梵净山自然保护区

GUIZHOU SNUB-NOSED MONKEY

CONSERVATION & PHVA WORKSHOP

梵净山自然保护区

贵州仰鼻猴
保护及种群和栖息地生存力评估工作组

Fanjingshan National Natural Reserve
25-29 October 1999
Report

CONSERVATION INTERNATIONAL

GUIZHOU SNUB-NOSED MONKEY

(*Rhinopithecus brelichi*)

Conservation and PHVA Workshop

Fanjingshan National Natural Reserve

25 - 29 October 1999

FINAL REPORT

Sun Dun Yuan, Gong Yazhen, Lei Xiaoping, Qui Yang, John Sale, Craig Kirkpatrick, Jon Ballou and Ulysses Seal, editors. *CBSG Guizhou Snub-nosed Monkey Conservation and PHVA Workshop Report.* 1999. CBSG, Apple Valley, MN.

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Additional copies of *Guizhou Snub-nosed Monkey Conservation and PHVA Workshop Report* can be ordered through the IUCN/SSC Conservation Breeding Specialist Group, 12101 Johnny Cake Ridge Road, Apple Valley, MN 55124, USA.

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(*Rhinopithecus brelichi*)

Conservation and PHVA Workshop

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TABLE OF CONTENTS

GUIZHOU SNUB-NOSED MONKEY

(*Rhinopithecus brelichi*)

Conservation and PHVA Workshop

Fanjingshan National Natural Reserve

25 - 29 October 1999

FINAL REPORT

EXECUTIVE SUMMARY AND RECOMMENDATIONS

Executive Summary

Workshop Organization and Process

The Fanjingshan Reserve is home to the only remaining population of the species, *Rhinopithecus brelichi* (formerly classified as a subspecies of *R. roxellana*) or Guizhou snub-nosed monkey or Guizhou golden monkey. Intensive fieldwork during 1988 – 1993, including a year-round census process, provided information on the distribution and density of the species which has not been systematically updated since. A captive colony was established in 1993 with a small group of 7 wild caught animals as founders and there has been successful breeding each year since 1995. Prior to this workshop, a population model had not been developed for the wild population and there was no studbook for the captive population. The reserve is under pressure from proposed increases in tourism but there are plans to remove 4 villages from the core area of the monkey's range.

A proposal for a PHVA Workshop for the Guizhou Golden Monkey, based upon CBSG processes, was suggested by Dr. John Sale in 1998. He stated that there was a strong interest among the Fanjingshan Reserve officials and the Guizhou provincial forestry officials in reviewing and analyzing available information on the status of the Guizhou golden monkey and suggesting management recommendations. CBSG expressed a strong interest in assisting with a workshop conducted using CBSG processes. CBSG sent further information on the process to Sale and to the Chinese officials to assist in preparing for the workshop. Dates for the workshop in the week of 24 October 1999 were agreed. The foreign participants were agreed to be limited to four: Dr. John Sale (Consultant), and a CBSG team of Drs. Craig Kirkpatrick (golden monkey field researcher, San Diego Zoo), Jon Ballou (Smithsonian Institution), and Ulysses Seal (CBSG). The Chinese hosts provided local support from Guiyang to the headquarters in Jiangkou and to the field station (Pan xi) at the Fanjingshan Nature Reserve. An official invitation was received from Jiang Ping, Vice Chief, Foreign Affairs and International Cooperation Division, Forestry Department of Guizhou Province, September 1999.

The foreign experts arrived at the Headquarters in Jiangkou from Guiyang, on Sunday afternoon. Discussions were begun on the work to be done and the agenda for the process. Initially it had been planned that most of the work would be done by a small group of the people who had led and participated in the survey work that had been completed in 1993 and who were responsible for the captive colony at the Reserve. After discussion it was agreed that additional people from the Fanjingshan Reserve, three other reserves in the province, and local forestry officials would participate. As a result there were about 27 Chinese participants during the week. Monday the small group reviewed the available information on the survey and census studies that had been done from 1988-1993. A tabulation was made of the observations recorded in the field notebooks on the sex and age composition of groups observed during the census. This provided fundamental information for the population modeling during the workshop. Also reviewed was the distribution information, largely limited to 1993 and earlier. Preliminary information on human occupancy of the reserve core area and buffer was

collected. Very detailed records of the captive colony were available and allowed preparation, during the workshop, of a complete studbook of the colony since it was established in 1993.

The workshop was conducted at the Pan xi Field Station, Tuesday through Friday. It was opened by Sun Dun Yuan and John Sale. Presentations were made by Ballou on small population biology and the use of VORTEX population modeling and by Seal on CBSG, the CBSG workshop process, and some of the CBSG workshops that have been conducted in China. The workshop process began with introductions by each of the reserve directors and their statements on primary protected species and major human impacts in their reserves. Some commented that a major problem is the relationship between the local people and the reserve staff. These issues were further explored during the working group sessions.

Three working groups formed were: Population Modeling for the Guizhou golden Monkey (Jon Ballou), Threats and Management of the Reserve (John Sale and Craig Kirkpatrick), and the Captive Population Management (Ulie Seal). These groups worked together throughout the workshop. One translator, who worked between two of the groups and in the plenary sessions, was provided by the Forestry department and Craig handled most of the communication in the Threats and Management group. The working groups recorded their notes on flip charts in Chinese with some parts in English. These flip charts were used for reporting in plenary. Discussions in the plenary sessions provided guidance for the next steps for the working groups. The interaction between the Modeling and Threats & Management groups led to agreement on risk and management scenarios for further analysis. The information on inter-birth interval, return to reproduction after loss of an infant, and age of first reproduction from the captive colony and the literature provided essential information for the modeling of the population. Thursday afternoon we began the process of compiling the report with parts in Chinese and in English. The participants expanded their sections and a member from each group transferred the drafts in Chinese to a word processor. The Final Report was prepared in paper copy and as computer files with copies to edit for the Chinese hosts and the CBSG team. It is planned to finish and distribute the report within one month.

The workshop was closed 1130AM Friday with comments from Sun, Sale and Seal.

Recommendations of Working Groups

Modeling Group:

Research programs with golden monkeys should have a clearly defined goal.

Simulation results show that total population size and proportion of females breeding are vital to determine population viability. Census and group composition data (age + sex composition) over multiple years are needed to make ongoing evaluation of population viability.

More accurate estimates of mortality and maximum age of reproduction are needed for this species.

Diseases from humans and human presence pose a significant threat to the survival of the population in Fanjingshan, even if the population were to double in size. Action needs to be taken to reduce this threat, either by reducing human presence or establishing an additional, geographically isolated population of the golden monkey.

Even in the absence of any external threats, populations smaller than 200 monkeys can not be considered viable. Locations considered for translocation should have this size as the minimum carrying capacity during the season of lowest food supply.

Threats & Management Group:

Work with local governments and other parties to reduce the negative impacts of tourism, current and planned.

Research the ecological and regulatory requirements for a translocation program for the golden monkey with a view to establishing a second population.

The foreign side also suggested working with local governments in support of current plans to relocate residents from the Reserve's core area to an outside location.

Captive Population Group:

Maintain the studbook.

Plan for a colony size of 20 animals over the next 5 years.

Determine the etiology and suggest preventative measures for the recurrent skin and respiratory infections in the colony. Examination of the facility indicates an urgent need for maintenance to reduce the continuing disease problem.

To assist accomplishing the above maintenance procedures, request that CBSG identify suitable materials (paints, concrete sealant) and, with an expert in their use in a folivorous primate facility procedures, return and demonstrate their application and maintenance.

Take suitable precautions for the personnel working with confiscated animals to reduce 9the risk of human illness and of transferring disease to the golden monkeys.

Each of the golden monkeys would benefit from a through physical, clinical, and dental examination by a veterinarian experienced with this group or related folivorous monkeys.

Expand the facilities to manage a golden monkey colony size of 20 animals at the field station. Include a laboratory and basic medical management space. Include two cage areas for holding sick animals.

Expand the acreage by 3.7 ha for growing the browse needed to feed the colony.

Obtain needed medical supplies.

Undertake a systematic research program on the molecular genetics, physiology, health, nutrition, reproduction, and behavior of the species.

Seek collaboration for the research programs.

