

# Chinese Gibbon Conservation and Population Management Workshop

Guangzhou, China

April 22-23, 2018

## Final Report

## 中国长臂猿种群保护和管理培训研讨会

广州·中国

2018 年 4 月 22 日至 23 日

## 总结报告





Workshop organized by the Chinese Association of Zoological Gardens, Cloud Mountain Conservation, Guangzhou Zoo, IUCN Primates Section on Small Apes, and the Zoological Society of London.

主办方：中国动物园协会、云山保护、广州动物园、IUCN 灵长类专家组小猿组、伦敦动物学会。

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## ABBREVIATIONS

### 略语表

CAS	Chinese Academy of Sciences 中国科学院
CAZG	Chinese Association of Zoological Gardens 中国动物园协会
GRASP	Great Apes Survival Partnership 联合国大型猿类存续联合会
IUCN Primates SSA	International Union for Conservation of Nature 国际自然保护联盟灵长类专家组小猿组
KCC	Kadoorie Conservation China 嘉道理中国保育
KFBG	Kadoorie Farm and Botanic Garden 香港嘉道理农场暨植物园
NHFZ	Nanjing Hongshan Forest Zoo 南京市红山森林动物园
NRR	National Nature Reserve 国家级自然保护区
OVAG	Orangutan Veterinary Advisory Group 红毛猩猩兽医联合会
SSA	Section on Small Apes 小猿专家组
ZSL	Zoological Society of London 伦敦动物学会

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## **总结报告**

### **SECTION 1**

#### **Opening Remarks**

#### **第一章 欢迎致辞**

## **Xie Zhong, Vice President, Chinese Association of Zoological Gardens**

Driven by the efforts of competent authority, China's wildlife protection work has witnessed much progress recently, which is not only eyeing the symbolic species in China, such as Giant Panda, South China Tiger and Golden Snub-nosed monkey, but also other species and the natural environments. It then further promoted the work of population management of captive species in zoo community.

This workshop is about the protection of gibbons which is the flagship species in primitive forest ecosystem. They are the small ape living in the tropical forests of Southeast Asia, and the smallest in size among all the existing apes.

In Xishuangbanna, the *N. leucogenys* used to be a common species in the forest, but is now only found in zoos and experimental forests for wild reintroduction. On Hainan Island, the number of existing *N. hainanus* is less than 30. Statistics show that the gibbons in China are as endangered as the Giant Panda. "If we continue this situation, the *N. leucogenys* and *N. hainanus* will be extinct before us". Their situation is really dire.

Zoos are vital in managing the population of wild animals, as they keep a back-up of the species which may go extinct in the wild and prepare optional high-quality provenance for their reintroduction in the future. The nature reserves work for the recovery of wild populations. They are thus fellows of the same ally who are both fighting for the survival and development of the gibbons. We have arduous tasks on shoulder!

This workshop aims at strengthening the conservation and management of captive gibbons, prepare for possible reintroduction in the future, while deepening public education. CAZG also hopes that the workshop this time can also build up our capacity for in-situ conservation of gibbons, while aligning up with the conservation work of international gibbon protection organizations and nature reserves to act together for the recovery and sustainable development of gibbons.

## **Liang Fengyun, Director, Guangzhou Zoo**

- 60<sup>th</sup> anniversary of Guangzhou Zoo. Wildlife rescue center established at Guangzhou Zoo this year.

## **Wu Qirui, Deputy Director, Guangzhou Zoo**

- Wildlife protection long-term aim for Guangzhou Zoo, strengthen community within the relevant parties.

## 谢钟 中国动物园协会副会长

在我国政府主管部门的推动下，我国的野生动物保护工作发展态势良好，现在的保护工作不仅是对我国的特有物种，如大熊猫、华南虎、金丝猴等给予了高度关注，也对其它的物种和自然环境保护加大了保护力度，这一系列的工作更是促进了动物园行业圈养物种种群管理工作的开展。

这次培训的主题是长臂猿的保护，大家都知道长臂猿是原始森林生态系统的旗舰物种，是生活在东南亚热带森林中的小型猿类，也是现存猿类中体型最小的类群。

在西双版纳，北白颊长臂猿曾经是森林中常见的动物，而今仅见于动物园和野外放归的试验林中；在海南岛，现存的海南长臂猿数量不足 30 只。大量数据表明，中国长臂猿的濒危程度绝不亚于国宝大熊猫，如果我们放任这种状况发展下去，北白颊、海南长臂猿等物种将会在我们的眼前走向灭绝，形势严峻。

动物园是野生动物物种保护的重要机构，通过动物园种群管理工作，可以为野外可能灭绝的物种提供备份，为这个物种的再引入提供可能的优质种源。从事野外种群保护的自然保护区坚守着野外种群恢复的阵地，从这一点上说，参加会议的各位都是同一战壕的战友，为长臂猿的生存与发展共同战斗，可谓重任在肩。

这次会议的目的，就是为了加强圈养长臂猿各物种的保育和管理工作，为将来可能的物种重引入做好准备，同时深化公众教育，让长臂猿保护的观念深入公众意识中。与此同时，中国动物园协会也希望借助此次培训，提高长臂猿小种群就地保护水平，同时尝试与国际长臂猿保护组织和自然保护区的物种保护工作结合起来，取得共识，共同行动，为长臂猿这个物种的复兴和可持续发展共同努力。

## 梁风云，广州动物园园长

- 2018 年广州动物园成立 60 周年。同年，广州动物园成立野生动物救护中心。

## 吴其锐 广州动物园副园长

- 野生动物保护是广州动物园的长期目标，要加强与相关方的合作。



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## **总结报告**

### **SECTION 2**

#### **Conference Background and Goal**

#### **第二章 会议背景与目标介绍**

**Dr. Samuel Turvey**  
**Zoological Society of London (ZSL)**

Dr. Samuel Turvey has been researching and protecting endangered wildlife for more than 20 years in China.

There are currently four surviving gibbon species in China, and all of them are critically endangered. The number of *N. nasutus* or Cao Vit gibbon and *N. hainanus* is less than 30 respectively in China. *N. concolor* and the Hoolock Tianxing or Skywalker gibbon still have multiple populations, but extremely fragmented in distribution with no connection and gene flow between each other. Each isolated small population has a different living environment and therefore needs to be managed independently.

Different isolated gibbon populations in China have different protection status and likely viability, and their future reproduction and population expansion possibility is thus different. Take the subspecies *concolor* of the western black-crested gibbons as an example: there are about 600 individuals in the Ailao Mountain in Yunnan province in about 170-180 groups; but for the same subspecies, there are only 25 individuals in Huanglianshan Mountain in Lvchun County, Yunnan province in only 1-3 groups in dire living conditions.

Gibbon conservation requires three stages both in China and the world:

1. Removal of threats (hunting, habitat loss);
2. Protection and maintenance of existing populations;
3. Recovery of populations
  - Increase in population size (social groups, individuals)
  - Increase geographical distribution
  - Increase in connectivity between isolated populations

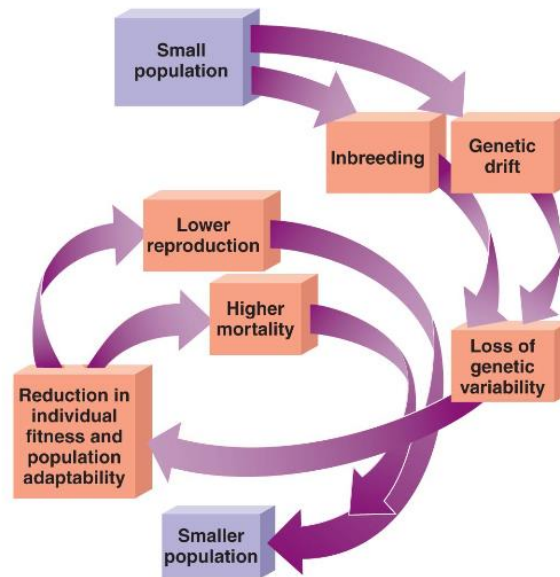
While protecting the existing populations, we need to recover the group size with the above three stages.

In terms of the removal of external threats, a lot of work has been done in China; for example, combating hunting and reducing the loss of gibbon habitats. In protecting the existing populations, China has already included gibbons into its list of first-class national protected animals; but for the third stage --- population recovery, more attention and input is urgently needed.

In China, nearly all gibbon populations are distributed in protected areas. Some of them are relatively secure and viable long-term due to large group size; while some others are very small in size, and therefore are intrinsically at risk of extinction, even if protected. And some population are too small and might not be viable any more, for example, those of only one group or only 1 or 2 individuals left.

Therefore, differentiated strategies need to be taken to protect and manage these gibbons of different population sizes. Not just gibbons, any animal with only very small populations are particularly vulnerable to extinction – as they are all vulnerable to the “Extinction Vortex”.

If only one very small population is left, close relative mating and genetic drift are likely to occur, and the loss of genetic diversity leads to a decline in the individual's health level and a weakened ability of the population in adapting to the environment, which further leads to a decrease in their breeding rate and increase in mortality. Thus the overall population will be decreasing. This process can be manifested as a spiral decline, that is, the fertility and viability of the population continue to decrease until it is extinct.



Even if a small population has been fully protected, there is still a certain chance that it will fall into the "extinction vortex." In addition, a very small population has very low defensive capabilities against accidents and natural disasters, such as typhoon or disease outbreak.

Not only for gibbons, any animal populations can be at great risk of extinction when their number of individuals is so small. So we can not afford to be complacent in conservation process. In the case of small populations such as Hainan Gibbon, it is not enough to just protect against external threats, as extremely small populations can CRASH with little warning. Therefore, it's very important to increase population size, habitat distribution, and connectivity, to reduce risk of stochastic population crash.

This means that it's not enough just to protect gibbon populations in protected area network with national legislation. Sometimes more direct conservation interventions are necessary.

The Hainan Gibbon in Bawangling once had only a few individuals left. Discussions and reports at the relevant meetings in the past pointed out that we need to reach an agreement and prepare an emergency response plan and have it in place before threats to gibbons occur, because this will allow quick response once catastrophe does occur without delaying time to have further discussions.

At the Hainan Gibbon Workshop in 2014, we discussed issues like what factors may cause the decline of gibbon population? How to define "emergency situation"? Should it be based on population state or its changing trend, or the discovery of new threat or the change in habitat state? From monitoring perspective, how would an emergency situation be detected? Is the existing monitoring is timely enough? If emergency happens, what alternative management strategies should we consider? How many options do we have and who would carry out the emergency response plan?

For these questions, we discussed some potential actions. Once emergency happens, we need to capture the left individuals for medical assessment, translocate them to different forest patch for protection and practice captive breeding. There are lots of expertise and existing techniques for these kinds of intensive actions elsewhere in the world, but no previous experience in China. There are lots of wariness and caution about even considering them as possible recovery actions for the extremely endangered Hainan gibbons. Scholars suggested trials in other gibbon populations in China as the first step.

For this meeting, we hope the gibbon conservation stakeholders in China can introduce different optional

emergency response plans, the international experience, share ideas and identify suitable management approaches to recover different Chinese gibbon populations.

This workshop will introduce fast and efficient monitoring methods for gibbons, the possible emergent situations when monitoring small populations, optional intensive management for extremely small populations (both in situ and ex situ), the ways to increase population size, distribution, and connectivity, to reduce risk of stochastic population crash. We will discuss the successful management approaches for gibbons outside China. Which options are particularly relevant for different Chinese gibbon populations? How can we make decisions about which management option is best for each Chinese gibbon population? What expertise, skills, training are necessary and available to be able to carry out each management option?

We also hope the meeting can help China side to understand what experience they need to learn and how they could be applied to gibbon conservation management at different sites in China.



**Samuel Turvey 博士**  
**伦敦动物学会研究员**

Samuel Turvey 博士在中国研究和保护濒危野生动物 20 年余。

中国现存有 4 种长臂猿，每一种都处于濒危状态，其中东黑冠和海南长臂猿的数量在中国各不足 30 只；西黑冠长臂猿和天行长臂猿虽然还保留有多个种群，但种群极度分散，群与群之间没有基因交流。每一个被隔绝的小种群生存境况不同，因此需要被独立进行管理。

中国被隔绝的长臂猿种群各有着不同的保护现状、生存力和未来繁衍、种群扩大的可能。以西黑冠长臂猿指名亚种为例：在云南哀牢山，现在还有大约 600 只个体，约 170-180 群；但同样的亚种，云南绿春县的黄连山仅剩不到 25 只个体，仅 1-3 群，生存状况却令人堪忧。

不管是在中国还是在世界，开展长臂猿的保护工作可以分为三步：

1. 去除威胁因子，如盗猎、栖息地丧失；
2. “严防死守”维持和保护现存种群；
3. 恢复种群——或以群计或以个体计；增加地理分布；增加隔离种群的连接。

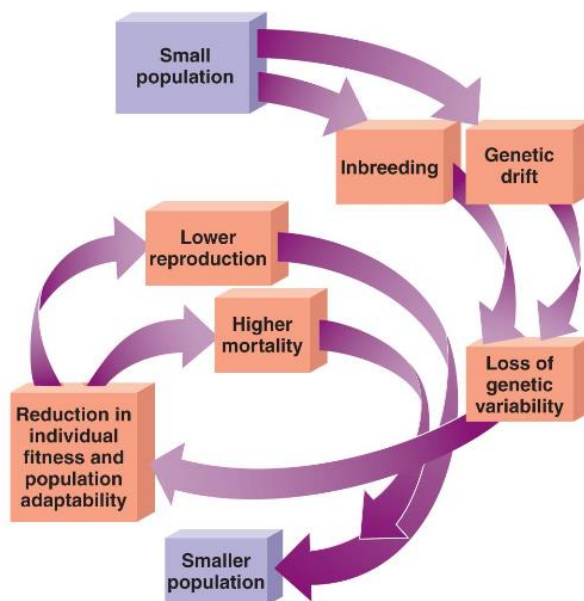
在保护现有种群的基础上，我们需要通过以上三个步骤来恢复种群的数量。

在去除外部威胁因子方面，中国已开展了很多工作，比如打击盗猎和减少长臂猿栖息森林的丧失；在保护现有种群方面，中国也将长臂猿列入为国家一级保护动物；但在第三步，即恢复种群、增加长臂猿的数量和地理分布上，急需我们的关注和投入。

在中国，几乎所有的长臂猿种群都分布在保护区内。其中的一些种群因数量较多而相对稳定，存活力强；但还有一些种群数量已极度稀少。就算这些长臂猿得到了全面有效的保护，它们仍然不可避免地处于灭绝危机中。中国的一些极小、孤岛分布种群很可能已经丧失了未来繁衍的前景，比如仅剩下一个家庭群或 1 到 2 只个体的。

所以在保护与管理这三种种群大小相异的长臂猿时，需要采取差异化的策略。不仅仅是长臂猿，任何一种只剩下极小种群的动物，都极度缺乏抵御灭绝风险的能力——因为它们都极易陷入“灭绝旋涡”（Extinction Vortex）。

如果只剩下一个极小种群，很可能出现近亲交配和遗传漂变（Genetic Drift），遗传多样性丢失，导致个体健康水平下降、种群环境适应能力减弱，进一步导致繁殖率降低、死亡率上升，种群数量不断减少。这一过程可表现为螺旋式下降，即种群的繁殖力和生存力不断降低，直到种群灭绝。



一个小种群即便已经得到了全面保护，还是有一定的几率会陷入“灭绝旋涡”。除了“灭绝旋涡”，一个极小种群对偶然事件和自然灾害的防御能力极低，如台风或疾病爆发。

不止是针对长臂猿，任何动物种群在个体数量如此小的时候都面临着极大的灭绝风险。所以我们在保育过程中切勿自满。以海南长臂猿这样的小种群为例，仅仅做好针对外部威胁的保护有可能是不够的，因为这种小种群很有可能在完全没有预警的情况下消失并灭绝。所以种群的恢复，栖息地的扩大，增加种群的连贯性，是小种群保护的重中之重，在此基础上才能降低小种群面临以上提到的情况下灭绝的几率。

这代表着，仅靠保护区和按现有法律规范的保护工作有可能是不够的，有些情况下有必要使用更加直接的人工干预办法。

霸王岭的海南长臂猿一度仅剩几只个体，过去会议的讨论和报告都指出，我们需要在威胁到长臂猿的灾难事件发生前，达成一致并准备好一个预备应急保护方案。因为只有这样，在灾难到来时，我们才可以立刻启动应急保护行动，而不需要再进行长时间的讨论耽误重要的保护时机。

针对海南长臂猿的小种群会议上我们讨论了威胁到海南长臂猿种群的一些因素，如何定义紧急状态，是种群数量低于一定数量，还是根据种群变化趋势，又或者是发现新的威胁或者栖息地质量变化？从监测的角度上看，我们如何发现紧急状况，现有的监测实时性足够吗？如果紧急情况发生了，我们用什么新手段进行应急处理，我们有几个方案，以及谁来开展这个方案？

针对这些问题，我们讨论了一些可能实行的手段，也许在紧急情况发生后，我们需要对仅剩的个体捕捉并进行健康检查，迁地保护，以及人工饲养。国际上有大量的专业案例和技术，但在中国

并没有尝试过类似的方法，所以学者们认为如果要针对极度濒危的海南长臂猿实施顾虑很多，如果先在其他中国分布的长臂猿种群中尝试一下会更加放心。

这次会议中，我们希望中国长臂猿保护的利益相关者为大家介绍一下可以考虑的应急保护方案，国际上的经验，以及培养中国长臂猿保护工作者对这些手段的了解与认知。

这次会议会为大家介绍国际上针对长臂猿开发的有效快速的监测方法，用以监测小种群有可能发生的紧急问题，探讨针对极小种群可以考虑的深度种群管理方案（包括在地和笼养），如何增强栖息地面积，质量，以及连通性进而减小种群数量锐减的风险。我们会探索国际长臂猿保护中有哪些手段曾经成功，哪些手段会适用于中国，我们如何选择合适的手段，使用这些手段需要用到那些训练与资源。

我们同时也希望这次会议可以让中方了解需要学习哪些经验，并针对中国的国情进行实施。

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### **SECTION 3**

#### **Population, Research, and Conservation of Gibbons in China**

#### **第三章 中国长臂猿的野外种群、研究进展与保护对策**



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There are 20 species of gibbons in 4 genera in the world, mainly distributed in Southeast Asia. West to India and south to Indonesia, China is the northernmost distribution boundary.

I will firstly introduce Siamang (*Symphalangus syndactylus*) which has only one species with two vocal sacs and combined index and middle toes. It's not distributed in China.

The second genera is Crested Gibbons *Nomascus* with seven species in the world, four in China; Third, Hoolocks with three species in the world, but only one in China--- *Hoolock tianxing* (Skywalker). Previously, we thought *Hoolock tianxing* was Eastern hoolock gibbon, but we later found that it is only distributed in China which has no other wild *Hoolock leuconedys*. We defined it as a new species then.

Last, *Hylobates* with 9 species in the world. China used to have *Hylobates lar*. But it may have already been extinct.

Now more details of each of them:

### *N. concolor*

With only a rough number of 1000-1300 in the world, it is categorized as critically endangered (CR) by IUCN. It is mainly distributed in Yunnan province in China, with a small population in northern Vietnam and northeastern Laos. The latest taxonomy divides it into four subspecies, three of which are distributed in China, and the Lao subspecies is only distributed in Laos. Among the three subspecies distributed in China, *N.c.jingdongensis* distributed in Wuliang Mountain in central Yunnan Province is of the biggest population with 400-600 individuals in 100 groups. The second subspecies *N.c.furvogaster* is also unique to China. It is distributed in the west of Mekong River in Yunnan. The latest survey results show an optimistic estimate of less than 30 distributed in three fragmented areas. The third *N.c.concolor* is distributed in Ailao Mt. It seems a relatively healthy population with 150 groups and some fragmented small population in southern Yunnan. There are no captive individuals for this species in the world.

### *N. concolor*

*N. concolor* has the largest population in China and the most attention from the world. Dr. Haimoff of the United States studied it in 1980s. To date, three international experts have completed their Ph.D. thesis by studying *N. concolor*, and several other scientists have also come to China to study it. The study was mainly carried out in Wuliang Mountain in Yunnan. In China, the study was largely led by Prof. Xuelong Jiang from Kunming Institute of Zoology, Chinese Academy of Sciences and me. Since 2003, we fostered a total of 8 doctoral and 5 master candidates and observed *N. concolor* at very close distance by successfully habituating three groups. The gibbons in this area have been monitored for 15 years now, so we've had in-depth study on its population dynamics, dispersal, genetic diversity, sleeping behavior, vocalization, overnight behavior, diet, home range use, time budget, and social relationships. It is the best studied among the six species that have existed in China.

### *N. nasutus*

*N. nasutus* was once considered extinct in the world before 2002 as no scientist in China have seen it in the wild ever since the founding of the PRC in 1949. Then in the 1960s, scientists believed that the population in Vietnam was also extinct. But in 2002, thanks to the continuous efforts of FFI (Fauna & Flora International), a small population was rediscovered at the Sino-Vietnamese border. Then in 2006, a team led by Kadoorie Farm and Botanic Garden (KFBG) Hong Kong rediscovered *N. nasutus* for the first time in China in the border areas with Vietnam. We began to study *N. nasutus* distributed in China since 2007.

So far we have done three comprehensive joint population surveys with Vietnam in 2007, 2012, and 2016, the result of which shows a slow increase of the population. In 2007, there were only about 110 species in one area and it slowly increased to about 120 in 21 groups after more than ten years of protection. We were also very pleased to find three new family groups in the survey. Same to *N. concolor*, there is no captive individuals of *N. nasutus* in the world. Its overall distribution area is very small, probably only 21 square kilometers in total which are completely isolated by two rivers. There are two relatively low-quality potential habitats outside the main habitat, but they don't have much capacity as there are many villages nearby. We concluded from the analysis of the habitat that in China they had the potential to form two to three new groups. We were very pleased to find out later that our prediction was correct. After more than ten years of protection, two new groups were discovered in the potential habitats. My team is the only team studying this species in the world. One doctoral and six master candidates had studied it. By this year, we have conducted 11 years of research on *N. nasutus* and got the key information needed for their conservation, such as population dynamics, dispersal, vocalization, diet and food choice, habitat evaluation and PVA, time budget, sleeping behavior etc. The most direct threat to this species is there is only very small population with no captive individuals, so any threat means its extinction.

#### *N. hainanus*

The next species is even more endangered. *N. hainanus* is the most endangered primate in the world. As a unique gibbon to China, *N. hainanus* was widely distributed on Hainan Island in the 1950s and 1960s, but the survey in 1960s and 1970s showed that there might be only 400-500 left, and by the 1980s, only 40-50. Then by 1989, the only distribution area of *N. hainanus* known for sure was Bawangling National Nature Reserve (NRR), with only seven individuals and the optimistic estimate was nine. Its population has been recovered slowly since the establishment of protected area in the 1980s but only followed by decline for unknown reasons. In 2003, a very large international team conducted a massive search in the Bawangling nature reserve which only found 13 gibbons in two families, with three adult females. At that time, the scientific community was very pessimistic and identified it as the most endangered primate in the world. Fortunately, since then, *N. hainanus* has been strictly protected. By 2014, a new group was discovered and then a total of 4 groups were finally formed in 2015 and 2016. Recent confirmation shows that there are now a total of 27 individuals. *N. hainanus* has a very small group for sure, and like the two gibbon species described earlier, there are no captive individuals in the world. The research on *N. hainanus* was mainly carried out by Bawangling National Nature Reserve, KFBG Hong Kong, Zoological Society of London (ZSL), and Guizhou Normal University. Dr. Zhang Mingxia from Kunming Animals of Zoology of CAS also did some study. We now know about its population dynamics. Although the population is small, its breeding is the best among all the gibbons distributed in China. One female gives one birth on average every two years, while the other gibbons in China take an average of 3-5 years to give one birth. Of course, the threat to *N. hainanus* is also over small population and limited habitat.

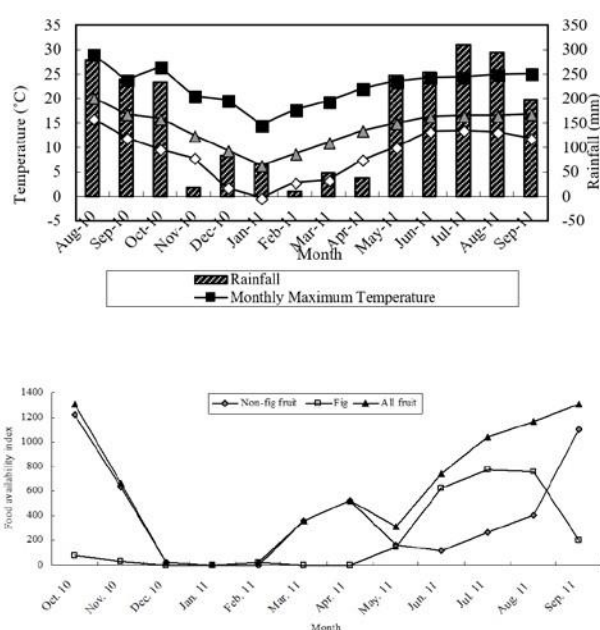
#### *N. leucogenys*:

*N. leucogenys* is currently extinct in wild in China. There were large distributions in the 1960s, and were commonly seen in Xishuangbanna. You could hear their call in the morning if you stayed in local hostel in Mengla County, Xishuangbanna. However, its population was reduced rapidly since the 1980s as a result of massive rubber planting (a similar threat to *N. hainanus*). In 1989, Hu Yu from Kunming Institute of Zoology conducted a survey in Xishuangbanna and identified a total of less than 40 individuals in only 9 groups scattered in 7 different habitats. However, due to insufficient attention to biodiversity conservation by the Chinese government then, plus low budget and inadequate manpower, the number of *N. leucogenys* dropped again as my field survey in 2011 revealed no traces of gibbons though I started in high hope as I was told of three potential distribution areas by the locals in 2008. Because there was still poaching in the protected area then, we concluded that even if several gibbons may still survive in the Xishuangbanna protected area, they are impossible to form effective groups for breeding, which means their functional extinction. No in-depth research has been done on it by any research teams in

China as *N. leucogenys* was already very rare in the 1980s. However, this species is reared in zoos all over the world, and there is also a relatively healthy captive population in China. To reintroduce the captive to the wild may be a way out for their future protection.

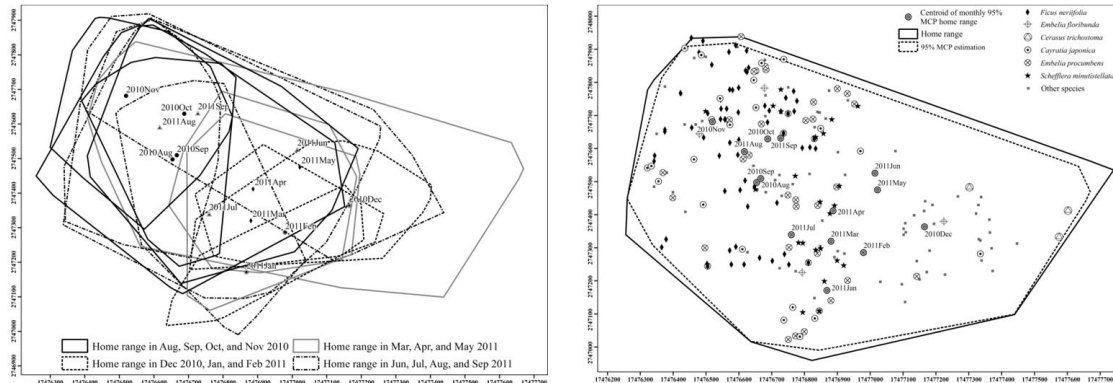
### *Hoolock tianxing*

The fifth species that I would like to introduce is *Hoolock tianxing* of the genera of Hoolock. There are currently less than 150 individuals mainly distributed in the western part of Yunnan Province, or west of the Salween River. Several of our surveys showed a decline of their population in the past decade. The number of captive individuals in the world is still not clear, but in China there is only one male in Kunming Zoo, and two males in the Beijing Zoo with no captive females, so there is no pairing possibility for the captive individuals. Invited by the Gaoligong Mountain National Nature Reserve in 2007, I began to study this species since 2008 and it's already ten years now. Basically, only my team in the world has studied this species, and so far one doctor and 4 master candidates had studied it as the subject for their thesis. I have studied *Hoolock tianxing* in 3 different places. The first was in Datang, Tengchong County, but it lasted only less than a year as our focus group was killed by poachers and one important guide died of diseases, so we had to stop the study there. For the second place, we studied there in two phases, from 2010 to 2011 and from last year until now. When I visited this population in 2007, there were only three individuals left, one male and one female, and another single female. This family group was not observed subsequent breeding after having two children. That single female could not find a male in the subsequent 11 years, because in this region, there were only 5 individuals, all from one family with only one adult male. If it dies, the population will never have the breeding possibility. So the biggest dilemma facing this region is pairing and breeding. As the group in this area is too small, I went to the third place (Banchang) and established a base for long-term observation and research. The study has been going on for more than six years there. We habituated in success a group of gibbons. The second group moved elsewhere when the habituation was nearly successful. The breeding of *Hoolock tianxing* is very slow. In our study, we observed a total of five single adults who moved out of their families, but unfortunately they were all male. The single female mentioned just now can find their mate, but here the males were having problems. This is a very serious problem faced by small populations. Unlike human beings, their range of activities is very limited, and there is no way for them to disperse far to find their mates.



Gibbons, a tropical species mainly distributed in Southeast Asia, are not suitable to the climate of Gaoligong Mountain which is very cold, and it sometimes snows in winter. The gibbons in history did not live in such habitats, but more in the valleys of the Salween River in more than 100 years ago. Now the

valleys are planted with coffee and sugar cane which forced gibbons to move to high-altitude areas where there are very low yield of the fruits they like in cold season. The poor food quality resulted in very low breeding rate.



- 66 food species
- 36 fruit species
- Annual diet: 49.1% fruit and 43.3% leaves
- Rely on leaves when fruit was not available

At the same time, the home range of *Hoolock tianxing* in this area is also very large. A family needs to travel about 100 hectares, but the gibbons living in Southeast Asia need only 20-40 hectares to meet their needs. The main reason is few foods of low diversity with only more than 30 kinds of fruit foods. The gibbons use nearly half of their time in eating leaves, and thus the calories are not enough.







