

ON THE DISTRIBUTION OF THIBETAN AND RHEBUS MONKEYS IN SOUTHERN ANHUI, CHINA

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Abstract

In Anhui province, Thibetan and Rhesus monkeys were found to be distributed to the south of Changjiang. The Thibetan monkeys were limited to the hill areas between 600 and 1,500m above sea level, while the Rhesus monkeys ranged from the plains to higher areas except the areas occupied by the Thibetan monkeys. The habitat preference of the Thibetan monkeys for higher altitudes may be dependent upon the occurrence of rocky cliffs and evergreen broad-leaved forest. The distribution of both species was reduced by strong human impact, but if the habitat is well protected, their population density should approach the population level of the Huangshan mountains. The boundary between the distributions of both species may reflect the general form of the ecological relations.

Key words (关键词): Thibetan monkey, *Macaca thibetana* Milne-Edwards (短尾猴), Rhesus monkey, *M. mulatta* Zimmermann (猕猴), Distribution (分布), Southern Anhui, China (中国安徽南部).

INTRODUCTION

There are few distribution studies on Rhesus monkeys (*Macaca mulatta*) in China (Tan et al., 1965; Zhang et al., 1981), while the work of Xiong (1984) exists on Thibetan monkeys (*Macaca thibetana*). The systematic status of the Thibetan monkey is somewhat confused. This monkey was assigned a status independent of *M. arctoides* (Fooden, 1982; Fooden et al., 1985). Rhesus monkeys are widely distributed to the south of 35°N, and in various types of forest (Zhang et al., 1981; Wada, 1984). Fooden et al. (1985) estimated the distribution range of Thibetan monkeys based on skull records, but the actual distribution was not clear.

In this paper, the distribution of both species, particularly the Thibetan monkey, is examined in detail.

METHOD

Since 1973, one of the authors (Xiong Chenpei) has surveyed the two kinds of mon-

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key by his own direct observations and by collecting monkey information from villagers in the southern part of Anhui province. The Huangshan mountain area was in particular surveyed by us in detail for a period of about 5 months from October, 1985 (Fig. 1).

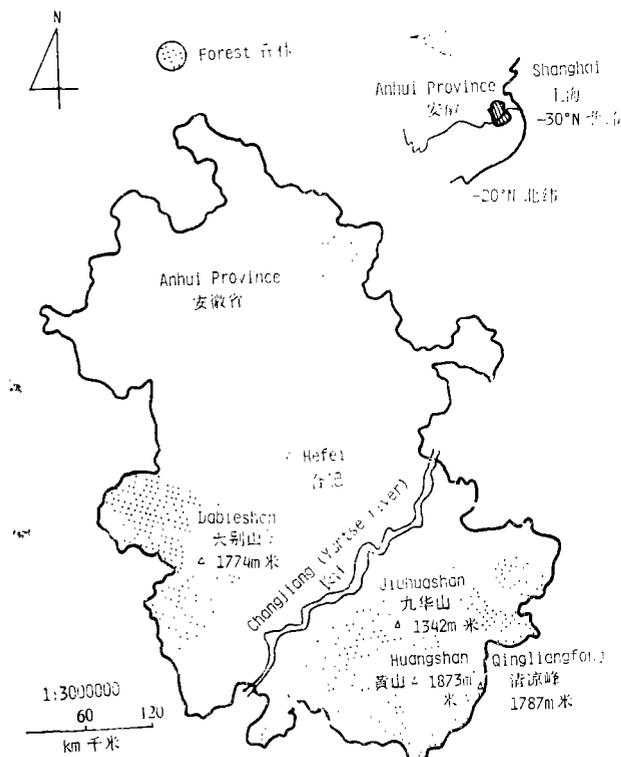


图1 在安徽省的调查区
Fig.1 Survey area in Anhui province.

RESULTS

1. Distribution and Habitat Range of Tibetan and Rhesus Monkeys in Anhui Province

Both species of macaque were found to be distributed to the south of the Changjiang (Yangtze river) in Anhui province. Recently, the northern boundary of Rhesus monkeys in Anhui has retreated southwards (Fig. 2). The extent of the Tibetan monkey distribution was more limited to hilly areas than that of the Rhesus monkeys, and has become gradually reduced (Table 1). According to information from villagers in the south of Huangshan, Tibetan monkeys were formerly present, but they have not been found there for the past several years. The size of each area of monkey distribution was broadly proportional to the frequency of monkey findings. In area 3 of the Rhesus monkey

distribution (Fig. 2), one Tibetan monkey was captured in 1964, but at present Tibetan monkeys are not found. In area 12 of the Rhesus monkeys, Tibetan monkeys were occasionally present in 1960-1965, but have not been found there recently.

