SMALL CARNIVORE CONSERVATION

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

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*Brown Palm Civet (*Paradoxurus jerdoni*) - Photo: Divya Mudappa*

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This number is dedicated to the memory of Hugh Idwal Griffiths (1958-2002)

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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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Obituary: Huw Idwal Griffiths 1958-2002

Huw Idwal Griffiths died at the tender age of 44 on 12 June 2002 in Hull, UK, after a brief battle against cancer. This sudden and unexpected tragedy has shocked his family and his many friends and collaborators all over the World. It was only as recently as February of this year that he accepted his new role as Chairman of the IUCN/SSC Mustelid, Viverrid & Procyonid Specialist Group after Roland Wirth, the former Chairman, decided to step down to devote more time to other duties. In the April 2002 issue of Small Carnivore Conservation Huw, as the newly appointed Chairman, formulated clearly his ideas for the future direction and priorities of the Group. He paid particular attention to the little known non-European species, and tropical ones in particular. To all of us who knew Huw it went without saying that he would struggle hard to achieve these goals. In December 2001, Huw had already discussed eagerly the possibility of promoting small carnivore research in southern Africa with Rod Baxter from the University of Fort Hare, South Africa, and was keen to travel there to participate personally in this venture. Nobody could have guessed that by this time Huw was already suffering from medical problems and increasing exhaustion. On the contrary, optimistic as always, he made a supreme effort throughout to adopt his usual ebullient character and to hide his illness from all but those closest to him. What is particularly sad is that Huw did not have enough time to develop fully as a scientist - he died full of ideas and plans and right in the middle of a pile of unfinished work. In spite of Huw's spectacular scientific career and impressive bibliography, he had certainly not yet achieved the peak of his potential which was promised by his work to date and by his brilliant mind.

Huw was born to Martha and Idwal Griffiths in Louth, Lincolnshire, England, on 14 May 1958, twelve years the junior of his sister, Sue. He is survived by his wife Dr. Jane M. Reed, a specialist in diatom analysis, and by their three-year-old son Thomas, who takes very much after his father. Huw was a born naturalist, scientist and conservationist. His keen interest in nature, and animals in particular, developed early on during his childhood. In spite of this, it was not until later in his life that the opportunity arose to pursue these interests.

After finishing secondary school, Huw opted out of university and spent many years going from job to job in search of a purpose in life. He was, amongst other things, a guitarist and singer-songwriter in a band, an interior decorator for BBC television shows and a menial worker in a sausage factory. This wandering period probably contributed to Huw's colourful character, which made him a unique personality as well as an indisputable authority in the scientific community. It was at the age of 27 that he chose zoology as his future career, obtaining a first class BSc Hons degree in zoology from the University of Wales in June 1988. During his undergraduate training Huw was known by his supervisors (with whom he remained in touch until his premature death) for his boundless enthusiasm, while his outstanding academic merit was reflected in the receipt of the Edith Sheppard and Tattersall Exhibition Awards for best second year work in Zoology and for final year research, respectively. As a promising young scientist Huw continued his studies at the University of Wales where he received an MPhil in April 1992. His thesis entitled "*The conservation status of the Eurasian badger* (Meles meles *L., 1758*) *(Carnivora, Mustelidae) in western Europe*" is still the most complete study on this topic. The results have been published as several original scientific papers, while the thesis in its entirety served as the basis for the Report to the Permanent Committee of the Convention on the Conservation of European Wildlife and Natural Habitats at the Council of Europe. This monograph, which appeared in English and in French, is a document of fundamental importance to the conservation of badgers in Europe and a prime example of how such a topic should be tackled.

Not content with this, Huw embarked with his characteristic spirit of diversity on his PhD research whilst still working on the MPhil, and completed his thesis on freshwater ostracod crustacea in May 1995 (University of Wales). The PhD and MPhil research were carried out while Huw was employed as a Research Technician at the School of Pure & Applied Biology, University of Wales College of Cardiff (1988-1989), a Research Assistant at the School of History & Archaeology at the same University (1989-1992), and a Research Associate at the Department of Genetics, University of Leeds (1992-1995). Huw then succeeded in obtaining a permanent lectureship in September 1995 in the Department of Geography, University of Hull, being promoted to Senior Lecturer in October 2000.

Unlike many scientists, Huw was renowned for the diversity and breadth of his interests, which often gave him a novel outlook on how best to tackle a scientific or conservation problem. As noted, these spanned a range of fields from mammalian ecology and conservation to freshwater biology and extended in recent times to combining pure and social scientific approaches to solving complex issues. Within this, his major specialisation was to combine modern and ancient datasets from species with excellent fossil records (notably mammals and ostracod crustaceans) to elucidate long-timescale evolutionary and biogeographic patterns, and to use these as analogues in modelling the effects of rapid modern environmental and climate change.

Recent collaboration with social scientists in Hull had led Huw to become involved with issues related to society and animals, and how animals are perceived by and interact with humans. It is hard to comprehend that someone who started their scientific career relatively late and died so young as Huw could achieve such mastery of so many different fields of biology. During his short scientific career Huw had a prodigious research output; he had become a recognised leading authority on small carnivores and, equally, was well known for his work on the use of freshwater Ostracoda in palaeoecological work and biological monitoring. Armed with this diversity of scientific research interests, Huw was particularly keen on applying his skills to dealing with the complexity of issues surrounding plans for sustainable conservation. In the field of small carnivore conservation research Huw worked at various scales, from local faunal surveys to regional action plans at the continental level, and from molecular biology at one level to human-carnivore interactions at another.

The European Badger was perhaps Huw's favourite, followed by the Marbled Polecat, Polecats, Pine Marten, and the European Mink. As was characteristic of Huw's entire scientific output, his research in mustelids was original, full of fresh ideas and consequently stimulating for scientists and conservationists. Huw's most

important single contribution to small carnivore biology and conservation must be the edited volume on mustelid carnivores (Griffiths 2000) which originated from the very successful and entertaining workshop which Huw convened during the Euro-American Mammal Congress in Santiago de Compostela, Spain, in July 1998. This unique publication reflects well the extremely broad background that Huw had on the topic, as well as his reputation in the academic community in attracting so many contributors. Huw's small carnivore bibliography is listed at the end of this obituary. A complete bibliographic list will appear in the forthcoming issue of Annales.

To get a more complete picture of Huw, one needs also to consider his ethical standards. He never regarded animals simply as tools or scientific objects; he disliked scarifying living creatures for scientific purposes, for example, and always took as little as possible when it was unavoidable. Huw adhered to these standards strictly, whether it be a carnivore or an ostracod at issue. Conservation biology filled an important part of both his private and professional activities. Although Huw perceived the biodiversity crisis as his own personal tragedy, and did the best he could to promote species conservation, he did not accept green fundamentalism. He was well aware of the potentials as well as the limitations of conservation attempts and understood that management of populations cannot be avoided in achieving long term conservation goals. In Slovenia, where he found hunters to be well organised in a national hunters' association, he developed a keen interest in the functioning of this body, the problems it is facing, and the possibilities for increasing awareness of conservation issues amongst its members. During his frequent visits to Slovenia he regularly contacted the authorities at the hunters' association central office in order to exchange information. Optimistic as he was, Huw believed firmly that as many groups of people as possible should be actively involved in the pursuit of conservation. Thus, although not interested at all in hunting *per se*, Huw saw no sense in banning it so long as it was based on a long term and sustainable population management strategy.

Huw was involved with the IUCN/SSC Mustelid, Viverris & Procyonid Specialist Group practically from the start. His first paper in Small Carnivore Conservation (known then as Mustelid and Viverrid Conservation) appeared as early as April 1990, and in 1992 Huw also became a co-editor of the journal. He started correcting manuscripts sent by non-English speaking authors and also looked up references. His contribution as an associate co-editor to the journal was highly above average and the chief editor could always count on him completely. Huw served for years also as a co-chair for the IUCN *Vormela* group in the Small Carnivores Group.

Besides his dedication to the Small Carnivore Group, Huw also served the academic community enthusiastically in many other respects. He was an invited member of two other IUCN Species Survival Commission Specialist Groups (Captive Breeding Group and Inland Waters Crustacea). He was invited international delegate, invited speaker, organiser and convenor, and member of the organising committee for numerous international meetings. His contribution was invariably original and highly stimulating to others. Huw was an assessor for grant applications from national research councils from the UK, Spain, Slovenia and Croatia, a frequent peer reviewer for various biology and palaeoecology journals and a PhD examiner at the universities of Valencia (Spain), Hull and York. He was an elected research associate at the Science and Research Centre of the Republic of Slovenia Koper (July 2001). He was also a Fellow of the Linnean Society of London (FLS; since 1988), Chartered Biologist (CBiol) and Member of Institute of Biology (MIBiol; since 1992), a Committee Member, IBG Biogeography Research Group (2000 on), and a member of many learned societies (Royal Geographical Society, Mammal Society of the British Isles, Biogeography Research Group, Quaternary Research Association, Systematics Association, Society for Conservation Biology, etc.). In addition to Small Carnivore Conservation, Huw served on the editorial boards of a further three scientific journals: Folia Zoologica (Associate Editor), Scopolia, and Annales (Annals for Istrian & Mediterranean Studies). To this end Huw invested an enormous amount of work and time on improving the quality of written English for manuscripts by non-native English speakers.

As a brilliant organiser and leader, Huw was running several projects simultaneously, mainly of them international, and encompassing a wide variety of scientific issues. Many of us liked and appreciated collaborating with him. It was not only his broad and deep knowledge of the life sciences and his skill in writing scientific papers which made Huw an exceptional partner. Of no less importance was his friendly approach to every individual and his reputation for playing fair. It is thus also not surprising that since his appointment in Hull, Huw had easily attracted a small, dynamic research group working both on mammalian conservation and on various aspects of the monitoring of environmental change in aquatic ecosystems. Huw was a superb and popular lecturer, whose approach to lecturing was as to a theatrical performance, while at the same time ensuring that the scientific content was impeccable. As a supervisor, he gave students complete academic freedom but supported them tremendously whenever necessary. Students deeply appreciated this and simply loved Huw.

Although science dominated every aspect of Huw's mind, and was, besides his family, the most important issue in his entire life, he was by no means a boring and narrow-minded scholar. He had experienced many things in his previous life, which made him very open to the problems and difficulties of others. Huw was always willing to help a friend or student, no matter whether the problem centred on their private life or academic career. He was a good listener and his comments, suggestions and advice were all wise.

Huw worked hard, starting early and leaving late. It was exceptional to see him just sitting and doing nothing - there was always a book in his hands or a heap of paper in front of him. As noted, he did a tremendous amount of work for his colleagues and friends by commenting on manuscripts and improving written English. In spite of his workaholic lifestyle, Huw threw himself with equal enthusiasm into his social life, and made a point of allowing time for relaxation with music and a bottle. Huw also did not pay much attention to formalities and was renowned for his crumpled T-shirts and shapeless pullovers, which accompanied him not only on field work but also to important meetings with the university authorities or other senior figures.

Huw's death is a great personal tragedy to me and to his many friends and colleagues worldwide. Huw was a tremendous influence on the professional careers of many of us and, as far as I am concerned, also enriched our personal lives. With him we lost an outstanding and unique person, a devoted friend, and an indisputable authority in several fields of science. It is very sad that we all had so little time to share with him.

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Observations of small carnivores in the Kalakad-Mundanthurai Tiger Reserve, Western Ghats, India

Divya MUDAPPA

When conventional methods of estimation of either the numbers or occurrences of rare and cryptic species such as small carnivores do not help in understanding the ecology of the species, casual or opportunistic sightings have to be used to deduce their behaviour and habits (e.g., Bahuguna *et al.* 1998, Kurup & Joseph 2001).

This paper is a compilation of all the direct sightings (during casual walks and drives) in the Kalakad-Mundanthurai Tiger Reserve (KMTR) of non radio-collared small carnivores. Sightings by my research colleagues were also noted down in detail and are being reported here. Most of the observations are from the three sites within the reserve – Kannikatti, Sengaltheri, and Kakachi – that were surveyed intensively during a detailed study of the Brown Palm Civet *Paradoxurus jerdoni* carried out between May 1996 and December 1999. Details of the study are given elsewhere (Mudappa, 1998; Mudappa, 2001).

I recorded a total of 14 sightings of Brown Palm Civet (*Paradoxurus jerdoni*), 12 of Nilgiri Marten (*Martes gwatkinsi*), 10 of Small Indian Civet (*Viverricula indica*), 4 sightings of Leopard Cat (*Prionailurus bengalensis*), 4 of the Brown Mongoose (*Herpestes fuscus*), and otters (Common Otter *Lutra lutra* and Small-clawed Otter *Amblonyx cinereus*) were seen eight times during this period.

Brown Palm Civet

Almost all the sightings of Brown Palm Civet were after dusk/sunset. Only once, we found an injured animal during the day by the road. During the radio-telemetry study, it was observed that the animals that were strictly nocturnal became diurnal when injured or ill.

Of the 14 sightings, once we saw two individuals together on the same tree (in July 1996). All the other sightings were of solitary individuals. Seven sightings were of animals on trees or lianas and they were noted moving (4), resting (2), or calling (1). Though the Brown Palm Civets were predominantly arboreal and often observed moving long distances through the canopy, they were also using the ground as indicated by the success in trapping and camera-trapping done on the ground (Mudappa 1998, 2001). They did not move away when they were sighted on trees or lianas (i.e., above ground). However, they usually disappeared without a trace when seen on the ground.

Two of the sightings were of trapped, non-radio-collared, non-target individuals within the home-ranges of the collared animals. Smaller individuals (< 1 kg body weight) were sighted between August and January. Once, when a young male (900 g) was trapped (in May 1999), we saw another Brown Palm Civet very close by on a tree. Sighting of non-radio-collared individuals within the territories of collared male and female Brown Palm Civets was not uncommon. They were easily attracted to track plots baited with banana. Two of the sightings were near such baited track plots.

The colour variation among individuals was very high. They ranged from being a uniform dark brown to grizzled or even rarely golden. Animals both with and without a white tail tip were seen.

The call of the Brown Palm Civet was a prolonged, loud and shrill moan. The call was either a single long, moan, or sometimes had two notes. Very often more than one individual was heard calling simultaneously. The calls were most frequently heard between August and December. The calls echoed in the valley through the nights.

The Brown Palm Civet was the most frequently seen small carnivore in KMTR. It is probably not as rare as it was previously believed to be, at least in relatively undisturbed rainforests. They were most common (based on camera-traps, scats, and direct sightings) in altitudes above 1,000 m, although they were seen in lower altitudes (700 m) of Kannikatti also. Being a highly frugivorous and arboreal species, fragmentation of its rainforest habitat is likely to have adverse effects on its abundance.

Small Indian Civet

The Small Indian Civet was sighted very rarely within the relatively undisturbed rainforests of KMTR. They were mostly seen near the garbage dump close to the base camp or in and around tea plantations (Manjolai Estates, BBTC) within the Tiger Reserve. They were not photo-trapped frequently in the rainforests, but were the most photo-trapped species in grasslands and in a riverine patch (Koovapatti, 850 m) which had a narrow connectivity to the rainforests of Sengaltheri. The Brown Palm Civet was also photo-trapped at this site, although only once, unlike in the rainforests where it was the most common. Nine individual Small Indian Civets were sighted 10 times during this period, including one sighting in a dry deciduous forest (Mundanthurai, 201 m). This individual was observed for nearly 15 min, when it was feeding on insects on the ground, and was seen scent-marking on the shrubs. Small Indian Civets are also nocturnal, but unlike the Brown Palm Civets, seem to forage on the ground and are more insectivorous.

Brown Mongoose

The Brown Mongoose is relatively rare. It was photo-trapped only twice, both times at night. They were sighted either late in the evenings or at nights. Fresh droppings of the brown mongoose were seen in the mornings. They also frequented garbage dumps near one of our base camps. The mongooses fed on groundnuts that were used to bait rodents during the study. They could be approached close. They preferred to eat the groundnut, and did not eat the bananas and boiled chicken egg placed along with it. An individual that was feeding on the bait gave a guttural growl when approached, but left the place only after eating all the groundnuts.

The Brown Mongoose has a bushy, conical tail. The feet are black and the pelage a dark brown. This species was sighted only in or close to rainforests within KMTR. In contrast, the Ruddy Mongoose (*H. smithii*) was a common species of the dry deciduous

forests. They were often seen in pairs and sometimes even in groups of four to five animals on the Mundanthurai plateau (Mahesh Sankaran, pers. comm.). They are a lighter brown in colour, with a tinge of rufous on the base and a black tip to the tail. The tail tip is usually held up. They seem to be more diurnal than the Brown Mongoose.

Nilgiri Marten

The Nilgiri Marten was seen frequently in KMTR. This reserve is probably a stronghold for the species. We had 12 sightings over the three-and-a-half years in KMTR. It has been previously seen in altitudes as low as 350 m (in moist deciduous forests adjoining wet evergreen forests in Srivilliputtur, Justus Joshua, pers. comm.). In KMTR, they have been sighted between 550 m and 1,350 m. Five of the 12 sightings were of pairs. Four times they were seen on trees – twice moving, and the other two times resting. They were also seen feeding on or chasing Mouse Deer (*Moschiola memmina*). Once it was seen chasing a Monitor Lizard (*Varanus bengalensis*). When encountered, they usually gave a spitting snarl and moved away. The paired individuals were seen in the months of September, and December to February.

The martens were mostly black in colour, with a pale yellow to orange-coloured throat patch. Their gait is typically like a weasel. At a casual glance, they could be easily mistaken for the Malabar Giant Squirrels (*Ratufa indica*) that occur in these forests. However, the Nilgiri Marten has a short black tail that is not as bushy or as long as that of the Giant Squirrel. Once, in order to avoid us, a marten entered a tree hollow, out of which flew a Large Brown Flying Squirrel (*Petaurista phillipensis*). All the sightings were between 06:30 h and 18:00 h. They were seen near streams on four occasions. These animals are probably wide-ranging and more carnivorous than the brown palm civets. Attempts to capture them using live chicken, rodents, or fruits failed although they seem to be as common as the Brown Palm Civets. They are known locally as *mara nai* or tree dog and sometimes as *kombu kuduka* as they are believed to hang below a branch in wait of prey. No ecological study of the species has been carried out as yet, although incidental observations have been reported (Madhusudan, 1995; Christopher & Jayson, 1996; Kurup & Joseph, 2001).