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FINAL REPORT

INTRODUCTION

Introduction

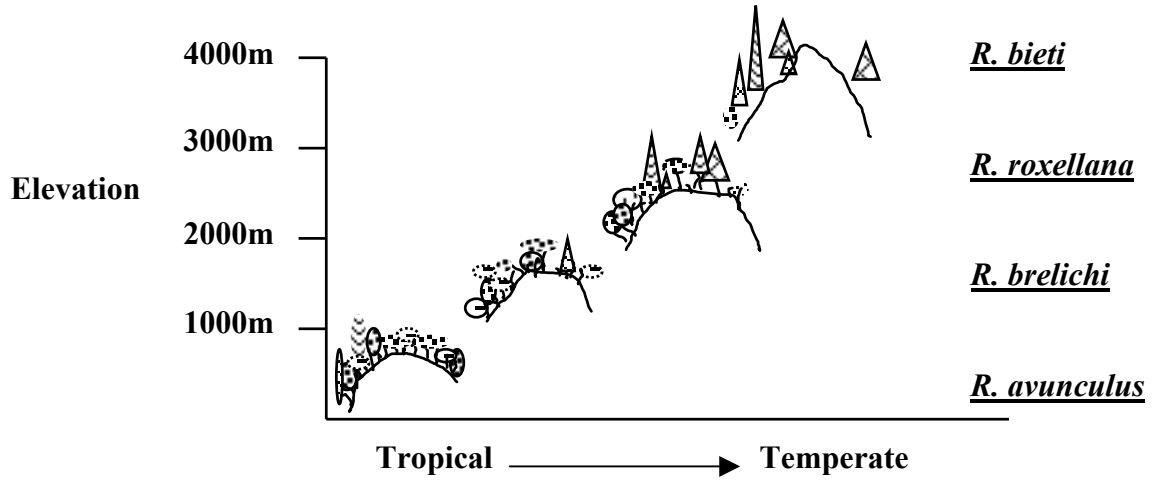
The only known population of Guizhou golden monkey *Rhinopithecus brelichi* is found in a small region of the Wuling Mountains of Guizhou Province, China. The world population is thought to number between 750 and 800 animals. The animals all live in a single nature reserve, called Fanjingshan (108°50' E, 27°57' N).

The Guizhou golden monkey is a member of the genus *Rhinopithecus* (subfamily Colobinae). The taxonomy of golden monkeys remains in dispute, but as data on morphological characters have accumulated, most specialists have accepted the view that there are four species and that they belong in their own genus (Groves 1993; Eudey 1997; Jablonski 1998). Three of the species live only in China: the Guizhou golden monkey, the Sichuan golden monkey *Rhinopithecus roxellana*, and the Yunnan golden monkey *R. bieti*. The fourth species, the Tonkin golden monkey *R. avunculus*, lives only in Vietnam.

Golden monkeys live in mountainous (montane) habitats in northern Vietnam and southwestern China (Table 1). Over evolutionary time, they have become isolated on different mountain ranges and this probably is why they evolved into distinct species. The Tonkin golden monkey lives in tropical, broadleaf forest in northern Vietnam, and compared with other species of golden monkey, lives in habitat and has a diet similar to other Asian colobines. The habitat and behavior of the Chinese taxa become progressively more atypical from the Guizhou golden monkey to the Sichuan golden monkey to the Yunnan golden monkey. The Guizhou golden monkey lives in evergreen and deciduous broadleaf forest at 1500 to 2200 m, the Sichuan golden monkey lives in deciduous broadleaf and conifer forests 1200 to 3000 m, and the Yunnan golden monkey lives in evergreen broadleaf and conifer forests above 3000 m. The forests of the Chinese species are highly seasonal, with snows common in winter. This adaptation to subtropical and temperate forests sets the Chinese species apart from other primates, most of which are adapted to tropical habitats.

Each species of golden monkey lives in a fragmented and limited distribution, with a low total population at a low density, and with large ranges for individual groups. The groups are really sub-populations, with most of the monkeys in an area first forming "small family units" (the technical term is "one-male units") and then joining in a "neighborhood" with multi-level social organization. The cohesiveness of these groups varies widely between species. Diets also vary widely between species. Taken as a whole, the snub-nosed monkeys represent an ecological array whereby shared characteristics show modification based on differing environments. This array is particularly striking because the step-wise gradation of environments – from the tropical limestone forests of the Tonkin golden monkey to the Himalayan, temperate forests of the Yunnan golden monkey (Figure 1) – provides for a step-wise gradation of morphology and behavior.

Figure 1: *Rhinopithecus:* An array of habitats.



Guizhou golden monkeys generally range in mixed deciduous and evergreen broadleaf forest between 1500 and 2200m. Within some of the forests used by the monkeys, mono-groves of Asian oaks (*Cyclobalanopsis* spp.) and beech (*Fagus longipetiolata*) often occur, although other forest types used by the monkeys do not have a dominant tree species. Common canopy trees include cherries (*Prunus* spp.), maples (*Acer* spp.), *Rhododendron* spp., and birch (*Betula* spp.). Social organization in Guizhou golden monkeys is based on small groups of around 10 individuals, each with a single male. A large number of these groups at times range together in large, semi-cohesive aggregations. All-male groups are found on the periphery of these aggregations. Although currently confined to Fanjingshan Nature Reserve, the Guizhou golden monkey probably was distributed throughout the mountains of northeastern Guizhou Province in the past (He in Zhang et al. 1997).

All species of golden monkey are vulnerable to extinction and, as a whole, the genus is one of the most endangered within the entire Order Primates (Eudey 1997). The Guizhou golden monkey is listed by the International Union for the Conservation of Nature as "endangered" (IUCN 1994). Fanjingshan Nature Reserve was established in 1978, became a national-level reserve in 1986, and was added to the UNESCO system of Man and Biosphere Reserves in 1987. The high priority of conservation for this species was reiterated in 1988 by its inclusion as a top-level protected species in the State Council's List of Main Protected Wildlife in China. Other important laws involving Guizhou golden monkeys include the Wildlife Protection Law and the Law Against Hunting of Endangered Animals, both of 1989. Conservation action is hampered, however, by gaps in scientific knowledge and conservation management. For example, we do not yet fully understand the size or population structure of groups of Guizhou golden monkeys – or of any other species of golden monkey – and therefore cannot accurately estimate total population size or truly assess whether the population is increasing or decreasing in size.

The Guizhou golden monkey has a low total population and lives in one isolated population, with a total distribution range of no more than 275 km^2. The current workshop was organized by Fanjingshan Nature Reserve and IUCN's Conservation

Breeding Specialist Group to develop an action plan to ensure the survival of this endangered species. Loss of this special animal would be a marked blow to diversity within the order Primates.

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Table 1. Ecological characters of golden monkeys. There is a gradual, progressive change in environments and behavior from the tropics-living Tonkin golden monkey to the temperate-living Yunnan golden monkey. References for the information in this table can be found in Kirkpatrick (1998); population densities are medians from that recent review.

	Tonkin golden monkey	**Guizhou golden monkey**	**Sichuan golden monkey** (Min & Qionglai Mts.)	**Yunnan golden monkey**
Altitude (m)	< 1,082	1,500 to 2,100	2,000 to 3,300	3,000 to 4,400
Temperature (annual, ^{o}C)	22.2	5 to 17	6.3	4.7
Main habitat	Tropical limestone forest	Semi-deciduous broadleaf forest	Conifer and deciduous broadleaf forest	Subalpine conifer forest
Main foods	Fruits, seeds, leaves	Leaves, leaf buds, fruit/seed	Leaves, leaf buds, fruit/seed, green winter stems, lichens	Lichens, leaves
Population density (monkeys /km^2)	6 (n = 2)	14 (n = 2)	12 (n = 1)	7 (n = 3)

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FINAL REPORT

THREATS AND MANAGEMENT

Threats and Management Group

Qui Yang, Wang Shuangxi, Yuan Jixi, Zhang Shusen, Tan Changfen, Zhang Jianbo, Luo Jian, Chen Zhengren, Zhao Deyin, Guan Henrui, Jin Jianquan, Deng Xia, Zhu Jin, Wen Zhengyin, Mo Guorong, Chen Tianming, Yu Zhibiao, Craig Kirkpatrick and John Sale

Management Considerations

A number of concerns relating to the management of Fanjingshan National Nature Reserve (FNNR) and other reserves in Guizhou Province were considered in the context of the conservation of the Guizhou Golden Monkey (GM). These included various forms of conflict arising from human activities in and around the reserves; the effects of tourism and a perceived shortage of reserve staff. Against this background, consideration was given to future goals of management in relation to the GM. These included the reduction of threats, improving the protection status of some areas of GM habitat and re-introduction into a new area within Guizhou Province.