Table 1 Distribution of Tibetan and Rhesus monkeys in Anhui province

表1 短尾猴和猕猴在安徽省的分布

Locality位置	County县(Xian)	Altitude (m asl) (海拔高度(米))
Thibetan monkeys (M.t.)短尾猴		
1. Pailou 牌楼	Guichi 贵池	600
2. Jiuhuashan 九华山	Qingyang 青阳	1,000-1,200
3. Guniujiang 古牛降	Shitai-Qimen 石台 祁门	1,000-1,500
4. Huanghuajian 黄花尖	Shitai 石台	600-1,200
5. Huangshan 黄山	She 歙县	700-1,400
6. Xinglong 兴隆	Jingde 旌德	600-800
		only one <i>M. t.</i> skin 仅1只短尾猴皮
7. Gegong 葛公	Dongzhi 东至	600-800
8. Jilian 际联	Yi 黟县	600-800
9. Banqiao 板桥	Ningguo 宁国	700-1,000
		only one <i>M. t.</i> skin 仅1只短尾猴皮
10. Shangyangjian 上杨尖	Jixi 绩溪	800-1,200
11. Xiancun 贤村	Taiping 太平	600-900

Rhesus monkeys 短尾猴		
1. Yangliu 杨柳	Xuancheng 宣城	200—400
2. Shimen 石门	Qimen 祁门	300—500, no <i>M. t.</i> 无短尾猴
3. Qihong 祁红	Qimen 祁门	200—600 one <i>M. t.</i> captured in 1964; 1964年捉到 1 只短尾猴 not found recently 近来未见
4. Liukou 流口	Xiuning 休宁	300—500
5. Guniujiang 古牛降	Shitai·Qimen 石台 祁门	lower than 700
6. Liukou 流口	Qimen 祁门	300
7. Fuxi 浮溪	She 歙县	400—700
8. Qingliangfeng 清凉峰	Jixi 绩溪	600—1,000, no <i>M. t.</i> 无短尾猴
9. Zhaotan 昭潭	Dongzhi 东至	200—500
10. Gegong 葛公	Dongzhi 东至	400—600
11. Jilian 际联	Yi 黟县	400—600
12. Rucun 儒村	Xiuning 休宁	500—800 <i>M. t.</i> observed at 500—1,000 m during 1960—1965; not found recently 1960—1965年在500—1000米处见到短尾猴, 近来未见。
13. Dalingxia, Gangcun 大岭下 岗村	She 歙县	400—700
14. Jiuhuashan 九华山	Qingyang 青阳	400—800
15. Biyun 碧云	Jingde 旌德	300—400
16. Tangxi 棠溪	Guichi 贵池	200—560
17. Hule 胡乐	Ningguo 宁国	200—500

