SMALL CARNIVORE CONSERVATION

The Newsletter and Journal of the IUCN/SSC
Mustelid, Viverrid & Procyonid Specialist Group

IUCN
The World Conservation Union

Number 18 April 1998

SPECIES SURVIVAL COMMISSION

Red panda *(Ailurus fulgens)* - Photo: Ian Pryce

The production and distribution of this issue has been sponsored by
"Blijdorp Zoo", Rotterdam, Holland,
"Columbus Zoo", Powell, Ohio, USA
and the "Royal Zoological Society of Antwerp", Antwerp, Belgium.

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We are particularly grateful to Walter Rasmussen for reading the manuscripts and improving the English style.

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Small Carnivore Conservation
c/o Dr. H. Van Rompaey
Jan Verbertlei, 15
2650 Edegem
Belgium

Printed on recycled paper

ISSN 1019-5041

Assessment on the current status of the Red panda in China

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The Red panda (*Ailurus fulgens*) is considered as a rare animal in China and, as such, is listed in Category II of the Wild Animal Protection Law. At the international level this species is listed on Appendix I of CITES.

The red panda is confined to the southern slopes of the Himalayas (Roberts & Gittleman, 1984; Glatston, 1989, 1994; Yonzon, 1989) and in China is endemic to the Hengduan and Himalayan mountains. Both subspecies, *A. f. fulgens* and *A. f. styani* can be found in China, however, subspecies *styani* is more typical of the region. *A. f. fulgens* is found through the Himalayas, in Tibet and the Gongshan area of northern Yunnan Province, as well as to the southern Nujiang River. *A. f. styani*, on the other hand, is confined to the Hengduan Mountains, in Sichuan and the eastern Nujiang River of Yunnan Provinces (Wei & Hu, 1993).

Radio-collaring the red panda. Photo: Fuwen Wei.

For a long time, there was not much exact information available on the red panda's status in China. At the request of the Endangered Species Scientific Commission and Endangered Species Import & Export Administrative Office, P. R. China, a survey was conducted about the "Assessment on Resources and Management Status of Red Panda in China" for the period 1994-1996. The possible range of red pandas was investigated during both years.

Current distribution

The red panda was distributed in China over a larger area than today, including western Sichuan and Yunnan, southern Shanxi and Gansu, northern Guizhou, and southwest of Tibet and Qinghai Provinces (Expedition Rare Animals in Sichuan, 1977; Feng *et al.*, 1986; Hu & Wang, 1984; Gao *et al.*, 1987; Kunming Institute of Zoology, 1989; Northwest Plateau Institute of Biology, 1989). However, its range retreated sharply and the red panda is now confined to Sichuan, Yunnan, and Tibet (Fig. 1).

Sichuan is the primary homeland of the red panda in China. In this province its range extends from the Daxueshan Mountains eastwards to Qionglai and the Greater Xingling Mountains, southwards across Lesser Xiangling into Greater Liangshan Mountains, westwards into the Shalulishan Mountains and northwards into the Minshan Mountains (Wei & Hu, 1993). This distribution encompasses six mountain ranges: Liangshan, Xianglin, Qionglai, Minshan, Daxueshan, and Shalulishan Mountains, and more than fifty counties (Table 1). However, the Liangshan and Xiangling Mountains contain the main red panda habitats.

In Yunnan red pandas are mainly distributed in the following mountains: Gaoligong, Meli Snow, Jiawu Snow, Biluo Snow, Yunlin, Haba Snow, Yulong Snow, and Dalou. Both subspecies occur in this province. *A. f. fulgens* is found to the south of Nujiang River, in the Dulong River Basin and in the Himalayan hills of the Gaoligong Mountains. This area is connected with Chayu, Tibet in the northwest and with Myanmar (Burma) in the southwest. *A. f. styani* is distributed east of Nujiang River. Its range includes eleven counties: Deqing, Baoshan, Tengchong, Lushui, Yunlong, Zhondian, Lijiang, Fugong, Bijiang, Yiliang, and Weixing (Table 1). In the past red pandas were reported in Xishuangbanna (Mongla county) (Gao *et al.*, 1987). This was not confirmed by our investigations.

Only *A. f. fulgens* is found in Tibet, where its range covers the counties of Mangkang, Changdu, Chuola, Nielamu, Linzhi, Milin, Bomi, Chayu, and Motuo (Table 1)(Feng *et al.*, 1986; Wei & Hu, 1993; Yin & Liu, 1993). Our researches indicate that there are no red pandas in Jilong, Dingri, or Yadong counties where they were reported in the past (Feng *et al.*, 1986). Furthermore, there were no signs of red pandas in Cibagou (Chayu county) and Mangdu county which were formerly areas where red pandas could be seen easily (Yin & Liu, 1993).

Current habitat status

According to our survey there are 76,245.5 km^2 of forest within the current distribution of the red panda. Sichuan has a total of 35,088.3 km^2 (including 7,596.8 km^2 in the Minshan Mountains, 7,681.3 km^2 in the Qionglai Mountains, 8,191.3 km^2 in the Lianghan Mountains, 4,280.4 km^2 in the Xiangling Mountains, 2,845.8 km^2 in Daxueshan , and 4,492.6 km^2 in the Shalulishan Mountains), while Yunnan and Tibet have 21,658.1 km^2 and 19,499.1 km^2, respectively (Table 1).

Our recent research on red panda ecology shows that this species exhibits a clear preference for particular habitats (Wei *et al.*, 1995; Wei, 1997). This means that not all forest areas are suitable for red pandas. In Sichuan Province, red and giant pandas (*Ailuropoda melanoleuca*) are sympatric and their habitat requirements are similar (Wei, 1997). In the period 1984-87, a study was made of the habitat requirements of the giant panda by the Ministry of Forestry of China cooperating with the WWF. This study demonstrates that, although the total forest available to the giant panda was 28,331.8 km^2, it used an area of only 13,921.52 km^2, i.e. 49.1% of the total forest cover (Wang, 1989). If we use this figure to estimate the area of red panda habitat in China, we find a probable area of 37,436.9 km^2 (17,228.4 km^2 in Sichuan Province, 10,634.2 km^2 in Yunnan Province, and 9,574.2 km^2 in Tibet)(Table 1).

