SMALL CARNIVORE CONSERVATION

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

Number 9 October 1993

SPECIES SURVIVAL COMMISSION

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

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

SMALL CARNIVORE CONSERVATION

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

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

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

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

Printed on recycled paper

ISSN 1019-5041

Small Carnivore 'GCAP' Meeting report

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

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

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

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

Preliminary captive breeding recommendations

Mustelids

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

Viverrids

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

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

Herpestids

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

Procyonids

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

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

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

Angela R. Glatston, Rotterdam Zoo
Van Aerssenlaan, 49, 3039 KE Rotterdam
Netherlands

Red Panda Global Conservation Plan

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

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

Angela R. Glatston, Rotterdam Zoo
Van Aerssenlaan, 49, 3039 KE Rotterdam
Netherlands

IUCN announcement

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

Information about task and requirements:

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

Erratum

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

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

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

Nitin D. RAI and Ajith KUMAR

Introduction

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

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

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

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

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

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

Ecological study

Introduction

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

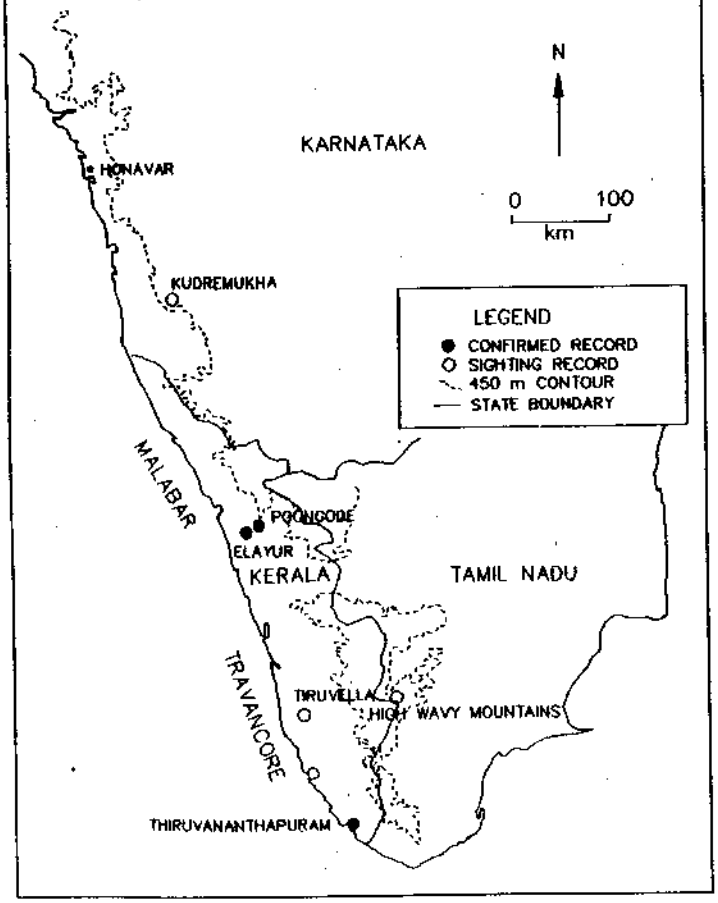
The major objective of the ecological study was to identify major habitat requirements and preferences of the species, particularly with reference to feeding and day time resting. Due to the natural rarity of the species, which is further aggravated by habitat degradation and chronic hunting pressure,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

Study area

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

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

FIG.1. PAST REPORTS OF MALABAR CIVET OCCURRENCE



Methods

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

CAMERA TRAPS

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

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

TRANSECTS

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

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

INTERVIEWS

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

SCAT IDENTIFICATION

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

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

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

Results

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

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

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

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

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

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

Survey

Introduction

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

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

Results

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

KERALA STATE

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

Kannur District

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

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

Kasargod District

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

Wynad District

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

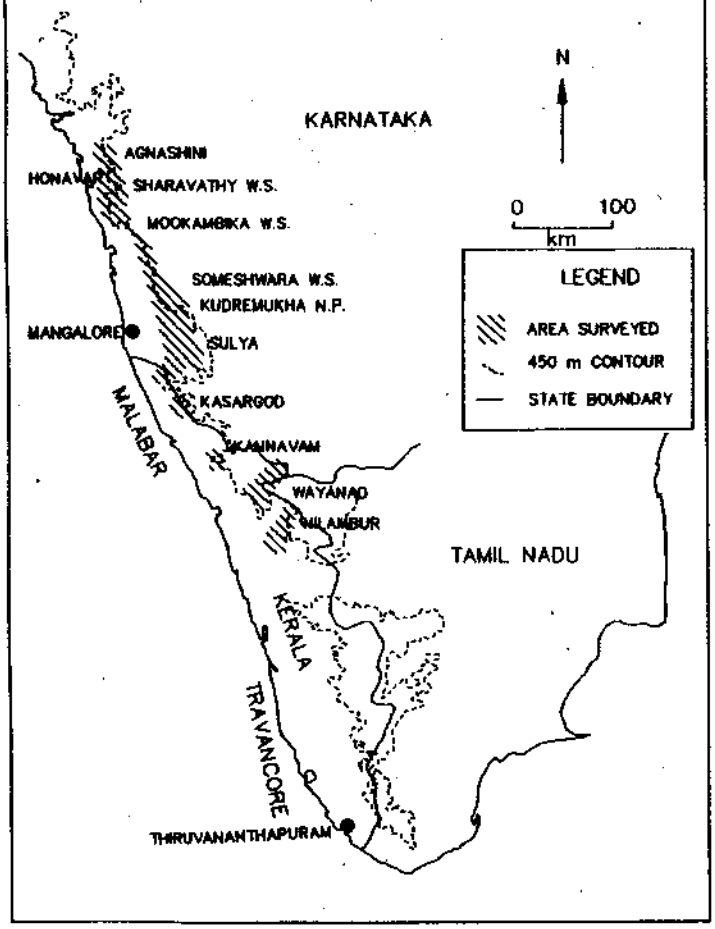
KARNATAKA STATE

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

South Kanara District

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

FIG.2. AREAS SURVEYED FOR MALABAR CIVET OCCURRENCE



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

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

North Kanara District

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

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

Shimoga and Chikmagalur Districts

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

Discussion and conclusions

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

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

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

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

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

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

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

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

References

Ashraf, N. K. V., Kumar, A. & Johnsingh, A. J. T. 1993. A survey of two endemic civets of the Western Ghats: the Malabar civet (*Viverra civettina*) and the Brown palm civet (*Paradoxurus jerdoni*). *Oryx* 27(2):109-114.

Dorst, J. & Dandelot, P. 1970. *A field guide to the larger mammals of Africa*. Collins, London.

Hutton, A. F. 1949. Mammals of the High Wavy Mountains, Madurai District, southern India. *J. Bombay Nat. Hist. Soc.*, 48:681-694.

Jerdon, T. C. 1874. *The mammals of India*. John Wheldon, London.

Karanth, K. U. 1986. A possible sighting record of Malabar civet (*Viverra megaspila* Blyth) from Karnataka. *J. Bombay Nat. Hist Soc.*, 83(1):192-193.

Kurup, G. U. 1987. The rediscovery of the Malabar civet, *Viverra megaspila civettina* Blyth in India. *Cheetal* 28(2):1-4.

Pocock, R. I. 1939. *The fauna of British India including Ceylon and Burma. Mammalia*. Vol. 1. Taylor & Francis, London.

Prater, S. H. 1971. *The book of Indian animals*. Bombay Natural History Society, Bombay.

Schreiber, A., Wirth, R., Riffel, M. & Van Rompaey, H. 1989. *An Action Plan for the Conservation of Mustelids and Viverrids*. IUCN, Gland.

Wildlife Institute of India, New Forest
Dehra Dun-248 006, India

A comment on the systematic position of *Poiana*

J. CRAWFORD-CABRAL

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

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

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

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

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

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

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

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

References

Dekeyser, P. L. 1949. Un Viverriné nouveau d'Afrique occidentale: *Pseudogenetta villiersi* (gen. et sp. nov.) *Bull. Mus. Hist. Nat.*, 21(4):421-424.

Ewer, R. F. 1973. *The carnivores*. Weidenfeld & Nicholson, London.

Gregory, W. K. & Hellman, M. 1939. On the evolution and major classification of the civets (Viverridae) and allied fossil and recent Carnivora: a phylogenetic study of the skull and dentition. *Proc. Amer. Philos. Soc.*, 81(3):309-391.

Mivart, St. G. 1882. On the classification and distribution of the Aeluroidae. *Proc. Zool. Soc. London* 1882:135-208.

Pocock, R. I. 1915. On some of the external characters of the genus *Linsang*, with notes upon the genera *Poiana* and *Eupleres*. *Ann. Mag. Nat. Hist.*, (8)16:341-351.

Rosevear, D. R. 1974. *The carnivores of West Africa*. Trustees of the British Museum (Natural History), London.

Simpson, G. G. 1945. The principles of classification and a classification of mammals. *Bull. Amer. Mus. Nat. Hist.*, 85:1-350.

Centro de Zoologia do IICT, Rua da Junqueira, 14
1300 Lisboa, Portugal

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

Huw I. GRIFFITHS

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

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

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

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

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

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

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

Data from Deutscher Jagdschutz Verband (1991)

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

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

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

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

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

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

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

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

References

Deutscher Jagdschutz-Verband. 1991. *DJV Handbuch Jagd 1991*. Verlag Dieter Hoffmann for DJV, Mainz.

Griffiths, H. I. In press. The Eurasian badger, *Meles meles* (L., 1758) as a commodity species. *J. Zool.*

Griffiths, H. I. & Thomas, D. H. 1993. The status of the badger *Meles meles* (L., 1758) (Carnivora, Mustelidae) in Europe. *Mamm. Rev.*, 23:17-58.

Long, C. A. & Killingley, C. A. 1983. *The badgers of the world*. Charles C. Thomas Publisher, Springfield.

Department of Genetics, School of Biol. Sciences
University of Leeds, Woodhouse Road
Leeds, LS2 9TJ, UK

Badgers breeding above ground

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

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

References

Anderson, R. M. & Trewhella, W. 1985. Population dynamics of the badger. *Phil. Trans. Roy. Soc. London* B 310:327-381.

E. A. 1903. Badgers breeding above ground. *Field* 101:573.

Fairfax-Blakeborough, J. 1914. *The life and habits of the Badger*. Foxhound, London.

Hancox, M. 1987. European badger breeding in captivity. *Int. Zoo News* 200:19-22.

Meade, H. H. 1956. Badgers above ground. *Field* 207:578.

Millais, J. G. 1904. *Mammals of Great Britain*. Longmans Green, London.

Neal, E. G. 1969. Badger nests above ground *in The countryman wildlife book*. David & Charles, Newton Abbot.

Neal, E. G. 1987. A litter of five cubs in an overground nest. *J. Zool.*, 212:349-350.

Tumanov, I. L. 1971. On the reproduction and postembryonic development of the badger. *Nauch Doklvyssh Shk Biol. Nauki* 9:20-26.

M. Hancox, 17 Nouncells Cross, Bisley Old Road, Stroud, Glos. GL5 1PT, UK

The Banded linsang, *Prionodon linsang*

Harry VAN ROMPAEY

The genus *Prionodon* Horsfield, 1821 (Carnivora, Viverridae) comprises two species: *P. pardicolor* Hodgson, 1842, the Spotted linsang, and *P. linsang* (Hardwicke, 1821), the Banded linsang. *Prionodon* was placed in subfamily Prionodontinae by Pocock (1933) because it differs from the other Viverrinae by an absence of scent glands in both sexes, and by its highly specialized dentition. Gregory & Hellman (1939) relegate *Prionodon* to the Prionodontini, a viverrine tribe.