### *Hylobates lar*

Lastly, I would like to introduce *Hylobates lar* which was once distributed in the southwestern part of Yunnan. In the 1980s, several researchers at the Kunming Institute of Zoology believed *Hylobates lar* a unique subspecies in China, but not enough attention was aroused. In 1992, Prof Daoying Lan of the Kunming Institute of Zoology concluded after survey that there were only about less than 10 individuals in three groups, but still not enough attention was attracted. In 2007, several experts from the University of Zurich in Switzerland organized an expedition team. I was fortunate enough to be the captain, but we did not find anything. We talked with local residents and they said that they hadn't heard the call of gibbons since 2000. When we were there for more investigation in 2007, there was no trace of the survival of the gibbons any more, with only many rubber trees in the habitat they once lived.

Now, the major threats to gibbons:

#### Illegal hunting:

Forest rangers had once run into the remains of *N. concolor* and the skull of *Hoolock leuconedys* trafficked from Myanmar to China which is said to be able to treat epilepsy.

#### Habitat destruction:

- Commercial logging and road building: But fortunately, things are much better now after special efforts by the Chinese government in protecting natural forests and their commercial logging has been well controlled.
- Plantation of "Cao Guo" or Amomum tsao-ko: Indirect deforestation of natural forest, and its extensive plantation in the gully region undermines the connectivity of gibbons habitats.
- Agricultural encroachment: Traditional inefficient slash-and-burn farming method was observed in Yingjiang County in 2008, but the survey in 2017 found that it had been controlled in a certain extent.
- Firewood collection: massive cutting down of neutral trees for firewood, but it has been gradually controlled after energy reform.
- Overgrazing: After the bottom plants are consumed, many vines are cut down, which has a certain impact on the gibbons.
- Deforestation for other reasons includes honey collection and house building.

Gibbons' habitat is damaged and fragmented for various reasons. The survived gibbons live in different forest patches, resulting in difficulties in pairing and breeding.

Finally a brief summary... there are six gibbon species in China. *N. concolor* has the largest population of about 1300. IUCN defined it as critically endangered. There are less than 150 for *H. tianxing* in China. IUCN's latest assessment also considers it critically endangered; Then *N. hainanus*, unique to China, with only one population of less than 30. It is the world's most endangered primate; And fourthly, *N. nasutus* living at the border areas between China and Vietnam. It was once considered extinct with only about 120 left in the world now, and less than 30 in China. *Hylobates lar* may have already been extinct in the wild in China and *N. leucogenys* may have already been extinct in China.

There are only four gibbon species left in China whose recovery is almost impossible by only protecting and managing captive populations, because three species have no captive individuals in the world, and there are only three captive individuals of *H. tianxing* but no females, and the males are not suitable for wild pairing due to various reasons. In situ conservation of these gibbons is essential, and the extinction of their wild populations means the extinction of the species due to lack of captive individuals. For *N. leucogenys* that has been extinct in the wild with only captive populations, reintroducing them into the wild can be a way out to restore its population.



The protection of wild and captive populations had been done by different institutions in China in the past with very little interactions and exchanges between each other. But today's workshop is a historic opportunity to pool together for the first time the insiders of the two sides to discuss the protection of gibbons. Previously, our research team did not have sufficient and effective communication with government authorities which failed to introduce timely and strong measures to protect gibbons in the country and thus not enough cooperation was achieved. All the gibbon species in our country are close to extinction, but our research capability and resources are limited. We thus need more international cooperation to share successful experience. We also need more public attention and the engagement of more scholars and students.



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全世界有 20 种长臂猿，4 属，主要分布在东南亚。西至印度，南至印度尼西亚，中国可以算是最北边的分布界限。

第一个介绍的合趾猿属的长臂猿只有一种，特点是有两个声囊，脚趾食指和中指合在一起，所以叫合趾猿，未在我国分布。

第二个介绍的是冠长臂猿属，在全世界有七个物种，其中四种分布在我国。

第三个介绍的是白眉长臂猿属，天行长臂猿也属于白眉长臂猿属，共有三个物种，其中在我国只有天行长臂猿分布。以前我们认为天行长臂猿是东白眉长臂猿，现在定义为新物种后我们发现事实上我国只有天行长臂猿分布，并没有其它的野生白眉长臂猿。

最后一个介绍的是长臂猿属，这个属在全世界有九个物种，我们国家曾经有其中的一个物种白掌长臂猿分布，但现在可能已经在野外灭绝了。

接下来简单介绍一下不同的物种：

西黑冠长臂猿，这个物种在全世界有大概 1000-1300 只，被 IUCN 评估为极度濒危物种，主要分布在我国云南，在越南北部和老挝东北部有少量的种群。按照最近的分类学观点，这个物种被分为四个不同的亚种，其中有三个亚种分布在中国，老挝亚种只分布在老挝。

在我们国家分布的三个亚种中，分布最多的是云南中部无量山的景东亚种，有大概 100 群，400-600 只。第二个亚种也是我们国家特有的滇西亚种分布在云南湄公河的西边，根据最新的调查，乐观估计的种群数量也不足 30 只，且片段化的分布在三个地区。第三个亚种是西黑冠长臂猿的指名亚种，在我们国家主要分布在哀牢山，现在看来相对来讲这个是一个比较健康的种群，大概有 150 群，在云南南部还有几个片段化的小种群。这个物种在全世界没有任何的笼养个体。

西黑冠长臂猿因为是我们国家种群数量最大的长臂猿，也是受到国际关注最多的长臂猿，从改革开放之后，上世纪八十年代就有美国的 Haimoff 博士开展过西黑冠长臂猿的研究。到目前为止，有三个国际专家以西黑冠长臂猿研究完成了他们的博士毕业论文，还有一些其他科学家来中国研究过西黑冠长臂猿。有关西黑冠长臂猿的研究主要就是在云南的无量山开展，中国的部分主要就是从昆明动物所的蒋学龙老师和我本人领导的。从 2003 年开始，一共培养了 8 个博士研究生和 5 个硕士研究生。在这里我们成功习惯化了三群西黑冠长臂猿，进而可以非常近距离的观察它们。对这个地区的长臂猿监测到现在已经持续了 15 年，所以我们对这里种群的动态，迁徙扩散，遗传多样性，鸣叫行为，过夜行为，食性，栖息地的利用，时间分配，以及社会关系都进行了相对深入的研究。目前位置在中国存在过的 6 种长臂猿里这是研究最为深入的物种。



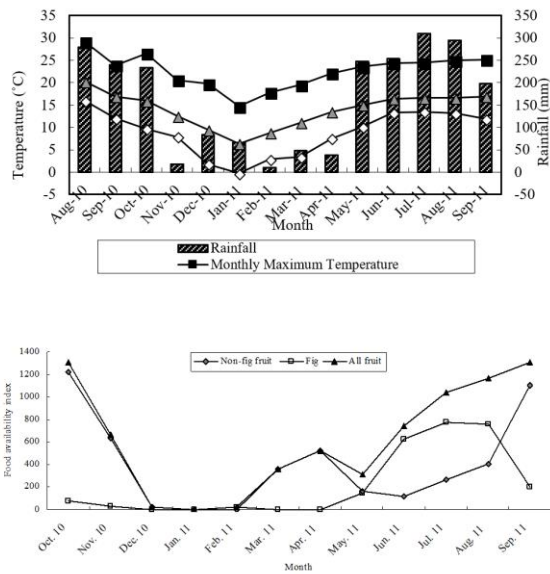
东黑冠长臂猿在 2002 年之前被认为在全世界已经灭绝。1949 年建国以后中国没有任何一个科学家在野外看到过这个物种，在 60 年代的时候科学家们认为越南的种群也已经灭绝。但是在 2002 年，通过 FFI（野生动植物保护国际）的不断努力，在中越边境重新发现了这个物种的一个小种群，然后在 2006 年，香港嘉道理农场以及植物园率领团队第一次在中国境内与越南接壤的地区重新发现了东黑冠长臂猿，从 2007 年开始我们开始对中国分布的东黑冠种群开展研究。目前为止我们做了三次全面的跨国界中越联合种群数量调查，第一次在 2007 年，第二次在 2012 年，第三次在 2016 年。通过这三次全面的种群调查我们发展这个物种的种群数量在缓慢的上升。在 2007 年这个物种只有 1 个分布区大概 110 只，经过十多年的保护后现在大概有 21 群 120 只左右。中国的调查很高兴地发现了三个新的家庭群体。与西黑冠长臂猿一样，这个物种在全世界都没有笼养个体。这个物种整体的分布区非常小，大概总共只有 21 平方公里，而且被两条河完全隔离开。在主要栖息地外有两个较为低质量的潜在栖息地，因为临近很多村庄，没有太强的容纳性。我们当时通过对栖息地的分析，得出结果认为中国还有潜在的可能可以形成两到三个新的群体，很高兴我们的预测非常正确，通过十多年的保护我们刚好在这些潜在栖息地发现了两个新的群体。针对这个物种，全世界只有我本人的团队在进行研究，有 1 个博士研究生，6 个硕士研究生曾经研究过此物种，到今年位置我们针对东黑冠长臂猿进行了 11 年的研究，掌握了一些关于这个物种保护所需要的关键信息，比如种群动态，迁徙扩散，鸣叫行为，食性和食物的选择，栖息地的评估，时间分配和过夜行为。当然这个物种最直接的威胁是在于这物种只有一个极度小的种群，也没有任何的笼养个体，所以这个小种群如果受到任何威胁就意味着物种的灭绝。

接下来要讲的这个物种比刚才的更加濒危，海南长臂猿是全世界最濒危的灵长类动物。作为我们国家特有的一种长臂猿，海南长臂猿上世纪 50-60 年代的时候曾经广泛分布在海南岛，但在 60-70 年代的调查中显示这个物种可能只剩下 400-500 只了，到 80 年代的时候可能只剩下 40-50 只，然后到 1989 年的时候，海南长臂猿确定的分布区只剩下一个霸王岭国家级自然保护区了，当时确定的种群数量是 7 只，乐观的估计是剩下 9 只。从 80 年代成立保护区后这个种群的数量就慢慢的有了一些恢复，但恢复一段时间后又会有一些不明所以的下跌，2003 年的时候国际上组织了非常大的一个团队对霸王岭保护区进行了拉网式的搜索，发现只剩下 13 只长臂猿，两个家庭，3 个成年雌性。当时的科学界针对这个现状一片悲观，认定它为全世界最濒危的灵长类动物，还好从那时候开始这个物种得到了比较严格的保护，到 2014 年发现形成了新的群体，然后到 2015/2016 年终于形成了总共 4 个群体。根据最近的确认，了解到这个物种现在总共有 27 只。毫无疑问这个物种也是一个非常小的小群体，并且同前面介绍的两钟长臂猿一样，全世界并没有任何的笼养个体。关于这个物种的研究主要由霸王岭国家级自然保护区，香港嘉道理植物园，伦敦动物学会，贵州师范大学开展，昆明动物所的张明霞博士曾经也做了一些工作。我们现在比较清楚这个物种的种群动态，这个物种种群虽小，但却是我们国家长臂猿里面繁殖最好的一个物种，大概一只雌性平均两年就可以产一胎，而其他在中国分布的长臂猿平均要 3-5 年才可以产一胎。当然这个物种面临的困境也是种群数量过小，栖息地面积有限。

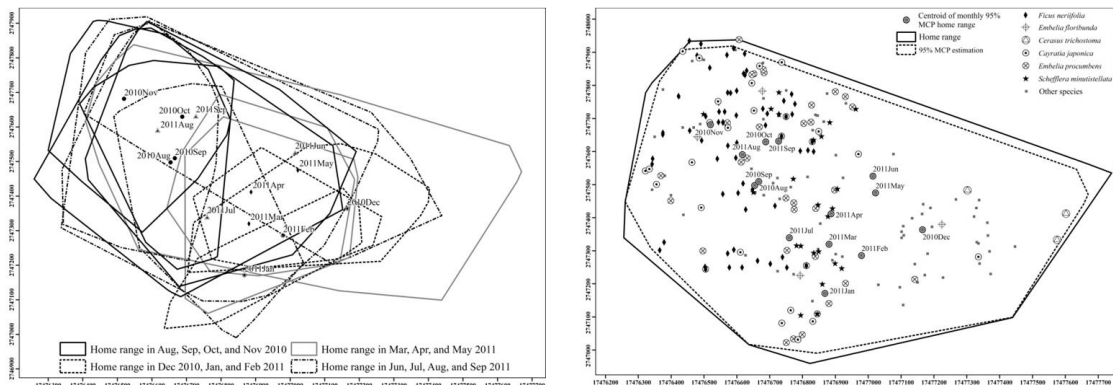
北白颊长臂猿，目前在我国野外已经灭绝。上个世纪六十年代曾经也有比较多的数量分布，在西

双版纳是比较常见的物种，那时候住在西双版纳勐腊县的县城招待所，早晨就可以听见这个长臂猿的鸣叫。但是八十年代开始种群数量下降非常快，因为西双版纳开始大量的种植橡胶（与海南长臂猿类似的威胁），89年中国科学院昆明动物所扈宇老师对西双版纳北白颊长臂猿进行的调查发现当时可以确定的只剩下9个群体，并且这9群长臂猿分散在7个不同的栖息地内，总共不到40只个体。但当时我们国家对生物多样性保护的重视程度还不够，也没有足够的经济能力和人力来开展保护工作。2008年我去西双版纳做了一个访问调查，当地的老百姓描述可能还有三个地方有长臂猿分布，于是我满怀希望的在2011年去做了一个野外调查，但很可惜野外调查没有发现任何长臂猿的痕迹，并且因为当时保护区内的偷猎现象依然存在，我们推断即使西双版纳保护区内依然有几只长臂猿存活，也不可能形成有效的群体进行繁殖了，也就是功能性的灭绝了。此物种在80年代就已经很稀少了，因此在中国没有研究团队对它们进行过深入的研究。但是这个物种在全世界的动物园里都有饲养，在中国也有一个比较健康的笼养种群，未来的保护工作中可以考虑笼养种群的野外放归手段。

白眉长臂猿属的天行长臂猿，这个物种现在的统计数量是不到150只个体，曾经主要分布在云南西部地区，怒江的西边，并且根据我们几次调查的对比发现，在过去十年中天行长臂猿的种群数量还在下降。这个物种在国际上的笼养个体还不太清楚，但在中国只有在昆明动物园有一个雄性，以及北京动物园有两个雄性，无笼养雌性，并没有笼养个体的配对可能。07年我受高黎贡山国家级自然保护区的邀请，从08年开始调查这个长臂猿到现在刚好研究了10年的时间。全世界基本上也只有我的团队研究过这种长臂猿，到现在有1个博士生和4个硕士生研究过天行长臂猿作为他们的毕业课题。针对天行长臂猿我曾经在三个地方开展过工作，第一个地点在腾冲县的大塘，这个研究只持续了不到一年的时间，重点观察的一群长臂猿就被猎人偷猎掉了，主要负责的一位向导也因为疾病不幸去世，所以在这里的项目只好被迫中断。后面转移到的第二个项目点我们进行了两个阶段的研究，第一个阶段在从2010-2011年，第二个阶段从去年到现在。这个种群在我07年去考察时只剩下三只个体，一雄一雌，还有一个独猿，这一个家庭群在繁殖了两胎以后就没有观测到后续的繁殖，而在07年观测到的这个独立的雌性一直到现在，经过了11年也没有找到配偶。因为这个区域只有5只个体，全部来自于同一个家庭，一只成年雄性，如果这个雄性去世，这个群落就再也没有了繁殖的可能，所以这个地区面临最大的困境就是繁殖配对。因为这个区域的群体太小了，所以我后来就去了第三个地方（板厂）开展研究，并建立了长期的观测研究基地。板厂的工作到现在持续了6年多的时间，这段时间内我们习惯化了一群长臂猿，第二个群的习惯化在接近成功的时候，这个群落迁去了其他地方。天行长臂猿的繁殖非常缓慢，在我们的研究过程中一共观测到了5只独猿成年迁出家庭，可不幸的是这五只全部都是雄性。刚才提到的群落独立的雌猿无法配对，而这里的雄猿无法配对，这就是小种群面临的很严峻的问题。与我们人类不同，它们的活动范围非常有限，没办法迁徙很远寻找配偶。

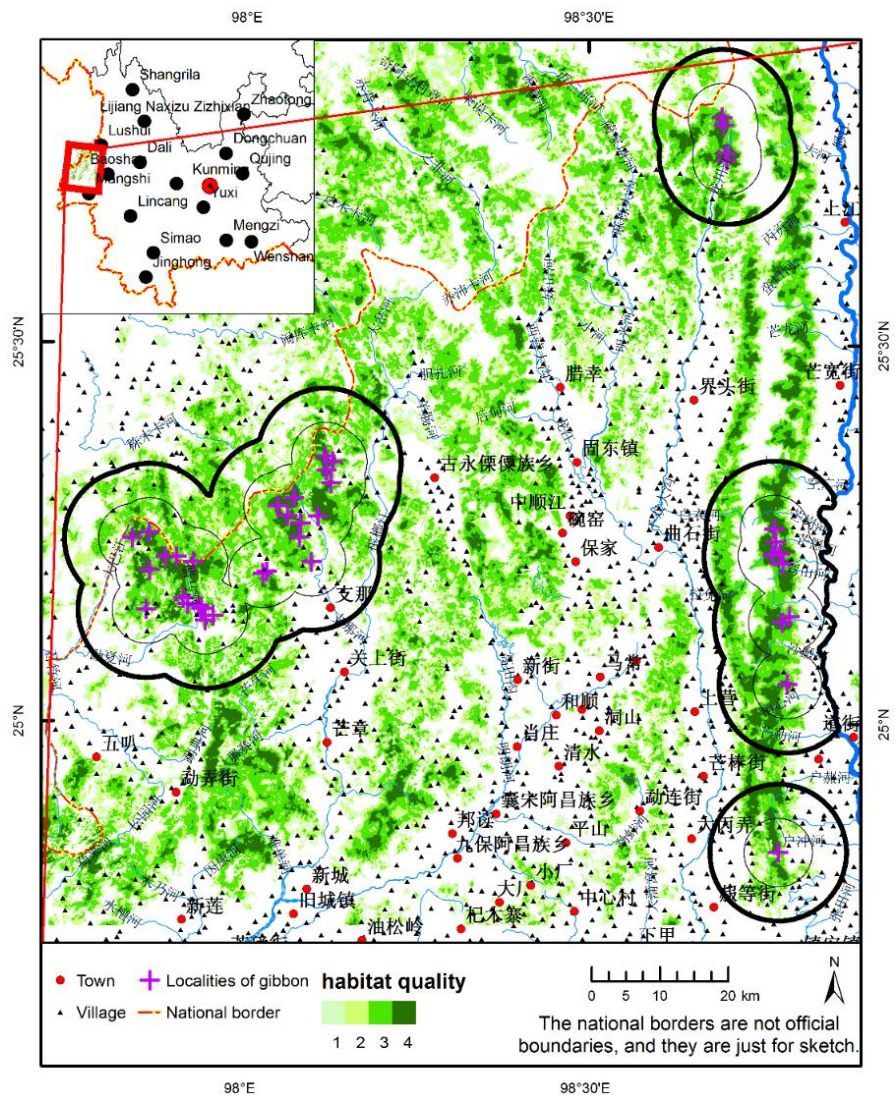


高黎贡山的气候非常寒冷，冬天有些时候甚至会下雪。长臂猿作为一个主要分布在东南亚的热带物种，非常不适应这样的气候。历史上的长臂猿并不是生活在这里的栖息地内，100 多年前更多地生活在怒江的河谷，而现在河谷都被种上了咖啡和甘蔗，长臂猿被迫生活到高海拔的地区。长臂猿喜欢吃的果实在寒冷的季节产量极低，食物质量差导致了长臂猿在这个区域繁殖速度非常低。



- 68 种食物
- 36 种水果
- 全年的食物： 49.1%水果，43.3%树叶
- 水果不足时依赖于树叶

同时天行长臂猿的家域范围也非常大，一个家庭需要大概 100 公顷的活动范围，而生活在东南亚的长臂猿家庭只需要 20-40 公顷就可以满足生活需要。这主要的原因是食物少，多样性低，只有 30 多种果实食物，将近一半的时间都在吃叶子，热量不够。



这是刚刚完成的天行长臂猿栖息地分析图，绿色的颜色越深代表着栖息地的质量越高，每个十字代表着一个家庭群落或者一个独猿。深颜色的圆是以长臂猿的所在地画的半径 10 公里的圆，代表着有可能的活动范围，可以看出赧亢的长臂猿即使向北十公里，板厂最南边的群体向南十公里还是没有有可能的交叉。白色的地方是山脊，长臂猿无法跨越这个区域。所有的三角形的代表着村庄，密密麻麻的村庄，可以看出破碎化非常严重。

最后介绍的曾经在我们国家分布的是白掌长臂猿，曾经分布在云南的西南部，在八十年代，中国科学院昆明动物研究所的几个老师认为我们国家的白掌长臂猿是一个独特的亚种，但也没有引起足够的重视。在 92 年的时候昆明动物所的蓝道英老师通过调查认为这个物种大概只剩三群不到 10 只个体了，但是也没有引起足够的重视。在 07 年瑞士苏黎世大学的几个专家组织了一个考察队，很幸运的我是当时考察队的一个队长，调查没有任何的发现。通过对社区的访问，当地居民说 2000 年以后就没有再听到长臂猿的叫声了，07 年去调查的时候已经没有任何长臂猿生存的痕迹遗留，曾经的栖息地基本上种满了橡胶。

下面就是长臂猿普遍遇到的问题：



- 偷猎:
- 护林员巡护过程中捡到了西黑冠遗体。
- 缅甸进入国内贩卖的东白眉头骨，民间传说可以治疗癫痫。
- 栖息地破坏:
- 商业性伐木，修路：好在我们国家进行天然林保护后这个情况有了明显的改善，商业性的天然林采伐已经得到了比较好的保护。
- 草果种植：天然林间接地砍伐，沟谷地区大量的种植破坏了长臂猿栖息地的连通性
- 刀耕火种：2008 年在盈江县观测到的原始的刀耕火种的低效率的耕作方式，还好 2017 年的调查发现这种劳作方式得到了一定的控制
- 砍柴：针对中性的树木大量的砍伐，消耗量极大，能源改造后逐渐有控制
- 过牧：在底层植物被消耗掉后砍伐很多藤本植物，对长臂猿有一定的影响
- 其他原因的砍伐：采蜜，建筑用

各种原因的森林破坏导致的长臂猿栖息地丧失，破碎化，片段化，残存的长臂猿生活在不同的森林斑块中，导致了配对繁殖的困难。

最后给大家简单的总结一下，我国曾经有六种长臂猿，最多的是西黑冠长臂猿有大概 1300 只，IUCN 定义为极度濒危物种；然后天行长臂猿在我们国家有不到 150 只，给 IUCN 最新的评估也认为应该是极度濒危物种；第三个物种是海南长臂猿，中国特有，只有一个种群，不到 30 只，是全世界最濒危的灵长类动物；第四个东黑冠长臂猿，生活在越中边境，曾经被认为已经灭绝，全世界剩 120 只左右，我们国家有不到 30 只；白掌长臂猿，我们国家可能已经在野外灭绝；北白颊长臂猿，我们国家可能已经灭绝。

我们国家最后剩下的 4 种长臂猿，依靠笼养种群的保护与管理来恢复几乎是不可能，因为其中 3 种在全世界都没有任何笼养个体，只有天行长臂猿养了 3 只个体，但没有雌性，雄性也因为种种原因不适合野放配对。对这 4 种长臂猿须采取就地保护，因为缺乏笼养个体，野生种群的灭绝就意味着物种的灭绝。而对于野外已经灭绝的北白颊长臂猿，仅有笼养种群，可以采取重新野放的恢复措施。

我们国家以前进行野生种群保护的和笼养种群保护的是两个完全不同的机构，互相之间基本上没有接触与交流。所以我们这次会议是可以说是一个历史性的沟通，是我们国家第一次让笼养种群保护和野生种群保护的团体有机会坐在一起共同讨论我国长臂猿的保护。之前我们的科研团队和政府部门的沟通也不够，没有能够促使更及时更坚决地采取措施保护我们国家的长臂猿。有可能是缺乏沟通，有可能是沟通了却缺乏技巧，没有能够促成足够的合作。虽然我们国家所有的长臂猿物种都接近灭绝了，但我们的研究精力和资源依然有限，需要更多国际上的专家组织合作，跟我们分享成功的长臂猿保护经验，也需要更多的公众关注，科学研究也需要更多的学生学者投入研究工作中。

# **Chinese Gibbon Conservation and Population Management Workshop**

**Guangzhou, China  
April 22-23, 2018**

## **Final Report**

# **中国长臂猿种群保护和管理培训研讨会**

**广州·中国  
2018 年 4 月 22 日至 23 日**

## **总结报告**

### **SECTION 4**

#### **Gibbon Conservation Outreach Experience Sharing**

#### **第四章 香港嘉道理长臂猿保护宣传宣教及社区工作回顾**

## **Philip Lo**

### **Senior Conservation Director, Kadoorie Conservation China (KCC), Kadoorie Farm and Botanic Garden (KFBG) Hong Kong**

Kadoorie Farm and Botanic Garden (KFBG) was established in 1951. It has three core programmes--- biodiversity conservation, holistic education and sustainable living. It has long-term partnership with Governments, Nature Reserves, Universities and Institutions from Hong Kong, Macau, Mainland and worldwide.

Kadoorie Conservation China (KCC) was established in 1997 as a department of KFBG. It has conducted active conservation projects in Hainan, Yunnan, Guangxi provinces, and Anhui, Shanxi and Sichuan.

In 2003, at the invitation of Hainan Forestry Department and Bawangling NNR, KCC initiated a long term project to conserve the gibbons. The survey of the year showed that there were only 3 groups of 13 gibbons in Hainan, and protection actions are urgently needed.

Kadoorie took a series of actions then faced with this dire situation:

- Planted over 84,000 fast growing gibbon food trees;
- Established gibbon monitoring teams (protected areas and communities);
- Supported scientific research;
- Conducted regular gibbon population surveys (autumn, 50-60 people);
- Village publicity in various ways;
- And publicity in schools (including in the surrounding communities of Hainan and Skywalker gibbons' habitats).

Community and public engagement:

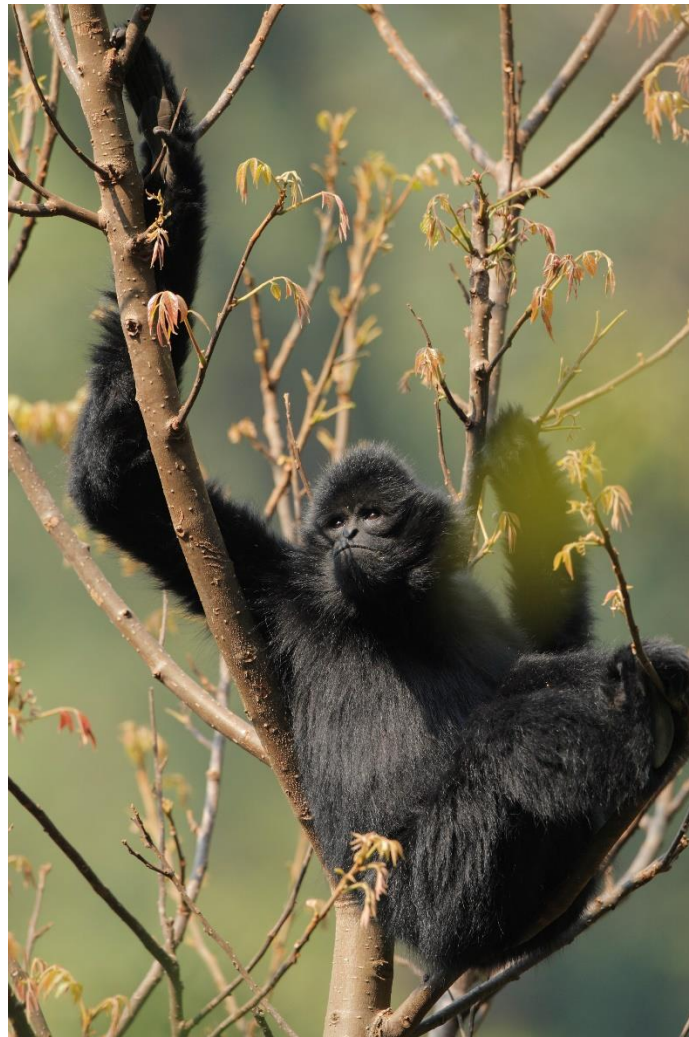
- We drove around the villages to voice concerns about gibbons and called for local protection. We also posted posters around the villages;
- Many local villagers around the highlands do not know about the Hainan gibbon. They don't know that it's a very special local species;
- In 2004, KCC distributed over 100 copies of brochures and Hainan Daily to villagers;
- FFI has done a lot of work to raise local awareness, i.e. in 2011, the gibbons began to move towards local villages;
- We designed and distributed calendars to local communities. It's a more useful way than brochures to raise local awareness as they can be used more in local's daily life;
- KCC co-organised themed school activities and held events at local schools in 2013 and 2015.
- T-shirts and traditional Chinese style stickers designed by a local artist were popular amongst the local villagers;
- Community mural painting;
- Sustainable agriculture demonstration (alternative income): we demonstrated and helped enhance production capacity for locals to replace destructive industries;
- We set up publicity and promotion boards at bus stations to increase local awareness.

Work for *Hoolock tianxing*:

- Used previous experience to help the Tengchong local authority with biodiversity research;
- Established a monitoring team of 10 people and identified the largest group in Gaoligong mountain;
- Launched another brochure and t-shirt, and had "funfair" events in schools.

Take-home message:

- Work with protected areas and local government for joint conservation work;
- Seek local support and input through community elites;
- Consider local community's interests and needs, give them an alternative livelihood and take appropriate means based on actual conditions;
- Seek experts and volunteers for external aid when needed.