Current population status

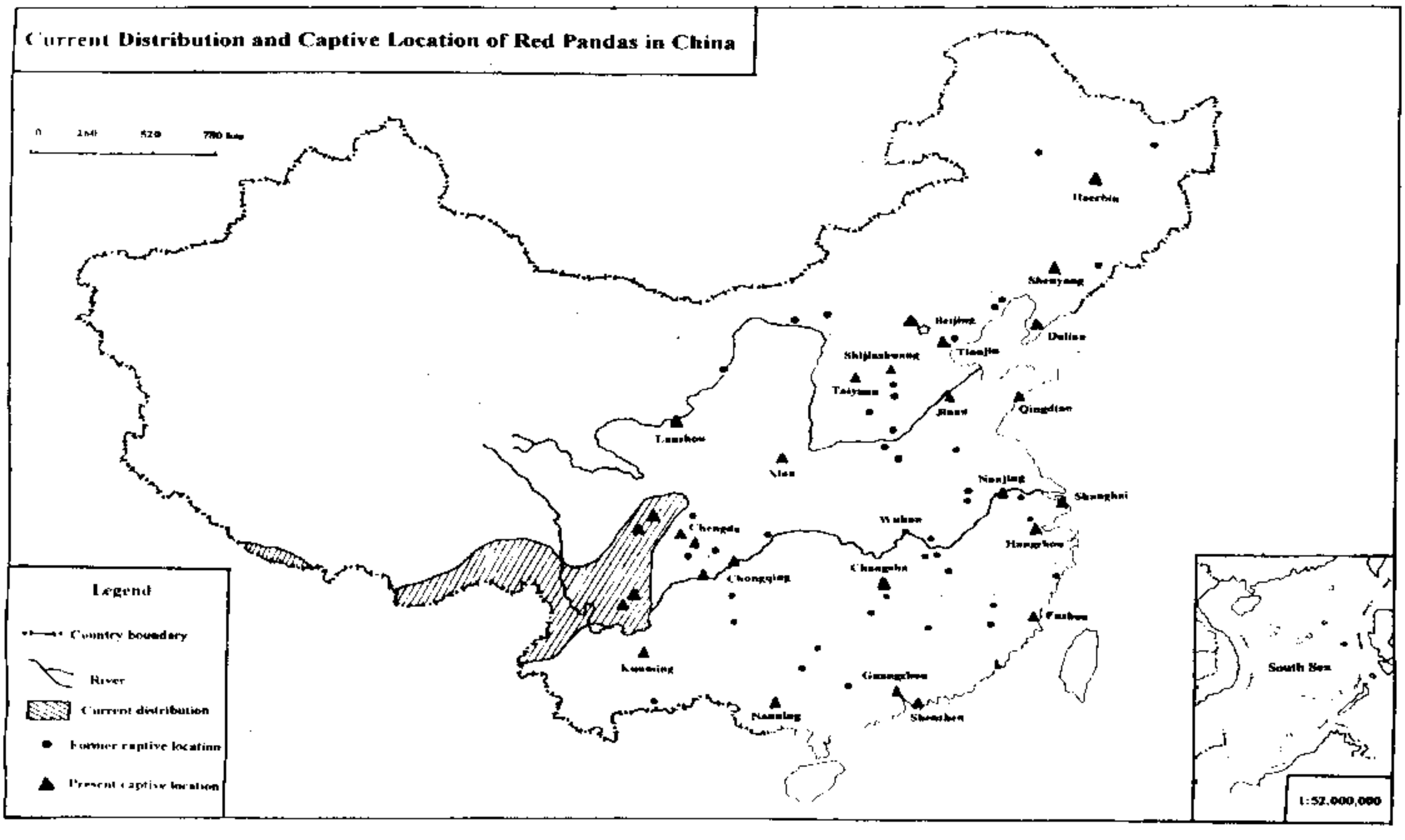
Relative density of red pandas was surveyed by investigation through feeding signs and droppings left by the animals in different counties of Sichuan, Yunnan, and Tibet. We classified the density in different counties in four categories: high, medium, low, and very low (Table 1).

During the past few decades, the number of red pandas has declined rapidly due to increasing human activity and massive habitat loss. It is estimated that their numbers may have decreased by as much as 40% over the last 50 years. Total population numbers estimated are about 6,000-7,000 red pandas in China (3,000-3,400 in Sichuan, 1,600-2,000 in Yunnan, and 1,400-1,600 in Tibet).

Fossil evidence indicates that red pandas formerly occurred in the Wufeng area of Hubei Province, the Xichou area of Yunnan Province, and the Fuminhe River and Zijin areas of Guizhou Province (Xu *et al.*, 1957). No red pandas are found in these areas today. To date, pandas have become extinct in Shanxi, Gansu, Qinghai, and Guizhou, and have disappeared from parts of the Qingchuan and Jiangyou counties of Sichuan Province. Only a few red pandas can be found in Yangliuba of Pinwu county, the region which was the type locality of Styan's panda (Wei & Hu, 1993). In the 1960s, red pandas were found in the Lushan area of Xichang in Liangshan Mountains, but they are now extinct.

Deforestation is the fundamental threat to red panda habitat. For a long period, annual forest consumption was much higher than annual forest growth. This led to a sharp decline in forest resources. According to the literature, there were 121 forestry enterprises with over 70,000 staff active in Sichuan province at the end of 1985 (Li & Yang, 1990). In the years between 1958-1960, the cut lumber stock of the Chuanxi Forestry Bureau was 929,000 m^3, 910,000 m^3, and 822,000 m^3 respectively, and timber production reached 359,800 m^3, 362,400 m^3, and 549,000 m^3 (Liang, 1990). From these data the scale of tree felling over the whole province can be imagined. According to some statistics, 200 million m^3 of forest resources were consumed during a 25 year period in Aba Autonomous Area of Sichuan Province. This constitutes 58.8% of the total forest growth and gives an annual forest consumption four times as high as the annual forest yield. It is predicted that, if tree felling continues at the same rate, Aba will be totally clear-felled by the end of this century (Liang, 1990). In Ganzi Autonomous Area of the same province, 120 million m^3 of forest resources were consumed over 30 years, which is 28% of current forest growth (Li & Yang, 1990). In Liangshan, another prime area for the red panda, 23.8 million m^3 of forest resources were swallowed up over the last 35 years. This constitutes 10% of current present forest growth (227.07 million m^3). In the Sichuan part of the red panda's range, 22 big forestry enterprises consumed up 3,597.9 km^2 of red panda habitat in the last 25 years. This represents 20.9% of current red panda habitat in Sichuan. The rate of forest loss in the upper region of Min river, prime red panda habitat, declined from 30% in the 1950s to 18.8% in the 1980s (Li & Yang, 1990). Similarly, forest loss in the Ya'an region has declined by 25%, by 14.1% in Mianyang, by 12.4% in Leijiang, by 13.2% in Nanchong, and by 15% in Wanxian (Liang, 1990). However, the situation is improving gradually. Today the Chinese government is also paying more attention to afforestation. According to current data, the total area of reafforestation in western Sichuan is over 70,000 ha. Total reafforested areas now cover 200,000 ha in the same area (Liang, 1990). This represents a very positive step towards maintaining forest cover. However, it must be remembered that forest renewal is a long process and that man-made forests may not easily lend themselves to habitation by red pandas.