LOCAL NAMES

Delundung (eastern Java; Horsfield, 1821); **Gensëlg** (also used for *Paradoxurus*; peninsular Malysia; Sen'oi Semai; Dentan, 1967); **Gurat gurat** (Borneo; Dusun; Banks, 1931); **Lasoenbeureum** (Java; Sundanese; Sody, 1938); **Matjantjonkok** [or **Meong tjonkok**; Koningsberger, 1902](western Java; Sundanese; Müller, 1839-1844); **Musang choreng** (peninsular Malaysia; Lim, 1973); **Musang blang** [or **Musang belang**, Harrison, 1966] (Malaysia; Pocock, 1939); **Saro-garong** (Java; Sundanese; Sody, 1938).

DISTRIBUTION AND STATUS

The banded linsang (Fig. 1) is widespread but either uncommon or rare. Its distribution is limited to southern Myanmar (Burma), southern Thailand, peninsular Malaysia, Sumatra (also Bangka I. and Belitung I. [=Billiton I.]), Java, and Borneo (Fig. 2). CITES status: Appendix II.

Myanmar (Burma)

Blanford (1878) describes two specimens (as *Prionodon maculosus*) from southern Myanmar: one from "Bànkàsun, southern Tenasserim" (=Bankachon) now in the BMNH, and one from "East of Moulmein". No other records have been found. *P. linsang* may be considered rare and endangered in Myanmar.

Thailand

Müller (1839-1844) mentions a specimen originating from Thailand in the RMNH, and there there is another from Bang Nara, Pattani in the ZRC. Prakobboon (in Humphrey & Bain, 1990) states that banded linsang occur in the Phu Miang-Phu Thong Wildlife sanctuary, and that there is no evidence of its occurrence elsewhere in Thailand. Here the species has been considered rare and localised (Chasen, 1940; Ellerman & Morrison-Scott, 1951; Davis, 1962; Lim, 1973; Lekagul & McNeely, 1977). Deforestation is detrimental to *P. linsang* (Humphrey & Bain, 1990) but according to Lim (1973) it may respond favourably to secondary growth and ecotonal habitats.

There is a minor trade in live animals (USFWS, 1970, 1971, 1972; Humphrey & Bain, 1990). Seven live specimens were reported by CITES Parties in 1980 (from Thailand to USA), but from 1975 to 1982 there was a total of only two consignments (Claude, 1988). Thai law, the "Wild Animals Reservation and Protection Act" (WARPA, 1980) prohibits hunting and regulates trade in this species.

Peninsular Malaysia

Flower (1900) mentions three specimens from the Larut District of Perak in the Taiping Museum, and one taken from about

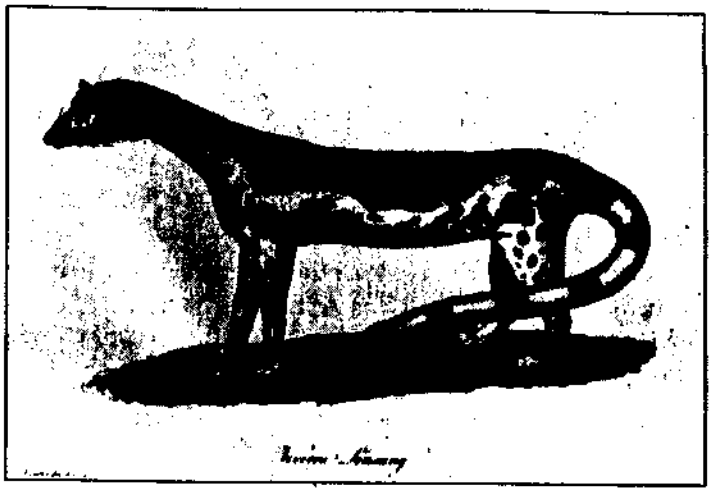


Fig. 1. Banded linsang (*Prionodon linsang*) from Hardwicke (1821)

8 km from Kuala Lumpur in the Kuala Lumpur Museum. More recently Hails (1982) states that *P. linsang* is rarely seen in the Ampang Forest reserve, 8 km E. of Kuala Lumpur.

Museum specimens: The BMNH holds specimens from Ulu Langat Forest Reserve, Taiping (Perak), and Ulu Ijok (Perak). The USNM has specimens from Kepong, Bukit Lagong Forest Reserve; Kuala Lumpur Batu, Bukit Lagong Forest Reserve (Selangor); Klang Tanjong Duablas, Bukit Mandol, Kuala Langat Forest Reserve (Selangor); and Besut, Kempong Kuala Kubang Forest. The MNHU and BMNH both hold a specimen from Melaka (Malacca), and the ZRC has one from Perak.

Lim (1973) mentions specimens from forest reserves within a 40 km radius of Kuala Lumpur: Kepong and Klang, Selangor; Parit Buntar, Krian, Perak; Tanjong Tong Forest Reserve, Kuala Terengganu, Terengganu.

In peninsular Malaysia *P. linsang* is widespread at all elevations but is nowhere common (Medway, 1969). It is totally protected in Malaysia (Kiew Bong Heang, 1982).

Sumatra

Müller (1839-1844) cites a specimen from Inderapura, and Schneider (1906) two from the Indragiri forest near Gading and Djapura.

Museum specimens: Siboelangit, near Medan (MNHU); Pelok Betong (MNHU); Suban Ajam (Redjang) on the north side of Bukit Kaba, Bengkulen (RMNH); Padang (RMNH); Pagaralam (RMNH); Moeara Laboeh (Muaralabuh), Barisan Mts. (RMNH); Sungai Mandau (NMNH); Siak River, mouth of Boewattan (=Buatan) River (NMNH); Palembang (ZRC); Siak (=Siak Sri Inderapura) (ZRC); and Pladjoe (MZB; M. Riffel, in litt.).

Belitung I. (Billiton I.)

Two specimens were collected by Sody (1949) in Tandjungpandan, and are now in the RMNH and MZB.

Bangka I. (Banka I.)

Sody (1937) collected two specimens on Bangka I., now in the RMNH.

Java

Müller (1839-1844) mentions a specimen from the NW side, Bartels (1937) one from Pasir Datar on the SW side of the Pangrango Mt., and one from Tjimentang, Djampang Mts., SW of Sukabumi. Bartels (1937, 1941) also observed specimens on the Parandje Mt. near Cianjur, in the forest near Sitoe Gunung, SW side of Pangrango-Gede Mt., in the forest near the mountain lake Tekaga Oatenggang, above Bandung, and near Pasir Datar, Sukabumi. He cites specimens from Tjisangiri, Mandalagiri Mts., Preanger, and from the Yang Plateau.

Museum specimens: The MZB holds specimens from Tsisangiri, Preanger, and Mt. Gede (M. Riffel, in litt.).

Dammerman (1929) cites its occurrence in the whole of Java, but according to Van Balen (1914) it was rarer in western than in eastern java. Bartels (1941) observed specimens from the southern coast up to ca. 1,100 m ASL in the mountains; he also thought that it was probably distributed all over Java, but considered it to be very rare (or difficult to observe?).

Borneo

Sarawak: **Museum specimens**: Mt. Dulit (BMNH, SM); Bario, Kelabit plateau (FMNH); Upper Sungai Selio, Usun Apau (FMNH); Pa Dali, S SE of Bario (FMNH); Ulu Samarahan (FMNH); Kuchin (SM; Banks, 1931).

Sabah: **Museum specimens:** Kinaratuan Forest (NMNH); Mt. Kinabalu, Luma Luma (MCZ); Mt. Kinabalu, Bundu Tahan (NMNH); Mt. Kinabalu (ZRC); Mt. Kinabalu, Kiau (ZRC); and Mt. Kinabalu, Tama Darat (ZRC). Payne *et al.* (1985) cite the Sandaran area and the upper S. Segema.

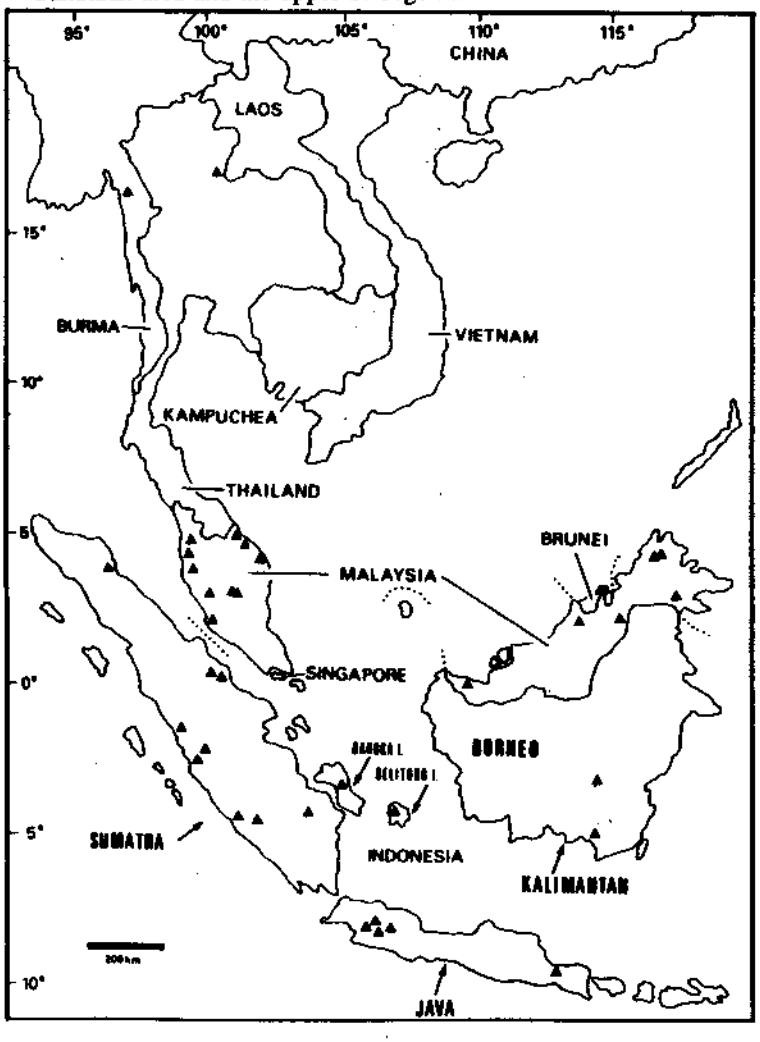


Fig. 2. Geographic range of the Banded linsang (*Prionodon linsang*). Triangles represent museum records, literature records, and sightings.

Brunei: Payne *et al.* (1985) cite Muara.

Kalimantan: **Museum specimens**: The MZB holds specimens from Pajakombo; Ulu Sungai; Banjarmasin; and the upper Barito River (M. Riffel, in litt.), and the ZMA has one from Apo-Kajain. Jentink (1897) cites G. Kenpai, S. Kapuas. According to Medway (1965) *P. linsang* is evidently rare in Borneo; Payne *et al.* (1985) say it is rarely seen, but probably widespread.

HABITAT

The habitat includes both primary and secondary forest plus fringe and occasionally human inhabited areas.