1. Other Reserves in Guizhou – A Brief Summary

1.1 Mayang: area 5,000 ha; 60% of forest under collective ownership (giving rise to issues of control); 650 residents inside reserve boundary; key species: Black Leaf Monkey. Problems in the reserve area include cutting of trees for fuelwood and building timber; presence of domestic stock; illegal hunting (wild pig, "mountain sheep" and pheasants) for sale of meat and fires started by hunters. Monkeys raid domestic crops, heightening conflict with local people.

1.2 Leigongshan: area 47,300 ha; 10,000 people live inside the reserve; lesser impact from residents outside the boundary. Problems include cutting of wood and hunting (wild pig, "wild sheep" and pheasants) typically not for personal use but to make money – not considered a serious problem due to resilience of populations involved.

1.3 Maolan: area 20,000ha; 8,000 people inside reserve boundary. Conflict arises from the fact that activities permitted in the area before creation of the reserve, such as cutting of trees and hunting, are no longer legal. Pressure arises from tourism based on a designated scenic spot in the reserve. A further serious problem is caused by the removal of firewood for a nearby factory, from which the local government earns a lot of revenue.

All of the above reserves perceived that a shortage of trained staff and equipment contributed to some of the management problems indicated.

2. Fanjingshan (FNNR)

Management concerns of FNNR were considered in greater depth than those of the three other reserves, on account of their more direct relevance to the conservation of the GM.

They are listed in an approximate order of priority, those considered most serious being indicated first.

2.1 Tourism: at present the reserve receives around 100,000 tourists per year, predominantly Chinese nationals; many walk the 7km trail to the "Golden Top" peak, halting at refreshment stalls en route and in some cases spending the night at lodges in the peak area. While this volume of tourism is clearly good for the local economy, in an otherwise poor area, it gives rise to a number of pressures within the reserve including:-

- disturbance of the wildlife, including the GM whose former migration route has been cut off, imposing a diversion
- pollution arising from littering and waste disposal
- a potential for contagious human diseases to be passed to the monkeys
- loss of wildlife (including GM) habitat to trails and erection of tourist lodges and food stalls
- a potential diversion of staff time and attention from important protection duties

Over and above the existing tourism, there are strong pressures from local government authorities in the reserve area for increased tourist facilities, including a cable car to carry visitors to the Golden Top area. The greatly increased tourist volume projected by these proposed developments would clearly add to the present high pressures on the reserve's conservation values and pose a serious threat to the conservation of the GM population.

2.2 Charcoal production: the burning of charcoal takes place in the reserve, mainly in the buffer zone. While it is not generally undertaken on a commercial scale but is for personal use, this activity results in some destruction of wildlife habitat.

2.3 Wood cutting: cutting of wood for fuel and construction timber by locals is a problem, primarily in the buffer zone. In addition to destroying forest habitat, wood cutting is a disturbance factor for wildlife, including the GM whose movements are significantly influenced by it.

2.4 Hunting: although some hunting does occur in FNNR, it is not considered a serious threat and is reported to have no discernable effect on the GM.

2.5 Livestock: there is some livestock grazing in certain buffer areas of the reserve, which, while it clearly degrades wildlife habitat, is not of very significant proportions.

In addition to the above readily identifiable concerns, there are two interrelated matters which greatly affect the quality of conservation afforded to the GM by the reserve. The first is the inadequate protection of a considerable amount of GM habitat; some of it is in the core area but the greater part is situated in the buffer zone. Adequate protection of both categories would require the prior removal of people presently residing in those areas. It is understood that plans to re-locate four large villages from the core area, where they adversely affect the breeding of the GM's, are currently under consideration by the government. To achieve this in the buffer zone would require the purchase of collectively owned forests and the re-location of their owners outside the reserve

boundary. Only then would it be possible to upgrade the buffer areas in question to core status.

3. Recommended goals for future management of the Golden Monkey population

Having regard to the conflicts with and threats to conservation of the Golden Monkey indicated in 2. above, the following goals are recommended for inclusion in any future management planning for FNNR and the single species population of the Gouzhou Golden Monkey.

3.1 Reduction of threats

A prime aim of management should be to reduce, and where possible eliminate, all threats to the survival of the GM which is the flagship species of FNNR. This goal should include attention to the following threats or potential threats identified during the PHVA Workshop:-

3.1.1 Threats from tourism

The best possible scenario would be to hold tourism at its present level, resisting pressure to increase tourist volume in the reserve. A scientifically based ceiling to tourist numbers should be agreed and any proposals for the further development of tourist facilities should be subjected to an Environmental Impact Assessment sensitive to the GM. In any event tourism should be continue to be confined to the southern aspect of the mountain range and no new lodging facilities should be constructed within the reserve boundary.

It is further recommended that existing tourism should be subject to appropriate regulation and visitor education aimed at an increased awareness of conservation issues relating to FNNR. For example, billboards outside the entrance to the reserve could highlight issues and inform visitors as to appropriate behaviour while in the reserve. Clearly labeled trash cans should be placed at frequent intervals on the tourist trail in an effort to reduce littering. The lighting of fires or cutting of fuelwood must continue to be strictly forbidden and stiff penalties imposed for infringement.

3.1.2 Charcoal production

Efforts should be made to reduce, and eventually eliminate, the use (and thus the production) of charcoal by people living in the buffer zone. The introduction of fuel-efficient charcoal stoves would be a first step in the desired direction. An alternative, environmentally friendly (in relation to the reserve) source of energy, such as electricity, would provide a better long-term solution but might require a degree of financial subsidy initially to encourage people to convert to it from their existing “free” supply of charcoal.

3.1.3 Hunting and wood cutting

Although these activities are not perceived as a current threat in the reserve, vigilance should be maintained against their re-appearance. Penalties in the courts for those convicted of poaching offences should be periodically reviewed by reserve management in collaboration with justice officials so as to ensure they are maintained at levels which constitute an effective deterrent.

3.2 Strengthening the protection status of GM habitat within FNNR

Every effort should be made to encourage growth of the GM population in FNNR. To this end management should seek ways of making currently unused or disturbed habitat available to the GM population by a) bringing buffer areas in question into core area status and b) ensuring zero disturbance in all GM habitat areas within the core. Judicious support should be given to government plans to re-locate core area residents outside the reserve by ensuring that an attractive, well funded package ensuring a better life (including waged work) is on offer. Ultimately such action should be sought for all areas of GM habitat in the buffer zone.

Habitat freed of recent human occupation would probably need some rehabilitation before becoming attractive to the GM. This might include random planting of tree and shrub species native to the areas in question and would certainly entail ensuring the absence of any residual disturbances arising from the presence of stray dogs or domestic stock. Return visits to the rehabilitated areas by former residents would need to be prohibited.

3.3 Re-introduction to a new location

Bearing in mind the vulnerability of a single species population, such as that of the Guizhou GM in FNNR, to major catastrophes like an epidemic of a lethal disease, it would be prudent for management to seriously consider the establishment of a second population of GM's, by means of a transplant from the FNNR population. The successful establishment of a second breeding population, while an onerous undertaking, would greatly increase the long-term survival chances of the species (and reflect very favourably on the wisdom and foresight of the present guardians of this flagship species). Such an exercise should be undertaken using the "IUCN Guidelines for Re-introductions" published by the IUCN/SSC Re-introduction Specialist Group (Chinese version available). An indicative list of the major steps to be taken in the case of the GM follows:-

- further research on the ecology of the FNNR GM population to elucidate predation and other mortality factors, habitat requirements for reproduction and strengthen existing knowledge of seasonal food requirements
- identify candidate areas, within the species' former range, which appear to meet its known habitat requirements and also have (or could be given) an adequate legal protection status – effective long-term protection must be assured

- carry out detailed research on the habitat characteristics of candidate areas, including estimating their carrying capacity for GM's (a minimum population of 200 should be capable of being carried over the long term) ; confirm absence of serious threats
- in the recipient area selected, check on the concurrence of all relevant government agencies and local communities in the proposed re-introduction programme; arrange conservation education for supporting groups as appropriate
- calculate the effects of removal of the animals to be translocated from the donor population (a total founder group for the new area of 30 animals might be appropriate in the case of GM)
- test capture, transport and release techniques on a small number of animals of different age/sex classes; establish protocol for the main translocation, including seasonal and climatic factors
- carry out main translocation as per protocol
- institute follow-up activities designed to monitor the adaptation of the released animals to their new environment (demographic, ecological and behavioural studies – use aids such as radio-tracking as appropriate)
- report results in conservation and wildlife management literature for benefit of the wider conservation community

If it was felt that expert international advice and/or assistance were needed at any stage in a GM translocation programme, this could be arranged via the IUCN/SSC Conservation Breeding or Re-introduction Specialist Groups.

