

Radio tracking of Hatinh langurs (*Trachypithecus laotum hatinhensis*) at a semi-wild enclosure in Phong Nha - Ke Bang National Park, Central Vietnam

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Summary

In 2005 the Frankfurt Zoological Society in cooperation with the Cologne Zoo launched a reintroduction program for two endangered primate species, the Hatinh langur (*Trachypithecus laotum hatinhensis*) and red-shanked douc langur (*Pygathrix nemaeus*) in the Phong Nha – Ke Bang National Park in central Vietnam. As a first step, a semi-wild enclosure was built and in early September 2007 two groups of Hatinh langurs from the Endangered Primate Rescue Center were transferred. All individuals were equipped with radio collars and continuously monitored over a period of nine weeks. The langurs settled-in well and rapidly explored the whole enclosure. Original group composition was not maintained, but the langurs finally merged into one group. While during the first half of the study, observation conditions were limited as animals were hiding under dense liana covers, later on the langurs gradually exposed themselves in more open areas, allowing extended data sampling periods. Follow-up studies are recommended.

Theo dõi loài vọc Hà Tĩnh (*Trachypithecus laotum hatinhensis*) bằng tín hiệu radio tại khu nuôi nhốt bán hoang dã, vườn quốc gia Phong Nha - Kẻ Bàng, Việt Nam

Tóm tắt

Năm 2005, Hội Động vật Frankfurt, Vườn thú Cologne kết hợp Vườn Quốc gia Phong Nha - Kẻ Bàng khởi động chương trình tái thả hai loài linh trưởng có nguy cơ bị tuyệt chủng về môi trường tự nhiên tại Vườn Quốc gia Phong Nha - Kẻ Bàng, miền Trung Việt Nam. Hai loài được thả gồm vọc Hà Tĩnh (*Trachypithecus laotum hatinhensis*) và loài vọc chà và chân nâu (*Pygathrix nemaeus*). Tháng 9 năm 2007, hai đàn nhỏ loài vọc Hà Tĩnh từ Trung tâm Cứu hộ Linh trưởng Nguy cấp Cúc Phương đã được thả về khu vực bán hoang dã. Tất cả các cá thể đều được gắn vòng thu sóng radio và được theo dõi liên tục 9 tuần sau khi thả. Kết quả cho thấy, các cá thể hòa nhập tốt với môi trường sống. Cấu trúc của hai đàn nhỏ không còn, thay vào đó các cá thể nhập thành một đàn lớn. Trong suốt nửa thời gian đầu của việc theo dõi, động vật thường lẩn trốn trong lùm cây nên khó quan sát. Sau một thời gian làm quen với môi trường mới, động vật đã dần dần xuất hiện ở những chỗ trống thuận tiện hơn cho việc thu thập số liệu. Nghiên cứu tiếp theo cần được tiến hành.

Introduction

In 2005, as part of the Vietnam Primate Conservation Programme of the Frankfurt Zoological Society (FZS), FZS in cooperation with Cologne Zoo initiated a primate reintroduction program in the Phong Nha - Ke Bang National Park (PNKB) in central Vietnam (Nadler & Streicher, 2003; Vogt et al., 2006; Vogt & Forster, in press). In the long run, the project strives to enforce and link currently isolated populations of two endangered primate species, the Hatinh langur (*Trachypithecus laotum hatinhensis*) and red-shanked douc langur (*Pygathrix nemaeus*) (IUCN 2006). Hatinh and red-shanked douc langurs are endemic to Laos and Vietnam. Both species are mainly threatened by poaching.

High hunting pressure, especially in the past, led to a severe decline of their natural populations (Nadler et al., 2003). The distribution of Hatinh langurs is limited to a small stretch south of 17°59'N and the only confirmed occurrence in Vietnam is located in two provinces of central Vietnam. Today, the total population in Vietnam is estimated to consist of between 520 to 670 individuals (Nadler et al., 2003). However these animals appear not to be a closed population. The complete eradication of Hatinh langurs in various areas has led to a high degree of fragmentation, and subpopulations might be separated from each other by large areas. The distribution of red-shanked douc langurs ranges from about 18°40'N latitude in Laos and 19°30'N in Vietnam southwards to about 14°33'N. In Vietnam the occurrence of this species has been confirmed in seven areas, but there are currently no estimates of the remaining population sizes. Over the last few years a rapid decline of the species has been observed and the remaining population appears to be small and highly fragmented (Nadler et al., 2003).

