responsible for logistics. Wu has many years of experience in on birds and zoo management, but relatively she is lack of experience in the fieldwork. She was trained extensively in the project to compensate field experience.



Zhongrong Wu had also strengthened her skills in wildlife conservation and management through the project and gained practical experience of conducting community-based public education in an interactive way which was conducive to her career when she goes back to work at the management position of the zoo again in Guiyang City, Guizhou Province.

### Yang Li (Female, Age 33)



Li is a local Miao minority people and got her degree from Kaili Forestry College, currently she is also studying towards graduate degree at SWFC through correspondence course program.

Li was appointed to work in the forest management division which belongs to Leigongshan National Nature Reserve Management Bureau.

Li had previously got involved with many forestry survey and species management tasks. Li's role in the project is to coordinate administrative work with her senior officers, and she had also actively participated into field survey. She conducted survey on investigating tadpole age structure, distribution, rate of survival, density and development. She helped other team members to educate school students and villagers through translating Mandarin Chinese into local Miao language at the same time. Li is devoted to her career as a female ranger works in the frontline of conservation field at local level.

### **Shaojun Yang (Male, Age 36)**

Yang is a local Miao minority people and graduated from Kaili Forestry College. Yang was appointed to work in Leigongshan National Nature Reserve and now serves as a station officer in Fangxiang Management Station.



He had joined in many surveys within the nature reserve, and he is very familiar with many animal and plant species distribution status within the nature reserve

range. He is the leading force of the team while in the field. He had also coordinated community-based education at local villages and schools.

The project helped Yang to develop expertise and practice skills in identifying and monitoring endemic amphibian species. He had also been trained in organizing community-based education program with the aim to encourage the community participation for a long-term conservation plan.

### **Zhenguo Xie (Male, Age 42)**

(Photo N/A) Xie has B.Sc. degree in Wildlife Conservation and Management from Northeast Forestry University, and now serves as a senior director of scientific research department of Leigongshan National Nature Reserve. Xie had a long experience in wildlife conservation and nature reserve management. Xie had provided administrative support such as help the team members to get permission to work in the nature reserve and he shared geographical information including paper and GIS maps with the team during the project implementation.

### **Jijun Chen (Male, Age 29)**

(Photo N/A) Chen graduated from Northeast Forestry University, and works in Leigongshan National Nature Reserve as an office staff, he had participated in many local surveys of wildlife resources and community development. Chen played a role as fieldwork and community education coordinator in the project. Chen did not get involved with specific fieldwork due to the pregnant status of his wife, but he provided much administrative support to the team.

**Yueqiang Liu (Male, Age 24)**



Originally from Guangdong province, where wildlife trade is widespread and prosperous, Liu is studying towards his M.Sc. in Wildlife Conservation and Management at SWFC and preparing to work in the wildlife conservation field back to his home province after graduation.

Liu loves bird-watching and nature photography, and has a wide range of interests in wildlife ecology study. His previous field experience include basic bird and amphibian survey in some nature reserves located in Yunnan province. His

role is to manage and implement fieldwork in Fanjingshan NNR with assistance from local nature reserve management bureau, and with local community.

Liu has gained experience of developing and implementing bird survey and environmental education project during his undergraduate studies. He has made his skill set well-rounded through the project. He had also learned how to identify amphibian species and some advanced methods to study them.

**Guangxu Huang (Male, Age 25)**

Huang received his B.Sc. degree from Southwest Forestry College, and currently pursuing M.Sc. degree in Wildlife Conservation and Management at SWFC. Huang works in the animal ecology lab of SWFC as a technician, and later got enrolled into graduate program of the same major. Huang previously gained experience of doing research on birds and primates in Mt.Gaoligongshan. Huang's role in the project was to conduct fieldwork in Fanjingshan NNR together with Yueqiang Liu. He was responsible for collecting basic data and population survey within Yu'ao-Kuai'Chang area along the streams.



**Xiaoping Lei (Male, Age 42)**



Lei got his B.Sc. degree in Wildlife Conservation and Management from Northeast Forestry University, and he currently works as a senior director of scientific research office in Fanjingshan National Nature Reserve. Lei provided a lot of administrative support and actively participated into fieldwork as well by helping setting conservation caution boards and public awareness education. Lei also gained new knowledge and practiced skills of collecting and monitoring Chytrid fungus occurrence through the project. He had also offered help with

participatory community-based public education which could enhance conservation awareness at local level.

**Jiawei Yang (Male, Age 24)**

Yang got his B.Sc. in Computer Science from Guizhou Normal University, and now works as a scientific research staff in Fanjingshan National Nature Reserve Management Bureau. Yang had participated into the project to coordinate administrative affairs with the nature reserve, and some fieldwork for setting drift fences, and searching for frogs and tadpoles in mountain streams. As a newly-recruited the nature reserve staff in 2006, the CLP project enabled him to experience more field-related conservation work, and gain practical experience wildlife and forestry management. Yang has been trained of how to perform monitoring program with advanced methods. This will help him to organize his colleagues to continue conservation work in the future.



**Tengfang Lai (male, age 22)**



Lai has just got his B.Sc. degree in Wildlife Conservation and Management from Southwest Forestry College. Lai currently works in the animal ecology lab of SWFC as technician. Lei participated into fieldwork conducted in Fanjingshan National Nature Reserve. His role is a minor fieldwork assistant and he assisted Yueqiang Liu for tadpole/adult population survey and telemetry tracking.

# Part B

## *Research and Assessment*

### Site A: Mt. Leigongshan Nature Reserve

#### 1. Study Area



**The Gateway of Leigongshan National Nature Reserve**

Leigongshan National Nature Reserve is located in the southeast area of Guizhou province, its geographical coordinates is E108°5'- E 108°24', N 26°15'- N 26°32', about 70 km away from Kaili City, the capital of Miao and Dong Minority Autonomous. Mt. Leigongshan belongs to Miaoling Mountain Ridge, and as the mountain peak its highest point reaches 2178.8 meters. The Nature Reserve, with the total area of 47300 hm<sup>2</sup>, its highest altitude point is 2178.8 m and the lowest points is 650 m, the humid subtropical monsoon in this region keeps the annual average temperature ranges remaining between 9.2 °C – 16 °C. Leigongshan Nature Reserve plays an important role of preserving water resource and forming creeks in the mountain which later converge into Bala river, Wumi River, Taiyong River, Pingjiang River and Paidiao River. All these small rivers are branches of

Qingshuijiang River and Duliu River that is critical to sustain local people's lives and economy development. Leigongshan is also a part of the watershed of Changjiang River system and Zhujiang River system.

The nature reserve itself was established initially to protect *Taiwania flousiana* Gaussen during 1980s, animal conservation was a less concerned issue at the time. The entire nature reserve included 42 villages which have more than 20000 people live inside different areas of the nature reserve. Therefore, unmanaged human activities are at a high level and hard to control.

*Vibrissaphora leishanensis* was discovered in 1963 for the first time and the identification result was published later on the academic journal as a new species in 1973. During early times, the species was only to be found in two places, Fangxiang and Getou as indicated on the map below.

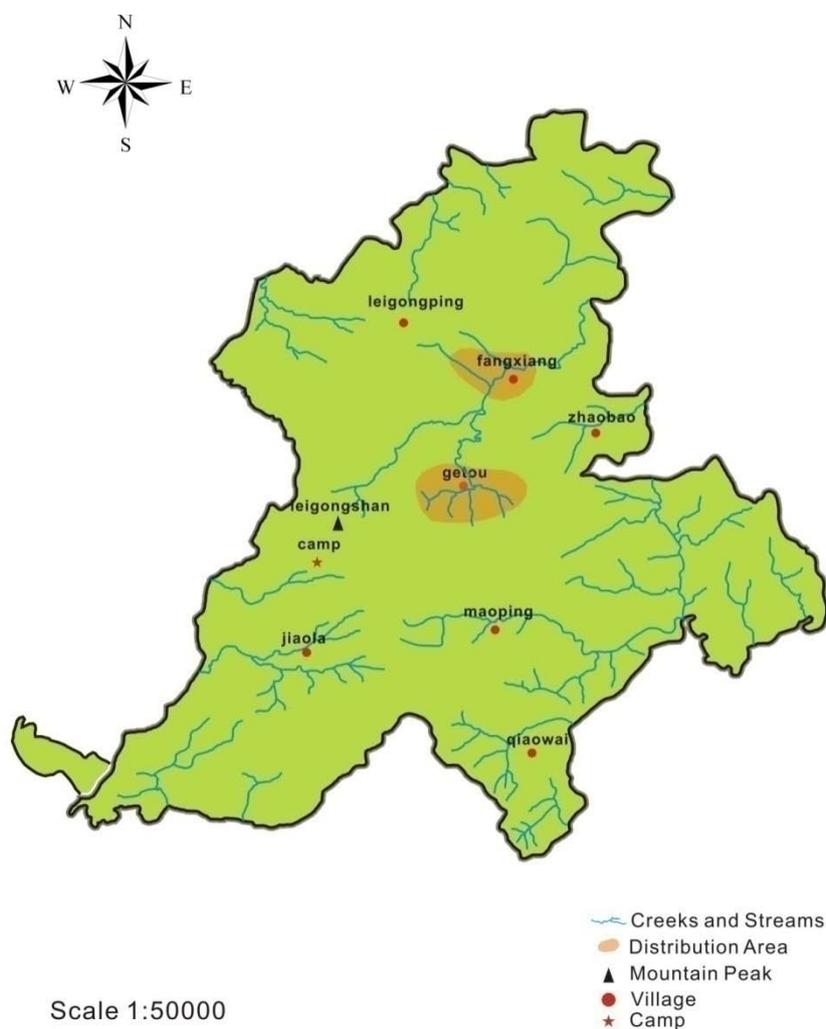


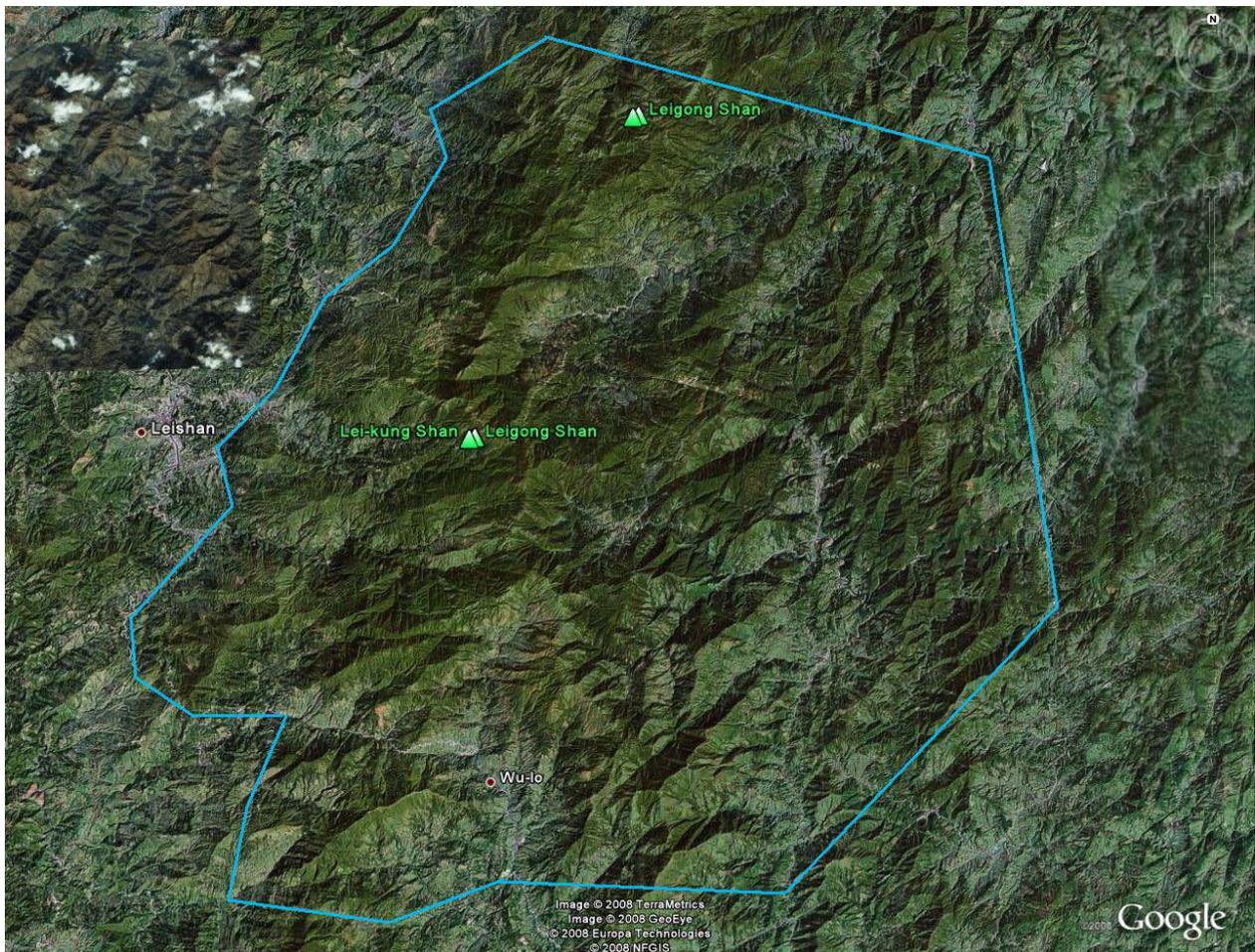
Figure 1. Early known distribution range before 1980s

## 2. Methods

### 2.1. Survey Range:

#### a. Main Areas for Fieldwork

The duration of the fieldwork and public education lasts about 60 days from October to November. According to early known but very limited species distribution range, we decided to enlarge cover area of the field survey in order to detect more possible species occurrence at the site. The general boundary of the covered areas during the survey is marked as below:



General covered areas by field survey

Our main project area had covered the extent of 1000 to 2100 a.s.l m. where mixed broadleaf and pine forest are dominant plant species.

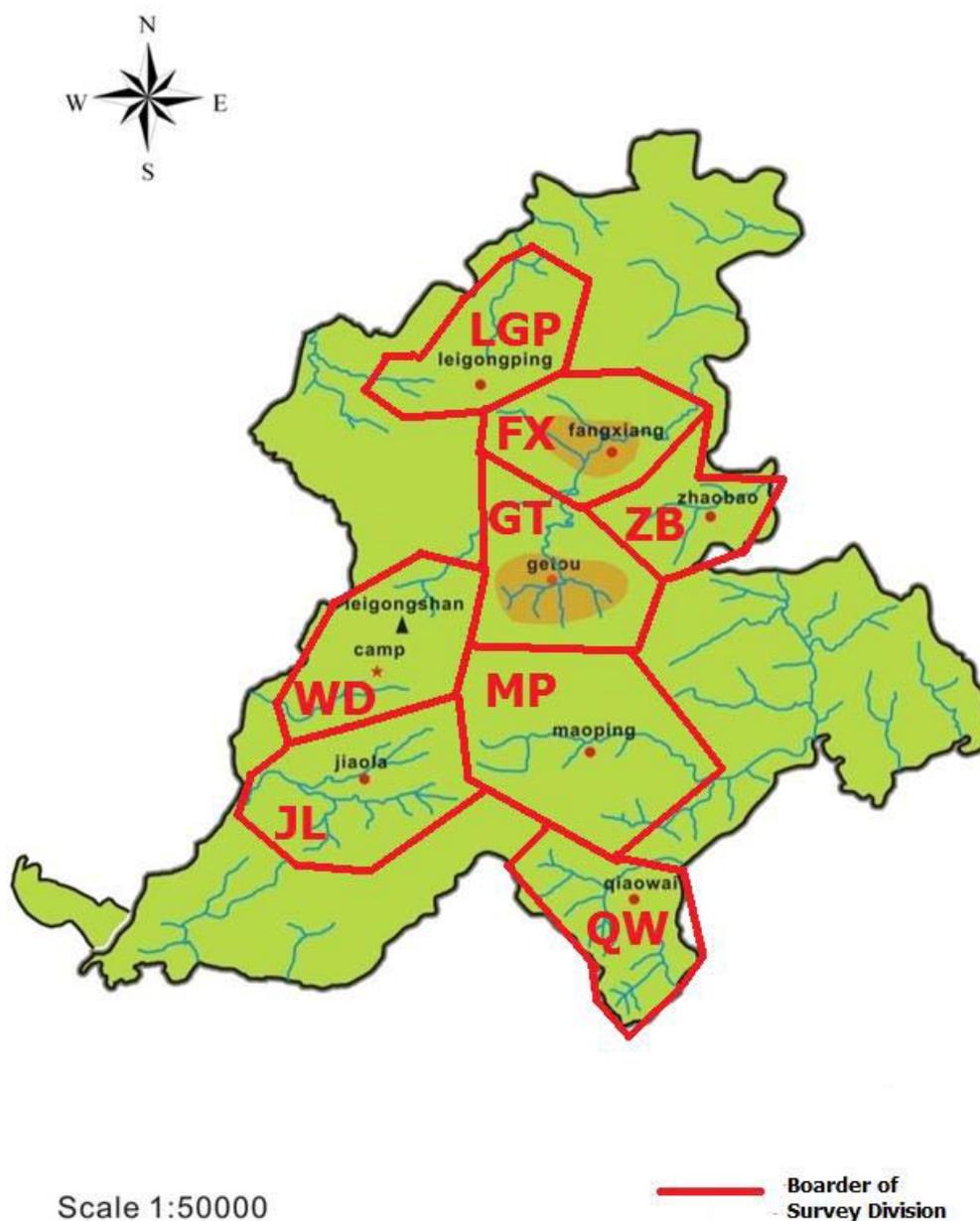


Figure 2. Range of Field Division

The field survey was mainly conducted at 12 places and areas listed as below: (1) Leigongping, (2) Mountain peak area, (3) Fangxiang, (4) Getou, (5) Datangwan, (6) Shuichang, (7) Maoping, (8) Wudong, (9) Jiaola, (10) Qilichong, (11) Wulaba, (12) Xiangshuiyan

### b. Streams Naming and Survey

All small streams and creeks which are located within the Leigongshan National Nature Reserve have no name, even common names by local residents. To perform survey systematically, team members need to name each surveyed streams by themselves while conducting surveys. These

names and stream list will be used for the long-term monitoring in the future. Two nature reserve staff, Yang Li and Shaojun Yang had collaborated with other student team members to accomplish stream surveys during October and November. The major survey had included 18 streams within the nature reserve.



*Survey team is en route to target streams*

Methods we used in the survey offered a good chance for these staff to learn new skills and the way of thinking. Through the project implementation, we had established a tighter connection between the Leigongshan Nature Reserve and Southwest Forestry College. Knowledge of writing scientific research paper and proposal, tips of monitoring endemic amphibians and chytrid fungus infected individuals, skin swabbing, radio tracking, sound recording and analysis were introduced to staff who participated in the project through a small workshop and practical experience.

The map of current toad distribution and future management plan will be made by the end of all fieldwork in Guizhou Province. The map will provide information of estimated individual numbers, tadpole densities, villager attitude towards conservation, and the high-frequency areas for toad harvest which need more conservation patrol by rangers.

#### **a) Survey Methodology**

During October 2007- November 2007, we spent about 60 field days to perform stream survey and other research activities to record and collect basic data. The accessible and surveyed area of the nature reserve was divided into different groups. The comparison of tadpole density in each stream were assessed as a conservation indicator of human harvest frequency and adult toad occurrence, especially the significant difference between vicinity and remote streams far away from normal roads and paths taken by local residents. A series of ecological research activities such as species current distribution, movement rate and range by radio tracking, sound recording, breeding

behavior observation, and individual call counting were conducted in those easily accessible streams near roads.

### **Visually Searching and Call Counting**

Usually adult individuals were found by directly walking in the stream and searching bottom part of rocks. In addition, we used nocturnal road call counting along the streams to compensate possible omission during diurnal survey. This method of survey was the most effective and frequently used technique to estimate population number throughout the study.

Visual encounter search was the most employed methods in the project. We searched particular streams and backwater ponds which appeared to be suitable habitats for potentially presence of either adults or tadpoles of the species. Search activities including turning and reversing rocks, digging through leaf litter, and prying crevices of shore stones.

During daytime we mainly searched for tadpoles in the stream. For adult toads, we performed call counting and acoustic searching along streams at night during the breeding season, call counting and searching usually starts from late evening from 1900 to 2230 hrs with the assistance by headlamp and flashlight.

### **Drift Fence Setting and Pitfall Traps**

We had set up drift fence by using plastic materials and sticks taken in the woods directly. Red buckets were used to build pitfall traps along the drift fence in order to capture and count the number of adult individual who come down into the stream to breed. Some stream sections were not appropriate to set up drift fence and pitfall traps, so we only focus on those streams which were suitable to conduct current survey and long-term monitoring in the future.



*Team was setting up drift fence and pitfall traps*

### **Skin Swabbing**

Skin swabbing was conducted following with protocols provided by Jodi Rowley. Before swabbing, each team member was wearing transparent and disposable plastic bags to cover hands in order to avoid cross-contamination between individuals. Each swabbed frog was marked with PIT tag in order to avoid repeat sampling. Samples had individual numbers (F001-F050 for Fanjingshan, L001-L050 for Leigongshan) written on it for identification and grouped testing if any chytrid fungus was occurred. information such as locality, weather, sex of the individual, time, altitude and habitat type of the collected samples was recorded separately on the tube and later gathered together on a general table.

### **Radio Tracking**

We used ICOM-R20 wide band receiver equipped with Yagi 4-element antenna to pick signals sent by radio transmitters. Radio transmitters was made by Holohil Systems Inc. We used Holohil model BD-2G transmitters, designed with a 20 week battery life and weighing 1.2 g. The total weight of transmitter unit with the waist silicone band was less than 2.0 g. Adults weighed 14.7–25.6 g, with males bigger than females. Radio-tagged frogs also were injected with PIT tags for individual identification in the event of recapture after transmitter failure or loss. Toads were captured at day and night, and captured ones were released as soon as possible onsite within 10 minutes after the mounting of transmitters. Radio transmitters were attached to toads by using soft silicone tubes that was secured around the waist

### **Behavioral Observations and Others**

We made behavioral observations, incidental observations any time a species was located in an area that was not actively being surveyed. We incorporated records of roadkill individuals, and the individuals caught by fringe village peoples. species species en of a species GPS points were collected at the location of the Observation and some general descriptions of the species and location were made as well.

#### **b) Data collection**

We collected basic environmental data such as locality, habitat status of mountain streams as breeding sites, date, time, weather condition (water, air and substrate temperatures, humidity), and microhabitat condition. We had also measured individual data such as weight and snout vent lengths (SVL) of each tadpole and frog captured, gender of adult individuals was also recorded, including detected position along stream transects, individual breeding behavior and reproductive condition of each individual. Data of tadpole distribution along streams, its density and age structure, egg masses development were also recorded.

The occurrence of a species were determined by finding tadpoles, sub-adults and adults including male vocalization. We had searched include forest floor, water bodies, and surrounding vegetation with the additional aid of pitfall trapping in order to find more individuals to estimate population number.

Individual number estimation survey were performed during day and at night, data collection was mainly rely on using nocturnal surveys, diurnal surveys and pitfall trapping along suitable stream sections. Each search was carried out once for a given stream section, surveys in specific stream groups were repeatedly conducted five days in a row. In streams, each section was defined as a 50 m transect, we searched for tadpoles and adult frogs by walking in the stream, we walked carefully to avoid stamp on tadpoles, even most of them were large enough to identify.

Pitfall traps were constructed in Linchang, Shuichang, Jiaola and Wulaba gourps. It is set up with drift fences to make frogs lean into the bucket traps. The pitfalls were opened in the day and at night and be checked regularly if any frogs or small mammals felt into it. In some places, plastic materials of drift fences and buckets were stolen by unknown local residents. So we have to narrow and focus on a smaller number of streams where the species would occur and strengthened monitoring frequency. Pitfall traps had successfully capatured some femal and male toads who were attempting to climb into streams to breed.

As species, especially the breeding adult is endangered and rare to find, we did not preserve any captured adult toads as voucher specimen because it is not necessary to do so, all toads and other frogs were released immediately after measurement work had been done at the point of capture. Frog species and tapoles were identified using two books, Fei (1999) and Fei (2004).

Geographic coordinates and elevation for surveyed site and streams were determined and recorded with a Garmin GPS receiver. Photos of representative habitats, species, landscape view, and education in the village with local residents were taken with a digital camera.

We have also interviewed with local residents who have been living in the villages, by explaining species described in the Herpetofauna field guides to find if any local name called by residents or clue of occurrences within the areas we were performing survey, which could enrich our field observation data pool. Through the interview, we came to know about the frequent harvest area by local people and consumptive use of *Vibrissaphora* and other endemic amphibian species.

Hindering problems occurred during field research were mainly caused by weather, venomous snakes prepared for wintering, people intervention and disturbance. Human disturbance caused the loss of transmitters and pitfall trapping materials. Toads with radio transmitters and some research equipments which left in the field were stolen by unknown thief. In order to avoid such a negative disturbance, we had withdrawn team members from places with high disturbance by people including possible risk to encounter with venomous snakes and changed survey plan on some sites, but to focus on relative secure areas with low human disturbance to conduct research and surveys.

### 3. Results

#### 3.1. Microclimate

We had recorded air and water temperature at three main field research sites, Wudong, Linchang, and Jiaola. HOBO data loggers were set to automatically record air and water temperature and relative humidity data at interval of 6 hours (0000, 0600, 1200, 1800).

During the fieldwork, clouded and windy weather was common in October, mildly with little rains after 20th. Water temperature was averagely remained between 9.3°C to 10.6 °C from daylight to night in October, but steadily decreased to the range of 8.1-9.8°C with the approaching of winter season since November. The air temperature varied to the weather from minimum 6.7°C to maximum 13.2°C between October and November.

Generally, local weather and microclimate in Leigongshan National Nature Reserve was relative dry but sometimes foggy in October, and started to rain a little bit in November, which is basically commensurate with the breeding period and peak time of oviposition by breeding pairs.

Air and water temperature and relative humidity have decreased gradually with the approaching of winter season, the lowest temperature could reach 2°C in following months according to continuous observation. The figures below were illustrated by calculating monthly average number of temperature recorded from three sites at the same interval (0000, 0600, 1200, 1800).