DESCRIPTION

The banded linsang has a long, slender body, short limbs, an elongated neck and head, and a long tail. The ground colour is dull, yellowish white. About four to six broad, irregular transverse brownish-black bands extend across the back, the last being narrow and broken, and tending to fuse with the first caudal ring. Two dark stripes extend from the forehead along the upper neck to the shoulders. Lesser striping and spots appear on the lower neck, flanks, and legs. The cylindrical tail has seven to nine complete, dark rings, separated by narrow white rings; the top of the tail is either light or dark coloured. Underparts and feet are uniformly pale coloured. The feet have five digits; the area across the pads is covered with hair; the claws are retractile. Blanford (1878) and Mivart (1882) note the absence of scent glands. Detailed descriptions of rhinarium, ear, and feet are given by Pocock (1915). According to Horsfield (1821) the iris is brown, and the pupil is circular, but Wemmer (1977) states that it is vertical.

Mean body measurements (in mm) and weight (in g) of ten Malayan specimens (Lim, 1973):

	females (n=7)		males (n=3)	
	mean	range	mean	range
Head & body	409	379-450	415	410-432
Tail	344	330-365	356	340-375
Weight	716	608-798	621	590-653

Measurements suggest that males are larger than females (Pocock, 1933), but the differences seem very small and there is considerable overlap: the mean condylobasal lenght of the skull of eight males is 71.9 mm (SD: 1.6; range: 68.7-73.3) against 70.4 mm (SD: 1.9; range: 66.5-72.8) for eight females.

A detailed description of the skull and teeth is given by Waterhouse (1842). The dental formula is I 3/3, C 1/1, P 4/4, M 1/2 = 38. M^2 is typically absent, and minute if retained. Of 16 specimens examined, 13 had no M^2, one (BMNH-551602) had no M^2 and no right M_2, and two (MNHU: 48081, 48089) had retained both M^2. The dentition is specialised for meat-eating with trenchant carnassials, their surface area being much reduced.

HABITS

Banded linsangs are excellent climbers which can descend head first. They are considered to be largely arboreal but food remains, and the fact that they are often trapped on the ground, indicate that they hunt both in the canopy and on the ground, even in disturbed forests and forest fringe habitats. Bartels (1937) observed a specimen disappear into a hole between rocks, and in 1941 stated they are probably exclusively terrestrial. Specimens collected in Malaysia had been either moving about amongst tree branches (between three and eight meters above the forest floor), or trapped on the ground (Lim, 1973).

P. linsang is nocturnal but may be active in day time. Captive individuals were active during the night and in the morning hours when offered food (Lim, 1973). They are considered solitary but Banks (1949) states that they usually go about in pairs. Several authors (Banks, 1931; Bartels, 1941; Louwman, 1970) report an apparent absence of vocalizations in adult specimens, but Louwman (1970) heard newly-born young make shrill, vibrating cries when being handled, and captive adults snarled and made sharp, whistling noises when confronted by other, strange animals (Lim, 1973).

The banded linsang sleeps with its long tail curled around the fore paws and head (Banks, 1949), and nests in hollows of dead trees on the forest floor, under the roots of large trees, or in holes in living trees above ground level. One animal was trapped at the entrance of its nest at the base of a Bertram palm (*Oncosperma horrida*). The entrance of the nest was about 13 cm in diameter, and its depth approximately 45 cm. Inside were bits of dried sticks, and leaves covered the floor (Lim, 1973).

Prey is killed by biting the head first (Lim, 1973) and, according to Eisenberg & Leyhausen (1972), *P. linsang* combines the acts of grasping and killing into one movement - either by means of a bite directed to the base of the skull, or as a series of crunching bites beginning where the prey was seized and proceeding anteriorly whilst the prey is held in the jaws. It does not often employ its fore paws in manipulating prey during feeding, although it has the ability to do this. A rat was killed without effort whilst held with the four paws. Pieces were torn from the prey whilst held with the fore paws. The head was eaten first (Gangloff, 1975). The banded linsang seems to be free from odor.

Behaviour in captivity was studied by Gangloff (1975): the banded linsang has a cat-like gait, is a good jumper, and often stands on its hind legs. It often sharpens its claws. To mark, the neck and shoulder, and subsequently the flank, are rubbed against the object. Selfgrooming and face washing are very similar to those of the genet. The male often walks while urinating thus marking about a metre.

The banded linsang has digitigrade hind feet and plantigrade fore feet (Taylor, 1988); Wemmer (1977) preferred to call the fore feet "sub-digitigrade".

FOOD

Stomach contents included long-tailed rats, spiny-furred rats, *Rattus* sp., ground squirrels (*Rhinosciurus laticaudatus*), lizards (*Calotes* spp.), frogs (*Rana* spp.), feathers, and cockroaches (Davis, 1958; Lim, 1973). Cantor (1846) remarked that they "displayed great dexterity and unerring aim when chasing small birds" and always refused fruit.

Captive specimens in Wassenaar Zoo (the Netherlands) were kept on a diet of finely minced meat, day-old chicks, hard boiled eggs, cottage cheese, and occasionally a whole chicken or pigeon (Louwman, 1970). Captives in Malaya thrived on white mice, occasionally supplemented with ox liver, house sparrows, fresh fish, and fresh eggs.

REPRODUCTION

Banks (1949) states that, in Borneo, two young are born in February. A female with two half-grown young was found in a hollow tree in Java in April (Bartels, 1941). Pregnant females have been taken in May in peninsular Malaysia: one had two embryos (28 and 32 g), the other had three (54.5, 58.7, and 62.8 g). Two other females were found to be lactating in April and October (Lim, 1973). The species is said to breed in February and August and to have litters of two young (Nowak, 1991). There are four abdominal mammae (Banks, 1931).

In Wassenaar Zoo (the Netherlands) two young were born on 4 December 1968 (see cover photo). It is not known whether the female was mated by the male, or already pregnant on her arrival at the Zoo. A few days before, the mother had been noted to have slightly swollen nipples, although without any reddening. The male was removed immediately after birth. The young weighed 40 g at birth and had a head to tail length of 16 cm. They doubled their weight by day 18, at an age of eight weeks weighed 275 g, and when four months equalled their parents' size.

The colouration of the young was the same as that of the parents, except that they had pink noses and white undersides. Their eyes only opened at 18 and 21 days. The mother was never observed to carry her young. When she started leaving the breeding box for one or two hours every afternoon (when the young were about ten days old), they were never heard calling whilst she was away (Louwman, 1970).

PARASITES

Felicola aspidorhynchus (Werneck) and *Felicola sumatrensis* (Werneck) were collected from Sumatran specimens (Werneck, 1948; Hopkings, 1949). Malayan specimens were infected with nymphal ticks, *Dermacentor auratus* (Lim, 1973), and other unidentified species (Hoogstraal *et al.*, 1969). Lim (1973) also found several endoparasites in Malayan banded linsangs: nematodes (*Physaloptera* sp.) attached to the intestinal walls, nymphal stages of pentastomids, *Armillifer armillatus*, attached to the hepatic mesentery, and also microfilaria. Another nematode, *Gnatostoma spinigerum* Owen, 1836, was found in the infected stomach of a specimen from Selangor, Malaysia. Two tumours were observed in the stomach wall: one contained six adult worms, the other only contained pus (Lim, 1976).

CAPTIVITY

The banded linsang has been kept in Thai zoos (Bangkok, Khao Kheow, and Pata). The first birth in captivity occurred in 1968 in the now defunct Wassenaar Zoo in the Netherlands. The only other births outside southeast Asia have been reported by Cincinnati Zoo (USA) since May 1989. At present (1993) there is a breeding group of ca. ten animals at Cincinnati Zoo, and two males born at Cincinnati are on exhibit at San Diego Zoo (R. Wirth, in litt.).

Cantor (1846) states that a newly captured animal was 'fierce but became very gentle and playful', and a captive female was 'fairly docile and easily handled'(Lim, 1973). One captive specimen lived more than nine years (Lim, 1973), another lived for ten years and eight months (Jones, 1982).

REMARKS

The diploid chromosome number is 2n=34, and the 'nombre fondamental' is NF=66 (Wurster & Benirschke, 1968). Chromosome banding interrelationships were studied by Wurster-Hill & Gray (1975), and relative hemoglobin mobility by Seal (1969).

FOSSIL RECORD

Teilhard de Chardin (1915) described a Quercy aeluroid as *Palaeoprionodon lamandini*; according to Hunt (1991) the auditory regions of *Palaeoprionodon* and *Prionodon* are nearly identical.

TAXONOMY

Four subspecies have been described. Due to the rarity of museum specimens no recent research has been done to assess the validity of any of them.

***Prionodon linsang linsang* (Hardwicke, 1821)**

Viverra? linsang Hardwicke, 1821 Trans. Linn. Soc. London 13:236, pl. 24 (read May 2, 1820).
Prionodon maculosus Blanford, 1878 J. Asiat. Soc. Bengal 47:152.
Viverra linsang is sometimes regarded as a synonym of *P. linsang gracilis* because Hardwicke (1821) states: "A knowledge of this animal was communicated to the Asiatic Society by Major Farquhar, from Malacca, from whence he sent a dead specimen. It is a native of the island of Java".

Distinguished from *P. l. gracilis* by its "slightly larger and better developed skull and probably by its larger body dimensions" (Pocock, 1933:974).

The condylobasal length of the skull of *P. l. linsang* is slightly greater than that of *P. l. gracilis*: 71.7 mm (SD: 1.3; range: 69.7-73.3 mm; 14 specimens: 5 males, 6 females, 3 unknown) to 68.6 mm (SD: 2.6; range: 64.3-73.1 mm; 7 specimens: 3 males, 2 females, 2 unknown).
Distribution: southern Myanmar, southern Thailand, peninsular Malaysia, and Sumatra.

***Prionodon linsang gracilis* (Horsfield, 1821)**

Felis gracilis Horsfield, 1821 Zool. Res. Java 1: unpaginated.
Viverra hardwichii (sic) Lesson, 1827 Man. Mamm.:172
The holotype (in the East India Company Museum; Horsfield, 1821) originated from the "District of Blambangan, situated at the eastern extremity of Java".

Its colour and pattern are the same as *P. l. linsang* from which it only differs in its smaller average size and less well-developed skull (Pocock, 1939).
Distribution: Java, Borneo.

***Prionodon linsang fredericae* Sody, 1936**

Prionodon linsang fredericae Sody, 1936 Natuurk. Tijdschr., 96: 43

According to Sody, this subspecies is distinguished by its small size: head & body: 320 mm; tail: 317 mm; condylobasal length of the skull: 63 mm.
Distribution: Bangka Island (Indonesia)

***Prionodon linsang interlinius* Sody, 1949**

Prionodon linsang interlinius Sody,1949 Treubia 20(2):157.

Sody found the most striking character of this subspecies to be the small secondary dark rings inside the light ring on the tail, especially in the posterior four. This is also a small subspecies: head & body: 316 mm; tail: 264 mm; condylobasal length of the skull: 62.7 mm.
Distribution: Beliton Island (Indonesia)

ACKNOWLEDGEMENTS

I am grateful to R. Angermann (MNHU, Berlin), W. Fuchs (AMNH, New York), D. Hills (BMNH, London), H. Kafka (NMNH, Washington), J. Kerbis Peterhans (FMNH, Chicago), M. Rutzmoser (MCZ, Cambridge, Mass.), C. Smeenk (RMNH, Leiden), P. J. H. van Bree (ZMA, Amsterdam), and Yang Chang Man (ZRC, Singapore) for permission to study specimens in their museum and/or for provided information; M. Riffel for drawing the map and looking up obscure localities; and H. I. Griffiths for commenting on the manuscript.