The PNKB National Park (17°22'-17°35'N; 105°58'-106°23'E), located along the border to Laos in Quang Binh Province, comprises about 90.000 ha and is one of the last remaining areas of retreat for both Hatinh langurs and red-shanked douc langurs. The animals for reintroduction will come from the Endangered Primate Rescue Center (EPRC) in Cuc Phuong National Park, northern Vietnam. As an initial step of the program, a semi-wild enclosure was built at the border of PNKB, where the langurs will be maintained, protected and monitored for an appropriate period of time. A single forested limestone hill of 18 ha in size (Fig. 1), containing different vegetation types as well as some small streams, rocks and limestone cliffs was selected as an appropriate area and was surrounded by an electrical fence.



Fig.1. The semi-wild area at Phong Nha – Ke Bang National Park.

In early September 2007, the first primates were transferred to the semi-wild enclosure. Two groups of Hatinh langurs, comprising four individuals each, all equipped with radio transmitters, were brought to the site. At that time a long-term, continuous monitoring program was started for general supervision and protection of the langurs, as well as to collect data on their behavioural ecology.

Objectives

The present report deals with the results of the initial monitoring period from September to November 2007. The purpose of the study was to document the release and adjustment of the langurs to the enclosure, providing particular information on the following topics:

1. Spatial use of habitat, i.e. movement, ranging and frequency use patterns
2. Group structure, i.e. will original groups remain stable in size and composition
3. General observation conditions and notes on behavioural ecology, as related to further studies

Material and Methods

The study animals

Both Hatinh langur groups, comprising one male and three females each, had been established at the EPRC several weeks prior to the transfer (Table 1, Fig. 2). They were kept in adjacent cages, and therefore all animals were familiar with each other. Each group contained one adult female, the other members were still sub-adult. All animals could be individually recognised by characteristic morphological features such as the shape and colour of the sideburns, face, tail, and body, as well as identified by distinct radio transmitter frequencies.

The following radio tracking equipment was used to locate the langurs: HOLOHIL MI-2Transmitters (weight 40,2 g, battery life 150 weeks), a TELONICS Receiver TR-4 164/168MHz, assembled to a TELONICS Antenna RA-14K 164/168MHz (+/-35 angle).

Direct observation was carried out by means of two types of binoculars, a NIKON SPORTER 10x36 and a SWAROVSKI HABICHT 10x42. The distance to detected animals was measured with a BUSHNELL YARDAGE PRO Rangefinder (14 - 850m).

Methods

For easier orientation in the field, some preparatory work was carried out prior to the transfer.

Table 1. Composition of transferred Hatinh langur groups.

Group	Name	Sex	Date of birth
A	Paul	M	03.12.2003
	Lila	F	08.04.2005
	Thom	F	06.02.2002
	Sonja	F	23.08.2004
B	Russ	M	21.11.2003
	Catherine	F	13.08.2000
	Tute	F	03.07.2005
	Wully	F	13.04.2003



Fig. 2. Group B. From left to right: Tute, Catherine, Wully, Russ.

The fence pillars encircling the enclosure (total girth 1700m, 781 pillars) were marked with red numbers. Following photographs, maps of the hill from four different views were drawn by COREL DRAW 8 (Fig. 3) and used as data sheets for recording movement patterns.



Fig. 3. Map of the semi-wild area, showing the front view, between pillar No. 400 to 1.

The Hatinh langurs were brought to the semi-wild area on September 4, 2007, kept in the enclosure's cages for two days and finally released to the hill on September 7, 2007. An intense study of their adjustment phase was started, mainly conducted by J. Riedel, a student from the University of Bonn, as well as the project managers B. Forster and M. Vogt. The study stretched over a total time period of 64 days, from September 7-November 9, 2007). Data recording took place on 49 days, totaling 232 survey hours, 129 in the morning, and 103 in the afternoon (Table 2). On the remaining 15 days monitoring was not possible, mostly due to bad weather conditions.