Poaching is another threat to red pandas, as their fur is used to make hats and clothing by local people. The fur-hat with its long, luxurious tail at the back looks beautiful and warm. In Zhongdian of Yunnan Province, this type of hat is still needed by newly married couples as it was regarded as a talisman for a happy marriage in the past. During our investigations in the field we still found some people wearing this type of hat in different areas. The exact number of people with such hats is difficult to estimate. The purchase of red panda skins was quite prevalent in the past. For example, 29 pelts were sold in the period 1979-1981 in the Mianning county of Sichuan Province where we conducted our ecological study recently (Yu *et al.*, 1983). In Tibet, some 200 skins were sold on an annual basis in the 1970s (Yin & Liu, 1993).



Current Distribution and Captive Location of Red Pandas in China

Table 1 Distribution, relative density and habitat of red pandas in different mountains of Sichuan, Yunnan and Tibet

Province	Mountains	Density Category	Distribution Counties	Forest (Km²)	Habitat (Km²)
Sichuan	Minshan	Very low	Pingwu, Beichuan, Anxian, Mianzhu, Shifang, Nanping, Pengxian, Songpan, Rouergai	7596.81	3730.0
	Qionglai	High	Wenchuan, Baoxing, Tianquan	2401.46	1179.1
		Low	Dayi, Lushan, Lixian, Xiaojing, Danba, Kangding, Luding, Chongqing, Qionglai	5279.87	2592.4
	Xiangling	Medium	Hongya, Mianning, Shimian, Hanyuan	3200.21	1571.3
		Low	Emei, Rongjing	1536.68	754.5
	Liangshan	High	Yuexi, Mabian, Meigu, Ebian, Lebo	3454.45	1696.1
		Medium	Zhaojue, Dechang, Puge, Xide, Ganluo	2835.31	1392.1
		Low	Jingyang, Butuo, Miyi, Huidong, Ningnan, Huili, Yanyuan	1445.12	709.6
	Daxueshan	Low	Yajiang, Jiulong	2845.81	1397.4
	Shalulishan	Low	Xiangcheng, Daocheng, Muli, Yanbian, Litang	4492.62	2205.9
Yunnan		Medium	Gongshan,, Lushui, Fugong	3066.70	1505.8
		Low	Deqing, Zhongdian, Weixi, Lijiang, Lanping, Yunlong, Baoshan, Tengchong	18287.40	8979.1
		Very low	Weixin, Yiliang	304.00	149.3
Tibet		Low	Linzhi, Milin, Motuo, Bomi, Chayu, Cuona, Mangkang, Changdu, Nielamu	19499.10	9574.3
Total		4	73	76245.54	37436.9

In Changdu, Tibet, alone 148 skins were sold in the period 1968-1971. In the 1970s more than 400 red pandas were caught in the eastern forests of Tibet (Feng *et al.*, 1986). The data above are remarkable, as they indicate that hunting and poaching pressure were severe especially for a declining population. This not only leads to an even greater decline of red panda numbers, but also to extinction in some areas. For example, today it is difficult to discover any trace of the red panda in the Chibagou of Chayu county or the Xiaochangdu of Mangkang county, Tibet (Yin & Liu, 1993). Red pandas in Qingchuan county and the Wanglang Natural Reserve of Pingwu county also disappeared at the end of the 1950s (Wei & Hu, 1993). Our present investigation shows there are probably only 10-20 individuals in Yangliuba of Pinwu county (the type locality of *A. f. styani*).

Red pandas are exquisite and beautiful with high exhibition value. Trapping for exhibition at different zoos had a great negative impact on the wild population in the past. Before 1974 they could be purchased freely because Wildlife Protection Laws had not been drawn up. Zoos have purchased large numbers of red pandas at their native lands since 1950. According to incomplete statistics, zoos in Sichuan have purchased over 1,000 red pandas since the 1950s. Zoos in Yunnan Province purchased more than 500 wild-caught specimens.

Captive status

Between 1936 and 1938, a Mr. Smith, an English banker called the 'Panda king' in the west, took a great interest in wildlife collecting while living in Shanghai. He often travelled to the giant panda's range and caught and shipped 12 live giant pandas to the west. He also trapped two live red pandas and after exhibiting in Shanghai Zhaofeng Park for a year shipped them to the USA. Thus Zhaofeng Park was the first place to exhibit red pandas in China and the USA became the western country that exhibited red pandas. After the Chinese liberation in 1949, Chengdu Zoo exhibited red pandas in February 1953. Two months later, Beijing Zoo exhibited red pandas in May 1953. According to our investigation, a total of 74 institutions have held pandas since the 1950s. Only 30 institutions (with ca. 250 red pandas) are left in China (map).

The breeding program of red pandas in China has made great progress since 1954. Beijing Zoo first successfully bred one litter with two babies in June 1954. Though this litter did not survive this was the first hand-raising breeding record in China. Shanghai Zoo successfully bred and raised a red panda in 1961. Chongqing Zoo successfully bred and raised red pandas: From 1972 to 1994, 173 young of 87 litters were born, 74 cubs survived (survival rate 42.8%). Since the middle of the 1970s and particularly from the 1980s over 20 zoos or reserves in China succeeded in breeding red pandas. These include following 18 zoos and reserves: Beijing Zoo, Shanghai Zoo, Chongqing Zoo, Chengdu Zoo, Kunming Zoo, Nanjin Zoo, Hangzhuo Zoo, Shijiazhuang Zoo, Zhongshan Park, Lanzhou Wuquanshan Zoo, Wuhan Zoo, Taiyuan Zoo, Wuxi Zoo, Hubei Huangshi Park, Nanchang Zoo, Lushan Huajin Park, Xi'an Zoo, and Wolong Natural Reserve.

Conservation status

Today the Chinese government pays much more attention to wildlife protection, and it has launched a series of laws and regulations to preserve rare animals and plants. These include the National Constitution, the Criminal Laws, the Wild Animal Protection Law, the Forestry Law, and the Environmental Protection Law. The red panda is listed in Category II of the Wild Animal Protection Law. This means that red pandas cannot be caught or hunted without a permit from the Ministry of Forestry or its duly delegated authorities. If red pandas are needed for scientific research or for exhibition in zoos, a lot of procedures must be completed to get permission. Anyone who hunts, catches, sells, or trades red pandas without a permit from the provincial wildlife authorities is severely punished.