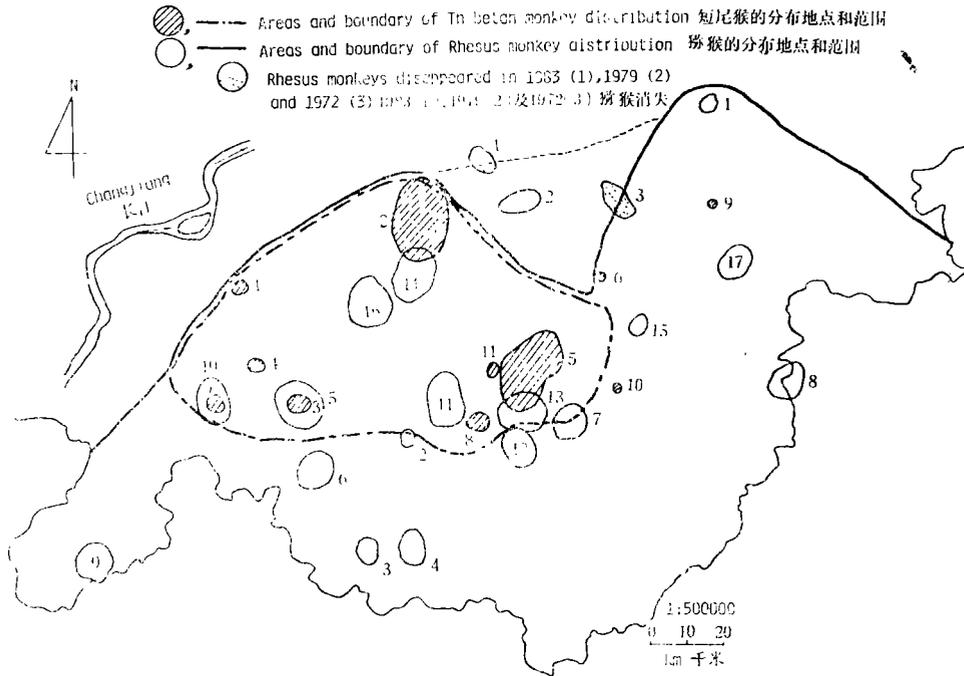


图 2 短尾猴和猕猴在安徽省南部的分布
 Fig. 2 Distribution of Tibetan and Rhesus monkeys at Wan-nan, Anhui province.

The habitat of the Rhesus monkeys includes evergreen broad-leaved, and evergreen-deciduous mixed broad-leaved forests which cover mainly Wanxi, the south-western part of northern Changjiang, and Wan-nan, the southern part of the area south from Changjiang. Rhesus monkeys are also distributed along the foothills covered by remarkably disturbed secondary forests composed mainly of *Castanea seguinii*, *Quercus glandulifera*, *Quercus acutissima*, *Lithocarpus glaber*, and *Liquidambar formosana* dominated forests and mixed forests of them (Fig. 3; Table 2). The habitat area of the Tibetan and Rhesus monkeys was estimated from the Anhui vegetation map (Research Group of Anhui Vegetation, 1983). The Huangshan mountains, up to 1,873 m above sea level (asl), the highest in Anhui province, are covered by the same types of forest as mentioned

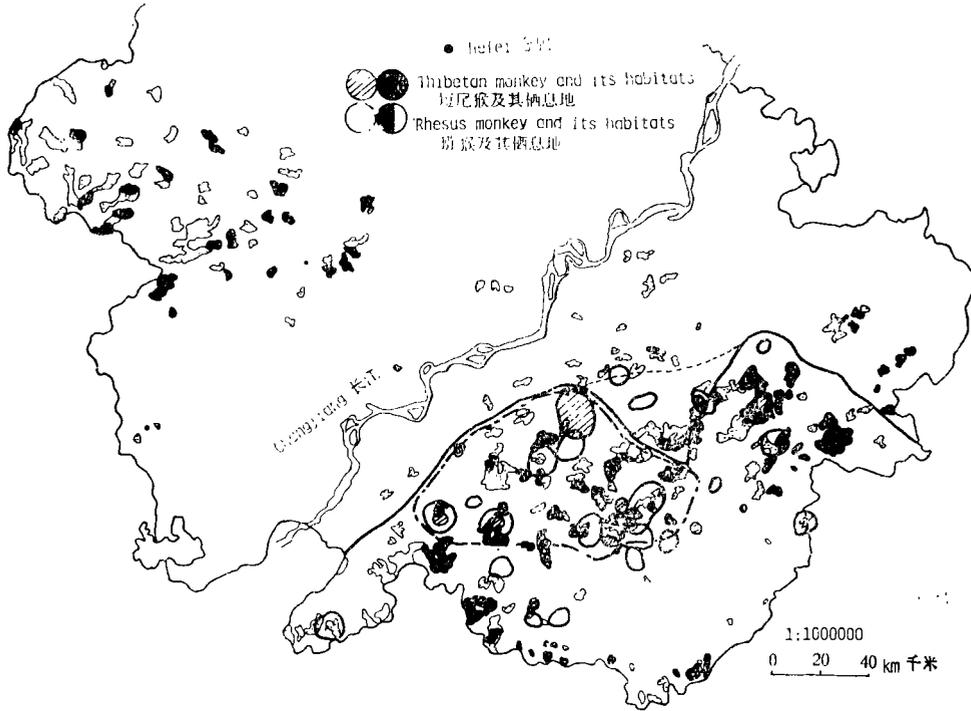


图3 安徽南部的植被及短尾猴和猕猴的分布
Fig.3 Vegetation and distribution of Tibetan and Rhesus monkeys at Wan-nan, Anhui province.