Zhao Chao, Cloud Mountain Conservation ©2019



## 罗益奎

### 香港嘉道理中国保育高级自然保育主任

香港嘉道理农场暨植物园成立于 1951 年，致力于生物多样性保护、多元整全教育、推广永续生活。与港澳内地以及国际的政府部门、保护区、高校和科研学术单位维持着长期的合作关系。

嘉道理中国保育成立于 1998 年，是嘉道理农场暨植物园的部门之一。在海南、云南、广西、安徽、山西和四川都持续开展着工作。

03 年嘉道理中国保育受海南省林业厅和霸王岭保护区邀请开展长臂猿的长期保护项目，当年的调查显示海南长臂猿仅剩 3 群 13 只，急需抢救性的保护行动。

嘉道理针对严酷的种群现状开展了一系列的行动：

- 设立苗圃，种植了超过 84,000 棵长臂猿喜食树种；
- 成立了长臂猿监察队（保护区和社区）；
- 支持科研工作；
- 定期长臂猿种群调查（秋天开展，50-60 人）；
- 软硬兼施的社区宣传工作；
- 以及学校宣教活动（包括海南和天行长臂猿栖息地周边社区）。

社区宣传和公众参与：

- 为了提升社区保护积极性，开车连续性地村庄间呼吁，张贴海报；
- 很多山区的居民并没有听说过海南长臂猿，不知道这对当地来说是很特殊的物种；
- 2004 年嘉道理保育发放了超过 100 份宣传资料和海南日报给村民；
- FFI 也做了很多提升当地人保护意识的宣传教育，2011 年长臂猿开始向村庄移动；
- 2013 年和 2015 年在当地学校开展了学校游园活动；
- 为当地人制作的日历，因为方便使用所以起到了比宣传册更持久的效果；
- 当地艺术家设计的 T 恤和窗花贴纸，非常受当地人欢迎；
- 社区壁画制作；
- 永续农业示范（替代生计），为当地人展示和提升生产能力替代破坏性强的产业。我们派有一个农业专家团队，提供替代生计的意见，以改善他们的生计。香蕉和橡胶是本地居民过去的主要收入来源。现在他们在阴凉处种植传统中草药。如果橡胶价格下降，他们还会有草药产品作为替代收入。当地社区热衷于推动嘉道理的工作。养蜂不仅给本地人提供了收入，还提高了本地人森林保护的意识。
- 汽车站等明显位置设立大型宣传牌。

针对天行长臂猿：

利用以往的经验帮助腾冲管护局进行生物多样性调查；建立了十个人的监测队，在高黎贡山发现了最大的群体；发行了另一种宣传册、t 恤、以及在当地开展了游园活动。“学校很乐意与保护区内的非政府组织合作。”来自两所学校的 200 名儿童参加了游园活动。

要点总结：

- NGO 需要联合保护区与当地政府共同开展保育工作；
- 通过社区精英寻求在地支持；
- 考虑当地社区利益，提供替代收入来源，并按实际情况采用合适手段；
- 需要时寻求专家和志愿者外援。

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## **总结报告**

### **SECTION 5**

#### **Work of IUCN Primate Specialist Group SSA and IUCN's Latest Assessment Result of Gibbon Conservation Status**

#### **第五章 IUCN 小猿专家组工作介绍及 IUCN 最新长臂猿 保护级别评估结果**

**Susan Cheyne**

**Vice Chair , IUCN Primate Specialist Group Section on Small Apes (SSA)**

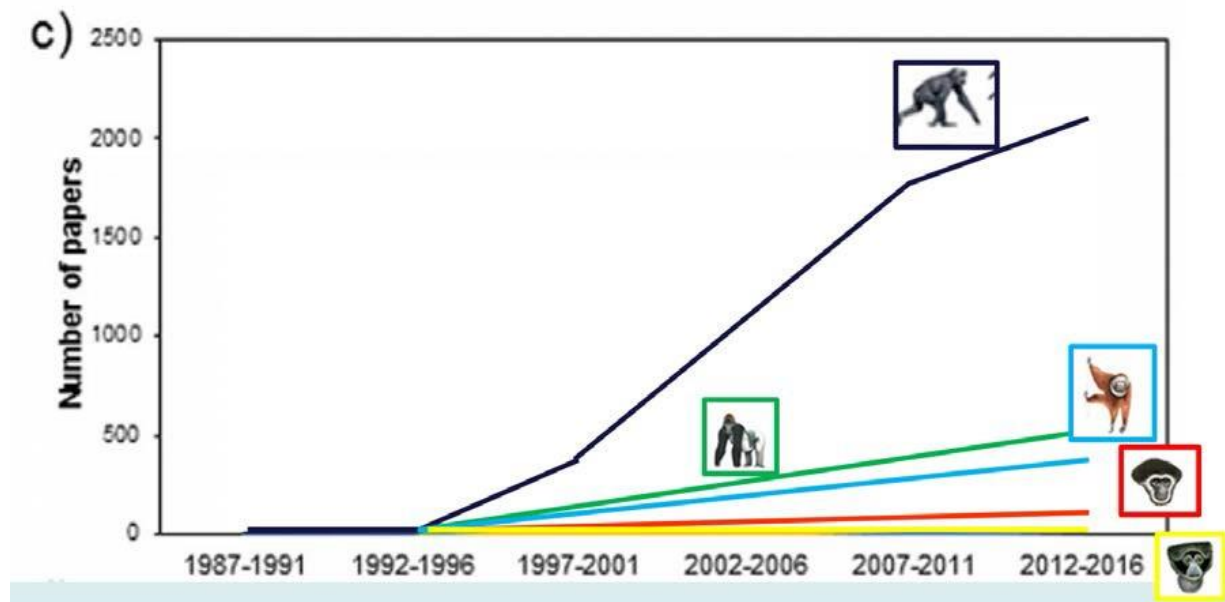
IUCN Primate Specialist Group (PSG) was of different regional sections in its early days: sections for Asia, Africa, South America and Madagascar. To liaise with other conservation efforts such as the UN Great Apes Survival Partnership (GRASP), IUCN established a separate section of the PSG to focus on great apes conservation in 2000 and the Section on Small Apes (SSA) in 2011. Dr. Benjamin Rawson was the first Vice Chair and then me since 2016.

IUCN Red List serves as a global criteria to evaluate the threatening risk of all species in the world. We held a conservation seminar in Singapore Zoo in 2015 with many experts from Asia, including China, where we made a new assessment over the primates living in Asia, but the results have not yet been released for various reasons. Hopefully it can be officially released in this June or July.

Among the 20 species of gibbons worldwide, five are critically endangered, and four of them are distributed in China. Two species of gibbons that once lived in China are not extinct in the world, but are extinct in the wild. There are 20 species of gibbons in 4 genera, 5 critically endangered (CR), 14 endangered (EN) and 1 vulnerable (VU). IUCN SSA now has more than 80 gibbon specialists dedicated to their conservation.

- Gibbons are generally threatened by loss of primeval forest;
- Large number of species are not found in protected areas;
- Less papers and conservation efforts on gibbons compared to the great apes.

Numbers of Publications



This workshop aims to strengthen coordination among gibbon conservation projects worldwide; to increase awareness of scientifically sound practice and techniques; to provide IUCN-endorsed implementation guidelines for scientists, policy makers and governments; to develop conservation action plan; to ensure the accuracy of the IUCN Red List; and to provide direct support for in-situ and ex-situ gibbon conservation.

SSA is equipped with a complete team of scientists and council members. *Best Practice Guidelines for the Rehabilitation and Translocation of Gibbon* was published in 2014.

Work plan for 2018:

- Finish and produce Best Practice Guideline on Surveying and Monitoring Gibbons and its free software;
- Update IUCN Red List assessment on the endangered status of gibbons;
- Hold Gibbon Conservation Symposium at IPS Nairobi (Congress of the International Primatological Society);
- Hold Conservation Journalism Workshop – training NGO's how best to use social media and engage with journalists;
- Investigate online sale of gibbons through social media;
- Provide a vet forum for gibbon projects by using the knowledge from Orangutan Veterinary Advisory Group (OVAG);
- Tackle emerging diseases in wild and captive species.

Future work plan:

- Gibbon distribution and GIS workshop (need more accurate distribution data);
- Engage more with zoo community;
- Support *in situ* projects by helping experts collaborate and share experience

For this workshop, think about techniques and knowledge that can be used in your own institutions; bring questions for the discussion sessions; make contact for new collaborations; and think how the SSA can help conserve gibbons.

**Susan Cheyne**  
**IUCN小猿专家组副主席**

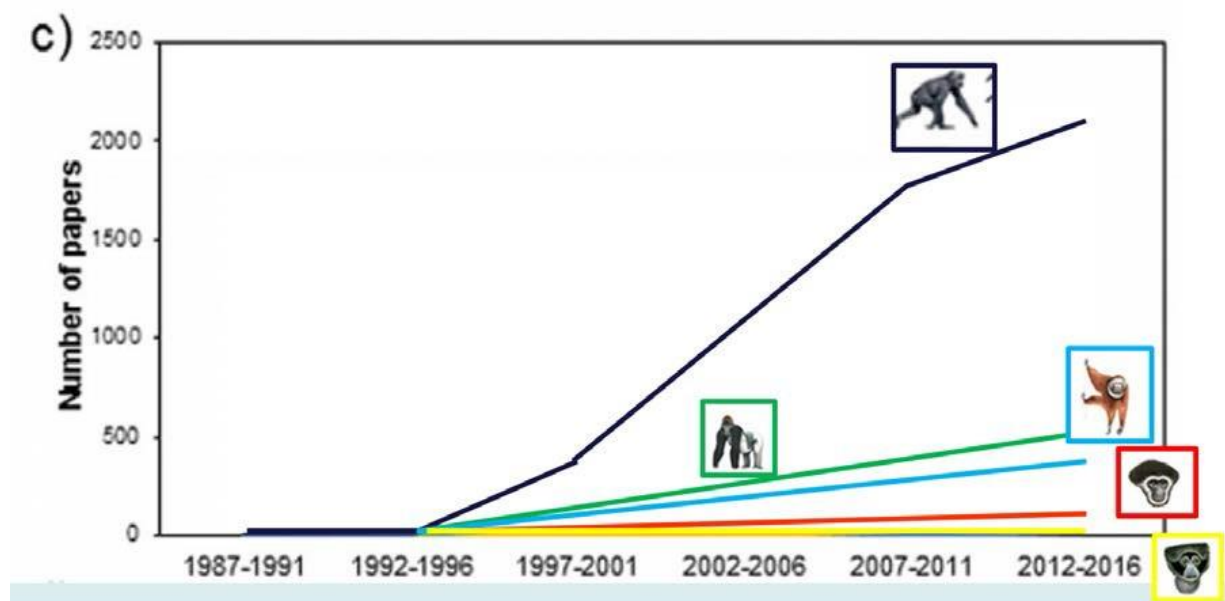
IUCN 猿类专家组最早根据地区分了很多分部：亚洲，非洲，南美洲，和马达加斯加。在 2000 年的时候，为了配合联合国大型猿类存续联合会（GRASP）的成立，IUCN 决定成立了大型猿类保护专家组。2011 年，相对应地成立了小型猿类专家组，第一任的副主席是 Dr. Benjamin Rawson，2016 年我成为了副主席。

IUCN 红色名录是国际上记录所有物种受威胁程度的一个标准，在 2015 年，我们在新加坡动物园开展了一次保护讨论会，很多亚洲包括中国的专家们参与在其中，针对亚洲生活的灵长类做了一次新的评估，很遗憾因为种种原因这次评估的结果到现在还没有发布，希望今年的 6 或者 7 月可以正式发布。

世界上的 20 种长臂猿中有 5 种处在极度濒危的状态下，而那 5 种长臂猿中 4 种都分布在中国，曾在中国有分布的 2 种长臂猿虽然在这个世界上没有灭绝，但在中国的野外种群应该灭绝了。长臂猿共分 4 属 20 种，5 种极度濒危（CR），14 种濒危（EN），1 种易危（VU）。IUCN 小猿专家组（SSA）现在有超过 80 个长臂猿专家致力于这方面的工作。

- 长臂猿普遍面临着原始森林丧失的威胁；
- 很多种群生活在保护区外；
- 而针对长臂猿的科学研究和保护组织的工作比起大型猿类非常欠缺。

论文数量



这次会议的任务就是加强长臂猿保护的国际合作；为保护工作者提供更多技术与经验支持；为科学家，政策制定者，以及政府组织提供规范化的实施指南；提出保护行动方案；保证 IUCN 红色名录的准确性；并为在地和笼养组织的保护工作提供必要的支持。

小猿专家组有一个完整的科研和理事人员构成，在 2014 年出版了针对长臂猿的野放和迁地保护技术手册（*Rehabilitation and Translocation Guidelines for Gibbons*）

2018 年的工作计划：

- 出版长臂猿监测技术指南和配套免费软件（*Best Practice Guideline on Surveying and Monitoring Gibbons*）
- 更新 IUCN 红色名录对长臂猿的濒危等级评估
- IPS Nairobi（国际灵长学会议）中开展长臂猿保护研讨会
- 保护新闻传播工作学习会（培养 NGO 如何最好地使用新媒体宣传和与媒体打交道）
- 通过网络媒体了解调查长臂猿贸易现状
- 以红毛猩猩兽医联合会（OVAG）的经验为基础发展长臂猿的兽医经验技术讨论
- 针对性地研究长臂猿野外和笼养过程中出现的疾病

未来工作计划：

- 长臂猿分布研究和 GIS 学习会（需要更准确的分布数据）；
- 联合动物园等笼养组织加入进保护工作中；
- 帮助在地保护者们互相合作。

希望大家在这次会议中可以多思考自己的组织或保护区可以借鉴到的技术与经验，带着问题参与进讨论中来，与不熟悉的组织或个人合作，寻找有什么小猿专家组可以帮助到的地方。

# **Chinese Gibbon Conservation and Population Management Workshop**

**Guangzhou, China**

**April 22-23, 2018**

## **Final Report**

## **中国长臂猿种群保护和管理培训研讨会**

**广州·中国**

**2018 年 4 月 22 日至 23 日**

## **总结报告**

### **SECTION 6**

#### **Captive Gibbon Pedigree Report in China**

#### **第六章 中国圈养长臂猿种群谱系管理报告**



**Yang Yuzhao,**

**Director of Pedigree Preservation of Ex-Situ Gibbon Population in Kunming Zoo**

Chinese Association of Zoological Gardens (CAZG) established the CCP team responsible for the conservation of gibbons (Level 1 management). Mr. Yang from Kunming Zoo is responsible for the work related to the pedigree of gibbon.

The survey on the current status of ex-situ gibbon population covered 36 institutions. As of February 2018, only 14 institutions replied, and the rest 22 did not out of three possible reasons:

1. Change of the person in charge of pedigree in each institution;
2. The identification in some zoos has not yet been completed;
3. With less attention to pedigree management from forestry authority, studbook keeper doesn't have to keep the pedigree analytical materials, and thus some institutions can't provide the data.

The survey report summarized the situation of the institutions and individuals of hoolock gibbons, white-cheeked gibbons and yellow-cheeked gibbons, and forecasted their development trend in the next 20 years with the mating plans.

Hoolock gibbon: There are 12 housing institutions with 37 individuals. There was no death in 2017, but a new-born in Kunming Zoo. The information of other zoos was not available. Among the current captive hoolock gibbons now, captive born outnumber the wild caught (the individual naturally goes to death) and male gibbons outnumber those of females. There are not a lot of reproductive gibbons at present but the number of young individuals is good and the captive populations have good development potential.

Hoolock Gibbon Housing Institutions					
Serial No.	Institution Name	Total	Serial No.	Institution Name	Total
1	Baoding Zoo	3 (2:1:0)	7	Guangzhou Zoo	1 (1:0:0)
2	Beijing Zoo	3 (2:0:1)	8	Guizhou Safari Park	12 (6:6:0)
3	Changsha Zoo	2 (1:1:0)	9	Hefei Zoo	1 (1:0:0)
4	Chengdu Zoo	1 (1:0:0)	10	Kunming Zoo	9 (5:4:0)
5	Chongqing Zoo	1 (0:1:0)	11	Wuhan Zoo	1 (1:0:0)
6	Gejiu Zoo	1 (1:0:0)	12	Shijiazhuang Zoo	2 (1:1:0)
			TOTAL		37 (22:14:1)

However, the exchanges and communication between zoos is not sufficient. Still 14 hoolock gibbons of the right age have not involved in reproduction. I hope that this conference can bridge the connection among different zoos for more communication and facilitate a possibility for the future development of captive populations. If the different zoos have intention for pairing and breeding, contact Mr. Yang for evaluation and analysis from the perspective of genetic diversity.

Captive Population Genetics			
Founder	9	Founder's genetic equal value	
Potential	14	Consanguinity based pairing table	4.66
Surviving animal		Gene-based variation	4.66
Number of individuals	37	Potential	21.00
Surviving offspring	19.00	Founder's genetic stocks	7.00
Ancestor known %	100%	Average consanguinity value	0.0132
Clear ancestor %	100%	Average effective population size	10.29
Genetic diversity		Generations	1.13
Consanguinity based pairing table	0.8927	Current Ne	2.67
Gene-based variation	0.8927	Based on breeding males	2.0
Potential	0.9767	Breeding female individuals	1.0
Gene value	0.8799	Ne/N	0.1404
Population average consanguinity value	0.1073		

White-cheeked Gibbon: 34 institutions with 143 individuals. Most of them have only one individual. There were two new-born individuals and one death in 2017. There are both wild caught and captive gibbons in zoo, but with reduced number from the wild. There are reproductive individuals and the future of the population is promising, but breeding work has to be prioritized later.

White-cheeked Gibbon Housing Institutions					
Serial No.	Institution Name	Total	Serial No.	Institution Name	Total
1	Jieke Zoo	1 (0.1.0)	18	Shanghai Wild Animal Park	4 (1.3.0)
2	Macao Zoo	1 (1.0.0)	19	Nanning Zoo	14 (5.8.1)
3	Hefei Ecological Zoo	1 (1.0.0)	20	Fanyu Safari Park	3 (2.1.0)
4	Hangzhou Zoo	1 (1.0.0)	21	Shenzhen Safari Park	8 (3.3.2)
5	Ningbo Youngor Zoo	7 (4.3.0)	22	Guangzhou Zoo	5 (4.1.0)
6	Wenzhou Zoo	1 (1.0.0)	23	Guizhou Forest Safari Park	5 (2.3.0)
7	Nanjing Hongshan Forest Zoo	3 (2.1.0)	24	Dalian Forest Zoo	8 (3.2.3)
8	Zhengzhou Zoo	2 (1.1.0)	25	Jinan Zoo	3 (2.1.0)
9	Beijing Zoo	7 (5.1.1)	26	Yantai Nanshan Zoo	3 (2.1.0)

10	Shijiazhuang Zoo	1 (0.1.0)	27	Xixiankou Safari Park	16 (8.8.0)
11	Beijing Daxing	4 (1.2.1)	28	Jinan Safari Park	4 (2.2.0)
12	Changsha Zoo	5 (4.1.0)	29	Chengdu Zoo	3 (2.1.0)
13	Wuhan Zoo	1 (0.0.1)	30	Chongqing Zoo	8 (3.3.2)
14	Nanchang Zoo	1 (1.0.0)	31	Sichuang Bifengxia	1 (0.1.0)
15	Shanghai Zoo	1 (0.1.0)	32	Kunming Zoo	3 (3.0.0)
16	Changzhou Zoo	3 (3.0.0)	33	Gejiu Baohua Park	11 (6.5.0)
17	Yangzhou Zoo	1 (0.1.0)	34	Tianjin Zoo	6 (2.3.1)
			Total		4 (1.3.0)

In the mating plan of white-cheeked gibbons, the genetic diversity (GD) contribution of some individuals' is 0, which means that they are old pairs. In this case, don't split them rashly just for genetic diversity, because gibbons are loyal to their spouse. If they are split, they might go on a hunger strike.

White-cheeked Gibbon Pairing Plan	Serial No.	♂	♀	GD Difference	Serial No.	♂	♀	GD Difference
	1	2	5	0.0002	17	18	13	0.0005
	2	445	443	0.0002	18	108	181	0.0009
	3	446	444	0.0000	19	28	222	0.0013
	4	104	103	0.0003	20	30	6	0.0017
	5	449	448	0.0003	21	107	105	0.0021
	6	218	219	0.0005	22	158	155	0.0024
	7	16	114	0.0006	23	190	91	0.0027
	8	175	184	0.0001	24	139	70	0.0029
	9	186	85	0.0003	25	233	232	0.0032
	10	131	132	0.0005	26	29	153	0.0035
	11	21	109	0.0006	27	152	153	0.0038
	12	36	376	0.0006	28	154	135	0.0041
	13	36	42	0.0002	29	220	188	0.0044
	14	335	336	0.0005	30	335	45	0.0046
	15	452	447	0.0003	31	111	178	0.0046
	16	190	133	0.0005	32	139	197	0.0047

Yellow-cheeked Gibbon: 15 institutions with 104 individuals (confirmed number of yellow-cheeked gibbons. Some institutions might have cross-bred individuals between yellow and white cheeked gibbons). There were five new born yellow-cheeked gibbons in 2017 and in 2009, the new born captive individuals outnumbered the total from the wild. Their breeding trend is similar to that of white-cheeked gibbons.

Yellow-cheeked Gibbon Housing Institutions	Serial No.	Institution Name	Total	Serial No.	Institution Name	Total
	1	Hefei Ecological Zoo	1	9	Yangzhou Zoo	2
			(0.1.0)			(1.1.0)
	2	Hangzhou Zoo	12	10	Shanghai Wild	3
			(3.4.5)		Animal Park	(1.2.0)
	3	Ningbo Youngor Zoo	1	11	Nanning Zoo	35
			(0.1.0)			(15.16.4)
	4	Fuzhou Zoo	4	12	Dalian Forest Zoo	1
			(2.2.0)			(0.1.0)
	5	Nanjing Hongshan	23	13	Sichuan Bifengxia	1
		Forest Zoo	(10.13.0)			(0.1.0)
	6	Zhengzhou Zoo	2	14	Kunming Zoo	8
			(1.1.0)			(2.6.0)
	7	Beijing Zoo	9	15	Gejiu Baohua Park	1
			(2.5.1)			(1.0.0)
	8	Nanchang Zoo	1	TOTAL	104	
			(0.1.0)		(39.55.10)	

Suggestions:

1. Continue pedigree survey, record the information of more individuals and strengthen pedigree management based on the existing studbook.
2. Improve population breeding, especially cooperative breeding to increase the number of individuals as soon as possible.
3. Continue the identification of the white-cheeked and yellow-cheeked gibbons, and strengthen pedigree management based on the existing studbook.
4. Try best to support the work of pedigree keepers who then can provide better service.

杨玉钊

### 昆明动物园长臂猿圈养种群谱系保存负责人

中国动物园协会成立 CCP 小组专门负责长臂猿这个物种的工作（一级管理），昆明动物园的杨老师负责长臂猿谱系这一方面的工作。

针对长臂猿的笼养种群现状调查，共涉及各饲养单位 36 家，截止 2018 年 2 月，共收到 14 家回复，有 22 家没有回复，未回复因素可能有 3 点：

1. 各单位的谱系员变化；
2. 部分动物园的鉴定尚未完成；
3. 林业局对谱系管理重视程度下降，不需要谱系保存人的谱系分析材料，也导致一些单位不再提供数据。

分别总结了白眉长臂猿，白颊长臂猿，黄颊长臂猿的饲养机构情况和个体统计，未来 20 年发展趋势预估，以及配对计划。

白眉长臂猿：共有 12 家饲养机构，37 个个体。2017 年没有死亡个体，昆明动物园有一新生个体，其他动物园的情况暂未收集。目前圈养的白眉长臂猿里，野外来源下降（个体自然老去死亡），出生个体增加。雄性个体增加，超过雌性个体。目前可繁殖的白眉长臂猿数量少，但是年轻的个体数量尚可，圈养种群的发展趋势向好。

白眉长臂猿饲养机构情况					
序号	机构名称	总数	序号	机构名称	总数
1	保定动物园	3 (2:1:0)	7	广州动物园	1 (1:0:0)
2	北京动物园	3 (2:0:1)	8	贵州野生动物园	12 (6:6:0)
3	长沙动物园	2 (1:1:0)	9	合肥动物园	1 (1:0:0)
4	成都动物园	1 (1:0:0)	10	昆明动物园	9 (5:4:0)
5	重庆动物园	1 (0:1:0)	11	武汉动物园	1 (1:0:0)
6	个旧动物园	1 (1:0:0)	12	石家庄动物园	2 (1:1:0)
			总计		37 (22:14:1)

但动物园与动物园之间交流不够，尚有 14 只适龄白眉长臂猿未参与繁衍。希望能够通过本次會議建立起各动物园之间的联系，进一步加强交流，为白眉长臂猿圈养种群未来的发展提供可能。若动物园之间有配对合作意向，也可以联系杨老师从基因多样性的角度进行配对效果的评估与分析。

在白颊长臂猿的配对计划中，有一些个体的基因多样性（GD）贡献为0，即他们是老配对了。这种情况下不要贸然为了基因多样性去拆配对，因为长臂猿对配偶的忠实度非常高。若贸然拆散，长臂猿可能会有绝食等行为。

白颊长臂猿配对计划	序号	♂	♀	GD不同	序号	♂	♀	GD不同
	1	2	5	0.0002	17	18	13	0.0005
	2	445	443	0.0002	18	108	181	0.0009
	3	446	444	0.0000	19	28	222	0.0013
	4	104	103	0.0003	20	30	6	0.0017
	5	449	448	0.0003	21	107	105	0.0021
	6	218	219	0.0005	22	158	155	0.0024
	7	16	114	0.0006	23	190	91	0.0027
	8	175	184	0.0001	24	139	70	0.0029
	9	186	85	0.0003	25	233	232	0.0032
	10	131	132	0.0005	26	29	153	0.0035
	11	21	109	0.0006	27	152	153	0.0038
	12	36	376	0.0006	28	154	135	0.0041
	13	36	42	0.0002	29	220	188	0.0044
	14	335	336	0.0005	30	335	45	0.0046
	15	452	447	0.0003	31	111	178	0.0046
	16	190	133	0.0005	32	139	197	0.0047

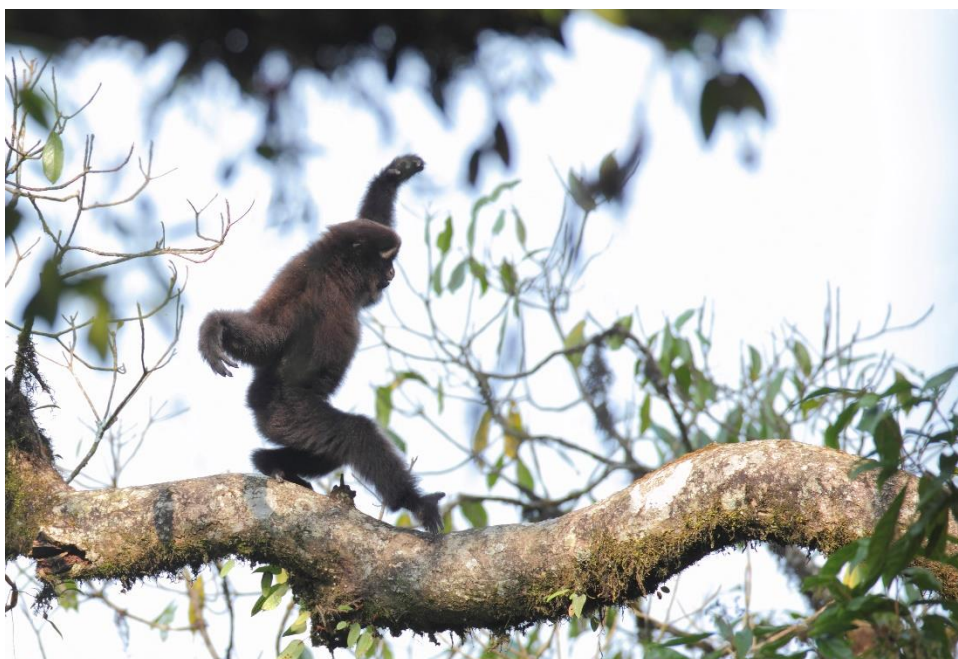
黄颊长臂猿：共有 15 个饲养机构，104 只个体（确定为黄颊长臂猿的个体，因为有些单位可能有黄颊-白颊杂交的个体）。2017 年出生 5 只黄颊长臂猿，2009 年圈养出生个体超过了野外来源个体，其繁殖趋势与白颊长臂猿相似。

黄颊长臂猿饲养机构情况	序号	机构名称	总数	序号	机构名称	总数
	1	合肥生态动物园	1 (0.1.0)	9	扬州动物园	2 (1.1.0)
	2	杭州动物园	12 (3.4.5)	10	上海野生动物园	3 (1.2.0)
	3	宁波雅戈尔动物园	1 (0.1.0)	11	南宁动物园	35 (15.16.4)
	4	福州动物园	4 (2.2.0)	12	大连森林动物园	1 (0.1.0)
	5	南京红山森林动物园	23 (10.13.0)	13	四川碧峰峡	1 (0.1.0)
	6	郑州动物园	2 (1.1.0)	14	昆明动物园	8 (2.6.0)
	7	北京动物园	9 (2.5.1)	15	个旧宝华公园	1 (1.0.0)
	8	南昌动物园	1 (0.1.0)	合计	104 (39.55.10)	



建议：

1. 继续加强谱系调查，将未加入的个体信息进行登录，并在现有谱系簿基础上重新对所有个体进行新的谱系调查管理。
2. 加强种群的繁殖工作，尤其是需要加强合作繁殖力度，尽快提高数量。
3. 继续对白颊、黄颊进行种的鉴定，并在现有谱系簿基础上重新对所有个体进行新的谱系调查管理。
4. 尽量支持谱系保存人的工作，以便能更好地为大家服务。



Zhao Chao, Cloud Mountain Conservation ©2019



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## **总结报告**

### **SECTION 7**

#### **Discussions on In Situ Protection**

#### **第七章 在地保护**

## Acoustic Spatial Capture-Recapture Methods

**Dr. David Borchers**

**University of St Andrews**

The technology overcomes two difficulties in traditional acoustic capture

1. Angle errors make the estimated position further than the actual position of gibbons
2. Only one person hears the gibbon (it is difficult to determine the position)

If possible, the use of multiple monitoring devices with vectors can greatly improve the positioning accuracy of the monitored target, and can more accurately estimate the density and activity of the target based on their behavior characteristics. In view of the questions relating to the concern about topography from professor Fan Pengfei and the directors of many protected areas, the software can also add acoustic resistance and angular constants of the target area in the calculation process for greater monitoring accuracy. Professor David Borchers' students are also developing acoustic capturing techniques using drones to further reduce capturing difficulties as a result of topography constraints.

