SMALL CARNIVORE CONSERVATION

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

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SPECIES SURVIVAL COMMISSION

Banded linsang *(Prionodon linsang)*. Photo by J. W. Louwman, Wassenaar Wildlife Breeding Centre.

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

The aim of this publication is to offer the members of the IUCN/SSC MV&PSG, and those who are concerned with mustelids, viverrids, and procyonids, brief papers, news items, abstracts, and titles of recent literature. All readers are invited to send material to:

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Small Carnivore 'GCAP' Meeting report

In the last edition of Small Carnivore Conservation, Shelagh Heard reported on the Small Carnivore CAMP (Conservation Assessment and Management Plan) Workshop which was held in Rotterdam Zoo. This workshop was only the first stage in a process which on the one hand leads to conservation in situ and on the other to coordinated captive breeding of selected endangered species. At the end of the Rotterdam meeting 20 critically endangered, 30 endangered, and 35 vulnerable taxa were recognised of which 26 were recommended for immediate captive management. Of the remaining taxa which were either believed safe or else were of unknown status 13 were recommended for immediate captive management. In addition the meeting felt that another 64 taxa might be considered for captive management in the future.

The next stage in the process of developing a captive management plan as recommended by a CAMP is to hold a GCAP (Global Captive Action Plan) meeting. In such a meeting the recommendations of a CAMP are discussed by representatives of the zoo community in order to decide which are feasible in the current zoo situation. The GCAP meeting then suggests how and in which countries, the zoo community can best incorporate these new breeding programmes. The recommendations of the GCAP meeting are then forwarded to the regional Taxon Advisory Groups. These latter groups are responsible for the realisation of the GCAP plans. However, it must be stated that, while the CAMP process is fairly well known, now the process of the GCAP and the Taxon Advisory Groups are still in the development stage.

Early in September a Small Carnivore GCAP meeting was held in Antwerp in association with the meeting of the IUCN Captive Breeding Specialist Group. During this GCAP, a small group of representatives of the zoos plus Roland Wirth (chairman of the MVPSG) discussed the CAMP recommendations for mustelids, viverrids, and procyonids. Unfortunately, due to time constraints and to the absence of any otter specialists, the Lutrinae were not considered. As a result of the discussions in Antwerp, a number of the species which had been proposed for captive management by the CAMP workshop were selected for immediate consideration while others were deemed unsuitable for captive management at the present time. The recommendations of this GCAP meeting are summarised below. However, it must be remembered that these can only be considered preliminary recommendations because the zoo representation during discussions was so limited and in addition much of the necessary information on the numbers of each species in captivity is not yet available.

The prime consideration in making the following recommendations was that, where possible, the primary impetus for the captive breeding of endangered species should be in the region of origin of that species. Where this region has insufficient means to establish a captive programme, zoos based in other regions should support the proposed programme by providing extra space, financial aid and advice. Taking geographical constraints and other factors into account this means that in practice zoos in the North American region should primarily support programmes based in Central and South America. However, in some particular instances they might be asked to support programmes based in Asia and Africa. Similarly the European zoos should primarily support programmes based in Eurasia and in some particular instances those in Africa. While the Australian zoos should primarily direct their support to South east Asia.

Preliminary captive breeding recommendations

Mustelids

The group recommended immediate action - this may mean establishing a breeding programme or expanding an existing one - in the captive breeding of the European mink, the Marbled polecat, and the Wolverine. All these species are European and European based programmes are recommended. It was also suggested that a programme be established for those Tayras already living in zoos in order to establish the husbandry and management requirements for this species with a view to establishing a programme for *Eira barbara senex* and other rarer forms of the tayra. Similarly it is recommended that the zoo population of the Yellow-throated marten be used as a model for the captive breeding of *Martes flavigula robinsonii*.

Viverrids

The Malabar civet was considered by the GCAP group members to be a prime candidate for a captive breeding programme. In the last issue of Small Carnivore Conservation, Sally Walker discussed the civet project planned in India. It was suggested that a joint programme be established for the Malabar civet in both Europe and India. A similar cooperative programme, this time between North America and Thailand, was recommended for the Large-spotted civet. The United States was suggested as supporting region in this instance because of the strong connections that have already been developed between these two countries in the field of zoo biology. Finally an immediate start was recommended for a captive programme for Owston's palm civet.

The Aquatic genet was also deemed a species in need of immediate support. However, nothing is known of its biology and therefore an immediate captive breeding programme would represent a risk to the survival of the population. It was therefore suggested that two pairs be brought into captivity to investigate captive breeding requirements. The possibility of establishing a captive breeding programme for this species would be decided on the basis of the success of this trial programme. A similar trial programme, but on a larger scale, was recommended for the Otter civet. Should this trial prove successful an eventual nucleus population of 50 captive animals was recommended.

Herpestids

Only two taxa of mongoose were believed to merit captive management, the Liberian mongoose (should any specimens become available), and the Malagasy narrow-striped mongoose.

Procyonids

At the end of the CAMP meeting, all taxa of procyonid were recommended for captive management, even those which are well represented both in the wild and captivity. This was to avoid further import of unnecessary wild caught individuals into captivity. However after review in the GCAP meeting it was decided that no recommendations should be made for the common raccoon or the South American coati although management of the captive Crab-eating raccoon population was believed to be a useful option. Furthermore it was recommended that any attempt to capture and breed the Mountain coati should wait until more data were available for this species.

As regards other procyonids, there are currently sizeable captive populations of Ringtail, Kinkajou, and the Central American coati. It was suggested that these populations be managed and used as models for the rarer (sub)species and, in the case of the kinkajou, be used as subjects for research into (sub)specific variation, and that these should eventually comprise the captive population. In addition it was recommended that, in the long term, the captive space currently allocated to the animals should be used for rarer (sub)species. Furthermore, it was suggested that programmes for the rare island forms of raccoon should be set up in situ with financial and other help from the North American zoos where required. Should any North American zoo be interested in participating in a raccoon programme there would be the possibility of participation.