**Table 1. Microclimate conditions in three survey sites, October to November**

**(Linchang, Wudong and Jiaola)**

Location	Elevation Range (m)	Air Temperature (°C)		Water Temperature (°C)		RH (%)	
		Day	Night	Day	Night	Day	Night
Linchang	1826-1900	7.5-13.2	6.7-9.2	9.7-10.6	8.1-9.2	80-84	86-89
Wudong	1608-1617	7.4-12.8	6.9-8.7	9.4-10.2	8.4-9.8	81-86	84-87
Jiaola	1577-1584	7.1-12.6	6.5-8.9	9.1-9.9	8.2-8.9	85-87	88-90

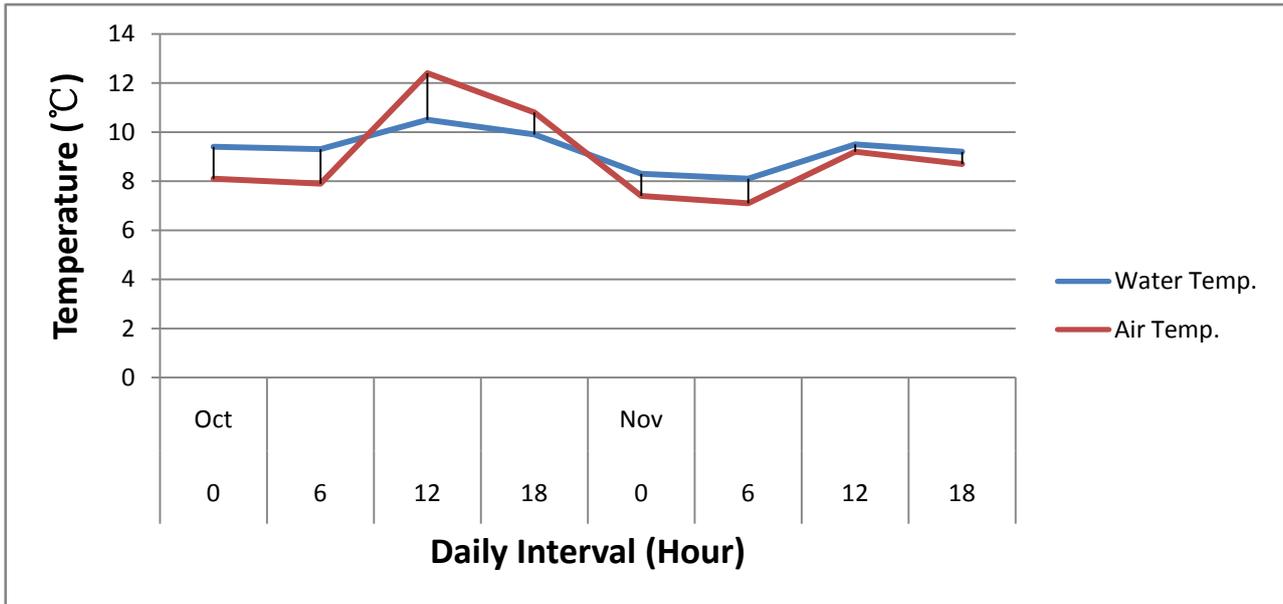


Figure 1. Average Water and Air Temperature

Water temperature was generally higher than air temperature at night but lower during daylight hours, and decreased slowly by comparing to the decreasing speed of air temperature since November.

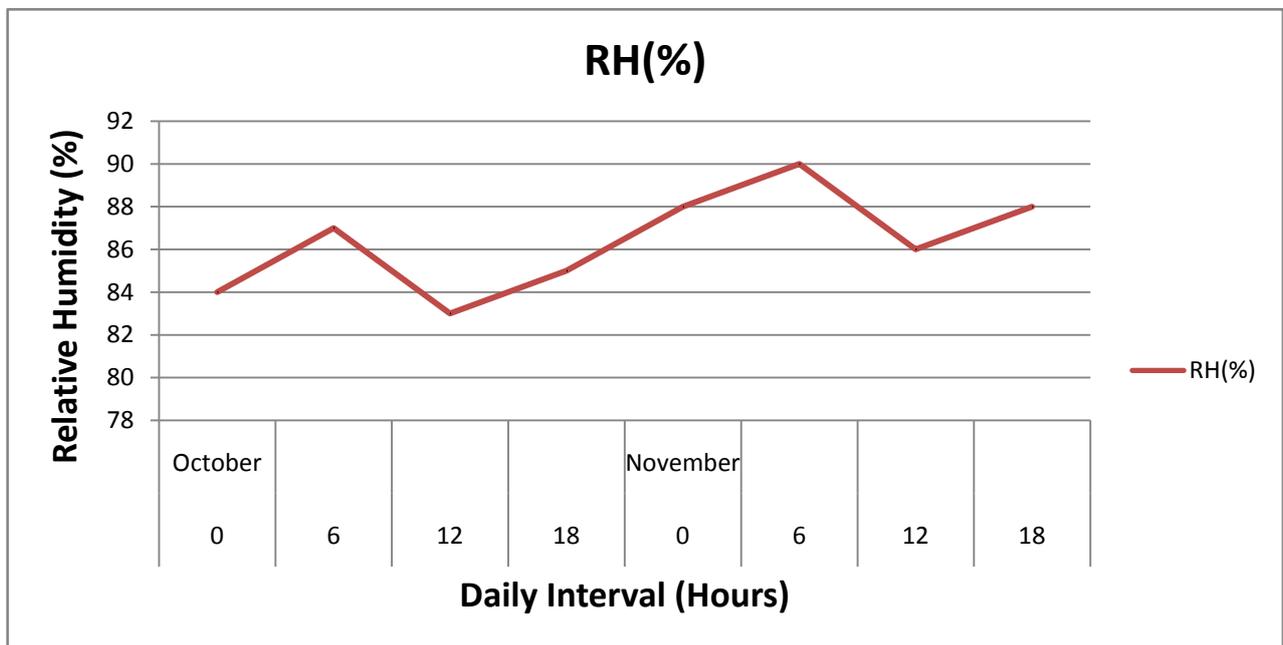


Figure 2. Average Relative Humidity

The relative humidity is generally higher at night and dawn due to foggy weather. It was also increased a little bit since the start of rainy and clouded weather in November.

## 3.2. Stream Groups and Species Distribution

### (a) Stream Groups

We surveyed most known mountain streams in the area, and we had set transect lines in 18 streams. The basic data of stream habitats was shown as below in the table 1.

**Table 2. Streams Habitat Factors Measurements**

Stream No.	Stream Name	Average Streambed Width(m)	Average Water Width (m)	Average Water Depth (cm)	Transect Line Length (m)	Altitude (m)
I	Zhangxuan	1.82	0.96	24.6	2040.00	1800-18262
II	Shuichang	2.49	1.16	18.40	2900.00	1562-1791
III	Linchang No.1	3.75	1.91	20.31	2380.95	1826-1900
IV	Jiaola No. 2	2.78	0.79	9.20	1020.00	1592-1614
V	Wulaba No.2	3.99	2.37	17.38	2560.00	1610-1663
VI	Wulaba No.2	3.60	2.13	59	740.00	1635-1669
VII	Qianniangushu	3.04	1.29	43.1	1420.40	1911-1914
VIII	Getou No. 1	2.62	0.87	9.07	1760.80	1319-1326
IX	Getou No. 2	7.24	4.19	42.38	2500.00	1174-1189
X	W. F. No. 3	1.61	0.59	3.76	1210.00	1354-1359
XI	Yaozi No. 1	3.02	1.61	6.50	658.00	1446-1454
XII	Wudong	2.13	1.57	27.67	874.00	1608-1617
XIII	Ouyao	2.10	1.61	21.50	1509.00	1770-1779
XIV	Xiangshuiyan. Waterfall	3.40	2.05	67.50	2103.00	1260-1286
XV	Chunjian	15.13	7.44	39.3	578.00	1260-1286
XVI	Linchang No.2	1.66	1.18	24.67	4500.00	1826-1900
XVII	Jiaola footway	1.73	2.2	31.9	750.00	1577-1584
XVIII	Datangwang to Shuichang	3.80	4.1	48.6	3200.00	1316-1353

The brief introduction to parts of stream groups and some highlighted findings were illustrated as below:



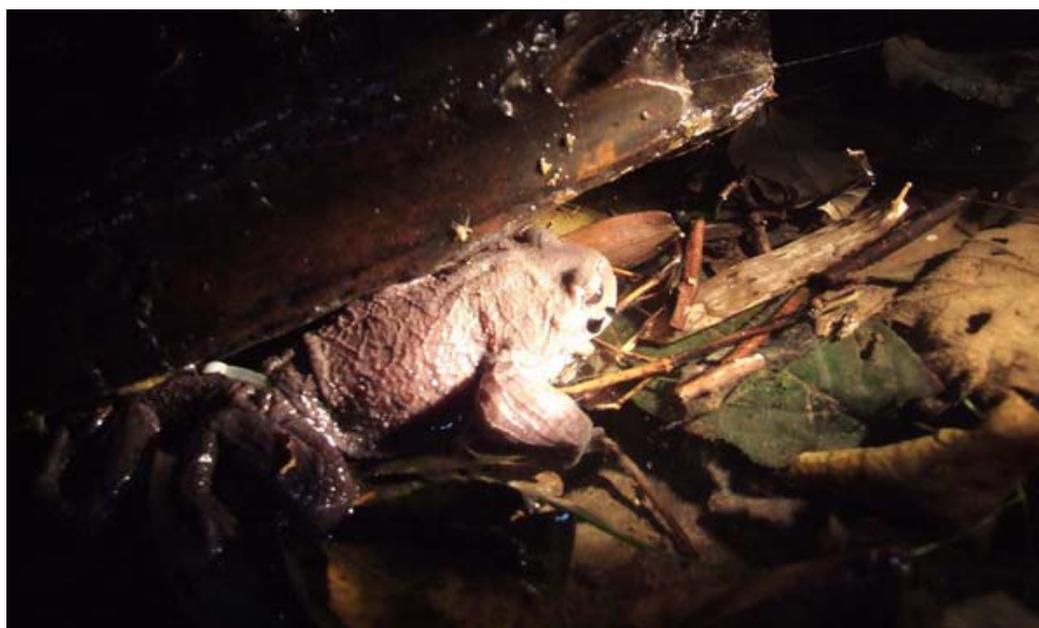
### **Qilichong Stream Group**

Qilichong stream is the farthest one in the range of nature reserve. Its remoteness ensured qilichong a well protected stream and little human harvest here. A number of tadpoles were measured in the stream to investigate its age structure and population status. Logistic constrains made it difficult to count number of mature adults here. We only use tadpoles as indicator of occurrence of mature adults and their living status.

### **Shuichang Stream Group**

Because of its distance convenience, most of radio tracking research was done in this area. The first photographic record that a mustache toad was predated by *Amphiesma octolineatum* made all team members excited for a while. Rock reverse

and poison kill was detected in some tributary streams of this group.



**A male toad with attached radio transmitter was found hiding under rocks in the stream at night**



*Amphiesma octolineatum* was swallowing a male toad on the stream bed

### Lingchang Stream Group

The team settled in the lingchang area. Survey on streams around was complete. Deserted toad internal organs and remains of camp fire were detected in this area. Tadpole age structure implied that human harvest had eliminated many 2nd and 3rd year tadpoles in the stream. Two dead tadpoles were found in a backwater pond of the stream. We did not detect other dead bodies of tadpoles or mature adults in subsequent surveys.



Streams near lingchang



One of two dead tadpoles encountered during the whole survey

### Maoping Stream Group

Maoping stream group suffered most intensive human harvest among all surveyed streams. Only in some devious tributaries, some small tadpoles (1st year age) were found. Bigger tadpoles were gone due to harvest. It seems no poison kill was used in the area.



A stream in Jiaola area

## Jiaola Stream Group



**A portrait of a male toad**

The Nature Reserve Management Bureau had constructed a walk lane in Jiaola area and opened to tourists, but few were there. At current stage, the number of tourists on this lane is very low and caused insignificant disturbance to the environment and little garbage were left. Three streams were surveyed in this area. The main stream was severely disturbed by human harvest still, little tadpoles and toads were found.

## Leigongping Stream Group

Leigongping is the currently known northernmost distribution range of *Vibrissaphora leishanensis* within the nature reserve. Its distance from our stationed place is over 30 km, and only by walk can get access to leigongping, which made it a difficult area to reach and assess. Two team members spent a day to investigate the area if any tadpoles or adults, but streams were found to be in a dire drought.



**Dry streams**

## Mountain peak area

Tadpoles and mature adults were found in this mountain peak area, this discovery set a new record on the altitude of distribution. Mature toads could forage and breed in the mountain peak area (above 1900 m a.s.l). The former data only sets its maximum range to 1800 m. Tadpole density in this area had been assessed, and several mature individuals were swabbed for chytrid fungus analysis.

## (b) General Species Distribution

Despite the original two places that the species occurrences were recorded, we had also increased the number of known sites where adult toads and tadpoles could be found. The current known distribution range of the species was shown in figure below:

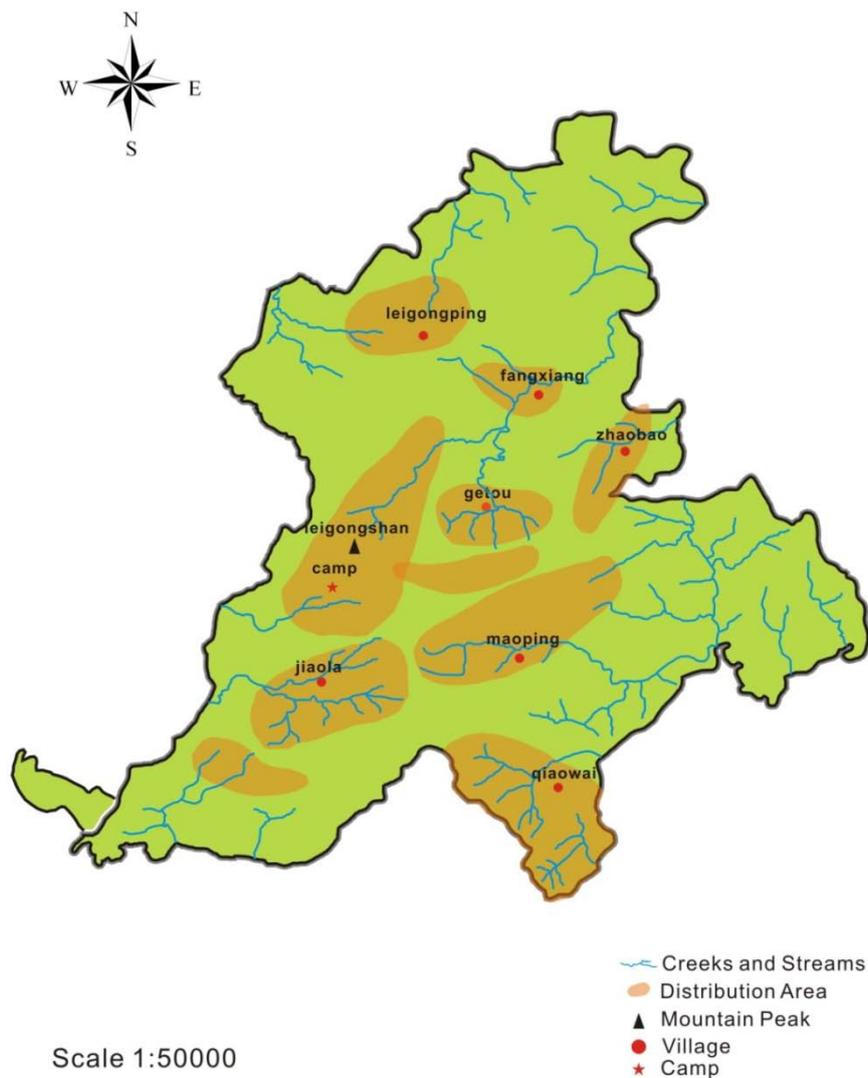


Figure 3. Map of species occurrence recorded during field survey



**The Autumn View of Mountain Peak in Late November**



**Mountain View of Shuichang and Linchang Area**

### 3.3. Tadpole Population Survey



Eggs which are developing into tadpoles (1)



Eggs which are developing into tadpoles (2)



Team members are working in the streams

### **(a) Altitude range of tadpole distribution**

The altitude of tadpole distribution was determined by using GPS devices. The field survey had recorded the occurrence of tadpoles at 21 sites, due to technical problem of devices (power cut of batteries) and survey plan, we only recorded 19 sites with complete geographical coordinates. According to collected data and recorded elevation of tadpole occurrence, assisted by Google Earth Professional edition to calculate on the satellite map, the square size of distribution range is about

12.04 km<sup>2</sup>. Most of tadpoles being found during field survey were concentrated between 1400-1800 m, which possess 63.2% of the entire surveyed population.

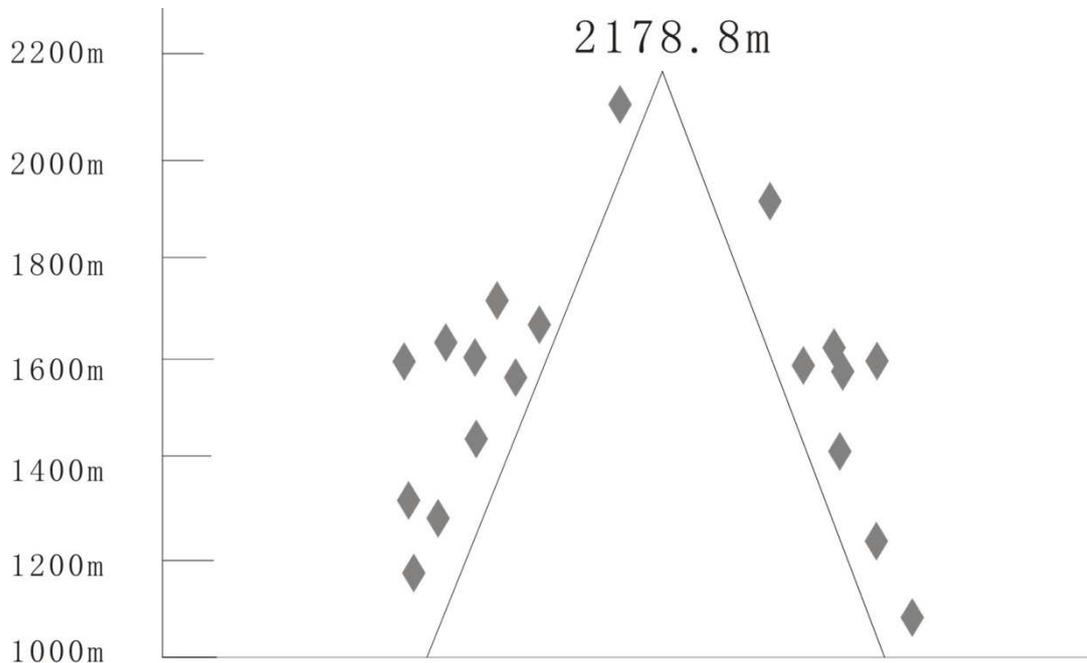


Figure 4. Altitude distribution range of tadpole population

**(b) The Distribution Density of Tadpoles**

Totally we had implemented quick survey in 18 mountain streams, including exhaustive sample study on 14 streams, 1079 individuals of tadpoles in all were measured on site and released immediately after the measurement.

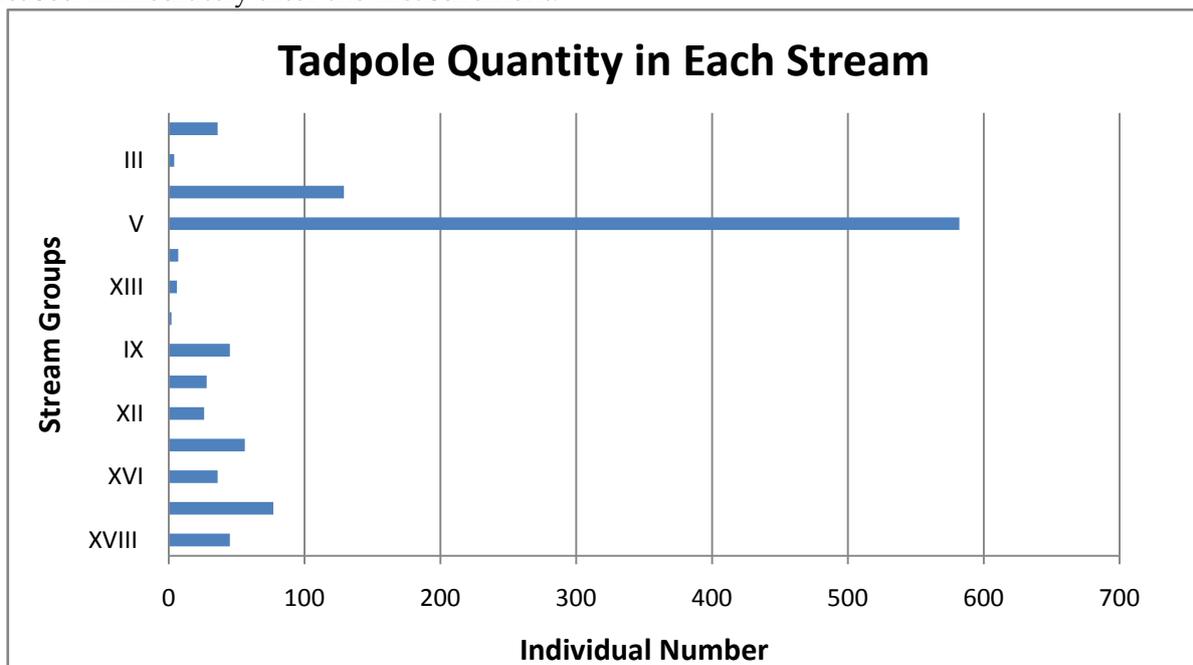


Figure 5. The individual quantity of tadpoles in different streams

Among 14 surveyed streams, areas that contains amount of tadpole population were Wulaba, Jiaola, Getou and Datangwan. These areas should be listed as the priority in the future conservation work.

### (c) Tadpole Population Structure

The development stage of all measured tadpoles ranged from 24 to 42 stage and no tadpole at 33 stage were detected during fieldwork. The tadpoles at 23-29 stages possessed 80% of total surveyed population. Tadpoles at 26 (35.5%) and 27 stage (31.14%) were most commonly group that being recorded in the survey. Tadpoles at 30-39 stages were only possessed 12% amount, and it was noteworthy that tadpoles at 33-38 stage were relatively rare (1.2%) compared to the entire surveyed groups, and also was small (10.24%) in the group of 30-39 stage. Tadpoles between 40 and 42 stage were only recorded for 8%. Based on the sampling data, it is inferred that death rate of tadpoles from 23-29 stages to 30-39 stages may reach 74.47%; For tadpoles from 30-39 stages to 40-42 stage, the death rate of tadpole could be 20.38%.

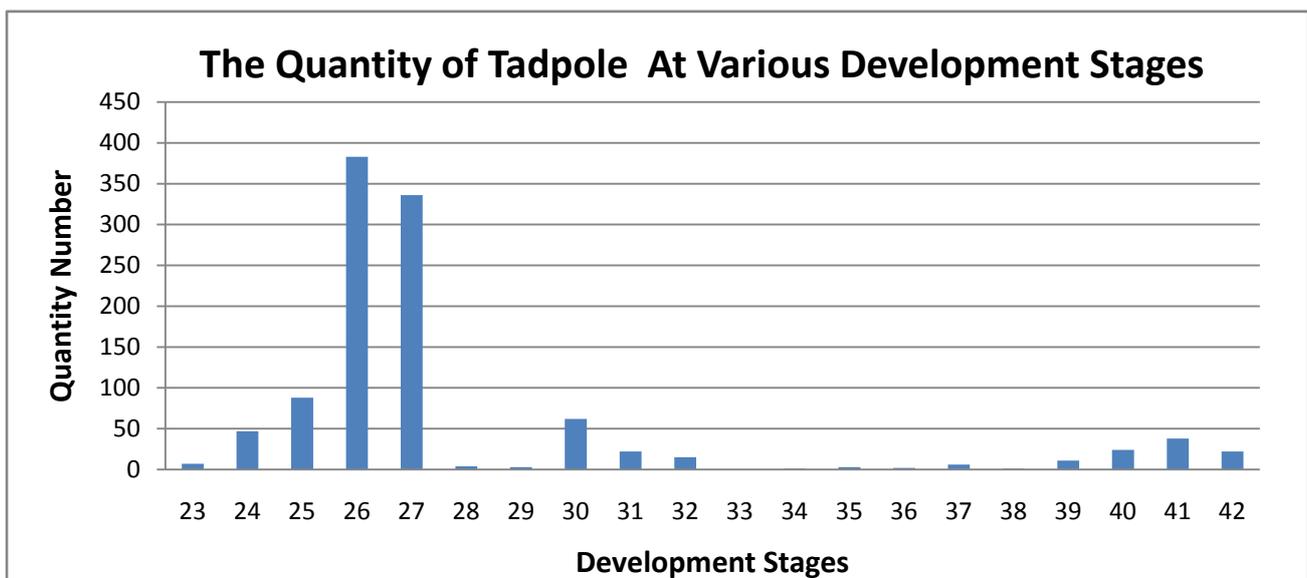


Figure 6. The individual quantity of tadpoles at different stages

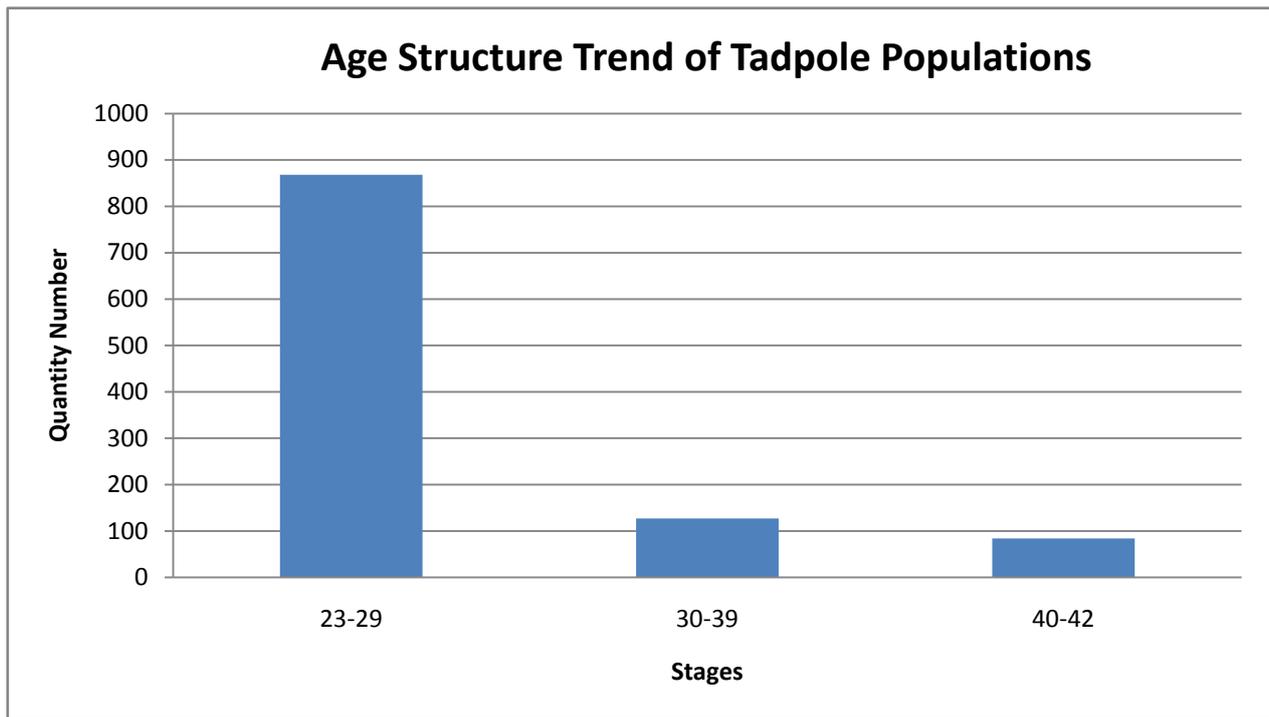


Figure 7. The population age structure of the tadpoles

#### (d) Growth and Development of Tadpoles

The data of tadpoles' total length, snout-vent length and weight was shown in table 1 as below and the curve of tadpole development at different stage and its body weight. Fig. 4 showed tadpoles at 23-42 stages had a wave curve that generally moving up. The development speed of tadpoles at 20-28 stages was relative slow; progressively following with 4 peaks at 29, 32, 38 and 42 stages formed 4 development speed peaks. Tadpoles at 30, 36 and 40 stage experienced a low development speed, this may caused by the season variation, water temperature and other physiological factors.