Discussion summary:

The technical merits of professor David Borchers are well recognized, but as most of the gibbon conservation areas have only a small number of individuals, the acoustic capture difficulty is quite low. Plus, there is already some track record in the past, so they don't quite need such technical improvement. However, this technology can be possibly introduced to other small creatures that are difficult to observe but with acoustic characteristics.

### 针对鸣叫监测技术的改进方案

**David Borchers 博士**

**圣安德鲁斯大学数学与统计系教授**

技术针对性地克服了两个传统鸣叫监测技术中的难点

1. 角度错误令长臂猿预估位置平均比实际位置更远
2. 只有一个人听到长臂猿叫声（很难确定位置）

在条件允许地情况下,使用带有矢量的多个监听设备可以极大地提高监测目标的定位准确度,并可以根据监测目标的行为特征更加准确地预估被监测对象的密度与活跃程度。针对范鹏飞教授和多个保护区负责人对地形上的顾虑,此软件也可以在计算过程中加入目标地的声阻和角度常量,进而更加准确的校正监测精度。David Borchers教授的学生也在开发利用无人机进行的声音监测技术,可以进一步缩减因地形限制的监测难度。

讨论总结:

David Borchers教授的技术优点受到明显认可,但因为大部分长臂猿保护区的个体数量偏少,监听难度低,并有一定的跟踪记录支持,并不太需要此技术改进。可能更适于推广给其他具有鸣叫特性又不易观察的小型生物。

## Design goals and applications of the SMART Patrol System

**Julien Godfrey**

**Regional Wildlife Protection Coordinator and Trainer, Asia Programmes, ZSL**

The SMART Patrol System is an improved system developed in 2011 by organizations such as ZSL, WCS, WWF and CITES-MIKE. There are a lot of highly successful cases in recent years of different applications in protected areas around the world (details were given concerning better patrolling results for wild elephants in Salakphra Wildlife Reserve in Thailand)

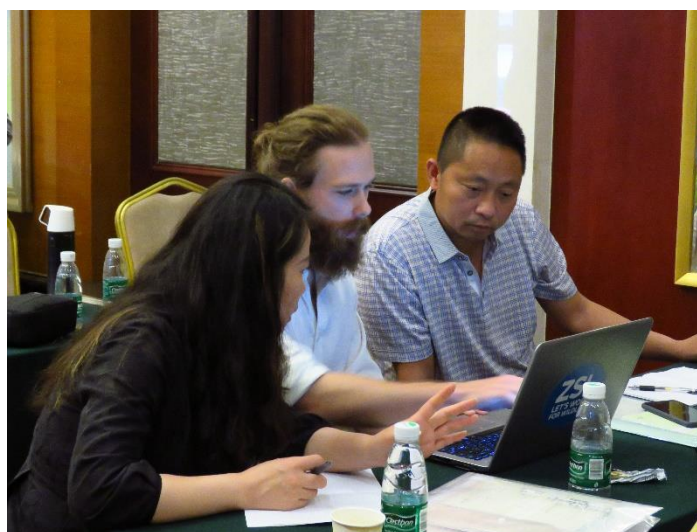
The SMART system utilizes a standardized recording method, and the ranger enters data from mobile terminals during the patrol process. Once all the data is aggregated, the software automatically analyzes it and generates a complete patrol report, which directly assists the decision makers in upgrading patrol route or frequency.

Advantages: standardized, flexible (multi-language, customized data model), simple, extensible, sustainable (free, open source, continuous update).

Necessary conditions: basic patrol staffing, flexible management and feedback mode, managers' positive attitude towards management improvement

Discussion summary:

Many people have already known about the SMART Patrol system. Although it has been very effective in many areas, there are still many limitations as Kashmira has mentioned. For example, the rangers need to be well armed with sufficient enforcement power to have a good deterring effect, and software application requires a basic level of education and passion. Out of confidentiality concerns, China excludes certain internationally developed software. Some domestic companies have developed similar software and reached cooperation intentions with many protected areas. Although SMART has some operational and statistical advantages, certain exam for approval process has to be followed as required by the government if it is to be widely applied in many protected areas in China.



## **SMART 巡护系统的设计目标和应用**

**Julien Godfrey**

**伦敦动物学院亚洲区域野生动物保护协调和培训师**

SMART巡护系统是在2011年由ZSL, WCS, WWF 以及CITES-MIKE等组织共同开发的一套改进系统。在近几年被全世界的保护区广泛的应用中涌现出了一大批非常成功的案例（着重介绍了泰国Salakphra 野生动物保护区对于野生象的巡护改进成效）

SMART系统利用标准化的记录方法，护林员在巡逻过程中从移动端录入数据，数据汇总后软件会自动分析并生成完整的巡护报告，直观地辅助决策者做路线或巡护频率上的改进。

优点：标准化，灵活性强（多语言，自定义的数据统计表），操作简便，拓展性强，可持续（免费，开源，持续的更新）

必要条件：基本的巡护人员配置，灵活的管理和反馈模式，管理者对管理提升持积极的态度

讨论总结：

Julien Godfrey讲解的SMART巡护改进软件许多人在很多年前就有了解，虽然在很多地区有了明显的成效，但也有诸如Kashmira提出的许多难以克服的限制。例如巡护人员需要有足够的武装和执法权才能有明显的震慑效果，以及软件应用需要一个基本的教育程度和积极性。中国因为保密原因，对国际开发的软件有一定的排斥性，可能是因为此顾虑所以有国内的软件公司开发出类似的应用软件，并已与很多保护区达成合作意向。SMART相比之下虽然有一些操作和统计上的优点，但如想广泛地让中国保护区使用需要按国家规定接受一定的审核报备程序。

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# **中国长臂猿种群保护和管理培训研讨会**

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## **总结报告**

### **SECTION 8**

#### **Discussion about SMART and Acoustics**

#### **第八章 关于 SMART 与鸣叫监测技术的讨论**

## **Gaoligongshan National Nature Reserve**

- Acoustic: Good but they already have a very clear picture of Hoolocks in reserves and have a management team in place. They know where the gibbons are located. There were also concerns about the elevation difference of 200-5,100m which could mean unreliable data are being collected.
- SMART: Very good method which is great for society to use the new technology. However, there were concerns about confidentiality if information is shared publicly. There were also concerns that the software was foreign.

## **Dehong Forestry Bureau Management Office**

- Acoustic: We already know about the Hoolock gibbons. Is it accurate enough for gibbons in mountain reserves?
- SMART: Our management team has already approached SMART/ZSL to see if it is useful. There are concerns that there is a similar software by a Chinese company.

## **Wuliangshan Nature Reserve**

- Acoustic: Very good method which is appropriate for their reserve. They welcomed both SMART (Julien) and Acoustics (David) training sessions to their reserve.
- SMART: The reserve representative had a short training session with Julien. It has a lot of advantages; they use similar software but it doesn't give the same thorough reports and have the same statistical capabilities. The representative invited Julien to the reserve to provide a training.
- Fan then reiterated that gibbon species in China are different to other species found in Asia. He supported the reserves that felt the technology was not appropriate.

## **Yang Donghua, Bawangling Nature Reserve**

- Acoustic: Not appropriate as they have a small Hainan gibbon population, therefore high accuracy of counts.
- SMART: Five days of training does not seem sufficient. However, if the software is used at a different reserve and a success, they will visit the neighboring reserve to see if they like it.

## **Li Xingkang, Guangxi Bangliang Cao Vit gibbon site**

- Main problem is probably landscape (karst mountains) but can probably put move listening posts higher.
- Already know where all groups are due to very small populations, need to increase personnel and capacity for using SMART i.e. number of staff, Vietnamese counterparts have used already but didn't find it very effective.

## **Zhou Jianguo, Xishuangbanna Mengyang**

- Would like to use SMART in Xishuangbanna, would like to have a few key slides translated into Chinese to show reserve director and see how it can be tailored (i.e. each variable) for specific sites/reserves.

## 高黎贡山国家级自然保护区

- 鸣叫：技术很好，但是我们已经非常了解本保护区内白眉长臂猿的情况，也组织了管理团队，已经知晓了长臂猿所在的位置。由于保护区内海拔差异在 200—5,100 米之间，我们担心数据的可靠性。
- SMART：方法非常好，但由于是外国软件，担心信息公开会造成泄密问题。

## 德宏林业局保护办

- 鸣叫：我们已经了解本保护区内的白眉长臂猿的分布情况。不知道对于山地保护区它的数据是否足够准确？
- SMART：我们的管理团队已经与伦敦动物学会保护和政策部门的 SMART 团队进行了联系，看看是否可以用到这个技术，但是国内的企业也开发了类似的软件。

## 无量山国家级自然保护区

- 鸣叫：非常好的方法，非常适合我们的保护区。欢迎 Julien Godfrey 和 David Borchers 两位专家到我们保护区介绍 SMART 和关于鸣叫检测的这两个技术。
- SMART：保护区参会代表与 Julien 当时有过一个简单的小组讨论，Julien 为我们介绍了一下软件的操作与使用。我认为这个技术有很多优点。我们使用过类似的软件，也可以进行数据统计分析，但是不能提供 SMART 所提供的较为全面完整的报告。邀请 Julien 到保护区提供培训。
- 范教授重申，中国的长臂猿物种与亚洲其他物种不同。他表示赞同保护区代表的想法，认为此技术不适合中国的保护区。

## 杨东华，霸王岭自然保护区

- 鸣叫：该技术不太适用，因为霸王岭保护区的海南长臂猿种群数量较小，因此本身已经有较高的计数准确度。
- SMART：五天的培训似乎还不够。但是，如果该软件已经在其他保护区投入使用，且非常成功，我们愿意到相关保护区了解具体情况。

## 李兴康，广西邦亮长臂猿自然保护区管护局

- 主要问题可能是地形的（如喀斯特石山），也许可以把移动监听站设立的更高些。
- 由于本保护区内的种群数量少，所以已经非常了解其分布情况。如要使用 SMART 技术，还需要增加人力。越南同行已经使用过，但并不是非常有效。

## 周建国，西双版纳傣族自治州国家级自然保护区勐养管护所

- 有意向在西双版纳使用 SMART 技术，希望将一些关键的幻灯片内容翻译成中文，让保护区的领导更好的了解一下，是否可以针对不同保护区的具体情况，对软件进行量身定做（比如变量的设定）。



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## **总结报告**

### **SECTION 9**

#### **Adaptation Strategy of Karst Langurs**

#### **White-Headed Langurs as an Example**

#### **第九章 喀斯特地区叶猴的适应战略 - 以白头叶猴为例**

## Huang Chengming

### Institute of Zoology, Chinese Academy of Sciences

- Video clip from Guangxi limestone karst forest.
- *Trachypithecus*: ca. 20 species of langurs in Asia, four groups.
- 100 individuals of Gold-headed langurs.
- Seven species within the Francois langur clade: all found in karst habitat; small distribution (except *T. francois* langur); small populations.
- Characteristics of karst formation: dry, shortage of water; harsh conditions; heat island effect (due to high temperatures and exposed cliffs). The vegetation is built upon alkaline soil where locals grow beans that provide a good income; habitat fragmentation and lots of human interference.
- White-headed langur: found in two nature reserves: Guangxi Chongzuo and Nongang; highly fragmented, isolated populations. Areas cannot be connected. After 20 years of protection through the assignment of a protected area and public outreach, there are now more than 1000 individuals. Alpha male, multi-female groups; all male groups.
- The “thumb hill” group in 2015: male takeover. 2015-2016: no new infants. Since then 8 new infants. Very successful group in terms of birth rates.
- Around the karst mountain outcrops, they are surrounded by cultivated land. White-headed langurs occupy the base of the mountain where there is vegetation to feed on. They use the middle cliffs and caves to use as their sleeping sites.
- Adaptation strategies: 1. Access to water: a lot of rainfall which they can’t access. Langurs drink in small puddles on the surface of the rocks; ca. 90% of their water comes from their food sources. 2. Access to food sources: adapted digestive system due to their enlarged intestine that harbours lots of bacteria which helps breakdown the cellulose. They therefore don’t need to consume a lot of food due to the efficiency of their digestive system. Seasonal differences so their activity range is limited during times of food scarcity and also need to spend a great amount of time preserving energy due to the disadvantages of a highly folivorous diet. 3. Access to different areas of the cliffs/forest: five patterns of locomotion. Ca. 50% terrestrial locomotion. 4. Breeding and mating: confused paternity. 5. Energy adaptation: Langurs self-thermoregulate. Currently focusing on this.
- Thirty years of research and have got lots of support.

- 广西石灰岩喀斯特森林地区视频。
- 乌叶猴：在亚洲约有 20 个种，四个组。
- 100 只金头叶猴个体。
- 黑叶猴组进化枝内的七个物种：全部出现在喀斯特地区；分布小（黑叶猴除外）；数量少。
- 喀斯特地貌特征：干燥、缺水；环境艰苦；热岛效应（高温与暴露的悬崖）。当地人在生长植被的碱性土壤上种植豆类，来获取较好的收入；栖息地碎片化且有许多人为干扰。
- 白头叶猴：两个自然保护区：广西崇左和弄冈白头叶猴自然保护区。种群高度碎片化、相互隔离，分布区域无法连通。在过去 20 年，由于保护区的建立和不断的公共宣传，现在有超过 1000 只个体。有包括首领雄猴和多个雌性个体的群体；还有所有个体均为雄性的群体。
- 2015 年“拇指山”群：一个雄性，2015-2016 年无新生幼崽。2016 年后产 8 个幼崽。繁殖非常成功。
- 喀斯特石山的岩层被耕地包围，白头叶猴在石山底部觅食可食用的植物性食物，使用石山半腰的悬崖和洞穴作为睡眠休息场所。
- 适应战略：1.水源：遇到天降暴雨，叶猴从石山上的石凹饮用存下的雨水；它们约 90% 的水都来自于植物性食物本身的含水量。 2.食物来源：叶猴的消化系统肠道变大，内含的大量菌类有助于纤维素的分解，消化效率较高。因此，叶猴不需要采食大量食物。季节性差异使得它们的活动范围在食物短缺期间受到限制，并且由于其食叶的饮食特点，在食物短缺期间，需要花费时间保存能量。 3.进入悬崖/森林的不同区域：五种运动模式，地上运动占约 50%。 4.繁殖和交配：让人困惑的亲子关系。 5.能量适应：叶猴进行自我温度调节。目前正在做这方面的研究。
- 已经进行了三十年的研究并得到了大量支持。

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## **总结报告**

### **SECTION 10**

**Husbandry and Captive Breeding of Yellow-cheeked Gibbon in**

**Nanjing Hongshan Forest Zoo**

**第十章 南京市红山森林动物园黄颊长臂猿饲养管理**

**概况及繁殖研究**

**Bu Haixia, Chen Rong**  
**Nanjing Hongshan Forest Zoo**

Nanjing Hongshan Forest Zoo (hereinafter referred to as NHFZ) has 22 yellow-cheeked gibbons with a male to female ratio of 9:8 and 17 sexually mature. There are two breeding families, the Dahuang family and the Erhuang family. The former consists of Dahuang and Dahei (introduced from Nanning Zoo in 2005, first breeding in 2007, and then 5 cubs in 8 years). The Erhuang family consists of Erhuang and Erhei (introduced from Nanning Zoo in 2005, a total of 9 cubs, all of which were hand reared except one).

**1. Husbandry of yellow-cheeked gibbons**

**1.1 Husbandry environment**

The outer space is 45m\*25m big, separated from the tourists by power grid and waters. It is planted with tall trees and shrubs, with shade shelters, perches and other enrichment items: plastic baskets, soft ladders and water hose.

The inner enclosure is of 4m \* 5m \* 5m structure, with anti-escape measures. There is a passage from the inner enclosure to the outer space. Once the gibbons develop signs of pregnancy, they will be moved to the breeding area (inner enclosure) in time.

**1.2 Feeding**

The food for primates are of five categories: melons and fruits, non-leaf vegetables, leafy vegetables, concentrates and leaves. There will be seasonal changes, but largely in two time periods---from June to September, and from October to May. Feed supplements are also provided such as melon seeds, peanuts, dried red dates, etc. If the females are in pregnancy or lactation, milk tablets and hawthorn slices will also be available.

In addition, NHFZ has developed a seasonal diet list based on their over ten years of experience in the husbandry of yellow-cheeked gibbons, considering their survival and mortality rate.

**Yellow-Cheeked Gibbon (Male) Daily Food (Unit:g)**

Item Month	Leaves	Melons & Fruits	Non-leaf Vegetables	Leafy Vegetables	Concentrates	Eggs
June-Sep	250	450	400	60	110	60
Oct- Next May	200	400	450	80	110	60

**Yellow-Cheeked Gibbon (Female) Daily Food (Unit:g)**

Item Month	Leaves	Melons & Fruits	Non-leaf Vegetables	Leafy Vegetables	Concentrates	Eggs
June-Sep	200	400	350	60	100	60
Oct- Next May	150	350	400	70	100	60

**1.3 Enrichment**

NHFZ provides enrichment in five categories: food, environment, sensory, cognitive, and social enrichment. With over ten years of experience, we have successfully established an enrichment database with a systematic review of the safe and feasible enrichment methods. The keepers provide at least 3 types of enrichment for gibbons every day.

**1.4 Training**

The basic training includes blood draw (blood-taking holder), medication and weighing. At present, 10

yellow-cheeked gibbons can work with us for successful blood draw. The training for medication is less difficult, but can help us give effective treatment when the gibbons are ill. We start the training from giving sweets, then switching to something sour. Weighing training is to monitor the physical conditions of the gibbons. Once we find they are overweight, we give less fruit but more vegetables.

## 2. Artificial rearing

The artificial rearing in NHFZ started in 2007 and all the nine cubs survived. The baby gibbon is placed in the incubator (the one for human babies) which should be spacious enough to allow the babies' ever-increasing amount of activity. The incubators and towels and toys placed inside are disinfected and replaced regularly.

The purpose of artificial rearing is to bring them "back to group". At present, it has taken a minimum of 8 and maximum 18 months to reintroduce the young gibbons back to their group in the zoo. All the artificially reared yellow-cheeked gibbons (except Fanghua) have successfully been re-socialized, and some have been recorded as being breeding.

## 3. Study on captive yellow-cheeked gibbon breeding

Four problems surfaced for ex situ yellow-cheeked gibbon: the need for better husbandry (lack of basic data); difficult mating (only 2 major breeding groups, and the other gibbons of breeding age don't pair); gene flow between species (yellow-cheeked gibbons are interested in white-cheeked gibbons); and lack of genetic diversity.

### 3.1 Yellow-cheeked gibbon species identification

We did the testing with mitochondrial gene collected from the hair of a total of 21 yellow-cheeked gibbons (not in pregnancy). The result showed that only 19 of them were identified as yellow-cheeked gibbons, and the other 2 (Dazai and Lianlian) were on the branch of southern white-cheeked gibbon. We suggested to raise the two separately, and considered introducing females.

In addition to molecular method, morphological approach had also been used. Male yellow-cheeked and white-cheeked gibbon can be easily distinguished, but females and cubs are difficult. Experience shows that the hair of female yellow-cheek gibbons will turn yellow during pregnancy.

### 3.2 Hormone determination

Saliva, urine, feces and blood can all be used for testing. At present, NHFZ chooses stool for testing as hormone testing is quite frequent during pregnancy, but excessive blood draw will affect the normal life of gibbons, and saliva or urine collection is difficult. However, due to the secondary hepatobiliary circulation and the hysteresis of the results of hormonal testing from feces as a result, the ovulatory period needs to be backward inducted by about 2-3 days. In addition, the perineum swelling of the gibbons should also be recorded as a reference later.

So far, there is no available study on the menstrual cycle of yellow-cheeked gibbon in the world. According to the papers on white-cheeked gibbons, the menstrual cycle of white-cheeked or yellow-cheeked gibbons is about 21-28 days. There is no obvious species difference in hormonal changes with their progesterone no more than 10 µg/g DW and estrogen no more than 5 µg/g DW. If the hormone data has always been higher than this value, the gibbons are likely pregnant.

Hormone level testing can help us understand whether their behavioral changes and physiological index is normal. In the past, we could only notice the obvious changes on gibbons in the middle and late stages of their pregnancy, but abortion may happen as a result of fighting and other reasons. Therefore, if special care is given in the early stage of pregnancy by testing their hormone level, greater breeding efficiency can be achieved.



#### 4. Follow-up study

As planned, we collected the blood of some yellow-cheeked gibbons, extracted their DNA, and designed 16 pairs of primers. Fluorescent primers were synthesized from 10 pairs selected. They were tested and the relevant data were obtained.

Summary of progress: 1. We selected 10 pairs of primers suitable for the paternity testing of yellow-cheeked gibbons; 2. We obtained the SSR data of 21 yellow-cheeked gibbons; 3. Data analysis is still in progress.

#### **Discussion on captive husbandry:**

Q: How to guarantee the safety of the food when animals forage from enrichments made of books, newspapers, and tires?

A: For food enrichment, the safety of the container is of top priority. We prefer dried hard books with inks removed. In addition, the food of the gibbons should be prepared by the nutritionist and cleaned by the keepers.

Q: Will the use of food enrichments, such as tires, newspapers, and books, have a negative impact on their reintroduction to the wild? After all, these things are not available in the wild. Will it mislead the gibbons when they forage in the wild?

A: The purpose of enrichment in the zoo is to remove stereotypes. Wild reintroduction is a slow process which calls for targeted training for the animals.

Q: You mentioned something sour when training gibbons to take medicine. How does that work?

A: We start from the fruits (sweet) that gibbons like, then, we blend it into fruit juice and add something sour to get the gibbons used to. And then we put the medicine into the juice. Being sour and sweet are just in a relative sense.

Susan: The animal care institutions in Thailand or Myanmar will give gibbons medicines that are not available in the wild, but can meet their nutritional needs. I agree with the practice of NHFZ very much. At the same time, the success of wild reintroduction of gibbons depends largely on whether the male and female can form a family.

Susan: Do the zoos in China have standard document to guide gibbon husbandry? You can talk with IUCN if you don't. IUCN has funds available to do the translation.

Answer: The CCP Working Group in NHFZ is preparing a guiding document for gibbon husbandry and management, covering husbandry, management, disease treatment, exhibition area design, species identification and breeding, etc. It is scheduled to be completed by the end of 2018.

Susan: IUCN's English version will also be completed by the end of this year. This work was organized by SSA, and all gibbon keeping institutions are included.

Q: Is progesterone testing done while also taking animal's traits into consideration?

A: Yes. An accurate judgment is made not just by the hormonal testing results but also the big data collected in the previous phase. Analytical curve has to be made as the basic data for a particular species. For example, with the help of big data, we conclude that gibbons have a progesterone concentration value greater than 10 µg/g during pregnancy.

Q: Why do you do artificial rearing?

A: Because gibbons sometimes abandon their cubs. There will be manual interventions when gibbons are a bit agitating. We will see whether they can focus on maternal-baby interactions. We also give infant formula, and add additives such as vitamin C and cod liver oil. There are many things to pay attention to during the rearing process: the temperature must be well controlled, and the food has to be changed.

Breast feeding lasts for 40 days at most. Problems are most easy to occur when shifting from feeding milk powder to fruit, so be sure to pay attention.

Q: Will young gibbons develop abnormal behaviors as a result of artificial rearing? An artificially reared young gibbon in Fuzhou still has the problem of sucking its fingers at the age of five.

A: The artificially reared gibbons will all develop stereotype behaviors of certain kinds. Finger sucking is a light stereotype.

Q: Will there be fight when the artificially reared primates return to their group in adulthood?

A: The introduction is done in sub-adult period, not the adulthood, roughly between 3 and a half and 4 years old. They are enclosed together with the gibbons of the same age then.

Q: How do the sub-adult gibbons learn to breed? Male and female gibbons are very difficult to pair with, especially those in captivity as they may fight if put together. What good experience do you have?

A: Make gibbons of no blood relationship as neighbors to let them be familiar and like each other. Observe for behaviors as grooming. Then, as the relationship heats up, try to enclose together. Separate if they fight. Then observe and try the introduction again.

PS: Enrichment is a long-term process that requires continuous efforts to accommodate the needs and behavior changes of gibbons. Increase complexity if needed to avoid stereotypes.

Q: What if digestion issues happen when feeding colostrum? What if abdominal distension occurs when feeding imported milk powder?

A: When feeding colostrum, the concentration has to be very low, and you have to observe the defecation. If the digestion is not good, do not medicate at the beginning, but rubbing the stomach with our hand, and applying warm towels, etc. If they don't work, then you may start giving medicine.



## 卜海侠、陈蓉

### 南京市红山森林动物园

南京市红山森林动物园（以下简称南京红山动物园）饲养有 22 只黄颊长臂猿，其中 17 只性成熟，雌雄比例为 9: 8。主要家族有大黄家族和二黄家族两个繁殖家庭，大黄家族由大黄、大黑（2005 年从南宁动物园引进，2007 年第一次生产，随后 8 年生产 5 个幼崽）组成，二黄家族由二黄、二黑（2005 年从南宁动物园引进，共生产 9 个幼崽，除芳芳外均为人工育幼组成）。

#### 1. 黄颊长臂猿的常规饲养管理

##### 1.1 饲养环境

外运动场整体为：45 米\*25 米，通过电网与水域与游客相隔，外运动场种植高大树木和灌木，配有遮阴棚，栖架及其他丰容物品：塑料筐，软梯，水管。

内室为：4 米\*5 米\*5 米的结构，设有防逃逸的措施。从内室到外运动场设有通道，当长臂猿有怀孕迹象时，会及时把长臂猿移到繁殖区（内室）。

##### 1.2 饲喂方式

灵长类饲料品种分为 5 大类：瓜果类、非叶菜类蔬菜、叶菜、精饲料和树叶。根据季节不同会进行改变，6 月-9 月为一阶段、10 月-次年 5 月为另一阶段。同时配置辅助饲料如瓜子、花生、干红枣等，若雌性长臂猿处于孕期或哺乳期还会增加奶片、山楂片等辅助饲料。

此外，南京红山动物园根据他们十余年的黄颊长臂猿饲养经验，综合考虑长臂猿的生存率、死亡率等问题，制定了季节性日粮配料表。

黄颊长臂猿（雄性）日粮（单位：g）

日粮种类 月份	树叶	瓜果	非叶菜类蔬菜	叶菜类	精料	鸡蛋
6 月-9 月	250	450	400	60	110	60
10 月-次年 5 月	200	400	450	80	110	60

黄颊长臂猿（雌性）日粮（单位：g）

日粮种类 月份	树叶	瓜果	非叶菜类蔬菜	叶菜类	精料	鸡蛋
6 月-9 月	200	400	350	60	100	60
10 月-次年 5 月	150	350	400	70	100	60

##### 1.3 丰容库的建立

南京红山动物园将丰容分为食物丰容（S）、环境分容（H）、感知丰容（G）、认知丰容（H）和社群丰容（Q）5 个方面。通过十余年的丰容经验累计，成功建立了丰容资料库，把一些安全可行的丰容方法进行整理，饲养员每日要根据丰容库为长臂猿提供至少 3 种丰容。

##### 1.4 长臂猿的训练

基础训练包括采血（采血架）、喂药和称重。目前已有 10 只黄颊长臂猿可成功采血。喂药训练的难度比采血训练小，在长臂猿生病时能够有效地进行治疗，可以先从喂食甜食开始，之后用酸口

替代，一步一步训练。称重训练主要是为了监测长臂猿的身体状况，如果超重了就要减少水果的量增加蔬菜的量。

- 黄颊长臂猿的人工育幼

从 2007 年开始人工育幼，共育幼 9 只全部存活。人工育幼时将婴猿至于保温箱中(人类宝宝用)，保温箱的高度要满足长臂猿日益增长的活动量，保温箱以及里面放置的毛巾和玩具，要定期消毒更换和清洗。

人工育幼工作最终应达到“回群”的目的。目前红山动物园人共育幼的“回群”时间最小在小猿 8 个月时，最大是一岁半。红山动物园人工育幼的黄颊长臂猿（除芳华外）均已完成再社会化工作，且人工育幼的长臂猿已有繁殖记录。

- 笼养黄颊长臂猿的繁殖情况研究

在圈养黄颊长臂猿的过程中发现有 4 个问题：饲养水平有待提高（缺乏基础数据的收集）；配对难（主要繁殖群为 2 个，其他适龄长臂猿不配对）；物种间基因流的产生（黄颊长臂猿对白颊长臂猿感兴趣）；遗传多样性的缺失。

### 3.1 黄颊长臂猿的物种鉴定

利用线粒体基因进行检测，共对 21 只黄颊长臂猿进行（处于孕期不参与）。采集毛发提取线粒体基因，得到结果只有 19 只确定为黄颊长臂猿，另有 2 只（大崽,怜怜）在南部白颊长臂猿分支上。对于这种情况建议将大崽、怜怜单独饲养，并考虑引进雌性长臂猿。

除了分子学鉴定外，形态学鉴定也被红山动物园所运用。雄性黄颊长臂猿与白颊长臂猿最好分辨，但雌性与幼崽比较难分辨。根据经验判断，雌性黄颊长臂猿在孕期，毛发会变黄。

### 3.2 黄颊长臂猿的激素测定

唾液、尿液、粪便与血液均可用于检测。目前红山动物园选择粪便检测，因为孕期激素检测比较频繁，采血过多会影响长臂猿的正常生活，而唾液或者尿液的采集难度比较大。但由于肝胆二次循环，激素检测时粪便的结果有滞后性，因此需要人工倒推排卵期（2-3 天）。除此之外，还要记录长臂猿的阴部肿胀情况，作为后期参考依据。

目前国际上还没有针对黄颊长臂猿的月经周期研究，根据对白颊长臂猿属相关文章的整理，白颊或黄颊长臂猿的月经周期大概是 21-28 天，激素变化并没有明显的种属差异，孕酮不超过 10  $\mu\text{g/g DW}$ ，雌激素不超过 5  $\mu\text{g/g DW}$ 。如果得到激素数据一直超过这个数值，则很有可能处于孕期。