The final group of species considered for captive action were the Olingos. This taxon includes a number of rare and even critical (sub)species and furthermore it is not well represented in captivity. It was suggested that a captive population of the most common form be established in Mexico for research purposes with a view to establishing programmes for the rarer forms at a later date. As the procyonid family is confined entirely to the New World it was accepted that the North, Central, and South American zoos should take the lead in the captive management of these species.

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Red Panda Global Conservation Plan

In the October 1991 number of Mustelid & Viverrid Conservation, I reported on the Panda Conservation Workshop held in the United States. During this meeting a number of agreements were made regarding the development of a global Red panda conservation programme. In the years since that meeting a number of important activities have already begun. In the field, a survey is under way of the red panda populations in Nepal, India, and Bhutan, and in China a field study has already been initiated. On the zoo side a studbook has been established for red pandas in Chinese zoos. These data have now been included in the International Studbook for this species which makes this international studbook a complete overview of the zoo population. In addition the plan for a global captive breeding programme was compiled. This programme utilises the existing regional programmes as the basis for a global cooperation which is designed to ensure that 90% of the natural genetic viability of this species in the wild will be retained in the zoo population for the future. Finally a PR brochure has been made on the red panda. This coloured brochure which provides general information on this species is intended to support requests for sponsorship for red panda conservation and/or research.

However, all this is in the past. During the Antwerp CBSG meeting, the opportunity arose for a number of red panda specialists to discuss the next stages in the development of a truly global conservation plan for this species. During the Antwerp meeting, the global captive breeding plan was ratified and the first steps towards making the plan a reality should occur in 1993/94. However, as the group agreed, the captive population seems to be developing in a stable way. This means that surplus animals will soon be available and as such it was felt that the time is ripe to establish red panda breeding centres in their natural home range. It was felt that India might be a suitable place to start with this project as there are already a few red pandas in the zoos there. Fortunately, Mr. Sharma, the head of the Indian Association of Zoos was also attending the Antwerp meeting so it was possible for the panda group to make their proposals to him directly. Mr. Sharma reacted very positively to the proposal of the breeding centres and suggested that a husbandry and management course on red pandas be given to representatives of a few relevant zoos. In addition, it was recommended that a red panda PHVA (Population and Habitat Viability Analysis) be undertaken and hosted in India. Again Mr. Sharma reacted very positively to this suggestion.It is therefore the intention that the management course be undertaken in the autumn of 1994 followed by the PHVA meeting. After this facilities could be developed in Indian zoos and the first pandas could arrive. All in all this represents a very substantial step forward in the development of a comprehensive conservation programme for red pandas.

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IUCN announcement

The IUCN is seeking a candidate for the post of: Programme Officer, Species and Protected Areas, based at the IUCN South American Regional Office (UICN-Sur) in Quito, Ecuador.

Information about task and requirements:

Personnel Officer, IUCN
Avenue du Mont-Blanc
1196 Gland, Switzerland

Erratum

In our April 1993 number we tried to print Boris Krystufek's name as it should be, that is with 'a little bird' on the 's'. But the printer who is reponsible for the film not only did not accept the code but played a dirty trick printing either ',' or 'TM' instead of the little bird.

For the time being we will stick to a simple 's'. Our sincere apologies to Boris Krystufek.

A pilot study on the conservation of the Malabar civet, *Viverra civettina* (Blyth, 1862): Project report

Nitin D. RAI and Ajith KUMAR

Introduction

In peninsular India there are four species of civets belonging to three genera. These are the Common palm civet (*Paradoxurus hermaphroditus*), Brown palm civet (*P. jerdoni*), Small Indian civet (*Viverricula indica*), and the Malabar civet (*Viverra civettina*). The genus *Viverra*, to which the Malabar civet belongs, includes three more species of large civets all occurring in Asia: the Large Indian civet (*V. zibetha*), the Malayan civet (*V. tangalunga*), and the Large-spotted civet (*V. megaspila*). While the large Indian civet is found in the north-eastern region and is abundant, the Malabar civet is endemic to the Western Ghats and extremely rare. It is listed as a priority species for conservation by the Small Carnivore Specialist Group of the IUCN/SSC (Schreiber *et al.*, 1989). In 1978 the IUCN declared that the Malabar civet was 'possibly extinct' and it is the only civet species listed in Schedule I of the Indian Wildlife Protection Act.

Malabar civet (*Viverra civettina*) from Pocock (1939)

The Malabar civet is as large as the large Indian civet, with a body length of about 125 cm, including tail (40 cm). The precise body weight is unknown, but is about 8 kg. The fur is grey or tawny in colour with a crest of black hairs or bristles on the back from the neck to the tail tip, and large black spots on the flanks which do not form any pattern. The large size, the crest of black hairs on the back, and the absence of a pattern in the black spots on the flanks distinguish it from the small Indian civet.

Concern about this species began early this century as several expeditions failed to obtain specimens (Pocock, 1939). The last (and perhaps only) live specimen of the Malabar civet in a zoo was at the Thiruvananthapuram Zoo in 1929. The type measurements in the literature are from this female specimen (Pocock, 1939). In 1987, after a gap of 58 years, two skins of recently killed animals were obtained by the Zoological Survey of India, Calicut, confirming the existence of a species long suspected extinct (Kurup, 1987). In recent times only two possible sightings have been reported: Karanth (1986), in Bhagavathy Valley, Karnataka, and Kurup, (1987), in Tiruvalla, Kerala. Ayurvedic physicians in Kerala reared the Malabar civets until only a few decades ago to obtain 'civetone', an extract from the scent gland, which was used in medicine, and as an aromatic. Due to the rarity of the species, musk from the small Indian civet and the African civet (*Civettictis civetta*) has been substituted over the past few decades.

Most of the past records of the species are from the coastal tracts of the Western Ghats (Jerdon, 1874; Pocock, 1939; Prater, 1948), and from Kanyakumari in the extreme south to Honnavar in Karnataka State in the north (Fig. 1). There are also two reports of its occurrence in the higher elevations of the Western Ghats, in the High Wavy Mountains (Hutton, 1949), and in Kudremukh (Karanth, 1986). But for these reports, the Malabar civet has remained more or less unknown to the scientific community and has attracted little attention.