GAZETTEER

Abbreviations: BAN: Bangka I.; BEL: Beliton I.; BOR: Borneo; JAV: Java; MAL: Peninsular Malaysia; MYA: Myanmar (Burma); SUM: Sumatra; THA: Thailand.

Ampang, MAL, 03°08'N, 101°42'E; Bangka I., BAN, 02°15'S, 106°00'E; Banjarmasin, Kalimantan, BOR, 03°22'S, 114°33'E; Bankàsàn (=Bankachon), MYA, -; Bario, Sarawak, BOR, 03°45'N, 115°27'E; Bengkulen, SUM, 03°48'S, 102°16'E; Bukit Lagong, MAL, 03°11'N, 101°36'E; Bukit Lagong Forest Reserve, MAL, 03°14'N, 101°38'E; Bukit Mandol, MAL, 02°55'N, 101°34'E; Cianjur, JAV, 06°50'S, 107°09'E; Dulit Mt., BOR, 03°10'N, 114°10'E; Inderapura, Tandjun, SUM, 02°08'S, 100°48'E; Kepong, Selangor, MAL, 03°12'N, 101°38'E; Kempong Kuala Kubang Forest, MAL, 05°50'N, 102°34'E; Kinabalu Mt., Sabah, BOR, 06°03'N, 116°32'E; Kinaratuan Forest, Sabah, BOR, 06°08'N, 116°52'E; Kuala Lumpur, MAL, 03°08'N, 101°42'E; Kuala Terengganu, Terengganu, MAL, 05°20'N, 103°07'E; Kuchin, BOR, 01°32'N, 110°20'E; Larut District, Perak, MAL, 05°15'N, 100°50'E; Medan, SUM, 03°35'N, 98°39'E; Melaka (Malacca), MAL, 02°14'N, 102°14'E; Moeara Laboeh (Muaralabuh), SUM, 01°32'S, 101°05'E; Moulmain, MYA, 16°30'N, 97°39'E; Muara, BOR, 05°01'N, 115°01'E; Padang, SUM, 01°00'S, 100°21'E; Pagaralam, SUM, 04°01'S, 103°15'E; Palembang, SUM, 02°59'S, 104°45'E; Pangrango Mt., JAV, 06°48'S, 106°56'E; Parit Buntar, Krian, Pattani, THA, 06°50'N, 101°20'E; Pelok Betong, SUM, -; Perak, MAL, 05°07'N, 100°27'E; Phu Miang - Phu Thong Wildl. Sanct., THA, ca. 18°004N, 100°30'E; Sandakan, BOR, 05°52'N, 118°04'E; Siak (=Siak Sri Inderapura), SUM, 00°50'N, 102°05'E; Siak River, mouth of Buatan River, SUM, ca. 00°50'N, 101°45'E; Sukabumi, JAV, 06°55'S, 106°50'E; Sungai Mandau, SUM, 01°00-'N, 101°30'E; Sungai Selio, BOR, -; Taiping, MAL, 04°54'N, 100°40'E; Tandjungpandan, BEL, 02°44'S, 107°36'E; Ulu Langat Forest Res., MAL, E. of Kuala Lumpur; Ulu Samarahan, BOR, near Kuchin; Ulu Selio, BOR, -; Yang Plateau, JAV, ca. 08°00'S, 113°35'E.

MUSEUM ABBREVIATIONS

AMNH: American Museum of Natural History, New York, N.Y., USA; **BMNH**: The Natural History Museum, London, UK; **FMNH**: Field Museum of Natural History, Chicago, Illinois, USA: **MCZ**: Museum of Comparative Zoology, Cambridge, Mass., USA; **MNHU**: Museum für Naturkunde Humboldt Universität, Berlin, Germany; **MZB**: Museum Zoologicum Bogoriense, Bogor, Java, Indonesia; **NMNH**: National Museum of Natural History, Washington, D.C., USA; **RMNH**: Nationaal Natuurhistorisch Museum, Leiden, Netherlands; **SM**: Sarawak Museum, Kuching, Sarawak, Malaysia; **ZMA**: Zoologisch Museum Amsterdam, Amsterdam, Netherlands; **ZRC**: Zoological Reference Collection, Singapore 0511, Singapore.

References

Banks, E. 1931. A popular account of the mammals of Borneo. *J. Malay. Br. Roy. Asiat. Soc.*, 9(2):1-139.

Banks, E. 1949. *Bornean mammals*. Kuching press, Kuching. 83 pp.

Bartels, M. 1937. Zur Kenntnis der Verbreitung und der Lebensweise Javanischer Säugetiere. *Treubia* 16: 149-164.

Bartels, M. 1941. Iets over de "Loewaks" en verwante kleine roofdieren van Java. *Nederl.-Ind. Jager* 11:172-176.

Blanford, W. T. 1878. On some mammals from Tenasserim. *J. Asiatic Soc. Bengal* 47(2):150-167.

Cantor, T. 1846. Catalogue of Mammalia inhabiting the Malayan Peninsula and islands. *J. Asiat. Soc. Calcutta* 15(87):171-203.

Chasen, F. N. 1940. A handlist of Malaysian mammals. *Bull. Raffles Mus.*, 15:1-209.

Claude, C. 1988. *Prionodon linsang. in* CITES, ed. *Identification manual. Vol. 1: Mammalia.* Lausanne, Switzerland.

Dammerman, K. W. 1929. On the zoogeography of Java. 1. A list of the mammals known from Java. *Treubia* 2:33-39.

Davis, D. D. 1958. Mammals of the Kelabit Plateau, northern Sarawak. *Fieldiana Zool.*, 39(15):119-147.

Davis, D. D. 1962. Mammals of the lowland rain forest of north Borneo. *Bull. Natl. Mus. Singapore* 31:1-129.

Dentan, R. K. 1967. The mammalian taxonomy of the Sen'oi Semai. *Malay Nat. J.*, 20:100-106.

Eisenberg, J. F. & Leyhausen, P. 1972. The phylogenesis of predatory behavior in mammals. *Z. Tierpsychol.*, 30:59-93.

Ellerman, J. R. & Morrison-Scott, T. C. 1966. *Checklist of Palaearctic and Indian mammals.* Second edition. Trustees of the British Museum (Natural History), London.

Flower, S. S. 1900. On the mammals of Siam and the Malay Peninsula. *Proc. Zool. Soc. London* 1900: 306-379.

Gangloff, B. 1975. Beitrag zur Ethologie der Schleichkatzen (Bänderlinsang, *Prionodon linsang* (Hardw.), und Bänderpalmenroller, *Hemigalus derbyanus* (Gray)). *Zool. Garten N.F.*, Jena 45(4/5):329-376.

Gregory, W. K. & Hellman, M. 1939. On the evolution and major classification of the civets (Viverridae) and allied fossil and recent Carnivora: A phylogenetic study of the skull and dentition. *Proc. Amer. Philos. Soc.*, 81(3):309-392.

Hails, C. J. 1982. The Ampang Forest reserve. *Malay. Naturalist* 36(1):10-11.

Hardwicke, T. 1821. Descriptions of the wild dog of Sumatra, a new species of Viverra, and a new species of Pheasant. *Trans. Linn. Soc. London* 13(1):235-238.

Harrison, J. L. 1966. *An introduction to the mammals of Singapore and Malaya.* Malaya Nature Society, Singapore Branch, Singapore.

Hoogstraal, H., Lim, B. L. & Anastos, G. 1969. *Haemaphysalis (Kaiseriana) bispinosa* Neumann (Ixodoidea: Ixodidae): evidence for consideration as an introduced species in the Malay peninsula and Borneo. *J. Parasitol.*, 55(5):1075-1077.

Hopkings, G. H. 1949. The host-associations of the lice of mammals. *Proc. Zool. Soc. London* 119:387-604.

Horsfield, T. 1821. *Zoological researches in Java, and the neighbouring islands.* Kingbury, Parbury & Allen, London. Unpaginated.

Humphrey, R. S. & Bain, J. R. 1990. *Endangered animals of Thailand.* Sandhill Crane Pres, Inc., Gainesville, Florida.

Hunt, R. M. Jr. 1991. Evolution of the aeluroid Carnivora: Viverrid affinities of the Miocene carnivoran *Herpestides. Amer. Mus. Novitates* 3023:1-34.

Jentink, F. A. 1897. Zoological results of the Dutch scientific expedition to central Borneo. The mammals. *Notes Leiden Mus.*, 19:26-66.

Jones, M. L. 1982. Longevity of captive mammals. *Zool. Garten N.F.* Jena 52(2):113-128.

Kiew Bong Heang. 1982. Conservation status of the Malaysian fauna. I. Mammalia. *Malay. Nat.*, 35(3):3-19.

Koningsberger, J. C. 1902. *De zoogdieren van Java.* Kolff & Co., Batavia.

Lekagul, B. & McNeely, J. A. 1977. *Mammals of Thailand.* Kurusapha Press, Bangkok.

Lesson, R. P. 1827. *Manuel de mammalogie.* Roret, Paris.

Lim, B. L. 1973. The Banded linsang and the Banded musang of West Malaysia. *Malay. Nat. J.*, 26(3/4):105-111.

Lim, B. L. 1976. *Gnathostoma spinigerum* Owen, 1836 (Nematoda: Gnatostomidae) from a civet cat, *Prionodon linsang* Hardwicke, with reference to its dietary habits. *S. E. Asian J. Trop. Med. Publ. Hlth.*, 7(4):530-533.

Louwman, J. W. 1970. Breeding the Banded palm civet and the Banded linsang at Wassenaar Zoo. *Int. Zoo Yb.*, 10:81-82.

Medway, Lord. 1965. Mammals of Borneo. Field keys and an annotated checklist. *J. Malay. Br. Roy. Asiat. Soc.* 36(3):1139.

Medway, Lord. 1969. *The wild mammals of Malaya and offshore islands including Singapore.* Oxford University Press, London.

Mivart, St. G. 1882. On the classification and distribution of the Aeluroidea. *Proc. Zool. Soc. London* 1882:135-208.

Müller, S. 1839-1844. De zoogdieren van den Indischen Archipel. Pp. 1-57 *in* C. J. Temminck, ed. *Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen. Mammalia.* Leiden.

Payne, J., Francis, C. & Phillips, K. 1985. *A field guide to the mammals of Borneo.* The Sabah Society with WWF Malaysia, Kota Kinabalu.

Nowak, R. N. 1991. *Walker's mammals of the world.* The John Hopkins University Press, Baltimore-London.

Pocock, R. I. 1915. On some of the external characters of the genus *Linsang*, with notes upon the genera *Poiana* and *Eupleres. Ann. Mag. Nat. Hist.*, (8)16:341-351.

Pocock, R. I. 1933. The rarer genera of oriental Viverridae. *Proc. Zool. Soc. London* 1933(4):969-1035.

Pocock, R. I. 1939. *The fauna of British India including Ceylon and Burma. Mammalia.* Vol. 1. Taylor & Francis, London.

Schneider, G. 1906. Ergebnisse zoologischer Forschungsreisen in Sumatra. Erster Teil. Säugetiere (Mammalia). *Zool. Jahrb.*, 23:1-172.

Seal, U. S. 1969. Carnivora systematics: a study of hemoglobins. *Comp. Biochem. Physiol.*, 31: 799-811.

Sody, H. J. 1936. Seventeen new generic, specific, and subspecific names for Dutch East Indian mammals. *Natuurk. Tijdschr. Nederl.-Indië* 96:42-55.