In addition, the Chinese government has established many national reserves as refuges for wildlife. To date 31 reserves have been established within the red panda's range: 18 in Sichuan, 7 in Yunnan, and 6 in Tibet. These reserves together protect 15,864.94 km² of red panda habitat, 6,561.1 km² in Sichuan, 6,946.3 km² in Yunnan, and 2,357.54 km² in Tibet (Table 2). This represents about 42.4% of the red panda's habitat in China. From our survey it can be seen that the densities of red pandas in these reserves are much higher than in areas outside of them. This indicates that these nature reserves have played an important role in the conservation of the red panda.

Table 2 Protected areas of natural reserves within red panda's ranges in China

Province	Reserve Name	Location(county)	Date	Area(Km²)	Total
Sichuan	Jiuzhaigou	Nanping	1978	600.00	6561.1
	Baihe	Nanping	1963	200.00	
	Huanglongsi	Songpan	1983	400.00	
	Xiaozhaizi	Beichuan	1979	67.00	
	Wolong	Wenchuan	1985	2000.00	
	Fengtongzhai	Baoxing	1975	400.00	
	Labahe	Tianquan	1963	125.00	
	Mabian Dafengding	Mabian	1978	300.00	
	Meigu Dafengding	Meigu	1978	130.00	
	Baiyang	Songpan	1994	582.90	
	Sier	Pingwu	1994	189.70	
	Piankou	Beichuan	1994	197.30	
	Wujiao	Nanping	1994	371.00	
	Qianfushan	Anxian	1994	172.30	
	Moshui	Lushan	1994	317.90	
	Anzihe	Chongqing	1994	101.00	
	Yele	Mianning	1994	247.00	
	Washan	Hongya	1994	160.00	
Yunnan	Gaoligongshan	Baoshan, Tengchong, Lushui	1986	1239.00	6946.3
	Tianchi	Yunlong	1983	66.30	
	Baimaxueshan	Deqin	1988	1879.77	
	Nujiang	Gongshan, Fugong	1986	3254.33	
	Habaxueshan	Zhongdian	1984	219.08	
	Yulongxueshan	Lijiang	1984	260.00	
	Haizhiping	Yiliang, Weixin	1984	27.82	
Tibet	Gangxiang	Bomi	1985	46.00	2357.5
	Motuo	Motuo	1986	62.62	
	Chayu	Chayu	1985	101.40	
	Zhangmukouan	Nielamu	1985	68.52	
	Mangkang Golden Monkey	Mangkang	1990	1853.00	
	Linzhidongjiou	Linzhi	1990	226.00	
Total	31				15864.9

Acknowledgements

This project was supported by the Chinese Academy of Sciences, the Ministry of Forestry of China, and the National Foundation of Natural Sciences of China. We are very grateful to Dr. A. Glatston for reviewing the manuscript and correcting the English. We also thank the forestry bureau in Sichuan, Yunnan, and Tibet for their assistance during the survey.

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Long-term latrine use by Rusty-spotted genet *Genetta rubiginosa* in Kenya

Thomas R. ENGEL

Introduction

The Rusty-spotted genet *Genetta rubiginosa* (sensu Crawford-Cabral & Pacheco, 1989 (1992); also Crawford-Cabral, 1981 [Van Rompaey, pers. comm.]; probably syn. *G. tigrina rubiginosa* Pucheran, 1855 syn. Large-spotted genet *G. tigrina* sensu lato, compare also e.g. Wemmer, 1977; Crawford-Cabral, 1980-81; Skinner & Smithers, 1990) is one of the viverrids (and herpestids) using latrine sites. So far, latrine use by "Large-spotted" genets was mentioned, e.g. by Haltenorth & Diller (1988), Stuart & Stuart (1988,1994), and near nest holes by Apps (1992). Use of dung middens is also known for the Common genet *G. genetta* (e.g. Roeder, 1980a,b; Stuart & Stuart, 1988,1994; Apps, 1992; Jordano, 1992; Palomares, 1993). Nevertheless, field data and detailed descriptions on latrine use seem rare for the rusty-spotted genet.

During a study on natural forest regeneration and comparative seed dispersal more than 50 basically viverrid/African civet (*Civettictis civetta*) latrine sites were discovered (pers. unpubl. data). However, at two exposed latrine sites, defecations were never caused by African civet, but by smaller viverrids or herpestids. At this two latrines huge accumulations of seeds and other food remains were recorded for more than two and half years until the frugivore species causing these particular seed depositions became finally known.

This paper examines the visitation and use of these two exposed latrine sites by genets, and part of their ecology will be discussed. Attempts and methods to prove genet presence are mentioned.

Material and methods

Investigations were carried out in the Shimba Hills National Reserve (near Mombasa, coastal Kenya, approx. 04°14,5'S, 39°22,5'E). Two latrine sites, a concrete roundabout (approx. 1 m high in centre) south of Makadara Forest at the crossing to Pengo Hill and the concrete floor inside Pengo Hill Lookout building were examined and regularly controlled from June 1993 up to 1996. At these two latrine sites, situated approx. 250 m away from each other, available defecations were either recorded at the site or collected each month. Occasionally, the sites were checked even twice during day and night. If highly frequented, defecation units were marked with a permanent pen on the floor to avoid double-counting. All accumulated faeces were removed irregularly in 1993, but basically every month in 1994 and 1995. In case of few weeks absence, material was kindly collected by S. Thießen and J. Kamaleh, or older defecations were backdated as far as possible. For September 1994, last records were taken mid-month; the next recording took place on 1/11/94.

Identification of the latrine visitors was attempted by exposing smoothed sand and loamy soil around the latrine sites to obtain foot prints, by direct observation (which included use of night vision), by setting electric camera traps (i.e. infrared movement sensors, switchboards, trembling sensors combined with fishing rope as trip wires) for several hundred nights, and by setting traps (for several weeks in total) nearby the latrines. Traps were approx. 1 m long tunnels of wood (close type) or wire netting (open type). Bait in the traps was renewed daily and usually consisted of banana or mango, papaya, meat and egg. Further, a total of up to seven traps were set on the ground at other areas of various habitat types for several hundred nights and days.