Otters

Otters were seen eight times. Four times they were seen in pairs, once in a group of four, and the other sightings were of solitary individuals. Only twice they were seen walking on the trail by the river. The other sightings were of animals swimming or feeding in the rivers. Three of the sightings were during the day. One of these was of a pair of otters feeding (probably on fish) in a pool in a river early in the morning (06:30 h), and another of a pair under a rocky outcrop giving an alarm call (probably on seeing us at 11:30 h). Otter spraints were common along the streams in the reserve. Although the species could not be identified decisively, these were probably the Oriental Small-clawed and the Common Otters. Smooth-coated Otters (*Lutrogale perspicillata*) occur in the reservoirs and rivers (Karaiar and Servalar) in the drier parts of the reserve. Three of the sightings were of relatively small sized animals, which were most probably Oriental Small-clawed Otters.

Leopard Cat

We had five sightings of four leopard cats over the study period. Three sightings were during the night in rainforests. They seem to be relatively rare. The individual seen during the day was seen twice (consecutive days). It had a cloudy left eye, and therefore could be identified as the same individual. It was seen resting on the trail at about 17:45 h and again the next morning at 09:00 h about 250 m from the previous sighting. This species also probably switches its activity rhythms and becomes diurnal, like the Brown Palm Civets, when injured.

Other carnivores

Other carnivores in the rainforests are the Leopard *Panthrea pardus*, Dhole *Cuon alpinus*, Tiger *P. tigris* and Sloth Bear *Melursus ursinus*. In the drier forests, the Small Indian Civet was the most common small carnivore sighted, followed by the Ruddy Mongoose and the Common Palm Civet *Paradoxurus hermaphroditus* in Mundanthurai (Mahesh Sankaran, pers. comm.). Jungle Cat *Felis chaus* and Rusty-spotted Cat *Prionailurus rubiginosus* were seen on a few occasions in the wooded grasslands of Thalaiyanai, at the base of the Kalakad hills.

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Distribution and status of the Brown Palm Civet in the Western Ghats, South India

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Introduction

The Brown Palm Civet or Jerdon's Palm Civet (*Paradoxurus jerdoni* Blanford, 1885) is an endemic carnivore restricted to the rainforest tracts of the Western Ghats, a 1,600 km long hill chain along the west coast of India. The species has been reported from an altitudinal range of 500–1,300 m, being more common in higher altitudes (Mudappa, 1998). They are known to occur in tropical rainforests of the Western Ghats, and in areas such as Coorg they are known to use coffee estates as well (Report of G. C. Shortridge in Ryley, 1913; Ashraf *et al.*, 1993). Due to the nocturnal and arboreal habits of this viverrid, there have been few reliable records of its occurrence and its distribution and abundance has remained poorly documented. This knowledge is critically needed, especially in the light of the major conservation concern in the Western Ghats, which is the loss of large tracts of forest to commercial plantations of coffee, tea, *Eucalytus* spp., and teak (*Tectona grandis*), and other developmental activities (Menon & Bawa, 1997).

The Brown Palm Civet replaces the Common Palm Civet (*P. hermaphroditus*) in tropical rainforests of the Western Ghats. It may be sympatric with the Common Palm Civet only in the transition zones between the rainforests and drier habitats. It has a uniformly brown pelage, darker around the head, neck, shoulder, legs, and tail (see cover). Sometimes the pelage may be slightly grizzled. Two subspecies have been described on the basis of the colour of the pelage but both Pocock (1933) and Hutton (1949) state that the colour is extremely variable going from pale buff over light brown to dark brown. The dark tail sometimes has a white or pale-yellow tip; white in four out of 14 examined (Corbet & Hill, 1992). It has no distinct markings on the body or the face as in the common palm civet. A distinctive feature is the reversed direction of hair growth on the nape, similar to that in the Golden Palm Civet (*P. zeylonensis*) of Sri Lanka. It is about as large as the Common Palm Civet, but with a long and sleek tail. The body weight of the males ranges from 3.6 kg to 4.3 kg, head and body length 430 mm to 620 mm, and tail length from 380 to 530 mm (Mudappa, 2001; measurements of museum specimens listed in Table 1). In the 1920s-1930s two individuals were kept in Bronx Zoo for respectively 11years & 6 months and 11 years (P. Thomas, *in litt.*).

Former and recent distribution

Until recently, the Brown Palm Civet was known only from museum collections (Table 1), captive animals in two European zoos and one American zoo (Schreiber *et al*., 1989), and more recently from a captive in Katrej Snake Park, Pune (Ashraf, 1992). In one early report, Ryley (1913) found them to be fairly plentiful in Coorg (Kodagu district in Karnataka), although not nearly so common as *P. hermaphroditus*. There were reports of the species from many sites in Tamil Nadu, including High Wavy hills of Madurai district (Hutton, 1949), Khukal in Palani hills (Pocock, 1933), Kateri in Nilgiri hills (Pocock, 1939), and from Tirunelveli (Webb-Peploe, 1947). In the past, the Brown Palm Civet has also been recorded in Trivandrum in Kerala (Pocock 1939), and from Castle Rock in North Kanara district of Karnataka (Kinnear, 1913).

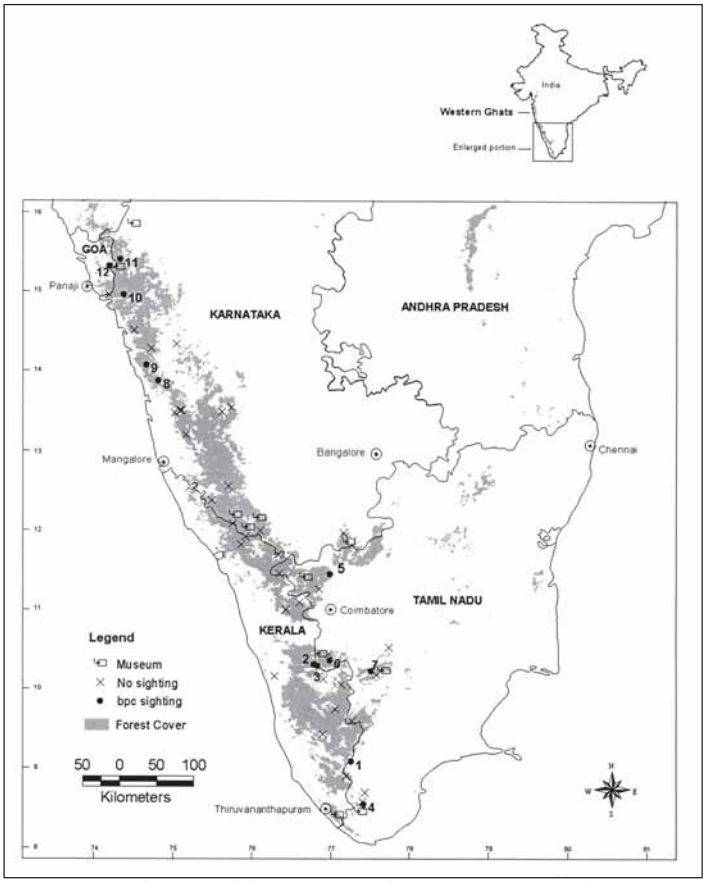

Fig. 1. Distribution of the Brown Palm Civet (BCP) in the Western Ghats as inferred from museum specimens and field survey.

Recent reports include photographs or sight records from Anamalais, Nilgiris, Coorg (Schreiber *et al*., 1989 and references therein), Silent Valley (Ramachandran, 1990), and Kalakad-Mundanthurai Tiger Reserve (Ganesh, 1997; Mudappa, 1998). Ashraf (1990) found no evidence of the Brown Palm Civet during a survey (in 1989) in the Anamalais. He also opined that the species was probably exterminated from localities like Ooty, Coonoor, Wellington, and Kodaikanal. Ashraf *et al*. (1993) stated that the Brown Palm Civet probably occurs in low densities throughout its range. However, the species appears to be fairly common in Kakachi-Upper Kodayar (Ganesh, 1997) and other areas above 1,000 m within the Kalakad-Mundanthurai Tiger Reserve in the Agasthyamalai hills and also in the Anamalai hills (Mudappa, 2001). Recent studies also suggest that the civets are not as rare as they were thought to be (Mudappa, 2001).

A survey conducted by the first author along the Western Ghats has thrown more light on the distribution and conservation status of this species, including evidence of its occurrence in some of the localities where it was not found by Ashraf (1990). This article is based on the sightings of Brown Palm Civets during a survey of flying squirrels carried out by the first author in 2001 and 2002 along the Western Ghats in Kerala, Tamil Nadu, Karnataka, and Goa.

Table 1. Records of the Brown Palm Civet in Bombay Natural History Society Museum (BNHS), The Natural History Museum, London, UK (BMNH), Zoologisches Museum, Universität Hamburg, Germany (ZMUH), American Museum of Natural History (AMNH),and Museum of Michigan State University, East Lansing, USA (MMSU).

REG. No	DATE	MUSEUM	LOCALITY, STATE	COLLECTOR	CURRENT STATUS
5695	00/04/1937	BNHS	Injipara Estate, Nilgiri Hills, Tamil Nadu	Col. H.G.H. William	Present
5697	26/10/1931	BNHS	Nilgiri hills, Tamil Nadu	Maj. Phytian Adams	Present
5699	22/01/1914	BNHS	Kotagiri, Tamil Nadu	C. Primrose	Present
5705	17/04/1934	BNHS	Nilgiri hills, Tamil Nadu	Maj. Phytian Adams	Present
5709	25/01/1924	BNHS	Kotagiri, Tamil Nadu	C. Primrose	Present
5700	14/10/1912	BNHS	Dhud Sagar, Goa	S. Prater	Present
5696	29/03/1923	BNHS	Belgaum, N. Kanara, Karnataka	L. E. Arkinson	Unknown
5703	-	BNHS	Billigirirangan Hills, Mysore, Karnataka	R.C. Morris	Likely
5704	27/01/1940	BNHS	Billigirirangan Hills, Mysore, Karnataka	R.C. Morris	Likely
6346	-	BNHS	Billigirirangan Hills, Mysore, Karnataka	R.C. Morris	Likely
5701	28/12/1912	BNHS	Haleri, N. Coorg, Karnataka	G.C. Shortridge	Likely
5706	29/12/1912	BNHS	Haleri, N. Coorg, Karnataka	G.C. Shortridge	Likely
5707	13/05/1913	BNHS	Haleri, N. Coorg, Karnataka	G. C. Shortridge	Likely
?	1914	BNHS	S. Coorg, Karnataka	? (GM, Madras)	Likely
5698	6/8/1918	BNHS	Aulikal	A.K. Weldo Dour	Unknown
?	1888	Indian Museum, Calcutta	Ootacamund, Tamil Nadu	W. L. Sclater	Present
33214	28/02/1931	BMNH	Haleri, N. Coorg, Karnataka	J.A.Graham	Likely
1382223	29/01/1913	BMNH	Virajpet, S. Coorg, Karnataka	G.C.Shortridge	Likely
1382224	28/01/1913	BMNH	Virajpet, S. Coorg, Karnataka	G.C.Shortridge	Likely
35116	?	BMNH	Billigirirangan Hills, Kollegal, Coimbatore, Karnataka/Tamil Nadu	R.C.Morris	Likely
5000	16/01/1957	ZMUH	Gund, N. Kanara, Karnataka	Baron von Maydell	Unknown
4925	18/01/1956	ZMUH	Gund, N. Kanara, Karnataka	Baron von Maydell	Unknown
4999	12/01/1957	ZMUH	Gund, N. Kanara, Karnataka	Baron von Maydell	Unknown
87791		BMNH	Kateri, Nilgiri Hills, Tamil Nadu	G.F.Hampson	Likely
3612141		BMNH	Lovedale, Ootacamund, Tamil Nadu	Maj. G.G.Phytian Adams	Likely
3612142		BMNH	Lovedale, Ootacamund, Tamil Nadu	Maj. G.G.Phytian Adams	Likely
3612143		BMNH	Lovedale, Ootacamund, Tamil Nadu	Maj. G.G.Phytian Adams	Likely
3612144		BMNH	Lovedale, Ootacamund, Tamil Nadu	Maj. G.G.Phytian Adams	Likely
6711141		BMNH	Madras?, Tamil Nadu	H.Day	Unknown
33212		BMNH	Pamba River, Kodaikanal, Tamil Nadu	C.McCann	Likely
251017	22/04/1922	BMNH	Tiger Shola, Nilgiri Hills, Tamil Nadu	C.McCann	Likely
251018	07/04/1902	BMNH	Tiger Shola, Nilgiri Hills, Karnataka	C.McCann	Likely
19371108		BMNH	Nilgiri Hills, Tamil Nadu	Maj. G.G.Phytian Adams	Likely
19371109		BMNH	Nilgiri Hills, Tamil Nadu	Maj. G.G.Phytian Adams	Likely
9410211	01/1892	BMNH	Near end of Mt. Range, Travancore, Kerala	H.S.Ferguson	Likely
94718		BMNH	Trivandrum, Travancore, Kerala	H.S.Ferguson	Likely
9712181	11/12/1884	BMNH	Near Wellington, Nilgiri Hills, Tamil Nadu	Capt. F.Sapte	Likely
5887	25/04/1961	MMSU	5 mi W Sarestal Resthouse Dindori (Mandla), MP	J.Touborg	Erroneous?
80124	21/03/27	AMNH	??	Zoo specimen	
88396	?	AMNH	??	Zoo specimen	
119488	?	AMNH	??	Zoo specimen	

Study Area

The Western Ghats is a 1,600 km long chain of mountains that runs parallel to the west coast of peninsular India from the river Tapti in the north to Kanyakumari in the south. Covering an area of 132,606 km^2, approximately 4.03% of the land area of India (Rodgers *et al*., 2000), the Western Ghats extends over five states (Kerala, Tamil Nadu, Karnataka, Goa, and Maharashtra) between 8° and 21°30' N latitude and 75° and 78°30' E longitude. The average elevation of the hills is 900-1,500 m, rising up to heights of more than 2,000 m. The diversity of rainfall regimes and topography has resulted in a variety of vegetation types in the Western Ghats, including tropical evergreen forest (Champion & Seth, 1968). The structure and species composition of evergreen forests varies with altitude, latitude, and bioclimatic factors along the length of the Western Ghats (Pascal, 1988).

Table 2. A summary of the survey of the Brown Palm Civet in the Western Ghats, India.

State	Total sites	Evergreen sites	km walked (evergreen)	# sites with BPC	# BPC sighted	Encounter rate (No./km)
Tamil Nadu	7	5	56.3	4	8	0.14
Kerala	20	13	55.3	3	3	0.54
Karnataka	18	15	81.1	4	7	0.08
Goa	2	1	3	1	4	1.33

Both protected areas (National Parks, Wildlife Sanctuaries, and Tiger Reserves) and non-protected areas (Reserve Forests and private land) were surveyed in Kerala and Tamil Nadu between January and May 2001 and in Karnataka and Goa between January and April 2002. The forest types surveyed during the study were tropical evergreen, moist deciduous, and dry deciduous forests, and plantations (teak, coconut, coffee, and cardamom) across a range of elevation gradients (0 – 2,050 m asl).

Methods

Existing trails were walked primarily between 19:00 and 01:30 hrs and spotlighting was the primary method used to locate animals, though animals were also detected by the sound of their movement through the canopy and their vocalisations. The vegetation was scanned at all levels with spotlights and flashlights and once eye-shine was detected, the animal was identified with 10 x 50 or 8 x 50 binoculars. A modified torch fitted with a halogen bulb and connected to a 12-volt battery was used in addition to torches and flashlights.

The vegetation characterisation is based on samples from random sites and sites where flying squirrels were seen within the same habitat. In 2001, plots were laid around sighting trees and the distance to the nearest four trees, their girths and heights were recorded. In 2002, this was revised to include the distances, heights, and girths of all trees within a radius of 12 m around the sighting tree in order to estimate tree density with greater accuracy.

The encounter rate of the Brown Palm Civet was calculated as the number of animals seen per km of walk. The encounter of Brown Palm Civets was explored with respect to latitude. Encounter rate was regressed with latitude to reveal any trend in the variable, and a chi-square test was performed on the frequency of encounter at each latitude to test the homogeneity of the distribution. Statistica (StatSoft, Inc., 1999) was used to perform the analysis.

Results

A total of 47 sites were surveyed, of which, 33 were wet evergreen forest sites (Table 2). Within these sites, 186 km in evergreen forest, 88.35 km in moist deciduous forest, 13.3 km in dry deciduous forest, and 18.7 km in plantations were surveyed (Fig. 1). Twenty-three Brown Palm Civets were sighted in 12 of these surveyed sites (Table 2) – 11 individuals between January and May 2001 (in Kerala and Tamil Nadu), and 12 between January and April 2002 (Karnataka and Goa). All twenty-three sightings of Brown Palm Civets were in evergreen forests, including five in high altitude montane evergreen forests or sholas (Southern Tropical hill forest 8A/C1; Champion & Seth, 1968), which typically have stunted trees with epiphyte-laden boles (Tables 3 and 4). No Brown Palm Civets were sighted in any of the other forest types surveyed. Although, no Brown Palm Civets were sighted between north Tamil Nadu (11° N) and Central Karnataka (13° N) during this survey, there were reliable reports of the species' occurrence in the region. Six Common Palm Civets were sighted in moist deciduous forests and one in a coffee estate in Mukkali, Kerala, in 2001. A dead Common Palm Civet, shot in an evergreen patch, was also seen with a hunter during the survey.

Examining encounter rates of Brown Palm Civets with respect to the four states surveyed revealed no significant differences in their occurrences ($X^2 = 2.86$, df = 3, $p>0.05$). There was also no significant difference in the occurrence of the Brown Palm Civet across different latitudes ($X^2 = 2.88$, df = 7, $p>0.05$). The encounter rate of the species was not significantly correlated with latitude ($R^2 = 0.0704$, $F = 0.6815$, $p>0.05$, $n=11$). The pattern observed was haphazard, with encounter rate neither consistently increasing nor decreasing with latitude. Encounter rate was highest in Goa and lowest in Kerala. However, only one site was surveyed in Goa and thus the data from this survey are not large enough to explain trends in occurrence of the species across states/latitude.