A preliminary survey of the species was conducted in May 1990, following its rediscovery (Ashraf *et al.*, 1993). This survey covered only the area around Nilambur in northern Kerala, where two skins had been obtained in 1987, and Kudremukh, where a possible sighting had been reported (Karanth, 1986). They obtained two more skins of recently killed animals near Nilambur, an area dominated by cashew and rubber plantations. They concluded that in northern Kerala the Malabar civet was confined to disturbed thickets in cashew and rubber plantations, and to highly degraded lowland forests. They also found that these habitats were disappearing fast. Moreover, hunting pressure in these remnant forests and cashew plantations was another major threat. They recommended: (a) an ecological study to gather preliminary information on food and other habitat requirements of the species, (b) an extensive survey of the coastal plain and the mountain ranges of the Western Ghats to identify extant populations, especially in protected areas and (c) a captive breeding programme using animals trapped from highly threatened remnant populations, like those in Nilambur and surrounding areas.

Ecological study

Introduction

Not surprisingly there is little information on the ecology and habitat preferences of the species and whatever exists is based on secondary information. Again not surprisingly, there is little consistency among the reports. Hutton (1949) claims that the Malabar civet is 'a fairly common animal in the evergreen forest', while others claim that it occurs in the lowland forests and is nowhere common (Jerdon, 1874).

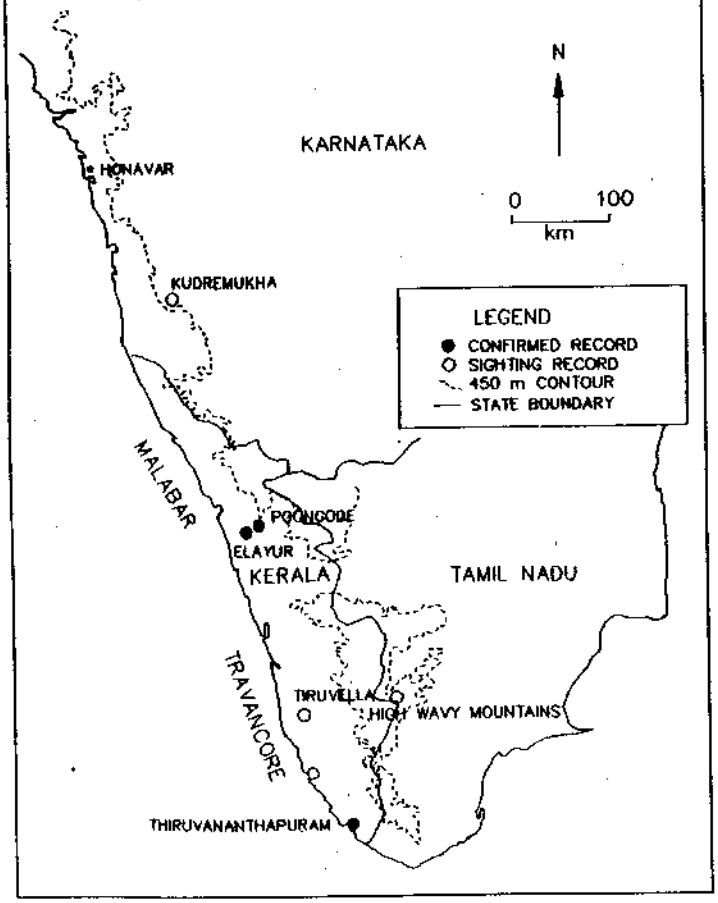
The major objective of the ecological study was to identify major habitat requirements and preferences of the species, particularly with reference to feeding and day time resting. Due to the natural rarity of the species, which is further aggravated by habitat degradation and chronic hunting pressure, it was expected that extensive data collection based on sighting, and indirect evidence such as pug marks and scats, was unlikely. Therefore, equal attention was paid to the collection of local information on the species, as several people had either kept Malabar civets in captivity, or hunted them in the study area during the last 30 years (Ashraf *et al.*, 1993).

Study area

The ecological study lasted three months and was conducted in the Karulai Range (Nilambur) and surrounding areas (Fig. 1). Nilambur and the adjoining areas were selected as the study site as Ashraf *et al.* (1993) had obtained the skins of two recently killed Malabar civets in the cashew plantations there; this was the only area where a population was known to definitely exist. Nilambur lies at the foothills of the Western Ghats, northwest of the Silent Valley National Park. The forest cover in the lowland is predominantly teak (*Tectona grandis*) plantations which are still worked for timber by the Kerala Forest Department. The area is well drained by numerous streams, but mammal densities are low. The fauna includes Sambar (*Cervus unicolor*), Wild boar (*Sus scrofa*), Mouse deer (*Tragulus meminna*), Elephant (*Elephas maximus*), Leopard (*Panthera pardus*), Tiger (*P. tigris*), Large brown flying squirrel (*Petaurista petaurista*), Small Indian civet, and Common palm civet.

The non-forest areas chosen for the study were in Chathangottupuram, 25 km west of Nilambur. The area is devoid of substantial forest cover, but private land holdings have cashew (*Anacardium occidentale*) and rubber (*Hevea brazilensis*) plantations in the hills, and paddy and betel palms in the valleys. Some pockets of scrub vegetation are still left on the dry hill tops. Cashew plantations have dense undergrowth, and the low spreading trees provide good ground cover. These plantations are relatively undisturbed through most of the year, since cashew nuts are only collected in summer. The vegetation types form a mosaic with a high level of interspersion. The mammals found here include: Jackal (*Canis aureus*), Jungle cat (*Felis chaus*), Black-naped hare (*Lepus nigricollis*), Porcupine (*Hystrix indica*), Small Indian civet, and Common palm civet.

FIG.1. PAST REPORTS OF MALABAR CIVET OCCURRENCE



Methods

In the ecological study we used camera traps, vehicular and foot transects, and also indirect evidence (mostly scats). We also interviewed local hunters to obtain information on the natural history of the Malabar civet.