Results

Evidence of genet. Footprints, some probably belonging to genet were observed on many nights on the sandy road nearby and on few occasions on soil exposed at the two latrine sites. One automatically-taken picture showed a Rusty-spotted genet actually visiting the latrine site on the roundabout (Fig. 1), another showed a genet visiting the latrine in the Pengo Hill building (Fig. 2). Only seven times were genets caught at night in traps in the Makadara forest (three individuals, one twice) and in Marere bushland (three individuals), but never close to a latrine site or in the grassland (where they were seen on roads as well). All recorded genets had comparatively large and rusty (but black surrounded) spots and a black tipped tail (resembling the whole type from drawing no. 268 in Skinner & Smithers, 1990).

Regularity of defecation. In total, 514 defecations were collected within a period of 31 months from the two sites (compare Fig. 3). Faeces deposition followed no regular daily scheme and was irregular over months and years. The number of defecations ranged from zero to 29 per site/month and varied between the sites. Apart from June 1994 (finding uncertain), during one month at least one of the latrines always carried defecations, but for a few months no new droppings were found at one of the two sites (compare Fig. 3). Occasionally, more than one fresh dropping was deposited at one site during one night and the contents differed - though not always. Sometimes both sites had fresh defecations with either similar or different composition/content.

Fecal contents. 74 % of 519 defecations (incl. one of four from trapped animals, and one from a further roundabout from June 1994) from the field carried diaspores which usually made up the bulk of the content, when present. 82 % of 519 defecations (including such with diaspores) had remains of arthropods (basically insects), small mammals and green grass leaves, among a few other food items (details see Engel, 1998). In total, diaspores of 35 plant taxa were found in 519 field defecations from the latrines including one taxon from one of four defecations of trapped genets.

Discussion

Was it always genet? At the two sites, the occasionally observed weak foot prints did not allow unambiguous specific identification (compare also Stuart & Stuart, 1988,1994; Skinner & Smithers, 1990; Walker, 1992), other small and similar viverrids and herpestids being present (Glover, 1968; Engel, 1996), and direct observation of the visitors having failed. During more than 1000 days and nights of presence in the field, genets and African civets were each sighted only approximately 10 times in the park; whereby White-tailed mongooses were seen slightly more often at night, but all other species were encountered less often (all

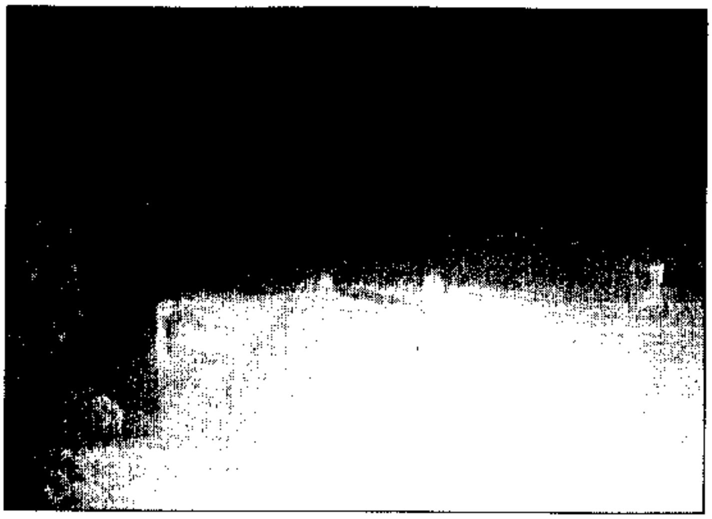

Fig. 1. Rusty-spotted genet visiting the latrine on the roundabout. The condensed water on the lens of an automatic camera trap indicates activity between late after midnight and before dawn in the clear, dry night at an exposed site.

Fig. 2. Rusty-spotted genet leaving the latrine at the Pengo Hill Lookout building (enlargement from wide-angle picture taken by movement sensor trap).

viverrids and herpestids mentioned in this paper were never seen in the field during the daytime). The two pictures of genets visiting the latrines per se, finally obtained by a trip wire and an infrared movement sensor photo-trap, cannot exclude other species causing the droppings as well. Unfortunately, the photographed genets did not defecate these nights probably due to disturbance by the flash light. Nevertheless, the defecations of interest always happened at night and were undoubtedly caused by nocturnal viverrids or herpestids. The more arboreal Two-spotted* palm civets (*Nandinia binotata;* *the two trapped animals had no white spots), which were also trapped and kept, probably stay in forests, were never observed on roads outside the forests and seem more frugivorous (e.g. Charles-Dominique, 1978; also Estes, 1991). Apart from the two-spotted palm civet, the co-occurring small herpestids like the white-tailed mongoose (few unpubl. data of fecal analysis and feeding experiments), the rare Sokoke bushy-tailed mongoose (*Bdeogale crassicauda omnivora;* Engel & Van Rompaey, 1995; Engel 1996), the diurnal Slender mongoose (*Galerella sanguinea;* Estes, 1991) and the Marsh mongoose are – as far as is known – less frugivorous (compare e.g. Estes, 1991; Skinner & Smithers, 1990 – though, Haltenorth & Diller (1988) mentioned fruit as an (exceptional?) part of the diet also for these species [apart from *Bdeogale* spp.]). Faeces found on the roundabouts and in the Pengo Hill building were too different in their general composition and contents spectra from those of well-known African civet, primate and most other droppings. Apart from the two-spotted palm civet (Skinner & Smithers, 1990), genets are most adapted to climbing and jumping on the roundabout, which might be more difficult for other co-occurring terrestrial species. Furthermore, all of over 50 investigated basically African civet latrines were always at ground level inclusive one close to the Pengo Hill roundabout. Whether another species "*Genetta genetta neumannii* Matschie" (probably syn. *G. genetta* sensu Crawford-Cabral, 1981) occurs as observed by Glover (1968) and his team is unknown; however, though they recorded other viverrids and herpestids as well, they did not record and prove *G. rubiginosa* (or syn. *G. tigrina*, etc. by that time). In conclusion, for the defecations at the two sites considered here as belonging to genets, the tracks and the size, smell, contents and constitution of the droppings resembled the ones obtained from trapped genets, and the defecations were all similar amongst each other, but different from faeces of most other frugivores. According to their known habits, other species can be excluded (almost certainly, see above) and evidence of latrine visitation was exclusively achieved twice for rusty-spotted genets only.