Table 2. Time schedule of study period.

Week	Date	Observ. days	Observ. hours	Observ. h morning	Observ. h afternoon
1	07.-14.09.	8	78,5	42,0	36,5
2	15.-21.09.	7	31,5	21,0	10,5
3	22.-28.09.	6	27,3	18,3	9,0
4	29.-05.10.	4	13,3	9,5	3,8
5	06.-12.10.	6	24,8	13,3	11,5
6	13.-19.10.	2	8,0	2,5	5,5
7	20.-26.10.	5	17,7	9,2	8,5
8	27.-02.11.	5	8,0	3,8	4,3
9	03.-09.11.	6	22,8	9,8	13,0
TOTAL		49	231,7	129,2	102,5

During the first week, the langurs were tracked and observed from sunrise to sunset. In order to determine the animals positions at the hill in regular intervals, telemetric records were taken every 30 minutes from different positions. Time, pillar number, individual signal records, the intensity of signals (1 = low, 2 = normal to high), as well as the direction of the signal (frontal = in line of direct extension of the recording pillar; from left or from right) were noted. At any time animals were visible, their perpendicular distance to the fence was measured and the location was marked in the map. In addition, behavioural data were collected by ad-libitum-sampling (Altmann, 1974).

After seven days of observation, recording time was reduced to two to three hours in the morning and afternoon, respectively. The first aim of each monitoring day was to locate all eight

individuals, to make sure that all langurs were still at the site and in good condition. To do this, telemetric records were taken at five fixed points around the enclosure (Pillars No. 1, 150, 300, 450 and 600). In this way, the complete area could be tracked. After the first contact, we tried to detect the langurs by binoculars and observe them as long as possible. If animals were not visible, radio records were taken in regular intervals to note travel activities. If the langurs were split up in several subgroups and spread over different locations, the observer either stayed with the biggest group or changed position from time to time, depending on subgroup size and observation conditions. Telemetric and behavioural data sampling took place as described above.

Data analysis

In total 2.992 individual signal records (ISR) were received: 2.232 frontal, 275 from left and 485 from right. To describe the langurs' spatial use, the semi-wild enclosure was divided into six sectors (Table 3), following topographical features, which determined tracking and observation conditions. Only frontal records were used for calculation.

Sightings correspond to the visible detection of one or more individuals. To analyse the use frequencies of the sectors, not all sightings could be regarded, in order to avoid multiple counts of the same individuals at the same area in a definite time span. Therefore, the maximum number of all visible individuals (MVI) at a certain place per continuous observation period was calculated. For example, if the langurs stayed in sector 3 from 8 to 10 am, and at 8:00 3 individuals were seen and at 9:00 5 animals, the latter number was taken into account as the maximum number of sighted individuals for sector 3 during the morning session. The total number of all MVI for the whole study period was 177.

Table 3. Division of sectors according to pillar number.

Sector No.	1	2	3	4	5	6
Pillar No.	65-209	210-319	320-444	445-569	570-699	700-64

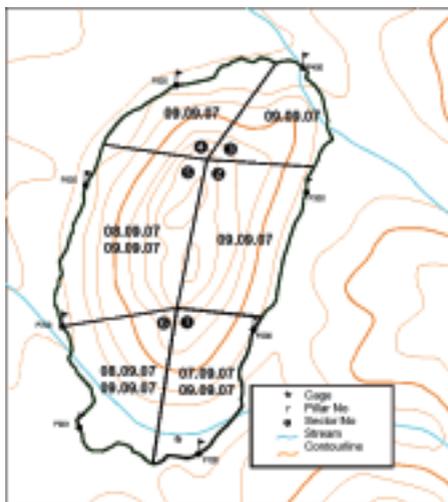


Fig. 4. Composition of transferred Hatinh langur groups.

Results and discussion

Spatial use of semi-wild enclosure

Figure 4 shows the use of the semi-wild area by the langurs during the first three days after release. The cage is located in sector 1, on the level of pillar No. 80.