Brown Palm Civets were detected both in undisturbed and large patches of contiguous forests as well as in fragments (e.g. Konavakarai), surrounded by plantations of tea, and also human habitations. They were encountered both along forest trails, as well as along main roads, often exposed to traffic even during night-time (Sites 3, 5, 7, 11). Peringyalkuthu (Site 2) and Megani valley (Site 9) were close to human settlements within large patches of forest, while Konavakarai (Site 5) was a forest fragment adjoining human habitation and plantations. Bombay shola (Site 7) was a fragment adjoining the Kodaikanal township and is bisected by roads, and surrounded by human habitation. All the above-mentioned sites suffer some degree of disturbance with exploitation for firewood, and movement of people from nearby villages. Arashinagundi Falls (Site 8) and Doodhsagar (Site 12) are major tourist attractions and the vegetation at these sites is disturbed and degraded along the edges of the road. The other four sites (1, 4, 6, and 10) were relatively undisturbed and three of these were included under the Protected Areas.

Brown Palm Civets were seen alone on 19 occasions and in pairs on two occasions. They were sighted mainly between 19:30 hrs and 23:30 hrs. Animals were seen resting on 6 occasions, and

were observed using branches of diameter >40 cm. Brown Palm Civets were also often disturbed by the presence of the observer and reacted by moving away (on 3 occasions), or by moving up or along a branch while continuing to gaze at the torch beam (on 2 occasions). Animals were seen feeding on 5 occasions (once on *Ficus* sp.), and on one occasion two individuals were seen foraging together on the same tree. One animal was observed feeding on flowers at a height of >14 m for over half an hour, and was observed to defecate from the tree in between the feeding bouts.

On two occasions intra- and inter-specific interactions were observed – one was between a Brown Palm Civet and a Large Brown Flying Squirrel (*Petaurista philippensis*) and the other between two Brown Palm Civets. In the first instance, a Brown Palm Civet chased a Large Brown Flying Squirrel which had moved on to the tree the civet was resting on. As the squirrel reached the tree, the civet made a spitting noise (similar to a domestic cat in a fight) and chased the animal away (23:00 hrs, March 2001, Site 7). On another occasion (22:00 hrs, February 2002, Site 9) two Brown Palm Civets were detected by a similar loud prolonged spitting/ brawling noise, and two civets were detected on the same tree. The animals immediately moved away, and it could not be ascertained if this noise was related to aggression or mating. At Dhud Sagar, long calls ending in a shriek were heard repeatedly between 20:30 and 21:15 hrs while sampling in March 2002. Though Brown Palm Civets were encountered along the trail close to the source of the calls, none was seen vocalising.

Conclusion

The Brown Palm Civet seems to be holding its own in its entire distributional range from the southern extremity of Western Ghats in Kalakad-Mundanthurai Tiger Reserve to Dhud Sagar in Goa in the north. As noted by Mudappa (2001), they do not seem to be as rare as they were previously thought to be. There were sightings of the species even in some places like Kodaikanal and Ootacamund, where they were otherwise believed to have been driven locally extinct. However, its presence in some of the earlier known locations like the site in Madhya Pradesh (MMSU-5887) could not be confirmed during this survey. We believe that the locality for that particular specimen could be erroneous. Some of the other sites which can cause certain confusion are the museum specimens from Belgaum and Biligirirangan Hills, since the former is located in an arid zone of the Deccan Plateau and the latter is more a semi-evergreen forest in the eastern aspect of the Western Ghats. No brown palm civet was sighted in Biligirirangan hills during the survey, nor were there any recent reports of the species. Both the sites, however, are geographically close to typical tropical wet evergreen forests in north Karnataka and Nilgiris, respectively.

It cannot be stated from the data collected during this survey if the species is more common in the southern Western Ghats, though earlier studies (Mudappa 2001) have suggested such trends. In Kalakad-Mundanthurai Tiger Reserve and the Indira Gandhi Wildlife Sanctuary in Anamalais, Tamil Nadu, southern Western Ghats, the Brown Palm Civet was more abundant in evergreen forests above 900 m in altitude. However, in the northern Western Ghats, particularly in Karnataka and Goa, where the wet evergreen forests do not extend above 800 m, they seem to be equally abundant. This probably indicates that they are more dependent on the structure and floristics of the forests rather than the altitude.

So far, the Brown Palm Civet has been reported largely from tropical rainforests of the Western Ghats. Even during this survey, Brown Palm Civets were sighted only in tropical rainforests. However, earlier, this species has been reported from coffee estates in Coorg and Anamalais (Ryley, 1913; Mudappa, 2001). Since the species is mainly arboreal and frugivorous in habit, it can survive in areas with relatively undisturbed canopy with adequate food resources, such as in coffee estates retaining most of the natural rainforest canopy tree and liana species. In the light of their requirements, the species will not be able to withstand conversion of its rainforest habitat to plantations such as tea, *Eucalyptus*, and teak, while it may continue to use patches that have been converted to coffee and cardamom without much loss of large canopy trees.

Table 3. Locations of Brown Palm Civet sightings during the present survey in the Western Ghats (2001 – 2002). RF = Reserve Forest, TR = Tiger Reserve, WLS = Wildlife Sanctuary, NP = National Park

No.	Location and State	Latitude & Longitude	Distance walked (km)	Number sighted	Encounter rate (No./ km)
1	Achankovil RF, Kerala	09º10' – 77º16'	4*	1	0.25
2	Peringyalkuthu, Chalakudy RF, Kerala	10º28' – 76º47'	1	1	1
3	Malakapara RF, Kerala	10º17' – 76º50'	1.6	1	0.625
4	Kakachi, Kalakad-Mundanthurai TR, Tamil Nadu	08º48' – 77º25'	3	2	0.666
5	Konavakarai, Nilgiris, Tamil Nadu	11º27' – 76º59'+	3	2	0.666
6	Manamboly, Indira Gandhi WLS, Tamil Nadu	10º30' – 77º01'	5.5	1	0.181
7	Bombay Shola, Kodaikanal RF, Tamil Nadu	10º23' – 77º31'	2	3	1.5
8	Arashinagundi Falls, Mookambika WLS, Karnataka	13º53' – 74º49'	5.75*	1	0.173
9	Megani Valley, Sharavathy WLS, Karnataka	14º04' – 74º40'	2.75	2	0.727
10	Barpal, Anshi NP, Karnataka	14º57' – 74º23'	4	4	1
11	Castle Rock, Haliyal RF, Karnataka	15º26' – 74º19'	**	1	
12	Dhud Sagar, Bhagwan Mahaveer WLS, Goa	15º19' – 74º19'	3	4	1.33

* Onward and return walk included. All other walks are only onward walks.
\+ GPS location taken approximately 5 km from site.
** Opportunistic sighting while driving through a forest patch.

Table 4. Forest classification and vegetation characteristics of sites where Brown Palm Civets were recorded during the survey (standard error in parenthesis).

No.	Location and State	Forest classification (Champion & Seth, 1968)	Altitude (m)	Canopy height (m)	Tree density (#/ha)
1	Achankovil RF, Kerala	West coast tropical evergreen forest 1A/C4	250	n.a.	n.a
2	Peringyalkuthu, Chalakudy RF, Kerala	West coast tropical evergreen forest 1A/C4	330	19.62 (2.09)	160.91 (11.15)
3	Malakapara RF, Kerala	West coast tropical evergreen forest 1A/C4	960	n.a.	n.a
4	Kakachi, Kalakad Mundanthurai TR, Tamil Nadu*	Southern hill top tropical evergreen forest 8A/C1	1200	23.83 (0.70)	851 (61.3)
5	Konavakarai, Nilgiris, Tamil Nadu	Southern tropical hill forest 8A/ C1	1800	11.40 (1.09)	299.78 (46.82)
6	Manamboly, Indira Gandhi WLS, Tamil Nadu*	West coast tropical evergreen forest 1A/C4	760	16.38 (0.53)	122.44 (32.84)
7	Bombay Shola, Kodaikanal RF, Tamil Nadu	Southern hill top tropical evergreen forest 8A/C1	2050	17.68 (.63)	153.84 (51.87)
8	Arashinagundi Falls, Mookambika WLS, Karnataka *	West coast tropical evergreen forest 1A/C4	190	14.53 (0.32)	228.41 (23.56)
9	Megani Valley, Sharavathy WLS, Karnataka*	West coast tropical evergreen forest 1A/C4	230	12.56 (0.74)	458.49 (83.24)
10	Barpal, Anshi NP, Karnataka	West coast tropical evergreen forest 1A/C4	560	12.42 (1.01)	1046.56 (124.75)
11	Castle Rock, Haliyal RF, Karnataka	West coast tropical evergreen forest 1A/C4	690	n.a	n.a
12	Dhud Sagar, Bhagwan Mahaveer WLS, Goa*	West coast tropical evergreen forest 1A/C4	110	n.a	n.a

*Sites that are included within the Protected Area network in the country.

Threats

Many regions, particularly the reserve forests and even some protected areas in the Western Ghats are threatened by development programmes. Mining activities in Kudremukh, hydroelectric projects, and large-scale plantations of coffee, cardamom, and tea in and around these protected areas have vastly depleted the forest cover (Ashraf *et al.*, 1993). Menon & Bawa (1997) estimated that between 1920 and 1990, forest cover in the Western Ghats declined by 40%, resulting in a four-fold increase in the number of fragments, and an 83% reduction in size of forest patches. In the present state of habitat loss and alterations, most species, particularly the endemics such as the Brown Palm Civet, face an uncertain future.

Hunting is unlikely to be a major threat to the species; however, illegal hunting is still common in privately owned coffee, cardamom, and tea estates (Ashraf *et al.*, 1993). Although occasional hunting of this species has been reported, there is no evidence so far of commercial trade (Hanfee & Ahmed, 1999; Madhusudan & Karanth 2000). A specimen was offered for sale in the Periyar Tiger Reserve by local tribesmen (Narikoravas) in 1997 (Gupta, 1997). Apparently, the Brown Palm Civet is a preferred wild meat in many regions of Karnataka (H. N. Kumara, *pers. comm.*). This species, together with the Common Palm Civet, is hunted for its fat, which is used for medicinal purposes as well as for food (M. D. Madhusudhan, *pers. comm.*).

At the same time, there is little awareness among people of the existence of many of the small carnivore species and their ecological roles. Sometimes, herpestids, viverrids, and mustelids are captured from the wild and sold to private collections and zoos. Roadkills are found commonly on busy highways, both within and outside wildlife reserves (Kumara *et al*., 2000; D. Mudappa, *pers. obs.*).

The extent of persecution of small carnivores in the Western Ghats is not clearly known. The fate of more restricted and endemic species such as the Brown Palm Civet, Malabar Civet (*Viverra civettina*), and the Nilgiri marten (*Martes gwatkinsi*) remains threatened in the face of changing and developing landscape in the Western Ghats (Mudappa, 2001).

Protection and conservation

The Brown Palm Civet is listed in Schedule II part II of the Indian Wildlife (Protection) Act 1972 (Anonymous 1994), Vulnerable (VU B1+2c) in IUCN Red List, and Appendix III in CITES. This level of conservation protection appears adequate for the present, given the species' wide distribution range along the Western Ghats. However, long-term protection of primary rainforests, both large stretches as well as fragments, is imperative. Conservation value of shade coffee and cardamom estates with natural canopy for the Brown Palm Civet needs to be recognised.

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Some recent records of the Spotted Linsang Prionodon pardicolor from India

Anwaruddin CHOUDHURY

The Spotted Linsang *Prionodon pardicolor* is a very rare small carnivore occurring from Nepal east through southern China and south to Thailand, Lao and Vietnam (Pocock, 1939; Corbet & Hill, 1992). It is the smallest and also among the most poorly known of the viverrids. In northeastern India, it is the rarest of the viverrids (Choudhury, 1999). There were only a handful of records from its entire range. In recent years it has been recorded in Upper Siang (Katti *et al*., 1990), Mouling National Park (Singh *et al.,* 1996), Mehao Wildlife Sanctuary (Chakraborty & Sen, 1991), Tato in West Siang district and Nacho in Upper Subansiri district (Kumar, 1999), all in Arunachal Pradesh. There was also a record from Arunachal Pradesh – Assam border area in (Pakhui Wildlife Sanctuary – Nameri National Park border) in 1999 (P.Saikia, *pers. comm*.). A killed specimen was on sale at Kohima market in Nagaland in 1997-98 (Choudhury, 2000). Considering its rarity and fewer records, any information seemed to be important. I here report of two recent records of the Spotted Linsang from Nagaland in northeastern India.

On 12 February 2002, while on a field trip to Dzülake area (25°38'N, 93°55'E) of Kohima district, I came across a stuffed specimen. It was shot in the forests towards south / southwest of this locality (exact year not known but may be during the past few years). It was reportedly in a tree in the evening hours when it was shot. The habitat in the area was some excellent primary subtropical broadleaf forest. The elevation of Dzülake (Dzülekema village) is 1,750 m asl. The specimen measured: head & body: 41.7 cm (neck stretched due to drying) and tail: 30.3 cm.

Then on 13 February 2002, I examined and measured another stuffed specimen of the linsang, this time at Chizami (25°36'N, 94°24'E) in Phek district. It was killed in December 2001 near here and was purchased by the present owner for Rs 50 (slightly more than $1). The villagers at Chizami reported that it is not uncommon. Although they regard it as a friend of farmers for its reported control of rodents, it is occasionally snared or shot by young people. Once killed, its meat is taken. The habitat in the area was degraded secondary forest in the lower areas and some primary forest in the upper reaches (all of subtropical broadleaf type). The elevation in the area ranged from 1,400 to 1,700 m asl. The specimen measured: head & body: 32 cm and tail: 30 cm.

The first site (forests near Dzülake) is a community-protected area. This area has been declared as a 'sanctuary', called "Khonoma Nature Conservation and Tragopan Sanctuary" covering more than 70 km^2 (approximately) of area in 1998. This sanctuary has not been notified by the Government under any Act or Rule but by the village council of Khonoma, who owns the land. The main threats to Spotted Linsang seems to be habitat loss due to felling of trees and conversion to *jhum* (slash-and-burn shifting cultivation) and terrace cultivation as well as opportunistic hunting for its meat.

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Khekiho Sohe and Thomas Kent of People's Group (NGO); Mr Ape, and Zievinyu Yalietsu of Khonoma; Ms Acuno Meyase, Kehevikho, Bano Meyase of Dzülake; Ms Aeple and her brother of Chizami; and Hakim.

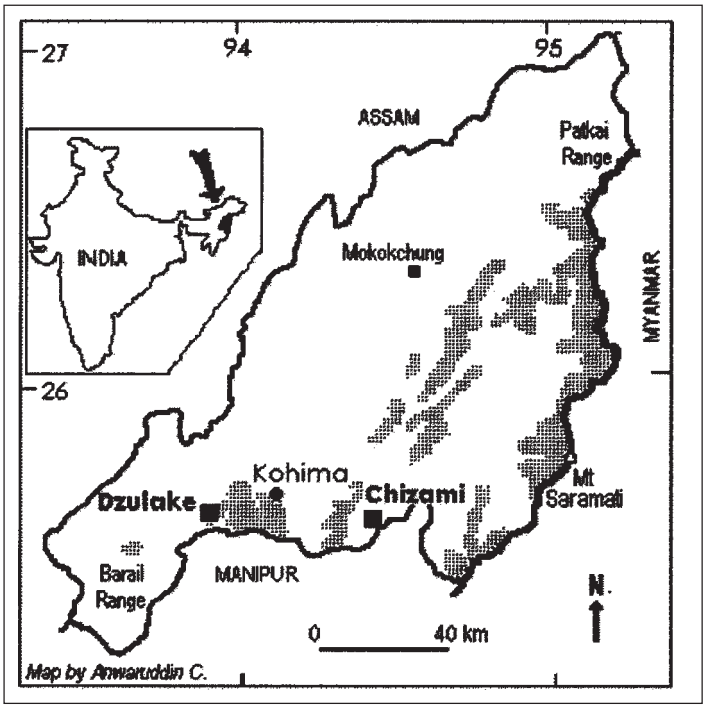

Fig.1. Map of Nagaland showing the places mentioned in the text (land above 1,800 m

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Physiological responses of Owston's Palm Civets and Large Indian Civets to immobilization with a combination of ketamine HCL, acepromazine and atropine sulphate

Linda KING

Abstract

We performed 47 immobilizations of 13 Owston's Palm Civets (*Chrotogale owstoni*); two immobilizations of adult Large Indian Civets (*Viverra zibetha*); and four immobilizations on one juvenile Large Indian Civet for short medical procedures. These immobilizations established the safety and effectiveness of using a combination of ketamine HCL, atropine sulphate and acepromazine. Paired t-tests showed no significant difference between the weights of female and male *C. owstoni. Chrotogale owstoni* were immobilized using a mean dosage of 17 ± 2.3 mg/kg ketamine, 0.04 ± 0 mg/kg atropine and 0.73 ± 0.1 mg/kg acepromazine (IM). Pulse rate varied widely with a mean of 154 ± 26, and body temperature decreased lightly with an overall mean of 37.1 ± 0.8°C. However, pulse rate was independent of time. Body temperature showed a significant negative relationship with time using regression analysis. *Viverra zibetha* was immobilized using a mean dosage of 18 ± 0.32 mg/kg ketamine, 0.04 ± 0 mg/kg atropine, 0.77 ± 0.01 mg/kg acepromazine for adults and 17.9 ± 1.7 mg/kg ketamine, 0.04 ± 0 mg/kg atropine and 0.77 ± 0.08 mg/kg acepromazine for juveniles. Mean pulse rate was 181 ± 4 and 157 ± 5 for adults and juvenile, respectively. Greater initial temperatures were observed for the adults (39.7 ± 0.4°C) compared to the juvenile (36.9 ± 0.3°C). The drug combination proved effective and has potential for use with other viverrids.

Introduction

Three subfamilies of viverrids are represented in Asia - the Hemigalinae, Paradoxurinae and Viverrinae. Owston's Palm Civet (*Chrotogale owstoni*) is a member of Hemigalinae and the Large Indian Civet (*Viverra zibetha*) of Viverrinae. Corbet & Hill (1992) placed Owston's Palm Civet in the same genus as the Banded Palm Civet (*Hemigalus derbyanus*). However, Veron & Heard (2000) found molecular evidence that two separate genera be maintained. Owston's Palm Civet has a distribution that includes Lao PDR, Vietnam, southern Yunnan and southwest Guangxi provinces, China (Schreiber *et al*., 1989). The Large Indian Civet is present from Nepal and Bangladesh to southeastern China, the Malay Peninsula and Hainan (Nowak, 1999).