CAMERA TRAPS

We used a 35mm compact camera with an electronic shutter operable by a pressure-pad operated triggering device. When the pad was depressed the camera recorded an image and also the time of the event. To lure animals to the pressure pad we used either a general carnivore lure or food (fish or live fowls).

The camera unit was set up in the evening at around 1800 hrs and dismantled at 0600 hrs the next morning, giving 12 hours of camera trapping effort for each trap night. Sampling effort was restricted by the availability of only one camera. The camera was set up in areas thought to be frequented by civets such as streams, trails, scat sites, and forest edges.

TRANSECTS

The study area was intensively traversed at night, both on foot and by vehicle. The areas to be surveyed were selected on the basis of recent sighting reports, and included both forest and non-forest areas. In the forested areas mostly vehicular transects were used, during which a bright spot beam (Q BEAM, 20,000 cp) was used to look for eyeshine. The average speed was approximately 10 km/h. The presence of elephants deterred walking in the moister riverine patches. Here foot transects were conducted in the degraded forests at the periphery.

In the non-forest areas only foot transects were used as spotlighting from a vehicle disturbed the local populace. Transects on foot were made in the private lands where the Malabar civet had been reported by local people. These transects were made in the cashew and rubber plantations which mostly covered the hill tops and slopes, and in *Areca* and paddy fields located in the valleys. We used a light beam of normal intensity during these foot transects, which were carried out at an average speed of about 3 km/h. In rubber plantations most of the surveys were carried out in young stands which had some undergrowth. None of these plantations were extensive, with areas ranging from less than 1 ha to 50 ha. These areas were also densely inhabited, with a lot of human movement at night. Foot transects were carried out after 9 p.m. (and often after midnight) and covered a total area of about 35 km^2.

INTERVIEWS

Reliable, experienced hunters were interviewed for information on the Malabar civet. Hunters were first carefully vetted by interview to establish their knowledge of the identity of the Malabar civet. Information on habitat types (riverine, plantation, scrub, etc.) in which they had seen the Malabar civet was also recorded. Given the extreme rarity of the species, this method proved useful in obtaining information and allowed preliminary conclusions to be made on its habitat preferences.

SCAT IDENTIFICATION

Scats which appeared to be those of a large civet were collected. The African civet defecates in specific sites (Dorst & Dandelot, 1970), and local hunters reported a similar behaviour in the Malabar civet. Such aggregations were collected whenever located, although there was no certainty that these were of the Malabar civet, since jackal may also have a similar behaviour (A.J.T. Johnsingh, pers. comm.).

Table 1. Number of animals seen during surveys in the forest and non-forest areas of Nilambur and adjoining areas.

Method	Forest area	Non-forest area
VEHICLE TRANSECT	129 km	
Small Indian civet	7	
Common palm civet	3	
Leopard	1	
Mouse deer	12	
Sambar	10	
Chital	3	
Slender loris	5	
Porcupine	1	
Unidentified	2	
FOOT TRANSECT	37 hours	72 hours
Common palm civet	1	
Porcupine	1	
Flying squirrel	4	
Jungle cat		1
Small Indian civet		3
Common palm civet		1
CAMERA TRAP	21 trap nights	15 trap nights
Jackal		2

Results

A total of 109 hours were spent in conducting night surveys on foot; 72 hours in non-forest areas, and 39 hours in reserved forest areas in Karulai Range. A total of 129 km were covered by vehicle transects. The results of the sampling are given in Table 1.

The Malabar civet was neither seen, nor photographed, during the ecological study. The camera traps and the transects did not provide any information on the occurrence of the species in the study area. Out of a total of 36 trap nights, only two were successful, but both were of jackal in non-forest area. Foot transects and camera trapping gave poor results in the forest areas, even for other animals, because the habitat was highly degraded in the foothills and lower slopes, especially at the fringes of human settlements. Vehicle transects covered areas farther away from the human settlements and, therefore, gave better sightings of other wild animals.

A number of defecation sites were located, all in non-forest areas. Almost all of these were on rocks in exposed areas in cashew plantations. Of the nine defecation sites located, only one had been used recently. It was possible that the sites were frequently abandoned, either due to disturbance, or conversion of the surrounding scrub or cashew to rubber production. Preliminary analysis of the scats showed seeds of fruits, fish scales, and rodent hairs and bones.

Preliminary information was obtained from knowledgeable hunters on the diet and habitat preferences of the Malabar civet. Most sightings were reported from near water or in riparian forests. Information on diet, obtained from a hunter who had reared a specimen in captivity, revealed a preference for frogs and fish, explaining its dependence on riparian areas for foraging.

The Malabar civet was reported to be mainly nocturnal, taking refuge in dense cover during the day. They were reported to move into the valleys at night to forage, and to retreat to the hilltop scrub forests and cashew plantations by day. This was also the pattern reported in non-forest areas, where disturbance and a lack of cover near streams force it into the scrub. Cashew affords a fair amount of cover as it has good undergrowth. The four specimens that have been obtained over the past five years in Malappuram District (Poongode, Elayur, and Wandoor) are all from cashew plantations.

Conversion of cashew to rubber plantations and hunting for meat are the major threats. Dogs are often used to track the civets, the dogs presumably being attracted by the strong- smell of civetine. The large size of the civet also makes it vulnerable to hunters.

Survey

Introduction

After obtaining some knowledge on the ecology of the species, a survey of the coastal plains and the Western Ghats was carried out. Most of the local informants were old hunters or tribesmen. Four to five days were spent at each locality. The populations were then subjectively evaluated and their status categorised on the basis of habitat quality, and the extent of biotic pressures. The status categories were:

1. Good populations with protection: Where local informants reported relatively frequent sightings, and the locality lies in a protected area that is both relatively undisturbed and extensive.
2. Moderate populations under threat: Where local informants reported infrequent sightings and the forest is extensive but degraded.
3. Depleted populations under threat: Occasional reports in highly fragmented and degraded habitats that are under threat from hunting and further habitat loss.

Results

The results of the survey are summarised in Table 2, along with the status category for each surveyed site. The survey covered the lowland forests along the foothills of the Western Ghats, from Nilambur in the south up to Agnashini Valley in Karnataka in the north (Fig. 2).