Notes On Census Method For *Rhinopithecus*

The mountainous terrain, dense forest, and large aggregations of monkeys all combine at Fanjingshan Nature Reserve to make censuses of *Rhinopithecus brelichi* quite difficult. Although total counts of the population are important and should be done on a regular schedule, they require much time, effort, and money. This suggests that comprehensive censuses should be done perhaps every 5 or 10 years. A simpler method can be used to census monkeys in the intervening years. This technique relies on population structure (such as the ratio of adults to immatures) to estimate population status. This simpler method has been used under conditions similar to Fanjingshan N.R. by the Kunming Institute of Zoology on *Rhinopithecus bieti* and the Sichuan Department of Forestry on *Rhinopithecus roxellana*.

In this simple census method, two researchers locate a monkey group (that is, collections of "family units") and follow the group until the monkeys are either (1) resting in clear view or (2) traveling in a line. It may take some time -- up to several days -- to find a good opportunity to see this. When monkeys are resting or traveling, however, there is little chance that any one monkey will be counted twice. As the researchers watch the monkeys, they record, systematically (for example, from left to right), all the monkeys they see, divided into the following categories:

1. Adult male (within a family unit).
2. Adult male (alone or outside a family unit)
3. Adult female
4. Unidentified adult (if clearly an adult, but sex cannot be identified)
5. Adult female or large juvenile (this category may include sub-adult males)
6. Large juvenile (this category includes sub-adult males when clearly identified)
7. Small juvenile
8. Unidentified juvenile
9. Small juvenile or infant
10. Infant
11. Unidentified animal

When a large proportion of the total group is seen (perhaps over 50% of the estimated group, over 100 animals), the above categories can be used to estimate (1) the ratio of adults to immatures, (2) the ratio of infants to adult females, and (3) the ratio of adult males to adult females. These ratios allow estimates of population health. If there are relatively few immature animals, for example, this means that there are few animals to grow into adults. This implies that, over time, the population will decline in size.

(A tape recorder is useful to record the line of monkeys as it travels, with the information *immediately* written down afterward.)

Several things should be kept in mind while conduct censuses such as these:

* Comparisons between years should be made with censuses collected during the same season. For example, censuses conducted in February (before the birth season) will have fewer infants in them than those conducted in June. Therefore, comparing censuses from February in one year and June in another would give a misleading idea about whether population structure has changed.

* The simple technique gives *estimates* of population structure. It is important to take several estimates ("replicates") so that an average can be calculated. This is the case both when the monkeys at Fanjingshan are in one big aggregation or when there are numerous small aggregations of three or four family units. In the first case (one big aggregation), replicates are needed for the same group. In the second case, several groups should be recorded, along with replicates for each group observed.

* Always record the time, date, and location at which the data were collected, along with notes about observation conditions (for example, the approximate distance to the group, whether there is fog, etc.). Also, write down the general characteristics used to assign individuals to particular categories (e.g., size, coat color).

The following forms may be useful. The first is to record the monkeys. The second is to sum the observations.

No.	Category	Mention if this monkey starts or ends a family unit
1.	Adult male	start
2.	Adult female	
3.	Infant	
4.	Unidentified adult	
5.	Large juvenile	end
6.	Adult female	
7.	Small juvenile	
8.	(etc.)	
9.		
10.		
…		

Date/ Time	AM	AM*	AF	AU	AF /J	LJ	SJ	JU	SJ /I	I	No ID	(total number counted)	Ratio, adults: immatures	Ratio, infants: adult females	Ratio, adult males: adult females
. . .															
. . .															
. . .	…	…	…	…	…	…	…	…	…	…	…	…	. . .	. . .	
												AVERAGE:			

AM = adult males in family units
AM* = adult males outside of family units
AF = adult female
AU = unidentified adult
AF/J = adult female or juvenile
LJ = large juvenile
SJ = small juvenile
JU = unidentified juvenile
SJ/I = small juvenile or infant
I = infant
NoID = unidentified

POSSIBLE SITES for TRANSLOCATION 1999 10 30

Legend for Guizhou map (translocation possibilities)
(R. brelichi PHVA, ecology/management working group)

1. Fanjingshan N.R. The area surrounding Fanjingshan may have appropriate forest to be considered for translocation.

2. Xishui/Tongzi. This is the area from which the type specimen of R. brelichi was collected in the early 1900s. Therefore, investigation of forests here for areas in which to translocate monkeys (perhaps after rehabilitation of forest) may be reasonable.

3. Foding Shan. Working group members thought that the Fodingshan forests would probably be appropriate for Guizhou golden monkeys. However, they also thought that the forest patches near Foding were too small to hold an adequately-sized population.

4. Leigongshan. Working group members thought that the forest patches at Leigongshan were probably large enough to hold an adequately-sized population of Guizhou golden monkeys. However, they were uncertain that the forest type in the Leigongshan area would be appropriate habitat for Guizhou golden monkeys.

GUIZHOU SNUB-NOSED MONKEY

(*Rhinopithecus brelichi*)

Conservation and PHVA Workshop

Fanjingshan National Natural Reserve

25 - 29 October 1999

FINAL REPORT

POPULATION INFORMATION AND MODELING

Population Modeling Group

Group Participants: Mr. Lei Xiao Ping, Mr. Yu Deng Li, Mr. Yu Yong Fu, Mr. Zeng Fan Yong, Mr. Yang Sheng Jun, Mr. Jonathan Ballou, Ms. Gong Yazhen (translator).

Introduction

Population viability simulation models are tools for exploring the potential fates of populations. Through incorporation of detailed information on the biology of a population, its threats, the interaction of its life-history parameters (survival and reproduction) with its environment, and potential management actions, PVA models allow wildlife managers to more completely understand the populations under their charge. PVA models can be used to:

- Identify those life-history characteristics that play a critical role in determining the viability of a population;
- Identify life-history characteristics that are important for viability but for which little data are available;
- Evaluate the effect of potential threats (poaching, disease, habitat loss, etc) and identify which is the most critical in terms of affecting viability;
- Help evaluate the effect of different management actions.

We used the population simulation program VORTEX (Version 8.03, Lacy 1999) to help understand the viability of the golden snub-nosed monkey or the Guizhou golden monkey in the Fanjingshan Nature Reserve, Guichou Province. VORTEX measures population viability in terms of two parameters over a 100-year period: the probability of the population going extinct and the loss of genetic diversity in the population.

Using data collected on the monkeys in Fanjingshan Reserve, we first developed a simple model of the life-table and mating structure of the population. Since several important life-history parameters were not known, we then explored the sensitivity of the model to these parameters by entering a range of values into the program to determine how they might affect the model outcome. If the outcome (probability of extinction) varied little across the range, then the model was not sensitive to that parameter and a precise measure of that parameter is not important.

We then evaluated the effect of the primary threat to the population, disease, on population viability, modeling a number of scenarios covering a range of possible disease conditions. Since we found that disease could be a very significant threat to the population, we then modeled some potential management strategies that had been suggested to reduce the effect of the threat. We conclude with a series of recommendations.

Population Size and Carrying Capacity

The Guizhou golden monkey inhabits only the Fanjingshan Nature Reserve in Northeast Guizhou Province. An extensive survey between 1988 and 1993 by the staff of the Fanjingshan (ref?) concluded that the population of monkeys consists of 764 animals (with a 95% confidence interval of 655 to 873). No previous estimates of population size are available, although the subjective impression of the staff at the Reserve was that the population has been stationary (stable in the sense of not growing or declining).

Population was assumed to be at carrying capacity. Over the last decade, several (9) male monkeys have been found outside the reserve boundaries. These are presumed to be dispersing males. No dispersing females have been found.

There is also a captive colony of 12 monkeys maintained in the Experimental Station at Panxi within the Nature Reserve. The captive colony was established in 1993 with 7 animals, with an additional animal added in 1994.

Data on Group Composition

In addition to estimates of total population size, perhaps the most valuable data on the wild population comes from data on age and sex counts within groups of golden monkeys. The basic social unit of golden monkeys is probably a family group with one male, several adult females, juveniles, and infants (Bleisch, 1993). Family groups frequently travel or feed in large groups up to over 100 individuals. Counts of numbers of adult males, females, juveniles and infants in these groups provide valuable information of the reproductive rates and age and sex distributions.