Latrine use. The extremely low number of only two successful pictures does not necessarily reflect the frequency of latrine visitation (even without defecation). On several occasions, there were fresh droppings, and although the camera systems were still active, they had either not released or produced plain pictures without any animal. For Common genets (*G. genetta*), more than one individual is known to contribute to latrine formation (Roeder, 1980a,b; Palomares, 1993). Here, lacking proof of more than one individual at one site, the irregular scheme of utilization and even the variable fecal contents can not explain how many individuals visited the sites. At Marere bushland, a pregnant female and an almost mature individual were trapped at 100 m distance during one night and two weeks before one more individual was caught in the same area; thus more than one individual occurred at one area. Nevertheless, due to a change in diet or variation in gut passage times, even one individual can defecate different contents during one night. Irregularities between nights and months might have been caused - on one hand – by cleaning and controlling the sites, what probably caused disturbance and reduced visitation and defecation rates. On the other hand, after cleaning or even after covering the roundabout with a new concrete sealing by the park authorities, defecations occasionally continued or even increased, and more visits also might have happened without defecation occurring. Supposedly, genets defecate exclusively at latrines, latrine switching between several latrines within the same area must have occurred (compare e.g. for Egyptian mongoose [*Herpestes ichneumon*]; Palomares, 1993), as although genets certainly defecate daily the sites did not carry fresh defecations every day. Genets probably defecate even twice (or more often) per 24 hours as was occasionally observed during feeding experiments - even though this seems still a very low rate compared with bushbabys or two-spotted palm civets of similar body size (unpubl. data).

Reliability of results. For June 1994, there might have been few defecations as well (non-visitation was not mentioned *expressis verbis* in record). In addition, less than approximately 10 % of the defecations were found already mixed to some extent or part of it had been removed (mainly by ants, dung beetles and rain), so that they had to be either subjectively separated again (following the intact units), or were treated as one defecation unit (a few times only). Thus, on one hand the total number of defecations and frequency of latrine use, respectively, might be very slightly higher for a few months. On the other hand, the real number of defecations might have been lower, because sometimes the separately defecated parts of a single defecation might have been counted as being more than one defecation. One defecation unit was preferably any faeces of same age (condition), micro location and composition; however, subjective decisions based on experience from similar but fresh defecations were occasionally necessary. Furthermore, after absence during the end and beginning of a month (particularly in September/October 1994), ageing the defecations was a subjective matter of experience. Thus, the number, relative content and phenology of defecations might have been slightly different in reality. However, these effects must be considered very minor, because on the concrete decomposition or diaspore export was, apart from a few exceptions, comparatively low. Most defecations were rather easily to distinguish from each other, providing comparatively reliable field data.

Activity pattern. One visitation probably took place before dawn, but certainly late after midnight, because one of the pictures shows the camera lens covered by condensed water (Fig. 1), as was occasionally observed on clear nights on the wind-exposed roundabout in the very early morning hours. Some defecations happened after 11.00 p.m., and some looked very fresh when checked in the morning. Otherwise, genets seem to be more active in the first part of the night (see Ikeda et. al., 1982; Estes, 1991) when they were also observed on roads at Shimba Hills by the author (early at night). Fresh defecations were also found even soon after sunset (7.00 p.m., 28/6/95). A road-killed animal was found at 1.45 am, but was already cold. In 1968, Glover and his team saw 'genets' (see above) "occasionally in the daytime but they are nocturnal and tracks were observed quite frequently on the roads in the mornings".

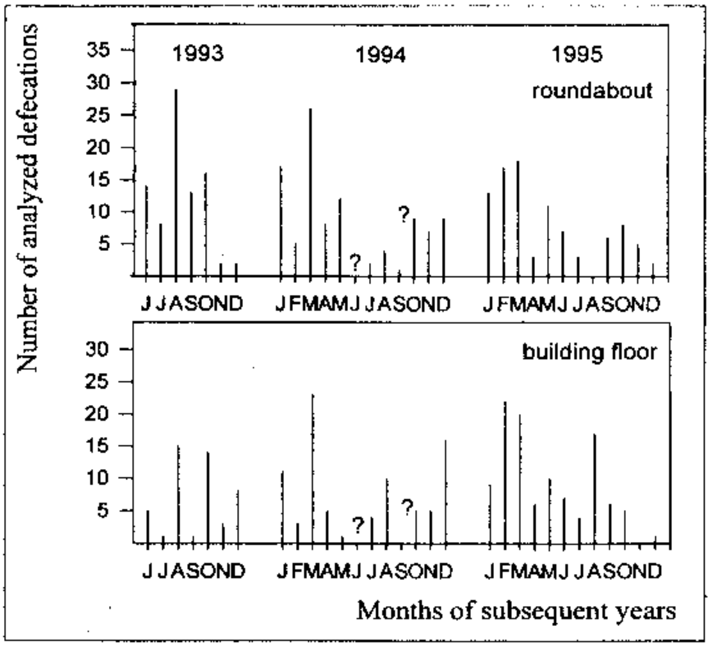

Fig. 3. Utilization of two genet latrines and frequency and phenology of dat collection (? = lacking proper data; see also text).

Conclusions

Direct proof of the identity of the investigated species, preferably by camera traps, seems necessary particularly in species-rich biocoenoses, and in areas where species with similar habits cannot be excluded or are simply not known (compare Engel, 1996). The roundabout is known to the author as having been in use as a latrine for more than five years. Thus, the sites seem to be permanently established and might be even continued by subsequent generations. Provided that all faeces from the roundabout and the Pengo Hill building floor belonged to rusty-spotted genets as assumed and shown here, *G. rubiginosa* seems to use the same latrines continuously over long periods, though on an irregular basis. Common genets (*G. genetta*) are (also) known to place their latrines in trees situated on the edges of the more frequently used habitat types (Palomares, 1993). In the Shimba Hills, the rusty-spotted genet (also) maintained latrines on the ground, as known for other viverrids and herpestids (unpubl. data). Nevertheless, compared to other viverrid or herpestid sites along roads or on the forest floor, these two genet latrines were still comparatively exposed. For a genet, a roundabout or concrete floor probably resembles solitary or topmost exposed rocks. Still, why genets use latrines is not known, and whether genets are territorial is not understood either (Estes, 1991). There are considerations that viverrids and genets (e.g. *C. civetta*: Estes, 1991; *G. genetta*: Palomares & Delibes, 1994) are territorial, which could explain the use of latrines to mark their territories. Due to competition, sexual activity, etc., the rate of defecation at latrines might also correlate with changes in marking behaviour (for latter compare for *G. genetta*; Palomares, 1993). In addition, marking (e.g. by urine and gland secretions) is described for the large-spotted genet '*G. tigrina*' (Wemmer, 1977) and *G. genetta* (Estes, 1991; see also Roeder, 1980a,b; Roeder, 1984), and scent-marking could happen at *G. rubiginosa* latrines even without defecation. Scent-marking occurs for *G. genetta* in short intervals (Roeder, 1980b), and individual recognition was reported even after nine weeks in captivity (Roeder, 1983). Thus, for permanent marking daily defecations or other daily marking visits are probably not necessary. As considered for other species (compare e.g. Palomares, 1993; also Wemmer, 1977; Roeder, 1980a), the latrines of Rusty-spotted genets might as well function as 'odorous centres of communication'.