The Asiatic viverrids contain a diverse group of carnivores that exploit a wide range of habitats and niches. In fact, civets may have a large role in creating and maintaining the actual infrastructure of the rainforest through seed dispersal (Rabinowitz, 1991). However, due in part to their nocturnal and elusive habits, we know less about viverrids than perhaps any other terrestrial carnivore. Throughout Asia, viverrids are increasingly threatened due to wildlife trade, habitat destruction, fragmentation and subsistence hunting (Schreiber *et al*., 1989). Future studies will likely require the use of sedatives, but effective dosages and drug combinations that minimize loss of sedated animals are poorly resolved.

Several studies of mustelids, viverrids and procyonids have involved the use of ketamine as a sedative. Joshi *et al*. (1995) used 15-30 mg/kg ketamine hydrochloride (KET) to immobilize Common Palm Civets *(Paradoxurus hermaphroditus*) and Large Indian Civets. Lopez Gonzalez *et al*. (1998) successfully immobilized Pygmy Spotted Skunks (*Spilogale pygmaea*) with a mixture of KET and xylazine (XYL) using a mean dose of 15.7 mg/kg and 8.1mg/kg, respectively. Fishers (*Martes pennanti*) have been immobilized using KET, KET/ XYL and telazol (TZ). Two Fishers experienced respiratory arrest after receiving KET-XYL. Ketamine was recommended for field studies that require short procedures because longer recovery times are required for KET-XYL and telazol. However, for better muscle relaxation and more extensive medical procedures KET-XYL or telazol was recommended. Of the three immobilants, telazol had the longest recovery time (Mitcheltree *et al*., 1999).

Mudappa & Chellam (2001) used a mixture of KET and XYL with a mean dosage of 36mg/kg and 3.7mg/kg, respectively to immobilize Brown Palm Civets (*Paradoxurus jerdoni*). Rectal temperature decreased slightly in the Brown Palm Civets and two individuals vomited during recovery. However, the mixture produced no other complications or fatalities and thus was deemed effective overall. Belant (1992) used a mixture of KET (30 to 82 mg/kg) and XYL (8 to 16.4 mg/kg) for American Martens (*Martes americana*) and KET (20.8 to 42.1 mg/kg) on Short-tailed Weasels (*Mustela erminea*). Body temperatures of both martens and weasels decreased after induction. Slight body tremors occurred in two of the Short-tailed Weasels that received KET alone, so the addition of a muscle relaxant to KET has been recommended in the future. Streicher (2001) used an average of 9.5mg/kg KET and 1.9 mg/kg XYL on Owston's Palm Civets. Although the mixture provided good muscle relaxation and no excessive salivation, slight vomitus was present in about half the civets. In addition, low body temperatures occurred on cold days.

The use of ketamine hydrochloride is suitable for a variety of wildlife species. It has a rapid effect and a substantial safety margin. In addition, food does not need to be withheld prior to injection and it is not accumulative. Therefore, repeated doses are not dangerous as with barbiturates. However, the drug has some disadvantages. Muscle rigidity is maintained; although this can be offset with the addition of acepromazine. Acepromazine provides excellent muscle relaxation and overrides the muscle rigidity induced by ketamine (Ramsden *et al*., 1976). In contrast, ketamine counteracts the hypovolemia and cardiovascular depression caused by acepromazine. Increased salivation resulting from KET can be regulated with atropine sulphate (Ramsden *et al.,* 1976). Increased salivation is frequent with ketamine but can be controlled by the addition of atropine sulphate (Ramsden *et al*., 1976). Atropine prevents vomiting, reduces salivation and strengthens heart activity. To provide a safe effective method for sedating viverrids, we used a combination of atropine sulphate, acepromazine and ketamine HCL in a mixture called ketamine plus. We report on the effectiveness of this mixture for immobilization of Owston's Palm Civets and Large Indian Civets, respectively.

Table 1. Formula for ketamine plus mixture.

Drug	Concentration	Amount	Final Concentration
Atropine	0.5 mg/ml	3 mls	0.12 mg/ml
Acepromazine	10 mg/ml	3 mls	2.31 mg/ml
Ketamine HCL	100 mg/ml	7 mls	53.8 mg/m
		= 13 mls of ketamine plus	

Materials and Methods

The civets were from Lak Xao, Bolikhamxay Province of Lao PDR. During September 1997 through July 1998, we periodically performed medical procedures on wounded wild and resident animals, and on unwounded resident animals that needed medical attention. Some of the more common injuries resulted from trap wounds and transport restraints, injuries caused as a result of twine or rope bindings. These injuries often resulted in substantial necrotic tissue that sometimes required amputation.

When a civet needed to be restrained for a medical procedure catchpoles were sometimes used to pull the animal out of its box. Nets were also used to restrain the animal for injection if they were outside of the nest box. We found that the Owston's Palm Civet did not become overly stressed during restraint. Streicher (2001) and Roberton (2001) found that by lifting the tail, the Owston's could be restrained for injection. We regularly and successfully used this technique with the Lao Owston's Palm Civets. If an animal required repeated treatment such as a bandage change every few days, we housed the animal in a bamboo cage within the main house. To inject the animal, the tail was pulled until the rear leg was outside of the cage. The door could be lowered to prevent the animal from turning to bite. In contrast, the Large Indian Civets were more difficult to restrain. This species easily stressed. They could seriously injure themselves in a panic while trying to escape capture by bashing frantically into objects or cage walls.

Ketamine plus (Table 1) was always available for medical procedures. We kept a prepared mixture available to reduce reaction time to emergencies and the probability of making a dosage mistake. The weight of the animal and dosage of KET plus was estimated followed by an injection in the muscles of the hind leg with a hand held disposable syringe. The animal was left in the den box or bamboo carrier until recumbency, then taken to a surgical room. An ointment was applied to the eyes to provide lubrication and prevent desiccation. As soon as practical after immobilization, we measured body temperature rectally and heart rate. The mean time in which vital signs were recorded after initial injection was 9.1 ± 4.1 min. (n=47) for *C. owstoni* and 7.0 ± 2.4 min. (n=6) for *V. zibetha*. Subsequent physiological data were taken at 5-min intervals until medical procedures were completed. Our goal was to help the animal maintain a safe body temperature. If body temperatures dropped below 37.2°C we placed hot water bottles around the animal to help it thermoregulate. In contrast, if body temperature increased above 38°C subcutaneous fluids were given and rubbing alcohol was applied to pads and ears. If temperatures rose above 41.5°C, an injection of dipyrone (500mg/ml) was given to decrease temperature. In addition, we recorded weights and in some cases took morphological measurements (see Correction).

We performed 47 immobilizations of 13 individual *C. owstoni* between Sept. 1997 and July 1998 using ketamine plus. (Two prolonged surgical procedures and three amputations that required repeated dosing are excluded from the data.) In addition to the dosage of ketamine plus, animals requiring amputations were given additional drugs such as butrophenol at 0.4mg/kg (IM) to reduce pain. We used SAS® (SAS institute Inc., Cary, N.C.) to perform data analyses. A mean and standard deviation was obtained for each individual civet and then a standard deviation and mean of the means was generated for dosage, temperature and pulse rate. The minimum and maximum values are represented by the lowest and highest value that occurred within the 47 anesthesia events. We used regression analysis to determine whether there was a relationship between temperature or pulse rate and time after injection. A students t-test was used to test whether there was a significant difference in mean mass between six female and eight male *C. owstoni*.

Two immobilizations of two adult male *Viverra zibetha* and four immobilizations of one juvenile male were performed between Sept. 1997 and July 1998 using ketamine plus. Data were reported separately for the two age classes. The analyses were the same as with *C. owstoni* excluding the regression for pulse rate.

*Table 2. Drug doses and physiological responses of 13 Owston's Palm Civets (*Chrotogale owstoni*) during 47 immobilization events using a mixture of ketamine, atropine and acepromazine.*

Owston's Palm Civet *(Chrotogale owstoni)*			
Dose (mg/kg)	**Ketamine**	**Atropine**	**Acepromazine**
N	47	47	47
Mean	17	0.04	0.73
Standard deviation	2.3	0.0	0.1
Minimum	11.5	0.03	0.5
Maximum	24.5	0.05	1.1
	Temperature(°C)		**Pulse rate**
N	47		47
Mean	37.1		154
Standard deviation	0.8		26
Minimum	34.9		80
Maximum	39.3		216

Results

Respective mean body weights of female and male *C. owstoni* were 2.6 ± 0.40 kg and 2.5 ± 0.54 kg and did not differ significantly (n=14, t=0.41; P=0.69). The mean dosage ± 1 SD for *Chrotogale owstoni* (n=47) was 17 ± 2.3 mg/kg ketamine (min=11.5; max=24.5), 0.04 ± 0 mg/kg atropine (min=0.03; max=0.05) and 0.73 ± 0.1 mg/kg acepromazine (min=0.50; max=1.1). Body temperature was 37.1 ± 0.8°C (min=34.9; max=39.3). Pulse rate averaged 154 ± 26 (min=80; max=216) (Table 2). Despite attempts at stabilization, regression analysis showed a significant decrease of body temperature with time (n=47, F=4.6; P=0.03, R^2= 0.03). There was no significant relationship between pulse rate and time (n=47, F= 3.63; P=0.06, R^2= 0.02). No vomiting occurred during 47 anesthesia events. In fact, only one adverse reaction occurred involving mild tremors.

Mean dosage ± 1 SD given to two adult *V. zibetha* was 17.9 ± 1.7 mg/kg ketamine (min=16.6; max=19.1), 0.04 ± 0 mg/kg atropine, and 0.77 ±0.08 mg/kg acepromazine (min=0.71, max=0.82). Mean rectal temperature during two immobilization events was 39.7 ± 0.4°C (min=36.7; max=41.7). Pulse rate averaged 181 ± 4 (min=168; max=200). The average weight for two adult Large Indian Civets was 5.9 ± 0.49 kg. The juvenile received a dosage of 18 ± 0.32 mg/kg ketamine (min=14.8; max=18.6), 0.4 ± 0 mg/kg atropine (min=0.03; max=0.04) and 0.77 ± 0.01mg /kg acepromazine (min=0.64; max=0.80) (n=4). Mean body temperature was 36.9 ± 0.3°C (min=35.7; max=37.9) and pulse rate was 157 ± 5 (min=105; max=188). Body weight of the juvenile was 2.9 kg. The juvenile did not exhibit any adverse reactions. However, the two adult males had very high body temperatures after initial injection. To decrease body temperature dipyrone (500mg/ml) was given at a dose of 25mg/kg. Additional measures were taken that included placing rubbing alcohol on the pads and ears and giving subcutaneous fluids. In both cases the temperatures dropped to safe levels within 20 to 30 minutes (Fig. 1).

Discussion

Successful immobilization has been recorded for civets using KET and KET-XYL mixtures (Joshi *et al.,* 1995; Mudappa & Chellam, 2001; Streicher, 2001). We found that a combination of ketamine, atropine and acepromazine is a safe immobilizing agent to anesthetize Owston's Palm Civets and Large Indian Civets. Researchers have recommended adding a muscle-relaxing agent when using KET (Belant, 1992; Mitcheltree, 1999; Ramsden, 1976). Ketamine alone gives no muscle relaxation or analgesia (pain relief) so additional drugs should be added for surgical procedures. Ketamine plus includes the addition of acepromazine, which provides excellent muscle relaxation and overrides the rigidity induced by KET. In contrast, KET counteracts the hypovolemia (diminished blood volume) and cardiovascular depression caused by acepromazine. We used acepromamize as a muscle relaxant rather than xylazine because vomiting is not a common side effect. Vomiting, and its potential for causing aspiration, was avoided by using acetylpromazine as a muscle relaxant rather than xylazine. Vomiting has been reported using KET-XYL mixtures (Mudappa 2001, Streicher 2001). Increased salivation resulting from KET can be regulated with atropine sulphate (Ramsden *et al*., 1976). The presence of atropine sulphate in KET plus reduces salivation, prevents vomiting, and strengthens heart activity. We did not experience vomitus as a result of immobilization. Overall, ketamine plus provides a safe effective method to sedate small viverrids, allowing good sedation and muscle relaxation with a short duration of action. In addition, it can be prepared ahead of time allowing for easy transport and fast response in emergencies.

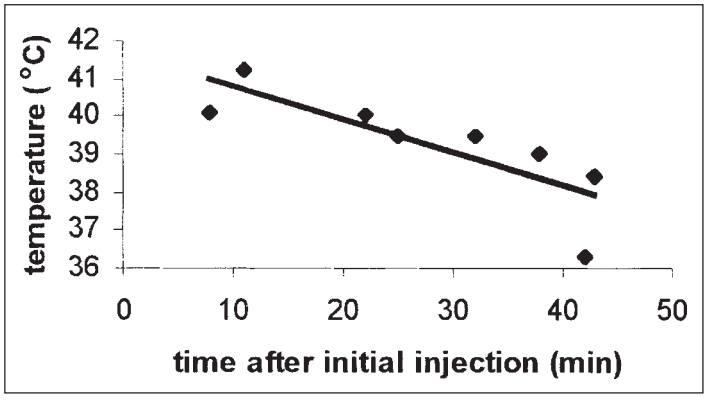
There are some disadvantages associated with using ketamine plus: (IV) injections must be given slowly; mixing acepromazine limits the total dose you can give to 3 mg (IM) or 1ml (IV). Tear production is decreased with ketamine, therefore the animal's eyes must be continually lubricated throughout the procedure. Acepromazine should not be used in animals in hypovolemic shock due to blood loss. Because ketamine lowers the seizure threshold it should be avoided in animals with head trauma. The suggested dose for ketamine plus is 0.1 ml/kg (IV) and 0.2 ml/kg (IM). However, we used an average dose rate of 0.3 ml/kg for (IM) injection of *C. owstoni* and *V. zibetha*.

During 47 immobilization events with *C. owstoni* using ketamine plus we experienced only one adverse reaction involving mild tremors. After initial injection, whenever body temperature fell below 37°C, we surrounded the animal with hot water bottles to help thermoregulation. Mudappa & Chellam (2001) reported a slight temperature decrease with Brown Palm Civets using KET-XYL and Streicher (2001) experienced low body temperatures on cold days using KET-XYL on *C. owstoni*. In addition, body temperatures of martens and weasels dropped after injection of KET-XYL and KET alone, respectively (Belant, 1992). Although, regression analysis of temperature and time showed a significant P-value for *C. owstoni,* R^2=0.03 is not considered biologically significant. The data were confounded because of our attempts to help the animal thermoregulate, thus raising the temperature after an initial drop. Therefore, we recommend having hot water bottles or heating pads available during immobilization events. In contrast, adult *V. zibetha* exhibited high body temperatures after induction. Temperatures were reduced via dipyrone, subcutaneous fluids, and rubbing alcohol. It is possible that greater initial temperatures may have resulted from increased capture avoidance activity prior to injection. However, during four immobilization events of a juvenile *V. zibetha* temperatures decreased after injection. We suggest that restraint of Indian Civets be done quickly and with extreme caution to avoid stress. A shift cage might be a good alternative when injecting this species.

Pulse rate varied widely between individual civets of both species and no relationship was found between time of induction and pulse rate.

Future research may determine the range of normal resting heart rate and body temperature in *C. owstoni* and *V. zibetha.* Immobilization monitoring may be done more effectively with such physiological data.

*Fig. 1. Post-injection changes in body temperature for two adult Large Indian Civets (*Viverra zibetha*). The trend was significant (Regression analysis P= 0.01; R^2= 0.88).*



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Correction

Attentive readers will have remarked that Table 1 on page 20 in Newsletter 26 (April 2002) made no sense at all. We bungled (in fact, we blame the computer). Our apologies to our readers and to Linda King. This time we hope to get it right:

Table 1. Summary statistics for body measurements (mm) and weight (kg) for adult Owston's Palm Civets and adult male Large Indian Civets. Total length and tail length were excluded for two amputees of Owston's Palm Civet.

(mm)	Total length	Tail length	Hind foot	Ear length	Girth	Weight (kg)
Owston's Palm Civet						
N	6	6	8	8	8	14
Mean	1038	430.3	85	50	290.1	2.6
Standard deviation	145	26.6	7.6	5.3	85.6	0.47
Large Indian civet						
N	3	3	3	3	3	3
Mean	1340	440	120	57	370	5.9
Standard deviation	230	53	0	11.5	26.5	0.49

Northern exposure!

The Wolverine (*Gulo gulo*) is thinly distributed throughout the whole of the Arctic, but in Europe it is particularly rare. Sweden has around 350, Finland 100 and Norway perhaps 230 animals. When a condemned den is located, Norway's 'specialist management team' dig down, shoot the mother and inject the cubs with a lethal dose of poison. People can also be licensed to track them across the snow and shoot them. Since October 2000, the total slaughter of Wolverines in Norway has accounted for at least 85 animals. A tiny, isolated population in the south-west, centred around Dovrefjell and Rondane National Park is genetically distinct from the northern animals, and there are only 50 left. Last year, the Norwegian authorities even destroyed a den here, as well as killing at least 14 Wolverines. In Sweden, Wolverines are totally protected, and only under very stringent conditions will a one-off licence be issued to cull a rogue Wolverine that is harassing livestock.

Norway, however, is not only killing its Wolverines but also its Eurasian Lynxes, Grey Wolves, and even Brown Bears.

The situation for the Eurasian Lynx is critical. Throughout the 1990s, more than 100 lynx were shot each year. The number of family groups has halved since 1995 and the population is probably only 200 to 250. Because the powerful, local hunting committees are dominated by farmers, the quotas keep increasing. In comparison, Sweden, which has a lynx population of more than 1,000, set a quota of 90 last year, and even that was challenged. At current rates of destruction Norway's lynxes face total elimination.

The situation of the Grey Wolves is, if possible, even worse. In February 2001, there were reckoned to be 28 wolves in the whole of Norway. By the end of March, the 40-strong hunting team had killed nine of them.

Last but not least Norway is not even managing its Brown Bears properly. Norway has between 26 and 55 bears but culls them at the unsustainable rate of between 10 and 20 per cent a year. In comparison, Sweden, with its secure bear population of over 1,000 allows fewer than 4 per cent to be culled.

Sheep subsidies and compensation for predator damage cost Norway more than £140 million a year with an additional £9.7 million for reindeer! Inevitably there is scope for fraud: reindeer herders in north Norway were claiming compensation for the loss of 40,000 calves a year to Wolverines and Golden Eagles!

Abstract of:

Mills, S. 2002. Norway's carnivores. The final solution. *BBC Wildlife* 20(6):64-66.