Bleisch (1993) studied Guizhou golden monkeys in Fanjingshan in 1991 and presented data on group composition of 15 groups. The data are shown in Table A. Proportion of females reproducing was calculated as (#Infants)/(#Adult Females) = 14/33 = 0.42. This is likely to be an underestimate since the dominator may include a small number of of subadult males (see Bleisch 1993). From these data, the proportion of adults was calculated as (#Adults)/(#Total) = 48/92 = 52%.

Table A. Group composition on 15 groups of Guizhou golden monkeys. From Bleisch (1993). Column of Females(?) may include a small number of subadult males, which are difficult to distinguish from adult females.

Group	Total	Adults	Adult Males	Females(?)	Females With Offspring
1	7	4	1	3	1
2	5	4	1	3	1
3	7	3	1	2	1
4	6	4	1	3	1
5	6	3	1	2	0

Group	Total	Adults	Adult Males	Females(?)	Females With Offspring
6	6	3	1	2	0
7	10	3	1	2	0
8	3	3	1	2	0
9	7	3	1	2	2
10	5	2	1	1	1
11	8	4	1	3	3
12	4	3	1	2	1
13	5	3	1	2	1
14	7	4	1	3	1
15	6	2	1	1	1
Totals	**92**	**48**	**15**	**33**	**14**

We were also able to use some data on group compositions collected during the 1988-1993 census and survey of golden monkeys in Fanjingshan (ref ??). With the help from Mr. Qiu Yang from the Fanjingshan Nature Reserve, group composition data were extracted from field notebooks maintained by observers during the census. These data are shown in Appendix I. We first used only data with information on number of adult females and infants. Since data were extremely sparse for 1988, we used only 1991 data and then included data collected late in the birthing season (mid-May and after) to insure that most of the infants had been observed. These observations extracted from the full data set and presented in Table B. Proportion of females breeding is calculated as above: 8/36 = .22. This is likely to be an underestimate since: 1) the "Mixed" category may include infants which are not included in the infant count; and 2) additional infants may have been born later since the birthing date may continue until late May. Adults consist of 60% of the population.

Table B. Group composition data from Fanjingshan Nature Reserve. Subset of observations which identify counts of adult females.

Date	Total	Adults	Male	Female	Subadults	Mixed	Infants
5/14/91	16	15	6	9		11	
5/10/91	6	4	3	1		2	
5/12/91	27	12	3	9	6	8	3
5/14/91	11	8	2	6		1	2
5/10/91	7	2	1	1	4		1
5/14/91	7	5	1	4		1	1
5/14/91	7	4	1	3	3		
5/14/91	8	4	1	3			1
Totals	**89**	**54**	**18**	**36**	**13**	**23**	**8**

We can also estimate female reproductive rate (proportion females breeding) from data where total adult counts and infant counts are available, but counts of adult females are lacking. Both the data from Bleisch and Table B indicate that about 70% of adults are

females (33/48 = 69% from Bleisch, and 36/54 = 67% from Table B). Table C shows group count observation from the Fanjingshan Census for which total adult counts are available, but the number of adult females is not given. If we can assume that 70% of adults are females, then the data in table C suggests a total of 93*0.70 = 65 Adult females. Using this to calculate prop. females breeding gives 15/65 = .23. Adults comprise 58% of the population.

Table C. Group composition counts lacking counts of adult females.

Date	Total	Adults	Male	Female	Subadults	Mixed	Infants
5/11/91	36	25				10	1
5/11/91	13	7				4	2
5/11/91	8	4				3	1
5/12/91	24	17					7
5/12/91	24	18				4	3
5/12/91	20	12				7	1
5/12/91	35	10			25		
Totals	**160**	**93**			**25**	**28**	**15**

Proportion of Females Reproducing

From the data on group compositions, we can estimate that the proportion of females reproducing is between 42% (Bleisch, 1993) and 22% (Fanjinshan Census Data).

Data from the captive colony of Guizhou golden monkeys provide another independent estimate of proportion of females breeding. Interbirth interval was 3 years for one female whose young survived till weaning. Interbirth interval for two females who lost young early (miscarried) was one year. Thus, proportion of females breeding would be 33% with no infant mortality. Any infant mortality would increase the proportion since females would recycle and give birth the year after losing an infant.

We therefore tested the sensitivity of the population to this range (22% - 42%) of values.

Age of First Reproduction

Assumed to be age 7 for both males and females. Reference is given in the literature to females breeding as early as age 4-5. However, this was debated among the group and some experience in the captive colony suggests that females breed later than that.

Maximum Number Of Offspring Per Female Per Year

One per year

Longevity (Maximum Age of Reproduction)

Estimated to be between 20 and 25 years.

Mortality Rates

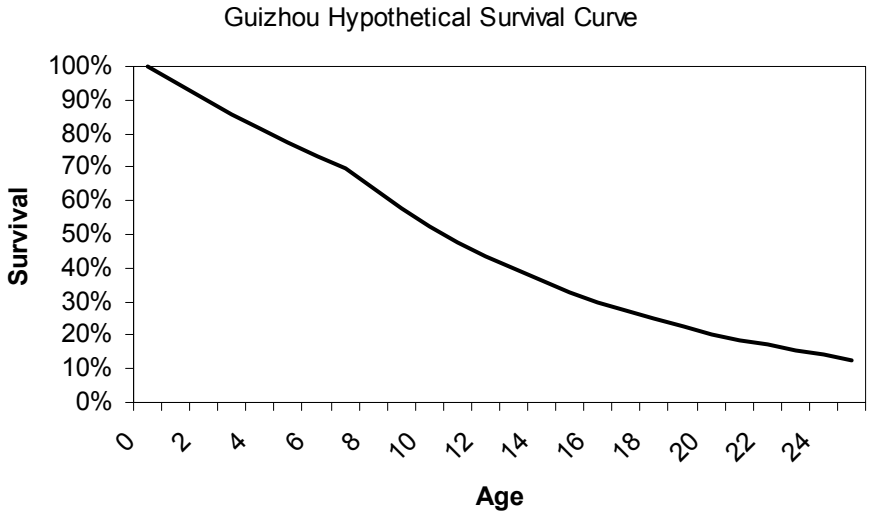
There are no data on age specific mortality rates in Guizhou golden monkeys or any species of snub-nosed monkeys. We therefore began with mortality rates for a similar sized monkey (lion-tailed macaque, from the Lion Tail Macaque PHVA, CBSG) and scaled the rates until we met the following constraints:

1) less than 15% of animals survive to the maximum age of reproduction ; and
2) adults comprise at least 50% of the total population size (as was found in the data on group composition, above);

VORTEX allows specification of age-specific mortality rates for age 0 to sexual maturity, as well as an "adult" mortality rate (age of sexual maturity to maximum age). To modify the macaque mortality data to fit the above constraints, we first set all pre-reproductive mortality rates to the same rate. While this does not allow for the typical much higher mortality rate often seen in the first age class, this was probably acceptable since observations of monkeys probably occurred after the majority of the first year mortality takes place (shortly after birth).

Adjusting the mortality rates to the above constraints resulted in 5% annual mortality for the pre-reproductive age classes, and 9% mortality rates for the adult age classes.

The combination of these mortality rates and the above female reproductive rates resulted in a deterministic r (population growth rate) of –0.016 when 25% of the females reproduced/year and a r of 0.024 when 42% of the females bred per year. Generation length was 13.5 years and 13.0 years, respectively.



Effects of Inbreeding

We included inbreeding depression in all simulations. Number of lethal equivalents set at the mean value found in a multi-species study of inbreeding effects on juvenile mortality (3.14 lethal equivalents, Ralls et al. 1988), with 50% of that being due to single lethal alleles.

Environmental Variation

Information on standard deviation of input parameters allows VORTEX to model the unpredictability inherent in all life-history rates. Estimates of standard deviations require data collected over multiple years (preferably more than 10). Since multi-year estimates of survival and reproductive rates were not available for Guizhou golden monkeys, standard deviations were assumed to be 50% of the mean life-history rates for mortality.