Acknowledgements

I wish to acknowledge the kind support of the Office of the President and the National Research Council of Kenya, the Botany Department of the University of Nairobi, the Kenya Wildlife Service (particularly at Kwale) and the National Museums of Kenya. This research was part of a project on natural forest rejuvenation, kindly funded by the 'Deutsche Forschungsgemeinschaft' (DFG). Many persons helped in different ways, to all my sincere thanks.

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REQUESTS

Request for veterinary information

I write to you as chairman of the Veterinary Group to ask for your assistance in supplying us with a list of any diseases which are perceived by any of your members to be a threat to the wild populations of the taxa in which your group has a special interest.

We are also anxious to receive details of the causes of any morbidity or mortality of which your members may be aware. Reference to reports, scientific papers, newspaper articles, etc. relating to disease in all its aspects as it may affect your Group's interests are also of concern to us and we would be grateful if you would be kind enough to draw our attention to any such publications or send us photocopies for our database, if you have them. Please also inform us of any specialist wildlife disease diagnostic laboratories of which you are aware.

In return, we hope to be able to offer you the service for which our Group was formed. We would particularly like to draw your attention to the extreme importance of obtaining veterinary advice whenever wild animal capture, translocation, reintroduction or restoration projects are components of your Action Plans. The risk of the transmission of important diseases of humans, domestic livestock, and other wild animals when wild or captive-bred animals are translocated, even over short distances from one ecozone or biotope to another, can be considerable and must be minimized by appropriate screening, quarantine, and where necessary, vaccination.

• **Michael H. Woodford,**
Chairman Veterinary Group IUCN/SSC, 500 23rd Street, N.W., Apt. B-709, Washington D.C. 20037 USA

Request for small carnivore records for Ecuador

With Luis Albuja, Escuela Polytechnica Nacional, Quito, I am writing a field guide to the mammals of Ecuador. It will be published by Conservation International, in the same series as their recent *Lemurs of Madagascar* guide, the format of which it will broadly follow.

The literature on small carnivores in Ecuador is sparse and museum specimens infrequent for many species. So, for both biogeographical and ecological reasons we want your field observations! Even fragmentary data and rumours may be of use, so don't hesitate to send snippits. All such contributions will be acknowledged in the book.

• **Adrian Barnett**
Akodon Ecological Consulting, 114 Petrie Av.
Bryn Mawr, PA19010 USA
Fax: 610-525-2539, e-mail: infovore@mail.op.net

Use of camera-traps to survey small carnivores in the tropical rain forest of Kalakad-Mundanthurai Tiger Reserve, India

Divya MUDAPPA

INTRODUCTION

Tropical rain forests often have a diverse community of mammalian carnivores, both large and small. Since most of these carnivores are nocturnal, rare, and elusive, very little is known of their ecology. The large carnivores have been studied in South Asia (Schaller, 1967; Sunquist, 1981; Johnsingh, 1983; Chellam, 1993; Karanth, 1993), whereas there have been but few studies of small carnivores in either south or south-east Asia (Rabinowitz, 1990, 1991; Yoganand & Kumar, 1995). In India, even the distribution and conservation status of small carnivores is inadequately known.

Most small carnivores, besides being small, are also rare, nocturnal, solitary, and often inhabit areas with poor visibility due to thick vegetation. This makes even assessments of their occurrence and abundance, based on direct sightings, almost impossible. Since many of the small carnivores are not sighted even by local people, knowledge of the natural history of these taxa is scanty. The distribution and relative abundance of small carnivores have been recently assessed using scat abundance as an indicator, with workers identifying scats to the family level in the Nilgiri Biosphere Reserve, Western Ghats (Yoganand & Kumar, 1995). Attempts at identifying small carnivore (particularly viverrid) scats to species level, using thin layer chromatography on extracts of bile acids from the scats, have not been successful (Kumar, *pers. comm.*). An assessment of the occurrence and abundance of small carnivores still remains a daunting task, especially when the community is species rich.

In this paper I discuss the use of camera-traps in surveying small carnivores in the tropical rain forest of the southern Western Ghats.

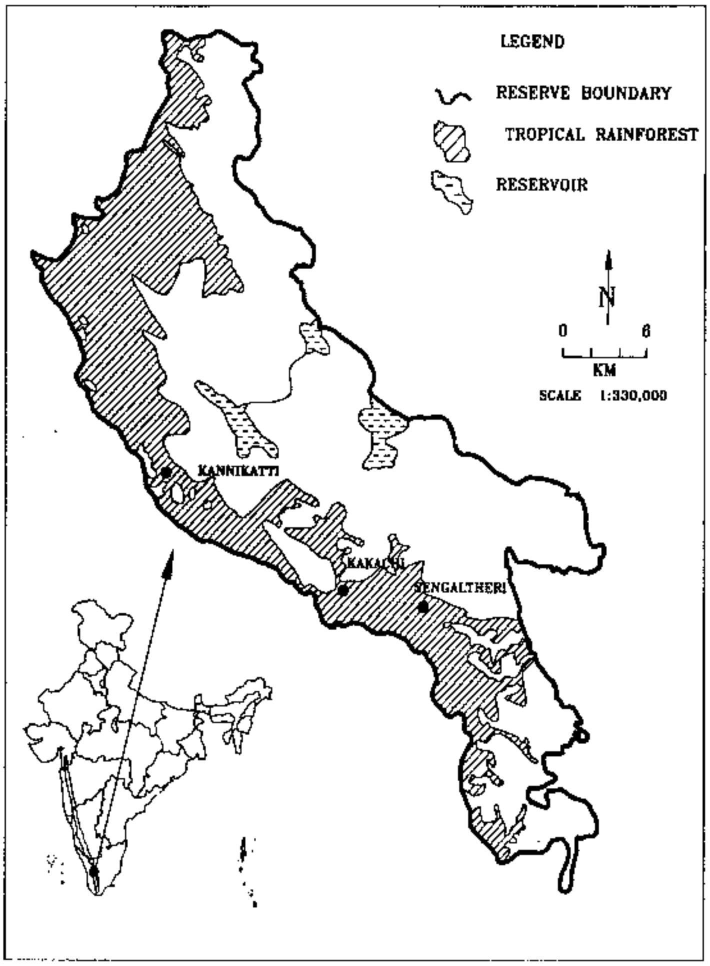

Fig. 1. Kalakad-Mundanthurai Tiger Reserve showing the location of the three sites and the extent of tropical rainforest.