Sody, H. J. 1937. On the mammals of Banka. *Temminckia* 2:221-250.

Sody, H. J. 1938. Lijst van de zoogdieren van Java. *Tectona* 31:741-764.

Sody, H. J. 1949. Notes on some Primates, Carnivora, and the Babirusa from the Indo-Malayan and Indo-Australian regions (with descriptions of 10 new species and subspecies). *Treubia* 20:121-190.

Taylor, M. E. 1988. Foot structure and phylogeny in the Viverridae (Carnivora). *J. Zool.*, 216(1):131-139.

Teilhard de Chardin, P. 1915. Les carnassiers des Phosphorites du Quercy. *Ann. Paléontol.*, 9(3/4):103-192.

USFWS. 1970. Mammals imported into the United States in 1968. Fish & Wildlife Service, US Dept. of Interior, Bureau of Sport Fisheries & Wildlife, Special Scientific Report-Wildlife No. 137;

USFWS. 1971. Mammals...1969...No. 147.

USFWS. 1972. Mammals...1970...No. 161.

Van Balen, J. H. 1914. *De dierenwereld van Insulinde. 1. De zoogdieren.* W. J. Thieme & Cie, Zutphen.

Waterhouse, G. R. 1842. Untitled (Observations on some species from Borneo). *Proc. Zool. Soc. London* 1842:114-116.

Wemmer, C. 1977. Comparative ethology of the Large-spotted genet *Genetta tigrina* and some related viverrids. *Smithson. Contr. Zool.*, 239:1-93.

Werneck, F. L. 1948. *Os malofagos de mamiferos.* Revista Brasileira de Biologia, Rio de Janeiro.

Wurster, D.H. & Benirschke, K. 1968. Comparative cytogenetic studies in the order Carnivora. *Chromosoma* 24:346-382.

Wurster-Hill, D. H. & Gray, C. W. 1975. The interrelationships of chromosome banding patterns in procyonids, viverrids, and felids. *Cytogenet. Cell Genet.*, 15(5):306-331.

Jan Verbertlei, 15, 2650 Edegem, Belgium

Helminth infestation in a declining population of European mink (*Mustella lutreola*) in Belarus

Vadim E. SIDOROVICH and E. I. BYCHKOVA

The European mink is well recognised as an example of a species whose numbers are now depleted over almost all of its former range (1-5). The reasons behind the decline in the species' numbers have been investigated repeatedly, but debate still continues (1-9). Hypotheses to explain the decline of the European mink were based, for the major part, on examinations of the ecological pecularities of the species and of potentially adverse ecological factors, e.g. interspecific competition, anthropogenic habitat transformation, the effects of hunting, etc. There are obvious pitfalls in these approaches. A better understanding of the causes of the mink's decline can be obtained from direct and detailed investigation of each ecological aspect of population decrease (9). In so doing, it is necessary to examine the full range of unfavourable factors that might affect the species, even if intuition suggests that some of these may only be of minor significance. Levels of helminth infestation can be considered as a possible contributor to the decline of many species, including the European mink.

The purpose of this study was to examine the level of helminth infestation in European mink, and to assess its importance in the context of population decline. The helminth fauna of the species has been investigated previously (10-14), these studies including data from Belarus (11,14). However, the aspects investigated in the current study are reported for the first time.

Material and methods

The investigation concentrated on the European mink population of the upper waters of the River Lovat of Gorodok District in the Vitebsk Region of north-western Belarus. The population is considered to be declining (see 9). During the period 1986-1992, it was estimated that the number of European mink in the area decreased by four fifths. In the winter of 1991/1992, the population numbered approximately 60-80 individuals.

European mink were collected between 1988 and 1992. Most of the carcasses were obtained from local hunters, although some animals were trapped under license by the authors. The specimens collected comprised 26 males and 15 females (27 adults, 14 juveniles). Animals were processed by the methods used in routine helminthological study: 17 were fully dissected, 24 were partially dissected.

Results

Helminthological investigation of the 41 mink showed that a total of 38 animals were infested with parasitic worms (93.7%). Only six individuals (14.8%) were infected by only one helminth species, and more diverse helminth assemblages were recorded from the remaining 32 specimens: 30.0% carried two parasite species, 20.0% had three, 14.8% had four, 9.8% had five, and 4.9% were infected with either six or seven helminth taxa. A total of 17 species of parasitic worms were recorded from the European mink (Table 1). These belonged to four classes: trematodes (6 species), cestodes (2 species), nematodes (8 species), and Acanthocephala (1 species). Table 1 shows that, in terms of percentage abundance, the most common were nematodes (47.6%) and trematodes (35.3%). The greatest variety of species recorded was amongst the nematodes (7 species). According to the work of Lyubashenko & Petrov (13), *Capilaria putori*, *Strongyloides martis*, *Skrjabingylus nasicola* and *Filaroides martis* rank amongst the most pathogenic worms of mink. *Capilaria putori*, a small intestinal parasite, was the most frequently collected species (35.3%), whilst slightly lower occurrences were found for *C. mucronata*, which occurs in the urinary bladder (29.4%) and *S. nasicola*, which infects the frontal sinuses (24.9%).

The six species of trematodes included only two (*Metorchis albidus* and *Opistorchis filineus*) that induced severe pathological changes, but these were not amongst the most commonly encountered species. The highest recorded incidence was for *Euparyphium melis* (40.0%). The pathogenicity of the larval form of *Alaria alaria* is still not clearly understood, but the incidence of this species in European mink was only 5.38%.

The commonest cestode was the larval form of *Spirometra erinacei*. This species was recorded from 37 mink. The incidence of *S. erinacei* changes seasonally; 100% infestation was found in animals caught in autumn, whilst in spring it was only 88.8%. As previously reported (14), the increasing level of *S. erinacei* infestation in recent years occurs not only in the European mink, but in all mustelids. This may possibly be a result of high population densities in the intermediate and supplementary hosts of the parasite.

Corynosoma stromosum was the only species of acanthocephalan recorded from our collections. This parasite causes cranosomatosis, but its incidence in the European mink was only 5.88%.

Helminth infestation in males (93.7%) approximately equalled that of females (93.7%). Practically no differences were observed between juvenile and adult infection levels where the respective helminth incidences were 96.5% and 93.3% ($P>0.1$).

Discussion

The data obtained were compared to results previously obtained by Petrov (12), Shimalov & Shimalov (11) and Danilov & Tumanov (10). Most interesting to us were Petrov's results, as these data relate to the period of stable European mink population levels. The results obtained by Shimalov & Shimalov in Belarus, and by Tumanov in neighbouring north-western Russia both belong to the time when the stability of european mink populations was already disturbed, and the species was already in rapid decrease in some areas (4, 10). These studies provide a combination of data obtained for both decreasing and relatively stable populations, although comparison of our results with these data does present some difficulties.

Analysis of our data, as well as those published already, shows that the general level of helminth incidence is significantly higher in declining populations ($t=2.2$; $P=0.02$). From the evidence of Petrov (12), in the 1940's the level of helminth infestation for relatively stable Russian populations was 56%, but increased to 77% between the 1960's and 1980's. In Belarus, the latter period was characterised by a level of infestation of almost 80% (11). Our

Table 1. Helminth infestation in a declining population of European mink in Belarus

Helminth species	Number of mink examined	Number of mink infected	Incidence %
TREMATODES			
Euparyphium melis (Schrank, 1788) Dietz, 1909	41	16	40.0
Rossicotrema donicum Skrajabin & Lindrop, 1919	17	2	11.8
Metorchis albicus (Braun, 1893) Looss, 1899	17	1	5.88
Pseudemphistomum truncatum (Rud., 1819) Luehe, 1903	17	1	5.88
Opistorchis filineus (Rivolta, 1844) Blanchord, 1895	17	1	5.88
Alaria alata, larvae (Goeze, 1782)	17	1	5.88
CESTODES			
Taenia mustelae Gmelin, 1790	17	2	11.80
Spirometra erinacei larvae (Rudolphi, 1849)	41	37	90.00
NEMATODES			
Capilaria mucronata (Molin, 1858) Travassos, 1915	41	15	36.60
Capilaria putorii (Rudolphi, 1819) Travassos, 1915	17	6	35.30
Trichinella spiralis (Owen, 1835)	8	2	25.00
Strongyloides martis Petrov, 1940	17	2	11.80
Skrajabingylus nasicola (Leuckart, 1842) Petrov, 1927	41	15	36.60
Filaroides martis (Werner, 1782) Dugherty, 1943	41	13	31.70
Molineus patens (Dujardin, 1845) Petrov, 1928	17	3	18.00
Ascaris devosi Sprent, 1952	17	2	11.80
ACANTHOCEPHALA			
Corynosoma strumosum (Rudolphi, 1802) Luch, 1904	17	1	5.88

results show a 93.7% level of infestation, although the infestation level of the most pathogenic species remains almost unchanged, *i.e.* 40% (11) and 41.2% (this study). Unfortunately, we have not had the opportunity to compare the combination of pathogenic helminths in mink listed by Petrov (12), as this author unites the helminth fauna of both the European and American mink. According to our data, and those of various other authors, filaroidosis and skrjabingulosis are the most frequent infections. Another combination of pathogenic species is that of *E. melis*, *C. putori* and *C. mucronata*. As already stated, infection by the larval form of the cestode *S. erinacea* showed a sharp increase, from 3.3% between the 1960's to 1980's (11), to 90% in modern Belarus.

Considering the results of our investigations, and comparing them with the data of other authors, we conclude that the levels of helminth infestation in declining American mink populations are considerably higher than when population levels were stable. We do not believe, however, that this rise in helminth infestation can so substantially influence mink demography as to be responsible for the sharp decrease in its numbers. It is well known that the host-parasite systems, being formed during a protracted evolutionary period, become stable only in those parasites who rarely kill their hosts (16, 17). Moreover, parasites often act as a regulatory factor, thus contributing to a proper (in biological terms) qualitative population composition and ecologically acceptable abundance levels (15). Despite this, rising levels of helminth infestation acting in combination with other unfavourable factors, may prove deleterious at the population level by decreasing the reproductive rate and raising mortality levels (17).

The rising levels of helminth infestation in the European mink reported here may, however, result from stressful conditions caused by some other adverse factor (7,9). The competitive ability of the acclimatized species is based on its higher reproductive rate (achieved through reproductive regulation), greater ecological plasticity and superior strength and aggression (9).