Table 3. Tadpoles Measurements

Stages	Quantity	Total Length (cm)	Snout-vent Length (cm)	Weight (g)
23	7	3.54±0.20	1.31±0.08	0.49±0.13
24	47	4.91±0.87	1.79±0.26	1.41±1.30
25	88	4.82±0.72	1.74±0.28	1.13±0.54
26	383	5.13±0.57	1.81±0.19	1.29±0.45
27	336	5.67±0.70	2.03±1.06	1.71±0.64
28	4	7.38±0.76	2.56±0.29	3.73±1.30
29	3	7.99±1.03	2.66±0.17	4.43±1.02
30	62	6.81±1.00	2.32±0.29	3.07±1.35
31	22	7.97±0.83	2.66±0.28	4.23±1.29
32	15	8.72±0.61	2.88±0.17	5.36±0.79

33	0	-	-	-
34	1	8.67	2.93	5.30
35	3	8.48±0.98	2.94±0.21	4.83±0.80
36	2	8.09	2.93	6.00
37	6	9.54±0.36	3.11±0.18	7.40±1.23
38	1	10.36	3.21	8.00
39	11	9.44±1.40	3.14±0.46	8.11±3.00
40	24	9.19±0.74	3.12±0.22	6.75±1.78
41	38	10.47±0.74	3.42±0.20	8.99±2.11
42	22	10.60±0.72	3.44±0.20	10.08±1.91

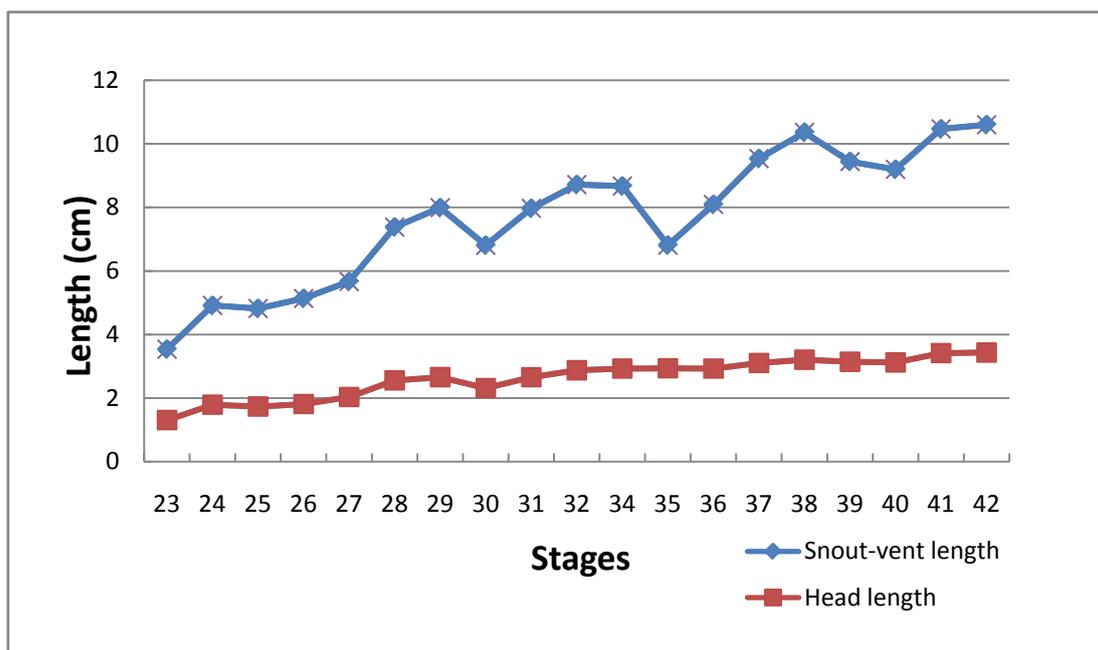


Figure 8. The curve of tadpoles at different development stages

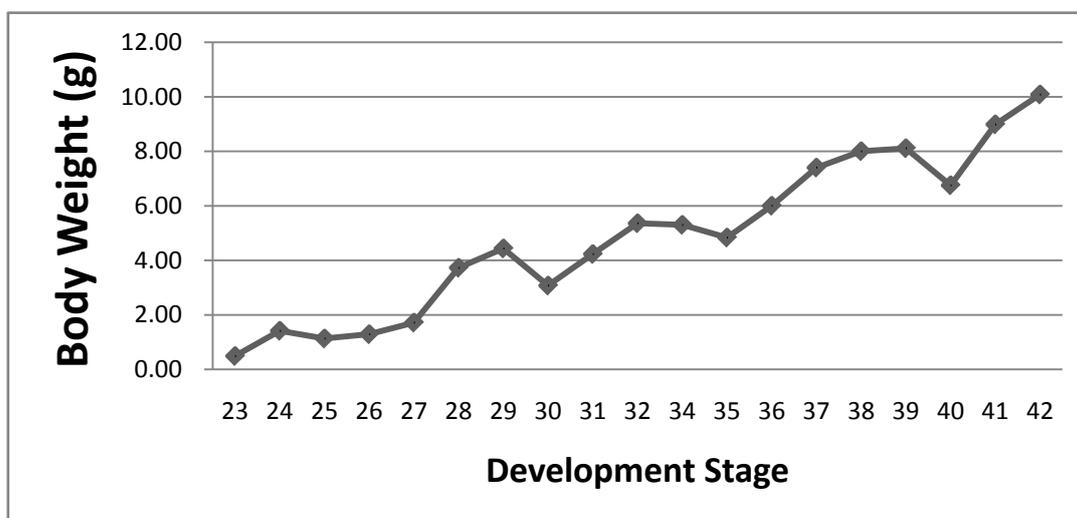


Figure 9. The curve of body weight at different development stage

### 3.4. Adult Population Survey

Adult population survey had revealed result that the number of mature toads is drastically dropping that beyond former expectations. The same situation happened on the population of tadpoles. In many surveyed stream sections, mature toads and tadpoles had disappeared. The main cause is widespread human harvest and poison kills. The secondary cause is drought and weather change. Rain fall during the breeding season in late 2007 was significantly delayed, and many section now completely drought as water flow had greatly reduced, foggy days in the mountain that is beneficial to frog movement also decreased with the comparison to the past years. We interviewed many local residents to attest if weather change and reduction of stream flows can be easily perceived, the feedbacks we got attested our observation.

Based on information given by historical records and interview with local rangers and residents, we had divided our focus area into eight parts: 1) Qiaowai (QW); 2) Jiaola (JL); 3) Wudong (WD); 4) Maoping (MP); 5) Getou (GT); 6) Fangxiang (FX); 7) Zhaobao (ZB); 8) Leigongping (LGP). Adult population surveys were conducted in these areas by majorly using VES approach and pitfall trapping. We searched through transect lines which set in the stream and riparian zones during October and November for 53 days, we had found 7 amphibian species, 77 individuals in total.

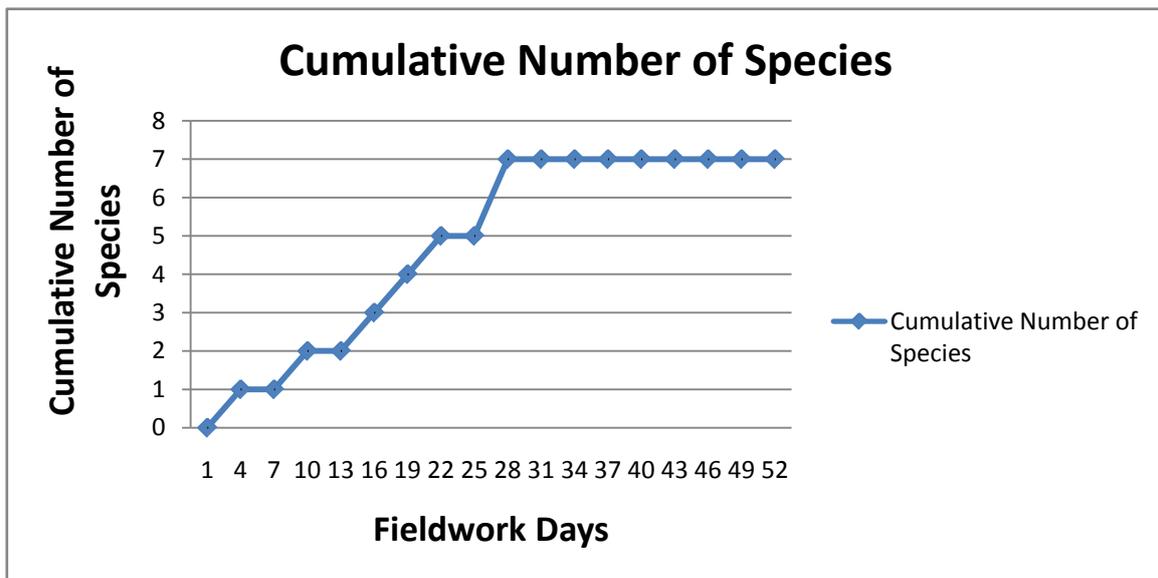
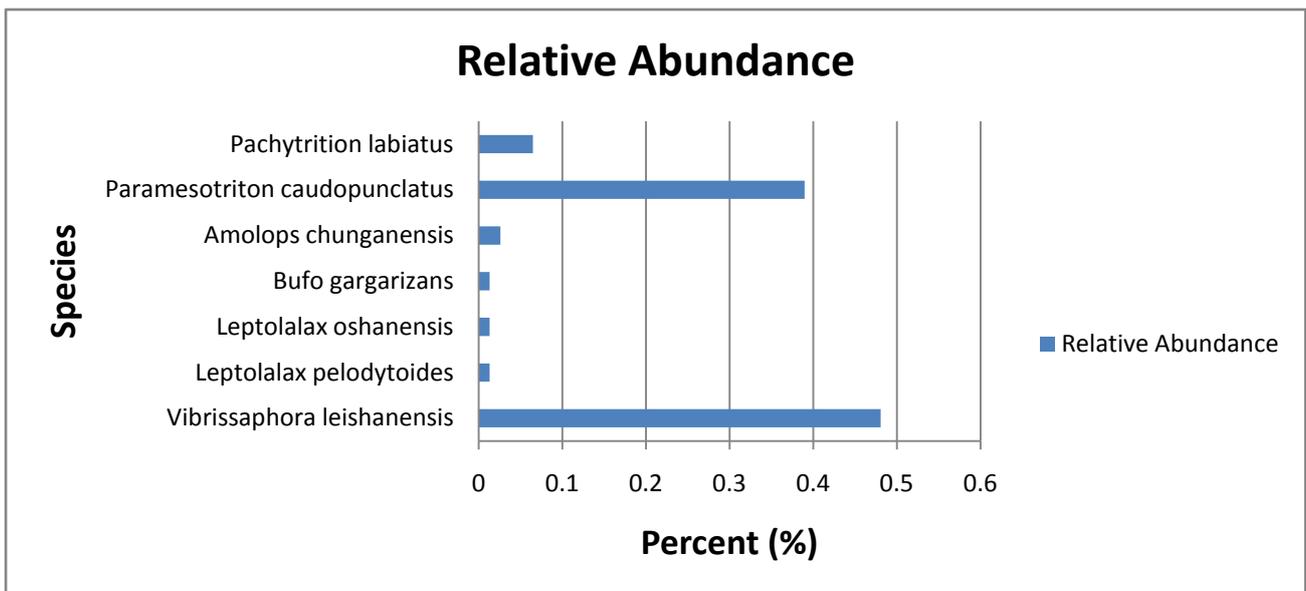


Figure 10. Cumulative number of species during survey days

**Table 4. Species total number and relative abundance**

Family	Genus	Species	QW	JL	MP	LGP	FX	GT	ZB	WD	Species	Relative
											Total	Abundance
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	2	9	8		4	7	1	6	37	0.4805
	<i>Leptolalax</i>	<i>pelodytoides</i>		1							1	0.0130
	<i>Leptolalax</i>	<i>oshanensis</i>								1	1	0.0130
Bufonidae	<i>Bufo</i>	<i>gargarizans</i>								1	1	0.0130
Ranidae	<i>Amolops</i>	<i>chunganensis</i>			2						2	0.0260
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>		2					28		30	0.3896
	<i>Pachytriton</i>	<i>labiatus</i>		1					4		5	0.0649
<b>Regional</b>			2	13	10		4	7	33	8	77	
<b>Total</b>												



**Figure 11. Relative abundance of species**

The most commonly found species in the stream between October and November were *Vibrissaphora leishanensis* (48%) and *Paramesotriton caudopunctatus* (38%). The low cumulative number of species was mainly because of seasonal transition from autumn to winter, most amphibian species started to hibernate underground which made them extremely difficult to be found, thus the total number of species being discovered was particularly low. Specifically, though number of mustache toads posed a relative advantage in the survey, however, the total number of adult *Vibrissaphora leishanensis* is low. As the first exhaustive population survey throughout entire area revealed, it suggested that more efforts on population number monitoring is required, it might be needed to level up its IUCN Red List rank with careful consideration.

### 3.5. Breeding Ecology and Behavior Observation



**A male toad was guarding eight egg masses and waiting for more chances to copulate**

The team members observed breeding behavior of *Vibrissaphora leishanensis*. A new record of eight egg masses implied polygamy evidence that a strong male toad would copulate with at least 8 female toads (the former record is just 2-3 egg masses underneath a rock). Male toads also showed a behavior to guard egg masses.

#### **(a) Modality difference of male and female during breeding season**

The average body length of measured male toads is  $77.5 \pm 11.5$  mm; its body weight is  $48.83 \pm 19.11$  g. The average body length of measured female toads is  $64.3 \pm 6.5$  mm, its body weight  $22.94 \pm 6.28$  g. T-test showed that male toad body length and weight are obviously large than female toad (Body length  $t = -3.696$ ,  $P = 0.001 \leq 0.01$ ; Body weight  $t = -2.919$ ,  $P = 0.007 \leq 0.01$ ).

The recorded smallest male's body length is 61mm and weight is 20.70 g; The smallest female's body length is 54.3 mm and weight is 13.30 g (see Table 1) .

Male toads have 2 black keratinized spines on left and right of upper lips, and females had orange small orange spots on same part. After breeding season, black keratinized spines of male toads fallen off. Male toads' forelimbs are much bigger and stronger than females', a distinct difference between male and female is existed (ANOVA,  $F = 27.702$ ,  $P = 0.000 \leq 0.01$ ) .

**Table 5. Measurements on Adult Toads**

	♂ (24 individuals)			♀ (9 individuals)		
	Average Value	MAX	MIN	Average Value	MAX	MIN
Weight(g)	48.83±19.11	90.6	20.70	22.94±6.28	31.40	13.30
Body length(mm)	77.5±11.5	98.1	61.0	64.3±6.5	75.3	54.3
Head length(mm)	26.7±5.2	38.5	20.0	22.2±2.6	25.7	18.0
Head width(mm)	32.2±4.5	38.9	21.7	25.1±1.8	28.2	22.0
Forelimb length (mm)	42.4±5.5	54.4	35.1	34.6±3.2	40.0	29.5
Forelimb width(mm)	10.3±2.6	15.8	5.0	4.5±1.0	7.0	3.5
Leg length (mm)	96.8±13.2	127.0	81.3	78.6±4.9	83.6	68.6
Tibia length(mm)	31.4±4.6	38.7	2.20	25.6±2.2	29.0	22.4

### (b) Breeding Dates

The first male toad of *Vibrissaphora leishanensis* being found in stream was on 24th October, 2007. That date was considered as the onset of breeding period with a bit variation on specific days ( $\pm 2$  days). The first female toad being found during stream survey is on 4th November, 2007.

Male toads always enter close-by mountain streams before females and occupied those suitable breeding sites to attract for female toads. According to observed status of egg masses under rocks, it can be assumed that the peak time for female toads to lay eggs was between 14<sup>th</sup> and 17<sup>th</sup> ( $\pm 2$  days) November. This period was matching with the peak time of courtship calling by male toads. Field observation in Linchang Stream and Zhangxuan Stream showed that male toads (fails to attract any females) started to leave stream on 11th November, following with the exodus of male toads in next several days. Female toads that successfully had finished copulation and oviposition were observed to firstly leave streams on 15 November.

### (c) Selection of Breeding Stes

Totally we had located 8 locations in the surveyed mountain streams with laid egg masses. Three locations in Zhangxuan stream, two locations in Yaozi No.1 stream, one in Shuichang No.1 stream, two in Shuichang No.2 stream.

We measured environmental factors around selected breeding site: the average water temperature is 8.16°C, average flow speed of water is 27.15 cm/s, but some sections were almost static. The average length of rocks chosen as breeding site coverage is 54.06±20.61 cm, width is 36.44±9.03 cm, and height for 12.5±14.57 cm. Usually the backside surface of these rocks to water relative flat and smooth so that egg masses could be easily stick to the downside surface of the rock in the water. The location of the rock formed backwater pools, the average length of these small backwater pools is

56.19±18.85 cm, average width is 45.75±14.70 cm, and average water depth is 9.05±2.57cm. The average distance of rock to left riparian zone is 18.63±14.48 cm, and 52.18±27.57cm to right riparian zone.

Component analysis was made to analyze nine ecological factors of breeding sites and the result showed that water temperature, the size of rocks and the size of backwaters is closely related to breeding site selection behavior, and *Vibrissaphora leishanensis* has a strong preference to select site with higher water temperature (which is critical to the development of eggs in streams), larger rock and larger backwater but relative shallow water depth as most suitable breeding sites.

**Table 6. Component Analysis on Breeding Sites**

Items	Component		
	1	2	3
Water temperature	.873	.022	-.398
Water flowing speed	.773	-.215	.346
Rock length	.918	-.141	.324
Rock width	.941	-.130	-.068
Rock height	.632	-.136	.698
Pool length	.957	-.135	-.099
Pool width	.897	1.068E-05	-.371
Water depth	.871	.206	-.300
Distance to left bank	.120	.904	.214
Distance to right bank	.555	.586	.121

#### (d) Breeding behaviors

During the breeding season, male toads will first arrive in streams and occupy those suitable breeding sites under rocks. Once male individuals occupied the sites, it would dig a small pit on the rocky and sandy substrate, and emit calls to attract for females. Male will make two sounds of call to attract female at the frequency of 6-7 times /per min at night until the dawn of the next day. But during the peak period of the breeding season, it can be heard that some males would emit call sounds all day and night.

Females that entered into streams would move along stream to seek for stronger males for copulation and oviposition. The time duration of copulation is difficult to observe in the field condition, but it was easily to be disturbed by external forces such as human harvest. Females usually lay eggs at night or dawn, the time duration is short that only lasts for 3-5 min, but the rare case also happened that females being disturbed by human harvest activities may finish oviposition in several hours.

Male toads with heavier weight (larger and stronger body) had more female mates during the breeding season were observed as well (see Table 7).

**Table 7. Relationship of Males' body weight and copulated female numbers**

Body weight of male toads (g)	Number of copulated females
32.3	1
81.6	9
25.1	2
48.6	2
33.0	2
31.4	2
53.0	7

### (e) Egg masses and egg

Each female individual is only capable to lay one egg mass. Eggs were in white color, glued to the backside surface of chosen rocks by male toads. The diameter of each whole egg masses is averagely 7.36 cm, with inner circle diameter for 1.06 cm. Each egg mass contains about 110-280 individuals eggs, the average diameter of each egg is  $0.405 \pm 0.052$ cm. With increase of egg masses, if the male toad is stronger enough to attract more females for oviposition, egg masses would overlapped under rocks.

**Table 8. Measurements on egg masses and individuals eggs**

Streams	Egg Masses Number	Egg number	Outer average diameter	Inner average diameter	Circle average width	Egg diameter (cm)	Notes
Zhangxuan	1	110-120	64.5	9.1	30.6	3.85±0.43	
		160-170	74.9	19.8	30.2	4.15±0.40	
		150-160	81.3	17.9	27.0	4.24±0.29	
		220-230	88.1	13.5	38.3	4.39±0.20	
		270-280	79.5	8.9	38.0	4.26±0.28	
Zhangxuan	9	230-240	75.5	11.3	36.4	4.08±0.37	
		190-200	88.2	—	—	4.24±0.37	Partly Overlapped
		170-180	74.0	17.4	22.9	3.73±0.44	
		220-230	61.4	14.1	31.3	3.83±0.35	
Zhangxuan	2	200-210	69.4	0	69.4	4.07±0.48	
		240-250	91.5	12.8	38.4	4.51±0.29	
Yaozhi No.1	2	180-200	70.2	0	35.1	4.53±0.27	
		250-260	70.8	0	17.9	3.44±0.40	
Yaozhi No.1	2	150-160	68.7	12.2	27.3	3.49±0.41	

		220-230	—	—	27.3	4.12±0.29	Strip egg masses
Shuichang No.1	2	230-240	81.5	9.4	35.4	3.73±0.28	
		200-210	70.5	12.5	30.9	4.03±0.47	
Shuichang No.2	2	220-230	76.6	0	38.3	4.63±0.46	
		160-170	53.7	0	26.9	3.38±0.27	
		—	—	—	—	3.67±1.14	Overlapped
		200-210	83.0	13.7	33.4	3.32±0.37	Partly Overlapped
Shuichang No.2	7	190-200	57.6	0	28.8	3.94±0.44	Partly Overlapped
		210-220	79.7	15.8	36.4	4.09±0.48	
		180-190	67.9	7.5	36.3	4.48±1.32	
		130-140	—	—	48.2	4.55±0.45	Strip egg masses
		200-210	66.1	6.3	26.6	4.02±0.51	
Average		110-280	73.6	10.6	33.8	4.05±0.52	

### 3.6. Radio Tracking



A male toad with radio transmitter attached



Team member were tracking a male toad in the day and at night

## Study species

*Vibrissaphora leishanensis* could only be found during the breeding season in the mountain streams, it occupies riparian zones in non-breeding season. The species breeds in mountain streams from late October to November in Leigongshan (Fei and Ye, 1984). Adult males (53–82 mm) are bigger than adult females (46–70 mm).

## Capture and radio transmitter attachment

Eight. We used LED flashlights to thoroughly search for adults in the stream but carefully act to minimize or avoid direct disturbance, and most of males toads were found by this VES method at day and night. Pitfall traps also helped to capture females. Captured toads were attached with Holohil model BD-2G radio transmitters (56 days nominal battery life and weighing 1.2 g) by silicon belts to secure around the waist and released immediately after 10–15 min measurements and harness attachment. The total weight of each unit, including the waist band, was less than 2.0 g. We maintained an equal sample size of both sexes (8 males and 8 females). We also injected PIT tags to radio-tagged toads for individual identification in cases of any failure or loss of transmitters.

## Radio-tracking schedule

In order to prevent human harvest that may disturb radio tracking, we just released 2 male toads in Shuichang and 6 toads (4 females and 2 males) in Linchang, where the places suffered from less disturbance from human activities. We initially planned to track each radio-tagged individual regularly at 2-hour interval during the breeding season initially; and at 1-hour interval during the post-breeding season. But as tracking progressed in three days, we've found that species is rather sedative during breeding period, and hibernate soon in post-breeding season, we thus changed schedule by expanding interval to 6 hours at day and 2 hours at night, all tracking activities at night were ended before midnight.

## Data records

Data on radio-tagged frogs were collected from 24<sup>th</sup> October, 2007 through 30<sup>th</sup> November, 2007. Toads in stream during breeding season always hide under rocks while picking up signals, but streambed was narrow, so that accurate position is hard to be directly detected. We draw a circle around the strongest signal, and searching rocks for its accurate position. Data such as its duration days under sheltering rocks, segment distance moved between two points, proximity to stream water and vegetation type were recorded. Segment distance and distance to stream water were estimated visually or paced. All segment distances travelled by toads were considered to be measured in a straight line between two points.

## Results

**Table 8. Dates tracked and duration days under sheltering rocks**

Toad #	Sex	Dates Tracked	SVL (mm)	Body Weight (g)	Duration in October (Days)	Duration in November (Days)	Total Duration (Days)
#1	M	23 <sup>rd</sup> , Oct – 27 <sup>th</sup> Nov	66.2	48.6	9	7	16
#2	M	26 <sup>th</sup> , Oct-18 <sup>th</sup> Nov	69.7	58.4	6	13	19
#3	M	27 <sup>th</sup> , Oct-30 <sup>th</sup> Nov	73.8	53.0	5	13	18
#4	M	31 <sup>th</sup> , Nov-28 <sup>th</sup> Nov	77.5	81.6	1	20	21
#5	F	4 <sup>th</sup> , Oct-29 <sup>th</sup> Nov	57.8	25.4	-	2	2
#6	F	6 <sup>th</sup> , Oct-28 <sup>th</sup> Nov	59.1	26.3	-	1	1
#7	F	14 <sup>th</sup> , Oct-30 <sup>th</sup> Nov	63.9	28.9	-	24	24
#8	F	14 <sup>th</sup> , Oct-29 <sup>th</sup> Nov	64.1	29.2	-	24	24

According to the data set, smaller and lighter male individuals tend to enter stream in October, a bit earlier than stronger and heavier ones in order take advantage of occupying suitable rocks that could be used as breeding site and emit calls to attract females, it indicated that by doing so the smaller individuals avoid intensive competition with stronger males. But the rarity of female toads significantly impaired such efforts by smaller males to seek for prospective mates. Stronger males entered the streams by the end of the October but still capable to attract more females, due to the occurrence dates of females were mainly happened in November.

Before finding a suitable mate to copulate with, male toads tend to adjust their positions in the streams and move on to search for more suitable sites along the stream. Radio tracking on male toad showed its largest movement distance could reach 63.4 m during the breeding season once they occupied a rock but need to make adjustment. But usually, most of male toads may make minor adjustments on their position, the movement distance is short, only within a small range that between 0.45 to 1 m. Once males finished their successful copulation for the first time, they will not move or adjust their position if there is no external disturbance until they leave streams for wintering and hibernating.

The distance of drift fences to the stream water was varied from 2.2-6.4 m. Drift fence and pitfall traps capture records showed female toads mainly moved into streams from close-by mountain slopes or riparian zones. Females would move according to the call direction of males and compare potential mates based on the sound, once entered into streams, females would carefully move to search for accurate location of available mates, the segment movement was quite short, and the segment distance recorded was between 2.5 to 8.1 m. Females would leave breeding site immediately after oviposition, the duration days last for only 1-2 days. Males tend to stay longer than females in the stream, usually last for 15-21 days. We also recorded one male and three females that stay a quite longer period under rocks chosen as breeding sites after laying eggs throughout the

winter, the reason is unknown. Commonly after oviposition, females would move to hide or hibernate in burrows formed at the root of trees on the close-by mountain slope. Males that failed or succeeded in attracting females would act the same pattern to hide or hibernate in nearby mud burrows or tree holes formed at the root.