BBC-Wildlife asks to contact Norway's environment minister Børge Brende, PO Box 8013 Dep, N-0030, Oslo, Norway and borge.brende@md.dep.no and ask why Norwegians cannot live with their carnivores.

We could add: Possibly it would not be a bad idea to think twice before taking a holiday in Norway as long as this disgraceful policy continues.

Preliminary observations of Lowe's Servaline Genet (*Genetta servalina lowei*) from Udzungwa Mountains National Park, Tanzania

Daniela De LUCA[1] and Noah E. MPUNGA

Introduction

Tanzania is home to the highest diversity of mammals in Africa including more than half of the continent's carnivores (Boitani *et al*., 1999). Among the 35 confirmed species many are considered to be of global conservation concern (Myers, 1975; Nowell & Jackson, 1996; Woodroffe *et al*., 1997; Hilton-Taylor, 2000), with habitat modification and human persecution considered to be the main causes of concern (Sunquist & Sunquist, 2001; Sillero-Zubiri & Laurenson, 2001).

Despite a long history of observation and outstanding ecological research in Tanzania, carnivore distribution ranges and the extent of threat are far from clear. This is particularly so in the more remote regions, where often the only information is the documentation of Kingdon (1977) and the predictions of continental-scale databanks (Boitani *et al*., 1999). Tanzania's remarkable systems of mountains (e.g. the Eastern Arcs and Southern Highlands) are important centres of biotic endemism (Kingdon, 1990; Lovett & Wasser, 1993) and many montane areas are seriously threatened by habitat degradation and modification. However, very little research and hence conservation attention has been paid to the carnivores, especially the smaller species. Indeed, according to recommendations by IUCN specialist groups (Schreiber *et al*., 1989), the Eastern Arcs and Southern Highlands must be surveyed in order to properly address the specific needs of carnivores and to develop suitable conservation initiatives.

The Udzungwa Mountains are a major component of the Eastern Arc Mountains hotspot and contain some of the most biologically important forests in Africa (Lovett & Wasser, 1993). Despite high levels of diversity and endemism and concomitant importance for global biodiversity, they are also among the most threatened ecosystems in the world (Bakarr, 2000). Efforts to document existing biodiversity in the Udzungwa began relatively recently (Rodgers & Homewood, 1982; Various authors, 1998; Ehardt *et al*., 1999; Dinesen *et al*., 1999), however, there have been no surveys up to now specifically to determine the carnivores of the area.

Our research was thus set up to provide information on the status, threat and distribution of carnivores (particularly the Mustelidae, Viverridae and Herpestidae), in areas considered to be data-deficient and of critical conservation significance by virtue of their biodiversity and endemism. Through a combination of ecological field research and detailed village interviews the project is addressing carnivore presence and diversity, habitat preferences and what limits their abundance (threats). A current focus is on the nocturnal forest species which are the most elusive and by far the least known. The project is still in its early stages and many of the data are yet to be analysed. However, this paper reports on some preliminary results from photo-trapping in the forests of Gologolo Mountains of Udzungwa Mountains National Park, south-eastern Tanzania.

Fig.1. Lowe's Servaline Genet (Genetta servalina lowei) *from the Gologolo Mountains, Udzungwa Mountains National Park.*

Fig.2. Lowe's Servaline Genet (Genetta servalina lowei) *from near Mwanihana Peak, Udzungwa Mountains National Park.*

Results

On the 17th of April 2002 at 21:12 in the Gologolo Mountains (07° 47.59'S, 36° 49.87'E), in a remote sub-montane forest (980 m asl) on the eastern side of the Udzungwa Mountains, we photographed with a camera trap set 30cm above the ground (Fig.1) the little-known Lowe's Servaline Genet *(Genetta servalina lowei*). Identification was confirmed by spot patterns and colouration, because no genetic material is yet available. Another photograph of the same subspecies (Fig.2) was taken in June 2002 at 1,800 m (07° 49.00'S; 36° 49.53'E), approximately six hours walking distance from the first location at the edge of a bamboo forest near Mwanihana peak.

Lowe's Servaline Genet is a subspecies that is known only from one incomplete skin found by Willoughby Lowe in 1932 in Dabaga, some 100 kms to the south-west of Gologolo. The original skin is housed in The Natural History Museum, London. Being both morphologically and geographically distinct from other

servaline genets, it was described as a separate subspecies as *"neither its pattern nor its provenance allow it to be included with any other known form"*. Furthermore, it has a yellower orange base colour, has white facial spots suffused with orange and the legs and feet are lighter coloured compared with all other subspecies (Kingdon, 1977). Only the capture of an animal (or genetic analysis) will show if it is a separate species.

The species itself the 'Servaline Genet' (of which this is one of six subspecies) is a nocturnal and primarily arboreal animal, endemic to the forest belt of central Africa from southern Cameroon and Equatorial Guinea to eastern Congo. There are also populations in southern Sudan, western Uganda, northern Rwanda, and western Kenya. In 1998 a new subspecies was described from the Island of Unguja (formerly known as Zanzibar) (Van Rompaey & Colyn, 1998).

With the exception of the new subspecies from Unguja, Lowe's Servaline Genet is the most geographically isolated and least well known of all subspecies. These are the first photographs within Udzungwa Mountains National Park. According to Frontier-Tanzania (2001), a specimen was also caught in a live trap and photographed before release during a survey in August 2000 in Nyumbanitu Mountains, outside the park some 70 km from Gologolo. The subspecies is approximately 40-50cm in head-and-body length (75-95cm including the tail). Although almost nothing is currently known of its ecology, our initial observations indicate that it seems to have a wide altitudinal range (between 900 and 1,800 m), favouring both sub-montane forest as well as high altitude bamboo.

Conservation Implications

The true extent of the distribution and abundance of Lowe's Servaline Genet is not known. It is possible that the species has been under-recorded, as few people have carried out surveys within its presumed range. Indeed, only future work will shed more light on the species. That notwithstanding, the animal has been recorded only inside protected forests, indicating that its survival may be linked directly to the conservation of forest habitats. Gologolo is bordered to the east by a heavily populated area, and forest exploitation has been high in the past. However, since the park was gazetted in 1992 exploitation has been regulated and limited to fuelwood and medicinal plant collection. Forest fires, often initiated by poachers, remain a serious threat and the volume of forest within the park has thus decreased over the years (Bakarr, 2000). On the Nyumbanitu Mountains, the success of a joint forest management project co-funded by the Danish Government (DANIDA-MEMA) may also prove to be an important factor for the conservation of this rare subspecies.

Meanwhile, we will continue to monitor this and many other species of small carnivores, investigating their distribution, abundance and threats (including possible consumptive use) with a view to providing much needed management-related information for this diverse but poorly known part of Tanzania.

Acknowledgements

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The status of carnivores on Bioko Island, Equatorial Guinea

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Introduction

The island of Bioko (2,017 km^2) is located on the West African continental shelf in the Gulf of Guinea (Fig.2). The island has been isolated from mainland Africa for approximately 14,000 years, and is now separated from the Cameroon coast by 32 km of shallow ocean.

Three dormant volcanoes form the boot-shaped island: Pico Basilé (3,011m elevation) in the north (top of the boot); Pico Biao (2,009 m) in the southeast (heel); and Gran Caldera (2,261 m) in the southwest (toe). Precipitation on the island is very high with the southern region recorded to receive up to 11 meters per year (Teran, 1962).

There are six major natural vegetation types found on the island. They are mangrove forest; lowland forest (sea level to 800 m), montane forest (800 to 1,400 m), mossy forest (1,400 to 2,500 m), two types found at heights over 2,500 m- shrub formations and sub-alpine meadows; and mangrove forest. Tracts of abandoned plantation secondary forest and cultivated oil palm and banana groves are common habitats on Bioko as well (Butynski & Koster, 1994).

In comparison to the mainland, the island has a limited mammalian fauna of 65 species. Twenty-six of these are bats with most of the remainder being rodents. Other mammals found on Bioko are two species of duiker, ten species of primates, the West African Tree Hyrax *Dendrohyrax dorsalis* and the Tree Pangolin *Phataginus tricuspis* (Kingdon,1997).

Fig. 1. Front and side photographs of a linsang, Poiana richardsonii richardsonii*, taken by R. Harrington in the forests on the south-western part of Bioko Island, January 2000.*

Although the number of species is low Bioko has developed and sustained a distinctive mammalian fauna as a result of its post-Pleistocene isolation from mainland Africa. For example among the large mammals found on the island are at least four endemic subspecies of diurnal primates (Drill, *Mandrillus leucophaeus poensis*; Red Colobus*, Procolobus pennantii pennantii*; Preuss's Guenon, *Cercopithecus preussi insularis*; Russet-eared Guenon, *Cercopithecus erythrotis erythrotis*) (Butynski & Koster,1994) and one endemic subspecies of duiker (Blue-*Cephalophus monticola melanopheusi*) (Butynski *et al*., 1995).

Four species of Carnivora have been listed as occurring on the island. They include three viverrid species (Central African Large-spotted Genet, *Genetta maculata*; Central African linsang*, Poiana richardsonii richardsonii*; African Palm Civet*, Nandinia binotata binotata*) and one mustelid species (Swamp Otter, *Aonyx* [*Paraonyx*] *congica poensis*). Of the four species three are considered to be endemic subspecies: the genet, linsang and otter (Kingdon, 1997).

Working under the auspices of the Bioko Biodiversity Protection Program (BBPP), a joint project of Arcadia University (USA) and the Universidad Nacional de Guinea Ecuatorial (UNGE), we have taken part in eight field surveys (March 1990-G.H., January 1996-R.B.& G.H., 1997-R.B.& G.H., 1998-R.B.& G.H., April 1999-R.H.& G.H., January 2000-R.B., R.H.& G. H., January 2001-G.H. and January 2002-G.H.) of primates and duikers in Bioko's Gran Caldera Scientific Reserve located in the southern end of the island. During the surveys other species of mammals, birds, reptiles and amphibians have been recorded as well.

In addition to these annual field surveys, local BBPP personnel have recorded information on the wild animals offered for sale in the island's only organized bushmeat market, in the capital city of Malabo. In 54 months beginning in October 1997, more than 37,900 individual animals have been identified and their location and method of capture has been recorded. We have also interviewed local employees of BBPP and well as several individuals of the Equatorial Guinean Forestry Department on the identification and status of the larger mammals found on Bioko (Hearn & Berghaier, 1996; Hearn & Berghaier, 1997). Based on this information, we report the following evidence for the current status of these four carnivore species on Bioko Island.

Central African Linsang, *Poiana richardsonii richardsonii* (Thomson 1842)

The Central African Linsang was originally named from a specimen from Bioko Island (the genus *Poiana* was derived from the island's earlier name, Fernando Po) and has been consistently reported from the island in all subsequent studies. For example, the German mammalogist Martin Eisentraut (1973) made two visits to Bioko Island, the first for 6½ months in 1962-63 and the second for 2 months in 1966, as part of his study of mammals of the West Cameroon and Bioko Island region. He was able to get two pelts and three freshly killed carcasses during these visits, all from the slopes of Pico Biao in the Southern Highlands region of the island. He describes the linsang as "definitely not rare on Fernando Po."

The linsang has also appeared in our bushmeat market surveys, but only infrequently. We have recorded five linsang: one from Pico Basile; one from Riaba; and, three from the area near Luba. In two earlier bushmeat market studies by Fa *et al.* (1995, 2000), one in 1990-91 and the other in 1996, no linsang were recorded. Likewise, a two-month study of the hunting practices of the Bubis in the southern highlands area did not find any evidence of hunting of this species (Colell *et al.*, 1994).

With a weight of only 500 to 700g, the linsang is one of the smallest animals to be sold in the bushmeat market. The other more commonly sold mammals in the same weight range, including juvenile Emin's Giant Pouched Rat, *Cricetomys emini* (1,031 carcasses), Giant Squirrel, *Protoxerus stangeri* (176 carcasses) and Lord Derby's Anomalure, *Anomalurus derbianus* (23 carcasses), all sell in the same price range of approximately 1,500 f.cfa ($2.50) as the linsang. Some local sources reported that it was hunted for its spotted coat, and used by Bioko's Nigerian Moslem community for wallets and wristbands, rather than for its meat. Some BBPP personnel have told us that this animal is considered sacred to the island's predominant tribe, the Bubis, and it is thought that bad luck will result if one is killed. However, one of us (GWH) recently (January 2001) saw two linsang skins drying by the doorway of a house in the Bubi village of Ureca near the southern coast of Bioko Island. When questioned about the species, which is occasionally trapped near the village, the homeowner presented one skin as a gift. This skin was photographed and then subsequently given to the Universidad Nacional de Guinea Ecuatorial in Malabo.

We were also able to obtain photographs of this species in the wild. On 12 January 2000, three participants (including RH) on BBPP's annual survey of Gran Caldera mammals encountered a linsang walking parallel to the Gran Caldera access trail (immediately west of the Rio Tudela/Ole) approximately 4.6 km north of the southern coast at about 17:10. A group of Black Colobus monkeys (*Colobus satanas*) was nearby. The linsang was observed and then photographed twice in a dry, rocky streambed with relatively little vegetation, before it fled to the forest (Fig.1). This is the first time that this species was observed during the BBPP field surveys and, to the best of our knowledge, the first time it has been photographed in the wild on Bioko Island.

Central African Large-spotted Genet, *Genetta pardina poensis* Bocage, 1895

The existence of a genet on Bioko Island has been problematic. Only two specimens have been described: The first (*Genetta poensis*), by Waterhouse in 1838, was part of a shipment of specimens said to be from Bioko Island but whose actual origin has been questioned (Pocock, 1907; Cabrera, 1929; Eisentraut, 1973; Rosevear, 1974). Although actually owned by Spain, Bioko Island and its north coast port (now Malabo, then Port Clarence) served as a major British outpost in Africa throughout much of the nineteenth century and ships often stopped on their way back to England. As a result, specimens picked up earlier in the voyage from the African mainland south of Bioko might have become confused with island specimens. However, even if the specimen was actually from Bioko Island, its relationship to mainland species remains unclear (Powell & Van Rompaey, 1998). The second (*Geneta insularis*), by Cabrera in 1921, was based on a specimen collected at Rebola, a town immediately east of the capital city of Malabo on Bioko's northern coast. Basilio (1962, cited in Eisentraut, 1973) reported that these genets were actually more common on Bioko Island than on the mainland.

If a genet exists on Bioko Island, it is now a rare species. Eisentraut (1973) did not collect this species on the island, although he was able to obtain a Large-spotted Genet specimen from the mainland near Mt. Cameroon. No genets have appeared in any of the Bioko Island bushmeat market surveys, although this species, with a weight of 1.5 to 3.1 kg, is well within the range of bushmeat species. In fact, Fa *et al.* (1995) reported 32 Servaline Genets (*Genetta servalina*) (1.0 – 2.0 kg) during a 1990-91 survey of 6,160 carcasses enumerated from Rio Muni (mainland Africa). The species was not reported from a two-month study of the hunting practices of the local tribe, the Bubis, on Bioko (Colell, *el al*., 1994).

African palm civet, *Nandinia binotata binotata* (Gray, 1830)

We have never recorded the African Palm Civet in either our field surveys or bush–meat market data, although its size (2.0-3.2 kg) would make it a logical bushmeat species. Our local sources tell us that they have never seen this animal on the island. The 1990-91 bushmeat survey by Fa *et al.* (1995) did not report the animal from Bioko although, in comparison, 72 were counted among the 6,160 carcasses from Rio Muni on the mainland. The species is frequently found on the mainland areas close to the island. It is considered as being common in the freshwater and beach-ridge forests of the Niger Delta (Van Rompaey & Powell, 1999) and is recorded as being one of the most common civets on Mount Cameroon (Eisentraut, 1973).

Eisentraut (1973) considered it very rare on Bioko. He was unable to collect a specimen. He was ready to delete the species from the island's fauna list until he received a letter from Padre Basilio, an individual he considered a very efficient local naturalist, who told him of a young female captured in January 1956, near Moca in the southern highlands (Eisentraut, 1973).

Swamp Otter, *Aonyx (Paraonyx) congica poensis* (Hinton 1921)

This species, and its status as an endemic subspecies from Bioko island, has been accepted for almost two hundred years (Waterhouse, 1838) and is still noted in current literature (Kingdon, 1997). However, others have contested its status on Bioko (Cabrera, 1929; Pocock, 1907; Eisentraut, 1974), again questioning whether specimens attributed to Bioko Island were in fact from mainland Africa.

Eisentraut was not able to collect this species on Bioko Island and he noted that Cabrera had doubts about the site of origin of a skin that he described in 1929 and that Pocock in 1907 expressed doubt about the origin of Waterhouse's specimen as well. After reviewing these concerns Eisentraut concluded that Waterhouse's specimen had mainland, rather than island origins. Therefore, he deleted the Swamp Otter from the list of Bioko's mammals on the grounds that it had never existed on the island.

We have identified an additional source of information on the status of Bioko's forest mammals at the end of the nineteenth century. Mary Kingsley, in her well-known "Travels in West Africa," (unabridged version, 1897, p.60) remarks that the rivers of Fernando Po supported "a very pretty otter (*Lutra poensis*) with yellow brown fur quite golden underneath: a creature which is, I believe, identical with the Angola otter." Although she was better known for her adventures than her science, Kingsley worked with naturalists at the British Museum and routinely collected specimens,

especially fish, as part of her travels. Her other remarks on Bioko Island mammals were accurate, and her description of the otter agreed with that given by Waterhouse (1938).

The Swamp Otter has not been seen on survey or found in any bushmeat market data collected on Bioko Island. Fa *et al.* (1995) reported no river otters in their Rio Muni (mainland) bushmeat surveys although with weights of 15-25 kg, this animal would be very profitable as bushmeat. Both the Swamp Otter and the Spotted-necked Otter presumably occur in Rio Muni but there is no recent information about either species (Turley *et al.*, 1990).