References

1. Saint Girons, M.-C. 1991. Wild mink *(Mustela lutreola)* in Europe. *Nature & Environment Series* No. 54. Council of Europe, Strasbourg.
2. Tumanov, I. L. & Zverev, E. L. 1989. Present-day distribution and abundance of European mink *(Mustela lutreola* L., 1761), in the USSR. *Zool. Zh.*, 65:426-435.
3. Youngman, P. M. 1982. Distribution and systematics of the European mink *Mustela lutreola* Linnaeus, 1761. *Acta Zool. Fenn.*, 166:1-48.
4. Sidorovich, V. E. 1991. Distribution and status of minks in Byelorussia. *Mustelid & Viverrid Conserv.*, 5:14.
5. Maran, T. 1992. Distribution of the European mink, *Mustela lutreola*, in Estonia: A historical review. *Folia Theriol. Estonica* 1:1-17.
6. Granqvist, E. 1984. Flodillern *(Mustela lutreola)* i Finlad samt den troliga oraken till dess mtillbakagang. *Mem. Soc. Fauna Fl. Fenn.*, 57:41-49.
7. Schropter, R. & Paliocha, E. 1989. Zur historischen und rezenten Bestandesänderung der Nerze *Mustela lutreola* (L., 1761) und *M. vison* (Schreber, 1777) in Europa -eine Hypothesendiskussion. Pp. 303-321 *in* M. Stubbe, ed. *Populationsökologie Marderartiger Säugetiere*. Hälle-Wittenberg Wissenschaft. Beiträge 39.
8. Ternovsky, D. V. 1977. *Biology of mustelids (Mustelidae)*. Akademiya Nauk, Novosibersk.
9. Sidorovich, V. E. In press. SSS Symposium on semi-aquatic mammals, June 1992, Osnabrück.
10. Danilov, P. I. & Tumanov, I. L. 1976. *Mustelids of the north-west of the USSR*. Akademiya Nauk, Leningrad.
11. Shimalov, V. T. & Shimalov, V. V. 1987. Helminthocenoses in minks of Byelorussia. Pp. 112-115 *in Parasitocenoses of domestic and wild animals in Byelorussia*. Reports of the 2nd Republican scientific and practical Conference on Parasitocenoses of domestic and wild Animals. Minsk.
12. Petrov, A. M. 1941. *Helminthic diseases of fur animals*. Mezhdunarodnaya kniga, Moscow.
13. Lyubashenko, S. Y. & Petrov, A. M. 1962. *Diseases of fur animals*. Selkhozizdat, Moscow.
14. Shimalov, V. T. , Sidorovich, V. E. & Shimalov, V. V. In press. Helminths of mustelids in water habitats of belarus. *Proc. Byelorus. Acad. Sci., Biol. Sci. Ser.*
15. Kontrimavichus, V. L. & Atrashkevich, G. L. 1982. Parasitic systems and their role in populational ecology of helminths. *Parasitologika* 16:177-186.
16. Dogkel, V. A. 1962. *General parasitology*. Leningrad University Publishing House, Leningrad.
17. Pianka, E. 1981. *Evolutionary ecology*, Mir., Moscow.

Institute of Zoology, Belarus Academy of Sciences
F. Skoriny St. 27, Minsk 220072, Belarus

Status of martens and genets in the Balearic and Pityusic Islands, Spain

Anthony P. CLEVENGER

Although carnivores occur on every major island of the western Mediterranean Basin, they have been the focus of relatively few studies. Most research on these insular populations has been taxonomic, whereas information on their basic ecology is scarce, and only recently more data have become available.

Two populations of high conservation interest are found in the Balearic (Minorca, Mallorca, Cabrera) and Pityusic (Ibiza, Formentera) Islands (Spain). The IUCN/SSC Mustelid & Viverrid Specialist Group included the Minorcan pine martens (*Martes martes minoricensis*) and Ibizan spotted genets (*Genetta genetta isabelae*) in their recommended Conservation Action Plan (Schreiber *et al.*, 1989), while the Spanish government has expressed concern also (Blanco & Gonzalez, 1992). Though the SSC/MVSG Action Plan implied that the two carnivore populations, and the others as well, are endemic to the archipelago, there are no fossil records of carnivores on any island, and most likely sporadic introductions to the islands occurred within the last 2,000 years (Alcover, 1980).

Today, Minorcan martens exhibit gigantism (Alcover *et al.*, 1986) while Ibizan genets dwarfism (Delibes, 1977), therefore, the morphological changes which have transpired since their arrival are of interest. Work is underway to determine when and from where the colonizing stock originated from to resolve the endemic question once and for all, know the evolutionary time frame, and the phylogenetic relationships of the two species in the Mediterranean Basin[1].

Since 1989, I have been studying the status, distribution, and ecology of carnivores (except *Mustela nivalis*) in the Balearic and Pityusic (none occur on Formentera) Islands. The objective of the research was to provide baseline demographic and ecological information for the species' conservation and management. The Minorcan marten population is unique among others within its range. Here a Eurosiberian species thrives in a competitor- and predator-free mediterranean setting, thereby providing opportunities to study the species adaptability in terms of habitat use and effects of interspecific competition on habitat choice. Herein I report on the findings of the mustelid and viverrid studies carried out. They are summarized briefly because of the voluminous nature of the data (five populations from four islands).

Eurasian pine marten (*Martes martes*)

Pine martens are found on the islands of Minorca (690 km^2) and Mallorca (3,640 km^2). Although the species was believed to be near extinction on both islands only 20-30 years ago, their populations have recovered and today they both occupy roughly half of the island area (Clevenger, 1993a). On Minorca, marten habitat consists of Aleppo pine (*Pinus halepensis*) and mixed pine-holm oak (*Quercus ilex*) forests, and shrublands; however, they also occur in riparian/cliff habitats in the southern part of the island. They are relatively common, and evidence of their presence (droppings) can be found in most forested and shrubland habitats. Martens appear to be absent in areas with low, scattered vegetation, situated far from their preferred habitat types. Marten were not selective of any of the available habitat types, as open shrubland habitats were shown to be as important to the species as forested ones (Clevenger, unpubl. data).

Marten habitat selection was not studied on Mallorca, however, based on the species distribution, it appears to be similar to Minorca (pine and oak forests, shrublands). On both islands, farm orchard areas are frequently used by martens, in particular those that are within close proximity to forest/shrubland habitats.

Like continental Eurasian pine martens, Minorcan and Mallorcan martens are opportunistic predators with a generalized diet (Clevenger, 1994). On Mallorca, seasonal diets varied slightly; plant material (fruits) was the most important dietary component year-round, followed by small mammals. Minorcan marten diets were highly variable seasonally as all five dietary components contributed near equally to the annual diet; diets were characterized by their wide food niche breadth compared to martens from the Iberian Peninsula (Clevenger, 1993b, c).

Marten home ranges and activity patterns were studied on Minorca (Clevenger, 1993d). Both sexes had non-overlapping ranges; female (n=3) home areas averaged 47 ha, while two males had ranges of 492 and 919 ha. Martens were primarily nocturnal. Despite the limited data, martens demonstrated a relationship between home range size, activity, and site conditions which merits further study.

Spotted genet (*Genetta genetta*)

Spotted genets are found on three islands in the archipelago, Mallorca, Ibiza (540 km^2) and Cabrera; the latter is a newly-created island (12km^2) National Park located 20 km south of Mallorca. Genets do not occur on Minorca as erroneously stated in the SSC/IUCN Action Plan (Schreiber *et al.*, 1989:83).

The genet is relatively common on all three islands. At the moment, habitat selection has not been quantified on any island, and only generalized descriptions are available which indicate a preference for rocky, pine forests and shrubland habitats (Delibes, 1977). On Mallorca, densities appear to be highest in the Sierra de Tramuntana mountains, howwever, presence has been detected in the islands' agricultural lowlands as well. On Ibiza, genets were distributed throughout roughly 20% of the island area and found occupying most of the available habitats (pine forests, shrublands, orchards) except areas with high and constant human activity, including farms (Clevenger, unpubl. data). A study needs to be carried out which addresses the effects of prey abundance, habitat fragmentation, and human activity on genet habitat choice on both islands.

Unlike Mallorca and Ibiza, Cabrera is practically unhabitated and remains one of the most-wild islands in the Mediterranean Basin. Because Cabrera was controlled by Spain's Defense department during the last 50 years, biologists rarely had access and therefore data on the vertebrate populations were scarce. Genets are known to have been introduced to the island in 1894 (six

[1] The author has collected all of the material from the island and proximate continental populations to perform a molecular analysis. He is searching for collaboration from a molecular genetics laboratory, and would be interested in hearing from anyone interested in performing the analyses.

pairs), probably survived until today, but some investigators have suggested that they may have become extinct 15-20 years ago. Nonetheless,the current population appears to be stable and well-distributed throughout the island. They are common in the islands' shrubland and pine forest habitats.

Year-round diets were studied among the three populations (Clevenger, unpubl. data). Mallorcan and Ibizan genet diets were similar and varied little between seasons, while Cabreran genet diets were markedly different from the other two and were the most seasonally variable. Small mammals (*Apodemus sylvaticus*) were the dominant food component on the two larger islands, whereas small mammals (rats primarily, *A. sylvaticus* is absent) and birds were taken most on Cabrera. Feral cats (*Felis catus*) also occur on Cabrera, however, Park authorities are in the progress of removing the species from the island. Part of the ecological studies being conducted will analyze the pre- and post-removal changes in genet diet.

Stone marten (*Martes foina*)

Stone marten were once part of the Ibizan fauna (Delibes & Amores, 1986); however, they apparently have become extinct (through hunting) during at least the last 30 years (Alcover, 1984). During my studies on this island, searches were made in areas where stone martens were believed to may still occur, however, all resulted negative. Farmers, hunters, and other islanders, all remarked that the species had not been seen or heard of within the at least 20-30 years. The high density of Ibizan hunters (with dogs) which cover nearly the entire island each year, and lack of stone martens encountered during the hunts, also suggests that this mustelid has disappeared from the island.

Conservation and Management

All pine marten and genet populations in the Balearic and Pityusic islands are protected from hunting. If these species cause damages to farm animals, authorization for their removal by trapping can be obtained from the regional natural resource agency. Both carnivores are still being taken illegally on Minorca, Mallorca, and Ibiza: incidentally by partridge and rabbit hunters, recreational trappers, and rabbit hunters training their dogs. Despite the illegal removal of martens and genets, in recent years farmers on the three main islands have reported an increased number of damage by the carnivores, and along with hunters, have expressed a need to begin controlling their populations.

Information is still lacking on habitat relationships of pine martens and genets on all islands (except Minorca) to begin preparing plans for the species management. Studies of this type should be a management priority of the Balearic Island regional government.

Endemic or not, the island carnivore populations are an integral part of the insular ecosystems, and may perform an important role in controlling rodent populations. Research should be directed at determining the effects of these predators on their prey populations (wild and domestic) so that sufficient data be obtained to begin properly managing their populations and implementing measures when needed. Given the present-day intra-specific morphological variation among martens and genets on each island, and in comparison to nearby mainland populations, many unique opportunities for studying biological theory are available (King & Moody, 1982).

References

Alcover, J. A. 1980. Note on the origin of the present mammalian fauna from the Balearic and Pityusic islands. *Misc. Zool.*, 6:141-149.

Alcover, J. A. 1984. Mammals of the Pityusic Islands. Pp. 455-467 *in*: H. Kubhier, J. A. Alcover & Guerau d'Arellano, eds. *Biogeography and ecology of the Pityusic Islands*. Dr W. Junk Publ., The Hague.

Alcover, J. A., Delibes, M., Gosàlbez, J. & Nadal, J. 1986. *Martes martes* Linnaeus, 1758 a les Balears. *Misc. Zool.*, 10:323-333.

Blanco, J. C. & Gonzales, J. L. 1992. *Libro rojo de los vertebrados de España*. ICONA, Madrid. 714 pp.

Clevenger, A. P. 1993a. The European pine marten in the Balearic Islands, Spain. *Mamm. Rev.*, 23:65-72.

Clevenger, A. P. 1993b. Spring and summer food habits and habitat use of the European pine marten on the island of Minorca, Spain. *J. Zool. (London)* 229:153-161.

Clevenger, A. P. 1993c. Pine marten comparative feeding ecology in an island and mainland population of Spain. *Z. Säugetierk.*, 58:212-224.

Clevenger, A. P. 1993d. Pine marten home range and activity pattern on the island of Minorca, Spain. *Z. Säugetierk.*, 58:137-143.