**Table 9. Summary data of breeding and post-breeding movement**

<b>Toad</b>	<b>Minimum segment distance moved (m)</b>	<b>Maximum segment distance moved (m)</b>	<b>Maximum distance from stream (m)</b>	<b>Total distance moved aquatic (m)</b>	<b>Total distance moved overland (m)</b>
<b>Breeding movement</b>					
#1 (M)	0.7	9.1		11.7	
#2 (M)	1	12.4		17.2	
#3 (M)	2.3	7.3		14.6	
#4 (M)	0.4	5.8		9.5	
#5 (F)	2.5	6.2		13	
#6 (F)	3.4	4.1		14.1	
#7 (F)	6.9	10.2		21.3	
#8 (F)	8.1	9.5		26.7	
<b>Post-breeding movement</b>					
#1 (M)	17.1	43	59		97.2
#2 (M)	28.7	37	34		89.4
#3 (M)	34.3	39	27		110.5
#4 (M)	13.6	63.4	48		98.7
#5 (F)	23.3	26.3	17		83.1
#6 (F)	30.2	31.4	39		99.5
#7 (F)	21.6	28.1	21		73.5
#8 (F)	19.4	23.2	29		56.1

Males generally tend to remain sedentary since they entered streams and spent days hide under chosen rocks to emit calls. Suitable rocks that could be used as breeding site was a limited resources due to disturbance caused by human harvest activities (people reversed rocks and altered original rock positions), movement in this period is less than 10 m before the breeding site was found, but adjusted movement (<20 m) was observed, male toads made such movements to choose proper rocks after days of calling that fails to attract any females. The distance between two males could be far more than 30 m, but sometimes it was close that only reached 13 m. As temperature dropped gradually, after breeding period or oviposition, males and females leave streams for hibernating, in the process of seeking for burrows and tree holes, individuals presented a longer movement distance between points until they found sites for hibernation. Thus, conservation of streams, riparian zones and mountain slopes with tree holes and burrows should be the future concerns.

### 3.7. Chytrid fungus Testing



The team is collecting skin samples during night surveys



Swabbing hands, feet and belly of the toad

We have collected 50 skin samples in total that representing the whole surveyed area. PIT tags were used to prevent re-sampling on the same individuals. No dead adult toads or infected symptoms were directly observed during the survey. Only two dead poles were observed in a stream survey, but we did not collect skin sample from those dead tadpoles, because dead tadpoles were extremely rare that only be found for just one time.

**Table 2. Information list of collected skin samples in Leigongshan NNR**

Leigongshan National Nature Reserve (50 sample)							
Family	Genus	Species	Latitude	Logitude	Elevation	Date	Bd Status
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.563'N	108°11.667'E	1590	2007/10/23	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.424'N	108°11.718'E	1559	2007/10/24	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.496'N	108°11.709'E	1567	2007/10/25	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.420'N	108°11.935'E	1560	2007/10/26	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.403'N	108°11.497'E	1487	2007/10/22	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.474'N	108°11.596'E	1636	2007/11/8	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.455'N	108°11.592'E	1512	2007/10/26	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.338'N	108°14.646'E	1575	2007/11/2	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.629'N	108°12.134'E	1719	2007/10/20	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.956'N	108°11.952'E	1748	2007/11/2	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°23.046'N	108°11.921'E	1907	2007/11/30	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°23.046'N	108°11.911'E	1906	2007/11/30	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.338'N	108°14.646'E	1575	2007/11/3	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.551'N	108°12.040'E	1596	2007/10/20	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.485'N	108°12.009'E	1563	2007/10/20	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°23.039'N	108°11.911'E	1914	2007/11/8	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.039'N	108°11.911'E	1914	2007/11/8	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°21.961'N	108°11.936'E	1592	2007/11/3	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.060'N	108°09.316'E	1160	2007/10/21	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.444'N	108°11.963'E	1562	2007/10/20	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.866'N	108°11.176'E	1608	2007/10/18	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.865'N	108°11.177'E	1609	2007/10/18	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.866'N	108°11.176'E	1608	2007/10/18	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.374'N	108°11.448'E	1610	2007/11/5	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.090'N	108°11.224'E	1352	2007/10/15	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.090'N	108°11.224'E	1355	2007/10/15	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.089'N	108°11.224'E	1353	2007/10/15	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.136'N	108°10.700'E	1316	2007/10/15	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.000'N	108°12.401'E	1601	2007/10/14	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.011'N	108°12.339'E	1577	2007/10/14	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.011'N	108°12.339'E	1577	2007/10/14	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.771'N	108°11.498'E	1615	2007/11/11	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.777'N	108°11.505'E	1617	2007/11/11	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>leishanensis</i>	26°22.396'N	108°12.063'E	1595	2007/10/28	Negative
Bufo	<i>Bufo</i>	<i>gargarizans</i>	26°22.623'N	108°12.134'E	1718	2007/10/25	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.465'N	108°15.237'E	1084	2007/10/19	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.466'N	108°15.238'E	1009	2007/10/19	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.467'N	108°15.239'E	1009	2007/10/19	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.468'N	108°15.240'E	1009	2007/10/19	Negative

Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.469'N	108°15.241'E	1009	2007/10/19	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.470'N	108°15.242'E	1009	2007/10/19	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.471'N	108°15.243'E	1009	2007/10/19	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	26°20.472'N	108°15.244'E	1009	2007/10/19	Negative
Salamandridae	<i>Pachytrition</i>	<i>labiatus</i>	26°22.517'N	108°12.632'E	1663	2007/10/16	Negative
Salamandridae	<i>Pachytrition</i>	<i>labiatus</i>	26°22.375'N	108°12.449'E	1612	2007/10/17	Negative
Salamandridae	<i>Pachytrition</i>	<i>labiatus</i>	26°22.221'N	108°11.691'E	1426	2007/10/27	Negative
Salamandridae	<i>Pachytrition</i>	<i>labiatus</i>	26°22.088'N	108°10.470'E	1260	2007/11/6	Negative
Ranidae	<i>Odorrana</i>	<i>schmackeri</i>	26°23.801'N	108°14.253'E	1174	2007/10/13	Negative
Amolopinae	<i>Amolops</i>	<i>chunganensis</i>	26°22.221'N	108°11.693'E	1425	2007/10/24	Negative
Amolopinae	<i>Amolops</i>	<i>chunganensis</i>	26°22.221'N	108°11.691'E	1426	2007/10/24	Negative

We collected skin samples from 34 individuals of *Vibrissaphora leishanensis*, 1 individual of *Bufo gargarizans*, and 8 individuals of *Paramesotriton caudopunctatus*, plus 4 individuals of *Pachytrition labiatus*, one *Odorrana schmackeri* and two *Amolops chunganensis*.

The most common and representative species during our fieldwork from October to November were *Vibrissaphora leishanensis*, *Pachytrition labiatus* and *Paramesotriton caudopunctatus*.

Based on the all negative laboratory test results, there is no apparent occurrence of Chytrid fungus at least among the 50 samples collected separately from various locations of Leigongshan NNR.

## 4. Problems and Suggestions

### a) Direct human harvest during breeding season



A sudden encounter with local residents strolling over streams to search and harvest adult toads



Fire remains to cook toad porridge can be often seen along the streams



**Deserted internal organs of mustache toads and damaged egg mass on the rock**



**Internal organs of another victim toad**

According to our fast interviews and encounters with people who harvest toads in streams, the harvest is currently remaining at non-commercial level. There is no massive collection to meet the demand from pet market or scientific specimen needs from education institutes were identified. Local residents teamed up to harvest toads just for picnic purpose, or to feed poultry. They usually bring some necessary kitchen utensils and a small bag of rice, then cook “toad-tadpole porridge” near the shore of the stream when a sound number of adults or tadpoles were collected through simple approaches such as rock reverse by tree trunk, dip netting and poison kill. Many remains of camp fire can be seen along most of streams we had surveyed, which indicated intensive human

harvest, both on adults and tadpoles.

We had recorded frequency of encounter with local residents throughout whole fieldwork schedule. Only those observed and encountered events of human harvest on toads were recorded, no specific monitoring approach was used to collect frequency data.

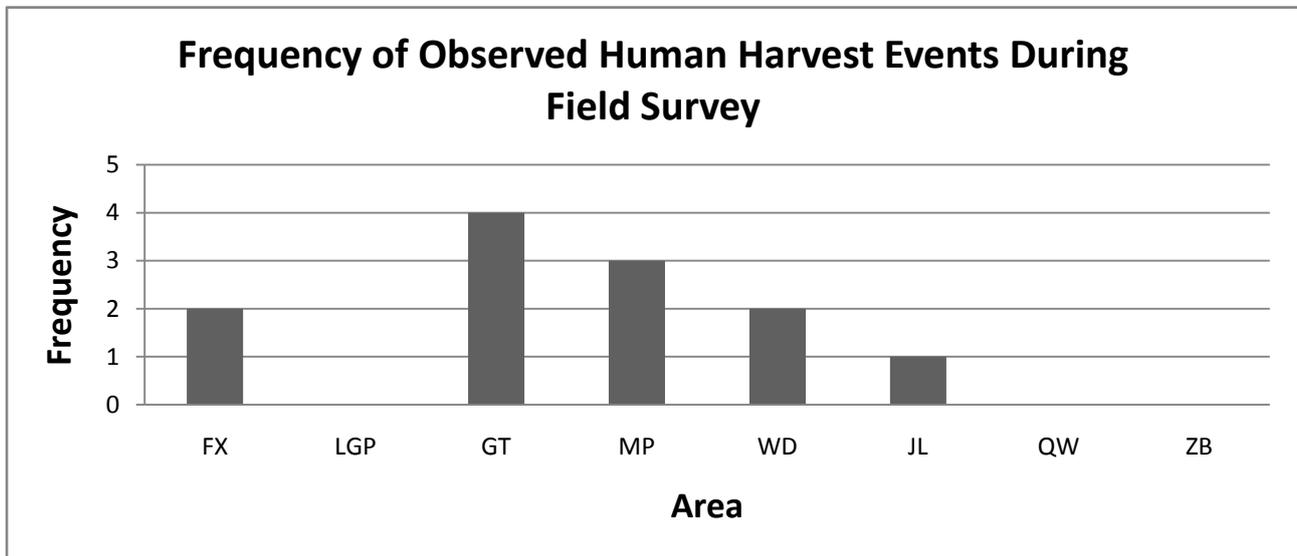


Figure 10. Frequency of observed human harvest on *Vibrissaphora* adult toads

According to the data, Fangxiang (FX), Getou (GT), Maoping (MP) and Wudong (WD) were four areas recorded with higher frequency of human harvest events compare to other areas. It is suggested that future conservational education should focus on these four areas.



Scene of tree trunk to reverse rock for toads underneath by villagers

## b) Killing tadpoles by poison streams



**Deserted empty bottle of agricultural-use poison on the streambed**



**Two dip-nets and an empty package of agricultural-use poison on the shore**

Poison killing is now a major concern for subsequent conservation work. It's a serious problem that will cause a sharp population decline. In the past, the harvest number of adult toads and tadpoles who reaches its 2nd or 3rd years of age is somewhat limited by only dipnetting and rock reversing search. Through newly-adopted poison killing method, many 1st year tadpoles would be indiscriminately killed as well. It would also kill other aquatic wildlife and contaminate the water. Astoundingly, local residents who harvest toads showed no fear to these poisoned tadpoles for food.

### c) Management suggestions

Conservation management for *Vibrissaphora leishanensis* is in an embarrassing status. Although *Vibrissaphora leishanensis* is listed as “Endangered” in the IUCN list, the gap between IUCN standards and China standards hindered advanced conservation work. In China, *Vibrissaphora leishanensis* was excluded from the state wildlife protection system of 1st and 2nd class. People who harvest toads will not be convicted of crime, that fact led to protect toad strictly by wildlife law enforcement is not an easy mission then.

As mature toads and tadpoles are almost disappeared in those larger and easily accessible stream sections, subsequent conservation efforts should be made to control human harvest in tributaries. We strongly suggest that the nature reserve should actively contact related superior governmental departments to urgently request a formal and strict legal protection on mustache toads. More actions on raising public concerns on endemic amphibian conservation are also needed in big cities to facilitate possible campaign for revising definition of 1st and 2nd state wildlife protection system aims at giving more attention to amphibians.

# Site B: Fanjingshan Nature Reserve

## 1. Study Area



MAB stele by the U.N. in Fanjingshan Nature Reserve

Fanjingshan National Nature Reserve is located in the northeast area of Guizhou province, it has covered areas which measured for 41900 hm<sup>2</sup> (geographical coordinates: E108°37'- E 108°46, N 27°45'- N 27°59'). The distance to access to the nature reserve is about 35 km drive from Jiangkou Town, the county seat of Yinjiang County and Tongren Administrative Region of Guizhou province.

Mt. Leigongshan belongs to Wulingshan Mountain Ridge, it is the mountain peak in the mountain ridge and its highest point reaches 2572 meters. The nature reserve is affected by humid subtropical monsoon climate, and the air temperature varies depends on the weather condition from 8 °C to 22 °C during the fieldwork period.

Fanjingshan National Nature Reserve was established in 1978 with the main aim to initially preserve small population of Guizhou Golden Monkey (*Rhinopithecus brelichi*), its habitat and surrounding environment. It was the first provincial nature reserve established in Guizhou province and upgraded to be managed as a national nature reserve. Fanjingshan also has a long history of Buddhism activities, these religious activities helped to preserve environment and habitat as well, due to beliefs in geomancy a.k.a “feng-shui” in Chinese. The site was identified as a

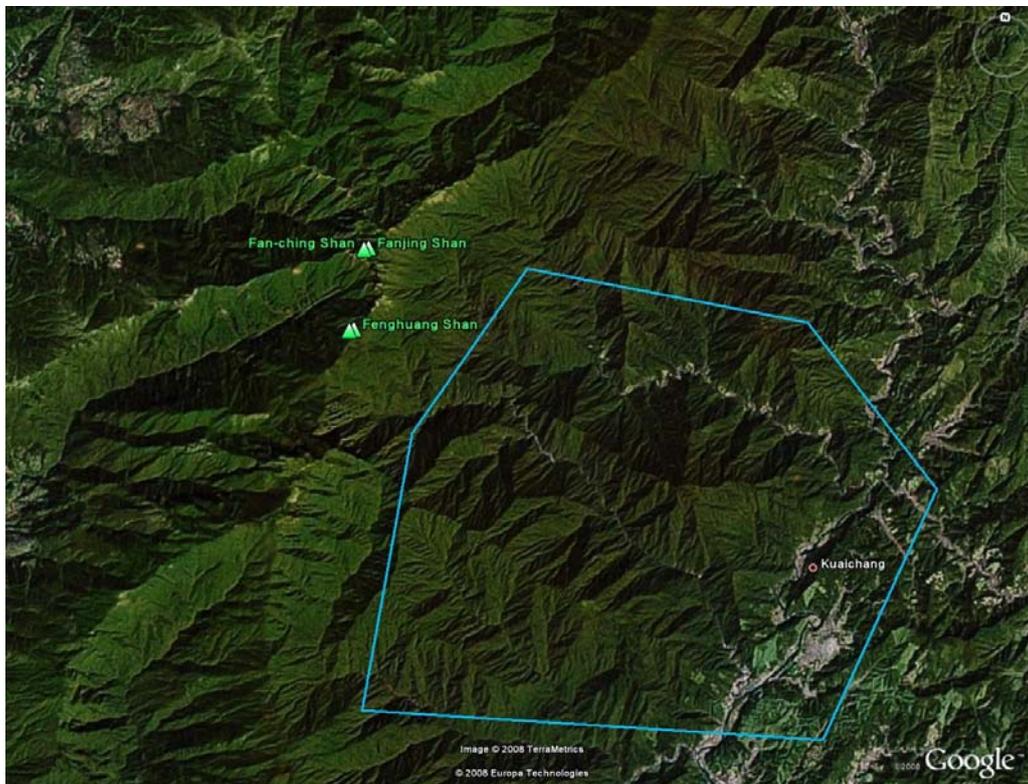
biodiversity conservation hotspot, important bird area (IBA code CN241) and member of man and biosphere (MAB) program by the United Nations.

The nature reserve has been investing heavily on saving large wildlife such as predator birds, mammals and primates. The management bureau is implementing a strict protection within the core areas of the nature reserve, and majorly due to the rugged terrain, there is no village located within the main route to the mountain peak along the stem stream where the *Vibrissaphora* species occurred and only to be found.

*Vibrissaphora boringiae* was first discovered and published on Chinese academic journal in 1945 as a new species and estabin 1973. During early times, the species can only be found in Emei Mountain, but later in Junlian, Fanjingshan, Badagongshan, and Hupingshan the occurrence of the species was detected. It is estimated that population are undergoing rapid declines in Emei Mountain due to various negative factors, and thus surveys in Guizhou and Hunan province are required in order to preserve more small population elsewhere.

## 2. Methods

### 3.1. Survey Range



General Covered Areas by Field Survey

Before our survey, there were several times of field survey conducted by Liang Fei, a Sichuan

individual herpetologist during 1980s. Heiwan River was identified to be the main stream where the occurrence of *Vibrissaphora boringiae* was recorded for the first time in the year of 1982. According to his report, the species can only be found in a specific stream section of Heiwan River. The total lengths of the Heiwan stream cannot be determined accurately due to the most of sections were not accessible and dangerous, we assumed that the river was roughly about 20 km by estimation.

After walked through the entire routes from the foot of the mountain to the mountain peak, along riparian zones and sidewalk constructed by human beings, we determined to put our main survey area on the middle stream section of Heiwan River which was about 3000 m in length, only in this section the major research activities and other fieldwork could be conducted safely and effectively. More important, these sections are also known as spots where the tadpoles and adults were correctly recorded in the past survey during 1980s, so that data collected in this region could be used to compare with former collected in 1980s to check if there was any significant variance.

The altitude of the chosen section is ranging from 805 to 860 meters. The drop height is 55 meters. Since there was intensive human activities on the riparian zones of upper section of the chosen stream (e.g. settlement of construction workers and infrastructure development), and less activities on the lower section, we therefore divided the entire section into two sub-sections: (1) Yu-ao section and (2) Tong-kuang-chang section as our major targeted research sections, and extended field transect lines to survey other smaller branch streams and neighboring Ma-cao River and Kuai-chang stream section of Taiping River, which are also the mountain streams originated from Mt.Fanjingshan, in order to explore more possible occurrence of the species, e.g. tadpoles, sub-adults or adults.



Heiwan River

The length of Tong-kuang-chang stream section is approximately 1600 m, altitude is ranging from 805 to 815 m; the drop height is 10 m. The section contains a flat streambed with slow water speed, and average flow speed is 0.34 m/s. The rocky substrate with sands is conducive to the hidden of adult toads and tadpoles. There were 6 backwaters in total and PH value of the water is 6.

Yu-ao section is relative shorter than Tong-kuang-chang, its length is about 1400 m, altitude ranging from 815 to 860 m, fall is 45 m. This section is influenced by infrastructure development, and naturally there were many big rocks on the streambed, thus the flow speed is faster than Tong-kuang-chang, there are less rocks suitable for breeding and hiding, so tadpoles usually congregate in 13 backwaters.

### **3.2. Survey Time**

The whole field research activities lasted for about 59 days from 18<sup>th</sup> March, 2008 to 15<sup>th</sup> May, 2008. Throughout the survey time, the extended quick survey along Ma-cao River was conducted separately at 26<sup>th</sup> March, 12<sup>th</sup> April, and 14<sup>th</sup> April. The survey at Kuai-chang stream section of Taiping River was conducted in 16<sup>th</sup> April and 17<sup>th</sup> April. The rest of spent time was focusing on two major research sections: Yu-ao and Tong-kuang-chang.

### **3.2. Visual Encounter Surveys**

Common field methods used in Fanjingshan were similar to what we used in Leigongshan Nature Reserve, only little variation due to terrain and other external factors.

Visual encounter surveys are effective approach in surveying rare species in identifiable aquatic habitats, such as riparian zones or shallow streams with good visibility. Visual Encounter Survey (VES) was the one of most commonly used techniques in the survey to determine relative species abundance, tadpole population structure, adult species number counting, individual activity and movement of target species and other encountered amphibian species. VES was used along set transects through specific sections of the stream and riparian zones. Two standard sampling designs for VES, randomized walk and transects were used (Heyer et al. 1994). We conducted randomized walks with pre-define time limit to walk through a designated area or transect line as standard visually searching approach for estimating number of adults.

We also interviewed people within the nature reserves such as rangers and staff of nature reserves, local residents for more distribution information of the species. Combined with historical records and information given by local specialists and rangers, we set transect lines through the stream sections to search for any occurrence of adults hiding under rocks or tadpoles.

### 3.3. Dip-net Collection

Dip-net collection was used for survey of tadpole distribution pattern and age structure. Considering the minor difference of stream habitat, the methods varied according to the section. In flat section like Tong-kuang-chang, we adopted transect lines and points to survey tadpole population by setting transect lines above the stream and searching rocks within the transect line for darting or visible tadpole individuals hidden under rocks; In places where contains a lot of relative deeper backwaters like Yu-ao section, we also used dip net and bait to capture tadpoles besides VES method. All measured tadpoles were harmlessly contained in a bucket filled with stream waters and released immediately after measurement. Tadpole development stage and age structure was determined by referring to the method introduced by Zhao Ermi (Zhao Ermi, 1990).

### 3.3. Drift-fence and Bucket Trap



**Setting up drift fences along riparian zones**

Drift fences and pitfall trap arrays are used to try to survey and capture amphibians especially the target species came from riparian zones and forests on mountain slope. During the March to May 2008, the team members constructed a series of drift fences (about 460 m in all) in the suitable riparian zones in Tong-kuang-chang and some upper sections beyond Yu-ao.

In this configuration, each array consists of a pitfall trap at interval of 3 m each. Ten-liter buckets were utilized for pitfall traps and well positioned so that the bucket lip was basically flat with ground level. Drift fences were made from plastic shade with the height of 35 cm.

Relevant data was collected before their release (species, SVL, sex, weight, and date collected). These fences are usually opened (trapping animals) during the day and night. The arrays were regularly checked twice daily beginning on 20th March and continuing through until 13rd May by team members on duty.

### 3.4. Radio Tracking

In order to track adult individual movement during the breeding period, we used 4-element Yagi antenna and ICOM R-20 wider band receiver to pick up the signal. The BD-2 transmitters used in the study were made by Holohil Systems Ltd., Canada.

Transmitters were attached to the toads by using silicon tubes. Captured moustache toads were swabbed with MW100 dry swabs to collect skin samples and therefore attached with radio transmitters within 10 minutes, and released after process at the capture point. However, radio tracking in Fanjingshan is not that successful due to the ragged terrain and deep running water.



**Narrating radio tracking techniques**

### 3.4. Skin Swabbing



**Prepare to swab skin of spiny-fingered horned toad**

We used a fine-tip dry swab (MW100, Medical Wire & Equipment Co.) to collect skin samples for Chytrid fungus testing. Adult individuals were captured opportunistically at chosen sampling sites or by VES and pitfall trapping. All captured individuals were swabbed twice or more over their posterior ventral surfaces of the lower abdomen, thighs, and all hands and feet.

We carefully avoid cross contamination between swab samples and repeatedly sampling the same

individual by using PIT tags or toe-clipping. All swabs taken only from adult frogs and salamanders were pooled together for PCR analyses. Pooled swabs were stored at - 10°C in icebox during fieldwork. Pooled samples were sent to the Pisces Molecular LLC (Boulder, CO, United States) for qualitative detection of *Batrachochytrium dendrobatidis* presence by real time PCR testing. Diagnostic PCR tests were performed using the Taqman RT-PCR.

### **3.5. Temperature and Relative Humidity**

General air temperature, water temperature and relative humidity were recorded automatically by HOBO data loggers with specific external sensors which were positioned in well chosen locations.

Habitat temperature of where the targeted species and other amphibians got caught was measured by a portable digital thermometer (DS-1, Shanghai Jingchuang Electronics Manufacturing CO., LTD.).

### **3.6. Threat assessment**

Because most of infrastructure constructions were developing along the main stream (Heiwan River) where *Vibrissaphora boringiae* occurs, thus the threat assessment included various of measurements on the width of cement road and height of retaining wall were implemented by team members along the stream.

We observed and assessed impact to the movement of adult individuals, return of tadpole after its metamorphosis and future distribution pattern of the region. Data was collected by dividing the entire road into single sections (each length is 100 m) and conducting measurement along the road (about 1704 meters in total length).

### 3. Results

#### 3.1. Microclimate

During the fieldwork, water temperature has a trend that slowly but steadily increased from 9°C to 17 °C with the approaching of summer season. The air temperature varied according to the weather from minimum 8°C to maximum 22°C . Throughout the period of fieldwork, only 10 days were sunny, while the rest are clouded or even mild rainy.

In general, microclimate in Fanjingshan was wet and mild from March to May. HOBO data loggers were set to automatically record temperature and humidity data at interval of 6 hours (0000, 0600, 1200, 1800). Though the research region experienced clouded weather and rains, both of temperature and relative humidity have increased gradually with the approaching of summer season. The figures were made by calculating monthly average number of temperature recorded at the same interval.

**Table 1. Microclimate conditions in two survey sites, March to May**  
(Tongkuangchang and Yuao)

Location	Elevation Range (m)	Air Temperature (°C)		Water Temperature (°C)		RH (%)	
		Day	Night	Day	Night	Day	Night
Tong-kuang-chang	805-816	9.1-16.1	8.2-13	9-20	8.4-18	93-91	85-90
Yu-ao	815-860	9.2-16.2	8.2-14	9-20	8.4-18	92-89	84-89
Kuai-chang	617-633	n/a	n/a	n/a	n/a	n/a	n/a
Ma-cao	774-789	n/a	n/a	n/a	n/a	n/a	n/a

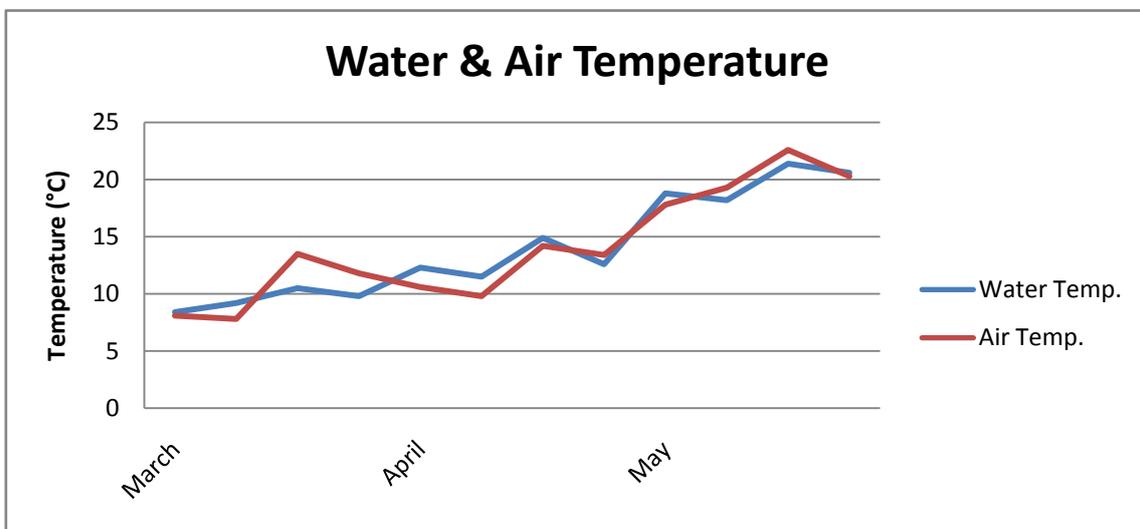


Figure 1. Average Water and Air Temperature

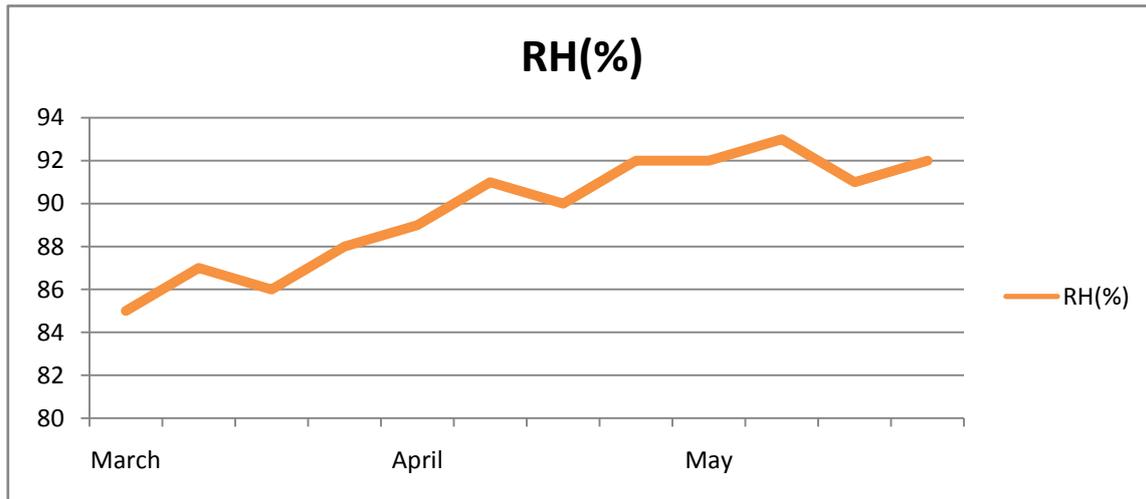


Figure 2. Average Relative Humidity



Debris of a dead frog body

### 3.2. Chytrid Fungus Test

A few of dead frog bodies were found on the drought streambed, it was assumed that chytrid fungus was not the major cause of the death due to the debris condition.