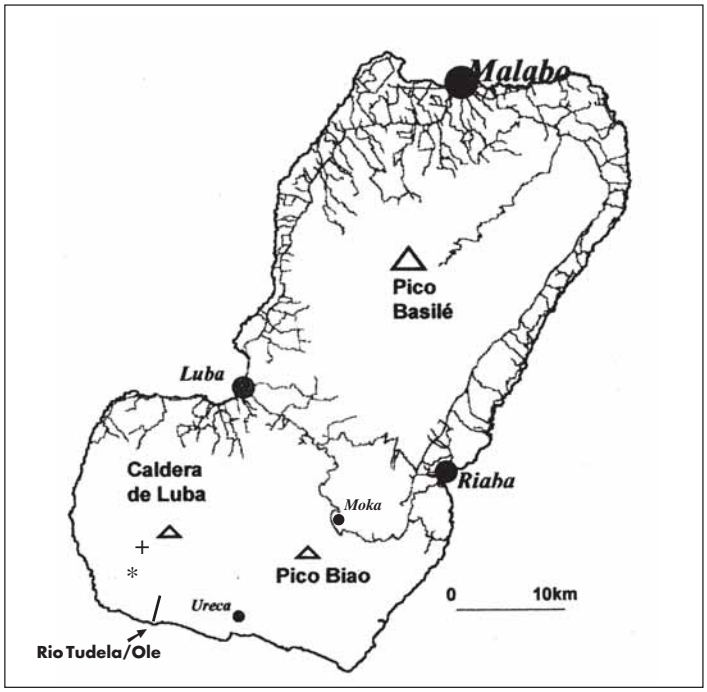
The Swamp Otter is not found in either the neighboring mainland areas of the Niger Delta (Van Rompaey & Powell, 1999) nor on Mount Cameroon (Eisentraut, 1973). In the Niger Delta both the Cape Clawless (*Aonyx capensis*) and Spotted-necked Otters (*Lutra macullicollis*) have been noted with *Aonyx capensis* being considered as common (Van Rompaey & Powell, 1999).

Typical swamp otter habitat, described by Kingdon (1977) as montane marsh and lowland swamp forest, existed on Bioko Island, and could have supported this species into the nineteenth century. De La Fuente (1972, cited in Kingdon, 1977) in his summary of the luxury fur trade, singles out the pelt of the swamp otter subspecies from the Cameroon highlands, *Aonyx congica microdon,* as being in great demand in Europe. It seems plausible that the fur trade may have eliminated the closely related subspecies from Bioko even before it was adequately documented in the 20th century.

Conclusion

Our field and market surveys have produced positive evidence (photographs and bushmeat market carcasses) of only one of the four carnivore species previously recorded as occurring on Bioko. This one species, the linsang, still exists in small numbers in more remote parts of the island.

Fig. 2. Map of Bioko Island showing locations of mountains and towns. The location of the linsang photographs (Fig. 1) is indicated by an asterisk; the location of the unknown small carnivore sighting is indicated by a plus sign.



Although we have no definite evidence of either Large-spotted Genets or African Palm Civets on Bioko Island, we believe that another forest-dwelling small carnivore might exist. Our local sources have always reported that another small carnivore, in addition to the linsang, could be found on the island. They called it "the cat of the forest" and related that it eats snails.

In January 2000, three BBPP survey participants (including GWH and experienced local guide Gonzalo Pons) observed an animal in the Gran Caldera on two different occasions that looked like a small carnivore. The first occurred on January 11 at 16:12 hrs. The animal ran along low-lying branches for about 10 m and then climbed a tree, where it was in view for several minutes. The second sighting took place on January 13th at 08:30 hrs. This animal was observed in a tree as well. Both sightings occurred on the same (south) census trail, about 1 km apart. The animal was not seen during the January 2001 census of the same area.

Although both the Large-spotted Genet and the African Palm Civet may have originally been described from Bioko Island specimens, their existence on the island today is uncertain. The Large-spotted Genet was routinely included in early lists of Bioko Island mammals (Cabrera, 1929; Krumbiegel, 1942) but hasn't been seen since these reports. The African Palm Civet has not been reported on Bioko Island since 1956. The unknown mammal we saw in the Gran Caldera forest in January 2000 could have been either of these species, or possibly even another species. The observers were familiar with the linsang (longer tail) and the local squirrels, and found this mammal to be distinctly different in appearance and locomotion.

The Swamp Otter was also originally described from a Bioko Island specimen. Although its existence on Bioko Island has been disputed, we believe the commentary by Kingsley provides convincing evidence. It too is now not recognized by knowledgeable local people (BBPP employees and Forestry Department employees), and has not been reported among the more than 40,000 bushmeat carcasses enumerated by various investigators in the Malabo market across the last 10 years. We conclude that the Swamp Otter is now extinct on Bioko Island.

If these conclusions stand, the demise of the Swamp Otter would represent the second recognized extirpation of a mammalian species from Bioko in recent history. The first, the African Forest Buffalo, was eliminated from Bioko Island between 1860 and 1910 by excessive hunting (Nosti, 1947; Butynski *et al*., 1996). Other mammals are now at immediate risk due to excessive hunting for the Malabo bushmeat market. These include the seven monkey species (Drill, *Mandrillus leucophaeus*; Black Colobus, *Colobus satanas*; Red Colobus, *Procolobus pennantii*; Red-eared Guenon, *Cercopithecus erythrotis*; Crowned Guenon, *C. pogonias pogonias;* Putty-nosed Guenon, *C. nictitans*; and Preuss's Guenon, *C. preussi insularis*) as well as one of the two duiker species, (Ogilby's Duiker, *Cephalophus ogilbyi*). Other hunted mammals, such as the Tree Pangolin, *Phataginus tricuspis,* are also vanishing rapidly, but little information exists on their status. Bioko presents special forest mammal conservation problems because the rapidly rising bushmeat prices, the result of increasing scarcity, do little to deter hunting on an island where cheaper protein sources are readily available and bushmeat is a very high-priced luxury. In fact, new prosperity in Equatorial Guinea, a result of the recent development of offshore petroleum reserves, actually provides the financing for additional hunting, making containment of the problem unusually difficult.

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Free love badger-style

One of the most surprising facts about badgers is that despite the large numbers of keen badger watchers, very few have seen badgers mating. This led to the long debate on when badgers mate, and the duration of gestation. Mortimer Batten was certain back in the 1920s that spring was the mating time, but the early editions of Neal's classic "The badger" in 1948 opted for late summer. Of course it is now well established that a spring post-partum rut is the norm, but mating may occur in any month of the year and yet cubs are in the spring thanks to delayed implantation.

Looking out for the spring rut can be chilly and unproductive business in wintry January-March, but over several years in the Cotswolds it has been relatively easy to see rutting behaviour. The very high density of up to 30/km^2 is only known to be exceeded by the Oxford Wytham Reserve population with 45/km^2; but it is hence possible to visit 5-6 setts in a night, they are only some 500 m apart based on nearest neighbour spacing. And the rut is characterised by early emergence of the boars who rush about with very typical deep "rumble-purring", displacement earth scratching, and musking.

When one or more sows are receptive there may be intense mutual grooming, noisy squabbles and excitement. Hence creeping up to setts upwind, it is easy to discover if any have badgers in full rut. Recently I saw seven erupt from one sett, and two of the 'girls' were clearly near peak oestrus, and were pursued noisily by 2-3 of the 'boys' each. Promiscuous mating has been seen before, indeed influxes of 'strange' boars may occur at peak rut. And studies of genetics underway in Wytham and Woodchester may unravel the extent of interbreeding between clans (Hancox, 1993).

Badgers are intensely social carnivores, and access to breeding females is the key to badger sociality and territoriality. Shared 'aunting' and even lactation may occur and sows teach cubs the home range, foraging skills, etc. But 'worming' is solitary since there is no point in cooperative 'hunting'. With superabundant worm prey it is absurd to claim that worm patches and an 'anti-social' lifestyle are the norm (Anon., 2001).

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The Ethiopian Genet, *Genetta abyssinica* (Rüpell 1836) (Carnivora, Viverridae): Ecology and phenotypic aspects

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Abstract

The aim of this note is to provide new data on the ecology and phenotypic variation of the Ethiopian Genet, *Genetta abyssinica*. New habitats and altitudinal limits, montane heather moorlands and Afro-alpine grasslands up to 3,750 m asl, are reported from the Abune Yosef massif, in the Northern Highlands of Ethiopia. Preliminary data on its dietary habits indicate that small vertebrates are the main staple, with insects and fruits as complementary sources. Diurnal activity is also reported for first time (possibly a local response to prey on the diurnal rodents of high altitudes). *G. abyssinica* has two distinct colour forms: pale (in the lowlands) and dark (in the highlands). Colour variation is probably associated with differences in humidity conditions. The number of pale tail rings ranges from 7 to 9 most probably reflecting individual variation.

Introduction

Genetta abyssinica (Fig. 1) is a rather small, short-haired genet with short legs, shortened face and a moderately long tail (nearly as long as head & body). The pelage is very distinctive, having a pattern of five longitudinal black stripes on the back rather than a series of spots as in other species. The spots on the lower flanks are also distinctly elongated, resembling stripes rather than spots. The tail is marked by at least seven pale rings and has a dark tip. Forefeet are distinguished by the absence of a hairy patch on the palmar surface (Coetzee, 1977). Skull measurements are given in Table 1.

G. abyssinica is smaller than the sympatric *G. genetta* and *G. maculata* but there is considerable overlap (Table 2).

Character	Holotype SMF-213	N	X	Min	Max
GSL	82.4	5	81.1	74.8	89.6
CBL	82.4	4	81.2	74.8	89.6
ROL	25.7	5	25.0	23.0	26.8
PAL	36.8	5	35.8	34.2	37.9
MAX	30.6	5	30.2	28.3	32.3
TYM	17.3	4	17.3	16.0	18.1
CAN	10.9	5	12.1	10.9	14.1
ROB	15.7	5	16.1	14.3	18.9
IOB	11.5	5	11.6	10.8	12.6
PAB	20.9	5	21.9	20.0	23.9
ZYG	40.8	5	41.7	38.8	46.4
BRB	28.4	5	28.6	27.6	29.7
MAS	25.2	5	26.8	24.4	29.8
BRH	23.4	5	24.6	22.2	26.8
MAL	55.7	5	54.6	50.5	59.5
MAN	33.5	5	33.0	29.9	35.2
CMH	20.5	5	21.4	18.7	24.3

Table 1. Cranial measurements (in mm) for *Genetta abyssinica*. N, number of specimens; X, mean; Min, minimum; Max, maximum. GSL, etc., see: List of skull characters and acronyms.

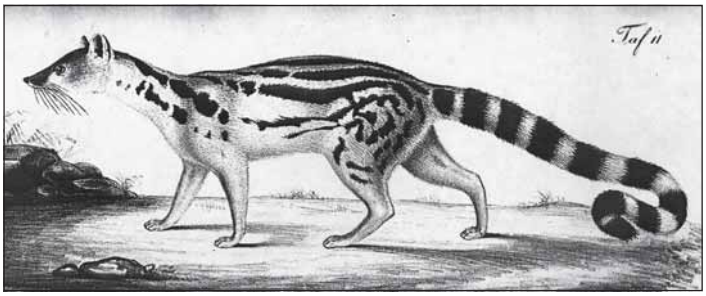


Fig. 1. Genetta abyssinica*. From Rüppell (1835-1840)*

Very little is known about its natural history. Rüppell (1835-1840) stated that "it was nocturnal in captivity" and Heuglin & Fitzinger (1866) that they could be "found in old buildings". Leyhausen (1973) observed that a captive, in contrast to the Felidae, did not pluck his prey. A tapeworm *Hymenolepis liguloides* and another *Dipylidium gervaisi* from a specimen from Eritrea was reported by Stiles & Baker (1935). Three *G. abyssinica* were kept at Frankfurt Zoo between 1949 and 1958 (Schreiber *et al*., 1989) and thus far only 16 museum specimens have been located (Table 3). Although recent work (Yalden *et al.*, 1996) has particularly extended the geographical and ecological range of this species, up to now, its behaviour, dietary habits and hence status remain unknown.

Taxonomy

Viverra abyssinica Rüppell, 1836, Neue Wirbelthiere z. d. Fauna Abyssinien gehörig, Säugeth. 1: 33, pl. 11. Ethiopia. Type locality: restricted to Gondar, Ethiopia by Schlawe (1981).

Anderson (1902) considered *G. abyssinica* as a form of *G. dongolana* (=*G. genetta*). Both Coetzee (1977) and Crawford-Cabral (1980-1981) placed *G. abyssinica* and *G. thierryi* in subgenus *Pseudogenetta.* A morphological cladistic analysis (Gaubert *et al.*, 2002) placed *G. abyssinica* and *G. thierryi* together with *G. genetta*, *G. tigrina*, and *G. angolensis* as a derived clade within the "savannah and grassland" species.

Pending further studies, the subgenus *Pseudogenetta* is likely to be considered non valid. There is no doubt about the validity of the species *G. abyssinica*.

Geographical distribution and ecological range

This rarely recorded, cryptic genet occurs along the Horn of Africa (Ethiopia, Sudan, Somalia, Eritrea and Djibouti), a very large territory where political instability and difficult access to remote areas have hampered systematic field investigations.

Until a short time ago, the geographical and ecological range of *G. abyssinica* was poorly known. It was formerly regarded as a montane endemic of the Ethiopian highlands (Dorst & Dandelot, 1972), and supposed to be associated with forested areas of the plateaux (Yalden *et al*., 1980). Additional records extended its geographical range to the lowlands of Sudan, Somalia, Djibouti and Eritrea (after its political independence from Ethiopia). These findings not only questioned the validity of its endemic status but

	G. abyssinica				*G. genetta*				*G. maculata*			
	X	Min	Max	N	X	Min	Max	N	X	Min	Max	N
CBL	81.4	74.8	89.6	5	86.8	83.3	91.2	11	85.7	80.7	91.8	13
ZYG	41.5	38.3	46.4	6	44.5	42.3	47.6	12	43.7	39.9	49.3	13

Table 2. Skull measurements of G. abyssinica (*from Ethiopia*), G. genetta (*from Ethiopia*), *and* G. maculata (*from Ethiopia, Sudan, and Somalia*) *in mm.*

also the reliability of historical records from the plateaux. As a result, its supposed ecological preferences shift from a montane forest form to a lowland one associated to dry, arid sub-desert areas and steppes (Yalden *et al*., 1980; Yalden & Largen, 1992). Finally, later revisions of collected specimens validated the former records on the Ethiopian highlands and lead the recognition that this species has an exceptionally wide altitudinal and ecological range from coastal plains to montane heather forests up to 3,400 m asl (Yalden *et al*., 1996).

Five specimens collected in Bados, Magangani, Kuka, and Ereif el Dik (Sudan) attributed to *G. abyssinica* by Allen (1914) were later re-identified in the Museum of Comparative Zoology, Cambridge, USA as not belonging to this species.

Abundance

Rüppell (1835-1840) found them rarer in Ethiopia than *G. genetta*. Heuglin & Fitzinger (1866) also found them "not numerous". According to Yalden *et al.* (1980) the species "appears to be very rare" and in 1996 "still seems to be remarkably uncommon". Eighteen months of collecting in the Chercher Highlands of eastern Ethiopia in the 1960s resulted in seven *G. genetta* and two *G. tigrina* (=*G. maculata*); no *G. abyssinica* was collected (Beadles & Ingersol, 1968). Present existence in Djibouti uncertain (Künzel *et al.*, 2000).

Study area

The Abune Yosef massif (12º12'N, 39º12'E) is located north of the city of Lalibela in the North Wollo province of Ethiopia (Fig. 2). Situated in the very extreme of the north-eastern side of the Ethiopian Highland physico-geographical region, it is limited by the fault escarpment of the Rift valley depression. The massif is part of the mountainous system surrounding and defining the basin of the Takezze River. It shows a complex mosaic of ecosystems, where montane savannah-woodlands, montane dry forests and Afro-alpine grasslands are represented. These ecosystems are sorted in altitudinal rings from 2,000 to 4,200 m asl, with diverse levels of human intervention (mainly agricultural activities and livestock grazing). No faunistic studies have been previously carried out in the Abune Yosef massif, with the exception of a brief survey on the Ethiopian Wolf, *Canis simensis*, by Marino *et al*. (1999).

Data here presented were recorded during two field studies conducted from December 26, 1999 to February 4, 2000 and September 27 to December 3, 2001 for an ongoing Biosphere Reserve project promoted by the Spanish Man and Biosphere (MaB) Program of UNESCO. The main goal of the fieldwork was to obtain an inventory of the large mammals and bird species of the massif.

Observations

Direct (sightings) and indirect (latrines) evidence of the presence of genets was found all along the three main ecosystems of the Abune Yosef massif: montane savanna-woodland, montane dry forest and Afro-alpine grasslands. Although the occurrence of other genet species (e.g. *G. maculata*) could not be completely excluded, we found no positive evidence for them. We observed two *G. abyssinica* individuals in the Abi Jakula and Zeyit areas, and also a *G. abyssinica* skin collected in the Degosay area. In addition, interviewed local people reported that genets (most of them positively identified as *G. abyssinica*) occur in Shumshiha, Medague, Abi Jakula, Astabir-Guadabiye plateau, Zeyit and Abune Yosef village areas.

Sightings

During the preliminary survey carried out between December 26, 1999 and February 4, 2000 we spotted two genets. On December 29, 1999 Belaynu Sefew (our field assistant) at 18h10 flash-lit (with a torch) a genet in the Abi Jakula moorland. Local farmers confirmed that genets, '*mitmat*', occur in the forest, and some of them informed that these genets have a striped pattern – a distinctive trait of *G. abyssinica*. On January 27, 2000 at 14h30 one of us (GD) spotted a genet in the disturbed heather moorland of Astókual, at 3,450 m asl, in the vicinity of the Abune Yosef village. Unfortunately, there was not enough time to clearly observe its fur pattern, but it looked striped, not spotted.

During the 2001 expedition we regularly surveyed the Abi Jakula forest and afro-alpine areas searching for more evidence of genets. On October 3, 2001, at 13h10 we clearly sighted a *G. abyssinica* on the north-western flank of the Abi Jakula *Erica-Hypericum* moorland, at 3,215 m asl. Located in an observation point above the forest we detected the genet slowly walking along the edge of a terrace at a distance of about 60 meters. Aided with 8 x 42 binoculars we had enough time (about 10 seconds) to clearly observe its unmistakably striped pelage pattern. This is the first report of *G. abyssinica* in a forested habitat. As mentioned above, this species was formerly supposed to be associated with forest habitats in the plateaux, but subsequent findings in lowland areas leaded to the rejection of this possibility (Yalden *et al*., 1980; Yalden & Largen, 1992; Yalden *et al*., 1996).