Table 2 Forests utilized by Tibetan and Rhesus monkeys.
表 2 有短尾猴和猕猴生活的森林

<i>Quercus variabilis</i> fr*. Fagaceae	M.t. <i>Liquidambar formosana</i> and <i>Quercus glauca</i> ** mixed fr.
M.t. <i>Quercus acutissima</i> fr*. Fagaceae	M.t. <i>Liquidambar formosana</i> and <i>Lithocarpus glaber</i> ** mixed fr.
M.t. <i>Castanea seguinii</i> fr*. Fagaceae	M.t. <i>Quercus glandulifera</i> var. <i>brevipetiolata</i> * and <i>Quercus glauca</i> mixed fr.
<i>Liquidambar formosana</i> fr*. Hamamelidaceae	<i>Fortunearia sinensis</i> and <i>Phoebe sheareri</i> mixed fr.
<i>Dalbergia hupeana</i> fr.	M.t. <i>Quercus glauca</i> fr.
<i>Platycarya strobilacea</i> fr*. Juglandaceae	<i>Castanopsis sclerophylla</i> fr**.
<i>Pteroceltis tatarinowii</i> fr.	<i>Castanopsis eyrei</i> fr**.
<i>Sassafras tzumu</i> fr.	<i>Schima superba</i> fr**. Theaceae
<i>Liquidambar formosana</i> and <i>Castanopsis sclerophylla</i> mixed fr.	

(After the Research Group of Anhui Vegetation, 依安徽植被协作组, 1983) All types of forest (fr): Rhesus monkeys 全部林型都有猕猴; M.t.: Tibetan monkeys 短尾猴; *: Deciduous broad-leaved forest 落叶阔叶林; **: Evergreen broad-leaved forest 常绿阔叶林.

above, except for the steep rocky slopes, and the habitat of the Tibetan monkeys consists of evergreen broad-leaved, deciduous broad-leaved, and evergreen-deciduous mixed broad-leaved forests with rocky cliffs.

In areas 6, 9 and 10 of the Tibetan monkey distribution, only one Tibetan monkey dried skin was found in a farmer's house. These are not considered to provide direct evidence of the monkey distribution, and were excluded from it.

2. Distribution and Habitat of Tibetan and Rhesus Monkeys in the Huangshan Mountains

Tibetan monkeys

Tibetan monkeys occur at higher altitude except in steep and rocky areas in the Huangshan mountains, while Rhesus monkeys occupy rather lower altitudes. The habitat of the Tibetan monkeys consists of two types of forest and mixed forest (Fig. 4). In the evergreen broad-leaved forest covering altitudes between 500 and 1,000 m asl, the dominant species are *Lithocarpus glaber*, *Quercus myrsinaefolia* and *Q. glauca*, and the subordinate species are *Zelkova schneideriana*, *Juniperus formosana* and *Loropetalum chinensis* which form the first canopy. The second canopy of the forest consists of *Rhododendron ovatum*, and the bush layer consists of *Hydrangea paniculata* and *Lespedeza buergeri*. Bamboo forest is distributed sporadically at altitudes between 600 and 700 m asl (Research Group of Anhui Vegetation, 1983). With the seasonally changing habitat, the Tibetan monkeys utilize forests with rocky cliffs between 600 and 1,500 m asl, and they also take maize mainly from crops in terrace fields in autumn.

Rhesus monkeys

Rhesus monkeys inhabit three types of forest in the Huangshan mountains with an altitudinal range area about 700 m asl, which is especially closely related with many kinds of crops such as bamboo shoots in spring, and maize, peanuts, potatoes, sweet potatoes, radishes and numerous kinds of vegetables in autumn. At all times, the Rhesus monkeys occupy a lower area than the Tibetan monkeys. Drive ways, cultivated fields, and the villages around the Huangshan mountains divide the forests into pieces, and the Rhesus monkeys so come frequently into conflict with the farmers. The Qingliangfeng mountains and adjacent areas of southern Wan-nan are covered by the same types of forest as the Huangshan mountains. In these areas there are no Tibetan monkeys, but Rhesus Monkeys occur in the lower parts to 1,000 m asl in the upper part of the mountains instead of Tibetan monkeys.