On September 7 at 9 am, the two cage compartments were opened. Both groups rapidly left the cage, but stayed and explored the area in its close vicinity for the rest of the day. The following morning (September 8, 2007), the langurs were recorded around pillar No. 19 in sector 6, moving further to the southern part of sector 5, being finally located around pillar No. 676 in the evening. On the next day telemetric records indicated that the langurs had split up into several subgroups (see below). The main troop

was found in sector 5, moving to the top of the hill and subsequently entering sectors 4, 3 and 2, respectively. One female, Wully, was seen on the top of the southern peak (sector 2). In addition, single individuals could be located in sectors 6 and 1. So within only three days, the langurs already had explored the whole enclosure.

As the study progressed, certain areas were used with different frequencies. Figure 5 shows the distribution of all frontal records (ISR, n = 2.232) as well as of all maximum sightings (MVI, n = 177) over the six sectors. With a total of 658 ISR (29.5%) and 51 MVI (28.8%) sector 4 was the most used part of the enclosure. Next, according to the telemetric records, the langurs spent approximately equal amounts of time in the three areas 6, 5 and 2 (23,5%; 21,1% and 20,9%), while sightings indicate a bit different order (25,4% for sector 2; 18,6% for sector 3, followed by 13,6% for sector 1). The lowest frequency was obtained for sector 3 (1,7% of ISR and MVI).

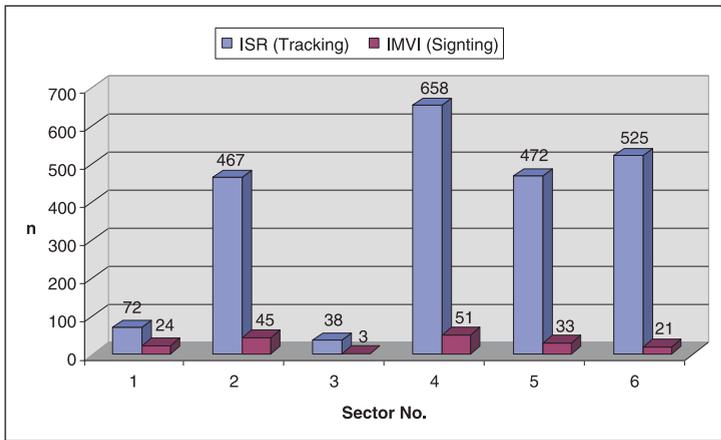


Fig. 5. Distribution of telemetric and visible records over sectors.

While during the first three weeks the Hatinh langurs often stayed in the upper parts of the enclosure between the peaks, they subsequently used the lower areas more frequently. This can be determined from Fig. 6, presenting the average daily distance to the fence on days with visible records. Especially beginning in the middle of October until the conclusion of the study, the langurs were mainly

encountered just 40 - 60 m away from the fence. During the first weeks, the animals might have felt safer on the top of the hill, away from the enclosure's border and human observers. As they became more familiar with their new home, they might have started to feel more comfortable in the lower

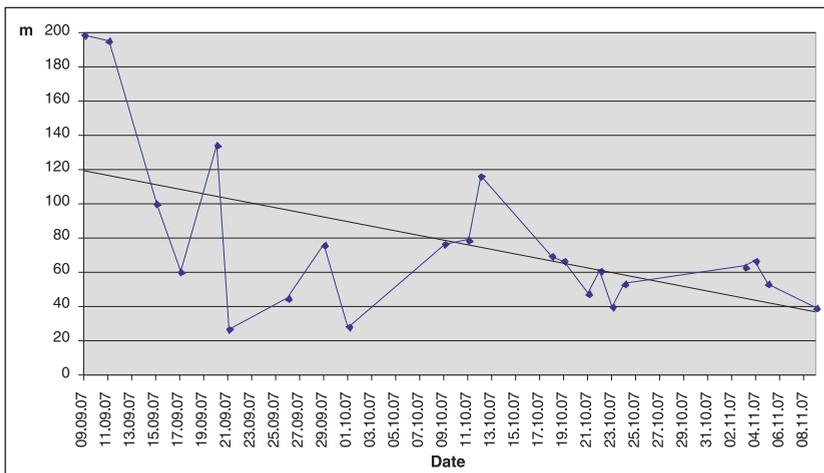


Fig. 6. Average daily distance of sighted langurs to the fence (in m).