进行激素的测定能够帮助我们理解长臂猿的行为变化、生理指数是否正常。以往长臂猿只有在怀孕的中后期才会有明显的变化，而在此期间长臂猿可能会因为打架等原因流产。因此如果通过激素检测在长臂猿怀孕的初期就及时进行特别的照料，那么可以有效提高长臂猿的生产率。

- 后续研究

按计划，采集了部分黄颊长臂猿的血液，提取 DNA，并对设计了 16 对引物。从 19 对引物中，筛选出 10 对引物合成了荧光引物后，进行检测并获得了相关数据。

进展总结：1.筛选出适合黄颊长臂猿亲子鉴定的 10 对引物；2.获得 21 只黄颊长臂猿 SSR 数据；3.正在进行数据分析

### 笼养管理讨论总结：

问题：针对食物丰容从书本、报纸、轮胎中取食的食品安全？

回答：食物丰容的容器选择，第一就是要保证安全，首选硬质的书，在给长臂猿丰容之前进行晾晒，排除油墨等影响。另外长臂猿的食物要经由营养师配料，饲养员清洗。

问题：利用轮胎、报纸、书本这类食物丰容手段会不会对野外放归起负面作用？毕竟这些东西是野外没有的，会不会引起野放后长臂猿对环境中食物的误判？

回答：动物园丰容的目的是解除刻板行为，野外放归是一个缓慢的过程，如果要野外放归，这需要进行针对性的野放训练。

问题：在训练长臂猿吃药的过程中，提到让他们习惯酸口味的东西，这会不会有什么影响？

回答：长臂猿喜欢水果（甜口味的东西），慢慢过渡，把水果打成水果汁，加一些酸味的口感让长臂猿习惯，之后再把药加入果汁中。酸和甜只是相对物品来讲。

Susan：在泰国或者缅甸的饲养机构会为长臂猿喂一些野外无法获得的药物以满足他们的营养需求，我非常同意红山动物园的做法。同时长臂猿野放成功很大部分取决于雌雄个体能不能组成家庭。

Susan：中国的动物园有长臂猿饲养规范文件吗？可与 IUCN 交流，IUCN 有资金可以用来翻译中英。

回答：南京动物园 CCP 工作组正在编写长臂猿饲养管理规范手册，里面的内容包括饲养管理、疾病治疗、展区设计、物种鉴定以及繁殖等等，计划 2018 年年末完成。

Susan：IUCN 英文版本也会在今年年底完成。这个工作是由他们 SSA 组织的，所有饲养长臂猿的单位都包括其中。

问题：长臂猿孕酮检测，这种测试方法和动物的特性有关吗？

回答：有关。做激素测量，要收集前期的基础数据，才能进行一个准确的判断。一定要做一个曲线，针对某一个物种做一个大数据的基础数据。就比如长臂猿我们得出怀孕时孕酮浓度大于 10  $\mu\text{g/g}$ ，这也是有大数据的一个支持。

问题：为什么做人工育幼？

回答：人工育幼是因为弃子的现象。育崽时，当长臂猿情绪比较激动时，人工将进行干预，看长臂猿是否能关注母婴互动，采用婴儿奶粉，增加添加剂如维 C 和鱼肝油。育幼过程中会出现很多问题：温度一定要控制好，另外是食物的转变，最长的母乳吃到 40 天。喂奶粉到喂水果之间最容易出现问題，一定要注意。

问题：人工育幼后幼猿行为会不会出现异常？福州有一只人工育幼的幼猿，目前 5 岁了还有有吸手指的问题。

回答：人工育幼的长臂猿都会有一些刻板行为，吸手指已经是比较轻的刻板行为了。

问题：灵长类的人工育幼，成年后回群会不会出现打架问题？

回答：回群是在亚成体时期回去，而不能等到成年了回群。大约 3 岁半-4 岁之间，和年龄差不多的关在一起。

问题：亚成体走向成年的过程中，怎么学习成家？长臂猿雄性和雌性配对是比较困难的，特别在圈养状态下，很不容易配对，可能会打架。南京动物园有什么好的做法？

回答：把没有血缘关系的放在隔壁，让他们互相习惯看顺眼了，观察会不会出现理毛等行为。之后随着关系的升温，逐渐尝试合笼，如果他们还会互打的话，还是先分开。再重复之间的观察，尝试再合笼。

红山动物园补充：丰容是一个任重道远的过程，需要不断的和长臂猿磨合，根据长臂猿的表现逐渐提高操作的难度以避免刻板行为。

问题：人工育幼喂初乳，遇到消化问题怎么办？喂进口奶粉但是不消化，腹胀怎么办？

回答：喂初乳的时候一定要把浓度弄得很低，同时观察排便。如果消化不好，刚开始不加药，人工揉肚子、敷温毛巾等措施。如果还是不消化会加药。

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**Guangzhou, China**

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## **Final Report**

# **中国长臂猿种群保护和管理培训研讨会**

**广州·中国**

**2018 年 4 月 22 日至 23 日**

## **总结报告**

## **SECTION 11**

### **Chinese Gibbon Species Identification**

#### **第十一章 中国长臂猿种类鉴别**

**Fan Pengfei**

**Founder and Science Advisor of Cloud Mountain Conservation**

**Professor, School of Life Sciences, Sun Yat-Sen University.**




**Black Crested Gibbons:**

Head shape:

*Nomascus. concolor*: erect hair, hidden ears, obvious triangle head shape

*Nomascus. nasutus*: small round crew cut, yellow brown spot on the chest

*Nomascus. hainanus*: ears visible from front, triangle head shape

Black crested gibbons: male differences		
<i>N. concolor</i>	<i>N. nasutus</i>	<i>N. hainanus</i>
		

Mootnick and Fan, 2011, AJP

Female:

*Nomascus. concolor*: black chin, black abdomen when older

*Nomascus. nasutus*: yellow abdomen which will not turn black when older, white face, and the black patch of fur on head extends down the back.

*Nomascus. hainanus*: Round face, and the fur on abdomen will not turn black




Infant gibbon:

*Nomascus. nasutus*: Born black

*Nomascus. concolor/N. hainanus*: pale white, slowly turning yellow, gradually a little black fur at 6 months

*Nomascus. hainanus*: darken at 2 or 3 months, full black at round 6 months



Black crested gibbons: female and infant differences		
<i>N. concolor</i>	<i>N. nasutus</i>	<i>N. hainanus</i>
		

Mootnick and Fan, 2011, AJP

#### White-cheeked and Yellow-cheeked gibbons:

##### Males:

*Nomascus leucogenys*: hairs on cheeks are long, reaching the ears

*Nomascus siki*: hairs on cheeks do not reach the ears

*Nomascus gabriellae*: hairs on cheeks similar in length to southern white-cheeked, turned outward

##### Females:

*Nomascus leucogenys*: hairs around the face are not dense

*Nomascus siki*: hairs around face more dense

*Nomascus gabriellae*: hairs on cheeks turned outward

#### Hoolock gibbons:

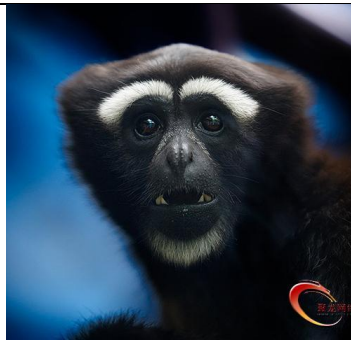
*Hoolock hoolock*: connected eyebrows

*Hoolock leuconedys*/*Hoolock tianxing*:

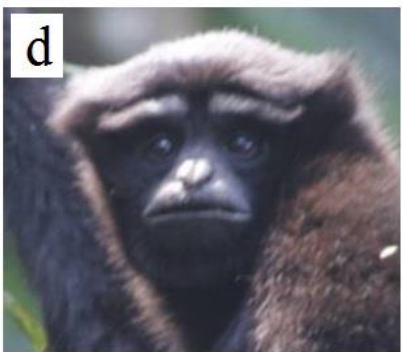
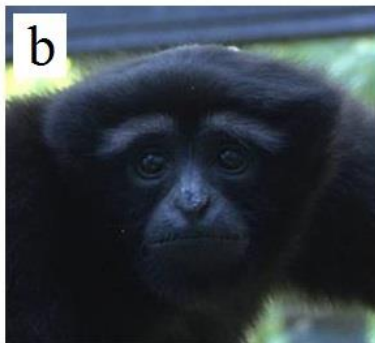
Similarity: obviously disconnected eyebrows

Differences: *Hoolock leuconedys* has white beard on the chin and the white hair under eyes; males have grey genital tufts. Skywalker hoolock has completely disconnected eyebrows, less thick white hair in eyebrows, curved slightly upward at outer end. Its beard is not white, similar to body fur color. Genital tuft is dark gray.

*H. leuconedys* males

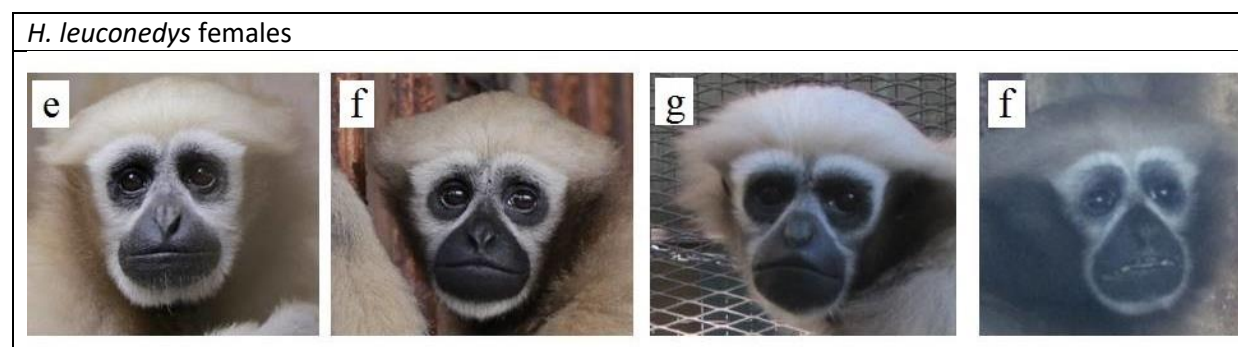
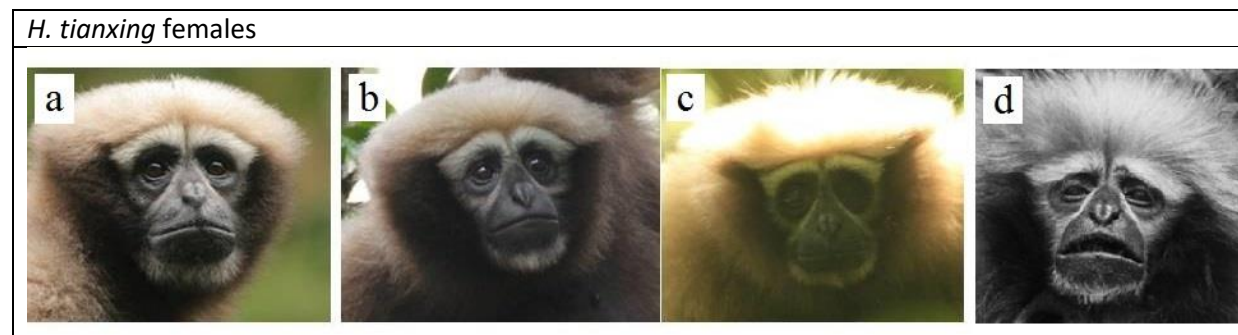


*H. tianxing* males



Fan et al., 2017, AJP

Female: *Hoolock leuconedys* has thick white hair under the eyes. The white hair in eastern hoolocks like a mask clearly dividing the eyes and face.



Fan et al., 2017, AJP

It's difficult to tell the gender of young gibbons because gibbons have peculiar reproductive organs. Females have long clitoris which is similar to males' penis. Their features are better shown at the age of 8 or 9 when testicle drops.



范朋飞

云山保护创始人、科学顾问；中山大学生命科学学院教授

### 冠长臂猿

雄性看发型：

西黑冠：毛发直立，看不见耳朵，明显的三角形发型

东黑冠：小圆平头，胸部有黄褐色小斑

海南：正面看见耳朵，三角形发型

冠长臂猿雄性		
西黑冠	东黑冠	海南
		

Mootnick and Fan, 2011, AJP

雌性：

西黑冠：下巴有黑色毛发，老了以后腹部是黑色的

东黑冠：肚子是黄色的，老了以后不会变黑，脸部是白色的，头上的冠斑延伸到后背中央

海南：圆脸，肚子上的毛发不会变黑

小长臂猿：

东黑冠：出生时是黑

西黑冠/海南：奶白色，慢慢变黄，6个月慢慢有点黑毛

海南：2,3个月就开始变黑，6个月差不多全黑

冠长臂猿雌性和小长臂猿		
西黑冠	东黑冠	海南
		

Mootnick and Fan, 2011, AJP

### 白颊和黄颊长臂猿鉴定

#### 雄性区分：

北白颊：颊毛比较长，可以达到他的耳朵

南白颊：颊毛达不到耳朵

黄颊：黄颊颊毛和南白颊差不多长，黄颊颊毛外翻

#### 雌性区分：

北白颊：脸部周围的白毛不浓密南白颊：倒下角的头型，脸部周围的白毛更加浓密

黄颊：颊毛外翻

### 白眉长臂猿鉴定

西白眉：一字眉，眉毛基本不分开

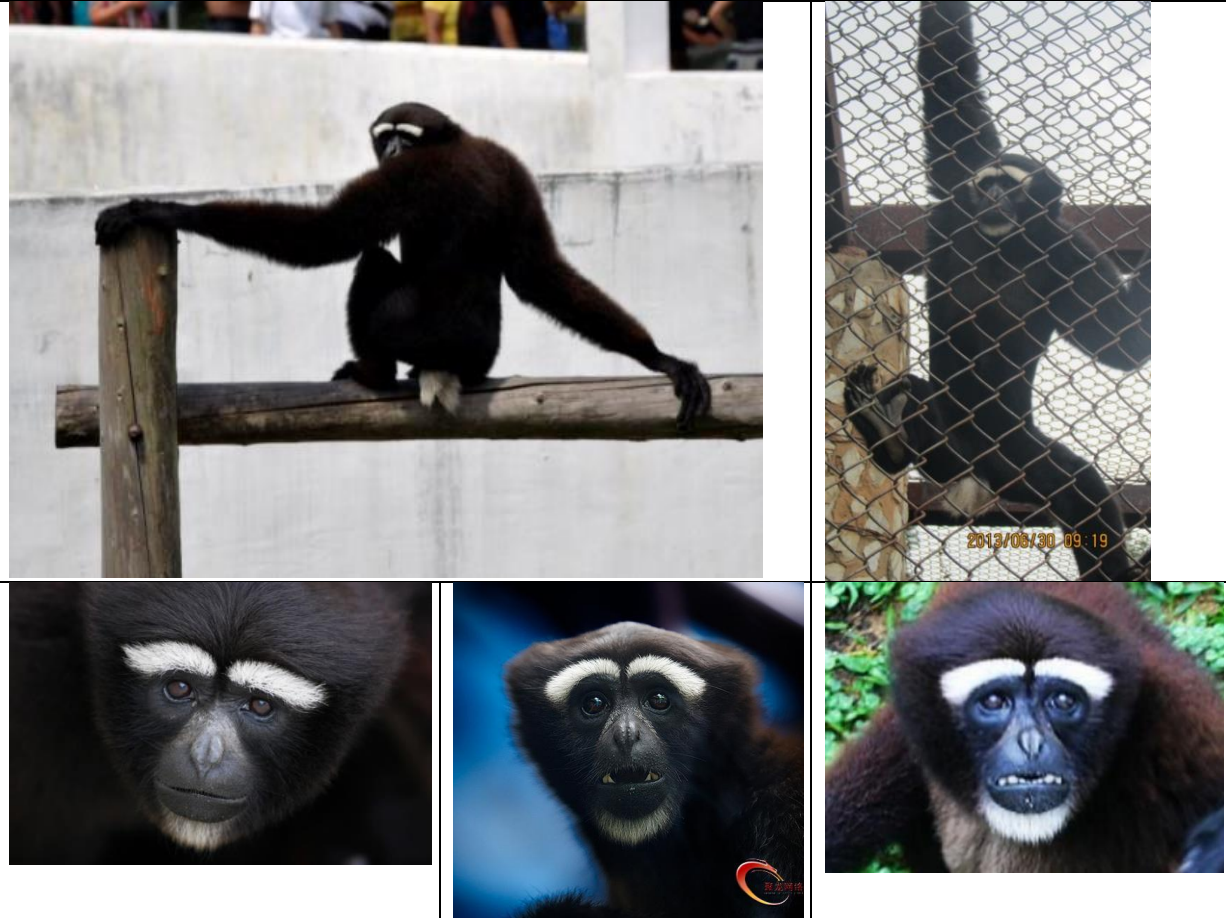
#### 东白眉/天行：

共同点：眉毛明显分开

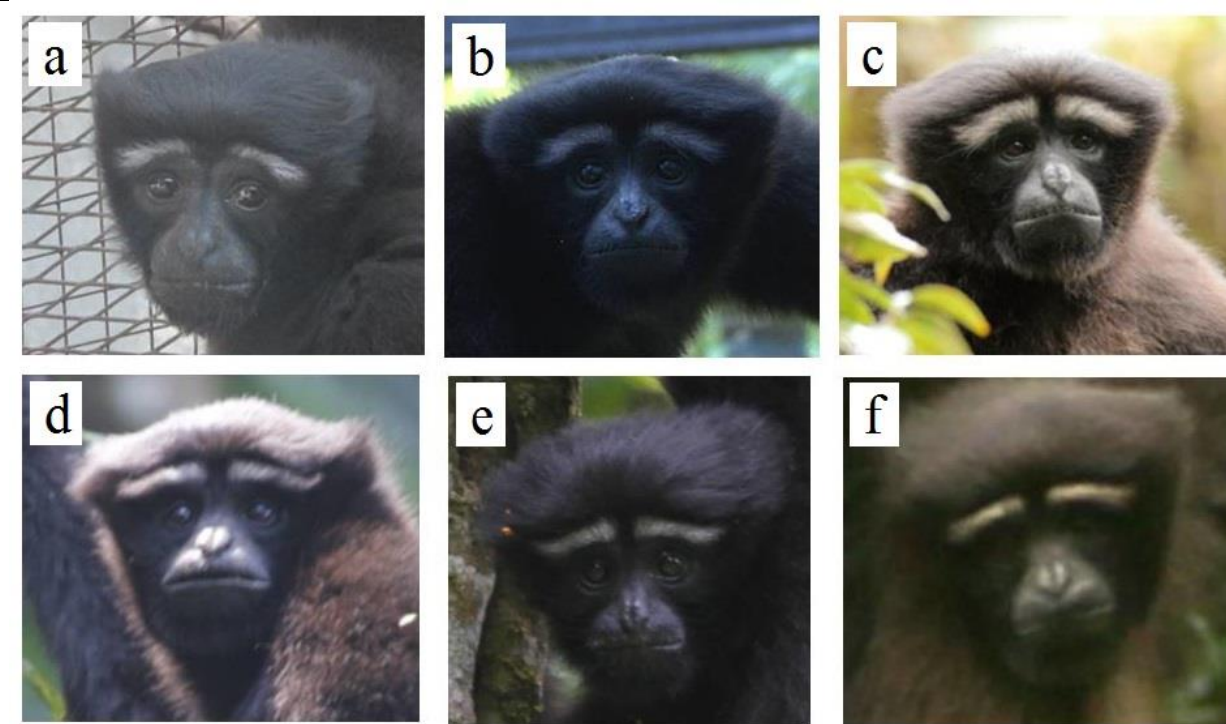
区别：东白眉长臂猿的下巴有白胡须，眼窝也有白毛；雄性阴囊上的毛是灰白色。

天行：眉毛截然分开，眉毛没有东白眉那么浓密，眉毛末尾向上翘，没有白色的胡子；阴囊上的毛偏黑灰色。

东白眉雄性



天行雄性

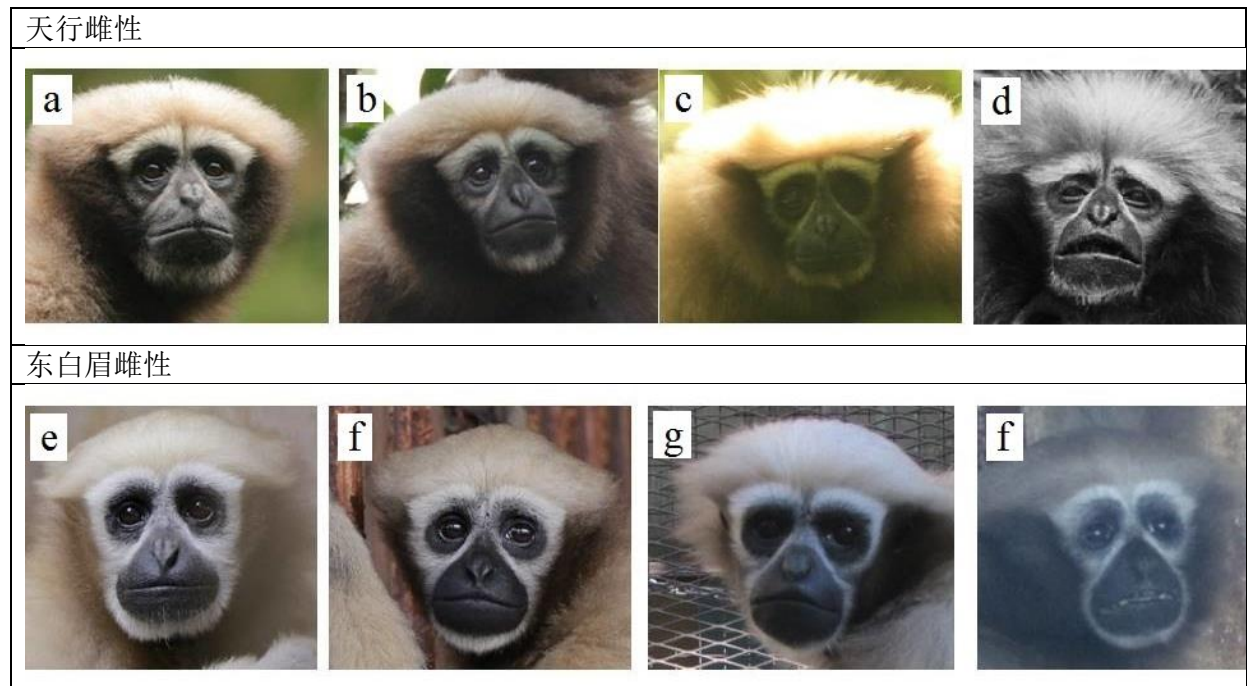


Fan et al., 2017, AJP



雌性：

东白眉眼眶中间的白眉特别多，东白眉的眼圈很明显，像戴了一个面具。



Fan et al., 2017, AJP

小长臂猿很难鉴别雌性，因为长臂猿的生殖器构造很奇特，因为雌性的阴蒂比较长，和雄性的阴茎相似。要到 8,9 岁的时候，睾丸下沉，长臂猿的生殖器特征才能显现出来。

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## **SECTION 12**

### **Applied In-situ Conservation Recovery Techniques for Gibbons**

#### **第十二章 长臂猿种群在地保护手段实施方案**



## Susan Cheyne

### Vice Chair , IUCN Primate Specialist Group Section on Small Apes (SSA)

We know that there are 20 species of gibbons distributed in 10 countries in the world and we have over 60 years of conservation action and scientific research from many different countries which can serve as very good reference for future gibbon conservation efforts.

Each species of gibbon faces more or less the same threats: fragmented small populations, in need of better law enforcement and management; and loss of habitat.

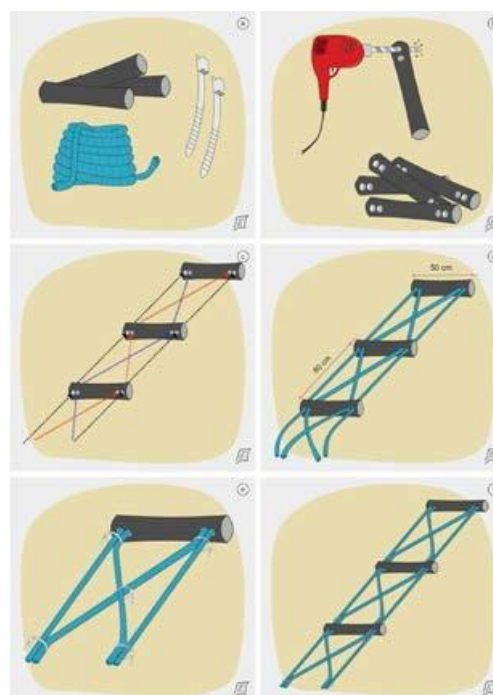
Approaches that we can take to solve the problems:

Habitat protection and connectivity:

- Stop habitat degradation through fire prevention, limiting/preventing encroachment from settlements, combatting new road construction etc. (try to keep away from key habitats if unavoidable);
- Involve gibbon habitat in REDD+ and/or carbon credit schemes to protect natural forests;
- Work with local communities to protect forest outside current conservation/protected areas;
- Optimise law enforcement by establishing effective patrols and clear collaboration between all law enforcement organisations (e.g. SMART - Spatial Monitoring and Reporting Tool--- very effective with Cao vit gibbons in Vietnam)

Reconnecting fragments:

- Tree planting is a good approach, but it's difficult to see results in short term. Rope bridges can be built in places where threats are found to reduce risks like electric shock.



- It's better to build multiple travel routes and more than one rope, so as to provide more options for gibbons.
- Note that other animals may also use the bridges and we must think about materials to guarantee their durability and bearing capacity.

Population Monitoring:

- Long-term accurate monitoring is needed to capture trends of population changes;
- Standardized monitoring tools ensure work data consistency, and facilitate comparison with other regions;
- Use monitoring data to take management decisions (eg. forecast the changes of habitat).

#### Captive Rehabilitation:

- 2013 workshop in Cambodia gave emphasis on these issues. Representatives from Beijing Zoo said that captive gibbon rehabilitation was not occurring in China and they were therefore not familiar with the matters they need to pay attention to.
- Gibbon pet trade is not a massive issue in China. Most of the rehabilitated individuals are born in the wild and are reared after being caught or injured out of different reasons. Health condition and pairing issue should be carefully considered before their assessment for rehabilitation.
- More than 80% of primates' past rehabilitation don't have a confirmed result (some failed and some lacked continuous tracking). But there have been many successful cases in Asia over the past 15 years, and there is plenty of practical experience.
- It should be noted that reintroduction does not make any sense if there is no potential self-breeding in the wild.
- The minutes of the workshop in Cambodia elaborated on the methods.
- Most of the re-introduction with follow-up monitoring by Indonesia has been very successful.

#### Communities, outreach and Education:

- Promote ecotourism only where population is large and stable, but with a standardized model;
- Launch awareness campaigns and education programs via traditional and new media;
- Conduct targeted activities in universities, primary schools and local communities;
- Link to local culture.

#### Translocation (Moving *wild* species to a different *wild* area):

- For small population or individuals without a future, this is the only way to protect them, otherwise their existence has no ecological meaning;
- India has cases of successful translocation of hoolock gibbons, which are not entirely applicable, but at least represent the possibility;
- It requires an experienced veterinarian, workable capture plan for local situation, appropriate timing, as well as expert capturers. Smaller group size is always ideal for easy capture.

#### Take-home Messages:

- Gibbons will go extinct if we don't protect them;
- Different approaches are needed at the same time;
- Strengthening international involvement and sharing experience is crucial;
- All ex situ institutions should have a tangible link to in situ conservation and share resources.

Q: Is there a safer way to capture gibbons? What way of anesthetizing is safer?

A: Many places, for example Thailand, have used blow pipe, but it requires a lot of practice to ensure accuracy, and it is effective only at a very close distance. Dart guns are more accurate, but you must be careful to hit areas where there is more muscle (butt), as the strength of guns may hurt gibbons.

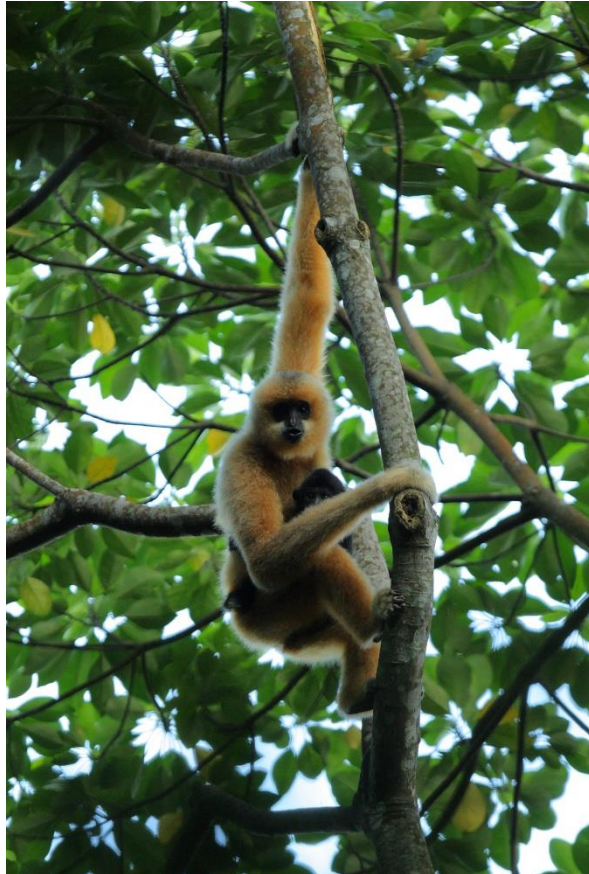
Q: Tongbiguan Nature Reserve has very serious fragmentation issue. What is the success rate of translocation?

A: So far, the previous translocation efforts have been successful with no cases of death. But it certainly has risks which can be lowered with experiences. Come to us if you need more knowledge about that.

Q: This is a question about community education. How should we improve awareness in communities around the habitats where villagers acquire local resources for production? Are there any good

experiences?

A: It's something unavoidable for the villagers to acquire local resources. One known method is underwood planting for greater resource efficiency. Farmers in Java grow "gibbon coffee" to support gibbon conservation projects rather than resorting to the more destructive production methods. It is better to help them improve the efficiency of their existing production model with greater yield, rather than teaching them something completely new.