KERALA STATE

In Kerala, Kannur, Kasargod, and Wynad Districts were surveyed.

Kannur District

Of all the places surveyed in Kannur District, the most positive response, if not the only one, came from Kannavam Forest Range, especially in Kannvam colony and in Changala. Many of the Kurichiar tribesmen who we interviewed had heard of the Malabar civet, locally called 'Kannan chandu'. However, most had not seen one, hunting being the major cause of their increasing rarity. The area has good moist, deciduous forests with riparian zones, despite being densely inhabited. We conducted night transects on four days in this area, and set up two camera traps on two successive nights, all in vain. It was here that we obtained the most positive sign, when a tribesman gave us a civet gland, reputedly that of a Malabar civet, which he had obtained by hunting with dogs in February, 1992. The gland, too large to be that of a small Indian civet, is being examined histologically to distinguish it from that of the small Indian civet. If the Malabar civet occurs in this area, the nearly 8,500 ha of moist deciduous forest offers a refuge for the species. With a better drive against chronic hunting, the species could perhaps recover in this area.

Another potential area, which we did not visit due to lack of time, was Kottiyoor Reserve Forest. Areas surveyed in and around Pulingome Reserve Forest gave ambiguous results and most people were ignorant of the species.

Kasargod District

The Reserve forests of Muliyar, Karadka, Adoor, and Parappa were surveyed in Kasargod District. The forest patches are extremely fragmented. Few people had any knowledge of the Malabar civet. Some old hunters recognised the species, known locally as 'Malé meru', though they were unable to provide any detailed information.

Wynad District

The Malabar civet had been reported from the higher elevations of Wynad more than a century ago (Jerdon, 1874). Intensive local enquiries in several areas included three days in the Wynad Wildlife Sanctuary protected area. However, this did not elicit any positive information. Local hunters and tribesmen were only aware of the other three species of civets. We suspect, therefore, that the Malabar civet does not exist here, and that it never has.

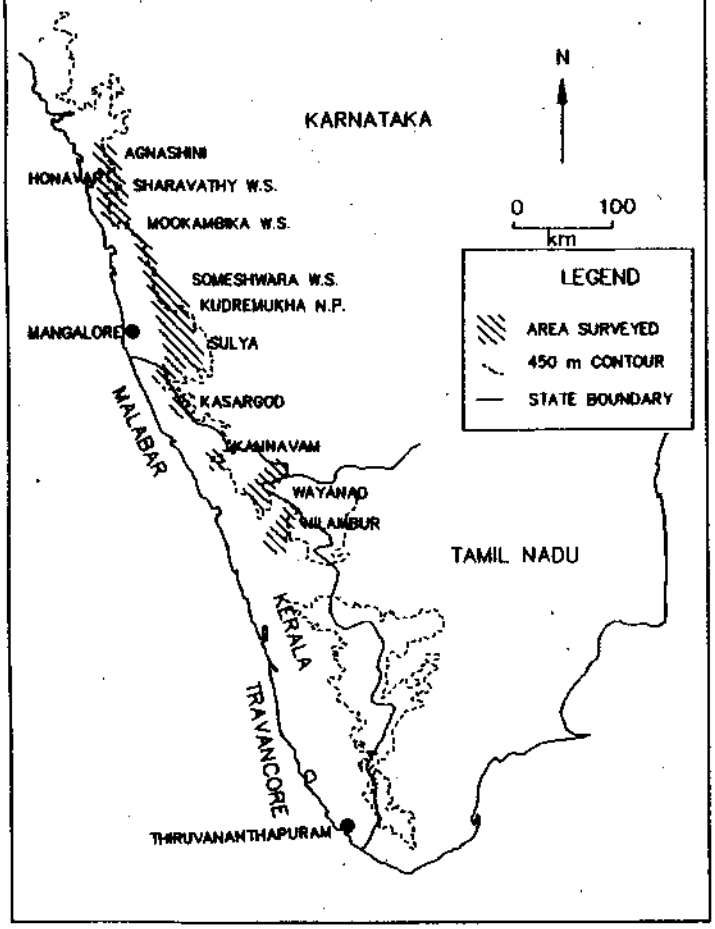
KARNATAKA STATE

In Karnataka, the Districts of South Kanara, North Kanara, Chikmagalur (Kudremukh National Park), and Shimoga (Sharavathy Wildlife Sanctuary) were surveyed.

South Kanara District

Puttur, Neria, and Naravi: Puttur, and the adjoining Sullya Range have small pockets of well-preserved lowland forest. Reports of the species were received from a few hunters, though none involved recent sightings. Hunting pressure in this area is relatively lower than in Kerala, thus the major problem is fragmentation of the lowland forests. Neria Estate and Naravi Reserve Forest have more extensive lowland forests with less hunting and other biotic pressures. Naravi, situated at the foothills of the Western Ghats, adjoins Kudremukh National Park. We received reports of Malabar civet occurrence only in the foothills.

FIG.2. AREAS SURVEYED FOR MALABAR CIVET OCCURRENCE



Someshwara Wildlife Sanctuary: With an area of 88 km², this wildlife sanctuary forms part of a larger complex of protected areas that include Kudremukh National Park and Mookambika Wildlife Sanctuary. The sanctuary is located at the foothills of the Western Ghats. Though hilly in terrain, we stil received reports of the presence of the Malabar civet. Our subjective assessment based on these reports is that this protected area has a moderate population.

Mookambika Wildlife Sanctuary: About 100 km² of the 247 km² sanctuary lies in the plains. Sharavathy Wildlife Sanctuary is contiguous in the north. We received many reports of the species' occurrence. This is the only protected area of those surveyed that has a considerable expanse of lowland forest, making Mookambika an important reserve for Malabar civet conservation. There are several colonies of the *Kudbi* tribe inside the protected area, and cultivation around their colonies has fragmented the lowland forests. Moreover, much of the lowland forest has been degraded.