The Abi Jakula forest, located on the south-western side of the massif, at an altitude between 2,950 m and 3,250 m asl, corresponds to the montane dry forest ecosystem. It is one of the relatively large forested patches that still remain in the massif, but it is under growing human intervention. During our surveys we daily observed local people collecting wood and pasturing their cattle along the forest edges. Central parts of the forest are less disturbed because they are densely vegetated. The dominant species is *Erica arborea* but *Hypericum revolutum*, *Rosa abyssinica* and other species such as *Dodone viscosa* or *Clematis* sp. are relatively widespread and common. The forest sustains a large diversity of mammals and birds: the large mammal community includes Leopard *Panthera pardus*, African Wildcat *Felis silvestris*, Spotted Hyaena *Crocuta crocuta*, *Canis sp*.- probably Side-striped Jackal *C. adustus*, Hamadryas *Papio hamadryas*, Honey Badger *Mellivora capensis*, Slender Mongoose *Herpestes sanguineus*, Klipspringer *Oreotragus oreotragus,* and Rock Hyrax *Procavia capensis*.

On October 6, 2001 Belaynu reported that he sighted an *G. abyssinica* individual at 16h in the Zeyit area (at about 3,700 m.). We have no doubt about the reliability of this record as he clearly observed the *abyssinica* of the Abi Jakula forest and was aware about pattern differences among *maculata*, *genetta* and *abyssinica*. This sighting confirms the occurrence of *G. abyssinica* in the Afro-alpine ecosystem and that latrines and scats collected there are most likely attributable to this species (no other genet species has been so far reported to occur above 3,500 m –the lower altitude

level of the Afro-alpine belt). Until this sighting the sole record for this species above 3,000 m was a specimen from Geech, in the Simēn Mts. (FMNH 27218).

The large mammalian community of the Zeyit Afro-alpine areas includes *Panthera pardus*, *Felis silvestris*, *Crocuta crocuta*, *Canis adustus*, *Mellivora capensis*, Gelada Baboon *Theropithecus gelada, Oreotragus oreotragus,* North African Crested Porcupine *Hystrix cristata,* and *Procavia capensis*.

Latrines

Genet latrines were found in Afro-alpine and montane savannah-woodland complex ecosystems. Latrines contained an average of about 30 droppings each.

A latrine was found at 3,750 m asl on a rocky ledge on the southern flank of the Zeyit peak, a steep rocky area covered by high-grass steppe (mainly *Carex* tussocks) with scattered Giant Lobelias *Lobelia rhynchopetalum* and Globe Thistle *Echinops giganteum*. This latrine, found in the very same area where Belaynu sighted the genet on October 6, 2001 extends for about 350 m the highest altitude ever reported for *G. abyssinica*. Two other latrines were found in the Afro-alpine ecosystem, both on the basis of the escarpment to the west of the Abune Yosef village, at 3,680 m asl. They were north orientated, placed in rocky holes, and with a distance of 15 m between them. The area has steep slopes with medium to high-grass steppe and scattered lobelias.

The fourth latrine was found near Shumshiha, in the south-western and drier areas of the massif, at 2,150 m asl -in the Savannah-woodland complex ecosystem. This latrine was placed on a rocky ledge in a moderately plain, open, shrubby-grassy area dominated by several *Acacia* species. We have not observed any genet species in the lowland areas of the massif, but *abyssinica* seems a more likely candidate than *genetta* or *maculata* after consideration of ecological preferences, geographical distributions, and local interviews.

G. genetta as a xerophilous species is rarely found on the plateaux. This species is generally found in regions receiving less than 100 cm of annual rainfall (Yalden *et al*., 1980). It might be considered an unlikely candidate. *G. maculata* is widely distributed on the plateaux, but it tends to be markedly associated with humid grasslands and forested localities (Yalden *et al.*, 1980; Yalden *et al.*, 1996). Hypothetically, this species could be found in drier habitats as the montane savannah-*Acacia* woodland of the Abune Yosef, but local farmers have not recognised this species while they positively identified *abyssinica*.

Caracal *Caracal caracal*, *Felis silvestris*, *Crocuta crocuta*, Common Jackal *Canis aureus*, *Mellivora capensis*, Vervet *Cercopithecus aethiops,* Bushduiker *Sylvicapra grimmia, Oreotragus oreotragus, A*ardvark *Orycteropus afer,* Scrub Hare *Lepus saxatilis,* Geoffroy's Ground Squirrel *Euxerus erythropus,* and *Procavia capensis* are some of the other mammals found in this area.

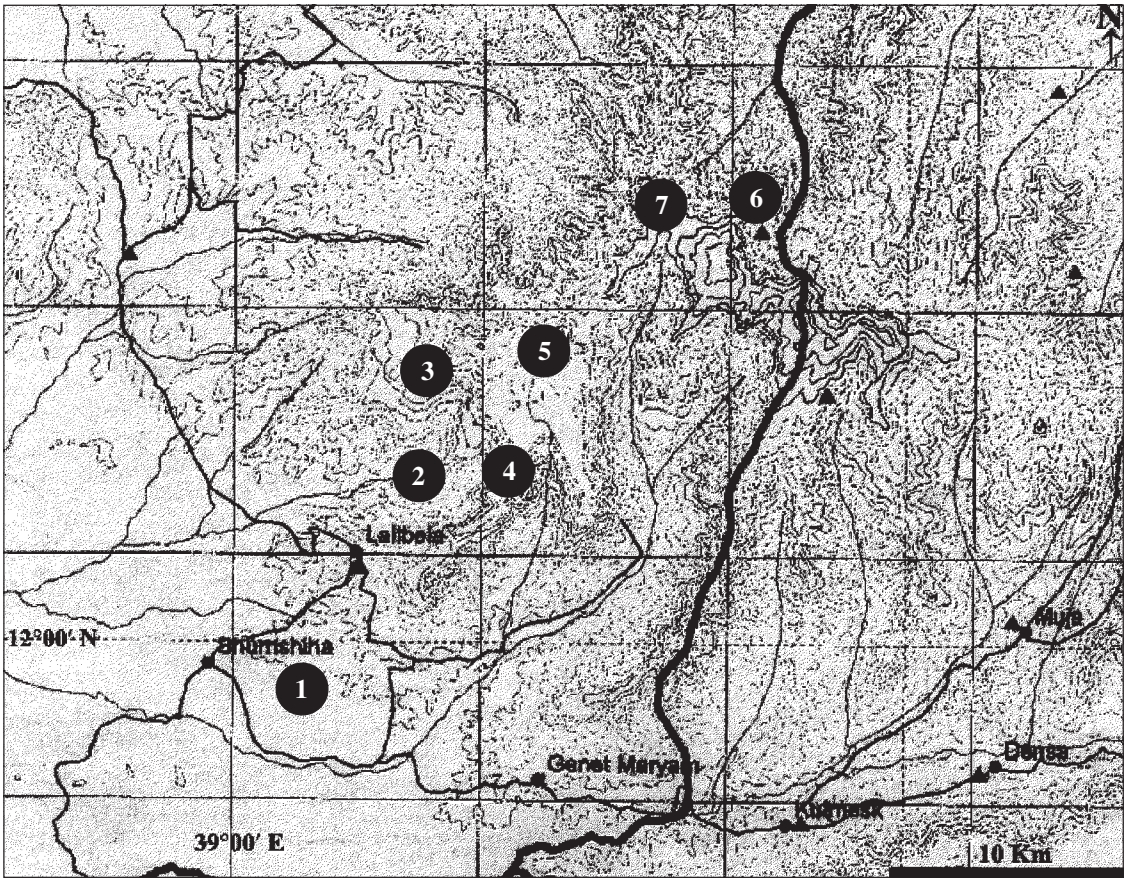
Diet

There is no information on the diet of *G. abyssinica* in its natural habitat. It is presumed to resemble that of other genets: a generalised diet of small vertebrates, insects and fruits (Kingdon, 1997).

We collected and examined 25 scats in order to provide preliminary information on dietary habits of this species. Small vertebrates (mainly rodents) constituted the main staple, with insects and seeds as complementary nutritional sources. Composition differences between habitat types were found.

In the Afro-alpine latrines, 15 relatively fresh scats were examined. They consisted mainly of rodent hair and bones (*Arvicanthis* and *Lophuromys* genus have been identified through inspection of upper molar patterns). Feathers and bones of small passerines were also found in some scats, but in small quantities - birds might be difficult prey in these open habitats, or less preferred

Fig. 2. Map of the Abune Yosef Massif. Numbers indicate localities. 1 Shumshiha, 2 Medague, 3 Degosay, 4 Abi Jakula, 5 Guadabiya, 6 Abune Yosef village, and 7 Zeyit (modified from Environmental Support Project DHV 2001).



prey. Most of the inspected scats contained also chitinous remains of insects, mainly from Coleoptera. However, their relative percentages have a wide degree of variation. They were found from none up to about 10% (average 3%). These data suggest that insects might be a rather opportunistic dietary complement in such habitats. Plant remains, particularly seeds, were found only in two scats and in remarkably small quantities (only 2 to 3 seeds/scat). Consumption of fruits, thus, appears to be very low and merely supplementary in the floristically poor Afro-alpine habitats. Moreover, these seeds resembled domestic lentils and they were probably obtained in cultivations around Abune Yosef village.

From the savannah-woodlands 10 scats were examined. Again, rodents and birds constituted the main staple, but they regularly contained more fruits and insect remains. Both seeds and chitinous remains represented an average of about 5-15 % of the total of the scat contents.

Such a variation might be related to differences in habitat trophic niche. At higher altitudes flora and fauna diversity is lower: fruits and insects are relatively scarce, rodents being the most abundant food. In contrast, lowland habitats are richer in overall food types, allowing genets to rely on a more diversified diet.

Scats average 13 mm in diameter -*G. genetta*: 14.1 mm in France (Livet & Roeder, 1987) and 15 mm in southern Africa (Stuart & Stuart, 1994).

Data here reported are preliminary and locally obtained and thus not applicable to generalisation about the dietary habits of a species that occurs in a wide variety of habitat types and regions. Data have been collected from only two montane habitat types and are based on a small number of scats collected early in the dry season. Dietary differences (as relative composition percentages) might vary to some extent depending on habitat type, region and season.

Phenotypic variation

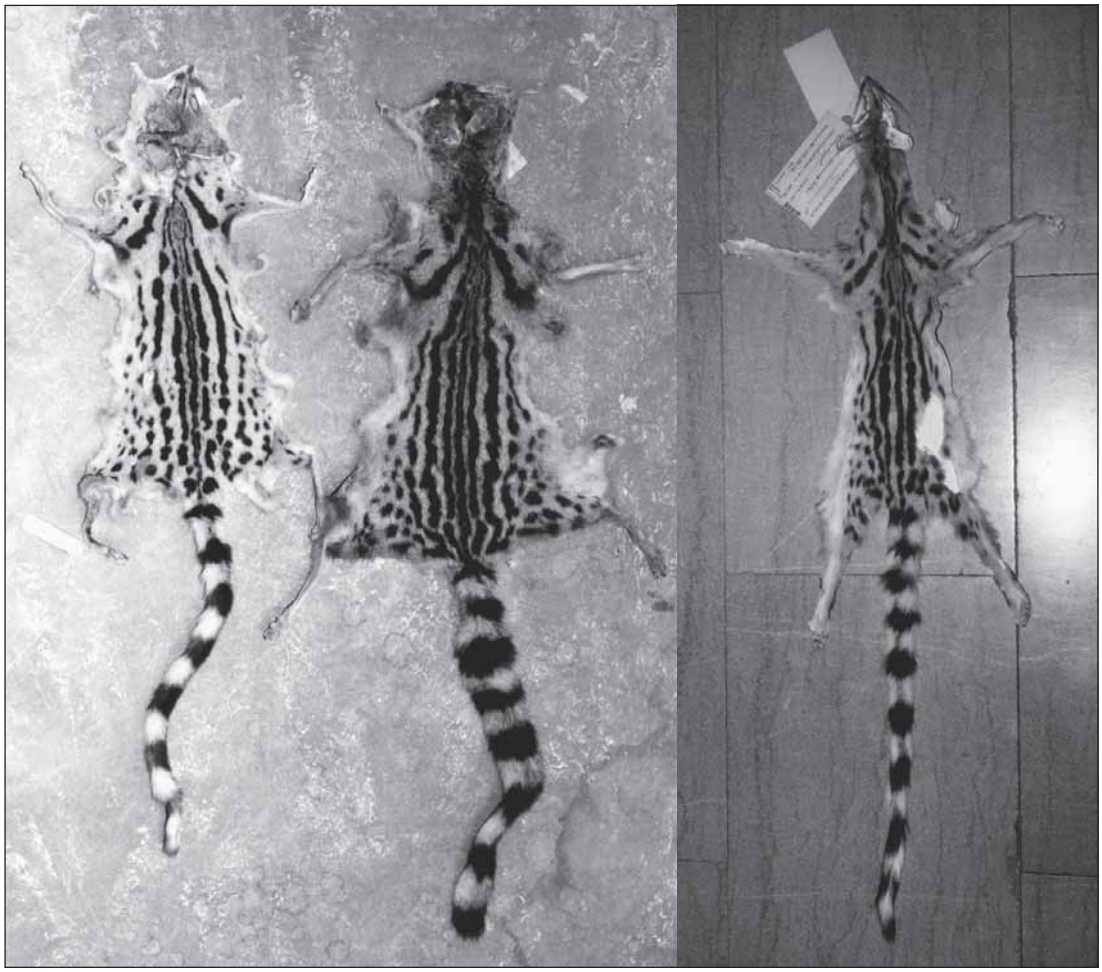
Thus far phenotypic variation in *G. abyssinica* has not been examined. Trying to understand if this variation is individual or geographical we have examined *G. abyssinica* skins housed in several museums.

Colour variation is probably related to differences in ecological conditions, rather than to regional or individual variations. Although we worked with only a small sample it seems that different overall colorations distinguish lowland forms from Ethiopia, Sudan and Somalia from those from the Ethiopian highland plateaux. Lowland forms are paler, because the absolute width of black stripes and black tail rings is significantly smaller than that of the plateaux forms. Tails of highland forms have clearly wider black rings and thinner pale rings (BMNH-4696), the opposite pattern characterising lowland forms (BMNH-3491420, Somalia). A specimen from Sudan (NMNH-342066) is intermediate: dark and pale rings of similar width (Fig. 3).

The number of pale tail rings varies from seven to nine, probably due to individual variation. SMF-213, ZMB-36744, ZMB-36746, FMNH-27218, FMNH-27025, and BMNH-4696 have seven pale tail rings; ZMB-36745, ZMB-36747, and BMNH-3491420 have eight; and NMNH-342066 and ZMB-36748 have nine pale tail rings; all tails have black tips.

The total pelage area coloured with black is more than 50% in highland forms while in lowland ones it is less than 50%. In addition, the yellow background is clearly paler in lowland forms (a rather light sandy yellow), being clearly more obscure in highland forms (a rather orange-yellow). Briefly, highland forms have more black colour and a darker tone of yellow; pelage of lowland forms is paler because they have less black and sandy light tone of yellow.

Fig. 3. Left: light form (BMNH-3491420) from Bulha, Somalia. Center: dark form (BMNH-4696) from Addis Ababa, Ethiopia. Right: intermediate form (NMNH-342066) from Bir Kansisrab, Sudan



Museum	Number	Collector	Number Date	Coll.	Locality	Country	Coordinates	Material	Sex	Age
SMF	213	Rüppell	IV<7	1832	Gondar	Ethiopia	12°39'N,37°29'E	skull & skin	M	adult
ZMB	36744	Heck	4		Addis Ababa (bought in)	Ethiopia	09°03'N,38°42'E	skull & skin	U	?
ZMB	36745	Heck			Addis Ababa (bought in)	Ethiopia	09°03'N,38°42'E	skin	U	?
ZMB	36746	Heck	270		Addis Ababa (bought in)	Ethiopia	09°03'N,38°42'E	skin	U	?
ZMB	36747	Heck			Addis Ababa (bought in)	Ethiopia	09°03'N,38°42'E	skull & skin	U	?
ZMB	36748	Heck	260		Addis Ababa (bought in)	Ethiopia	09°03'N,38°42'E	skull & skin	U	?
BMNH	4696	Gajdars	9		Addis Ababa	Ethiopia	09°03'N,38°42'E	skin	U	adult
FMNH	27218	Bailey	690	25/03/27	Geech, Simēn Mts.	Ethiopia	ca. 13°15'N, 38°27'E	skull & skin	M	adult
BMNH	23451	Mitchell	60		Bahr Dar Giorgis	Ethiopia		skull & skin	F	adult
AMNH	81048	Sanford-Legendre Abys. Exp.	157		Lake Metahara*	Ethiopia	08°58'N,39°57'E	skin	U	?
FMNH	27025	Osgood	6247	1926	nr.Addis Ababa	Ethiopia		skull frag. & skin	U	?
ZMB	1097	Lepsius?	1609		Sennar	Sudan	13°31'N,33°38'E	skull & skin	M	adult
FMNH	80818	Hoogstraal	10024	4/03/54	Bir Kansisrab, Jebel Elba	Sudan		skin	F	juvenile
NMNH	342066	Hoogstraal	10070	8/03/54	Bir Kansisrab, Jebel Elba	Sudan		skull & skin	M	adult
BMNH	3491420	Drake-Brockman	611	20/11/13	Bulhar, Brit. Somaliland	Somalia	10°24'N,44°26'E	skull & skin	M	adult
MNHN	1954-323	Chédeville			Somalie française	Djibouti		skin	U	adult

Table 3. Museum specimens of G. abyssinica*. See: Museum abbreviations – * The label of the specimen from Lake Metahara states that "the skull was stolen from hand by an African kite".*

Colour variation in mammals is usually influenced by differences in the degree of humidity between their habitats. Under increasing levels of humidity individuals become progressively darker. In *G. abyssinica* colour variation between lowland and plateaux forms might be associated with humidity differences.

The annual amount of rainfall in the Ethiopian highlands ranges from 1,000 to 1,800 mm (depending on altitude), while in the lowlands of Sudan, Eritrea, Djibouti, Somalia and Ethiopia, rainfall ranges from <200 to 1000 (Gamachu, 1977).

Ethiopian genet skin

One of us (GD) examined a skin of *G. abyssinica* held in Lalibela village. It had the typical features of highland forms: obscure yellow-orange background, with wide stripes and wide black tail rings. It had also nine pale tail rings (and nine dark rings plus black tip). The genet was reported to have been captured above 3,000 m asl in the vicinity of Degosay village, an area highly disturbed by human activities. The natural vegetation (montane dry forest) has been replaced by cultivations, open, grassy pasture areas and patches of eucalyptus trees.