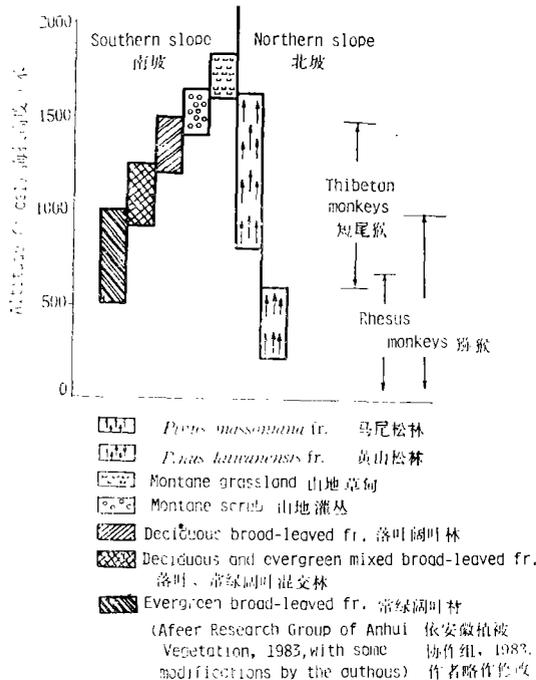


图4 黄山植被及短尾猴和猕猴的垂直分布
Fig.4 Vertical distribution of vegetation and Tibetan and Rhesus monkeys in the Huangshan mountains.

The forest in the Huangshan mountains is well maintained because of nature reserves, and the monkey troops are also in a similar state of nature conservation. Our survey was concentrated on this mountain area.

Eleven troops of Tibetan monkeys were identified (Table 3; Fig. 5). The sizes of the Tianbangshi I and Guimenguan troops were 34 and 37, respectively. However, these two

troops disappeared because both were captured. Ten animals were captured from the Yulingkeng troop in 1974, as well as 17 animals in 1977, and 15 animals from the Xiangrupeng troop in 1980. Thus, before the capture of these monkeys, the Yulingkeng troop may have been composed of more than 40 animals, and the Xiangrupeng troop of about 30 animals.

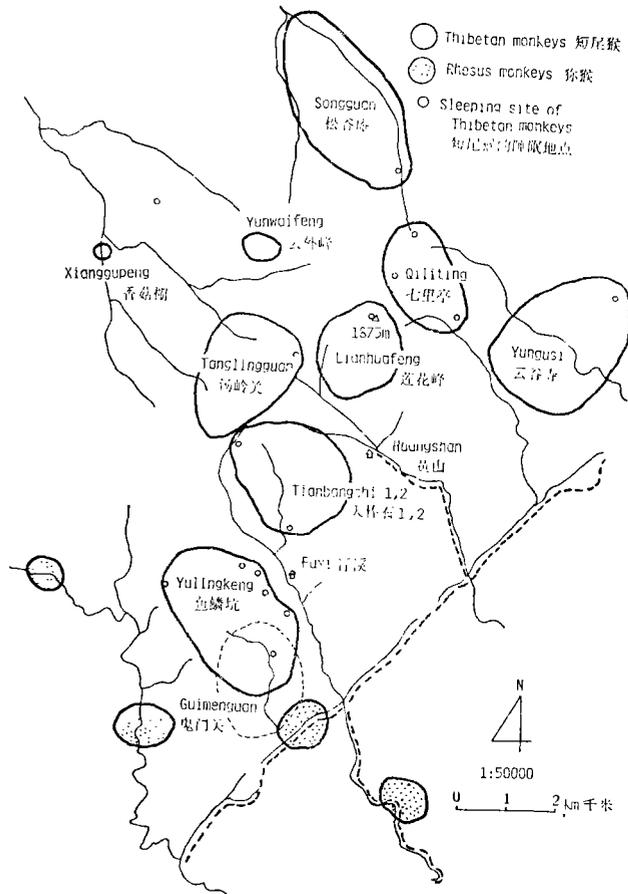


图5 短尾猴和猕猴在黄山的分布
Fig.5 Distribution of Tibetan and Rhesus monkeys in the Huangshan mountains.