Clevenger, A. P. 1994. Comparative feeding ecology of the Eurasian pine marten and stone marten in Europe. *In*: S. W. Buskirk, A. S. Harestad, M. G. Raphael & R. A. Powell, eds. *Martens, sables, and fishers: biology and conservation*. Cornell University Press, Ithaca, N.Y. (in press).

Delibes, M. 1977. Sobre las ginetas de la isla de Ibiza. *Doñ. Acta Vert.*, 4:139-160 (English summary).

Delibes, M. & Amores, F. 1986. The stone marten from Ibiza. *Misc. Zool.*, 10:335-345.

King, C. M. & Moody, J. E. 1982. The biology of the stoat in the National Parks of New Zealand. III. Morphometric variation in relation to growth, geographical distribution, and colonisation. *N. Z. J. Zool.*, 9:81-102.

Schreiber, A., Wirth, R., Riffel, M. & Van Rompaey, H. 1989. *Weasels, civets, mongooses and their relatives. An Action Plan for the Conservation of Mustelids and Viverrids*. IUCN, Gland. 99 pp.

Departamento de Biologia Animal
Universidad de Léon, E-24071 Léon, Spain

JMSP Small Carnivore Taxon Advisory Group

The "Small Carnivore Taxon Advisory Group" (SCTAG) of the "Joint Management of Species Programme" (JMSP) of "The Federation of Zoological Gardens of Great Britain & Ireland" held a meeting on March the 2nd, 1993 at Southport Zoo. Several topics were discussed, a few of which we mention here.

- **A "SCTAG Action Plan: A Resource Manual"** will be produced in a loose-leaf folder to facilitate ease of updating information. Andrew Greenwood, on behalf of the International Veterinary Group, offered to sponsor this document.
- **European wolverine**: In recent discussions with Leif Blomqvist concerning the Scandinavian breeding programme, it was agreed that the JMSP programme for the species will augment this well-established coordinated programme and it is hoped an EEP will be developed in the near future. L. Blomqvist is intending to produce a protocol for the wolverine which can be used by the JMSP/SCTAG. Helsinki Zoo has surplus animals from previous year; interested collections will be notified.
- **Malabar civet**: Further funding is required to follow up the initial surveys. For recent papers summarising the project to date, see ORYX vol. 27(2) and also this newsletter.
- **Colombian Weasel Project**: see April newsletter. Paul Robinson informed the SCTAG of interest in this programme from North American SCTAG colleagues. John Carnio of Toronto Zoo has offered to provide Tomahawk Traps and possibly other equipment; Don Moore might be able to assist with fund-raising activities.

Small carnivore survey in the coastal forests of Côte d'Ivoire

Peter J. STEPHENSON

As part of the FED/SODEFOR Projet Forêts Côtières, I am planning to implement the first extensive mammal survey of remnant coastal forest in Côte d'Ivoire (Ivory Coast). The study area incorporates forest blocks between Grand Lahou and San Pedro. The survey will commence around October 1993 and continue for at least six months. I will concentrate on systematic live-trapping of insectivores and rodents to determine distribution patterns and centres of species diversity within surviving forest fragments. I will also establish a long-term monitoring system for Thai National Park. This encompasses part of the largest remaining area of undisturbed lowland rain forest in West Africa (Stuart & Adams, 1990) and surveys in the reserve will provide baseline data on species diversity.

In addition to the small mammal survey, I propose to trap small carnivores systematically to determine species richness, distribution and abundance. Carnivores have never been trapped extensively in Côte d'Ivoire, yet several species of viverrid are recorded from rain forest areas. These include *Civettictis civetta, Genetta poensis, Genetta pardina, Nandinia binotata, Herpestes sanguineus, Crossarchus obscurus* and *Atilax paludinosus* (Hoppe-Dominik, 1990). Data on the status of all species encountered will be of interest. However, there are three species of particular conservation importance that may occur in the study area (Schreiber *et al.*, 1989). The Liberian mongoose, *Liberiictis kuhni*, is known from Thai NP (Taylor, 1992), but a recent expedition to Côte d'Ivoire failed to trap any individuals (De Groot, 1992). Since this species appears to be restricted to sandy soils, coastal forests may provide a suitable refuge. Johnston's genet, *Paragenetta (Genetta) johnstoni*, has been recorded in Liberia and in adjacent forests in Côte d'Ivoire but is known from only 8-12 specimens (Lamotte & Tranier, 1983); Schreiber *et al.*, 1989). Similarly, Leighton's linsang, *Poiana leightoni (=P. richardsoni liberiensis)*, is also known from a small number of specimens and and only one site in Côte d'Ivoire. The taxonomic status of this viverrid is still unclear but it is undoubtedly very rare (Rosevear, 1974; Schreiber *et al.*, 1989). Although no live specimen has been obtained during recent surveys (Taylor, 1989; De groot, 1992), it is known to occur still in Liberia (Taylor, 1989). All three of these viverrid species are high conservation priorities and any information obtained on their present status and distribution will be invaluable (Schreiber *et al.*, 1989).

I propose to trap small carnivores using Tomahawk live-traps baited with meat. I will set a number of traps off the ground whenever possible, since species such as *P. leightoni* are arboreal. A series of habitat variables will be measured at each trap site to determine floral composition and architecture and provide information on carnivore ecology. Levels of habitat disturbance and hunting pressure will also be assessed.

Captured individuals of common species will be marked with ear tags and released. Rarer species will be sedated (Palomares, 1993), photographed and biometric measurements recorded. I am also investigating the possibility of maintaining rare species in captivity, given that a number of foreign zoos have expressed an interest in endangered West African viverrids.

This survey offers exciting possibilities for the study of a very poorly known carnivore fauna. The FED/SODEFOR project eventually aims to provide recommendations for the location of new protected areas within coastal rain forests. It is hoped, therefore, that the outlined survey will lead to the improved conservation of small carnivores in West Africa.

References

De Groot, P. J. 1992. *Report on the Metro Toronto Zoo Expedition to the Côte d'Ivoire*. Unpublished report.

Hoppe-Dominik, B. 1990. On the occurrence of the Honey-badger *(Mellivora capensis)* and the viverrids in the Ivory Coast. *Mustelid & Viverrid Conserv.*, 3:9-13.

Lamotte, M. & Tranier, M. 1983. Un spécimen de *Genetta (Paragenetta) johnstoni* collecté dans la région du Nimba (Côte d'Ivoire). *Mammalia* 47:430-432.

Palomares, F. 1993. Immobilization of Common genets, *Genetta genetta*, with a combination of ketamine and xylazine. *J. Wildl. Dis.*, 29:174-176.

Rosevear, D. R. 1974. *The carnivores of West Africa*. British Museum Publications, London.

Schreiber, A., Wirth, R., Riffel, M. & Van Rompaey, H. 1989. *Weasels, civets, mongooses and their relatives. An Action Plan for the Conservation of Mustelids and Viverrids*. IUCN, Gland.

Stuart, S. N. & Adams, R. J. 1990. Biodiversity in sub-saharan Africa and its islands: Conservation, management, and sustainable use. *Occas. Papers IUCN/SSC* No. 6, IUCN, Gland.

Taylor, M. E. 1989. New records of two species of rare viverrids from Liberia. *Mammalia* 53:122-125.

Taylor, M. E. 1992. The Liberian mongoose. *Oryx* 26:103-106.

Department of Zoology, University of Aberdeen, Tillydrone Ave., Aberdeen AB9 2TN, Scotland, UK
&
FED/SODEFOR Projet Forêts Côtières, 06 B.P. 948 Abidjan 06, Côte d'Ivoire.

Mustelid publication

The Association of British Wild Animal Keepers (ABWAK) intends to publish a husbandry booklet on mustelids next year (this booklet follows on from those already published on cats and bears/ raccoons). Specialist papers are being solicited from selected authors but the editor would like to hear from people who have good photographs and lists of text references which may be of use to him for this publication.

For further information please contact: John Partridge, 2A, Northcote Road, Clifton, Bristol BS8 3HB, UK (John Partridge is a full time member of staff at Bristol Zoo).

Senility and ill-health in the badger

M. HANCOX

The European badger is a long-lived species, but remarkably little is known regarding health problems with advancing age. This is perhaps not surprising since most natural deaths occur underground, including even a proportion of road casualties. A longevity in excess of ten years of age is achieved by few wild badgers: - the current Ministry of Agriculture study records several individuals of 11-12 with one sow of 14 years of age, and a Swiss study of 827 badgers noted only 3.8% over 10 with two of 15-16 years old. A dozen or so captive badgers have lived for 10-15 years however, including one boar of 18 y 8m and a sow of 19 1/2 old (Flower, 1931; Hancox, 1987). Autopsy reports encompass a wide range of bone and non-skeletal health problems (Hancox, 1980).

A study of 1520 skulls reveals a surprisingly high incidence of tooth loss during life, with some healing over the alveolus, but accompanied by abscesses in some 5% of the material. The smaller anterior teeth are most prone to loss during digging/foraging, although incisors may be loosened in territorial fighting (Hancox, 1988). Although numbers are small amongst a 470 known age subsample (Table 1), the loss of larger teeth is exacerbated with age. Nevertheless, most abscesses occurred amongst the demographically preponderant under 5 years old, including the three major cases involving two upper canines and a third premolar which led to fracture of the mandible. Less severe damage or infection of the bone may lead to periodontitis or periostitis, as in one skull affecting the glenoid fossa, or to superficial acropachia on skull or limb bone surfaces in some cases probably of tuberculous aetiology. Such dental disease, tooth loss, or tartar accumulation may have contributed significantly to impaired foraging ability and premature mortality by starvation in a minority of cases.

Dwelling socially potentially damp and poorly ventilated setts, one might expect extensive rheumatoid arthritic, and respiratory complaints such as adiaspiromycosis, pneumonia, and tuberculosis in badgers (Hancox, 1980). Although spinal arthritis or spondylosis deformans was noted in 34% of 252 urban foxes including even a 9-month cub (Harris, 1977), spondylosis has only been described in two old badgers from Melbourne and Prague zoos. Spinal disc prolapse was noted in a further individual, and osteoarthropathy in five other cases (Gallagher & Nelson, 1979; Heran, 1988; Stocker, 1989). Inadequate sampling of older material probably also accounts for paucity of osteoarthritis cases in otters (one in Devon, two in Germany, Jefferies & Hanson, 1988). Similarly, there are only odd reports of renal calculi in otter and one case in badger although there are other cases of cystic kidney and chronic nephritis (Cheeseman *et al.*, 1989; Gallagher & Nelson, 1979). Amongst a half dozen reported cases of liver damage, several of benign angiomata and cirrhosis may have been age related (Gallagher & Nelson, 1979; Heran, 1988; Paget, 1978). Amyloidosis has only been noted twice in badgers from Australia (zoo) and Denmark, but may also be age related (Hancox, 1980).

It is widely accepted that badgers are not true hibernators, but body weight may be doubled for up to 4-5 months of winter torpor. And the complex control of lipid metabolism involving gonadal, thyroid, and pituitary hormones, with a melatonin day-length mediated response is also implicated in moult and delayed implantation. The badger is hence an important subject for studies of potential medical value; with arteriosclerosis in a quarter of older badgers studied (Gallagher & nelson, 1979; Laplaud, 1984). Circulatory problems reported relate to obesity, mesenteric infarction, and a stroke in three captive badgers, and three cases of cardiopathy (Cheeseman *et al.*, 1989; Gallagher & Nelson, 1979). Finally, there is a widespread 'folklore' belief in Britain and on the Continent of the efficiency of badger grease as a cure for human ailments as diverse as asthma, rheumatism, silicosis, shortness of breath, the cough of the lungs, stones, sprained sinews, collachs, etc. Amusingly however, recent studies reveal corticosteroids in badger fat which may after all have an anti-inflammatory effect in treating rheumatism and arthritis (Wagner & Nusser, 1988).