North Kanara District

This district has one of the highest forest cover to land area ratios in the country. We surveyed Manki Range and Agnashini Valley in this District. Manki lies south of Honnavar and has a mosaic of lowland forest and cultivation. This area has a large percentage area of lowland forest, the major problem being that of fragmentation. Though we received no positive reports of the existence of the species, we believe that the possibility of its occurring here is high.

The Agnashini Valley lies to the north of Honnavar and has extensive moist forests. The valley leads to the Doddamane Ghats, a prime evergreen forest habitat. The extensive lowland forests and a low human density combine to make this a potential area for a good population of Malabar civet. We base our assessment on reports received, as well as the extent and status of the lowland forests. We have also obtained information on possible occurrence in Karwar, North Kanara (T. Bhaskaran, pers. comm.), further north of Agnashini.

Shimoga and Chikmagalur Districts

These districts were surveyed to investigate the existence of the species at higher elevations. Agumbe, which borders the Someswara Wildlife Sanctuary at the crest of the Western Ghats, Sharavathy Wildlife Sanctuary which borders Mookambika Wildlife Sanctuary in the north, and Kudremukh National Park were surveyed. We obtained only one positive report which was from the lower elevations of the Sanctuary. It is therefore very unlikely that the Malabar civet occurs at higher elevations in the Western Ghats in Karnataka.

Discussion and conclusions

Since no live animals were seen during the three-month ecological study and the two month survey, our conclusions are based on carefully collected local information and indirect evidence. These reveal that the Malabar civet is most probably confined to the lowland riparian forest areas along the foothills of the Western Ghats. Contrary to some earlier reports (Hutton, 1949), the species most probably does not occur in the elevated areas of the Western

Table 2. Localities surveyed, vernacular names and status of the Malabar civet in northern Kerala and Karnataka. Figures in parentheses are the number of persons who recognised the Malabar civet. Localities are listed south to north. Status categories are described in Methods. R.F. = Reserve Forest; N.P. = National Park; W.S. = Wildlife Sanctuary.

District	Protected area	Locality	People interviewed	Local name	Status category
KERALA STATE					
Kannur	Kannavam R.F.		6(4)	Kannan chandu	2
	Pulingome R.F.		3(1)	Malé meru	3
Wynad		Chundale	2(0)		
		Meppadi	2(0)		
	Wynad W.S.				
Kasargod	Muliyar R.F.				
	Karadka R.F.				
	Parappa R.F.		3(1)	Malé meru	3
KARNATAKA STATE					
S. Kanara	Puttur Range		2(2)	Mangala kutri	2
		Neria Estate	3(2)	Bal kutri	2
	Naravi R.F.		4(1)	Kutri	2
	Kudremukh N.P.		3(1)		2
	Someshwara W.S.		4(3)	Kutri	2
	Mookambika W.S.		8(6)	Jawad/Jawadiyo	1
	Sharavathy W.S.		2(1)	Jawadi	2
N. Kanara	Manki Range		1(0)		
		Agnashini Valley	2(2)	Dodda punugina	2
				Bekku	3

Ghats. The distribution range was previously recorded as extending northwards up to Honnavar in North Kanara (Jerdon, 1874). We have obtained information regarding the presence of the animal in two areas north of Honnavar: Agnashini and Karwar. The extension of its range to Karwar increases the possibility of its existence in the states of Goa and Maharashtra. Protected areas such as Molem in Goa, and Ratnagiri and Mahabaleshwar in Maharashtra might also be of significance.

In Nilambur and adjoining areas, most animals are confined to cashew plantations in private lands, with paddy fields providing the major feeding grounds, and thick vegetation in cashew plantations and adjoining degraded forests providing daytime refuges. Hunting and loss of habitat pose serious threats to the already depleted population in the Nilambur area. In Kerala, the population is also severely depleted and fragmented, and mostly confined to private lands. However, reserve forests in Kannavam and Kottiyoor almost definitely harbour the species. Continuing loss of habitat and hunting are major problems throughout Kerala.

The Malabar civet probably occurs more widely in Karnataka because lowland forest is still relatively extensive. Hunting pressure is also less intensive. The major areas for the species are lowland forests in Naravi, Someshwara Wildlife Sanctuary, Mookambika Wildlife Sanctuary, and the Agnashini Valley. Thus, ironically, the best relict populations which were in Kerala have been mostly lost in the past few decades, and continue to be lost, whilst marginal relict populations in Karnataka are better protected. Habitat degradation is the major threat in Karnataka.

It is not possible to even speculate on the present population sizes or densities of the Malabar civet. Being much larger than most other civets, and with habitat requirements which are more specific, we may expect densities to be considerably lower than that of the other civets. The conservation of this species, which occurs at very low densities in highly fragmented, sub-optimal habitats where hunting is prevalent, is thus a very challenging task.

Very urgent conservation measures are required if we are to save the Malabar civet from extinction. These include protection of populations and habitats, ecological and population studies, and a captive breeding programme.

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A comment on the systematic position of *Poiana*

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Similar in appearance to a small genet, *Poiana richardsoni* (Thomson, 1842) has often been regarded as more closely related to the Asiatic genus *Prionodon* than to the genus *Genetta*, an opinion that is reflected by the common name, African linsang. This view goes back to Mivart (1882), who argued that he was unable to find cranial distinctions between *Poiana* and *Prionodon*, except for small differences in the size of the cerebellar chamber and in the form of the coronoid process of the mandible, and concluding that *Poiana* "might be considered an African *Prionodon* which had acquired a genet-like tarsus". Instead I prefer to regard *Poiana* as a genet which acquired a *Prionodon*-like dental formula.

A closer examination of skulls led Gregory & Hellman (1939) to recognise further differences. Though these authors admit that some of them might be due to differences in skull size they were, however, supported by external morphology e.g. the arrangement of the paw pads and the presence/absence of perineal scent glands, as pointed out by Pocock (1915). *Poiana* and *Prionodon* were consequently allocated by Gregory & Hellman to different subfamilies of Viverridae, an arrangement not far from that established by Simpson (1945).