Some deserted internal organs of frogs maybe left by bird predation or illegal human harvest. But, no direct evidence was observed found to show that within the nature reserve exists phenomenon of human harvest.

Species which were found in streams, drought streambeds, local forest and rice field on the shores of the streams. Representative species included mustache toad (*Vibrissaphora*

*boringiae*), little horned toad (*Megophrys minor Stejneger*), spiny-fingered horned toad (*Megophrys spinatus Liu and Hu*), some salamanders and other common frog species.

In all, we had collect 50 skin samples from Fanjingshan Nature Reserve which were tested in group by a U.S.-based biological laboratory and all of results were negative.

**Table 2. Information list of collected skin samples in Fanjingshan NNR**

Fanjingshan National Nature Reserve (50 sample)							
Family	Genus	Species	Latitude	Logitude	Elevation (m)	Date	Bd Status
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°52.208'N	108°44.372'E	874	2008/3/28	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°52.208'N	108°44.372'E	874	2008/3/28	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°52.124'N	108°44.457'E	875	2008/3/27	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°52.251'N	108°44.361'E	846	2008/3/31	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°54.223'N	108°43.322'E	930	2008/4/5	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°54.140'N	108°43.097'E	1055	2008/4/1	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°54.223'N	108°43.322'E	930	2008/4/5	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°54.239'N	108°43.267'E	945	2008/4/4	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°53.122'N	108°43.363'E	942	2008/3/22	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°53.560'N	108°43.445'E	908	2008/3/24	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°53.282'N	108°43.218'E	1020	2008/3/26	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°53.104'N	108°43.472'E	947	2008/3/21	Negative
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	27°54.211'N	108°43.240'E	956	2008/4/2	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.445'N	108°44.402'E	780	2008/4/8	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.445'N	108°44.402'E	780	2008/4/8	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.445'N	108°44.402'E	780	2008/4/8	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.445'N	108°44.402'E	780	2008/4/8	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.445'N	108°44.402'E	780	2008/4/8	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.445'N	108°44.402'E	780	2008/4/8	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.445'N	108°44.402'E	780	2008/4/8	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.315'N	108°43.179'E	1049	2008/4/12	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.315'N	108°43.179'E	1049	2008/4/12	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.315'N	108°43.179'E	1049	2008/4/12	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.315'N	108°43.179'E	1049	2008/4/12	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.315'N	108°43.179'E	1049	2008/4/12	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.315'N	108°43.179'E	1049	2008/4/12	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°53.315'N	108°43.179'E	1049	2008/4/12	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°52.307'N	108°44.444'E	971	2008/4/13	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°52.307'N	108°44.444'E	971	2008/4/13	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°52.307'N	108°44.444'E	971	2008/4/13	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°52.307'N	108°44.444'E	971	2008/4/13	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°52.307'N	108°44.444'E	971	2008/4/13	Negative
Megophryidae	<i>Xenophrys</i>	<i>spinata</i>	27°52.307'N	108°44.444'E	971	2008/4/13	Negative
Megophryidae	<i>Xenophrys</i>	minor Stejneger	27°51.155'N	108°45.549'E	614	2008/4/10	Negative
Megophryidae	<i>Xenophrys</i>	minor Stejneger	27°51.155'N	108°45.549'E	614	2008/4/10	Negative
Megophryidae	<i>Xenophrys</i>	minor Stejneger	27°51.155'N	108°45.549'E	614	2008/4/10	Negative
Megophryidae	<i>Xenophrys</i>	minor Stejneger	27°51.155'N	108°45.549'E	614	2008/4/10	Negative
Megophryidae	<i>Xenophrys</i>	minor Stejneger	27°49.453'N	108°44.464'E	583	2008/4/15	Negative
Megophryidae	<i>Xenophrys</i>	minor Stejneger	27°49.453'N	108°44.464'E	583	2008/4/15	Negative
Megophryidae	<i>Xenophrys</i>	minor Stejneger	27°49.453'N	108°44.464'E	583	2008/4/15	Negative

Megophryidae	Xenophrys	minor Stejneger	27°51.526'N	108°44.596'E	890	2008/4/21	Negative
Megophryidae	Xenophrys	minor Stejneger	27°51.526'N	108°44.596'E	890	2008/4/21	Negative
Ranidae	<i>Amolops</i>	<i>ricketti</i>	27°53.341'N	108°46.255'E	676	2008/3/8	Negative
Ranidae	<i>Amolops</i>	<i>ricketti</i>	27°53.472'N	108°45.547'E	757	2008/3/8	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	27°51.486'N	108°45.385'E	719	2008/3/20	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	27°51.486'N	108°45.385'E	719	2008/3/20	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	27°54.170'N	108°45.319'E	708	2008/3/17	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	27°52.221'N	108°44.382'E	867	2008/4/2	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	27°52.193'N	108°44.403'E	870	2008/4/2	Negative
Salamandridae	<i>Paramesotriton</i>	<i>caudopunctatus</i>	27°52.143'N	108°44.442'E	873	2008/4/2	Negative

Apparently, there is no occurrence of Chytrid fungus at least among the samples collected from Fanjingshan, we may assume that Bd does not occur in Guizhou province and south China as well unless further exploration and sampling work is made possible and positive evidence emerged.

So far as evidence shown above, Bd is not posing threat to the survival of the species, but still the human activities.

## 4.2. Adult Population Survey

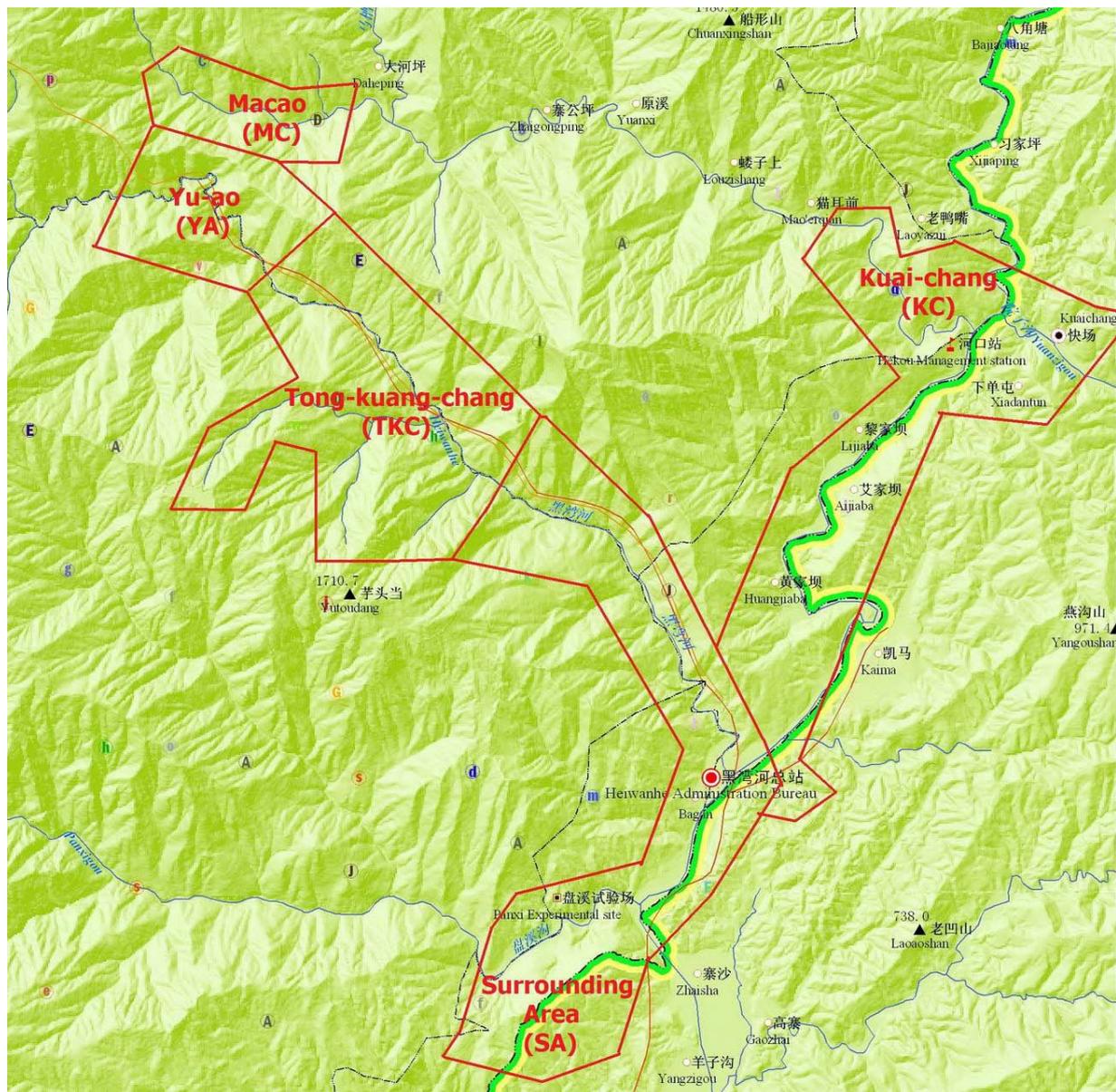


Figure 3. Maps of Major Areas for Adult Population Survey (Macao-Yuao-Tongkuangchang-Kuaichang-Surrounding Area)

Adult population surveys were conducted in four areas by majorly using VES approach. According to historical records and interview with local rangers, Heiwan River was the only stream that *Vibrissaphora* adult and tadpoles can be found so far.

We had divided our focus area into four different parts: 1) Yu-ao (YA); 2) Tong-kuang-chang (TKC); 3) Kuai-chang (KC); 4) Surrounding Areas (SA). By repeatedly searching through set transect lines of the stream, riparian zones, and fields of surrounding areas, from March to May, we had found 18 amphibian species, 609 individuals in total. The number of discovered species remained low at initial stage of field survey, but increased to 18 gradually with the progress of fieldwork and seasonal variation (Spring to Summer).

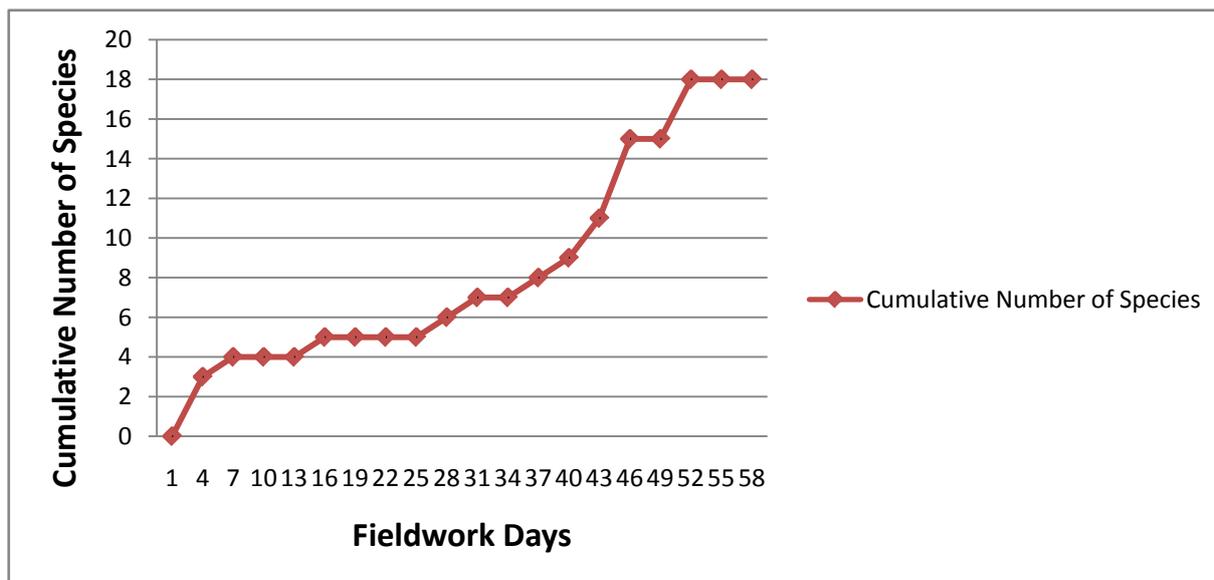


Figure 4. Cumulative number of species during survey days

Table 3. Species total number and relative abundance

Family	Genus	Species	TKC	YA	MC	KC	SA	Species	Relative
								Total	Abundance
Megophryidae	<i>Vibrissaphora</i>	<i>boringiae</i>	11	2				13	0.0213
	<i>Xenophrys</i>	<i>spinata</i>	6	2	3			11	0.0181
	<i>Xenophrys</i>	<i>minor Stejneger</i>	28	34	19			81	0.133
	<i>Leptolalax</i>	<i>oshanensis</i>	57	42	36			135	0.2217
Bufo	<i>Bufo</i>	<i>gargarizans</i>	2				1	3	0.0049
Ranidae	<i>Hyla</i>	<i>annectans Jerdon</i>				3	24	27	0.0443
	<i>Fejervarya</i>	<i>multistriata</i>				17	231	248	0.4072
	<i>Odorrana</i>	<i>livida</i>				2	3	5	0.0082
	<i>Odorrana</i>	<i>schmackeri</i>					2	2	0.0033
	<i>Pelophylax</i>	<i>nigromaculatus</i>					12	12	0.0197
	<i>Hylarana</i>	<i>guentheri</i>					3	3	0.0049
	<i>Hylarana</i>	<i>adenopleura</i>					8	8	0.0131
	<i>Microhyla</i>	<i>butleri Boulenger</i>					9	9	0.0148
	<i>Microhyla</i>	<i>heymonsi</i>					7	7	0.0115
	<i>Microhyla</i>	<i>ornata</i>					35	35	0.0575
	<i>Microhyla</i>	<i>mixtura</i>					2	2	0.0033
	<i>Amolops</i>	<i>ricketti</i>					3	3	0.0049

<b>Salamandridae</b>	<i>Paramesotriton</i>	<i>caudopunctatus</i>	3	1	1	5	0.0082	
<b>Regional Total</b>			107	81	59	22	340	609

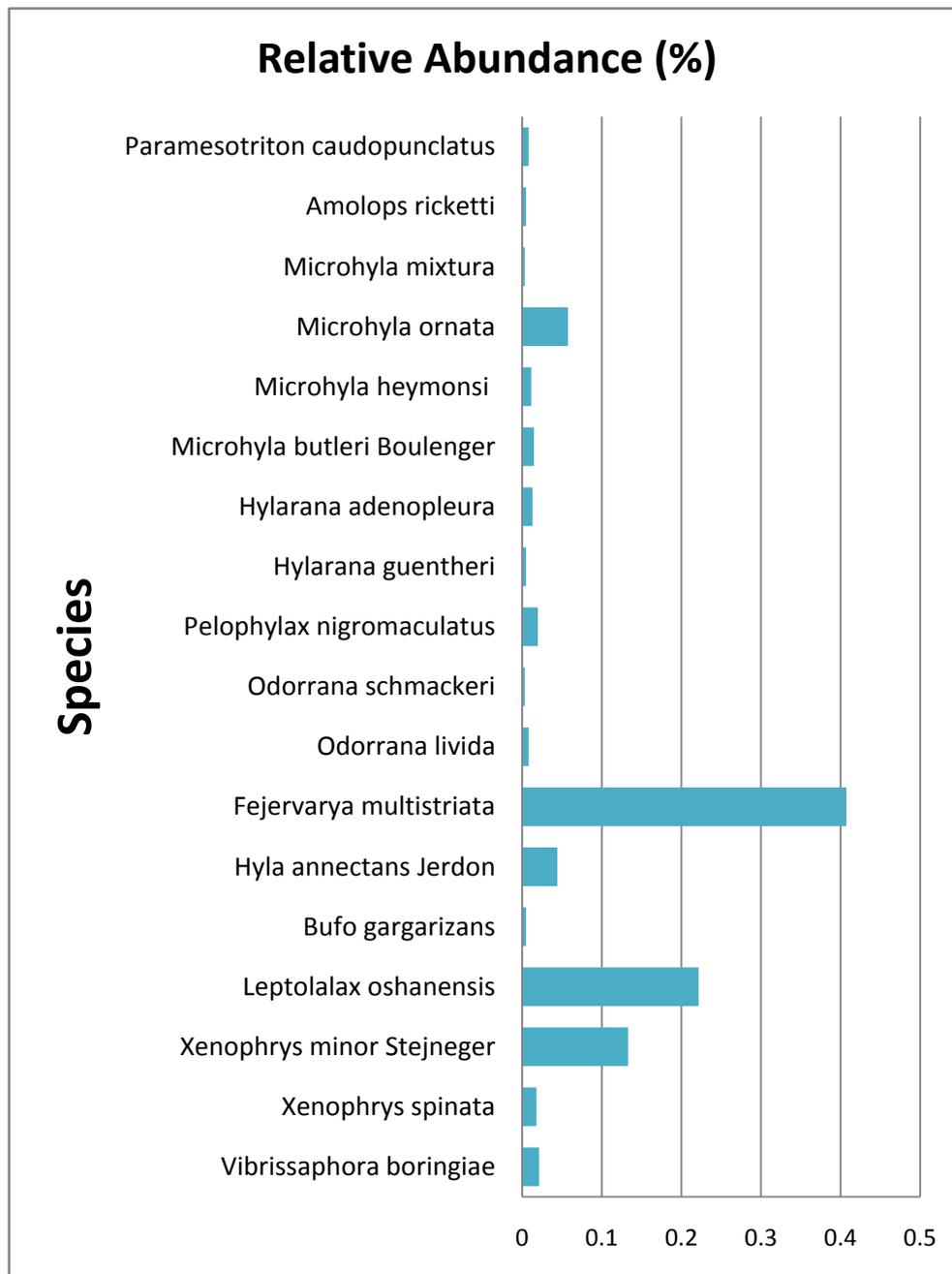


Figure 5. Relative abundance of species

The most abundant species in the stream of core nature reserve area during March and April were *Leptolalax oshanensis* (22%) and *Xenophrys minor Stejneger* (13%). From April to May, the most abundant species that were found in the fields of Surrounding Areas (SA) is *Fejervarya multistriata* (40%). The abundance of *Vibrissaphora* only consisted of a tiny part of the whole (2%).

Vibrissaphora tadpoles and adults were mainly discovered in chosen sections of Heiwan River by searching egg masses under rocks, pitfall trapping and VES-assisted dcapture, but an extremely rare tadpole occurrence in middle stream section of Macao River was recorded as well. In Kuai-chang section of Taiping River and other surrounding areas, we did not find any evidence to support occurrence of *Vibrissaphora* species. Of 13 detected individuals, 9 were males and 4 were females (included a dead one by road kill). Male toads showed a strong tendency to guard eggs, two of male toads was continuously monitored by the team member that it did not leave the chosen rock after successful copulation and oviposition until the incubation of tadpoles from embryonic status. The Heiwan River apparently was the key site for the successful breeding and survival of *Vibrissaphora* population in Mt.Fanjingshan. Due to the ragged terrain, there might be more undetected individuals, but the general number of the entire region was assumed to be low than 500. For further confirmation, more explorations and monitoring activities are essentially required.



Downstream of Heiwan



Portrait of *Vibrissaphora boringiae*

### 4.3. Egg Masses

Egg mass underneath the rocks in the streams is a critical factor to evaluate oviposition rate, incubation rate, and estimate number of breeding pairs, due to the rare chance to directly count or capture adult toads. This year, only three egg masses in all were found in two major studied stream sections during the survey, which indicated that there might be few of breeding pairs remain in active, and the entire population of the area is possibly in sharp declines.



Egg masses of *Vibrissaphora boringiae*

Each discovered egg mass contained over 190 eggs but some of eggs were not fertilized and failed to develop into tadpoles. There was about 80 undeveloped eggs in the No.1 egg mass. the individual eggs of No.2 and No.3 egg masses were developed to stage 19-23 when discovered by team members searching in the stream. Eggs that developed to stage 23-25 will begin to apart from egg masses and enter the stream waiting for fully development into active tadpoles. The total length of tadpoles at stage 23-25 ranging from 14.2-15.3 mm

Table 4. Egg Masses

No.	Discovered Date	No. of Individual Eggs	Stage of Developing Eggs	Undeveloped Eggs	Incubation Rate
1	2008-3-20	198	Stage 13-15	Approx.80	59%
2	2008-4-28	207	Stage 19-22	Approx.33	92.7%-93.0%
3	2008-5-2	213	Stage 20-23	Approx.21	95.1%-95.3%

## 6. Tadpole Population Survey

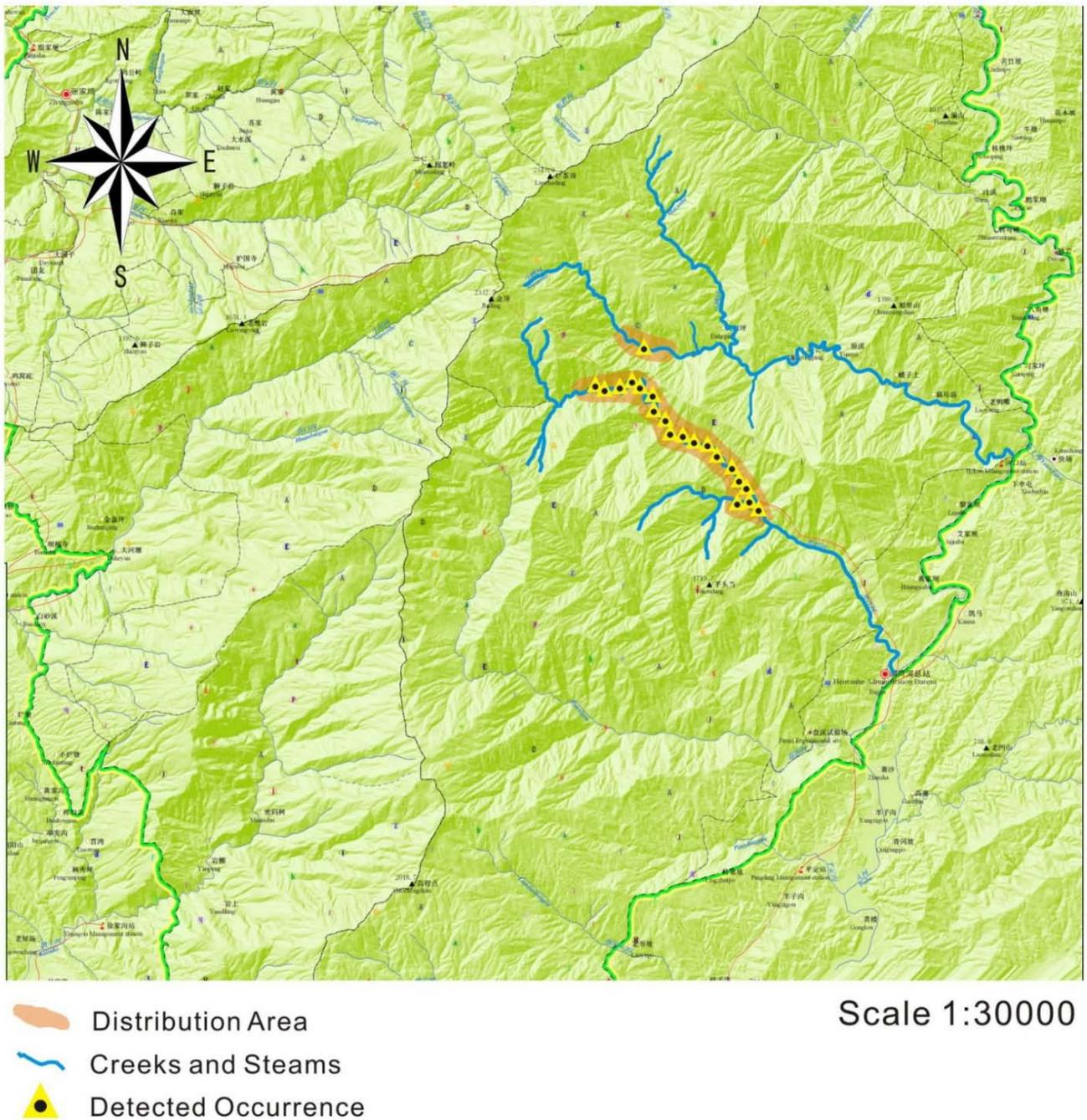


Figure 6. Distribution map of *Vibrissaphora* tadpole in Fanjingshan Nature Reserve

We conducted surveys in two sub-sections of Heiwan stream, and 580 tadpoles in total were found. The purpose of survey on *Vibrissaphora boringiae* tadpole population in the stream of the region was to investigate data as below: approximate number of tadpole population, population structure, distribution pattern, and sampling measurement of individual tadpole including its development stage, length, weight, hindlimb buds, and etc.

Tadpoles were captured by dip-netting work, and their SVLs and weights were measured and recorded in order to construct its age structure for further analysis. Each measurement on a single tadpole was accomplished within 2 minutes; tadpoles were released harmless and alive immediately after the measurement.

Tadpole of *Vibrissaphora boringiae* tend to congregate in stream backwaters throughout the Yuao section due to the faster flow of stream water, but it is evenly distributed in Tongkuangchang stream section where the flow speed reduced. Such a difference in tadpole distribution pattern is mainly caused by width, flatness of streambed and the water flow speed.

10 transect lines were established at Tongkuangchang stream section, the total length reached 651 m. Among 1612 transect points, the number of the tadpole occurrence point is 239, and 298 tadpole individuals were visually detected. The team member who conducted the survey estimated that there might be over 700 tadpoles occur in the Tongkuangchang section. The data of sampling measurement that included 189 tadpoles and illustrated in Table 3 and Table 4 with following figures.