well by the Huangshan Administration Bureau, and since 1974, the human impact at Jiuhuashan has been severely controlled by the Jiuhuashan Management Office. Hunting of monkeys has been seriously prohibited in both areas. The numbers of monkeys at Jiuhuashan were unclear, and it was difficult to compare the density of monkeys per unit area. However, since the number of monkey troops is known, the troop density was calculated. The areas and number of troops at Huangshan and Jiuhuashan are 80.49 and 95.12 km² and 8 and 6, respectively (Fig. 6). The troop density in these areas is thus 0.099 and 0.063 per km², respectively. In other areas which were utilized for collecting nuts, and firewood by villagers, the troop density was extraordinarily low.

4. Change in Boundry of Distribution Between Both Species

There is only one known example of a change in the distribution boundary between the two species of macaque (Fig. 7). Rhesus monkeys utilized the area up to the Zhangtianwu stream in 1973, but in spring of 1975 the monkeys appeared on the slope opposite Fuxi village, and in autumn of the same year attacked a farmer's field on the right bank at Fuxi village. Thus, the Rhesus monkey had expanded its home range along the Fuxi valley,

Of the original 11 troops in the Huangshan mountain areas, 9 troops remain. Their troop size varied from about 20 to 80 animals, with a mean of about 40 animals. The home range size of the troops was inaccurately known, but that of the Yulingkeng troop was precisely measured. Within each home range of the Tibetan monkeys, there were many rocky cliffs. During 83 observation days of the monkeys from 1972 to 1980, the sleeping site was ascertained 26 times (Table 3). Each time, terraces on rocky cliffs were used as the sleeping site of the monkeys. The range of Tibetan monkey distribution was associated with rooky cliffs.

The number of troops per unit area was adopted as a measure of the density of the monkeys. In the area westward from the Yulingkeng troop of Tibetan monkeys, neither species was found in spite of the well preserved forest. Since 1952, the Huangshan mountain areas have been maintained

Table 3 Troop size of *Macaca thibetana* in the Huangshan mountains.

表 3 黄山短尾猴群的大小

Troop name 猴群名称	Troop size(N.) 猴群大小 (只)	Altitude 高度 (m asl)	Observation 观 察 days (日)	Days using rocky cliff as sleeping site 在悬崖上睡眠 的天数	Observation period 观察日期
Yungusi 云谷寺	ca. 80	570—1,000	2		1973, 1975
Qiliting 七里亭	ca. 40	1,000—1,400	2		1976
Songguan 松谷庵	ca. 30	890—1,700	3	2	1976, 1977
Yunwaifeng 云外峰	ca. 1,000	2		1977
Tanglinguan 汤岭关	ca. 40	800—1,350	3	1	1977
Lianhuafeng 莲花峰	ca. 40	800—1,600	1		1976
Tianbangshi I 天棒石1号	34	800—1,000	0		captured in Nov. 1972
Tianbangshi II 天棒石2号	ca. 20	700—1,100	1		1975—1977, 1985
Guimenguan 鬼门关	37	500	23	3	Captured in Nov. 1975
Yulinkeng 鱼鳞坑	24(40 <)	800—1,100	42	19	1973—1977, 1980 1985, 10 monkeys captured in 1974 and 17 in 1977
Xianggupeng 香菇棚	ca. 20(30 <)	ca. 800	2		1980, 15 monkeys captured
Unknown 未知			2	1	
Total 总数			83	26	