Otherwise, *Poiana* and *Genetta* are not so different as was formerly supposed. According to the original description of *Pseudogenetta villiersi* Dekeyser, 1949 (a junior synonym of *Genetta thierryi* Matschie, 1902), the under surface of the fore feet has no hair in the space between the plantar and the metacarpal pads, a condition which was considered a distinctive character of *Poiana*, and led Dekeyser to create the subgenus *Pseudogenetta*. The same situation is also observed in *G. abyssinica*. A large number of caudal rings and the absence of a median dorsal stripe (which are also characteristics of *Poiana*) can be seen in *G. servalina*. Size is in no way a reliable character for genera. The result is that the unique diagnostic feature that distinguishes *Poiana* from *Genetta* is the absence of the last upper molar (M^2) in the first genus; not, however, a very consistent detail (BMNH specimen No. 1.11.21.7 has a minute M^2, as it was reported by Rosevear, 1974).

Different from the situation in *Poiana*, but like that found in the majority of the species of *Genetta*, in *Prionodon* the under surface of the fore feet has an intervening hairy space between the plantar and the metacarpal pads. However, if the hind feet are considered *Prionodon* differs both from *Poiana* and *Genetta* as the tarsus and the metatarsus are entirely hairy, whereas there is a narrow, double bald stripe (metatarsal pads) in the last two genera.

If palms and soles that are entirely naked, and with four plantar and two metapodial (metacarpal/metatarsal) pads (as in *Galidia*) represent the ancestral condition of Viverridae (Ewer, 1973), then the naked palmar surface observed in *Poiana* and in *Genetta thierryi* and *G. abyssinica* can be considered a plesiomorphic character, whilst the palmar surface of *Prionodon* and of the remaining species of *Genetta* is an apomorphic character. Similarly, the under surface of the hind feet can be considered plesiomorphic in *Poiana* and *Genetta*, but apomorphic in *Prionodon*. Ewer, following Pocock's papers, expresses the opinion that a plantigrade foot is commonly naked, whereas the development of digitigrady leads to hairy surfaces except in those parts that contact the soil. These parts are normally the pads, but even the metatarsal pads have disappeared in *Prionodon*, which in this respect can be regarded as the most apomorphic of these three genera. The absence of M^2 is also an apomorphic character which, being a characteristic of both *Poiana* and *Prionodon*, reinforces the apomorphic condition of the latter genus.

However, if coat patterns are considered instead, *Poiana* and *Prionodon*, with no median dorsal stripe and a large number of caudal rings, are plesiomorphic taxa, but the same can also be said of *G. servalina*. On the contrary, *G. thierryi* and *G. abyssinica*, which have a plesiomorphic palmar surface, are apomorphic as far as markings are concerned. This is a noteworthy situation, and suggests that *Genetta* may have radiated from a very old basal stock not far from the origin of *Poiana*, and that several independent trends towards apomorphic conditions may characterize the evolution of these animals, thus making the parsimony criterion rather ineffective.

Without doubt, the disappearance of M^2 is likewise a homoplasy, which most probably occurred in Africa in a very primitive genet, and in Asia in a form akin to the same stock. The probable ancestor of *Poiana* would be a genet, perhaps similar in aspect to *G. servalina*, but much smaller and with an intervening hairy space between the palmar and the metacarpal pads, as in *G. thierryi*. Therefore, my first question is: are there reasons to maintain *Poiana* as a valid genus?

My second question concerns *Poiana richardsoni liberiensis* Pocock, 1908. The type of this form (in the BMNH) has no skull. It would be very interesting to check all skulls of specimens collected recently and identified as *liberiensis*, in order to verify whether they have a *Poiana* dental formula or, if amongst them there are specimens in which a division line from *Genetta* cannot be traced. *P.r. liberiensis* is indeed rather different from the nominate form, and the possibility that it represents a separate species is not unworthy of consideration.

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Badger game-bag data estimates of badger *(Meles meles)* population sizes in Europe

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The Badger *Meles meles* occurs throughout the Palaearctic. It is particularly well-known in western Europe, where it may attain conspicuously high densities in Ireland, southern Sweden, and the south-west United Kingdom.

The species has been traditionally hunted as a commodity species: as source of furs, hair, fat, and meat (Griffiths, in press). Although the badger is rarely hunted for these reasons in modern Europe, the animal is still regarded as game in many countries. Over recent years there has been an increasing trend to accord protected status to the badger. Holland was the first country to provide protective legislation, and since that time the UK, Ireland, Greece, Italy, Albania, Estonia, Belarus, and the other Benelux countries have all passed protective legislation. In other countries the species receives the benefit of the protection of a closed season during which hunting is forbidden, although this is not the case in Macedonia, in three of the Austrian Bundesländer (as a result of rabies control), or in Finland (where only the shooting of females with cubs is forbidden).

Table 1: Minimum national badger population sizes (assumming sustainable hunting) & annual game-kills.

Country	Pop. est.	Game-bag	Status
Albania	2,500	500?	F
Austria	30,000	5,500	R
Belgium	3,000	Nil	F
Bosnia & Croatia	9,000	1,700	R
Bulgaria	35,000	2,000	R
Czechoslovakia	21,000	900	R
Denmark	25,000	1,500	R
Estonia	2,000	Nil	F
Finland	72,500	10,200	N
France	80,000	5,500?	R
Germany	72,000	14,400	R
Hungary	>20,000	Nil	F
Irish Republic	250,000	?	F
Latvia	Unknown	40	R
Liechtenstein	100?	12	R
Lithuania	>2,000	20?	R
Luxemburg	2,000	Nil?	F
Macedonia	4,000	750	N
Netherlands	2,200	25?	F
Norway	45,000	4,500	R
Poland	12,000	1,000	R
Rumania	27,000	9,000	R
Slovenia	4,300	700	R
Sweden	>250,000	37,000	R
Switzerland	7,500	1,500	R
UK	250,000	10,000	F
Yugoslavia[1]	10,000	2,000	R

Absolute minimum: 1,220,200
No data available for Italy, Spain, Greece, and Portugal.
[1]) includes data from Serbia and Montenegro only. F = hunting forbidden, R = hunting regulated, N = hunting not regulated