**Table 5. Sampling Measurement of Tadpole in Tongkuangchang**

Transect Line No.	Length (m)	Flow Speed (m/s)	Transect Point No.	Point with tadpole occurrence	Discovered Tadpole No.	Tadpole No. of Sampling Measurement
1	57	0.71	44	3	3	2
2	61	0.13	154	31	31	21
3	60	0.25	157	19	26	9
4	75	0.35	156	15	16	6
5	41	0.24	91	14	15	13
6	77	0.27	126	36	30	23
7	50	0.36	31	4	5	1
8	90	0.41	209	28	43	30
9	70	0.32	230	33	56	35
10	70	0.34	414	56	73	49
Total	651	/	1612	239	298	189

**Table 6. Sampling Measurement of Tadpole in Tongkuangchang**

Tadpole Stage	Numbers	Average Length (mm)	Average Weight (g)
Stage 25	113	55.80	3.76
Stage 26	7	66.50	5.89
Stage 27	6	67.60	5.57
Stage 28	4	72.90	6.28

Stage 29	2	71.10	7.00
Stage 36	5	8.47	8.3
Stage 37	20	9.2	9.75
Stage 38	22	10.28	11.28
Stage 39	10	10.5	11.1

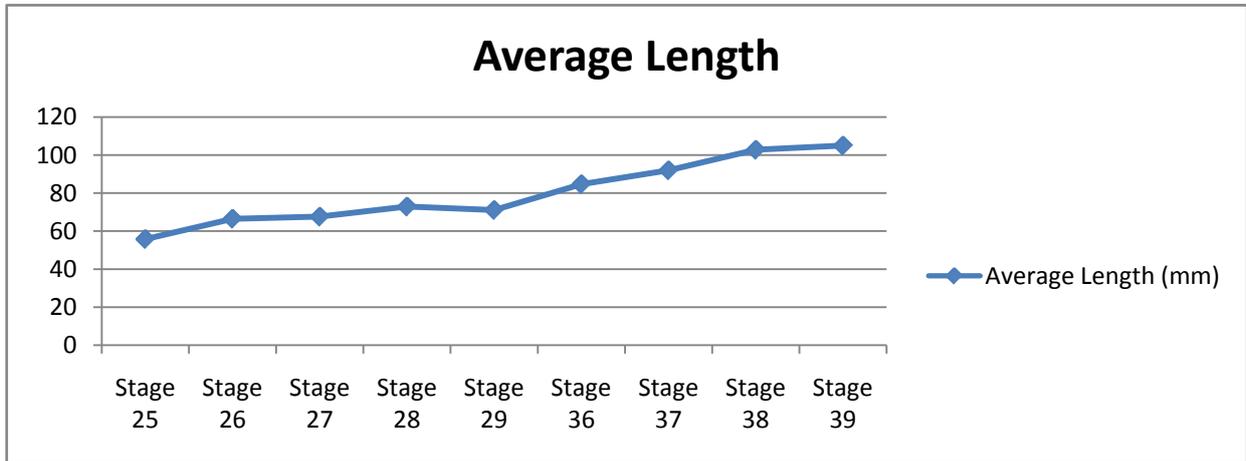


Figure 7. Average length of captured individual tadpoles in Tongkuangchang

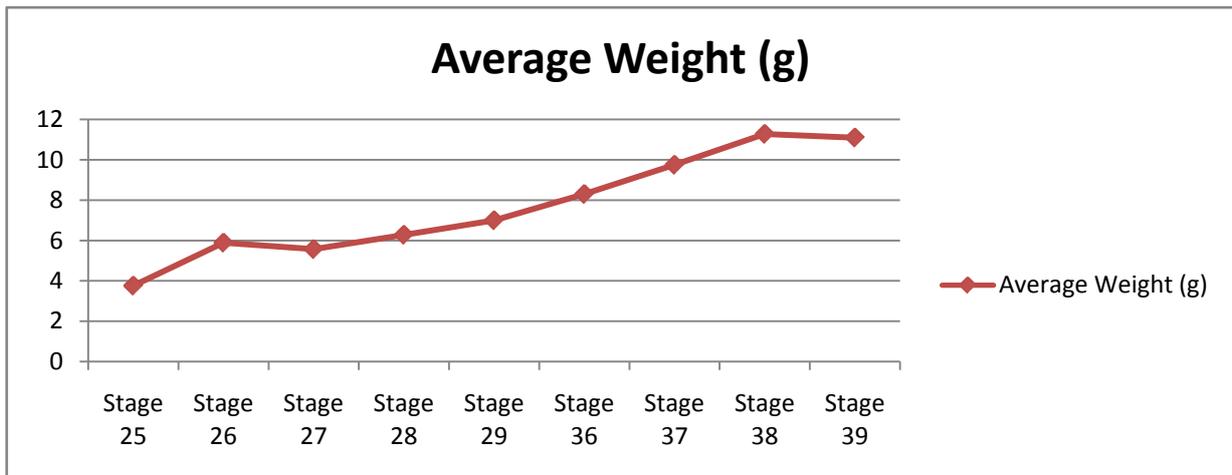
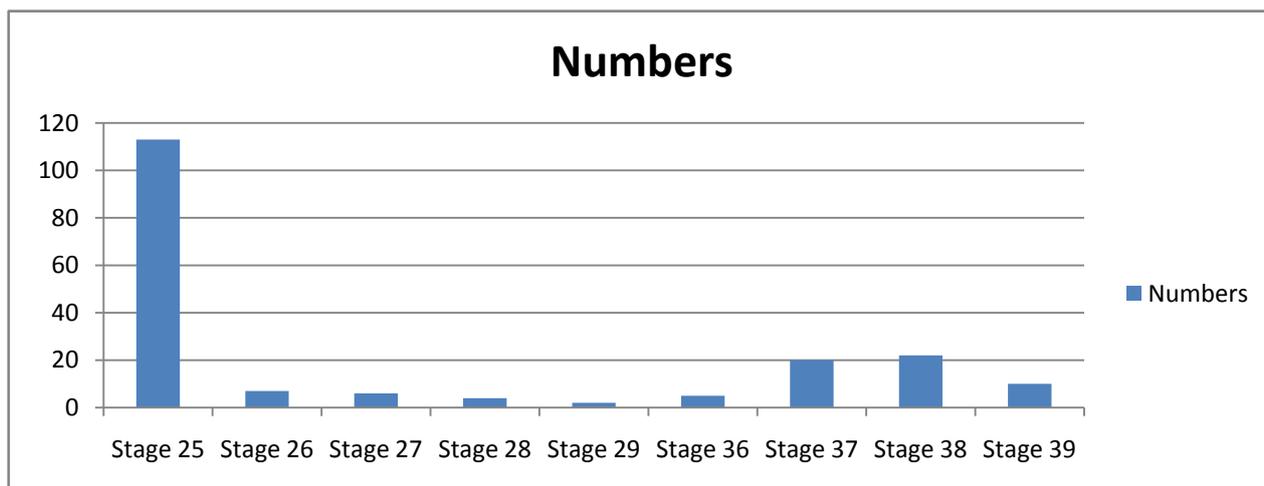


Figure 8. Average weight of captured individual tadpoles in Tongkuangchang



**Figure 9. The number of Captured tadpoles at various development stage in Tongkuangchang**

Tadpoles in Yuao section were snared into the plastic bucket by bait, the bucket was immersed into the stream backwaters, tadpoles were captured and measured. Two stream backwaters were sampled, and the rest tadpole number was confirmed by visual counting.

Tadpole counting was conducted in two backwaters of the Yuao stream section where tadpoles congregated for foraging. There were 120 tadpoles in the first backwater, and 168 tadpoles in the second backwater. Following VES survey boosted the number of backwater to 13, and it is estimated that there were over 1800 tadpoles throughout the Yu-ao section and upper stream sections beyond Yu-ao, but not all tadpoles were collected and measured. The sampling measurement in Yuao is small due to ragged terrain and fast deep running water, only 65 tadpoles were collected and measured in Yuao section, data was shown as below in the table 5.

**Table 7. Sampling Measurement of Tadpole in Yuao**

Tadpole Stage	Numbers	Average Length (mm)	Average Length Of Hindlimb Buds (mm)	Average Weight (g)
Stage 25	3	58.69	0	2.3
Stage 26	5	65.69	0.46	2.5
Stage 27	13	71.37	0.64	4.2
Stage 28	8	77.91	0.83	5.0
Stage 29	3	80.16	1.21	6.0
Stage 31	1	93.42	2.2	8.0
Stage 38	4	102.74	5.13	10.5
Stage 39	5	107.61	7.39	12.4
Stage 40	22	114.78	11.3	16.8
Stage 41	1	115.20	18.0	18.0

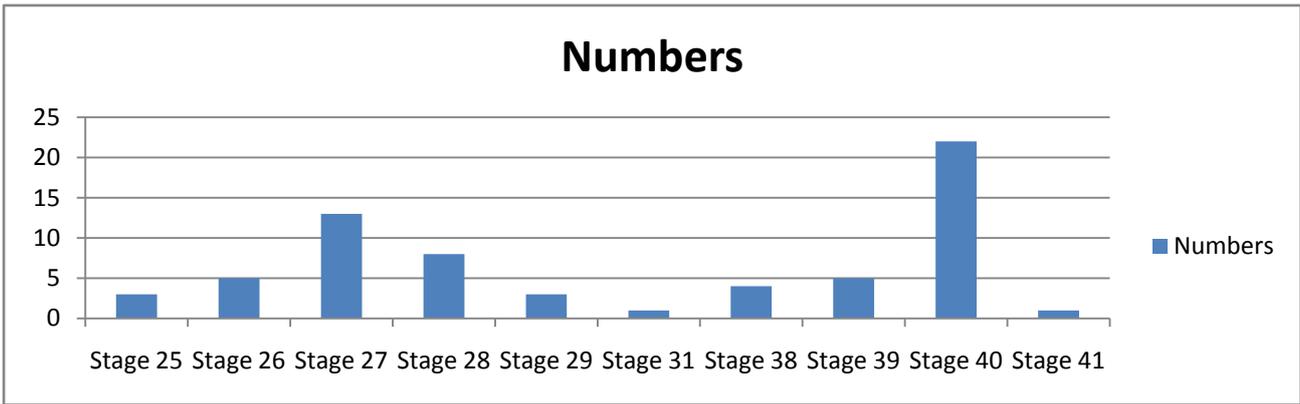


Figure 10. The number of Captured tadpoles at various development stage in Yuao

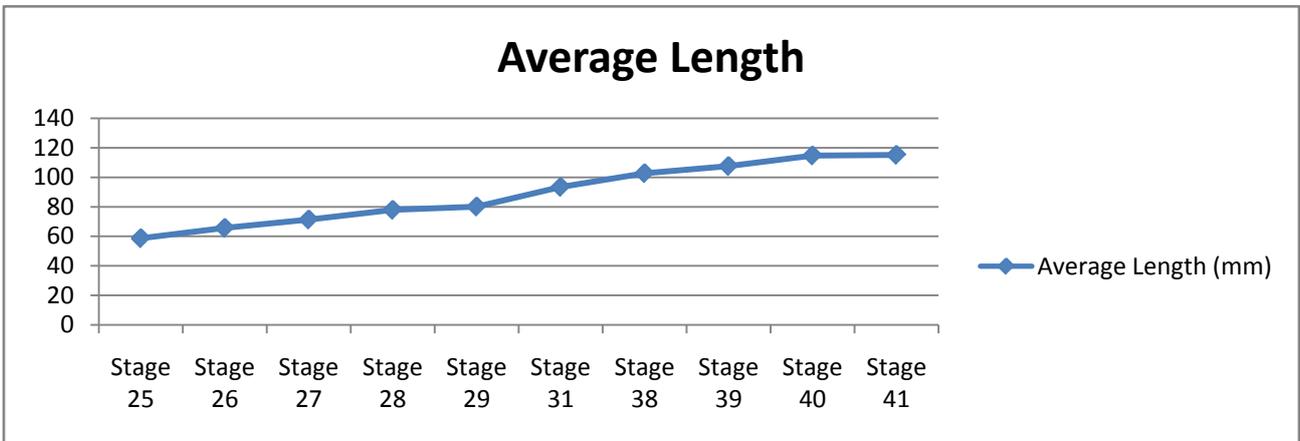


Figure 11. Average weight of captured individual tadpoles in Yuao

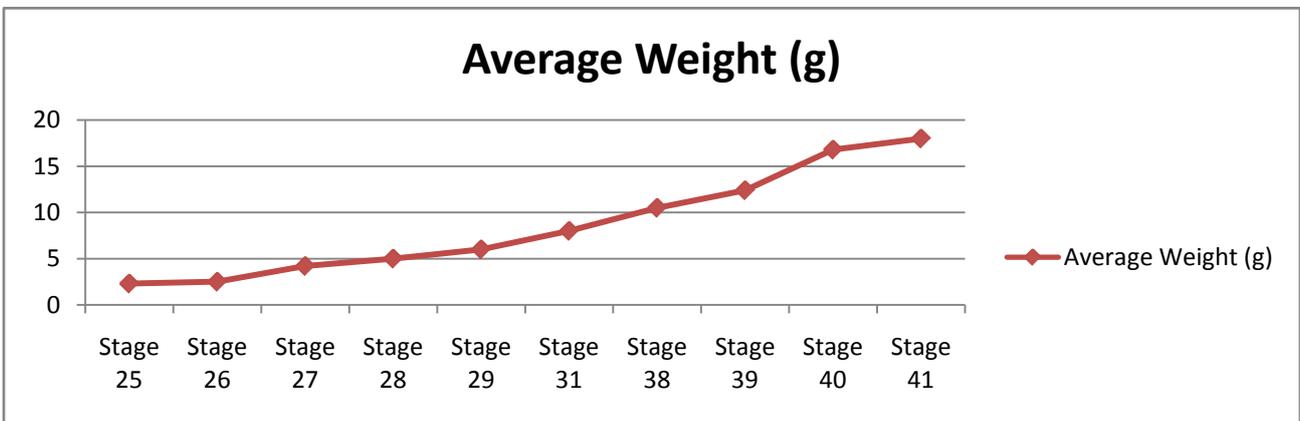


Figure 12. Average weight of captured individual tadpoles in Yuao

The team member estimated that the total number of tadpole population in two surveyed stream sections of Heiwan River plus its upper section beyond Yu-ao is above 2500. The age structure of sampling group population is showed as below (see Figure 7). In April 2008, according to the survey in Tong-kuang-chang, among sampling groups, 59% of the whole is at stage 25, 10% remain at the early development of hindlimb (stage 26-30), 21% at the late development stage of hindlimb (stage 31-39). The age structure of tadpole population in Yuao section was surveyed in May 2008. A major group is tadpoles at early hindlimb development stage (stage 26-30), 16% at late hindlimb

development stage (stage 31-39), and there is 33% of the group reached stage 40 and prepare for complete metamorphosis.

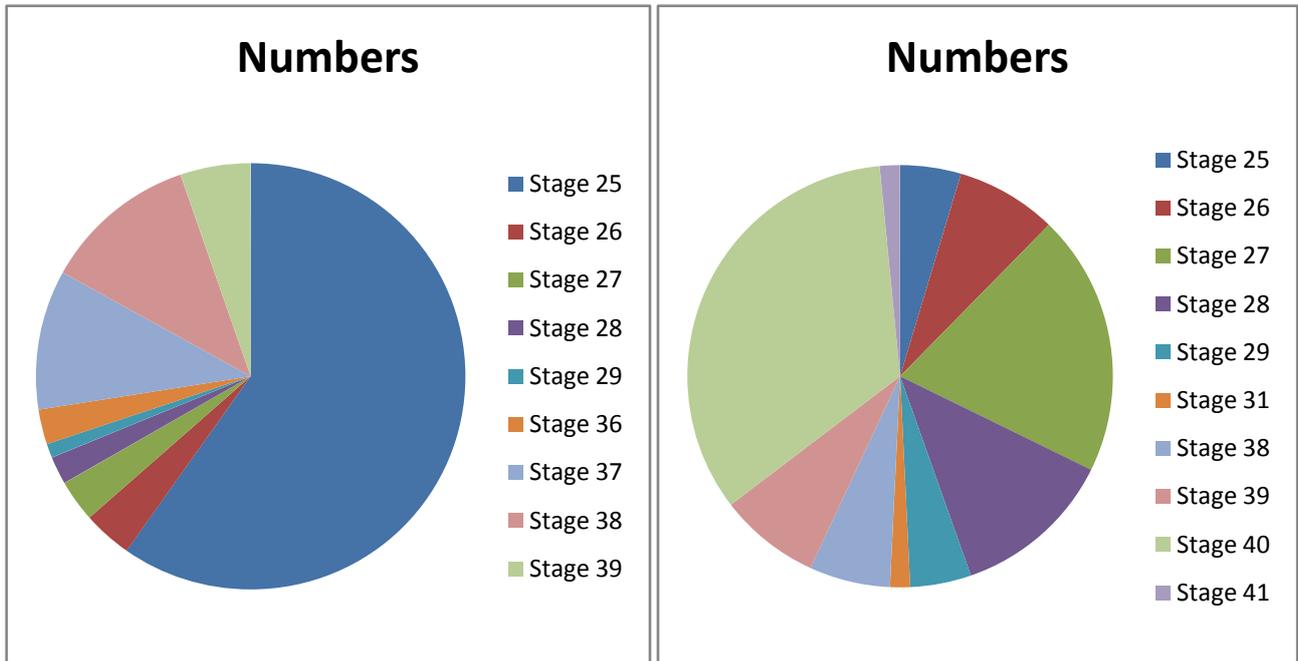


Figure 13. Average weight of captured individual tadpoles in Tongkuangchang



Tadpole of *Vibrissaphora boringiae*



Team member are collecting and measuring tadpoles



Searching for adult toads, egg masses and tadpoles in the streams

## 7. Hibernating

Because various of *Vibrissaphora* species usually breed in separate period such as late autumn, winter or early spring, and it is extremely hard to find any individual adult toad in non-breeding season, so it has been argued that whether species hibernate or not.

One of our team members, Xiaoping Lei, who works in Fanjingshan Nature Reserve, had encountered a male *Vibrissaphora* hibernating in the mud during winter through a field conservation patrol at the elevation of about 900-1000 m a.s.l. near the stream.



Hibernating male toad in the mud (a)



(b)



(c)

This is the first photo evidence to directly demonstrate *Vibrissaphora boringiae* would hibernate in the winter and wake up to breed in the spring.

## 8. Radio Tracking





Radio tracking is difficult to implement in Fanjingshan Nature National Reserve. We were only able to track four toads successfully, while other units were lost or cannot be tracked anymore due to human disturbance by workers, technical problems and rugged terrain.

### **Study species**

Individuals of *Vibrissaphora boringiae* are assumed to be active in a broad spectrum of riparian habitats during non-breeding season but can only be found under rocks in stream during breeding season. The species breeds only within limpid mountain streams in mid-March in Fanjingshan (Fei and Ye, 1984). Tadpoles mature in 3 years before complete metamorphosis. Adult males (69–82 mm) are bigger than adult females (61–67 mm).

### **Capture and radio transmitter attachment**

Our efforts to capture toads at daylight hours and night were assisted by pitfall trapping and searching rocks in the stream, and toads were processed and released onsite within 10–15 min. Because we had only found 13 individuals (including a dead body of female toad), it is hard to maintain equal sample size of both sexes as initially planned (8 male and 8 female), we harnessed 6 transmitters to 6 individuals (four males and two females), the locations of where other 7 individuals being found were not proper for radio tracking due to safety consideration. In general, all tracked individuals were haphazardly selected. Holohil model BD-2G radio transmitters were attached to toads by using silicon belts that was secured around the waist. The transmitters were designed with a 56 days nominal battery life and weighing 1.2 g. The total weight of each unit, including the waist band, was less than 2.0 g. Radio-tagged toads were also injected with specific PIT tags for individual identification in the event of recapture after transmitter failure or loss.

### **Radio-tracking schedule**

Data on radio-tagged frogs were gathered from 20th March 2008 through 10th May 2008. We had attempted to maintain tracking on six individual toads, but we lost signals of two transmitters due to attrition as individuals shed transmitters or transmitters failed, we lost one male and one female after their leave from chosen breeding sites. In all, 4 radio-tagged individuals contributed to the

summary data reported here. Each radio-tagged individual was tracked regularly at 6-hour interval during the breeding season; and at 4-hour interval during the post-breeding season.

### Data records

All radio tracking was done during daylight hours when adults are generally inactive. We did not track signals at night due to safety consideration (ragged terrain). Toads occupying aquatic and terrestrial habitats were located by homing in on and then circling the tagged individual at a distance of 2 meters or less. Because Toads in stream during breeding season and on land post breeding period were nearly always tend to hid beneath concealing cover while picking up the signals, so close-range tracking did not disturb the target individual.

Each time a frog was located its position. Data were recorded on its duration days hide under sheltering rocks, moved distance between points, behavior, proximity to stream water and vegetation type. Distances of normal movement and proximity to water were estimated visually or paced if they were <50 m, and measured by a laser range finder if they were in the range 50–100 m.. In measuring segment distances travelled by toads, movement was considered to have been in a straight line between points.

### Description of Data

**Table 8. Duration Days under sheltering rocks**

	March (Days)	April (Days)	Total
#1 (M)	10	5	15
#2 (M)	8	9	17
#3 (M)		11	11
#4 (M)		13	13
#5 (F)	1		1
#6 (F)		2	2

#5 and #6 were lost during tracking process due to unit attritional lost and ragged landscape that counteracted tracking activities. Only the number of their duration days hiding under rocks in the stream during the breeding period was recorded.

Females left breeding site almost immediately after successful copulation and oviposition, the duration days only last for 1-2 days, which made it extremely difficult to capture and track. Males tend to stay longer than females in the stream, usually last for 11-17 days.

**Table 9. Summary data of breeding and post-breeding movement**

<b>Toad</b>	<b>Minimum segment distance moved (m)</b>	<b>Maximum segment distance moved (m)</b>	<b>Maximum distance from stream (m)</b>	<b>Total distance moved aquatic (m)</b>	<b>Total distance moved overland (m)</b>
<b>Breeding movement</b>					
#1 (M)	3	17		22	
#2 (M)	2	5		7	
#3 (M)	1.7	9		10.7	
#4 (F)	1.2	11		12.2	
<b>Post-breeding movement</b>					
#1 (M)	17	58	35		390
#2 (M)	28	44	29		312
#3 (M)	8	49	46		286
#4 (F)	13	67	51		351

Males had a tendency to remain sedentary throughout duration days under chosen sheltering rocks (usually movement in this period is less than 3 m once the breeding site was chosen), but a minor movement (<17 m) in order to select more proper rocks to construct breeding sites was observed as well. Males that are sedentary under rock will emit sounds to attract potential female mates, but the distance between two males could be far more than 20 m, but this might caused by the rarity of the adult toads which were capable to breed.

Both of males and females would demonstrate a significant increase on movement distance after breeding period. The maximum overland segment distance moved could reach over 60 m. Toads become more active in a wide range of riparian zones and slopes of the mountain while summer was approaching.

Compared with other amphibian species of the region, *Vibrissaphora boringiae* is rather weakened in movement capacity, and relatively constrained to the stream and surrounding mountain slope areas (less than 300 m). This indicated that the conservation of riparian zones should be prioritized in the future works.

## 9. Environmental Impact by Infrastructure Development

The major negative impacts to adult individuals during the breeding period are illustrated as below:

### *a. Impact by Road Face-lift and Expansion (Road Kill)*

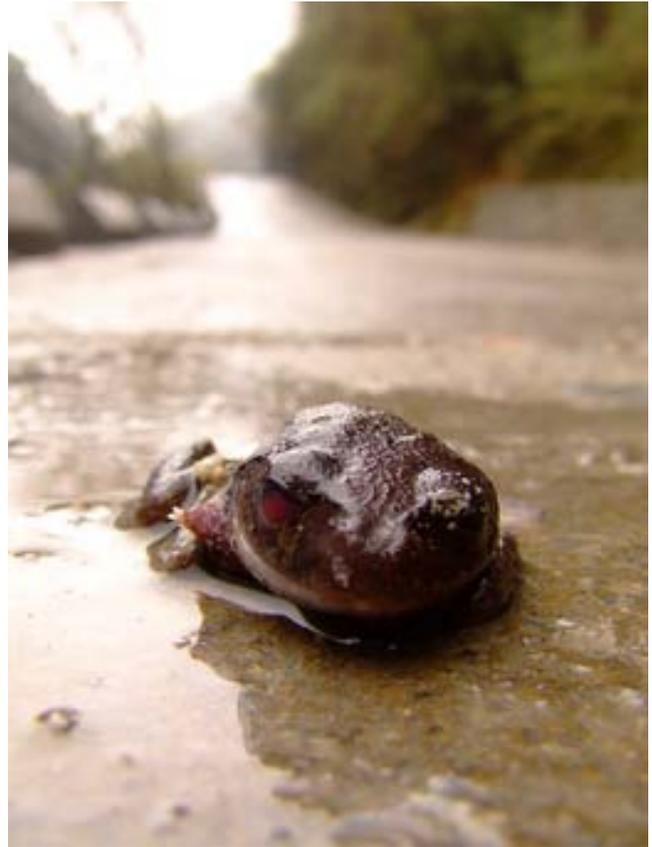
As road renovation project has accomplished, vehicles which take visitors and tourists could drive faster than they used to be. Thus, road kill has becoming a problem that could reduce active *Vibrissaphora boringiae* breeding pairs by accident while the species trying to across the road.

At the same time, many of construction workers now living within the core areas of the nature reserve along the main stream where the species occurred, their construction vehicles are running on the way for carrying materials more frequently than tourist cars. This traffic change on the road will continue for at least 2-3 years until the all infrastructure construction to be finished.

Increased vehicles on the road will raise the possibility of road kill. Though currently road kill seems at a low rate, because the nature reserve and other religious sites were closed to the visitors due to infrastructure development, but when it's finished, the visitors and cars will increase and the rate of road kill is expected to rise up, because the road design does not contains corridor and crossing structures for amphibians and reptiles.



Female *Vibrissaphora* toads dead due to road kill (1)



**Female *Vibrissaphora* toads dead due to road kill (2)**

(1) The average width of the cement road that cut off the original pathway from the natural mountain slope to the breeding stream is 4.80 meters. The average height of upper retaining wall is 3.83 meters, and for the bottom section of retaining wall, the average height is 2.71 meters.

(2) The design of cement road and improper height of retaining wall apparently ignored the survival and successful breeding of *Vibrissaphora boringiae*. There is no green corridor for the species to crawl through and may cause deadly accidental fall of adult individuals who attempt to enter the stream for breeding.

(3) Road kill may quickly rise as a major threat to *Vibrissaphora boringiae* in Mt.Fanjingshan especially during the breeding period. It is noteworthy that Fanjingshan National Nature Reserve is also a tourism hotspot for nature landscape viewing and religious sightseeing, the road and the area where the species occurs is currently closed to collective groups of visitors due to the massive infrastructure construction, but at least one female adult and one male adult were identified to be killed by passing cars, trucks, construction workers or casual visitors. Once the road is back into normal operation, a significantly increased number and frequency of passing cars and visitors may pose a big threat and cause unexpected disturbance to the breeding and survival of both adult toads and tadpoles in the easily accessible stream.

(4) Upper and bottom retaining walls may handicap some adults who prepare to enter the stream for copulation and breeding, and made the return to the original habitat became more risky or even impossible.