parts of the enclosure. Moreover, the lower levels of the enclosure are densely covered with an invasive climber species, which turned out to become a preferred food source for the langurs (see below). Therefore the increased use

of these parts might be linked to their feeding ecology. In general, the use of a habitat over time and space is related to essential ecological factors such as food availability, shelter, and sleeping places (Clutton-Brock, 1977; Dunbar, 1988; Fleagle, 1999). However, these considerations already go far beyond the scope of the present study and must be left open for further research.

Group structure

On the release day, all langurs gathered around the cage. Besides exploring the close surroundings, they were mainly engaged in social contact with each other. On the second day, they already had split up into several subgroups, which is how they remained for the next weeks. According to radio tracking data, most of the time there was one main group containing 4 to 5 langurs, the remaining animals hanging around alone or in pairs. Although the latter often were females, no stable pattern could be recognised in the composition of all the different clusters. Constantly new groups formed and dissolved, showing new combinations from one day to the next across the whole enclosure.

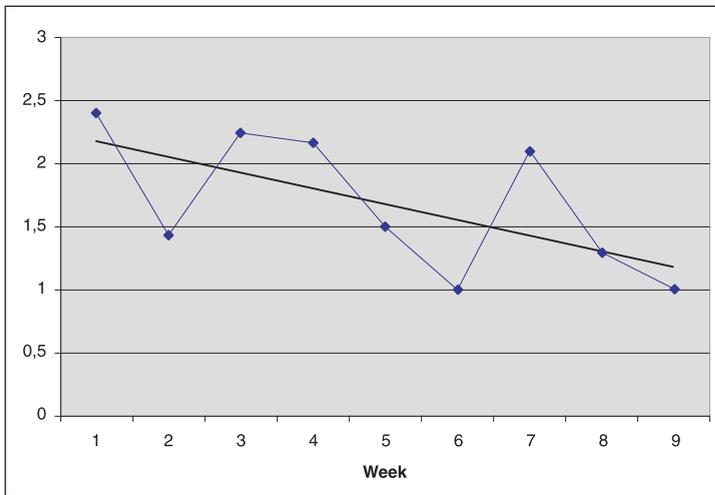


Fig. 7. Average daily number of subgroups over study period (week 1: without release day).

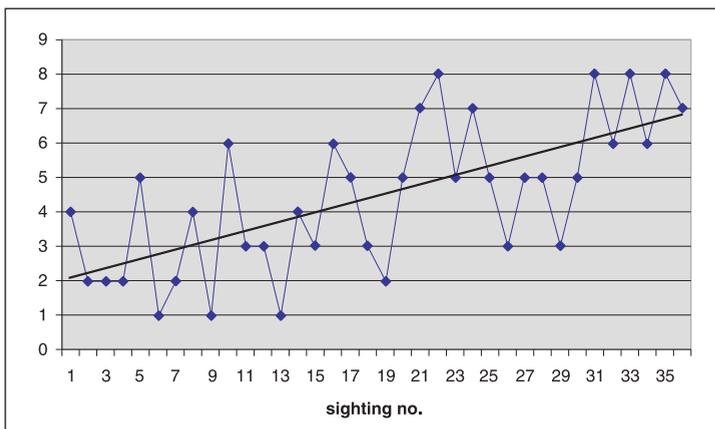


Fig. 8. Number of individuals counted per sighting (in chronological order).

Over time, the Hatinh langurs gradually came together (Fig. 7). The average daily number of subgroups constantly decreased over time, and by the end of the study period, all eight individuals merged into one group. This is also indicated by the increasing number of individuals per sighting, as shown in Fig. 8. On October 19, 2007 (sighting No. 22 in Fig. 8), all eight langurs were observed together for the first time.