Remarks and discussion

Afro-alpine habitats impose severe ecological conditions and preliminary data suggest that *G. abyssinica* living at high altitudes have local adaptive responses. Climatic conditions differ markedly from those in the more arid, drier habitats of the species. Afro-alpine ecosystems have extreme cold weather (temperature ranges between 16ºC in the warmest month and –13ºC in the coldest month), and high rainfall (about 1,800 mm/year). In addition, Afro-alpine ecosystems are rather poor in resource diversity and biomass.

(1) The Abi Jakula and Zeyit sightings reported for the first time diurnal activity in *G. abyssinica*. All genet species are considered entirely nocturnal, as is *G. abyssinica* (Rüppel, 1835-1840). This behavioral shift may be more likely interpreted as a local adaptive response to prey on the rodent community of high altitudes, which is by large the most abundant food and has a marked diurnal activity. We propose (Díaz & Juste, *in prep.*) the same explanation for the diurnal activity of *C. adustus* inhabiting the Afro-alpine areas.

In the escarpment of the Abune Yosef village area, containing the genet latrines, we found rocky holes also used as latrines by African Wildcats. Examination of wildcat scats reveals a very similar diet (mostly small vertebrates, particularly rodents), indicating that both species are direct competitors for food. However, wildcats have been exclusively seen active at dusk and dawn. In this regard, diurnal activity of the genet might help to also minimise direct competition with wildcats.

(2) Lack of arboreal support increases aerial and terrestrial predator risk. Genets inhabiting Afro-alpine habitats might respond to such predator pressure by selecting potential habitat types that offer a more complex physical structure. The sighted genet as well as other evidence such as latrines was found only on steep slopes with rocky areas covered by high-steppe ground cover; apparently they avoid the more open and exposed areas such as plain short-grass steppe habitats. Afro-alpine habitats hold large raptor species as Verreaux's Eagle *Aquila verreauxii*, Steppe Eagle *Aquila nipalensis,* Greater Spotted Eagle *Aquila clanga*, Tawny Eagle *Aquila rapax* and Lesser Spotted Eagle *Aquila pomarina,* and potential terrestrial predators such as *Panthera pardus* or *Mellivora capensis*.

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Museum abbreviations

AMNH: American Museum of Natural History, New York, NY, USA; **BMNH**: The Natural History Museum, London, UK; **FMNH**: Field Museum of Natural History, Chicago, IL, USA; **MNHN**: Muséum Nationale d'Histoire Naturelle, Paris, France; **NMNH**: National Museum of Natural History, Washington, DC, USA; **SMF**: Forschungsinstitut & Natur-Museum Senckenberg, Frankfurt am Main, Germany; **ZMB**: Zoologisches Museum, Berlin, Germany.

List of skull characters and acronyms

GSL, greatest skull length; CBL, condylobasal length of skull; ROL, length of rostrum; PAL, length of palate; MAX, greatest crown length of maxilarry tooth row; TYM, greatest length of tympanic bulla; CAN, breadth of canines; ROB, breadth of rostrum; IOB, least interorbital breadth; PAB, breadth of palate; ZYG, greatest zygomatic breadth; BRB, breadth of braincase; MAS, mastoid breadth; BRH, height of braincase; MAL, mandible length; MAN, greatest crown length of mandibular tooth row; CMH, mandible height.

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A study of the hybrids between the European Mink *Mustela lutreola* and the Polecat *M. putorius*

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Introduction

Occasional hybrids between the European Mink *Mustela lutreola* and the Western Polecat *M. putorius* have been known for a long time (Ognev, 1931; Novikov, 1939; Kuznetsov, 1941; Heptner *et al*., 1967; Danilov & Tumanov, 1976; Granqvist, 1981; Youngman, 1982; Tumanov & Zverev, 1986).

Experimental research by Dr. Dmitri Ternovsky and Dr. Yulia Ternovskaya (Novosibirsk, Russia) confirmed the possibility of Polecat-European Mink hybridisation. Under laboratory conditions Polecat-European hybrids were obtained in different combinations. European Mink females and Polecat (or ferret) males participated in all the variants of crossing, but hybrids were not obtained in the other combination. Hybrid females are fertile, but males (or at least hybrid males from the first, second, and third generations) are sterile (Ternovsky & Ternovskaya, 1994). The karyotype of the European Mink is 2n=38, NF=62, the karyotype of the Polecat (and ferret) is 2n=40, NF=68. Polecat-European Mink hybrids have an intermediate karyotype 2n=39, NF=65 and have a new nucleolus organiser region that is absent from the parental species (Graphodatsky *et al*., 1982, 1985).

Sidorovich (2000) investigated some ecological features of hybrids in northeastern Belarus. His data show that in terms of patterns of daily activity, diet and habitat usage, hybrids are an intermediate between European Mink and Polecats.

Material and methods

This study is based on 86 skulls of *M. lutreola* and 54 skulls of *M. putorius* from the northwest part of Russia (Leningrad, Pskov, and Novgorod Provinces). Ten skulls and six skins of Polecat-European Mink hybrids were also examined. Eight hybrid specimens were collected in the field in Moscow, Pskov, and Leningrad Provinces, and two specimens had been captive-bred. We studied specimens from the collections of Dr. I. L. Tumanov (St. Petersburg), Dr. D. V. Ternovsky (Institute of Animal Systematics & Ecology, Novosibirsk), the Zoological Institute of the Russian Academy of Science, St. Petersburg, and the Zoological Museum of Moscow State University, Moscow.

Twenty-two measurements were taken on each skull using sliding callipers with an accuracy of 0.1 mm. These were: 1= condylobasal length, 2 = neurocranium length, 3 = viscerocranium length, 4 = braincase height, 5 = palatal length, 6 = maxillary toothrow length, 7 = upper carnassial Pm^4 length, 8 = length of auditory bulla, 9 = greatest length between oral border of auditory bulla and aboral border of occipital condyles, 10 = zygomatic breadth, 11 = mastoid width of skull, 12 = upper molar M^1 breadth, 13 = interorbital width, 14 =breadth at canine alveoli, 15 = greatest palatal breadth, 16 = width of auditory bulla, 17 = minimum palatal breadth, 18 = total lenghth of mandible, 19 = length between the angular process and infradentale, 20 = mandibular toothrow length, 21 = length of lower carnassial M_1, 22 = vertical height of mandible.

Morphology of the hybrids

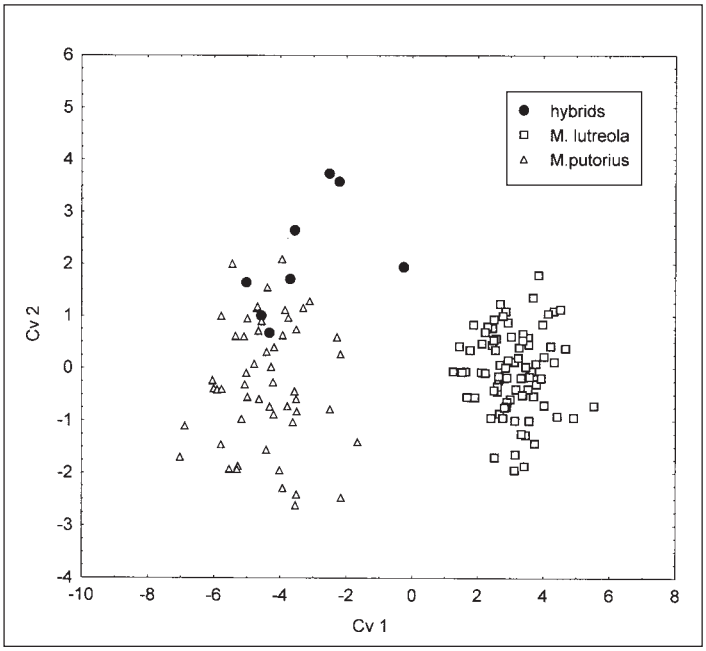
The results of Multiple Discriminant Function Analysis of the adult skulls are presented in Fig. 1. Specimens of *M. putorius* and *M. lutreola* formed two clearly distinct clusters when the data were plotted onto the first two canonical variates. This showed that the hybrids did not form a discrete morphological group and discriminant analysis of 22 craniometric characters failed to divide hybrids from their parent species, even though most were placed close to *M. putorius*.

Comparative analysis of the skulls of European Mink, Polecats and hybrids from the north-western part of Russia showed that most of the hybrid specimens were craniologically very similar to *M. putorius* (see also Youngman, 1982). In addition, all diagnostic skull morphotype characters permitting European Mink and Polecat to be distinguished (form of the skull and auditory bullae, presence of postarticular foramen, form of stylomastoid foramen, etc., Novikov, 1956; Glushkova *et al*., 1999) were also similar to those seen in *M. putorius.* Only one hybrid specimen (from Pskov Province) had an auditory bullae with the same shape as that of the European Mink – here the bullae were relatively short and narrow, the lateral part of the bullae was separated from the mastoids by a deep groove, and the mastoids did not form the lateral bullar wall. In other respects (skull shape and most other craniological features) this specimen looked like a Polecat.

Ternovsky & Ternovskaya (1994) point out that the captive-born hybrids are larger than European Mink in body size and weight, however, the skulls of the hybrids we studied were not notably larger than those of the parent species.

Skins of hybrids have intermediate characteristics. Captive-born hybrids (from the collection of Dr. D. V. Ternovsky) had a dark brown pelage (as in European Mink). The tail, legs, belly, and back had colouring of the same intensity; the chin and lower and upper lips are white. Hybrids do not have a white-yellow face mask as seen in *M. putorius* -there is just a hint of such a mask in some specimens which have short, narrow, whitish streaks behind the eyes as well as whitish ear tips.

Fig. 1. Plot of specimens of M. lutreola, M. putorius *and Polecat-European Mink hybrids on the plane of two first canonical axes*



The underfur on the body is rather light, similar to *M. putorius*. A hybrid specimen from Moscow Province has a similar type of head colouring, however, the legs, throat, breast, and inguinal region were darker than the back and belly. The undercoat of this specimen was considerably darker than Ternovsky's specimens.

Many hybrid specimens have no light streaks between the eyes and ears or light-coloured ear tips; they differ from the European Mink only in their lighter undercoat.

According to Ternovsky & Ternovskaya (1994) second-generation hybrids have a greater variety of fur colour. Some specimens had dark coloured bodies -the head, neck, and sides being dark brown, with a dark 'band' lengthways along the back merging with the black colour of the tail. Other specimens were lighter coloured, with a transition from dark chestnut to yellowish-red fur or from grey to sandy-yellowish fur.

The appearance of the hybrids in nature: hypothesis and remarks

There is no general agreement about the reasons for the appearance of Polecat-European Mink hybrids. Youngman (1982) supposed that the appearance of hybrids was only possible in sympatric areas in which the two species had only recently come into contact. Youngman believed that in some 'unstable' areas hybridisation might have occurred because of the breakdown of premating behavioural patterns (related to a scarcity of appropriate mates). In his opinion these areas were in eastern Finland, adjacent Karelia, and the Moscow Province. However, these areas are not zones of recent contact for the two species, as both the European Mink and Polecat have lived sympatrically there for a long time. The majority of hybrids examined by us were collected from Pskovsky district, Leningrad Province (six specimens) (apart from one specimen from the Volosovsky district, Leningrad province). Moreover, it is incorrect to name this territory as being a zone of recent range overlap for these species.

According to another hypothesis (Granqvist, 1981) hybridisation between *M. lutreola* and *M. putorius* is mainly initiated by a low density of one of the parental species (i.e. European Mink). The data of Sidorovich (2001) on the frequency of occurrence of Polecat-European Mink hybrids near the River Lovat (northeast Belarus) confirm this point of view. Using local hunting bag data, Sidorovich (2001) was able to show that hybrids were not found in 1986-1992 – i.e. when the European Mink was still common in his study area. However, after decreases in European Mink population density, hybrids appeared to be common – approximately 1-2 specimens per 100 mink (i.e. American Mink an European Mink) and Polecats (Sidorovich, 2001). According to the 1950-1980 data of the Leningrad Fur Storehouse (Leningradsky Pushno-mekhovoy Kholodil'nik) there were 3-5 skins of European Mink-Polecat hybrids in each set of 500-600 skins of Polecat and Mink (both species) from different districts of the northwest part of the former USSR (Danilov & Tumarov, 1976; Tumanov & Zverev, 1986).

During this period the European Mink population numbers weres rather dense and stable in this region. Over a 30-year period (1964-1993) the frequency of hybrid occurrence did not increase in the provinces of Pskov, Novgorod and Leningrad (Tumanov, 1996) –even though there were different phases in species population cycles during this period that included times of low European Mink densities and high Polecat densities (when hybrid numbers should theoretically increase). There are 165 American Mink, 205 Polecats, 99 European Mink and seven European Mink-Polecat hybrids in the collection of Dr. I. Tumanov from the Pskov and Leningrad provinces (collected during 1980-1989), so the frequency of hybrid occurrence (1.5%) is the same as in the earlier data. It is obvious that the frequency of hybrid occurrence is not dependent on decreases in the numbers of the parental species.

The occasional hybridisation of closely related, sympatric small mustelids is not rare. Hybrids between the Steppe Polecat *M. eversmannii* and the Siberian weasel *M. siberica* are known from western Siberia and the southern Urals, and hybrids between *M. putorius* and *M. eversmannii* occur in eastern Europe. It is possible that hybridisation between closely related mustelids might depend on the individual preferences of particular animals. Data on the individual peculiarities of some specimens of Mink and Polecats were obtained during interbreeding experiments (Ternovsky & Ternovskaya, 1994) and in studies of the behaviour and interspecific interactions of small mustelids (Rozhnov & Petrin, 1998).

The further study of hybrids between closely related *Mustela* spp. in experimental and, especially, natural environmental conditions may help explain their occurrence. Unfortunately, the absence of marked differences between hybrids and the parent species in either skull structure (*putorius*-type) or pelage (basically *lutreola*-type) considerably hampers the determination of hybrid specimens in museum collections. Probably, the usage of cytogenetic data would be of help in defining and studying hybrids in nature.

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Recent publication

Brown Palm Civet

Divya MUDAPPA. 2001. *Ecology of the Brown Palm Civet* Paradoxurus jerdoni *in the tropical rainforests of the Western Ghats, India*. Ph. D. Thesis, Bharathiar University, Coimbatore, 162 pp.

This thesis explores the ecology of the Brown Palm Civet (*Paradoxurus jerdoni* Blanford 1885), a nocturnal viverrid endemic to the rainforests of the Western Ghats hill ranges of India. It also examines changes in the structure of the small carnivore community due to rainforest fragmentation.

The study examined the ecological role of the Brown Palm Civet as a seed disperser, and the factors governing its diet composition, and ranging and activity behaviour. The research was carried out in the relatively undisturbed, large tract of rainforest in the Kalakad-Mundanthurai Tiger Reserve (KMTR), between May 1996 and December 1999. The small carnivore community here was compared with that in the rainforest fragments of the Anamalai Hills surveyed during 2000.

The Brown Palm Civet was found to be highly frugivorous with over 91% of scats containing seed, fruit, or flower remains of 55 native species. Only about 14% of the scats had animal remains. There was considerable intra- and inter-annual variation in the diet linked to pronounced intra- and inter-annual variation in flowering and fruiting. The thesis suggests that the Brown Palm Civet plays a major functional role as a seed disperser in the rainforests of the Western Ghats. They do not damage seeds of the fruits they consume, and assist in dispersing them away from the parent plants, where, otherwise, the seeds probably have a higher chance of predation. The Brown Palm Civet is also a reliable disperser as it consumes a variety of species, even in times of low fruit availability in the habitat.

Factors influencing home range size, activity, and habitat choice of the Brown Palm Civet were examined with data from a radio-telemetry study in Sengaltheri, KMTR. Five males and two females, fitted with activity transmitters, were tracked for up to 238 days. Their home ranges varied between 6 and 57 ha, substantially smaller than the home ranges of similar species elsewhere. Besides the high-quality rainforest habitat, body size was also found to influence home range size in the civets. The civets showed a distinct nocturnal activity regime, spending significantly less time moving and greater time foraging (including feeding) during months of greater fruit availability. The Brown Palm Civets predominantly used Malabar Giant Squirrel (*Ratufa indica*) nests for day-bedding. The day-beds were on trees characterised by larger size, better canopy contiguity, and greater density of surrounding trees than random trees in the habitat.

A combination of methods, such as track plots, camera-traps, spot-lighting (night walks and drives), and direct sightings were used to assess the relative abundance of small carnivores in KMTR and Anamalai Hills. The major effects of fragmentation included a decline in small carnivore abundance, particularly endemics, with a relative increase in more omnivorous-insectivorous and widespread mongooses and civets. The Brown Palm Civets persisted in degraded fragments probably due to the occurrence of food tree species and the presence of relatively large (>200 ha) protected rainforest fragments in an otherwise highly disturbed landscape.

Therefore, the study suggests that even in a fragmented landscape, conservation efforts should include protection and maintenance of relatively undisturbed and large tracts of forests with high diversity of native trees and lianas. At the same time, efforts should be made to protect and restore small and degraded rainforest fragments that support populations of many endemics, including the Brown Palm Civet.

Badger TB politics: Continuation

Sadly, although the rationale and justification for badger culling in connection with bovine tuberculosis has long since been discredited (1) it seems that MAFF [the UK Ministry of Agriculture, Fisheries and Food], now DEFRA [Department of the Environment, Food and Rural Affairs] are recruiting 14 new 'badger cull field officers' with three year contracts. So even though the badger trial has descended into pure farce (2) it is apparently politically expedient to continue the 'scientific trial'.

Cattle TB has now spread far and wide beyond the original supposedly important high density 'badger TB southwest hotspots'. And TB has spread into 53 out of 408 herds restocked after 'foot & mouth'. Unbelievably the Independent Scientific group are still trying to work out if cattle-to-cattle transmission is important or not (3). And of course there are at least 10 universities involved with the badger TB 'research' bandwagon, but since these studies ignore the fact that badgers are simply catching TB from cattle, the computer simulation modelling is meaningless (4,5). Sadly, the Ministry show no signs yet of increasing cattle TB controls, and indeed are saying via a spokesperson that the 'Badgers Act allows farmers to cull sick badgers' which would allow free for all culls. Untrue, the Act Section 10(2)a is only under license (6). So yet again conservation and farming conflicts succumb to power politics.

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