Simulation Scenarios and Results

1) **Sensitivity Analysis of Proportion Females Reproducing**

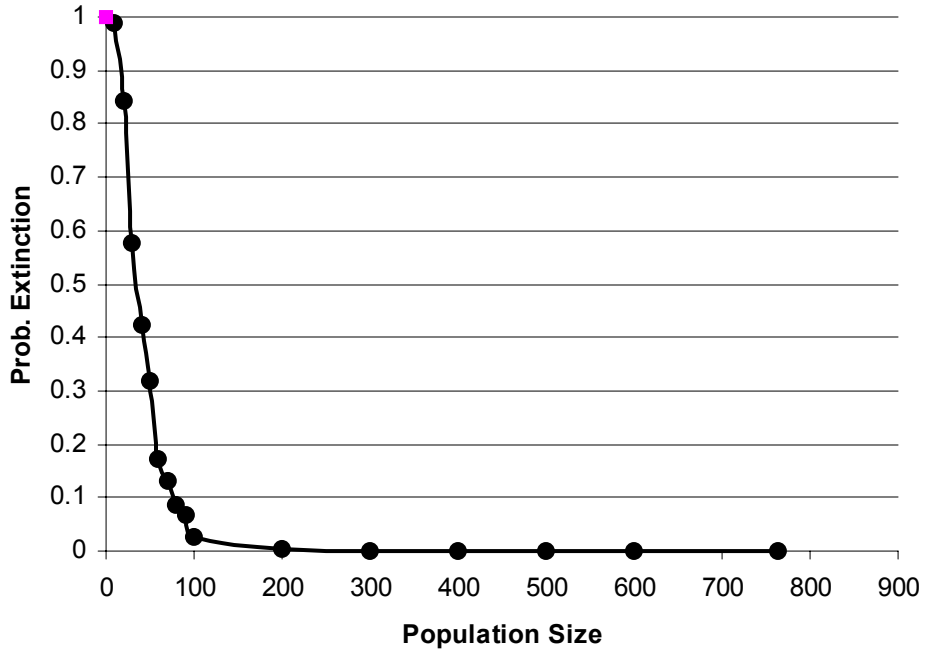
   Estimates of the proportion of females breeding ranged from 22% to 42%. Model scenario GM1 and GM2 estimated viability parameters for these two values. Although prob. extinction was 0 for 25%, the stochastic r was –0.019 (Table 1) . For 42%, r was 0.021. Clearly more detailed information of the value of this parameter is needed (see Conclusions and Recommendations). We then modeled 33% proportion breeding females as the average of the two, resulting in an r of 0.002. We used 33% as the proportion of breeding females for the rest of the simulations (unless noted otherwise) since 25% resulted in a deterministic population decline and certain population extinction.

2) **Sensitivity of Model to Maximum Age of Reproduction**

   The baseline model was run with maximum age of reproduction set at 25 (GM3). This value was uncertain, so we compared those results with maximum age set as 20 (GM32). Reproductive rate of females was kept at 33%. Differences were minimal – probability of extinction did not change (zero in both cases) but final population size (at year 100) dropped from 528 using age 25 to 339 using age 20.

3) **Effect of Population Size in Ideal Conditions**

Results from the above simulations using 33% females breeding show a zero percent probability of extinction although the population size is reduced from the estimated 764 to an average size of 528. To determine at what point the population became not viable we systematically reduced the size from 764 to 10 (Scenarios GM 13 to GM 27). Results showed that the probability of extinction increased dramatically as the population size approached 100. These simulations ignored all potential threats to the population.



4) Effects of Disease

A number of potential threats to the population were discussed (see conclusions and recommendations below). The most significant threat identified was the potential for disease transfer from macaques in the reserve and from humans. Tourist activity is heavy in portions of the reserve and there is strong interest and pressure to increase access to tourists. Although contact between tourists and golden monkeys is currently considered minimal, the high likelihood of increased tourist activity over the coming years presents disease as a threat. Managers of the captive colony also indicated that the captive Guizhou golden monkeys were particularly susceptible to diseases (although disease has not been specifically indicated in either of the two (?) deaths in the colony to date).

Detailed information on the frequency or effect of disease in this population is lacking. Therefore the group modeled a range of potential disease frequencies and disease effects. We varied the probability of a disease infecting the population at 1%, 2% and 5% per year. If a disease were to strike the population, we also varied its effect: 5%, 10% and 50% increase in mortality for the year the disease strikes the

population. A disease frequency of 5% with an impact of 50% increased mortality is an extremely heavy disease impact. However workshop participants agreed that this did reflect their level of concern over the potential effect of disease. These scenarios were identified as GM4 through GM 12. (see Table 1).

The results and a discussion of the implications are presented in the Conclusions and Recommendations.

5) Effect of Increasing Population Size to Minimize Threat from Disease

Will increasing population size protect the population from disease? Golden monkeys primarily use an area of 8000ha in the Northeast part of the reserve. An area of 10,000ha in the Northwest portion has similar habitat, but is not used by the houzi probably because of the presence of human activities (villages and roads in the buffer area). Monkeys could presumable utilize this area or part of it if human presence were reduced or removed.

We modeled the potential expansion of the population into this area (and thereby presumably increasing population size) under the presumption that human activity could be reduced or eliminated. We first modeled a 50% increase in carrying capacity (from 764 to 1148) to reflect reduced, but not eliminated human presence. (GM 29).

Despite the increased area, the low growth rate of the population using 33% reproductive females frequently did not allow the population to capacity. Extinction probability was 21%. We then used 42% reproductive females, which allowed the population to grow more rapidly (GM 30). With this more rapid growth, extinction probability dropped to 6% at 100 years; however, average population size at year 100 was only 347 – well below the capacity of 1143. Doubling the area accessible to the monkeys (which would assume complete removal of human presence) did not improve the situation (GM31).

Even with expanded population size, a disease threat of this magnitude is enough to substantially reduce population size. Alternative methods need to be considered to minimize the threat of this disease threat.

Conclusions and Recommendations

Research programs with golden monkeys should have a clearly defined goal.

Simulation results show that total population size and proportion of females breeding are vital to determine population viability. Census and group composition data (age + sex composition) over multiple years are needed to make ongoing evaluation of population viability.

More accurate estimates of mortality and maximum age of reproduction are needed for this species.

Diseases from humans and human presence pose a significant threat to the survival of the population in Fanjingshan, even if the population were to double in size. Action needs to be taken to reduce this threat, either by reducing human presence or establishing an additional, geographically isolated population of the golden monkey.

Even in the absence of any external threats, populations smaller than 200 monkeys can not be considered viable. Locations considered for translocation should have this size as the minimum carrying capacity during the season of lowest food supply.

Table 1. Model Scenarios and Results

Scenario	Initial Population Size	Carrying Capacity	Proportion Females reproducing	Long-evity	Disease	r	Sr	SDr	PE	N	SD(N)	Het	SD(H)
GM1	764	764	25%	25	-	-0.016	-0.019	0.072	0	136.35	95	0.9657	0.0237
GM2	764	764	42%	25	-	0.024	0.021	0.078	0	697.36	79.94	0.9891	0.001
GM3	764	764	33%	25	-	0.005	0.002	0.071	0	528.15	158.35	0.9872	0.0037
GM4	764	764	33%	25	5%/50%	-0.02	-0.034	0.174	0.245	96.3	122.38	0.9025	0.1014
GM5	764	764	33%	25	2%/50%	-0.005	-0.011	0.123	0.01	261.8	207.06	0.969	0.0291
GM6	764	764	33%	25	1%/50%	0	-0.004	0.101	0	383.01	212.62	0.9799	0.0128
GM7	764	764	33%	25	5%/10%	0	-0.003	0.079	0	424.48	194.28	0.9836	0.0069
GM8	764	764	33%	25	2%/10%	0.003	0.001	0.077	0	495.82	178.04	0.986	0.0047
GM9	764	764	33%	25	1%/10%	0.004	0.002	0.075	0	517.15	169.47	0.9869	0.0033
GM10	764	764	33%	25	5%/5%	0.002	0.001	0.076	0	494.36	160.78	0.9863	0.0048
GM11	764	764	33%	25	2%/5%	0.004	0.002	0.075	0	517.84	178.97	0.9865	0.004
GM12	764	764	33%	25	1%/5%	0.004	0.001	0.075	0	509.9	172.7	0.9865	0.0046
GM13	600	600	33%	25	2%/10%	0.003	0	0.077	0	366.18	137.93	0.9814	0.0067
GM14	500	500	33%	25	2%/10%	0.003	0	0.077	0	306.22	118.9	0.9779	0.0086
GM15	400	400	33%	25	2%/10%	0.003	0	0.078	0	240.64	97.65	0.9717	0.0122
GM16	300	300	33%	25	2%/10%	0.003	0	0.078	0	186.66	74.53	0.963	0.0152
GM17	200	200	33%	25	2%/10%	0.003	-0.002	0.082	0.005	112.66	47.94	0.9415	0.0338
GM18	100	100	33%	25	2%/10%	0.003	-0.004	0.09	0.025	49.5	26.8	0.8812	0.0565
GM19	50	50	33%	25	2%/10%	0.003	-0.012	0.111	0.32	21.18	12.97	0.7627	0.1081
GM20	60	60	33%	25	2%/10%	0.003	-0.009	0.104	0.172	25.4	15.61	0.7912	0.0982
GM21	70	70	33%	25	2%/10%	0.003	-0.008	0.101	0.13	31.42	18.55	0.822	0.0868
GM22	80	80	33%	25	2%/10%	0.003	-0.007	0.097	0.086	34.89	21.31	0.8323	0.0922
GM23	90	90	33%	25	2%/10%	0.003	-0.006	0.094	0.068	41.43	24.23	0.8564	0.0694
GM24	40	40	33%	25	2%/10%	0.003	-0.014	0.119	0.424	15.72	10.45	0.6996	0.1622
GM25	30	30	33%	25	2%/10%	0.003	-0.015	0.128	0.576	12.15	7.47	0.6318	0.1537
GM26	20	20	33%	25	2%/10%	0.003	-0.018	0.142	0.842	9.18	5.23	0.5871	0.1171
GM27	10	10	33%	25	2%/10%	0.003	-0.016	0.164	0.99	5.4	3.05	0.3656	0.2834
GM29	764	1146	33%	25	5%/50%	-0.02	-0.035	0.176	0.215	107.72	178.66	0.9064	0.0842
GM30	764	1146	42%	25	5%/50%	-0.002	-0.014	0.172	0.06	347.46	336.88	0.9535	0.0629
GM31	764	1528	42%	25	5%/50%	-0.002	-0.014	0.173	0.055	390.77	426.01	0.9571	0.0666
GM32	764	764	33%	20	-	-0.005	-0.007	0.075	0	338.89	191.62	0.98	0.0095