The original composition of both groups was not maintained, but animals finally formed one group, comprising two males and six females. Langurs usually are organised in one-male-multi-female groups (Yeager & Kool, 2000). In the present case, most langurs were still quite young, familiar with each other and brought to a new, unknown and spacious environment, which likely

caused them to stay together. Throughout the study period, no severe conflicts of males competition for females were observed. Besides their familiarity, this lack of conflict might be due to their young age, and changes are expected when they reach sexual maturity.

Observation conditions and notes on behavioural ecology

Hatinh langurs could be seen on 26 days (including the release day), which corresponds to 53,1% of all monitoring days (n=49). Time spans of visible records ranged from less than one minute to two hours. Continuous observation (defined as periods with regular sightings) for more than 30 minutes was possible on just 14 days. Especially during the first half of the study phase, it was quite hard to spot any langurs and animals often could be detected only by radio tracking.

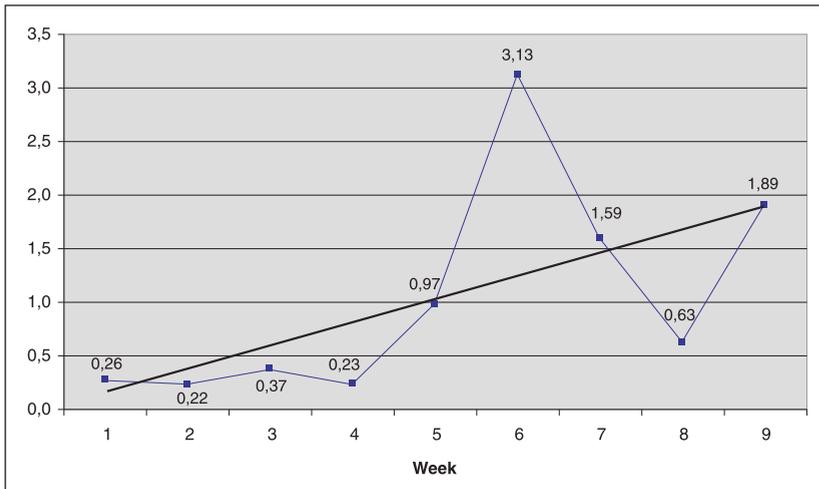


Fig. 9. Average number of sighted langurs per observation hour in the course of the study period (week 1: without release day).

observation time increased. This is not only due to the progressive enlargement of group size (see above), but also to better observation conditions. Figure 10 shows the percentage of observation time during which animals could be observed for all sighting days (release day excluded) in

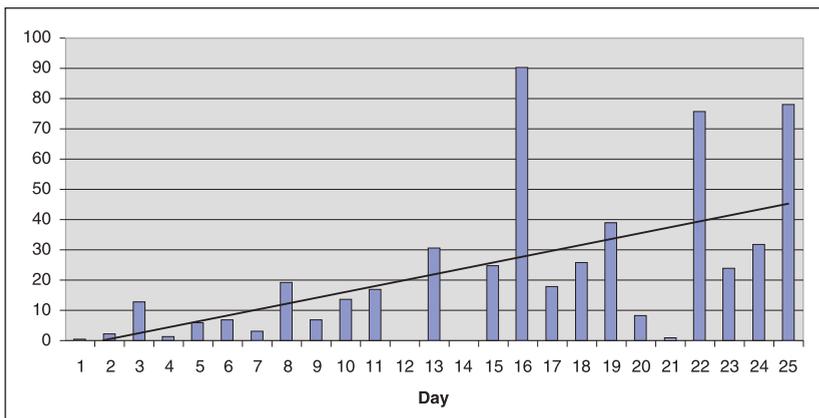


Fig. 10. Amount of time langurs were visible (as % of observation time) on days with sightings (days arranged in chronological order).