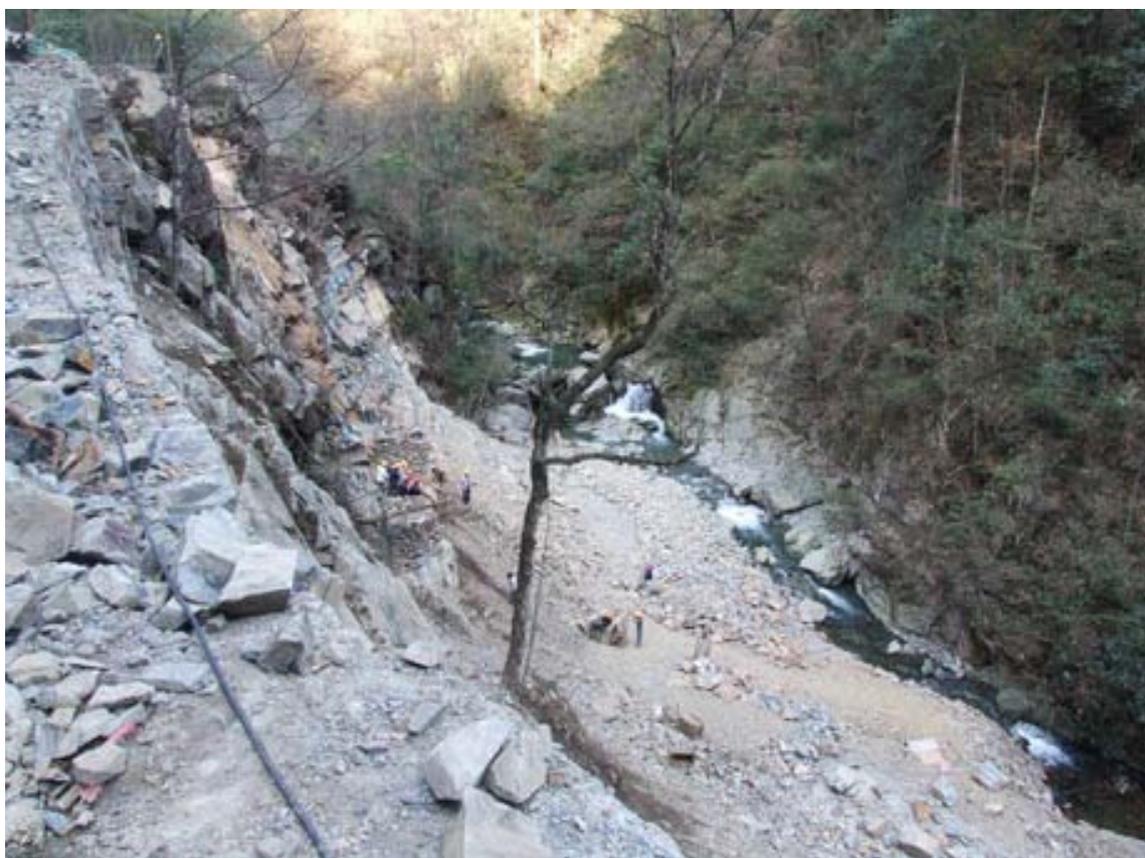
(5) Once tadpoles have finished their metamorphosis, the retaining walls and cement roads would barricade the successful return of many sub-adults from the stream area to the mountain slope on the other side.

***b. Impact by Telpher Construction***

(1) Construction caused unnatural stacking of huge fallen rocks on the streambed has narrowed the width the stream and thus produced a quicker flow of the water, which is extremely detrimental to the tadpole population and adult breeding.

(2) Construction project made temporary residents in the core area of the nature reserve increased significantly comparing to the past level. Settled workers harvest toads purely for fun or food, we observed that a male mustache toad was killed during the survey by the worker on purpose;

(3) Construction development destroyed and altered parts of suitable habitat and pathways from riparian zones to the streams, which is critical to the conservation of local small population.



**Early development stage of telpher building**

In the past, although the nature reserve was trying to develop ecotourism, it remained at a moderate and traditional level. Now, as telpher system is under construction, it has brought a huge ecological pressure on current environment and specific stream sections of streams which is suitable for *Vibrissaphora's* breeding activities. Another problem caused by infrastructure development is road renovation. The road renovation project cuts off the regular route from mountain areas to streams in the bottom of the valley. It built some concrete walls and deep drains along the road to prevent the road being soaked by the rainfall water, and toads are hard to get into the stream or get back to its original habitat by climbing over these artificial constructions.



**Telpher construction site**

*Vibrissaphora boringiae* requires and has a strong preference to choose smoothly flowing stream section for breeding, but deserted construction materials and construction site has dramatically altered the original landscape and increased flow speed of the stream by narrowing streambed, this human activity causes a huge impact to Yu-ao stream section where used as a breeding site in the past by *Vibrissaphora* breeding pairs. The construction project has further reduced the size of suitable habitat for *Vibrissaphora* breeding, and it is irreversible negative result.



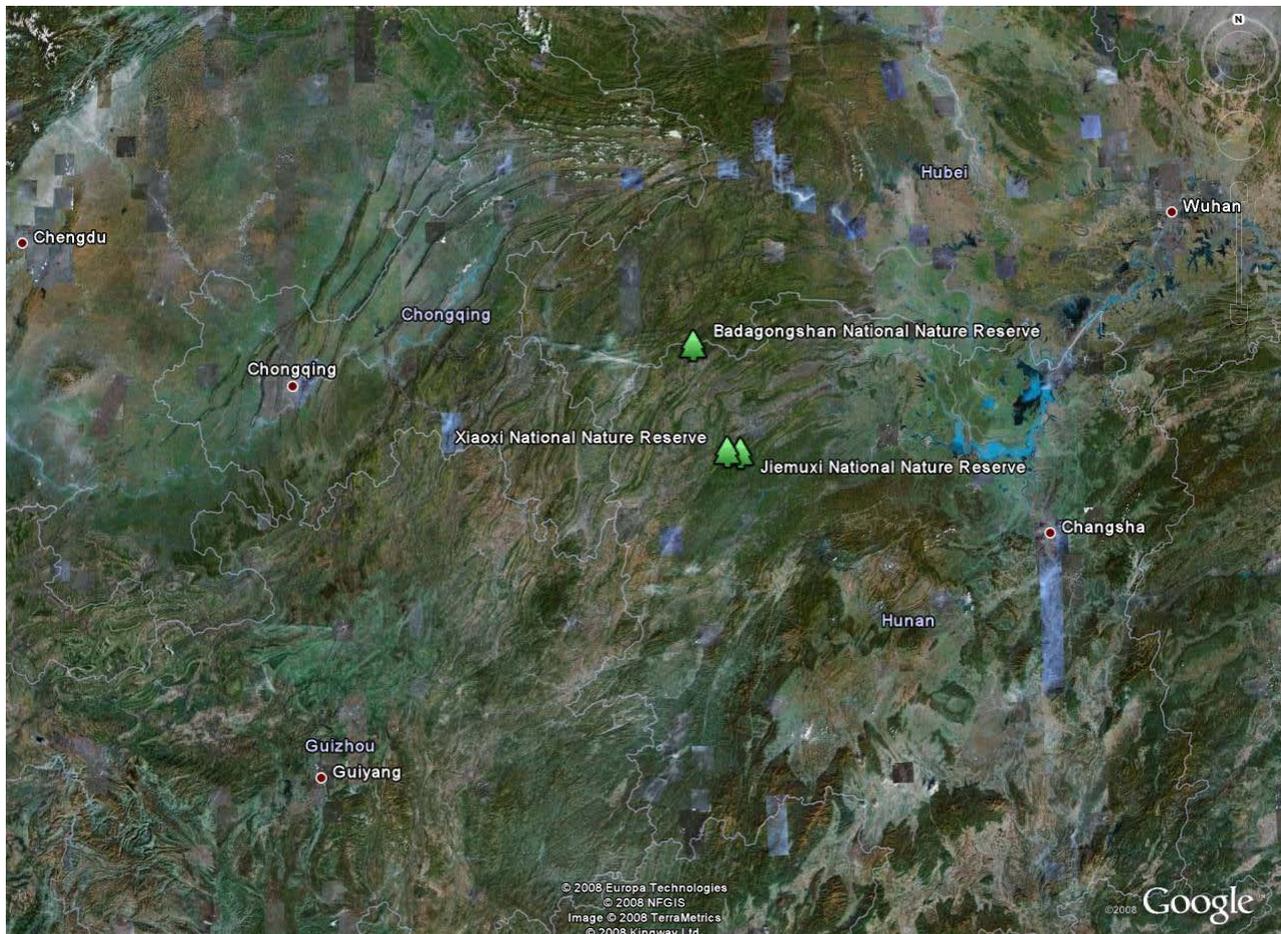
Gluing education poster to the living facility rented by workers



Telpher building under construction has narrowed and devastated part of streams in Yu-ao

# Site C: Distribution and Status in Hunan province

## 1. Study Area



Map of quick survey in Hunan province

As *Vibrissaphora boringiae* is rare and very hard to find in Fanjingshan Nature Reserve, it is necessary to expand field searching in Hunan province and find more distribution sites if possible.

Hunan province is an important geographical area that divides the distribution of *Vibrissaphora boringiae* and *Vibrissaphora liui*. In this province, *Vibrissaphora* species begin to diversify into different species, though the boundary lines may lie in Wulingshan Mountain Radge, a specific mark line cannot be determined due to the shortage of distribution site data. It is possibly the species is widely distributed in mountain streams on the whole, but appears to be rare at any given single site.

We conduct a quick survey in Hunan province, but due to limitation of the budget and time schedule, we were able to cover only three national nature reserves within a short period of 12 days.

Among three surveyed nature reserves, two were established in 1980s and another Jiemuxi National Nature Reserve was established as a new national nature reserve very recently. Quick assessment on current conservation status and distribution in Hunan province was conducted during 12 days. Species occurrence was determined by tadpole in the streams and interview with local rangers work in the forestry and wildlife management stations.

Generally, human harvest pressure on *Vibrissaphora* species in Hunan province seems low according to our interview with local residents, many of whom showed no knowledge about the existence of the species, or misidentified species by confusion with other local amphibian species. However, it is an amazing result to discover such a low level of human harvest on stream frogs in a specific area, however, the pressure may mainly transferred on common frog species distributed in agricultural rice fields, and another reason to account for the situation is that the remote, rugged and dangerous terrain may hinder local people to explore most of mountain streams deep in the mountain.

### Badagongshan National Nature Reserve



The Gateway of Badagongshan Nature Reserves



Bagagongshan Streams



Interview with staff who are works in local forestry management stations



Interview with local residents about occurrence of species



**Interview and dissemination of leaflets to local residents**



**Middle Section of Mountain Streams**

Bagagongshan National Nature Reserve is located between the border area of Hunan province and Hubei province. The nature reserve itself is renovating its road access to the deep mountain, so that some places at higher altitudes are not available to us. We just conduct surveys in the middle section and downstream, and we interviewed with local people and related officers in the nature reserve management bureau to collect information. Giant salamander (“CR” in the IUCN Red List) was ranked as one of the top threatened species in this nature reserve and in Hunan province. A problem is that local residents would harvest common frog species to feed giant salamander in captivity. Giant salamander is nearly removed from streams in the field due to intensive human hunt.

## Xiaoxi National Nature Reserve



**The Gateway of Xiaoxi National Nature Reserve**

Xiaoxi National Nature Reserve was established in the year of 1985. There is no occurrence record reported in related scientific reports or academic journals. The nature reserve is remote to access as parts of the road are under renovation. The management bureau of the nature reserve is also developing ecotourism with local residents who have been living inside the core area of the nature reserve, which led to construction of a numerous of hotels and private homes providing lodging for travelers, and basic infrastructure such as docks and boats.

We had interviewed with local residents in the village, rangers and staff who work in the local nature reserve management station, but they all expressed that they never take notice about if any occurrence of the species. That means, no body harvest *Vibrissaphora* toads.

Habitat and streams are under well protection, and nearly no human disturbance was identified, some illegal logging though, but only at small scale.

Villagers rely on tourism to bring incomes due to limited agricultural lands within the nature reserve. Thus, road kill on wildlife by vehicles became a problem once the roads were renovated for faster transportation.



**Interview with staff in the management station**



**Landscape of Xiaoxi Nature Reserve**



**Streams (1)**



**Streams (2)**



**Streams (3)**



**Tadpole**



Caution boards set up in the nature reserve



Road Kill by Vehicles



Human settlement and hotels for tourists and visitors within the nature reserve



Closed tourism management station



Another gateway to enter nature reserve



River dock



Anchored boats

Tadpoles were found widespread in various streams, even near the village. Age structure is well balanced based on quick assessment and sampling on several sections of streams that further indicated no human harvest on either adult toads or tadpoles. The discovered tadpole might be the *Vibrissaphora liui* rather than *Vibrissaphora boringiae*, as Xiaoxi Nature Reserve is closed to Jiemuxi Nature Reserve, and tadpole of *Vibrissaphora liui* can still be found in northern areas in Zhangjiajie city, and *Vibrissaphora boringiae* did not occur until Sangzhi County in Hunan province. That represents the distribution range of *Vibrissaphora boringiae* is very limited in Hunan province and further field surveys to determine the species boundary is required if possible.

Visitors and tourists are majorly access to the nature reserve by taking boats from another place of interest, once the road renovation project from another direction is accomplished, more visitors may come and cause pressures on the environment, but it is not likely to happen at current stage.

## Jiemuxi National Nature Reserve



**The gateway of Jiemuxi National Nature Reserve**

Jiemuxi nature reserve was newly established national nature reserve and no amphibian survey was conducted until 2005. In that 2005 survey by Central China Forestry University, they did not find occurrence of any *Vibrissaphora* species. Also, in the early submitted version of academic research articles by Rao and Zheng et al (2008), they did not collect DNA samples from Jiemuxi and Xiaoxi Nature Reserves.

Earlier month in 2007, a short news online revealed the possibility that *Vibrissaphora* species might occur as well in this nature reserve. We thus had decided to survey if in this area *Vibrissaphora boringiae* could be found. Unfortunately, at this site the species is still be identified as *Vibrissaphora liui*, but the environment is under well protection and few visitors even though local management station is seeking opportunity to develop ecotourism.



**Streams (1)**



**Streams (2)**



Other amphibian species which were found in the streams



Middle section of streams



Forestry Management Station



Deserted empty agricultural poison bottle in the rice field



We had found some deserted empty agricultural-use poison bottle in the rice field near streams, but there is no direct evidence to show that local residents would use these poison to kill tadpoles or adult individuals for food as residents who live in Leigongshan Nature Reserve did.

# Part C

## *Conservation Actions*

The level of human activities is a key factor to the successful conservation of threatened mustache toads in south China. Following conservation actions are positive efforts made to reduce harvest pressure on the species survival and raise conservation awareness among public groups.

### **1. Public Education and Community Awareness**

Since the movement ability of mustache toads are relative weaker than other amphibian species, and male ones tend to be sedative underneath the rock in the mountain streams for quite a long time during its breeding season, so it becomes much more vulnerable to external disturbance such as human harvest. Therefore, human factor plays an important role in the conservation of two threatened mustache toads, and intensive human harvest on mustache toads, including other frogs has been identified as a serious problem prior to and during the entire project implementation process. Hence, besides ecological research and assessment, public education that targets to raise community-based conservation awareness and attempt to cause further impact on future nature reserve management is another important part of the project.

Amphibian conservation is a tough issue to address in south China at present. Although frogs and toads are considered beneficial to agriculture as they eat pest insects, which is particularly important to the rice production, however, this reciprocal relationship was well maintained until the massive use of agricultural chemicals in China after 1980. Agricultural chemicals are demonstrated more effective to kill pests and in many places local residents have a well-established tradition to harvest some frogs for food to improve life quality due to the shortage of meat supply or feed poultry such as ducks and chicken, but the harvest activities was remaining at moderate level in the past. When agricultural chemicals were widely introduced and used by local villagers, they begin to harvest frogs intensively, first only on the frog species in the rice field, and later harvest range was expanded into areas of mountain streams. The government had issued wildlife laws to protect many endemic species including frogs but the law is flawed during practice. Its hierarchy system categorized species into three levels: (a) first class, (b) second class and (c) beneficial to research and commerce class. The definition for category (c) is vague, though “beneficial to commerce” appears, it does not allow harvest and sell without official permit or certificate. Moreover, any species which was appointed into this category will receive less attention, and unfortunately most of amphibian species in China were listed in this class, despite they are internationally identified as endangered or critically endangered by the IUCN or not.

To address these separate conservation issues, our proposed public education work was thus divided into two levels: (a) local site and (b) nation-wide. At each level, we used different ways to cause impacts and raise conservation awareness. We designed and made education materials listed as below to reach our education goals.

**Table - Education materials for public awareness education**

Material	Number
T-shirt	140
Caution board	24
Questionnaire	500
Poster	1000
Leaflet	3000
Project website	1
Magazine Exposure	2

On the site-level conservation, considering the background of local communities which are consisted of Han and Miao ethnic minority people, and they have a long tradition to eat frogs to improve life quality because shortage supply of meat. We decided to use questionnaire, leaflets and posters to conduct interviews and education directly by face-to-face talk and lectures in local schools. At some project points, many Miao ethnic minority people are unable to speak, read and write mandarin Chinese fluently because they still keep and use their own language so far. This brought difficulties in understanding each other. We did invite some bilingual local rangers work for the nature reserve management bureau to offer help, so the education program went successfully anyway. As frequency of harvest aim for mustache toads majorly happened during the breeding season, we also made some caution boards and set them up along the main roads and some of confirmed species breeding sites which are easily accessible along the roads, in order to warn and educate potential harvesters not to do so.

On the nation-wide level, we have submitted popular science articles to two magazines, “Chinese National Geography” and “Nature Watch”. The content of article to “Chinese National Geography” is mainly introduced *Vibrissaphora* species in China covered our fieldwork in Leigongshan and we appealed for more attention to endemic amphibian conservation in China. Another article was submitted to “Nature Watch”, a non-profit magazine produced by Southwest Forestry College and funded by Hong Kong Bird Watching Society. This article mainly covered the small stories happened in Fanjingshan Nature Reserve and copies of this magazine will be distributed to various of non-profit environmental organizations and related governmental departments in China for free, we do hope these magazine exposures can attract more attention from these organizations and public. Otherwise, we had submitted highlighting photos of threatened *Vibrissaphora* species taken in the field to a nation-wide photography competition about nature reserves of China. Each photo was attached with one of our field stories, and all those information was disclosed on the competition website which clicked and visited by many Chinese people. We are also constructing

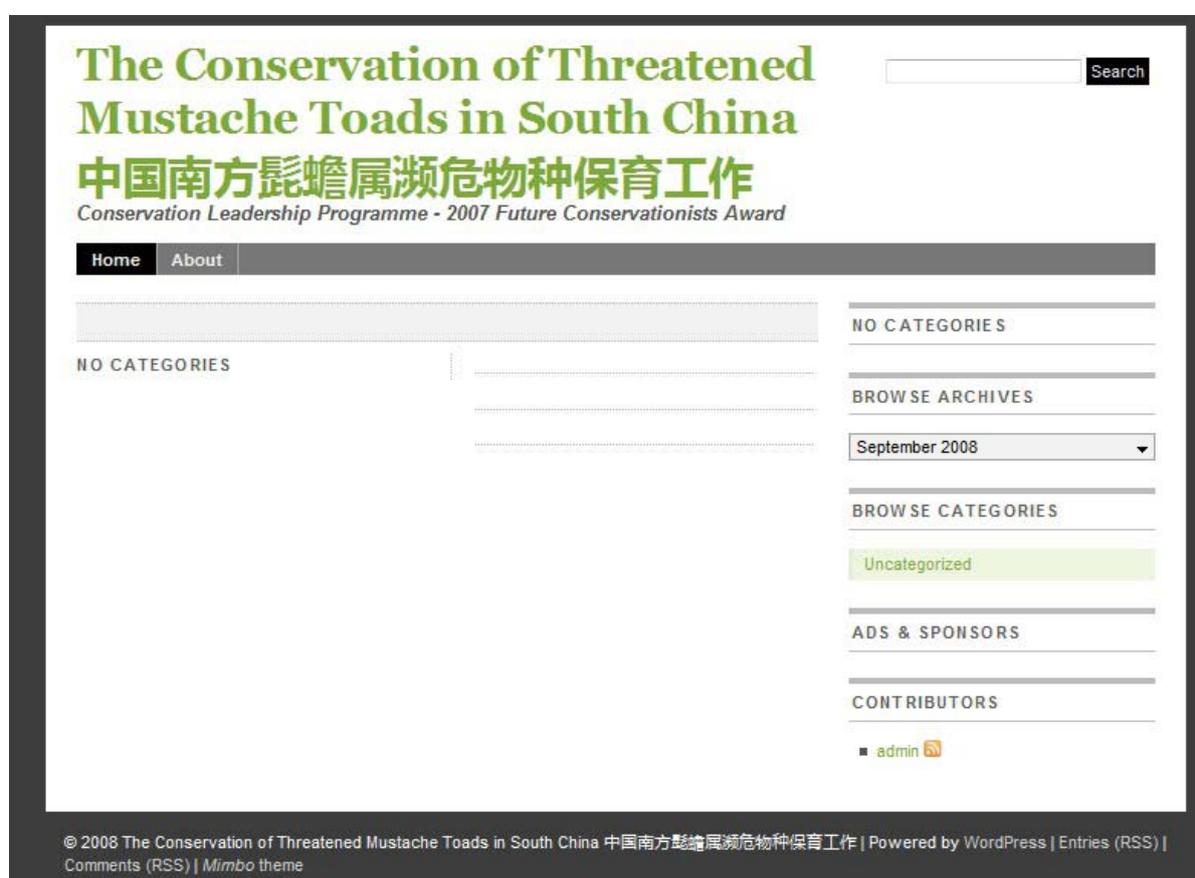
our own project website at the same time, as the website is a useful tool and important information source to made our appeal for more conservation awareness not only available to local public groups but also to the other parts of the nation and even the entire world.

With all these environmental education activities, it is expected the local communities and people live in other parts of the nation will not only increase their knowledge about global amphibian declines, frog conservation and endangered status of *Vibrissaphora* species, but also to change their behavior and improve nature reserve management in order to solve current existing conservation problems.

Below is each component of our conservation actions in detail description:

## 2. Project Website

The project website is under construction and will be online soon. The link to the website is <http://www.china-wilderness.com/vibrissaphora/>, it is a sub-site under the main domain name [www.china-wilderness.com](http://www.china-wilderness.com). The web index of the main domain is also still under construction, but the *vibrissaphora* sub-site will be work out at the first priority.



Snapshot of the web site under construction

The content of the website will include species knowledge, endangered status, threat analysis, other related project information, support and collaborative institutions and organizations, a gallery of highlighting photos taken in the field, etc. The website will enable more people live in the city or any place with internet to access to learn specific knowledge about *Vibrissaphora* species and conservation issues.

### 3. T-shirts



T-shirt with CLP logo, Slogans, Project Symbol and *Vibrissaphora* Image

The T-shirt with CLP and project-specific logo was originally designed as the primary identification symbol for the team and as award for public education program to promote community-involved conservation with nature reserve rangers, but due to the onset of breeding period by *Vibrissaphora* species was during the winter and early spring, and considering the coldness of the local weather, the team members were unable to wear it in the field, though other way for person identification was used at the same time.

T-shirts were therefore mainly given to active participants in the participatory process of questionnaire survey, or as award to those excellent students who contributed their essays and paintings during the environmental education program in local schools. Students who were awarded with the T-shirts will be expected to wear it during late spring, summer and early autumn, the conservation information printed on the T-shirt will be publicized among the community members.

## 4. Poster



Poster for Awareness Education

Therefore, we added a calendar onto it. Villagers can hang it on the wall of their home, use it to check date throughout the whole year. The calendar can be removed by the end of the year, and the rest part could still be used for long-term education.

The posters were not only exhibited in villages, but also the places like the gateway of the nature reserve, some inspection stations for illegal logging within the nature reserves, visitor centers, schools and restaurants.

The poster was designed to meet long-term communication and education goal for at least one-year within the range of all project sites.

The poster with amount of conservation information could be exhibited at individual home or public places, it can be kept and remain on the same position for effective education in a long period.

The pattern of the poster gives clear indication of current conservation status of the species by two standards: IUCN and China. We have considered that a simple poster for conservation and education purpose which to be disseminated to local villagers may be abandoned soon due to the less practical value to use by them.