APPENDIX I: Data on Age and Sex Compositions of Guizhou golden monkeys collected during the 1988-1993 Survey and Census. Data extracted by Mr. Qui Yang.

Date	Total	Adults	Male	Female	Subadults	Mixed	Infants
4/20/88	65	25			30	10	
4/29/88	21						6
4/30/88	12						4
4/30/88	10						3
5/1/88	7				3		
5/1/88	353	133					10
5/2/88	6	4			2		
5/2/88	16			8			8
5/2/88	10	7				2	1
11/21/88	7	3				4	
11/23/88	80						5
11/24/88	157	125				30	4
4/27/91	8						1
4/27/91	40					4	1
4/27/91	135				30	15	2
5/2/91	148	125				15	8
5/7/91	8						1
5/7/91	12	8	3	5	3		1
5/10/91	7	2	1	1	4		1
5/10/91	6	4	3	1		2	
5/10/91	10					1	1
5/11/91	36	25				10	1
5/11/91	13	7				4	2
5/11/91	8	4				3	1
5/11/91	27					2	2
5/12/91		5				2	
5/12/91	24	17					7
5/12/91	24	18				4	3
5/12/91	27	12	3	9	6	8	2
5/12/91	14					2	2
5/12/91	20	12				7	1
5/12/91	10					4	
5/12/91	35	10			25		
5/12/91	18					3	1
5/12/91	128						35
5/14/91	7	5	1	4		1	1
5/14/91	7	4	1	3	3		
5/14/91	8	4	1	3			1
5/14/91	16	15	6	9		11	
5/14/91	11	8	2	6		1	2
5/17/91	31						5

Date	Total	Adults	Male	Female	Subadults	Mixed	Infants
5/29/91	40				4		4
7/4/91	11	9				1	1
7/5/91	34	26				7	1
7/11/91	11	5	2	3			
8/8/91	62	40	10	30		20	
8/13/91	11	6	1	5		8	
9/13/91	20	14	6	8		6	
10/6/91	8	3					1
10/19/91	14	10	4	6		2	2
12/24/91	30					3	

GUIZHOU SNUB-NOSED MONKEY

(*Rhinopithecus brelichi*)

Conservation and PHVA Workshop

Fanjingshan National Natural Reserve

25 - 29 October 1999

FINAL REPORT

CAPTIVE POPULATION

Captive Population

Introduction

The captive population group had 8 members including Sun. The afternoon Tuesday and Wednesday morning was taken with creating the studbook, data collection, and data entry. The working group began its discussion with consideration of the goals for the captive program, then moved to problems and needs, and then to recommendations for the program. This provided the structure to continue the analysis Wednesday afternoon and Thursday. More detail was provided on the medical problems the colony has experienced, details on the facilities and resources needed to allow the colony to expand to 20 animals, and research needs for the species in captivity. Several members of the group served as facilitators and they conducted the working sessions and recorded the discussions on flip charts. It was agreed that the goal for size of the colony is 20 golden monkeys which given its current size, demographic structure, and 4% growth rate will take about 5 years if no new animals are added to the colony.

History of the Colony

The colony was started in 1993 with the capture of 9 wild monkeys and one more in 1994. One died shortly after capture with a tumor on necropsy. One other survived three years and died of 'old age' without reproducing . One of the captures was a male infant and the others adults. Birth of young began in spring 1995. The seven surviving adults, 3 males and 4 females, have produced 5 surviving offspring and two still births. The inter-birth interval has been 3 years, with an infant produced in the year following the still births. This information was useful for the wild population modeling. There has been no mortality of the live-born infants. Medical care is provided by doctors from a local human hospital. The animals are fed on fresh browse and supplements of fruit and an occasional raw egg. Two of the males are paired with a female and one male with two males. There has been no interchange of pairings. The outdoor cages are 20 sq meters and about 4 meters high. Connected indoor cages are of similar height and width but not as deep. There also are several macaques housed in the facility.

We suggested that since the pairings have been successful they should not be disrupted. The most important need is for demographic expansion and genetic representation of the colony, particularly since the adults captured in 1993 are of uncertain age and some may be nearing the end of their lifespan. Another suggestion was to undertake a cage enrichment program with advice from a person experienced in such programs with captive folivorous primates. We also suggested that no further additions of macaques be made to the facility because of possible disease risks and the need for the space for the golden monkeys.

Review of the Facility

These comments and recommendations were discussed and agreed by members of the Captive Population Working Group responsible for the local facility.

The facility was constructed in 1993. It includes two outside banks of 10 cages with approximately 20 sq meters of floor space and a four meter wire top. These two banks connect to indoor holding spaces. Which in turn open on an interior corridor so that both sets of cages are serviced from this corridor. One one side there is a connecting large, aviary style cage about 8 meters high and 20 meters long which is used as an exercise yard. Families are released one at a time into this space. The entire facility is in need of maintenance and cleaning as noted below. They do use disinfectant on the floors but they are of unsealed concrete. The painted walls are dirty and moldy.

Feeding is done with daily collected browse (rose family) from the surrounding forest providing about three kg perday (including stems which they do not eat). This is supplemented with a raw egg on alternate days and various fruits and vegetables. The appearance of the faeces is similar to that observed with the other species in the wild according to Kirkpatrick.

Determine the etiology and suggest preventative measures for the recurrent skin and respiratory infections in the colony. Examination of the facility indicates an urgent need for maintenance to reduce the continuing disease problem. There ia an urgent need to clean and seal all concrete floors, remove the paint and repaint with a suitable paint the walls, plaster the rough stone work dividers between the cages, seal, and paint if needed. Check the paint on the bars for lead content and, if leaded, remove and repaint with a lead-free nontoxic paint. Institute suitable cleaning procedures for the new surfaces.

To assist accomplishing the above maintenance procedures, request that CBSG identify suitable materials (paints, concrete sealant) and, with an expert in their use in a folivorous primate facility procedures, return and demonstrate their application and maintenance. It will be necessary to determine if these products are available in China – perhaps through 3M.

Take suitable precautions for the personnel working with confiscated animals to reduce 9the risk of human illness and of transferring disease to the golden monkeys. Needed minimum techniques are: (face masks, disposable gloves, shoe bath on entry and exit, and vaccination of keepers for hepatitis, rabies, and influenza. The keepers should also be checked for tuberculosis. Confiscated primates need to be kept in a separate facility and to have separate keepers. The rhesus monkeys should be removed from the golden monkey facility as soon as possible and the cages steam cleaned, disinfected, and the surfaces treated as above.

Each of the golden monkeys would benefit from a through physical, clinical, and dental examination by a veterinarian experienced with this group or related folivorous monkeys.