Zhao Chao, Cloud Mountain Conservation ©2019

Susan Cheyne

IUCN 小猿专家组副主席

大家已经知道我们有 20 种长臂猿分布在 10 个国家内，在不同的国家我们有着超过了 60 年的保护与科研经验可以用来学习和参考于未来的长臂猿保护中。

每一种长臂猿或多或少的都面临着同样的威胁：破碎化的小种群；需要完善的执法与管理；以及进一步的栖息地丧失。

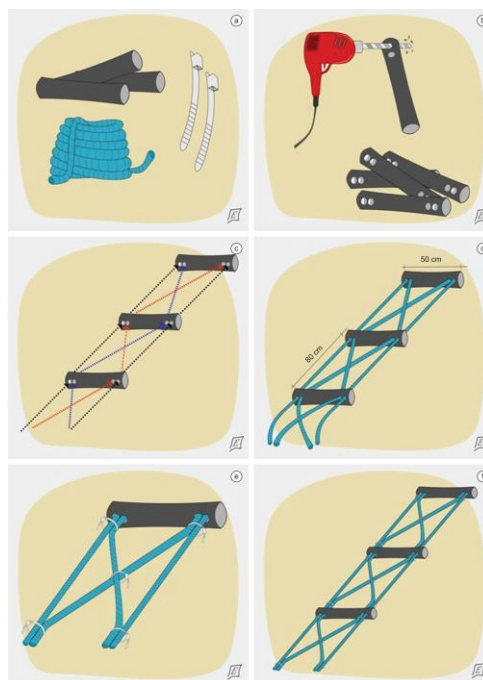
接下来分别介绍一下针对各个问题可以开展的工作。

栖息地保护：

- 防火，限制迁入人口的破坏性，控制道路修建（虽然无法避免，但尽量绕开关键栖息地）
- 利用针对生态环境，或者类似 REDD+ 的碳补偿项目保护天然林。
- 在保护区外与当地社区合作开展保护工作。
- 优化保护地区的巡护与监管，促进不同执法队伍之间的合作（例如在越南的保护工作中很成功地利用 SMART 系统提升了巡护效果）。

连通性建设：

- 种树是一个好方法，但短期内很难有成效，相对地可以在发现威胁的地方建设桥梁减少类似触电之类的威胁。



- 类似这样地桥梁最好不要只建设一种，多提供一些选择。
- 需要注意其它动物可能也会使用搭建的通道，同时建设过程中要考虑到桥梁的耐久性和承载力。

种群监测：

- 准确地监测需要长期地开展才能了解种群变化地趋势

- 标准化的监测手段保证了持久工作数据的一致性，同时方便与其他区域对比
- 以监测的数据做为保护工作的依据（例如对栖息地未来变化的预测）

#### 笼养野化

- 2013 年柬埔寨的会议着重讨论了这些内容，当时北京动物园的负责人表示笼养长臂猿在中国从没有尝试野外放归，不是很熟悉类似工作中的注意事项
- 中国的长臂猿并没有被大量地当成宠物饲养，重新野外放归的个体大部分也出生自野外，
- 因各种原因被捕捉或受伤后接受饲养，需要在健康状态调整好，谨慎地考虑配对问题，再评估是否适合重新野放
- 历史上 80%的灵长类野放无法确认成功率（一部分失败了，一部分缺乏放归后的跟踪）。但是亚洲在过去的 15 年内陆续地有很多成功的案例，可以使用的经验很充足。
- 需要注意的是如果没有在野外自我繁衍的希望的话，野放没有任何意义
- 柬埔寨会议记录有详细的手段描述
- 印尼做了后续监测的野化大部分都成功

#### 社区教育和宣传

- 在稳定的大种群区域可以推进生态旅游，但需要参考一个规范化的模式
- 通过新旧媒体进行宣传教育
- 高校，小学，当地社区针对性的开展活动
- 与当地文化紧密结合

#### 迁地保护（野外的种群转移到不同的野外位置）：

- 针对的是没有未来的小种群或个体，这是唯一能着手的保护方式，不然它们的存在没有任何生态意义
- 印度有过白眉长臂猿成功转移的案例，虽然并不完全适用，但至少代表了这个可能性
- 需要一个有经验的兽医，适用于当地情况的捕捉方案，适宜的时间以及可以胜任捕捉工作的人，越小的群体越容易成功。

#### 关键内容总结：

- 如果我们不做足够工作的话，长臂猿走向灭绝无法避免；
- 长臂猿保护需要很多不同的手段同时进行；
- 国际上的信息和经验交流极其重要；
- 笼养和在地保护的机构要加强合作以及资源分享。

问题：是否有更加安全的捕获长臂猿的方式？什么样的方式麻醉比较安全。

回答：很多地方使用过，比如泰国用过吹标麻醉，但需要大量地练习才能保证准确性。并且要在很近的距离才有效，用枪支射击更加准确，但需要注意射击的位置（屁股），因为枪支力度大很有可能会伤害到长臂猿。

问题：铜壁关自然保护区面临严峻的破碎化问题，个体转移是否有准确的成功率？

回答：迄今为止，尝试过的个体转移基本都很成功，没有在过程中死亡的例子出现。但这个手段

肯定有风险，通过经验可以降低这个风险，可以联系我们来提供相关信息。

问题：社区教育问题，我们在栖息地周边的社区，以从栖息地获取资源为主要生产方式，应该怎么做宣教？是否有经验？

回答：我们知道人类不可避免地会使用资源，已知的调和办法是促进林下种植，提高资源使用效率。爪哇地区地农民种植“长臂猿咖啡”支持保护，替代破坏性更强地生产方式。最好是提升已有生产模式的效率，提升原本的劳动产出，而不是教他们全新的劳作模式。



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## **Final Report**

# **中国长臂猿种群保护和管理培训研讨会**

**广州·中国**

**2018 年 4 月 22 日至 23 日**

## **总结报告**

### **SECTION 13**

#### **In-situ Hoolock Gibbon Conservation in India**

#### **第十三章 印度白眉长臂猿的就地保护**

**Dr. Dilip Chetry**

**Vice Chair of Aaranyak, devoted to research and conservation of primates in India for 24 years.**

There are two species of gibbons in India, Eastern hoolock gibbon (*Hoolock leuconedys*) (3,500-4,000) and Western hoolock gibbon (*Hoolock hoolock*) (less than 10,000).

Western hoolock gibbons are widely distributed in India, while Eastern hoolock gibbons are only found in small area. There are 37 hoolock conservation areas in the country, but only 3 of them have Eastern hoolock gibbons, mainly in the bordering areas with China.

In addition to the protected areas, there are also 10-20 groups of gibbons living in gibbon population monitoring area. The gibbons are well protected and highly habituated under the supervision of the locals.

Threats to gibbons are similar to those in China including hunting, logging, habitat loss, agricultural cultivation (Mandarin oranges, oranges, ginger, tea), coal mining, oil drilling, and clearing of forest for cultivation.

There are 7 species of primates in the conservation area and many other mammals.

Gibbon protection background in India:

Conservation actions mainly focused on Western hoolock gibbon in three stages:

1. Before Indo-US Primate Project phase (before 1994): low attention.

- 2-3 monkey-related research projects;

- Most attention was on large mammals, for example, tigers, elephants, rhinos, and etc.;

- Primates had very low attention.

2. Indo-US Primate Project phase (1994-2002): basic survey and many scientific research activities

- The first research especially on primates;

- Many studies on gibbons;

- Extensive survey and monitoring of primates distribution with the engagement of many universities, such as Gauhati University;

- Many bamboo bridges built to connect fragmented habitats.

3. Post Indo-US Primate Project phase (after 2002): conservation actions led by Indian research institutions and NGOs

(A video clip introducing mobile bridge for gibbons built with bamboo.) We have tried a lot of materials and found that bamboo works the best, and shaped as X, they help better connectivity for gibbons.

The traditional belief of local Mishmi people is no hunting, no killing or even touching gibbons is considered evil. They may not be killing gibbons but their agricultural and logging activities have led to the fragmentation of gibbons' habitats. In some forest patches, some trees are observed living 2-3 gibbons.

Eastern hoolock gibbon translocation project (Dello area to Mehao Wildlife Sanctuary)



- The canopy is lost in Dello area. Even if artificial bridge is built, the space for activities is still not enough. We have to resort to translocation.
- We tried different methods using traditional bamboo baskets to capture and translocate, with no anesthesia.
- Background: Habitat degradation caused by village development makes it no longer suitable for gibbons and strong human intervention is required.
- In 2011-2013, 6 family groups were captured and translocated with some follow-up monitoring (monitoring results were not elaborated).

Following the success of this action, in 2016, we conducted the translocation of Eastern hoolock gibbon from Wakro to Kamlang Wildlife Sanctuary. There were four adult males, four adult females and one adolescent male.

In 2007, Indian government supported the artificial breeding efforts of Eastern hoolock gibbon (Itanagar, AP). It was very successful. Wild re-introduction is in preparation.

Now, a few words about my work place Hollongapar Gibbon Wildlife Sanctuary, a very small tropical rainforest (or known as island forest) with a spectrum of less than 2 square kilometers. It's located in the Assam province, adjacent to the Nagaland province. We have 7 primate species in the sanctuary, including Western hoolock gibbon and many other animals to be protected, such as elephants and leopards. By having gibbons as the flagship species, we have protected many other valuable species and the overall forest biodiversity.



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The frequent mentioning of the word of gibbon in Hollongapar sanctuary helped a change of the mind of the people living around and an obvious increase of visitors. Visitors now come to see gibbons specifically. More and more places are willing to use the name of gibbon. The popularity of gibbon grows, so does their population size.

However, paper work is still not enough. Although the gibbons are more endangered than many elephants and rhinos, they have not received much attention. We need more publicity and education in the future work. New media, like Facebook, can play very important role to attract students to come to study or work. Forestry bureau is an indispensable partner in our conservation efforts. In India, even the conservationists have no access to the gibbons, so we must maintain a good relationship with the management department and we will invite more international experts to the sanctuary.

The construction of the railway blocked the connectivity of forest. Aaranyak replanted trees on both sides of the tracks. The gibbon protection project has had a very positive social impact. There are gibbon-themed ecotourism and homestay.

The population of hoolock gibbon in this sanctuary rose from 17 groups with 64 individuals in 2004 to 30 groups with more than 125 individuals last year (2017). At the same time, under the strict supervision and management, the number of other primates, such as stump-tailed macaques, increased by many times.

**Comments from Prof. Fan Pengfei:** Indian gibbons are distributed in low-altitude areas, very different from the gibbons in China. Some gibbons even just inhabit on sparse trees scattered around the farmland, as they will be chased and threatened by dogs if they get down. Therefore, Indian takes different protection measures to deal with different threats.

Q: We use iron cages during the translocation process, but the animals reacted very strongly. Do you have this kind of concern when using bamboo basket?

A: There were no injuries or deaths in our past translocation. We used plastic or bamboo baskets to capture after cornering them to somewhere. We didn't bait.

Q: Will it scare gibbons? Are gibbons psychologically affected when being caught?

A: It's possible. If done efficiently then there is less stress on the gibbons, especially as they already had a lot of psychological stress from habitat fragmentation in their original habitat. Once captured, we will release them to higher quality habitats as soon as possible to minimize their psychological impact.

**Dilip Chetry 博士**

**印度 Aaranyak 灵长类研究与保护部部长，在印度从事了 24 年的灵长类研究与保护**

印度有 2 种长臂猿，东白眉长臂猿（3500-4000 只）和西白眉长臂猿（少于 10000 只）。

西白眉长臂猿的分布区很广，东白眉相比之下就小很多。印度共有 37 个拥有白眉长臂猿的保护区，但其中只有 3 个有东白眉长臂猿分布，主要分布在跟中国接壤的区域。

在正规保护区之外，我们还有 10-20 群长臂猿生活在长臂猿种群监护区。在当地人的监管下保护成效很好，长臂猿也达到了很高程度的习惯化。

长臂猿受到的威胁和中国的种群很像，捕猎，伐木，栖息地丧失，农业种植（橘子，橙子，姜，茶），煤矿，石油，刀耕火种。

保护区共有 7 种灵长类动物，同时也有许多其他的哺乳动物生存。

印度长臂猿的保护背景：

保护行动主要集中在西白眉长臂猿，分三个阶段：

1. 印美合作灵长类项目前（1994 以前）：受关注低
  - 2-3 个猴类相关的研究项目
  - 印度大型哺乳类受到的关注最多，老虎，大象，犀牛等，灵长类关注度极低
2. 印美合作灵长类项目（1994-2002）：基础调查及诸多科研行动开展
  - 第一个专门的灵长类研究
  - 开展了很多针对长臂猿的专项研究
  - 广泛地调查和监测了灵长类分布，很多高校例如 Gauhati 大学都参与其中
  - 建设了许多竹桥连接破碎化的栖息地
3. 印美合作灵长类项目后（2002 以后）：印度本地的科研机构和 NGO 为主的保护行动

（播放视频并介绍了利用竹竿搭设的供长臂猿使用的移动桥梁）我们试过用过很多材料后发现只有用竹子，并使用了 X 形的支撑方式前提下长臂猿才会使用这种人工搭建的通道。Mishmi（傣人）种族的传统观念中不会狩猎，不会杀生，甚至接触长臂猿都被认为是邪恶的行为。虽然他们并不直接地狩猎长臂猿，但社区的发展中依然存在大量的树木砍伐以及农业活动，导致了长臂猿栖息地的破碎化，破碎化的栖息地中观测到的有些树上生活着 2-3 只长臂猿。

Dello 村到 Mehao 野生动物庇护所的东白眉长臂猿迁地保护：

- 冠层丧失，即使搭建人工桥梁也没有足够的空间移动，只好开展迁地保护。
  - 尝试方法，并没有使用麻醉，竹制篮筐捕捉和转移。
  - 背景：村落发展导致的栖息地退化，不再适合长臂猿栖息，需要强烈的人工干预。
- 2011-2013 年陆续进行了 6 个家庭群落的捕捉和转移，也进行了一定的后期监测（并没有描述监测结果）

在这个行动成功后，2016 年又开展了 Wakro 地区到 Kamlang 野生动物庇护所的东白眉迁地保护。4 只成年和雄性 4 只成年雌性以及 1 只未成年雄性。政府支持 2007 年开展了东白眉长臂猿的人工繁殖

殖尝试（Itanagar, AP），结果非常成功，准备进行野外放归的尝试。

接下来讲一下我的工作地点 Hollongapar，一块儿非常小的热带雨林（或者可以叫孤岛森林），不超过 2 平方公里，坐落在 Assam 省，与 Nagaland 省相邻。这个保护区内我们有 7 种灵长类动物，包括西白眉长臂猿，同时我们也有大象和金钱豹等很多其它需要保护的动物。利用长臂猿作为旗舰物种的呼吁效果，在保护它们的同时我们也保护到了许多宝贵的物种以及森林整体的生物多样性。



Hollongapar 在频繁的使用长臂猿这个名字的前提下，庇护所附近人们的观念发生了显著的转变，游客明显增多，曾经来看猴子的游客，现在知道了长臂猿专门来看长臂猿。且越来越多的地方愿意使用长臂猿的名字，长臂猿的名气增长后，种群也增长了许多。

只是纸面上的数据很难真正的达到呼吁效果，尽管长臂猿比很多大象犀牛更加濒危，但并没有得到更多的重视。未来工作中应该加强传播与教育，可以考虑利用类似 Facebook 之类的新媒体，已经吸引更多学生在这里学习或者工作。林业局是我们保护工作中不可或缺的合作伙伴，即使在印度普通的保护工作者也不能接触长臂猿，所以一定要维持好与管理部门的关系。以及邀请更多国际学者访问。

因为铁路的修建阻断了森林的连贯性，Aaranyak 就重新在铁路的两边种植树木。长臂猿保护项目

造成了很积极的社会影响，比如说长臂猿主题旅行团、家庭客栈（guesthouse）等。

白眉长臂猿种群在这个保护区从 04 年的 17 群 64 只上涨到去年的 30 群超过 125 只个体，同时在保护区更加严格的监管下，其他灵长类动物如短尾猴的数量更是增长了许多倍。

范鹏飞点评：印度长臂猿分布于低海拔地区，行为与中国分布的白眉长臂猿有极大差异，甚至有的长臂猿栖息在农田周围仅剩的几颗零星的树上，会因为下地的时候受到狗的追逐而威胁。与之相对的保护手段也有很大的区别，威胁因素不同。

提问：我们在动物转移时用铁笼子，铁笼中动物反抗很激烈，在竹筐里面是否有这个顾虑？

回答：我们的转移工作中没有受伤或者死亡案例。捕捉手段是使用塑料或者竹筐，围堵驱赶后直接捕捉，没有用诱饵。

提问：是否会惊吓长臂猿？影响长臂猿精神状态？

回答：有可能，因为树少，所以长臂猿原本的生活中就有很大的压力了，如果我们提高捕捉效率，会尽量能减少它们的焦虑。我们抓捕后会尽快的重新放归到质量更高的栖息地，以期最小化长臂猿的心理影响。

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## **总结报告**

### **SECTION 14**

## **How Forest Fragmentation Affects the Western Hoolock**

### **Gibbon**

## **第十四章 森林破碎化对西白眉长臂猿的影响**

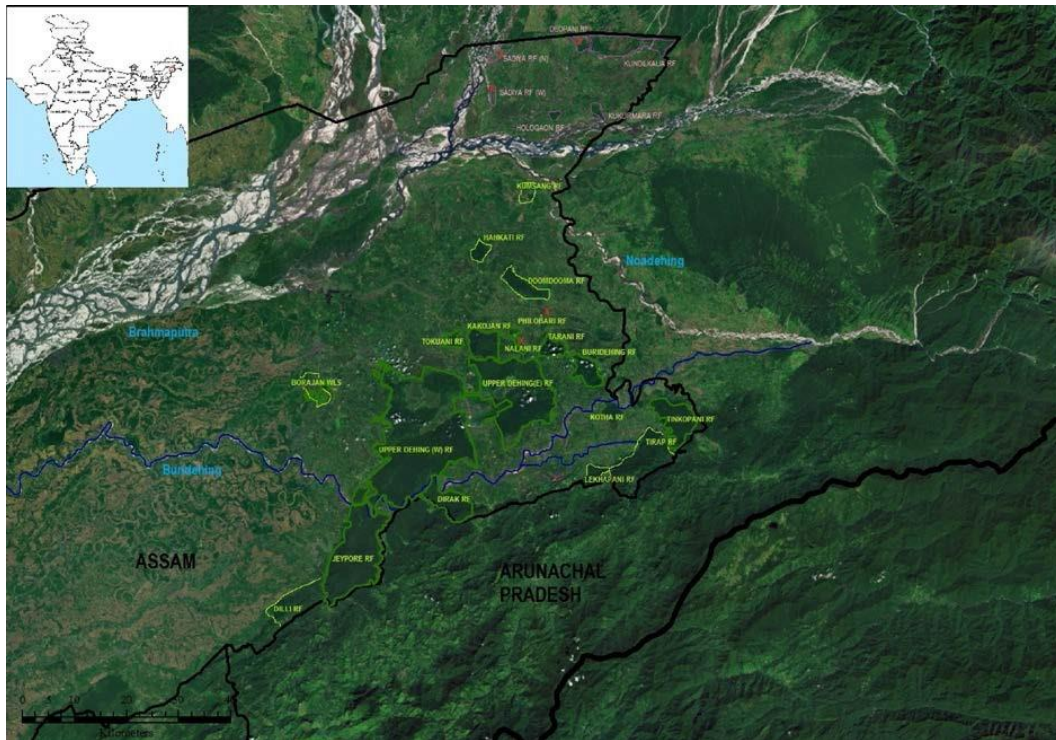


**Dr. Kashmira Kakati**  
**Indian gibbon small population specialist**  
**Independent wildlife scientist in India**

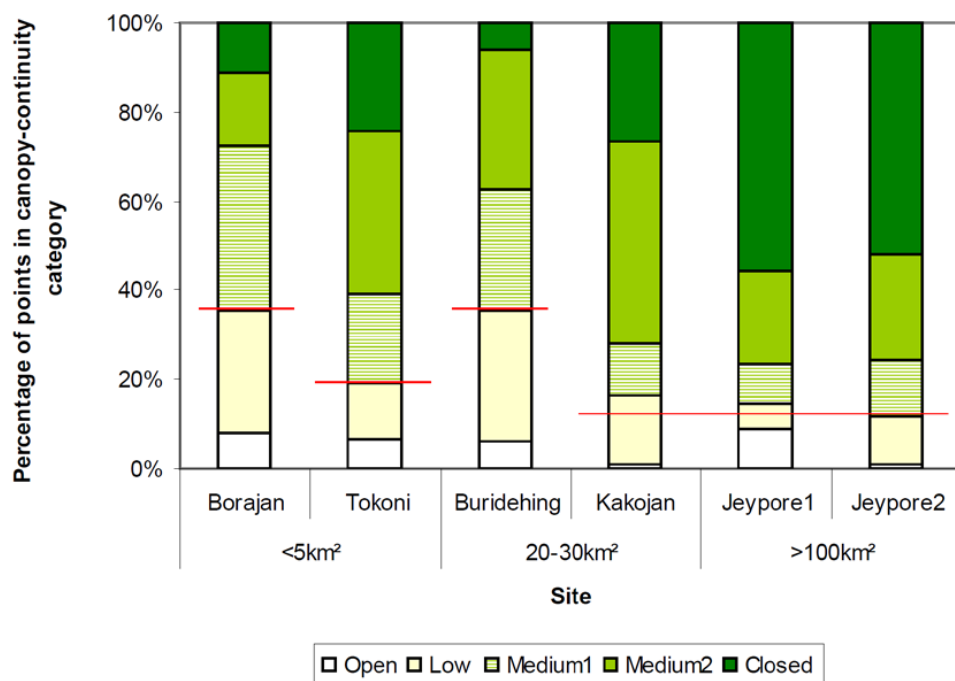
I focused on gibbons in a small habitat (less than 5 square kilometers) for my Master research. In this short study of 6 months and my first contact with gibbons, I noticed the completely different behaviors of the gibbons from the descriptions in books. They didn't eat fruits and lived in a very small area with no call even for a month. At first, I felt worried and was afraid of doing something wrong, then I realized it wasn't my problem, but the gibbons behaved abnormally in this very small habitat. I originally planned to study elephants for my Phd research, but I felt that these gibbons need more study and attention, so I finally choose the behavioral ecology of Western hoolock gibbon in fragmented habitats as the subject of my doctoral thesis.

Gibbon is very beautiful, gentle, and smart. You won't get bored after observing them even for a few years. I'd like to start with a story about gibbons which happened in February 1997 when I was tracking gibbons for my research. There was once a very heavy a storm. One morning, I found that a 2-or-3-month-old gibbon in the family was not in good health and could not hang on its mom as usual. Its mother had been trying to hold it but was not successful. I observed them for a few hours, and found that the mother was trying to make the baby comfortable, even stretching her legs to let it lie down for a while. The father was also worried and kept coming back and forth to see what was going on, attempting to do something but in vain. After a while, the little gibbon fell off the tree when the mother tried to move. The father quickly ran down to check the situation, but soon back onto the tree. The siblings were also watching nervously. A moment later, the mother finally came down and picked up the little gibbon, but I could only see her back, and didn't know what she was doing then. I thought she would take the little gibbon back, but after five minutes I found she was back on tree alone. Then, about half an hour later, the group of gibbons that had not called for a long time began to call. We know that gibbons vocalize to signalize land occupation, looking for a spouse, or out of other ecological functions. But at least on that day, I thought they vocalized to express their condolence and sorrow, or to mean the death of their family member. After they left, I ran over to look for the little gibbon, it was strange that I knew exactly where he was, but couldn't find it. After looking for a long time, I found that the mother hid it in the bamboo bush and covered the body with bamboo branches and leaves. Later, I took the little gibbon to the city for veterinarian help, but we failed to save its life because its head was hit heavily. A veterinarian asked me in surprise what animal I had taken. I was disappointed at the loss of one day's data and continued to track the gibbons the next day, but I couldn't find the mother after trying for a long time. An hour later, I found her who was lying alone on the tree with a bamboo branch in arms.

When we talk about gibbons, we are not talking about an ordinary animal, not a mouse, cockroach or others. We are talking about an animal with high IQ, very emotional and sentimental. They have feelings and emotions. Therefore, as to the question asked just now about whether the capture activity will affect the psychology of gibbons, the answer is absolutely yes. They felt terrified as we are, and they have all kinds of emotions.

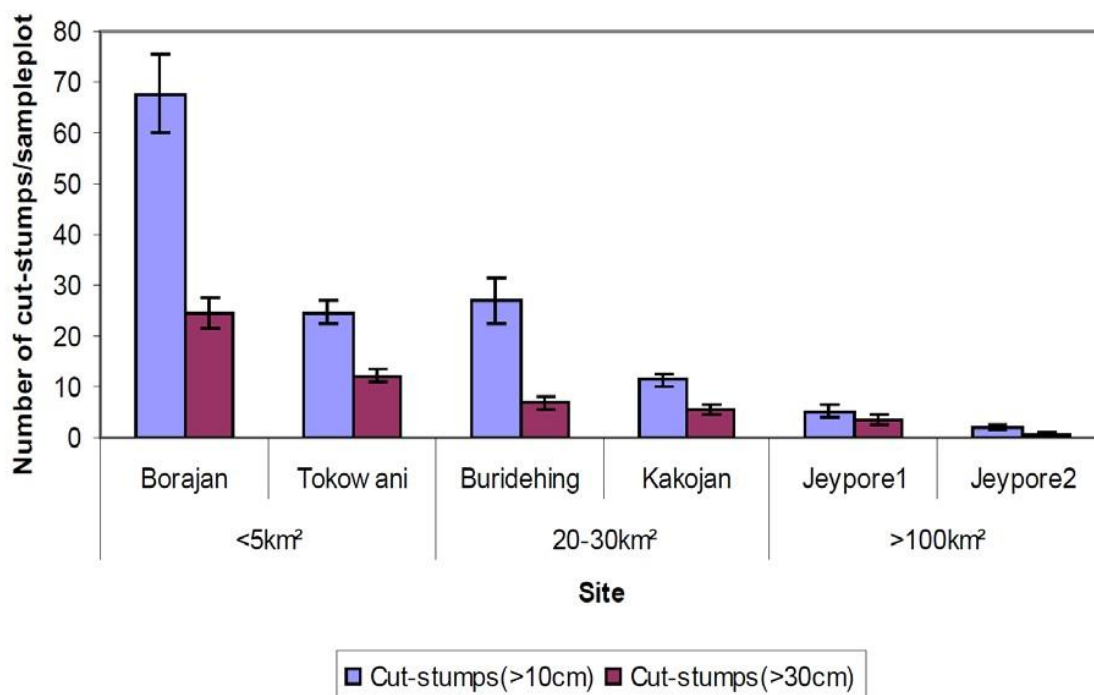


The fragmented gibbon habitat I studied is located in the east of Assam Province. The forest fragmentation here is very serious. The surrounding villages and towns and their needs for social development will inevitably encroach the remaining forests slowly. The situation in Assam is very similar to some regions of China. The influx of immigrants (such as war refugees) has increased local needs for land. It's a difficult policy decision as to how to settle these new residents against the needs for ecological conservation. I divided the forest here into three sections. The most seriously fragmented habitat is less than 5 square kilometers, the medium-sized is about 20-30 square kilometers, and the large one is over 100 square kilometers (gibbons' behavior here will serve as the healthy benchmark), and comparative analysis was conducted.

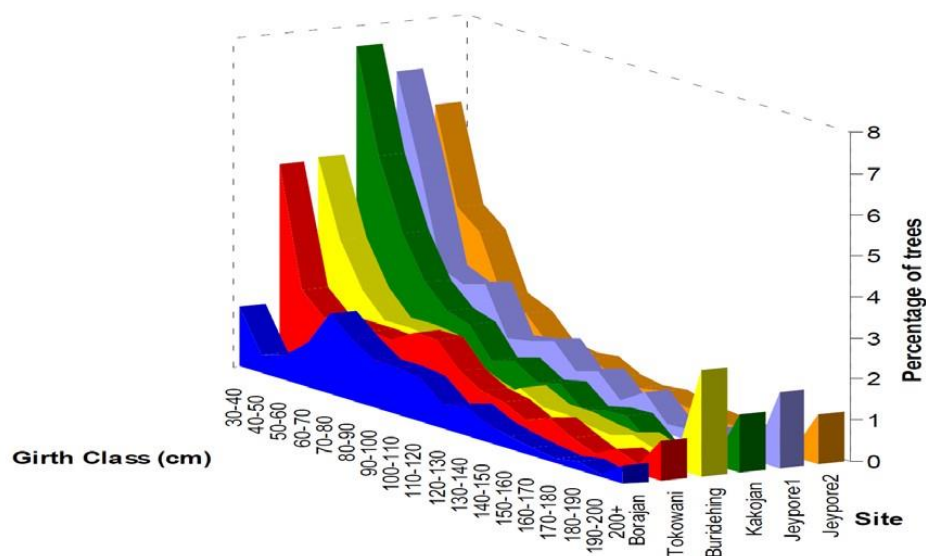




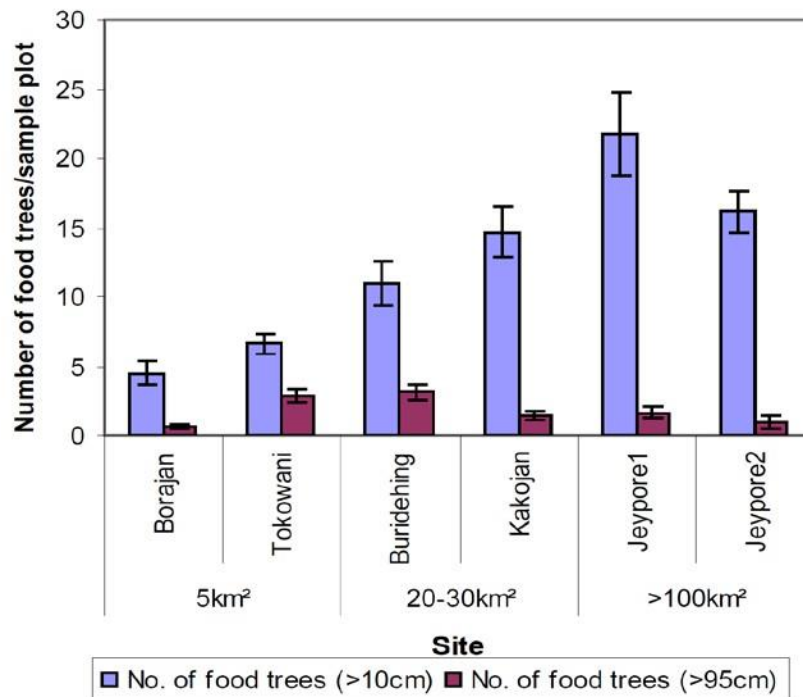
Comparative analysis shows that the canopy density in small and medium-sized habitats is significantly lower than that of the healthy large habitats. In the face of lots of unconnected canopies, gibbons often need to do dangerous long jumps to reach their destination. Although gibbons are “flying trapezes” in the jungle with very strong capability of moving around in the canopy, frequent long jumps inevitably increase their activity difficulties and risk of death.