Table 2: Comparison of national game-bags of the three most important game species and their legal badger kills

Season	Country	1° Species	2° Species	3° Species	Badger % of 1
88/90	Austria	Roe deer	Hare	Red Deer	2.02%
n		237,922	205,229	38,675	4,817
89/90	Denmark	Hare	Roe deer	Red fox	0.99%
n		162,000	59,000	51,000	1,600
89/90	Finland	Hare	Elk	Red fox	1.69%
n		650,000	53,600	34,200	11,000
1989	Germany	Roe deer	Wild boar	Red fox	0.21%
n	(DDR)	155,700	150,000	101,003	325
1989	Germany	Roe deer	Rabbit	Hare	1.58%
n	(FDR)	727,157	689,775	619,929	14,022
1988	Hungary	Hare	Wild boar	Roe deer	N/A
n		173,000	42,500	33,500	0
88/89	Holland	Hare	Roe deer	Wild boar	N/A
n		207,000	7,872	990	0
1989	Norway	Roe deer	Hare	Elk	1.61%
n		280,000	126,000	26,127	4,500
1989	Sweden	Hare	Roe deer	Elk	19.77%
n		188,600	187,400	134,937	37,300
1989	Switzerland	Roe deer	Red fox	Chamois	4.08%
n		36,317	26,602	17,502	1,481

Data from Deutscher Jagdschutz Verband (1991)

Until now, there has been very little information on the status of the species in Europe, although Long & Killingley (1983) did collate large amounts of data on the species. Recently Griffiths & Thomas (1993) have attempted to review what is known of the population status of the badger in Europe, largely through the collation of game-bag returns data and other sources of information on anthropogenic mortality (where available). These figures (Table 1) can only be considered as minimum estimated levels of badger abundance, and rely on the assumption that levels of anthropogenic mortality are sustainable (as seems generally to be the case), and that other causes of mortality do not act significantly upon population levels. It is known, however, that countries such as the UK and the Netherlands do have high levels of badger road-traffic mortality. In the case of the Netherlands, this may almost equal the annual level of cub production, whilst in the UK, illegal hunting, loss of habitat, habitat fragmentation and road kills may actually be leading to population declines despite what were thought to be very high badger numbers (S. Harris, pers. comm.).

Despite apparently large game-bags from some countries, there is no evidence that these are a cause for concern at the present time. Badgers are not a popular game species, and the hunting of badgers is a minority pursuit when compared to that of other mammalian game (Table 2). Also, the hunting of badgers may represent other activities than sport hunting *e.g.* the control of animal diseases such as rabies and bovine tuberculosis (the latter

Table 3: Known reasons for the hunting of badgers in Europe

Country	Sport	Ethnic products	Pest control	Disease control
Albania	P	+	+	–
Austria	L	+	+	R
Belgium	P	–	–	–
Bulgaria	L/P	+	+	–
Czechoslovakia	L/P	+	+	–
Denmark	L	–	+	–
Finland	L	+	+	–
France	L	–	+	–
Germany	L	–	+	R
Greece	P	–	+	–
Hungary	P	–	+	–
Italy	P	–	–	–
Irish Republic	P	–	+	B
Liechtenstein	L	–	–	–
Lithuania	L	+	+	–
Luxemburg	P	–	–	–
Netherlands	P	–	–	–
Norway	L	–	+	–
Poland	L/P	+	–	–
Rumania	L	+	+	R
Slovenia	L	–	–	–
Spain	P	+	+	–
Sweden	L	+	+	–
Switzerland	L	–	+	–
UK	P	–	+	B
Yugoslavia	L	+	+	R

L = legal hunting; P = poaching; R = rabies; B = bovine tuberculosis

in the UK and Ireland only), or the protection of ground-nesting game, or of crops, or property (Table 3). There is also still some minor use of badgers as a commodity species in some areas.

This does not represent cause for complacency. Although badgers are clearly not endangered, some national populations do represent a cause for concern. The difficulties of the populations of the Netherlands and Britain have already been mentioned; habitat fragmentation has also reduced the numbers of badgers in Flanders to very low levels (<100 animals), and the Albanian population is subject to intense illegal hunting, despite theoretical protection (F. Bego, pers. comm.). The possibly endemic subspecies of Crete and Rhodes are also totally unknown in terms of their modern conservation status. In addition, the data on many national populations cannot really be considered as robust.

Only Britain, Ireland, the Netherlands, and Belgium have undertaken comprehensive sett surveys, and the chances of these being an option in other countries would seem to be remote at this time. However, states that operate revier hunting tend to have more advanced concepts of wildlife management, and it seems probable that some (particularly Germany and Austria) have managed to monitor their badger abundances quite well, even if there has been no assessment of the numbers of animals present.

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Badgers breeding above ground

Although the Red fox usually breeds in an underground den, it is not unusual for vixens to produce 'scrub-bred' litters above ground. By contrast, the Eurasian badger *Meles meles* seldom breeds above ground, and a review of the literature reveals only some eight records, six of which were from southern England: 1) Somerset, 1956 (Neal, 1969); 2) Somerset, 1968 (Neal, 1969); 3) Somerset, 1986 (Neal, 1987); 4) Somerset, 1956 (Meade, 1956); 5) Staffordshire, 1903 (A. E., 1903, cited in Fairfax-Blakeborough & Pease, 1914 and Millais, 1904); §) Buckinghamshire, 1990 (Stocker, pers. comm.); 7) NW Russia, 1962 (Tumanov, 1971); 8) Several under artificial conditions (Hancox, 1987).

These various records comprise three in scrub, two in hayricks, and two in sheds, whilst additional comments draw attention to the atypical nature of the country, and the sows being perhaps evicted individuals in three cases, four to waterlogged conditions, and four to the situation arising in high density areas. The captive cases are atypical, and few zoological collections provide the ideal substitute sett conditions suitable for breeding. Perhaps the most significant common factor is that cases occur in high density English populations where surplus sows may be forced into unsuitable areas, densities can reach 20/km^2 whereas 1-3/km^2 is more usual on the Continent (Anderson & Trewhella, 1985).

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