## 5. Leaflets

### 两栖类动物的全球性危机

**【气候变化】** 全球变暖, 气候升温, 使适宜青蛙的栖息地逐渐干燥。

**【化学制品污染】** 有毒的工业和农用化学污染物可以轻而易举地透过青蛙的卵、皮肤, 造成大量死亡和畸变。

**【栖息地的丧失】** 对森林的过度砍伐降低了当地的水源涵养能力, 对湿地、草地的破坏导致了沼泽地干涸、草地减少; 使河流改道、筑坝等行为了造成了蛙类生活环境的变更和消失, 使蛙类渐渐失去了立足之地, 走向绝灭。

**【过度开发】** 对蛙类的商业性捕捉, 导致了世界上每年数百万青蛙的死亡。印尼、印度、孟加拉国等国因青蛙下降以后, 导致蚊子、疟疾的发生频率显著上升。

**【引入物种】** 世界各国之间经贸活动日益频繁, 有意无意地会将有害物种引入。如引进养殖的美国牛蛙逃逸到野外, 捕食当地原有的青蛙和蝌蚪, 给本地物种造成重大危害。

**【疾病】** 在澳洲和美洲, 壶菌传染病导致大量蛙类死亡, 亚洲也有爆发的可能, 人们对此毫无对策。

**【畸形】** 北美洲的蛙类产生了严重畸变。吸虫寄生虫的影响和杀虫剂及副产品的使用, 都是相关原因。

**【紫外线辐射】** 地球臭氧层变薄, 紫外线照射加强可以改变DNA, 降低动物的免疫力。紫外线的发射正在使部分地区的大量青蛙卵死去。

### 请遵守野生动物保护法有关条例 促进人与自然和谐共处

**第二十条** 在自然保护区、禁猎区和禁猎期内, 禁止猎捕和其他妨碍野生动物生息繁衍的活动; 禁猎区和禁猎期以及禁止使用的猎捕工具和办法, 由省级以上人民政府或者其野生动物行政主管部门规定。

**第三十二条** 违反本法规定, 在禁猎区、禁猎期或者使用禁用的工具、方法猎捕野生动物的, 由野生动物行政主管部门没收猎获物、猎捕工具和违法所得, 处以罚款; 情节严重、构成犯罪的, 依照刑法第一百三十条的规定追究刑事责任。

**第三十四条** 违反本法规定, 在自然保护区、禁猎区破坏国家或者地方重点保护野生动物主要生息繁衍场所的, 由野生动物行政主管部门责令停止破坏行为, 限期恢复原状, 处以罚款。

**第三十五条** 违反本法规定, 出售、收购、运输、携带国家或者地方重点保护野生动物或者其产品的, 由工商行政管理部门没收实物和违法所得, 可以并处罚款。违反本法规定, 出售、收购国家重点保护野生动物或者其产品, 情节严重, 构成犯罪的, 依照刑法有关规定追究刑事责任。没收的实物, 由野生动物行政主管部门或者其授权的单位按照规定处理。

注: “三有”保护动物指列入《国家保护的有益的或者重要的经济、科学研究价值的陆生野生动物名录》中的动物。鼋龟所有种类皆属于“三有”保护动物, 同样受到野生动物保护法的法律保护。

【折页设计】  
西南林学院保护生物学院 韩奔



摄影: 韩联亮

## 保护我国西南地区濒危的特有髭蟾

高枬类动物  
保护和教育  
南方工作组





IUCN 濒危(EN)

国家“三有”保护动物 摄影: 董明海

### 峨眉髭蟾

**【物种特征】** 峨眉髭蟾又叫胡子蛙, 为中国特有的世界级珍稀濒危两栖动物。每年繁殖季节, 雄髭蟾上颌边缘会长出8至11枚黑色角质刺, 有“中国角怪”之称。

**【生活史】** 每年2-3月繁殖, 产卵189-488粒。蝌蚪经两次越冬在第三年完成变态。

**【分布】** 我国特有物种, 主要分布于四川峨眉山、间断分布于贵州梵净山及湖南西北部。

**【生境】** 栖息于海拔600-1000 m植被丰富、水源充足、气候温和较湿润的常绿阔叶林带。

**【保护】** 世界自然保护联盟和中国濒危物种红皮书列为“濒危”物种, 同时属于国家“三有”保护动物。

**【致危因素】** 蝌蚪期长, 易遭天敌吞食, 成活率低, 成体数量稀少, 加以过度的人为捕捉, 在四川峨眉山几乎绝迹, 贵州与湖南尚有少量。



IUCN 濒危(EN)

国家“三有”保护动物 摄影: 韩奔

### 雪山髭蟾

**【物种特征】** 中国特有的世界级珍稀濒危两栖动物。繁殖季节, 雄蟾上颌边缘长出2对黑色角质刺。

**【生活史】** 每年10-11月繁殖, 每个卵群有卵约212-347粒。蝌蚪在水中经过两个冬天, 第三年完成变态。

**【分布】** 我国特有物种, 仅见于贵州雷山。

**【生境】** 栖息于海拔800-1800 m山区植被丰富、水源充足、气候温和湿润的常绿阔叶林带。

**【保护】** 世界自然保护联盟和中国濒危物种红皮书列为“濒危”物种, 同时属于国家“三有”保护动物。

**【致危因素】** 雷山髭蟾分布区域狭窄, 数量不多, 蝌蚪期长, 易遭天敌, 成活率低, 加以当地群众大量捕捉成餐食用, 数量急剧减少。

### 池塘, 溪流和森林

**【静水型繁殖的蛙类】**  
两栖动物的繁殖分配方式可以分为两种: 一种是静水产卵的物种, 多在夏季产卵, 通过增加窝卵数来增大窝卵能量投入, 偏重卵的数量。其种群具有较高的增殖能力, 卵径小, 发育迅速, 孵化和变态的时间短。蝌蚪数量多而个体小, 尾较短, 尾肌弱。越冬的蝌蚪极为少见(刘承钊和胡淑琴, 1961)。

**【流水型繁殖的蛙类】**  
另外一种则是流水产卵的物种, 通过增大卵径来增加窝卵能量投入, 能量分配偏重卵的质量。这些物种产卵数量少, 卵径大, 孵化和变态的时间长, 蝌蚪数量少而个体大, 尾较长, 尾肌发达。越冬现象较为普遍(刘承钊和胡淑琴, 1961)。

**【森林的保护】**  
无论是静水型繁殖, 还是流水型繁殖的蛙类物种, 其依托的大环境都是被良好保护的森林。森林在涵养水源、为动物提供栖息地和食物, 吸收二氧化碳, 延缓全球变暖速率方面, 都有着积极的作用。



### Leaflets for Public Education

The leaflets introduced general knowledge of global amphibian declines, natural history of two endangered mustache toads, different amphibian species, wildlife protection law, and conservation of vernal ponds, streams and forests. The leaflets were a major tool to educate local residents through a face-by-face way. We were able to draw their attention quickly by disseminating leaflets

copies, teachers, students and local residents had showed a great interest in reading it during our activities, some of harvesters also expressed directly that they harvest toads only because they think it's just for fun or treat it as small amount of diet, but they will not harvest toads anymore as they have realized its rarity by reading the leaflets.

## 6. Caution Boards

The original proposed budget for caution boards was to make 20 boards for public education and warning. Finally we had made 26 caution boards in total thanks to successful price negotiation with the dealer. Caution boards were set up at nature reserve management stations, or along the main roads of the nature reserve which lead to each separate villages, and some of confirmed mustache toad occurrence sites during the breeding season beside these roads and trails. Based on the purpose of educating and warning those local residents who harvest frogs during the frog breeding season or in the evening at any time, we requested the dealer to make caution boards by adopting light reflection materials, therefore it can be seen at night when harvester's hand-held flashlight is pointing at it.



Stack of caution boards

According to the former survey by herpetologists in 1980s, *Vibrissaphora boringii* only occurred in a main stream within the Fanjingshan NR. Otherwise, considering the wider occurrence of *Vibrissaphora leishanensis* in numerous mountain streams and intensive human harvest in Leigongshan, 16 boards were set up in the Leigongshan Nature Reserve and 10 boards were set up in the Fanjingshan Nature Reserve. Each board was attached to a visible position of a tall tree or the wall of the building.

## Setting up Conservation Caution Boards in Leigongshan National Nature Reserves







Setting up Conservation Caution Boards in Fanjingshan National Nature Reserve







## 7. Public Education in Leigongshan

### General Summary

There are more than 20,000 local residents live in the nature reserve, and their daily activities have been causing a series of management problems such as illegal logging and small-scale wildlife illegal hunting or harvest. Most of local residents speak two languages, Miao minority language and mandarin Chinese. They have received little environmental education, especially the education for species-specific conservation in the past, so they don't obtain awareness about the species rarity.

We chose to conduct environmental education in two elementary schools and one middle school within the Leigongshan National Nature Reserve. More than 320 students and 15 teachers attended in our education activities. Villagers as students' parents also got involved via questionnaire survey and "small hands to stop big hands" activity. During fieldwork, we educated over 150 local residents who were harvesting toads or harvesting on other wildlife or logging. Posters and leaflets were given to as many as villagers we encountered. 15 employees of Kangli mineral water workshop were also received education.

### Maoping Village



Maoping Village

Lectures were given in Maoping Elementary School for two hours. Student participants ranged

from grade one to grade six, with 103 pupils and 6 teachers. Essay and painting competition among students were held as a conservation awareness raising action. T-shirts and pencils were awarded to students who contributed their wonderful work. We also conducted questionnaire survey through students to investigate toad harvest status and motives. Students were asked to fill the survey form with their parents, and feedbacks were positive. Students using their learned knowledge on the lecture to educate their parents, hopefully this “small hands to stop big hands” education activity will reduce human harvest. We gave our education materials and lectures to teachers, and if they need any help while editing their own green school textbook, we would offer our help. Posters and leaflets were distributed to Maoping villagers, and exhibited in the village health care room, the school, and on the walls of some villagers’ houses.

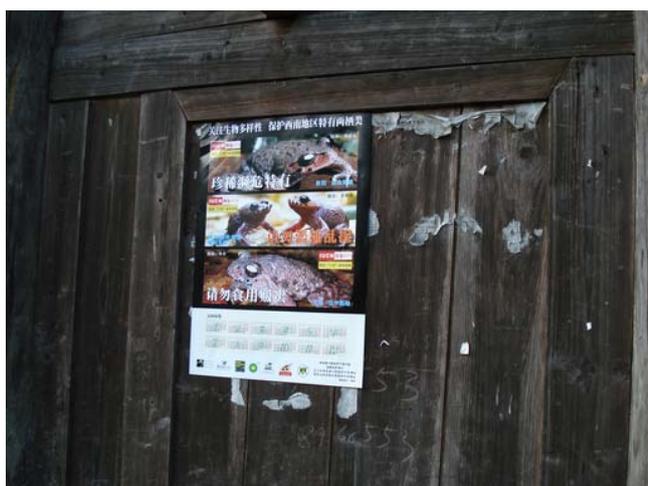
### Environmental Education Activities in Maoping Elementary School



Discussing with school teachers about education



Smearing Glue on Poster with Students



Poster on the Door of Villager's House



Poster on the Wall of Local Health Center



**Gluing Poster to the Wall of the School**



**Pupils Are Reading Given Leaflets**



**Giving lecture to pupils of grade 1-3**



**Giving lecture to pupils of grade 4-6**



**Explanation on filling questionnaire to promote "small hands stop big hands" activity**



**Selection and discussion on excellent works contributed by students**



Sketchy Painting by Student (1)



Sketchy Painting by Student (2)



Awards Ceremony for Active Students



Team Members with Students



School President Giving Awards to Students



Students Holding Awarded T-shirts

## Fangxiang Village



**Fangxiang Middle School**

Fangxiang is an important administrative village located in northern part of the Leigongshan Nature Reserve. It is also the place where the species was discovered in early times, and now has been identified as a site with intensive human harvest that endanger the survival of small population in this area.

Our education lectures were mainly given in Fangxiang Middle School due to available presentation facilities there. The number of student who had attended lecture and contributed to fill out questionnaire is about over 200 and 14 teachers also joined the workshop. After lectures, we hold essay competition among students to help them learn and recognize the rarity and importance of mustache toads in the environment surrounding them. T-shirts and pencils were awarded to students who contributed their wonderful work during the competition activities as same as we did in Maoping village.

Other parts of education program such as questionnaire survey for students and their parents, “small hands stop big hands” education activity, education materials share with school teachers, dissemination of posters and leaflets to Fangxiang villagers also went as the same as what happened in Maoping. Local residents expressed that it’s the first time to receive education for species-specific conservation and they appreciate the opportunity.

## Education in Fangxiang and Local Middle School



Giving lecture to students



Students attending lecture



Filling questionnaire (1)



Filling questionnaire (2)



Team members are disseminating leaflets to villagers

## Wudong Village



**Wudong Elementary School**

Wudong is the first village along the road after the entrance of the whole nature reserve from the gateway. The village is trying to develop ecotourism and attract more tourists and visitors from surrounding cities and small towns. Education activities were conducted at Wudong elementary school which has 60 pupils and 4 teachers.

We held a public lecture at the play ground and the school president gave a short speech by himself after we introduced him some basic knowledge about the species. Student participants ranged from grade one to grade five, and the rest of teachers had participated in a workshop with students. Students and teachers showed a great interest and took notes actively of what they have learned from our team members. To raise conservation awareness and encourage students to join conservation actions in the future, T-shirts and pencils were awarded to students after essay and painting competition.

As same as we executed education program at other sites, students who had obtained knowledge were requested to fill out questionnaire together with their parents, and educate their parents not to harvest rare toads.



**School President is Giving Speech to Students**



**Students Are Reading Leaflets**



**Students Are Reading Leaflets**



**Students Are Taking Notes During Workshop**



**Liu Is Presenting Poster at Workshop**



**Teachers and Students Are Attending Workshop**



Li is Disseminating Leaflets to Students



Students Received Leaflets Are Reading

### Shuichang and Other Places

Shuichang is another human settlement place near our camp and about 20 employees received our environmental education. We had also distributed the rest of education materials to many of local residents encountered during our field survey.



## 8. Public Education in Fanjingshan



**The Gateway of Fanjingshan National Nature Reserve**

The human settlement point is mainly located outside the gateway of the Fanjingshan Nature Reserve. There is no village within the area of the nature reserve along the main road to the mountain peak. The Nature Reserve itself was a famous religious site in the past and now it is developing ecotourism that allows small business to be operated around its gateway section.

The frequency of human harvest in this nature reserve is very low, as many local residents nearly know nothing about species occurrence in the streams. The local people were consisted of owners of shops and restaurants from other places, and some villagers who have been living outside the core area of the nature reserve long time ago. Our environmental education was conducted by face-to-face talk during the dissemination of leaflets and posters. The owners of small business showed strong interests to cooperate with conservation activities, because they deem conservation of endemic frogs is a positive advertisement to attract more visitors and tourists.

Disseminating Leaflets and Posters to Owners of Restaurants and Shops







## 9. Online Photo Contest

### a) Photo Contest: Nature Reserves of China Through the Viewfinder



**The Logo of Online Photo Contest**

A photography contest with the theme defined as “Nature Reserves of China through the Viewfinder” was calling for photos taken in the nature reserves of China. The contest was sponsored by the State Administration of Forestry, The Beijing Organizing Committee for the Games of the XXIX Olympiad, and The Nature Conservancy, it is undertaken by the China Wildlife Conservation Association and the Wild China Film. The category includes landscape of nature reserves, endangered species, birds, mammals, plants and other wildlife, etc. Selected winner photos and excellent single photos will be exhibited for non-commercial use in the stadiums for 2008 Olympic Games hold in Beijing, and hotels that athletes to live in during the games as decorations and an education measure to raise public awareness and introduce nature landscape and wildlife to people from all over the world.

We the project team had sort out some of photos taken during the project implementation in the Leigongshan Nature Reserve and Fanjingshan Nature Reserve, and actively applying for this contest.



**Our Representative Photo Submitted for Contest**

endangered species. However, we are not sure if our submitted photos were selected to be exhibited

in the buildings for Olympic Games, but the exhibition on the contest website attracted many visitors live in the city with internet access opportunity. It is still a great opportunity to educate and raise awareness more Chinese people who live in big cities who surf on the internet.

搜狐网.com 搜狐新闻 设为首页 - 新闻 - 体育 - 娱乐 - 财经 - IT - 汽车 - 房产 - 女人 - TV - ChinaRen - 邮件 - 视频 - 博客 - 365 - 搜狗

大中华区 | 参赛说明 | 保护区地图 | 参赛作品库

## “自然中国，和谐家园 我眼中的自然保护区”摄影大赛活动

品牌首页 | 我的个人资料 | 上传图片 | 注册 [nb2006p]

类别	标题	照片
自然保护区摄影大赛《投稿作品》	自然中国，和谐家园——我眼中的自然保护区摄影大赛	11
《主投票作品》	参赛作品上页失读及不符合要求的，视为非投稿作品	188

6602 张图片于 199 个相册及 2 个类别，有 777 个留言，浏览量 755776 次

最新上传

人与自然\_保护区垦荒地的生产方式\_最新此称《青林》.jpg

人与自然 保护区居民古朴的生活方式 最新此称《青林》 canon5d 光圈f2.8 速度50 保护区部分村民依旧保存着古朴的生活方式。

最新此称

四月 13, 2008

D9CF1151.jpg

中国特有种京军靴蟾

2007年1月份，我们西南林学院的学生和老师在京军山国家自然保护区内，对京军靴蟾的繁殖和分布进行了一次初步调查，并拍摄到了雄性京军靴蟾的珍贵影像。

nb2006p

四月 13, 2008

人与自然\_白马雪山夏季牧场\_最新此称《青林》.jpg

人与自然 白马雪山夏季牧场 最新此称《青林》 canon5d 24-85mm,光圈4.5 速度400 白马雪山有多处水草丰美的高山牧场，供牧民夏季放牧。

最新此称

四月 13, 2008

D9CF2351.jpg

发生在滇藏型的婚食故事

2007年10月下旬的一天，因为得到动物保护先锋项目(Conservation Leadership Programme)的资助，我们在云南省白马雪山国家自然保护区内进行滇藏型的雪山鹧鸪的种群调查。包括我在内的由西南林学院学生和保护区工作人员共同组成的研究组的三名成员，沿着山腰的一条溪流溯溪而上，搜寻和记录在繁殖季节下半繁殖的成鸟及幼鸟数量。因为雪山鹧鸪的体型较大，当地居民也对其进行捕食并用来煮汤。一路上看到许多当地居民在溪流内捕捉幼鸟与成鸟还有煮汤的痕迹，还看到了漂浮在溪流上用来捕捉幼鸟的空衣的网与抄网。当路过之一看，非常惊讶地发现一条疑似为科喉的蛇正在吞吃一只进入溪流试图寻找配偶进行繁殖的雄性雪山鹧鸪，于是我激动地按下了相机快门，这也许是人类首次在野外拍摄到蛇类捕食鹧鸪的记录，以前并未见到类似报道，这为鹧鸪的科学考察留下了一份宝贵的影像资料。虽然照片由我拍摄，但是能够在白马雪山保护区内记录到这份珍贵的婚食场景，实在是归功于三名调查组成员共同的努力。

nb2006p

The Snapshot of Our Submitted Photos in the Online Photo Contest Exhibition Gallery

b) Photo Contest: Yangtze—The River of Life



Logo of Yangtze photo contest

The online photo contest, Yangtze—The River of Life, was held by WWF China and Secretary Committee of Yangtze Forum. As the announcement of the contest indicated photos to reflect living status of that amphibian species which is endemically distributed in the region of Changjiang River (Yangtze River) will be especially encouraged, we had also submitted a group of photos for both purposes: public awareness education and contest for awards.

最新作品选登



更多

《[组照]雷山髭蟾的生活片段——(十一) 落入蛇口的雄蛙》



作者:tbulls  
票数:0  
上传时间:2008-12-18 22:44:06

《[组照]雷山髭蟾的生活片段——(九) 落入蛇口的雄蛙I》



作者:tbulls  
票数:0  
上传时间:2008-12-18 22:42:20

《[组照]雷山髭蟾的生活片段——(七) 雄蛙肖像I》



作者:tbulls  
票数:0  
上传时间:2008-12-18 22:35:48

《[组照]雷山髭蟾的生活片段——(十) 落入蛇口的雄蛙II》



作者:tbulls  
票数:0  
上传时间:2008-12-18 22:43:13

《[组照]雷山髭蟾的生活片段——(八) 雄蛙肖像照II》



作者:tbulls  
票数:0  
上传时间:2008-12-18 22:39:11

《[组照]雷山髭蟾的生活片段——(六) 爬向产卵场所的雄》



作者:tbulls  
票数:0  
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Snapshot of submitted photos to the contest online gallery

## 10. Magazine Exposure

The project team had prepared a popular science article that introduced the endangered status of *Vibrissphora* species which also covered many field stories during the project implementation in

Leigongshan Nature Reserve and submitted it to the “Chinese National Geography” magazine. Chinese National Geography (Chinese: 中国国家地理) is a Chinese monthly magazine similar to the National Geographic Magazine published in the U.S.A., but the readers group only restricted to Chinese people, and has a large monthly circulation which reached one million copies recently.



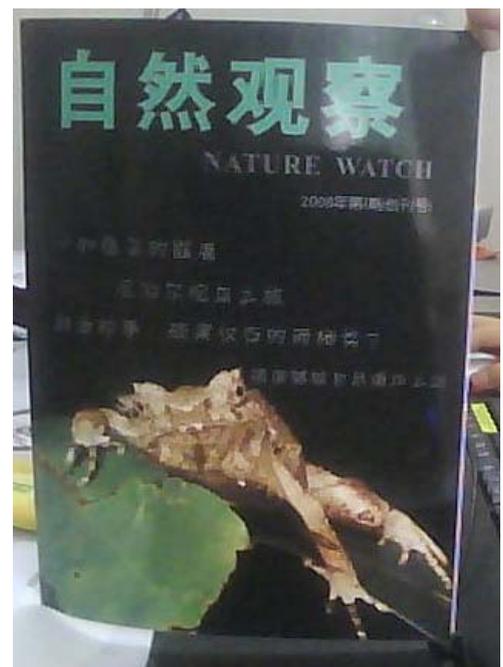
The magazine editor had accepted the article and approved to publish the article, it will likely to be exposed on the issue 11, November, 2008. The detail schedule may vary according to the arrangement by the editor. The article acknowledged the sponsorship by Conservation Leadership Programme and assistance from related experts. The article will be expected to raise conservation awareness and draw attention from related departments and NGOs.

The cover of Chinese National Geography, Issue 11, 2008

Otherwise, we had also prepared a similar article that covered other field stories of rest parts of the project. The article will be published on a non-profit magazine which is supported by Hong Kong Bird Watching Society, edited and published by the Department of Conservation Biology at Southwest Forestry College. The magazine is distributed to related governmental departments, local environmental organizations, education and research institutions, and etc.

All of our efforts made to raise public conservation awareness cannot change human's behavior immediately, but we had planted seeds in people's mind and they will grow bigger in the coming future.

Sample Cover of Nature Watch



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## Appendix 1. Fieldwork Schedule

Date	Site	Events
06.01-09.25, 2007	Kunming	(a) Discuss research plan (b) Purchase of research equipments (c) Apply for working permission in Leigongshan Nature Reserve (d) Design and print tables and materials for field survey and community education
09.26.-09.30, 2007	Kunming	(a) Discuss work plan and protocols (b) Training of members in order to be familiar with the use of equipments.
10.08-11.30, 2007	Road Trip: a) Kunming to Guiyang, b) Guiyang to Leigongshang	Car driving and transfer of research equipments including conservation education materials
	Leigongshan National Nature Reserve	(a) Be familiar with map, paths, important locations landscape and paths within research region. (b) Major field research work. (c) Conservation education activities in local schools and communities.
12.1.-12.3, 2007	Road Trip: (a) Leigongshan to Guiyang (b) Guiyang to Kunming	
The accomplishment of main fieldwork in Leigongshan NNR (The end of project phase I)		
03.01.-03.04, 2008	Kunming	(a) Group training (b) discussion and preparation for fieldwork in Fanjinshan NNR.
03.06.-05.16,2008	Road Trip: a) Kunming to Guiyang b) Guiyang to Jiangkou c) Jiangkou to Fanjingshan NNR	One person first went to the Fanjingshan NNR for initial stage of fieldwork.
	Fanjingshan NR.	The start of fieldwork.
	Road Trip: a) Kunming to Guiyang b) Guiyang to Leigongshan NNR	Two team members continued to finishe the setting of permanent conservation caution boards in Leigongshan NR.
	Leigongshan NNR	The finish of setting conservation caution boards in Leigongshan NNR.
	Road Trip: a) Leigongshan to Jiangkou b) Jiangkou to Fanjingshan NNR	Other team members join in the fieldwork at Fanjingshan NNR.

	Fanjingshan NNR	a) The progress of main fieldwork b) Community-based awareness and public conservation education.
05.17-05.20, 2008	Road Trip: a) Fanjingsha to Jiangkou b) Jiangkou to Guiyang c) Guiyang to Kunming	
The accomplishment of main fieldwork in Fanjingshan NNR (The end of project phase II)		
07.10-07.24, 2008	a) Badagongshan NNR. b) Xiaoxi NNR c) Jiemuxi NNR	Quick survey and assessment in three national nature reserves of western Hunan for Moustache Toad distribution
10.01, 2008. - Present	Kunming	a) Composition of preliminary and final report b) Preparation and submission of articles

## Appendix 2. Articles

### Published Popular Science Article

“Huziwa”: mysterious life of Leishan moustache toads. *Chinese National Geography Magazine*, Issue 11, p96-103.

### Submitted Journal Paper

Egg Masses Development of Leishan Moustache Toad under Natural Status Observation, *Sichuan Journal of Zoology*. (Accepted, in press)

### Papers Under Preparation

- (a) Breeding behaviors of Leishan Moustache Toad.
- (b) Distribution pattern and density of Leishan Moustache Toad.
- (c) Tadpole population of Leishan Moustache Toad.
- (d) Status of Emei Moustache Toad in Fanjingshan NR.

Note: the final number of paper under preparation may vary according to the composition decision by author, data integration and further analysis, and submission to journal is undecided.

## Appendix 3. Financial Report

Note: all prices were calculated in US dollar

<b>Purchase of Scientific/Field Equipments and Materials</b>				
Items	Budgetary	Actual Price	Handling charge	Total
Holohil System Ltd.BD-2 radio transmitters	2688.00	2751.00	29.41	2780.41
Radio transmitters shipment	154.00	154.00	0	154.00
Directional 4-element YAGI antenna	94	88.24	7.5	95.74
Garmin eTrex Vista CX Handheld GPS Navigaior, 1 set	250.00	250.00	0	250.00
Waterproof Boots 8 pairs	48.00	24.85	0	24.85
First aid box for poisonous snake biting.	80.00	80.00		80.00
Petzl Duo Led flashlight 4 sets	440.00	470.59	0	470.59
Rechargeable battery and charger	No budget	57.35	0	57.35
Small handy Led flashlighe	20	20	0	20
Onset Hobo H08-004-02 data logger,3 sets.	380	380.00		380.00
TMC6-HD 6ft Air/Water/Soil Temperature external sensors for H8 loggers	90.00	90.00		90.00
Hobo Shuttle Data transporter, 1 set.	159.00	159.00	123.75	282.75
Hobo H8 Software san Software Starter Kits.	99.00	99.00		99.00
Medical Wire and Eguipment MW 100 Dryswabs(For collect frog skin sample)	90.00	122.08	29.41	151.49
Trovan LID-560 Pocket Reader,1 set	220.00	220.00	Bank Handling charge 29.41 Custom fee 123.75	373.16
Trovan ID-100USB Transponder with lanced and barcode	70X4.40 =308.00	308.00		308.00
TravanIM-100US Retractor, for use with ID-100USB	4X2.5=10.0 0	10.00		10.00
The shipping cost for the Trovan PIT tagging kit in 108.82 via FedEx	109.00	109.00		109.00
Gloves, drift fence materials and plastic buckets	146.00	149.00		149.00
In total	5385.00	5542.11	343.23	5885.34
<b>Public Education Materials and Permanent Conservation Caution Boards</b>				
Foldouts (3000 copies) Poster (1000 copies)	175.00	217.58	Handling charge 7.30	224.88
T-shirts (quantity: 140)	500.00	517.35	Handling charge 35.18	552.53
Permanent Conservation Boards (quantity: 20)	700.00	24X\$30=720.00	0	720.00

In Total	1375.00	1454.93	42.48	1497.41
<b>Stipends for Fieldwork during Project Implementation</b>				
Stipends: Field expenses for team members(130 days for 4 people at \$8/per day)	4160.00	Leigongshan NR:8 people in total 320 daysX8/per day=2560.00  Fanjingshan NR: 8 people in total 210 daysX8/day=1680.00		4240.00
In Total	4160.00	4240.00		4240.00
<b>Long-distance and Regional Transportation for Phase I of Fieldwork and Community Education (10.08.-12.03, 2007. Kunming - Leigongshan - Kunming)</b>				
Train and bus (60 days and 2 persons)	Round trip 280.00	Driving to Leigongshan Highway pike 65.59 Gasoline 249.66 Train and bus 77.35		392.60
Regional travel in Leigongshan (By jeep)	120.00	100.00		100.00
In Total	400.00	492.60		492.60
<b>Long-distance and Regional Transportation for Phase II of Fieldwork and Community Education (03.06.-05.20,2008. Kunming - Fanjingshan - Kunming)</b>				
Train and bus(70 days and 2 persons)	Round trip 300.00	Train and bus 91.12+80.96 Driving : Highway pike 129.41 Gasoline 150.74		452.23
Regional travel in Fanjinshan	108.00	0		0
In Total	408.00	452.23		452.23
<b>Long-distance and Regional Transportation for Quick Survey in Western Hunan (07.10.-07.24, 2008. Kunming – Badagongshan – Xiaoxi – Jiemuxi - Kunming)</b>				
GasolineX2 people(By jeep)	108.00	Highway Pike 121.03 Gasoline 265.44		386.47
Stipends: 2peopleX12daysX\$8=192.00	192.00	3peopleX16dayX\$8=384.00		384.00
In Total	300.00	770.47		770.47
<b>Post-Project Expenses</b>				
Report production and result dissemination	770	Published 4 papers (Had to pay1paper published fee)		136.76
Telephone fee	51.00			51.00
Buy paper for print report	29.47			29.47
TOTAL				13552.28