Note: ca. calculation 估计

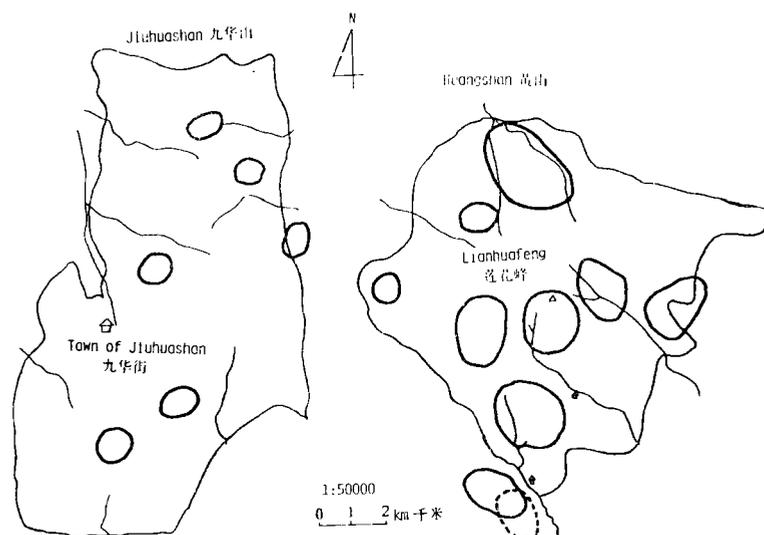


图 6 短尾猴猴群在黄山和九华山的密度

Fig.6 Density of Tibetan monkey troops in the Huangshan and Jiuhuashan mountains.

On the other hand, some troops of Tibetan monkeys were captured. As shown in Table 3, in the Fuxi valley, the Tianbangshi I troop was totally captured in November, 1972, and the Tianbangshi II troop was found in the same area in November, 1975. The Guimenguan troop was totally captured in November, 1975, and 10 animals were captured from the Yulin keng troop on December 3, 1974. The troop home range sizes were not measured exactly, and may be underestimated.

DISCUSSION

1. Difference in Distribution of Both Species

Thibetan monkeys occupy the Huangshan mountains and adjacent areas. However, the hill areas neighbouring the Jiangxi and Zhejiang provinces lack Thibetan monkeys in spite of the presence of suitable habitat conditions, and Thibetan monkeys are replaced by Rhesus monkeys. Although it is not possible to ascertain whether Thibetan monkeys were previously distributed in areas where there are now no monkeys of this species, it is thought that after a retreat in the Thibetan monkey distribution, Rhesus monkeys did expand to that area.

Thibetan monkeys are distributed sporadically at higher altitudes in comparison with the relatively

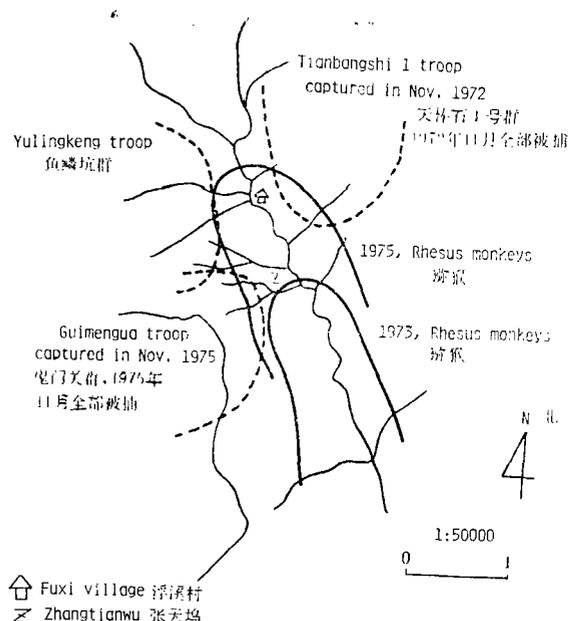


图7 短尾猴和猕猴在黄山浮溪的分布边界的变化
Fig.7 Distribution boundary changes of Thibetan and Rhesus monkeys in the Fuxi valley, Huangshan.

continuous distribution of Rhesus monkeys in lower areas. Nevertheless, the former type of distribution may have derived from a continuous distribution (Wada, 1985).

Natural forest fit for use as a monkey habitat covers Dabieshan, in Wanxi of northern Changjiang, but it lacks any monkeys. This may reflect the faunal succession of the Quaternary period.

2. Habitat Preferences

As mentioned above, in terms of forest type, the habitat preferences of the Thibetan monkeys are more specialized than those of the Rhesus monkeys. One factor deciding the habitat preferences of the Thibetan monkeys could be their daily utilization of rocky cliffs as a sleeping site. For example, the Yulinkeng troop slept at a definite site on the same type of rocky terrace every night during a survey period of two and half months in 1985-1986. The rocky terrace selected as the sleeping site was in fact surrounded by forest, but the Thibetan monkeys never used trees as a sleeping site. Such occupation of a rocky terrace as a sleeping site could be one of the limiting factors of governing the Thibetan monkey distribution.