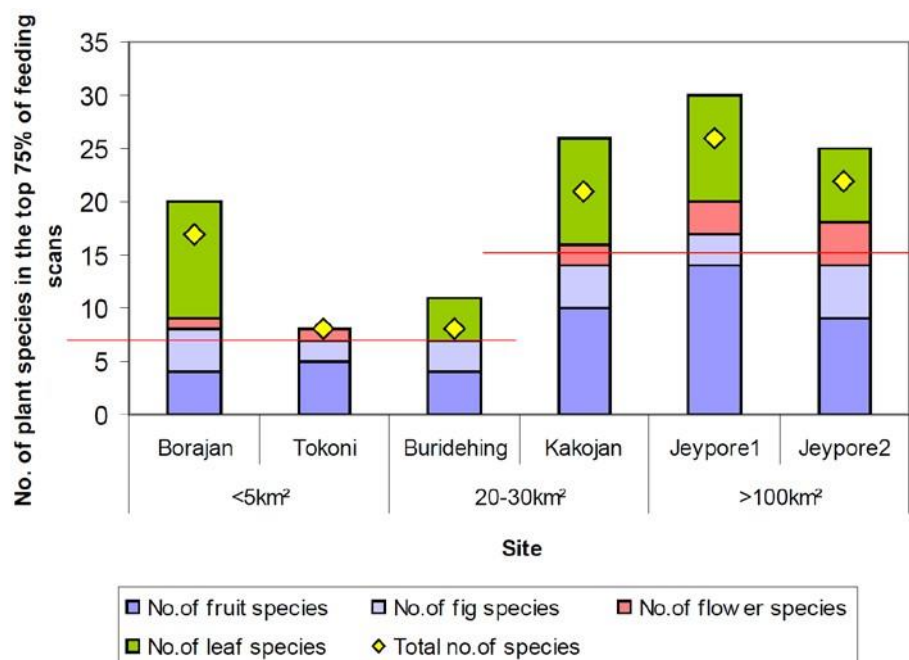
People sometimes have a very strange mentality. In a protected complete forest, it will be very obvious if one single tree is cut down, so the forest will not be destroyed so easily. But in an already destroyed forest, people tend to think that since it's already like this, it does not matter to cut one more tree, which may lead to faster forest degradation. In this sense, the threats to small fragmented habitat are greater than the intact large ones.



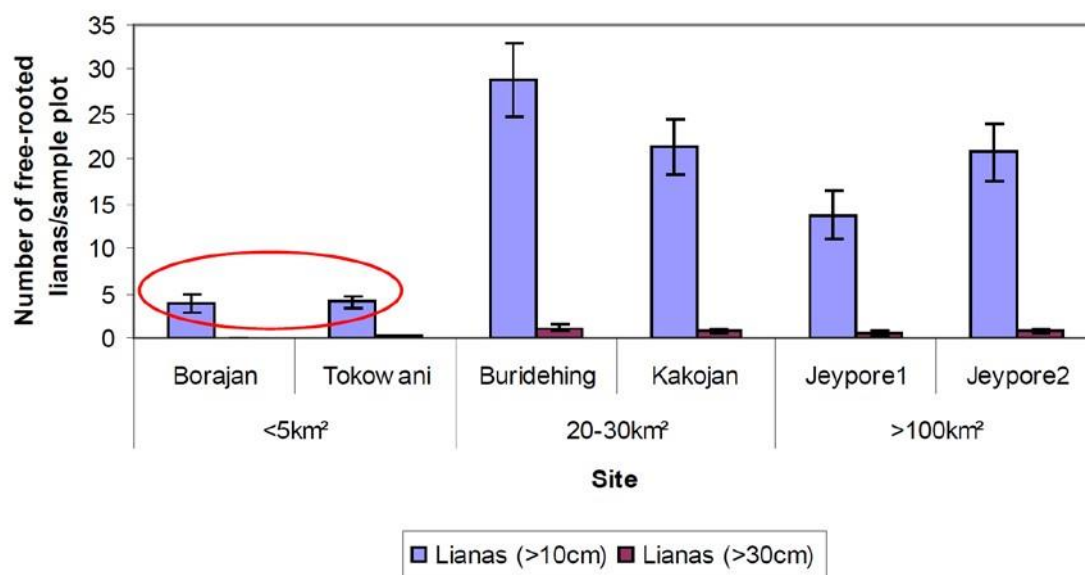
The seedling replenishing rate in small fragments is also significantly lower than that in large fragments.



What's more worrying is that the number/density of large food trees in fragmented habitat is less than a fraction of a large habitat.

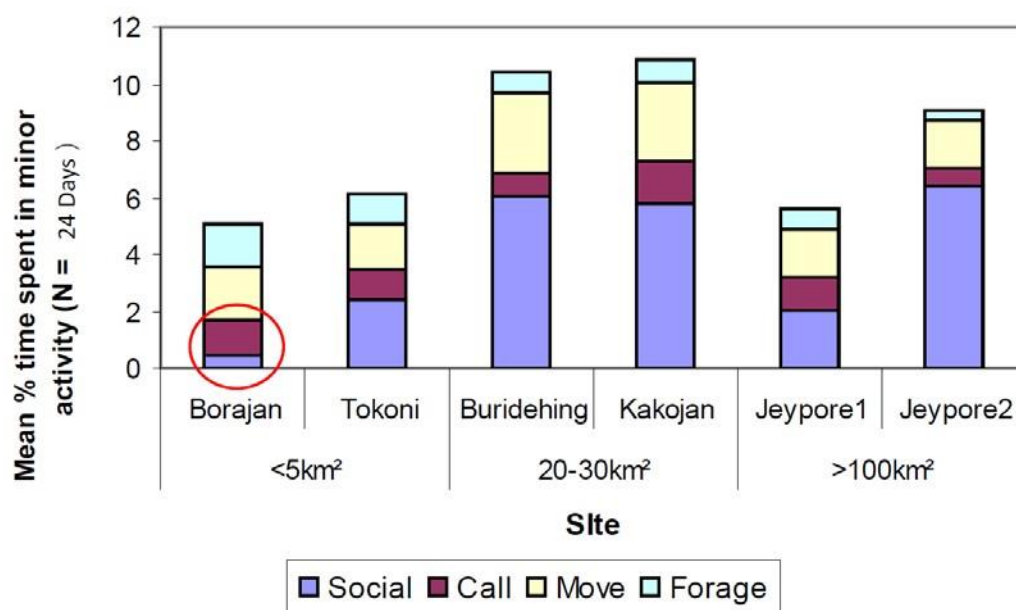


There are over 20 types of food trees in fragments, but the key food----heat-producing fruits----are only about half of that in large and healthy habitats.

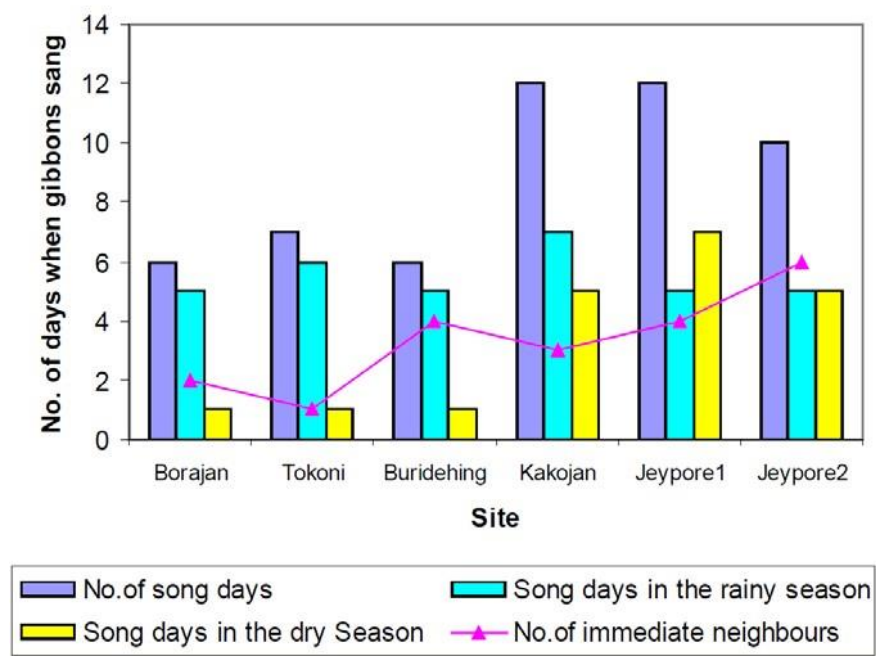


I later found out that more than 60% of the food of gibbons in large habitats comes from lianas, but in small habitats, lianas are only one quarter or one fifth of that in medium and large fragments. However, lianas are not a priority in forest vegetation statistics. In India's traditional forest management, lianas are prone to be cut as they affect the growth of trees. Therefore, in the future, the deforestation of lianas needs to be stopped at least in forests with gibbons.

Behavior:



Gibbons in different fragments call, move and forage similarly. But gibbons in small fragments of Borajan have less social behavior because they have to split up to find food resources due to low food density. I don't know how reduced social behavior affects the gibbons, but I'm sure there will be impact, because the gibbons in large fragments have displayed high social behaviors.



Regardless of the number of their neighbors, gibbons' call frequency in fragmented habitats is not very high. The monitoring results in different seasons show that gibbons call significantly less in dry season, sometimes not even for 12 days. Therefore, we must budget long-time monitoring to locate gibbons in smaller fragments in future survey as they have been shown to sing less in dry season.

Population:

GIBBON POPULATIONS (N = 59 GROUPS)				
Forest Size Class	Forest Loss 1990-2000 (%)	Gibbon Group Density (No. of groups/km <sup>2</sup> )	Group Size	
Small (4) ● 5 km <sup>2</sup>	6 – 70	0.28 ± 0.16 (n=2)	2.5 ± 1.5* (n=2)	
Medium (7) ● 20-30 km <sup>2</sup>	2 - 3	1.18 ± 0.43 (n=26)	3.29 ± 0.23 (n=24)	
Large (3) ● 100 km <sup>2</sup>	1.6	3.18 ± 0.89 (n=31)	3.96 ± 0.13 (n=28)	

In habitats of different quality and sizes, population density and group size vary significantly. I had thought that habitats of 20-30 square kilometers could be enough, but later I found this was not the most natural situation. Larger forests absolutely have higher carrying capacity. As mentioned before, the rate of forest loss is faster in the smaller forest fragments, and the life of the gibbons there is not very optimistic.

Age-sex class ratios (n=54 groups)	Forest Size Class (km <sup>2</sup> )		
	<5	20 - 30	>100
No. of groups	2	24	28
Adult male: Adult Female	0.50	1.10	1.00
Infant : Female	0.50	0.52	0.60
Juvenile : Female	0	0.76	0.85
Immature <sup>2</sup> : Female	0.50	1.28	1.46
Sub-adult : Adult	0.33	0.18	0.25

Small fragments have less juveniles/immature individuals perhaps as a result of less suitable food sources. For baby gibbons, breast milk will be enough. But there won't be suitable food for them when they grow bigger due to poor habitat environment, thus a lot of them cannot survive this critical stage.

Another problem is that the sub-adults stay with the group for longer time as they have no place to disperse to. During my two-year monitoring, I witnessed an interesting but sad story. A sub-adult didn't want to leave the family when he was old enough. His family drove him away, but he stayed behind and followed them for 9 months. He even came back and kidnapped his younger brother once. I was very worried at that time with no idea of where the little kidnapped gibbon was, but only found out the next day that his older brother took him away for one night, probably I think, out of loneliness as he could not find a spouse.

Although I've focused on gibbons and thought they need the most attention, what can really catch the eye of others is the felidae. There are elephants and gibbons in the habitat, but it is difficult to gain enough attention and policy support with gibbons alone. Therefore, I strongly urged to name our patrol unit after "Gibbon", hoping to attract more attention for them.

India forestry department has been understaffed for the conservation area. I think that many places in China may have similar problems. There is always lack of patrol personnel due to fund shortage. Then, we hired locals as "volunteer" rangers. Although they are not authorized to take weapons, they have received some special training. And with the SMART software, they are very helpful in protecting the gibbons. Those who intend to do something illegal now know that they are very likely to run into the rangers and will then be concerned and hesitate. Our patrol unit, though of no law enforcement power, can deter the criminals in a certain extent.

Problems to SMART software:

- The cost is not high, but there is no stable source of fund.
- The patrol staff has no long-time passion and self-identity and feels bored and tired in the work.
- Data collection and handling is difficult. Many staff has very low educational background.
- Leadership of the reserve is critical. They need to be proactive and far-sighted, but it's not commonly seen in many areas.
- There is frequent dishonest data reporting or information confidentiality issue which has to be taken into account for data statistics.
- Due to unstandardized law enforcement and insufficient evidence and information, many criminals are habitual and are not punished if caught. Without tough penalty, it is difficult to deter violators by only relying on patrol unit.
- I have personal concerns with the waste generated during the patrol process. The large amount of batteries is difficult to be recycled or destroyed systematically.

#### Rescue and reintroduction:

- The Huro Program: The gibbon rescue center often receives many gibbons, not merely those rescued from pet markets, but mostly the injured individuals or babies found around the fragmented habitats by locals. Long-time husbandry is necessary before reintroducing them into the wild. But artificial rearing is very costly and it's also difficult to find the habitats suitable to reintroduce them to. In many cases, we found that the pre-selected habitat for reintroduction was destroyed and we had to continue the rearing which needs a lot of resources and staffing. Besides, post-rehabilitation monitoring is also a big challenge.
- Dilip mentioned the trans-location project in Dello village. It was very successful and can serve as a very good reference for similar fragmentation issues.

I want to end with a story about a hero involved in conservation work. We know that most of the successful cases of wildlife protection we've heard happened in the western countries which offer great resource and policy support. But we seldom hear similar cases from developing countries. In fact, in the less developed regions, there ARE many unknown heroes who are protecting wildlife. Indochinese Tiger is an endangered species with only small population left. There is an Indochinese Tiger Conservation Center in the bordering area of Thailand and Myanmar, and in the reserve in Thailand, manager Saksit Simcharoen has worked with great passion. He doesn't talk much and is always at a low key, but he is serious and earnest in monitoring the reserve and protecting the wildlife. Indochinese Tiger has survived in the reserve with larger population as a result of his dedication. But his name is seldom heard in the world.

## Kashmira Kakati 博士

### 印度长臂猿小种群专家、独立动物生态学家

我的硕士学业重点研究了一个很小的栖息地内的长臂猿（小于5平方公里），这虽然是一个短暂的半年研究，也是我第一次接触长臂猿，但很奇怪我发现我研究的这群长臂猿跟书本上描述的长臂猿行为完全不一样，他们没有吃果实，活动范围极小，有时候甚至一整个月都没有鸣叫。我一开始觉得很紧张以为自己做错了什么，后来意识到这不是我的问题，是这群非常小的栖息地内的长臂猿行为不正常。我原本博士计划研究大象，但因为观测到的长臂猿问题，我认为这更需要研究和关注，所以最终决定还是选破碎化生境中西白眉长臂猿的行为生态作为我的博士课题。

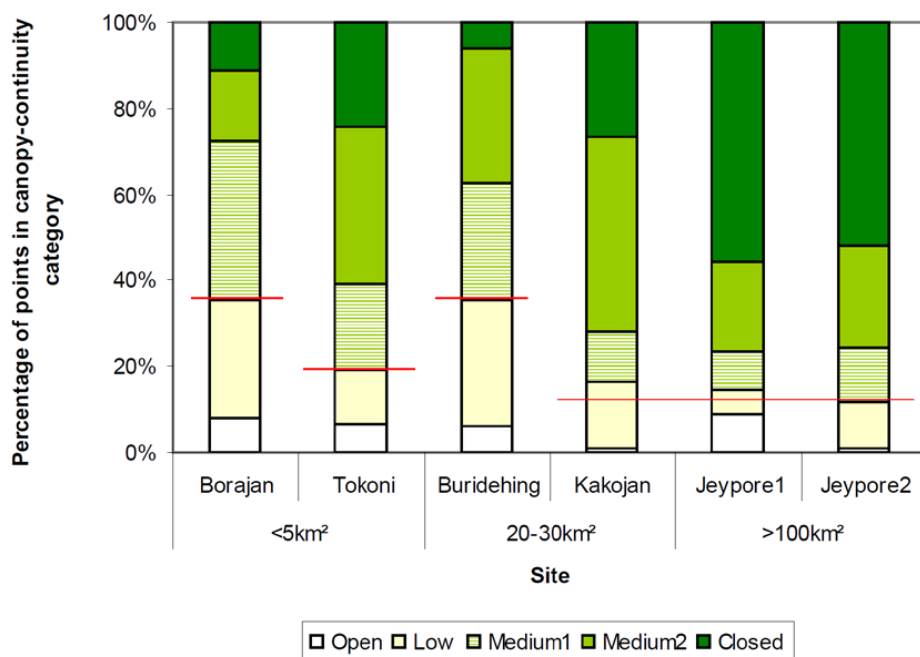
长臂猿是一种非常漂亮，温柔，也聪明的动物，看上几年也不会感到厌烦。我想给大家讲一个长臂猿有关的故事。1997年的2月，我在跟踪研究的时候遇上了一场风暴，有一天早晨我发现跟踪的家庭中一个2-3个月大的长臂猿宝宝健康看着有些问题，没有办法正常地挂在它妈妈身上。他的妈妈一直尝试着抱住这个宝宝但总是不太成功，我跟着观察了几个小时，妈妈一直在尝试着让宝宝舒适，甚至伸长腿想让宝宝躺一会儿，长臂猿爸爸也很担心，不停地回来看到底怎么样了，看起来想做点什么可又没有什么可以做的。过了一会儿长臂猿妈妈试着移动的时候小长臂猿摔下了树来，长臂猿爸爸迅速的跑了下来查看情况，可很快就回到了树上，小长臂猿的兄弟姐妹们也都很紧张地在树上观察，过了一会儿长臂猿妈妈终于下来抱起了小长臂猿。这时候长臂猿妈妈抱着小长臂猿离我远了一些，我只能看见她的后背不知道她在干什么。我以为她会带着小长臂猿回去，可是过了五分钟我发现她只是独自回到了树上。然后过了大概半小时，这群很久没有鸣叫的长臂猿开始了鸣叫。我们说起长臂猿的鸣叫行为总是说这是标志领地，寻找配偶，或者其它的一些生态功能，可至少在那一天，我认为这群长臂猿的鸣叫是代表着一种缅怀与哀思的情绪，或者宣示着家庭成员的离去。他们走后我跑过去找小长臂猿，可是很奇怪我明明知道他应该在的位置，可并没有看到他。找了很久后才发现，长臂猿的妈妈把小长臂猿藏在了竹子丛中并用竹子枝叶把他盖住了。我后来把长臂猿带去城市里找兽医救助可是因为头部受到了撞击并没有能成功挽救他的生命，有一个兽医还惊奇地问我到底带了个什么动物过来。损失了一天数据的我很失望，第二天继续去跟踪这群长臂猿，可我找了很久都没有找到小长臂猿的母亲，过了一小时后我才找到她，当时这个妈妈独自躺在一棵树上，怀里还抱着一杆竹子。

当我们说起长臂猿，我们说到的不是一个普通的动物，不是老鼠或者蟑螂什么的，我们说的是一个高智慧，感性的，会思考的动物。他们是有感觉与感情的，所以前面我们问到，捕捉长臂猿不会对他们的心理造成影响，当然是会的。他们与我们一样会感到恐惧，会有各种各样的情绪。

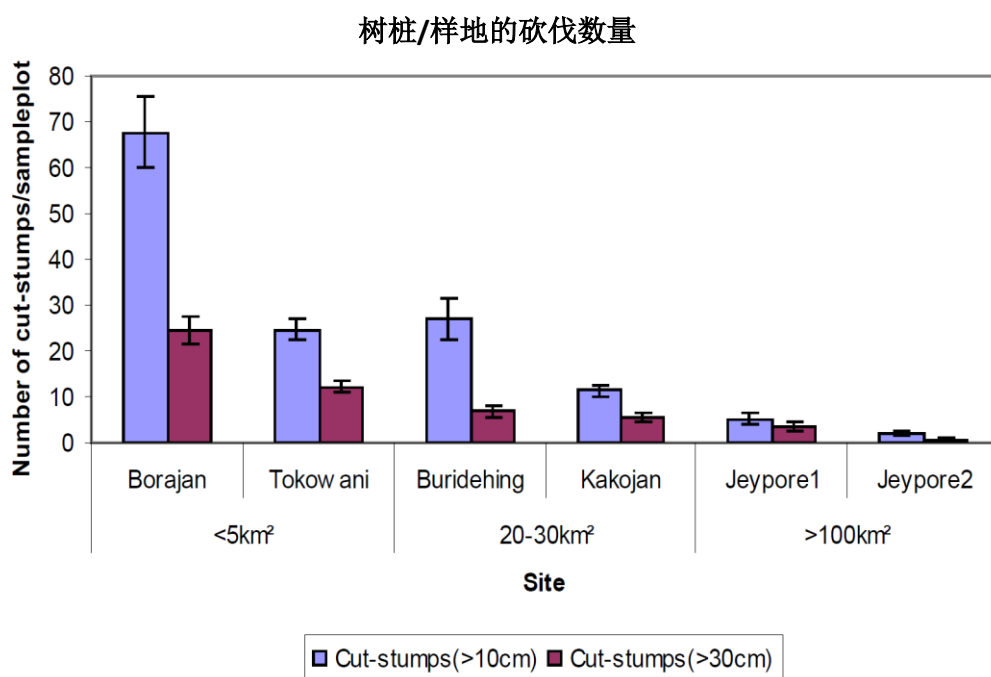




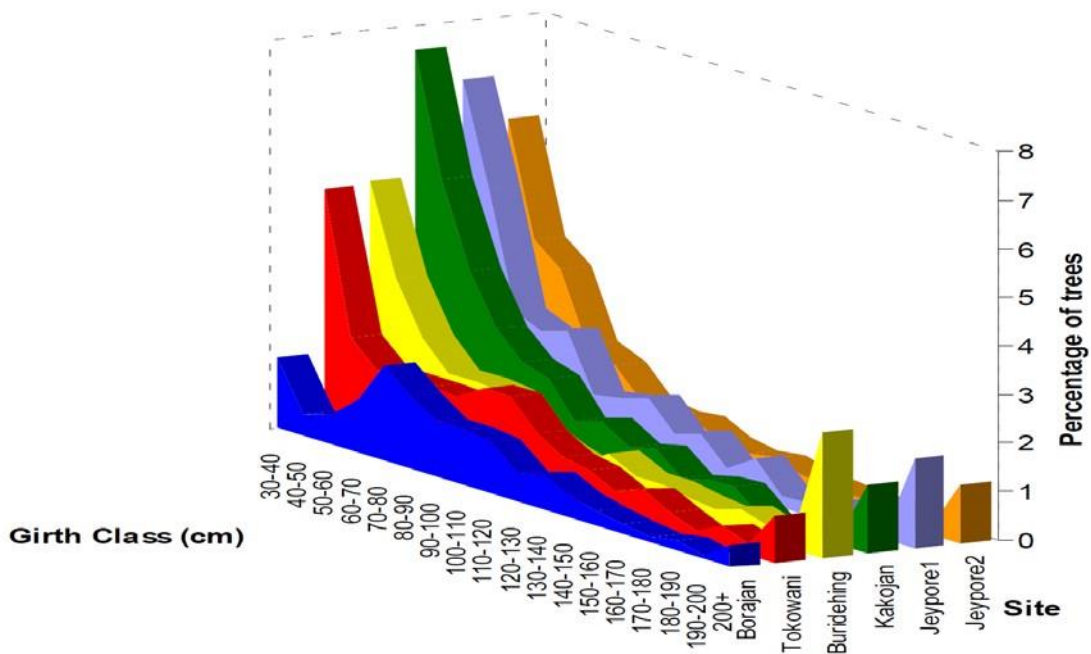




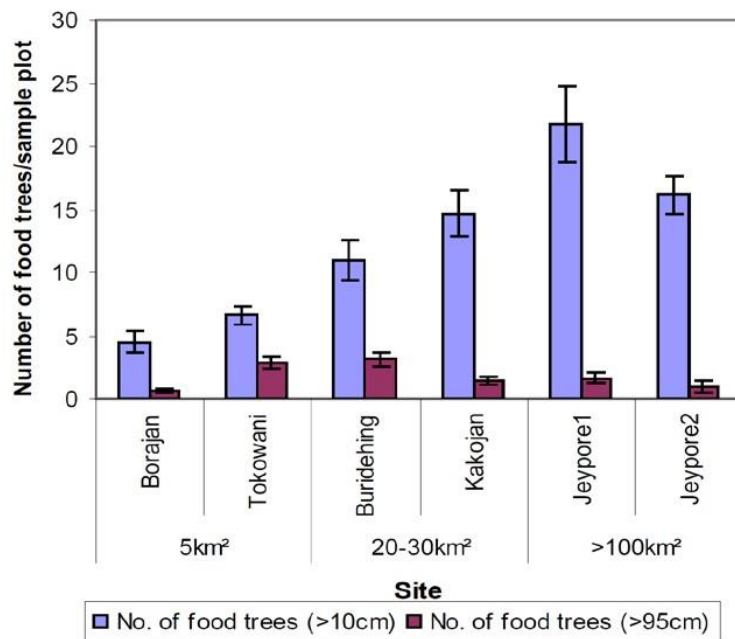
通过三个区域的对比可以发现，中小面积的栖息地冠层的密集度明显低于健康的大型栖息地。在面临大量的不连通的冠层时，长臂猿经常需要做很多很危险的远跳才能达到目的地。虽然长臂猿被认为是丛林中的“空中飞人”，在冠层的活动能力很强，可是频繁的远跳无法避免的增加了长臂猿的活动难度和死亡风险。



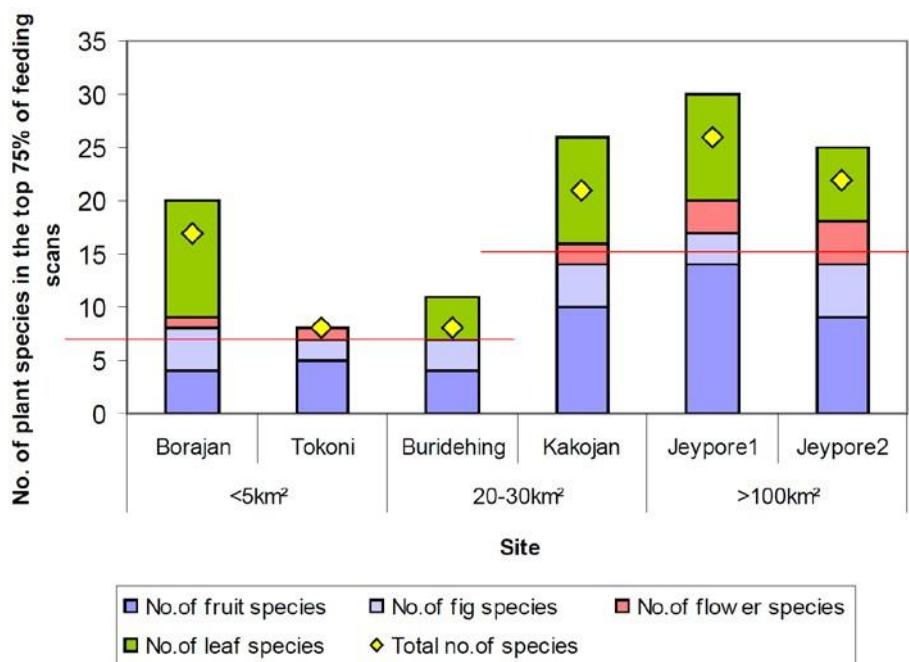
人们有一个很有趣的心理，在一个受保护的完整森林，人们会觉着砍一棵树会很明显，所以不会太轻易地破坏。而在一个已经开始被破坏的森林中，大家会认为反正也开始破坏了，我砍一些也不会那么要紧，进而非常快速的催进这片森林的退化。所以破碎化的小面积栖息地受到的人为威胁比完整的大森林要大。