This includes physical examination, dental examination, fecal exam for parasites, ultrasound of the abdomen, and blood work. This project could be undertaken in collaboration with a CBSG biomedical team. This process would assist in establishing normal values for the species. The animals would benefit from a bath using soap (human hand soap) and water to clean their skins at the time of this handling or when they are ill and being treated.

Recommendation: Completion of the above maintenance procedures and removal of the macaques would then provide ample space for the golden monkey colony to grow to 20 animals and allow for some treatment capability. The current strucutre appears sound.

Studbook Analysis

The capture of the wild animals occurred over several months so they may represent a random sample of the wild population currently thought to number 700-800 monkeys. There has been no inbreeding and the construction of a pedigree chart provided a convenient way to illustrate possible pairings that would avoid inbreeding in the next generations. The value of not doing back crosses with a parent or sibling crosses was noted and agreed. The male infant captured in 1993 with its mother (G011) is likely to be ready for breeding next year. Detection of possible relationships in the founders will require nuclear DNA analysis. The management of the colony allows a reasonable assumption that the parents have been correctly indentified.

The projected annual growth rate colony is about 4%, but the picture is complicated by the fact that the founder cohort may be 12-20 years of age and hence of uncertain life expectancy. This was explored further with a VORTEX simulation model. Generation time currently is estimated at 11-13 years. Neonatal (first year) mortality was 25% - a crude estimate based upon these limited data, but it also corresponds to some of the inferences from the wild population modeling. This mortality may be reduced by the cleanup of the facility. .

Recommendation: Maintain the studbook and use SPARKS to assist the analyses. Use the pedigree information to guide the breeding program which should allow for no inbreeding for the next generation which will carry the colony about 8-10 years into the future.

VORTEX Captive Population Model

Construction of a population model in VORTEX allows precise use of the available information from the experience with this species in captivity.

VORTEX Input File

Parameter values from the captive population as described in the text `and the literature.

```
BRELICHI.004     ***Output Filename***
Y     ***Graphing Files?***
N     ***Details each Iteration?***
500     ***Simulations***
100     ***Years***
5     ***Reporting Interval***
0     ***Definition of Extinction***
1     ***Populations***
Y     ***Inbreeding Depression?***
3.140000     ***Lethal equivalents***
50.000000     ***Percent of genetic load as lethals***
Y     ***EV concordance between repro and surv?***
1     ***Types Of Catastrophes***
P     ***Monogamous, Polygynous, or Hermaphroditic***
7     ***Female Breeding Age***
7     ***Male Breeding Age***
25     ***Maximum Breeding Age***
50.000000     ***Sex Ratio (percent males)***
1     ***Maximum Litter Size (0 = normal distribution) *****
N     ***Density Dependent Breeding?***
Pop1
30.00  **breeding
5.00  **EV-breeding
25.000000  *FMort age 0
5.000000  ***EV
2.000000  *FMort age 1
1.000000  ***EV
2.000000  *FMort age 2
1.000000  ***EV
2.000000  *FMort age 3
1.000000  ***EV
2.000000  *FMort age 4
1.000000  ***EV
2.000000  *FMort age 5
1.000000  ***EV
2.000000  *FMort age 6
1.000000  ***EV
2.000000  *Adult FMort
1.000000  ***EV
25.000000  *MMort age 0
5.000000  ***EV
2.000000  *MMort age 1
1.000000  ***EV
2.000000  *MMort age 2
1.000000  ***EV
2.000000  *MMort age 3
1.000000  ***EV
2.000000  *MMort age 4
1.000000  ***EV
2.000000  *MMort age 5
1.000000  ***EV
2.000000  *MMort age 6
```

```
1.000000  ***EV
2.000000  *Adult MMort
1.000000  ***EV
5.000000     ***Probability Of Catastrophe 1***
1.000000     ***Severity--Reproduction***
1.000000     ***Severity--Survival***
Y     ***All Males Breeders?***
N     ***Start At Stable Age Distribution?***
1     ***Initial Females Age 1***
0     ***Initial Females Age 2***
0     ***Initial Females Age 3***
1     ***Initial Females Age 4***
1     ***Initial Females Age 5***
0     ***Initial Females Age 6***
0     ***Initial Females Age 7***
0     ***Initial Females Age 8***
0     ***Initial Females Age 9***
0     ***Initial Females Age 10***
0     ***Initial Females Age 11***
1     ***Initial Females Age 12***
1     ***Initial Females Age 13***
1     ***Initial Females Age 14***
1     ***Initial Females Age 15***
0     ***Initial Females Age 16***
0     ***Initial Females Age 17***
0     ***Initial Females Age 18***
0     ***Initial Females Age 19***
0     ***Initial Females Age 20***
0     ***Initial Females Age 21***
0     ***Initial Females Age 22***
0     ***Initial Females Age 23***
0     ***Initial Females Age 24***
0     ***Initial Females Age 25***
0     ***Initial Males Age 1***
0     ***Initial Males Age 2***
1     ***Initial Males Age 3***
1     ***Initial Males Age 4***
0     ***Initial Males Age 5***
0     ***Initial Males Age 6***
1     ***Initial Males Age 7***
0     ***Initial Males Age 8***
0     ***Initial Males Age 9***
0     ***Initial Males Age 10***
0     ***Initial Males Age 11***
1     ***Initial Males Age 12***
1     ***Initial Males Age 13***
1     ***Initial Males Age 14***
0     ***Initial Males Age 15***
0     ***Initial Males Age 16***
0     ***Initial Males Age 17***
0     ***Initial Males Age 18***
0     ***Initial Males Age 19***
0     ***Initial Males Age 20***
0     ***Initial Males Age 21***
0     ***Initial Males Age 22***
0     ***Initial Males Age 23***
0     ***Initial Males Age 24***
```

```
0     ***Initial Males Age 25***
50     ***K***
0.000000     ***EV--K***
N     ***Trend In K?***
N      ***Harvest?***
N     ***Supplement?***
Y     ***AnotherSimulation?***
```

Studbook

GUIZHOU SNUB-NOSED MONKEY Studbook (Rhinopithecus brelichi)

Stud #	Sex	Birth Date	Sire	Dam	Location	Date	Local ID	Event
G001	F	~ 1985	WILD	WILD	FANJING	~ 1 Apr 1993	UNK	Capture
G004	M	~ 1985	WILD	WILD	FANJING	~ 1 May 1993	UNK	Capture
G005	M	~ 1985	WILD	WILD	FANJING	~ 1 Jun 1993	UNK	Capture
G010	F	~ 1980	WILD	WILD	FANJING	~ 1 Apr 1993	UNK	Capture
						~ 1 Jul 1997		Death
G011	F	~ 1985	WILD	WILD	FANJING	~ 1 Apr 1993	UNK	Capture
G012	M	~ 1993	WILD	G011	FANJING	~ 1 Apr 1993	UNK	Capture
G014	M	~ 1985	WILD	WILD	FANJING	~ 1 Sep 1993	UNK	Capture
G015	M	~ 1990	WILD	WILD	FANJING	~ 1 Oct 1993	UNK	Capture
						~ 1 Nov 1993		Death
G016	F	~ 1985	WILD	WILD	FANJING	~ 1 Oct 1993	UNK	Capture
G017	F	~ 1985	WILD	WILD	FANJING	~ 1 Apr 1994	UNK	Capture
G019	F	18 Apr 1995	G005	G001	FANJING	18 Apr 1995	UNK	Birth
G020	F	11 Apr 1996	G014	G016	FANJING	11 Apr 1996	UNK	Birth
G021	M	7 Apr 1996	G004	G011	FANJING	7 Apr 1996	UNK	Birth
G022	M	7 Apr 1997	G004	G017	FANJING	7 Apr 1997	UNK	Birth
G023	F	16 Apr 1999	G005	G001	FANJING	16 Apr 1999	UNK	Birth
G9501	F	19 Mar 1995	G014	G016	FANJING	19 Mar 1995	UNK	Birth
						19 Mar 1995		Death
G9801	F	20 Apr 1998	G005	G001	FANJING	20 Apr 1998	UNK	Birth
						20 Apr 1998		Death

TOTALS: 7.10.0 (17)

Compiled by: Sun Dun Yuan thru Conservation Breeding Specialist Group

SPARKS v1.4

GUIZHOU SNUB-NOSED MONKEY
(*Rhinopithecus brelichi*)

Conservation and PHVA Workshop

Fanjingshan National Natural Reserve
25 - 29 October 1999

FINAL REPORT

PARTICIPANTS AND DOCUMENTS