Thibetan monkeys utilize two types of forest: evergreen and deciduous broad-leaved forests. In particular, they take certain kinds of nuts in autumn and winter, and bamboo shoots, unfolding buds and leaves in spring (Xiong et al., 1984; and unpublished data of Mr. Xiong Chenpei) as staple foods mainly in the evergreen broad-leaved forest. The patchy evergreen broad-leaved forest below 500 m asl has been disturbed by heavier human impact, and its seed production tends to be lower than that at higher altitudes. Thus, the presence of rocky terraces and abundant seeds of evergreen and deciduous broad-leaved forests may comprise the main factors in the habitat preferences of the Thibetan monkeys.

3. Difference in Troop Density in Some Areas of Distribution

The highest troop density, observed at Huangshan and Jiuhuashan, may reflect the conservation conditions of the monkeys and their habitat conditions. Huangshan has been protected for about 34 years under the management of the Huangshan Administrative Bureau, and Jiuhuashan has been protected for about 12 years by the Jiuhuashan Management Office. In both areas, monkey shooting and capturing have been prohibited and the forest as a habitat has also been well maintained through the banning of forest cutting

The extremely low troop density in many other areas compared to Huangshan and Jiuhuashan may be related to their shorter management history. However, after recovering the forest, the troop density should increase and reach almost the same level as in the preserved areas under wildlife management.

The troop density in other areas where there has been no administrative control was still almost zero. This depended largely on the very strong human impact.

Although the Guniujiang natural reserve exists in the southwestern part of Wan-nan, this area is omitted from the present discussion due to the lack of any adequate survey being made.

4. Boundary Between Both Species

As mentioned above, in spring 1975, Rhesus monkeys took bamboo shoots on the slope opposite Fuxi village, and in autumn of the same year took many kinds of crops from a terrace field near the village. In the same seasons before 1975, the bamboo shoots and corn in the field were used by Tibetan monkeys. At that time, Rhesus monkeys were unable to penetrate into the areas because of the dominant inhabiting Tibetan monkeys. Such home range expansion of the Rhesus monkeys may have been closely related to the reduction of the Tibetan monkeys, since this reduction is known to have just preceded of the expansion of the Rhesus monkeys.

REFERENCES

- Fooden, J. 1982 Taxonomy and evolution of the Sinica group of macaques: 4. Species account of *Macaca thibetana*. Fieldiana Zoology, 17, 20pp.
- Fooden, J., Quan Guoqiang, Wang Zongren, and Wang Yingxiang 1985 The stump-tail macaques of China. Amer. J. Primat., 8:11—30.
- Research Group of Anhui Vegetation 1983 Anhui vegetation. Anhui Sci & Tech. Publ., 321pp. Hefei. (In Chinese).
- Tang Chanzhu, Ma Yong, Wang Jiajun, Wang Ziyu and Zhou Caiwu 1965 Fauna of Birds and Mammals in the Zhongtiao mountain, Shanxi Province. Acta Zoologica Sinica. 17(1):86—102. (In Chinese).
- Wada, K. 1984 Rhesus monkey distribution in the lower Himalayas and secondary forest succession. J. Bombay Nat. Hist. Soc., 81(2):355—363.
- Wada, K. 1985 Essay on some ecological and evolutionary characteristics of the genus *Macaca*. Contemp. Mamm. in China and Japan, Kawamichi ed., 36—38.
- Xiong Chengpei 1984 Ecological studies of the stump-tailed macaque. Acta Theriologica Sinica, 4(1): 1—9. (In Chinese with English summary).
- Zhang Yongzu, Wang Sung and Quan Guoqiang 1981 On the geographical distribution of Primates in China. J. Hum. Evol., 10(3):215—226.

中文摘要

短尾猴和猕猴在中国安徽省南部的分布

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短尾猴 (*Macaca thibetana*) 和猕猴 (*Macaca mulatta*) 在安徽省的分布见于长江以南, 短尾猴限于海拔 600—1500 米的山地, 而猕猴则从平地一直分布到没有短尾猴占据的较高山地。短尾猴所选择的栖息地海拔高度较高, 并决定于是否有悬崖和常绿阔叶林。两种猴的分布区, 都因人类的严重干扰而缩小。但是, 如果其栖息地得到很好的保护, 它的种群密度可以接近黄山的水平。两种猴之间的分布界限也反映了它们生态关系的一般形式。

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