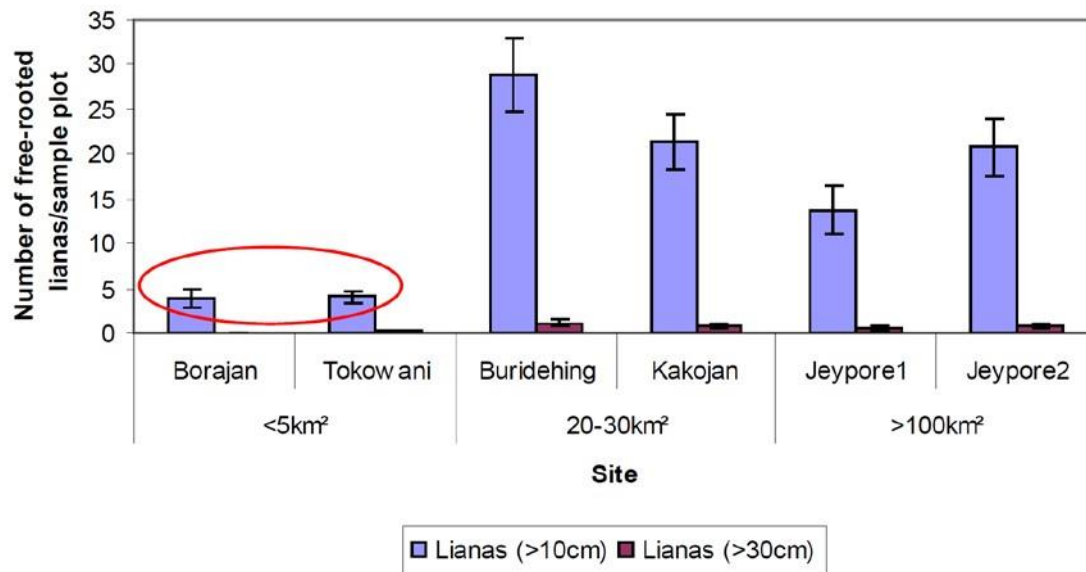
小面积栖息地的树苗（补充率）也明显的低于较为完整的大栖息地。



接下来讲一个很可怕的现象，破碎化的栖息地内，长臂猿大型食物树的数量/密度不到完整的栖息地的几分之一。

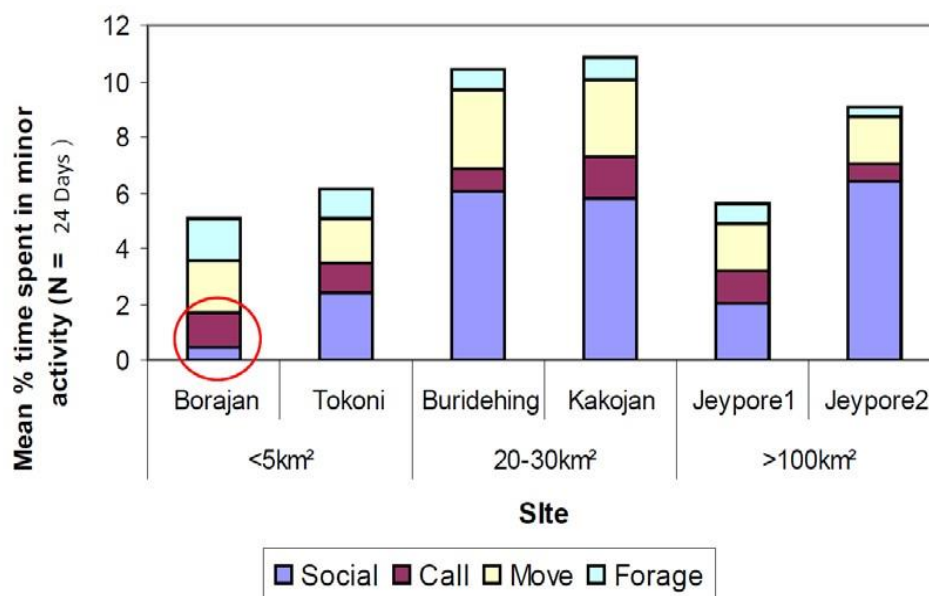


食物树的种类超过二十种，但是长臂猿食物中真正关键的，提供热量的果实类食物在破碎化的栖息地内只有完整栖息地内的一半左右。

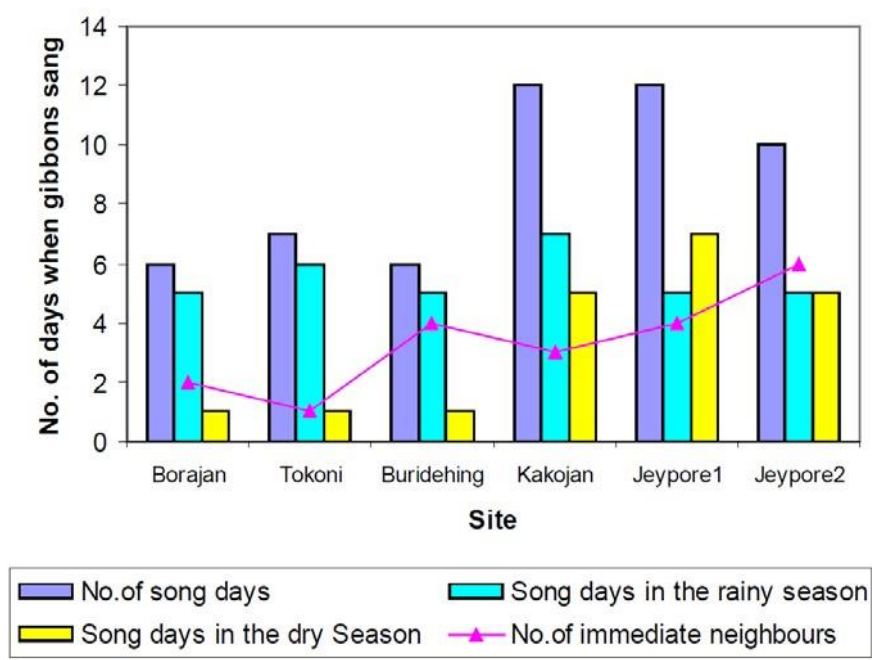


我一开始并没有太过关注这方面，是后来才意识到，在完整的栖息地内长臂猿食物来源超过 60% 都是来自藤本植物。可以看到在小栖息地内的藤本植物只有中大型栖息地内的四分之一或者五分之一。但藤本植物的统计并不是森林植被统计中的一个重点，印度传统的森林管理中，因为会影响到树木的生长速度，藤本植物是会被主动的砍伐掉的。所以未来至少在有长臂猿分布的森林中，这种针对藤本植物的砍伐行为需要被禁止。

行为:



不同大小的栖息地内长臂猿花费的鸣叫时间，移动时间，觅食时间都很接近。但在极小栖息地 Borajan 内，因为食物密度低，长臂猿家庭中的个体不得已需要分离开活动，所以没有办法维持较高的社交频率。我不知道降低的社交活动会如何影响长臂猿，但我认为是一定会有影响的，因为在完整的栖息地内长臂猿家庭都维持了比较高的社交行为。



长臂猿鸣叫天数

不管种群附近的邻居们多不多，破碎化的栖息地内长臂猿鸣叫的频率都不是很高。在我把鸣叫习惯根据雨季和旱季分离开后发现，旱季破碎化栖息地内长臂猿鸣叫次数极低，甚至出现过 12 天不鸣叫的情况。所以以后作调查的时候，尤其如果是旱季的小型栖息地，可能需要更加持久的监听时间才能确定这个地区到底有没有长臂猿分布。

种群：

GIBBON POPULATIONS (N = 59 GROUPS)			
Forest Size Class	Forest Loss 1990-2000 (%)	Gibbon Group Density (No. of groups/km <sup>2</sup> )	Group Size
<b>Small (4)</b>  5 km <sup>2</sup>	6 – 70	0.28 ± 0.16 (n=2)	2.5 ± 1.5* (n=2)
<b>Medium (7)</b>  20-30 km <sup>2</sup>	2 - 3	1.18 ± 0.43 (n=26)	3.29 ± 0.23 (n=24)
<b>Large (3)</b>  100 km <sup>2</sup>	1.6	3.18 ± 0.89 (n=31)	3.96 ± 0.13 (n=28)

不同质量，大小的栖息地内，种群密度和每个种群的个体数量都有明显的区别，我原本以为中

型20-30平方公里的栖息地以及足够了，可后来发现这并不是最自然的情况，更大的森林明显有更高的承载力。之前也提到了，破碎化的小森林被破坏的速度也更加快，在那里生活的长臂猿生活非常不容乐观。

Age-sex class ratios (n=54 groups)	Forest Size Class (km <sup>2</sup> )		
	<5	20 - 30	>100
No. of groups	2	24	28
Adult male: Adult Female	0.50	1.10	1.00
Infant : Female	0.50	0.52	0.60
Juvenile : Female	0	0.76	0.85
Immature <sup>2</sup> : Female	0.50	1.28	1.46
Sub-adult : Adult	0.33	0.18	0.25

小栖息地内并没有青年个体，这个原因我的猜想是栖息地内缺乏适合青少年长臂猿的食物。在他们还是婴儿的时候，因为依赖母乳还没有什么问题。可刚成熟需要自己觅食的时候因为栖息地质量差，没有足够的适合他们的食物，导致它们无法存活过这个成长过程中的关键阶段。

另一个破碎化的小栖息地面临的问题是，因为没有足够的资源让它迁走，青年个体在原有家庭滞留时间更长。我监测长臂猿的两年中看到了一个很有趣也很伤感的故事，有一个青年到了该独立的年龄但不想走，原有的家庭把他赶出去，他就一直跟在后面，跟了9个月才离开，甚至还回来把自己的弟弟绑架走了一次。我当时很紧张，不知道这个小长臂猿哪去了，过了一天才发现是他的哥哥把他带走了一晚上。我认为长臂猿哥哥会有这样地行为只是因为太孤单了，因为他找不到配偶。

虽然我一直的工作重心在长臂猿身上，也认为它们最需要关注，但真正给我带来足够关注度的是一些“性感”的猫科动物。虽然这个栖息地内有大象，有长臂猿，但单靠长臂猿很难吸引到足够的关注和政策支持。所以后面我强烈要求我们的巡护队起名叫“长臂猿”巡护队，希望可以给它们带来更多的重视。

印度的林业局保护区一直缺人，我认为中国很多地方可能也有类似的问题，因为资金原因，总是没有足够的巡护人员。所以后来我们开始尝试雇佣当地人“志愿”帮助巡护森林。虽然没有权力佩戴武器，但接受了一定的特殊训练，并应用 SMART 巡护技术后，他们可以有效的起到一定的保护作用。村民进山非法活动的时候，他们知道有一定的几率会遇到保护人员，他们就会犹豫，心理上就会有一层顾虑，而我们的巡护队尽管没有很好的执法权，也因此对犯罪分子起到了心理上的震慑作用。

智能巡护软件应用过程中遇到的问题：

- 开销虽然不是太大，但也很难维持稳定的来源；
- 巡护人员在长期的工作中很难维持热情与自我认同，枯燥的巡护工作容易使他们疲惫；
- 数据采集与整理有一定的困难，很多支援帮助我的工作的人员文化程度极低；
- 保护区管理者扮演着关键的职责与作用，需要一个积极先进的态度，而在很多地方这并不常见；
- 因为种种原因，在不同层面出现的不诚实的数据汇报或信息保密是经常会发生的，数据统计的时候要考虑到这一点；
- 因为执法不够规范，证据和信息采集不够完整，被抓住的犯罪者经常不会受到处罚，而过了几年抓到的经常是之前抓到过的惯犯。在处罚不严的前提下很难依赖巡护达到足够的震慑效果；
- 我个人对巡护过程中产生的垃圾处理也有很大的顾虑，大量的电池很难系统地回收销毁。

救护与重新放归：

- The Huro Program: 长臂猿救护中心经常接受很多长臂猿，并不只是宠物市场中解救的个体，事实上救护中心收到的大部分都是很多居民在破碎化栖息地周围发现的受伤的个体或幼体。小长臂猿需要很长时间饲养才有重新野放的可能，可人工饲养开销很大，同时也很难找到合适的栖息地放归野外。很多时候，原本计划放归的地方在饲养的几年过程中受到了破坏，不得已只好继续人工饲养。这个工作需要很多资源与人力支持，野放后如何监控等等也有着很多挑战。
- Dilip 前面已经提过了 Dello 村庄的人工迁徙工作，作为少有的案例这次项目非常成功，值得面临类似的破碎化栖息地借鉴。

最后我想讲一个有关保护工作的英雄的故事。我们提到野生动物保护的时候，很少听说发展中国家的案例，已知的成功大部分都是在西方国家，有着大量的资源和政策支持。而事实上在不那么发达的地区有很多默默从事着保护事业的英雄。泰国和缅甸接壤的地方有一个印支虎保护中心，我们知道这是个受威胁很大的种群，仅剩的个体保护情况也不容乐观，可就因为一个叫 Saksit Simcharoen 的泰国保护区管理人的热情，作为一个不太爱说话不太爱炫耀自己的人，他就这样强势地严谨地监管者保护区，严密的保护着他热爱的野生动物，可以说这个物种之所以能存续下来，能在这一个保护区维持一定的数量，基本上都归功于他的运筹帷幄。可国际上却鲜有人听说过他的名字。

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**Guangzhou  
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## **Final Report**

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**广州·中国  
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## **总结报告**

### **SECTION 15**

#### **Q&A Session with All Experts**

#### **第十五章 专家集中问答环节**



Q: Are there zoos in Europe that have built embryo banks or sperm banks?

A (Teague): I haven't heard of it, but I can help consult about it. Some organizations indeed are collecting these samples, but I don't know whether they keep them in these banks. An institute of zoology related with Berlin Zoo is conducting professional research in this area.

Q: Captive gibbons have low possibility of having infectious diseases, but there can be tetanus, pneumonia, and etc. What are commonly seen diseases for gibbons in the wild?

A: Two kinds of hepatitis B were found in the rescue center. One is from wild group, and one from human, which need further testing for confirmation. Checks are necessary before reintroduction. Herpes zoster and tuberculosis were also found in the rescue center. Wild population also has parasites and germs, not much of others. Small population has greater threats from disease as they can be infected after contacting humans and from livestock. Human may also be infected by diseases of gibbons through livestock. A reliable method that can yield results through rapid testing is badly needed.

Q: Wild gibbon population is very small and so is captive one. Therefore breeding is very important. Is there a better way of artificial breeding if animal swap is impossible?

A: It is difficult to reach agreement among the management of different institutions. We suggest developing a system among different institutions to do the statistics and swap individuals for breeding. It's unnecessary for family groups of course. Ensure successful pairing in the rescue center. If gibbons don't have signs of pairing or sing together after living together for 6 months, separate them and try other methods as early as possible. (Singing together is a sign of successful pairing, which is easy to be observed.)

Q: Responsible for pedigree management. In terms of the population structure of gibbon family, can we pair a male with several females? When the offspring grow up, do we need separate captive husbandry?

A: We don't recommend to pair one male with several females. We need to ensure the success of the pairing first as the resources are limited, but second, we must also maintain their genetic diversity which may be impaired if many offspring come from one father. This is also undesirable from the perspective of genetics and evolution. The zoos in Europe will separate the little apes after observing how to raise the cubs when they sexually mature at 7 or 8 years old, at least 5 or 6 years old when their family has new-born apes.

Q: Does IUCN finance and support cross-regional cooperation in protected areas along the border?

A: Unavailable now, but there is support for migratory animals. Maybe its funds can be used for this purpose.

Q: How are the border and border resident issues handled?

A: Government deals with it.

Q: Are there any constraints from local laws and regulations for gibbon translocation?

A: Great efforts in protection and very strict legal and policy restrictions. In Indonesia, gibbons enjoy very high conservation status. Rescue efforts can start only when permitted after application. Many rescue centers need to specify conditions and wait for approval.

Q: What are the suggestions for *hoolock tianxing*?

A: This is exactly what this conference intends to do. The first possibility is to release the captive gibbons into the wild; second, build corridors connecting different habitats. Some places are too far away, but there are corridors that can be used. Individual ape's vocal call can be recorded and played to connect individuals; third, capture and pair directly.

Have to consider issues of whether they have reproductive ability after reintroduction; Is healthy

survival possible? Where should the corridor be built and how to build it? Whether can genes circulation be promoted accurately? (identify whether gene circulation is possible before taking measures)

Q: There are 50 individual hoolock gibbons in 16 groups on Gaoligong Mountain. Isolation and fragmentation are serious issues there. Breeding is a problem due to few connections among different groups. If with no human intervention, will they go extinct in a few years?

A: There have been a lot of discussions on this issue, and the current situation is very bad. Human intervention is necessary, but need to consider how to do it better.



提问：欧洲是否有动物园建设胚胎库或者精子库？

回答（Teague）：我没有听说过，但我可以帮你咨询一下，确实有专门的组织采集这些样品，但我不知道他们有没有入库保存。柏林动物园相关的一个动物研究所有在进行这方面的专业研究。

提问：圈养长臂猿发生传染病的可能性比较小，会有破伤风、肺炎之类，野外是否有长臂猿的疾病？

回答：在救助中心有发现 2 种乙肝，1 种是野生群体的，1 种是人类乙肝，需要化验确定，进行放归之前需要检查。在救助中心发现过带状疱疹和肺结核。野外的种群还有寄生虫和病菌，其他的不多。小种群面临的疾病威胁更严重，小种群通过人和长臂猿接触获得疾病，家畜也有可能传染给长臂猿。长臂猿也有可能通过家畜传染给人。急需研究一个可靠的方法，可以通过快速检验获得结果。

提问：野外种群中长臂猿数量很少，圈养数量也很少，繁殖是首要任务。在交换动物不可能情况下，是否有更好的人工办法促进繁殖，人工干预？

回答：管理上很难在单位之间达成协议，建议笼养单位之间建立系统，然后统计交换和配对个体。已经形成家庭群的就不用了。在救助中心的，就尽量保证配成对。如果尝试配对的长臂猿共同生活 6 个月都没有迹象会交配或者会合唱，就尽早分开进行别的尝试。（合唱是很容易观测的配对成功的预示）

提问：负责谱系管理，在长臂猿家族种群结构方面，是否可以 1 个雄性配对几个雌性？后代长大之后，需要不需要分笼？

回答：不建议一雄配多雌，首先因为资源有限，配对要保证成功率，其次要维持基因的多样性，如果大量的后代来自同一个父体会损失大量的基因多样性，遗传与进化的角度上讲不合理。欧洲动物园，小猿出生后最少 5、6 岁，一般在 7、8 岁性成熟之后，当家庭群又有新的小猿出生，他们观察到是如何抚育小猿之后才会分开饲养。

提问：IUCN 对于边界保护区是否资助支持跨区域合作？

回答：目前还没有，但有针对迁徙动物的相关支持，也许可以使用这方面的资金。

提问：他们怎么处理边界边民问题的？

回答：政府处理。

提问：长臂猿转移过程中是否受到当地的法律法规限制？

回答：保护力度非常大，有很严格的法律和政策限制。印尼的长臂猿保护等级很高，组织要申请许可才能进行救助，很多救助中心申请要说明条件，和等待批准。

提问：针对天行长臂猿这种情况，有什么建议？

回答：会议的目的就是探讨这个问题，第一个可能途径，把笼养的放到野外去；第二个可能途径，

联通栖息地廊道。有些地方距离太远了，但是可以通行的廊道仍然存在，可以通过人为播放独猿叫声尝试连接个体；第三个，直接捕获配对。

放归后，有没有生殖能力；有没有健康生存的可能；廊道建设在哪里，如何建设，是否能够精确促进基因流通（采取措施之前确定是否有基因流通）。

提问：高黎贡山生存中有 16 群 50 只白眉长臂猿，种群发展有问题，孤岛化和片段化严重，群间交流很少，种群繁衍有问题。如果不采取人工干预，若干年后是否自动灭绝

回答：已经有了很多讨论，现状很不好。肯定需要做，但是什么方式更好。

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## **总结报告**

### **SECTION 16**

#### **Feedback from Reserve Officials**

#### **第十六章 保护区代表发表意见**

**Gaoligongshan National Nature Reserve, Zhang Fuyou, Vice-Director of Baoshan Management Bureau:**

- I very much agree with the idea of promoting population communication with human intervention.
- Translocation is feasible
- – but capture will probably be difficult in mountains; maybe more difficult than in isolated forest patches in India – but need to promote dispersal of single males and females between patches
- Isolation within the nature reserve is not great, so no need for canopy corridors
- Problem = how to disperse gibbons – they are isolated by DISTANCE, not by GAPS

**Tongbiguan Provincial Nature Reserve in Dehong Prefecture:**

Zuo Changsheng and Zhang Lixiang from Tongbiguan Nature Reserve in Dehong Prefecture and Yingjiang County Forestry Bureau: Dehong Prefecture is lagging behind others in hoolock gibbon conservation, and thus needs more attention and support from specialists. Much basic information in the area is unknown. Biological corridor is preferred to connect isolated populations. Tree bridges are also considered. We are not sure whether the captive gibbons in Dehong are *hoolock tianxing*. There are six captive hoolocks (2 male, 4 female). 1 pair was successfully formed (reproduced in 2015, infant died). We are also cooperating with zoos and Dehong Gibbon Rescue Centre. In the future, they will be released into the forest.

**Director Xie from Wuliangshan and Ailaoshan National Nature Reserve:**

- Largest concolor population – healthy and increasing
- Survey planned in 2020
- No captives in zoos, so no need to consider captive approach
- Isolation is not a serious problem – so no need for translocation
- But: asks for technical support/advice to rescue gibbons – small infant fell from tree in Recent years and died 2 days after release as we had no technical capacity to save it.
- Main threat = livestock grazing and human disturbance – funding needed to increase patrolling

Two suggestions from Kashmira: 1. It is very difficult to capture gibbons during translocation process. What we can do is to habituate them in the first place. It's simple, but only needs some time. 2. As to the rescue of gibbons, there are mobile rescue stations in India. The facilities there are not complicated, but can rescue animals of various kinds.

Fan Pengfei: We should consider trying different approaches.

**Hainan Bawangling Reserve, Yang Donghua:**

Bamboo poles and canopy bridges are feasible in Hainan.

Fan Pengfei: Susan has just received an email from Myanmar. The war in northern Myanmar has escalated, so it is impossible to do investigation and projects in the short term.

**Guangxi Bangliang Reserve, Li Xingkang:**

The method for gibbon capturing is very applicable in Bangliang. The logging and habitat loss have been basically controlled here, but the gibbon population is close to the environmental carrying capacity. We can capture the gibbons and translocate them to other suitable habitats.

Xishuangbanna NRR: there are 6 white-cheeked gibbons in Wild Elephant Valley. All were released in the forest, 4 of them paired.

Q: Have any zoos abroad released their captive gibbons to the wild after rearing them for a long time? How to do rehabilitation training?

A: There are many cases. The zoos in Thailand have released 50 pet gibbons directly to the wild, but 25 were dead. One female was paired with wild males. The rest were captured and reared for several years, but was suspended due to financial shortage. Later, they were paired in zoos and had one successful breeding. As the competition with wild gibbons was too strong, the gibbons had to be released in places without wild ones. After years' efforts in giving human guidance, providing feeder, changing places, guiding wild exploration, and reducing food, the reintroduction was quite successful according to the results of years of monitoring. The pairing was maintained, the field was established, and breeding was successful.

There are also many successful small-scale reintroduction cases. It's technically feasible if implementation standards are followed.

Question from Baoshan Forestry Bureau:

Will reintroduction be done only after pairing? What should we do after reintroduction? Can family be established among different gibbon species, such as Eastern hoolock and *hoolock tianxing*?

A: If the transportation process is long, the best way is to keep the paired gibbons captive in the wild, and release them into forest after they adapt to the environment and call again. If you worry about insufficient food in forest, you can feed a bit in early stage and gradually reduce it. Whether interspecific cross is possible or not, we should avoid breeding between different species.

讨论后保护区代表发表意见



**高黎贡山保护区保山管护局张富有：**人工干预促进种群交流，这种措施很赞同。

- 可以对长臂猿进行迁地保护，但山区捕获很困难，可能比印度破碎化的栖息地更难，需要促进不同破碎化栖息地之间雄性和雌性个体的沟通；
- 保护区内栖息地的隔离问题不是很严重，不需要树冠走廊；
- 问题是如何推动长臂猿的沟通，现在不是没有设施，而是距离太远。

**德宏州铜壁关保护区和盈江县林业局左长盛、张利祥：**表示德宏州白眉长臂猿基础落后，希望专家给予更多关心和支持。本区域很多基础信息不明。倾向于生物廊道的建立，在较近的地方可以使用。树桥也考虑在内。德宏保护区有六只圈养长臂猿（两只雄性、四只雌性），一次成功配对（2015 年繁殖，幼猿死亡）。正在与动物园和德宏长臂猿救援中心合作，将来对它们进行野放。笼养长臂猿不能确定是否是天行长臂猿。

**无量山保护区谢局长：**

- 最大的西黑冠长臂猿种群，非常健康，数量也在不断增加；
- 计划于 2020 年进行调查；
- 动物园无圈养，无需考虑圈养方法；
- 孤立问题并不严重 – 所以无需迁地转移；
- 但是：需要技术支持/建议来拯救长臂猿 – 发生过野放两天之后有一只小长臂猿掉下山并死亡的情况，因为我们没有技术能力进行拯救；
- 主要威胁来源于牲畜放牧和人为干扰，需要资金以增加巡逻力量。

**Kashmira 有 2 个建议：**1 在长臂猿转移时非常难捕获，可以先习惯化，非常简单，只是需要花点时间；2 长臂猿救护问题，在印度有流动的救护站，设备不复杂，可以救护各种动物；

**范鹏飞：**尝试多种方法，可以考虑。

**海南霸王岭保护区杨东华：**在海南区域竹竿，索桥可以使用。

**范鹏飞：**Susan 刚刚收到缅甸邮件，缅甸北部战争形势恶化，短期内无法调查和开展项目。

**广西邦亮保护区李兴康：**捕获长臂猿的方法在邦亮很适用，在这里砍伐和栖息地丧失已经基本控制好，但是现有数量已经接近环境容纳量，如果捕获的方法行得通，可以转移到其它适合的栖息地。

**提问：**国外有没有动物园长期饲养的个体被放归野外？如何实现野化训练？

**回答：**有很多。有一次泰国，长臂猿宠物很多，直接放归了 50 个，死亡 25 个，有一个雌性和野外雄性配对。剩下的又抓回来，养了几年，但因为经费原因无法维持饲养。又在动物园做配对，然后成功繁殖一次，因为与野生种群竞争性太弱，只好放归到野外没有长臂猿的地方去。通过一

系列人工引导，投食平台，改变位置，引导探索，减少投食量，经过几年监测后，发现成功。配对维持，建立领域，成功繁殖后代。

小规模野放也有很多成功案例，技术上有很多支持完全可行，只要维持一定的实施规范。

**保山市林业局提问：**

是否需要配对以后才能放到野外去，野放后需要做什么？不同种类的是否会建立家庭关系，比如东白眉和天行？

**回答：**如果运输过程较长，最好的方法是，配对后的一对长臂猿先放在野外的笼内适应，直到接受了当地的环境重新开始鸣叫后再放入森林。如果担心森林内没有足够的食物，可以在前期进行一些投喂补充再逐渐减少投喂。不管有没有种间交配的可能，我们都要避免不同种类间建立家庭进行繁殖。

## ATTENDEE LIST 参会代表名单

Organization 单位	Name 名单
Suzhou Zoo 苏州市动物园	LI Linxiang 李林翔
	DI Min 狄敏
Nanjing Hongshan Forest Zoo 南京市红山森林动物园	BAI Yali 白亚丽
	LIU Yuanyuan 刘媛媛
	CHEN Rong 陈蓉
	BU Haixia 卜海峡
	LV Rai 吕冉
Chongqing Zoo 重庆市动物园	YUAN Li 袁梨
	YU Yuan 喻元
	CAO Liang 曹亮
Beijing Zoo 北京动物园	ZHANG Yuanyuan 张媛媛
	ZHOU Kaidi 周凯迪
Changsha Ecological Zoo 长沙生态动物园	HUANG Wenhui 黄文会
	WANG Jiao 王姣
Dalian Forest Zoo 大连森林动物园	WANG Bin 王斌
	姚琳 YAO Lin
天津市动物园 Tianjin Zoo	王建永 WANG Jianyong
	柴恭春 CHAI Gongchun
成都动物园 Chengdu Zoo	赵波 ZHAO Bo
	宋婷 SONG Ting
南宁动物园 Nanning Zoo	王松 WANG Song

Shenyang Forest Zoo 沈阳森林动物园	ZHAO Fangju 赵芳菊
	GUO Xingqi 郭星岐
Wenzhou Zoo 温州动物园	YI Honghua 伊红化
Zhengzhou Zoo 郑州市动物园	TIAN Shuliao 田澍辽
	XING Guangsheng 邢广生
Guizhou Forest Wildlife Zoo 贵州森林野生动物园	CHENG Jun 程军
Beijing Wildlife Park 北京野生动物园	DUAN Yujing 段宇婧
Wuhan Zoo 武汉动物园	XIONG Liang 熊亮
	GONG Chi 龚驰
Hongkong Ocean Park 香港海洋公园	ZHU Xiaozhong 祝效忠
	HE Yingsi 何颖思
	DENG Qiaoxian 邓巧贤
Hangzhou Zoo 杭州动物园	HUANG Fei 黄飞
Shaanxi Rare Wildlife Rescue and Husbandry Research Center 陕西省珍稀野生动物抢救饲养研究中心	GAO Gengeng 高更更
	ZHANG Qiang 张强
	MA Junquan 马军权
Shanghai Zoo 上海动物园	ZHU Yingdi 朱迎娣
Kunming Zoo 昆明动物园	HUANG Song 黄 松
	YANG Yuzhao 杨玉钊
	XU Jianing 徐建宁
Harbin Zoo 哈尔滨北方森林动物园	LI Ruonan 李若楠
Fuzhou Zoo 福州动物园	CHEN Lin 陈霖
Chinese Academy of Forestry 中国林业科学院	ZHANG Yuguang 张于光
Ningbo Youngor Zoo 宁波雅戈尔动物园	ZHUO Kaicun 卓开存

	YE Zhenghua 叶正华
Guangzhou Zoo 广州动物园	LIANG Fengyun 梁风云
	WU Qirui 吴其锐
	CHEN Wu 陈武
	YU Jianguo 余建国
	XIE Weijun 谢伟骏
	QIU Tianyan 邱甜艳
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Zoological Society of London 伦敦动物学会	MA Heidi 马天骄
	Carolyn Thompson
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	YANG Xiang 杨祥
Yunnan Gaoligongshan National Nature Reserve 云南高黎贡山国家级自然保护区	DUAN Shaozhong 段绍忠
Yunnan Wuliangshan and Ailaoshan National Nature Reserve 云南无量山哀牢山国家级自然保护区	XIE Youneng 谢有能
	LIU Changming 刘长铭
	WEI Qijun 魏启军
Dehong Forestry Bureau 德宏州林业局	ZHANG Youbing 张友兵
Yunnan Tongbiguan Provincial Nature Reserve 云南铜壁关省级自然保护区	LI Yueti 李月体
	ZUO Changsheng 左长盛
Guangxi Bangliang Nature Reserve 广西邦亮长臂猿自然保护区	LI Xingkang 李兴康
Baoshan Forestry Bureau 保山市林业局	LIU Yong 刘勇
Forestry Bureau of Yingjiang County 盈江县林业局	LI Ensheng 李恩胜
	ZHANG Lixiang 张利祥
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