Figure 9 shows the average number of sighted langurs per observation hour over the course of the study. During the first four weeks, an average of five observation hours were necessary to see one individual. Starting in week five (early October), the number of langurs visible per observation time increased. This is not only due to the progressive enlargement of group size (see above), but also to better observation conditions. Figure 10 shows the percentage of observation time during which animals could be observed for all sighting days (release day excluded) in chronological order, independent of group size. In the further course of the study, longer observation periods were achieved. On the one hand, this was related to the fact that around the same time, the Hatinh langurs started to use the

lower parts of the enclosure more frequently and therefore could be more easily detected and monitored. During the first weeks after the release the animals often were hiding under dense liana covers, thwarting study. There were often days without any sightings, but acoustic and visual clues (such as shaking tree branches and sounds of jumping between trees/scrub) indicated the presence of the langurs to the observer. As weeks passed, the animals increasingly exposed themselves on the outer / upper parts of vegetation substrates as well as in more open areas such as tree gaps, and therefore extended data sampling periods were possible.

Although observation conditions were limited, some data on their behavioural ecology could be collected. First, all langurs seemed to be in good health throughout the study period. No major injuries were detected and everytime langurs were seen they appeared to be in good physical condition.

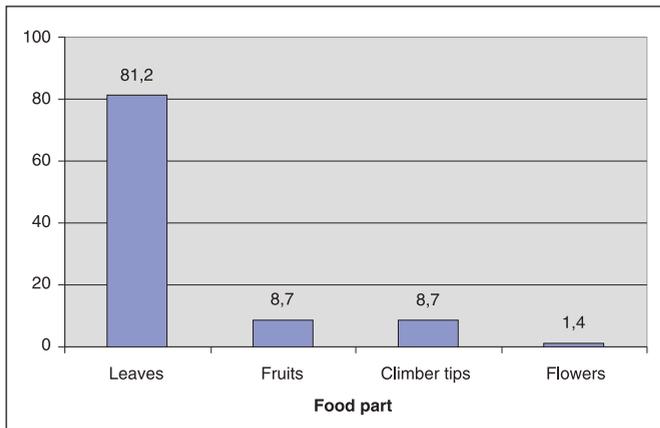


Fig. 11. Food parts eaten by the langurs.

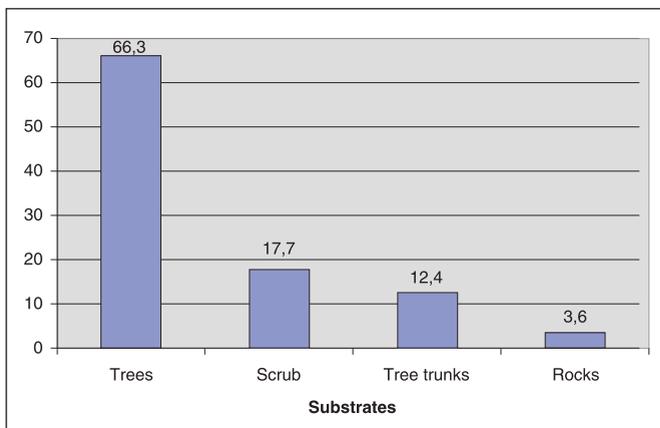


Fig. 12. Substrates used by the langurs.

In total 121 data points feeding records were obtained, but the food source or part was only identified in 46 cases. Out of the remaining 75 data points, 28% of the time a climber plant was eaten (leaves 9 = 42.9%; tips 6 = 28.6%; rest unknown). Regarding all identified feeding records for food parts (n=69 data points Fig. 11), the langurs mostly ate leaves (81.2%), followed by fruits (8.7%), climber tips (8.7%) and flowers (1.4%).

During 169 sightings, the substrate used by the langurs could be identified (Fig. 12). Most of the time, they were seen inside trees (112 times = 66,3%), 30 times (17,7%) on scrubs, 21 times (12,4%) on fallen dead tree trunks and 6 times (3,6%) on rocks. In the course of this study it could not be determined where the Hatinh langurs spent the night, due to reduced visibility at dusk. As species belong to of the "limestone langurs" (Nadler & Streicher, 2004), free-ranging

Hatinh langurs are adapted to limestone cliffs, which they often use as sleeping sites. The released langurs from the EPRC however have been born in captivity and therefore are not familiar with these natural conditions. So it would be interesting if they show a different behaviour than wild Hatinh langurs. This and other important aspects of their biology should be evaluated in future studies.

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