Study area and study species

A survey was conducted using many direct and indirect methods to confirm the occurrence of the different species of small carnivores in the tropical rain forest of the Kalakad-Mundanthurai Tiger Reserve (KMTR; 08°25'-08°35'N and 77°25'-77°35'E; Fig. 1), the southernmost protected area in the Western Ghats, in Tamil Nadu State, India.

Camera trapping was carried out during a period of five months from November 1996 to March 1997, in order to make a preliminary assessment of the occurrence and distribution of small carnivores in the area, and prior to a radio-telemetric study. In an area of about 250 km², three sites were selected, ranging in altitude from 750 m to 1,300 m ASL. The sites were Kannikatti, Sengaltheri, and Kakachi.

The small carnivore community in the Western Ghats consists of four species, mongooses, and small cats. They are the Small Indian (*Viverricula indica*), Common palm (*Paradoxurus hermaphroditus*), Brown palm (*P. jerdoni*), and Malabar (*Viverra civettina*) civets, the Indian grey (*Herpestes edwardsii*), Ruddy (*H. smithii*), Stripe-necked (*H. vitticollis*), and Brown (*H. fuscus*) mongooses, and the Leopard cat (*Prionailurus bengalensis*), Jungle cat (*Felis chaus*), Fishing cat (*Prionailurus viverrinus*), and the Rusty-spotted cat (*P. rubiginosus*). The family Mustelidae is represented by the endemic Nilgiri marten (*Martes gwatkinsi*), and the Ratel (*Mellivora capensis*). The Small-clawed (*Amblonyx cinereus*), Common (*Lutra lutra*), and Smooth-coated (*Lutrogale perspicillata*) otters form the aquatic small carnivore community.

The brown palm civet, the Malabar civet, and the Nilgiri marten are endemic to the Western Ghats at the specific level, whilst the stripe-necked mongoose and brown mongoose are endemic at the sub-species level (the species being also found in Sri Lanka.

Methods

Each camera-trap consisted of a fixed-focus Yashica camera (with electronic shutter release, flash, and auto-winder) and a pressure pad. The pressure pad consisted of two sheets of aluminium foil (30 x 45 cm) separated by a 0.5 cm thick sponge with several perforations, and enclosed in a water-proof air pillow. The aluminium foil was connected by a thin cable of about 2 m in length to the electronic shutter release. The circuit is completed and the shutter released when contact is established between aluminium foil layers by an animal that steps on the pad. Two such camera-traps were used in the survey.

Fig. 2. Paradoxurus jerdoni *in KMTR. Photo: Ravi Chellam*

Fig. 3. Viverricula indica *in KMTR. Photo: Ravi Chellam*

Fig. 4. Herpestes fuscus *in KMTR. Photo: Ravi Chellam*

The cameras were placed near existing forest trails, streams, or fruiting trees. The pressure pad was placed on the ground and covered with a thin layer of sand and baited with banana (89.4%, n=66), dates, and chicken scraps, and occasionally dry fish and wild fruits. Commercial lures for carnivores (Cat Passion, Weasel Lure, Feline Essence, and Skunk and Opossum Lure) were used on many occasions. A camera-trap was run for a period of 2 to 9 days at one station. Traps were checked every morning, when the frame number, presence of tracks, use of bait, and any other indication of a small carnivore or another animal's visit was recorded. The traps were kept functional through the day and night.

The results are presented as percent success, out of a total number of photo-trap days. A trapping day was considered successful only if at least one picture of a small carnivore was obtained. Multiple pictures of the same species on the same night at a trap are taken as a single incidence. The effect of lure is analyzed using the chi-square test (Siegel & Castellan, 1988).

Results

The two camera traps were set at 17 different stations for a total of 66 trap-days, with each session lasting for a period of 2-9 days (Table 1). Three stations were by streams, and the rest were along existing forest trails. Lure was used on 39 days. Only four stations (two each in Sengaltheri and Kannikatti) failed to attract any small carnivores. At least one small carnivore was photo-trapped on 41% of the trap-days. Three species were photo-trapped: the brown palm civet (Fig. 2), the small Indian civet (Fig. 3), and the brown mongoose (Fig. 4). One station in Kakachi had all the three species, and four stations (in Sengaltheri and Kakachi) had two species, either over the same night (n=4) or session (n=4). In Sengaltheri only two small carnivores were photo-trapped (brown palm civet and brown mongoose) and in Kannikatti only one (brown palm civet). Kakachi also had the highest trapping success of 68.4% (n=19 trap days), followed by Sengaltheri with 37.5% (n=24), and Kannikatti with 21.7% (n=23). The brown palm civet was photo-trapped on 25 days, accounting for 92.6% of the success, the small Indian civet on four days (14.8%), and the brown mongoose on two days (7.4%). Traps with lure (n=39 days) had a significantly greater success rate (56%) than traps without lure (12.8%, n=27, chi-square = 4.28, $p<0.05$). (Table 1).

Discussion

Camera trapping was found to be an effective method, with a high success rate in surveying terrestrial small carnivores in rain forest habitats in the Western Ghats, when compared to those reported from similar habitats in north-eastern India (Rai & Johnsingh, 1993; Athreya & Johnsingh, 1995). The Brown palm civet, which has been considered to be very rare (Ashraf *et al.*, 1993) was found to be the most common civet in these forests. They were photo-trapped more frequently than either the small Indian civet or the brown mongoose. They also have been sighted regularly in the study area, sometimes on trees.

Observations recorded at the stations indicate brown palm civet to be more frugivorous than either the small Indian civet or the brown mogoose. On all the incidences when a brown palm civet had been photo-trapped, the bait (fruit) had been consumed. The small Indian civet consumed the fruit bait only once, and the brown mongoose never did. All three species were nocturnal, being photographed only at night. The brown mongoose has, however, been sighted during the day in the study area. The wild fruits laid along with the main bait, though commonly found in the scats, were not consumed at the baited camera stations. The baits also attracted non-focal animals such as the Sloth bear (*Melursus ursinus*) and White-bellied wood rat (*Rattus rattus wroughtoni*) to the stations. In addition to the effect of lure, the greater densities of small carnivores (D. Mudappa, *unpubl. data*) could be responsible for the higher camera-trapping success in Katachi as compared to Sengaltheri and Kannikatti.