Table 1. Dental loss & disease amongst 470 known age badger skulls

Tooth type	Number of cases of tooth type lost, with associated abscesses A, osteomyelitis O		Total of individuals
	Under 5 years old	Over 5 years old	
Incisors 1 / 2 / 3			30 6,3% loss
Upper	7 / 9 / 4 1A 2O / 1A 3O / . .	11 / 8 / 3 . . / 1O / . .	
Lower	1 / 1 / 2	4 / 3 / 4 1O / 1O / 1O	
Canines			5 1,0% loss
Upper	-	3	
	2A 1O	1A 1O	
Lower	1	2	
	2A 2O		
Premolars 2 / 3 / 4			25 5,3% loss
Upper	8 / 2 / . . 1O / . . / . .	5 / 5 / . .	
Lower	1 / 2 / 1 . . / 1A / . .	1 / 5 / 2	
Molars			4 0,8% loss (&3 part molars)
1 Upper	1	1 (& 1 part)	
Lower	(1 part) 1A	1 (& 1 part)	
2 Lower		2	
ABSCESSES			9 1,9%
OSTEOMYELITIS			12 2,5%

References

Cheeseman, C. L., Wilesmith, J. W. & Stuart, F. A. 1989. *Epidemiol. Infect.*, 103:113.

Flower, S. S. 1931. *Proc. Zool. Soc. London* 1931:176.

Gallagher, J. & Nelson, J. 1979. *Vet. Rec.*, 105:546.

Hancox, M. 1980. *Mamm. Rev.*, 10:151.

Hancox, M. 1987. *Ratel* 14:88.

Hancox, M. 1988. *Acta Theriol.*, 33:575

Hancox, M. 1988. *J. Zool. London* 216:606.

Harris, S. 1977. *J. Archaeol. Sci.*, 4:183.

Heran, I. 1988. *Lynx* 24:87.

Heran, I. 1988. *Gazella* 21:61

Jefferies, D. J. & Hanson, H. M. 1988. *Vincent Wildl. Trust Rep.*, 1987.

Laplaud, P. M. 1984. *Atherosclerosis* 53:129; 61:43.

Pajet, R. J. 1978. *J. Zool. London* 186:572.

Stocker, L. 1989. *Something in a cardboard box.* Chatto & Windus, London.

Wagner, H. & Nusser, D. 1988. *Naturforsch. B Chem. Sci.*, 43:631.

17 Nouncells Cross, Bisley Old Road, Stroud, Glos. GL5 1PT, UK

Rabies in a Palm civet

Three kittens of the Common palm civet (*Paradoxurus hermaphroditus*) were taken from a house at Feroke in Calicut, Kerala, India on 10.7.1993. Two of them were returned to the mother, one being retained by an Ayurvedic physician who is interested in keeping pet animals. On 28.7.1993 I was informed by telephone by the son of the physician that the kitten was not feeding and looked very ill -he was feeding the kitten bottled milk. He also told me that the kitten was very fond of him, playing with him and the neighbours, and even sleeping in his bed. Furthermore, the kitten had previously been very active and had hunted cockroaches and taken milk independantly.

When I was told that the kitten was sick and unable to drink milk, I asked him to keep watch, and also advised him to take it to the Veterinary College if it died. When it died on 11.8.1993 it was taken to the Veterinary College at Mannuthi, Trichur. The brain was examined for Negri bodies and then the kitten was identified as having been rabies positive. The owner's family (of eight), many of whom were either bitten by the kitten or received scratches from its claws, were advised to take anti-rabies injections. I received daily telephone calls from the family, who were in great distress due to their reactions to the rabies injections. They had to take doses of the Rabipour vaccine (a purified chick embryo vaccine, made in Germany) over intervals of 0, 3, 7, 14, 30, and 90 days. One vial of the injection costs Rs 250 (8$). In all probability the kitten must have got the infection whilst still with its mother, as there was no chance of its having become infected after being taken as a pet. Now local people in the area are very wary of toddy cats, thinking that they may spread the rabies infection. Local hospital doctors say they have not come across rabies in toddy cats in recent years, although viverrids are considered to be reservoirs of rabies. Any comments on the episode will be appreciated.

We are monitoring the situation, and trying to discover if there is any spreading of the disease in the area, although there are reports of rabies in Calicut. The case number of the palm civet rabies incident at the Mannuthi Veterinary Hospital is Reg. No. 909/93-94 dated 12.8.1993 (Rabies Pos.). We will be discussing the episode in the forthcoming seminar on the endangered fauna of Malabar that will be held in Calicut on 11.9.1993. Papers on civet cats are to be submitted at the seminar.

R. S. Lal Mohan, Conservation of Nature Trust
B/24 Gandhinager West Hill, Calicut 673005
Kerala, India

Fox rabies in France

Rabies prevalence reached a unique height in 1989. A year later oral vaccination of foxes covered a very significant part of the affected part of the country. Since then rabies cases have continued to decrease. The oral vaccination campaign of autumn 1992 extended over the total affected area (111,558 km^2). On the average 13 baits per km^2 were dropped by helicopter. The bait contained tetracycline as an uptake biomarker.

Out of 1990 examined foxes, 1175 (59%) showed at least one tetracycline coloured mark in the canine tooth, and 414 out of 761 (54%) showed blood sero-neutralising antibodies. In 1992, 1285 rabies cases were noted, a 41% decrease to 1991. Research into the efficiency of vaccine baits and baiting procedures were pursued at the "Laboratoire d'études sur la rage et la pathologie des animaux sauvages" in Malzéville. This research deals with the efficacy and safety of a new low-pathogenicity rabies virus, called SAG_2, obtained by mutation, and field trials using camera-traps to check which animal species take the bait. Surprising results showed that only 3% of the bait takers were foxes. But this low rate is consistent with a 70% proportion of foxes having consumed at least one bait when bait density is 13/km^2.

M. Artois, CNEVA, Laboratoire d'études sur la rage et la pathologie des animaux sauvages
Boite postale 9, 54220 Malzéville, France

Small Carnivore TAG/EEP meeting, Salzburg June 1993

Participants: J. Cobo, R. Dmoch, E. Princee, B. Kral, V. Jirousec, M. Boussekey, C. Ensenot, J. Xampeng, U. Seal, W. Zimmermann, S. Wakefield (for Peter Bircher), T. Pagel, B. Holst, C. Bohm, K. Rudloff, N. Bemment, R. Ratajszczak, K. Struyf, R. Wirth, R. Willis, L. Blomqvist, P. Vogt, K. Bleijenberg, T. Maran.

- Roland Wirth reported to the meeting on the Small Carnivore CAMP held in Rotterdam Zoo in February 1993. The results of this meeting as concerns captive breeding are summarised together with the minutes of the GCAP meeting enclosed.
- Tiit Maran reported on his work on the European mink and on the results of the European mink PHVA meeting held in Rotterdam. The prognosis of the PHVA is not very promising.
- The proposal to establish a Small Carnivore EEP TAG was circulated to the participants and accepted by the meeting.

It was impossible to proceed further with the TAG as the European Small Carnivore Survey has yet to be circulated to the European zoos. When these data become available the next phase in the TAG can follow. A close cooperation between the Small Carnivore TAG and the felid TAG was recommended as the caging requirement of small felids are very similar to those of other small carnivores. The use of this cage space should be approached by the two TAGs in an integrated fashion. The meeting developed into Species Committee meetings for the European otter and the Red panda EEPs.

Blood samples of European mink wanted

For genetic studies a single female of European mink was captured in 1992; she is kept in the Atton Experimental Station and is doing well. We took blood samples several times and also hair follicles in order to do some genetic and biologic tests. According to the preliminary results it proved fairly easy to differentiate between the European mink (*Mustela lutreola*), the American mink (*M. vison*), and the ferret (*M. putorius* var. *furo*). Although these first results are encouraging, they involve only one individual.

I would be grateful if anyone, in charge of captive European mink, would find the possibility to send us a blood sample. If necessary I would come and collect it personally. Otherwise, I will be pleased to send all the details on taking and mailing the sample.

M. Artois, CNEVA, Laboratoire d'études sur la rage et la pathologie des animaux sauvages, Domaine de Pixérécourt, B.P.9, 54220 Malzéville, France

Wildlife rescue Petit Saut - French Guiana

90% of French Guiana is covered with neotropical rain forest. Its major part is at present intact due to low human density and lack of penetrating roads. In January 1994, as part of a hydroelectric project, 310 km² of this forest will be flooded. A wildlife rescue operation is underway and will be financed by the public company building the dam. This kind of operation is controversial but we believe strongly that if it is well conducted and well documented, it will be very useful and worthwhile. A large amount of scientific information will be obtained.

Mammals, reptiles, amphibians, birds...will be captured under the surveillance of wildlife veterinarians. A suitable release area has been selected and will be prepared. Control animals will be followed (radio-tracking & visual check) for at least two to three years. This area is close to the capture area and has been overhunted, so the risk of disturbing populations in balance and of importing diseases is minimal. The area will be protected by law.

An important objective of the operation is public awareness. Local actions are being planned and will be focused on schools. International education will be possible through the media which have shown much interest in the operation.

A scientific study based on analysis of biological samples is planned. A biological bank (serum, cells, parasites...) will be constituted and accessible to the international scientific community, but there will be no funding for shipment and research. Laboratories are invited to express their interest and submit their proposals. The possibility of adding new projects to the actual plan will be considered if such propositions are formulated.

Several positions will be opened in January and February for staff veterinarians, biologists and volunteers with interest and experience in wildlife restraint, care and management. Candidates should be in good physical condition in order to work under hard field conditions for seven months. Knowledge of French is highly desirable.

Send either scientific proposals or a letter of intent, a curriculum vitae and references to:

Dr J.-Christophe Vlé
Opération de Sauvetage de Petit Saut
EDF/CNEH, Savoie Technolac, 73373 Le Bourget-du-lac Cedex, France. Fax: (33)-79-25-30-09.

Recent publications

The mink

Dunstone, N. 1993. *The mink*. T. & A. D. Poyser, London. i-viii, 231 pp. (including references and index), 24 col. plates, plus many figures, graphs, b/w photos, £19.95.

At the start of this book Dunstone states that his aim is to produce a "readable" account of the biology of the mink, and he has succeeded admirably. *The mink* is well written, entertaining, and contains a wealth of information from the literature, personal experience in both the lab and the field, and also a great deal of previously unpublished data, mostly from the doctoral theses of his PhD students.

Eight pages bound into the centre of the book include 24 high-quality colour photographs, most by Dunstone himself. Having said that, I found the most remarkable photo (and certainly the most unpleasant) to be a b/w photograph by Dave Hatler that shows the dissected head of an American mink infested with the sinus parasite *Skrjabingylus nasicola*.

The book is well organised and laid out. Each topic is dealt with in discrete chapters that include: basic biology and anatomy, field signs and tracking, distribution and evolution, feeding, general ecology, reproductive biology, population ecology, the fur trade, and the now seemingly mandatory "interactions with man and other animals". The discussions of the mink as a furbearer (both wild and farmed), and as a pest and enemy of waterfowl, are well-balanced, and provide much food for thought. The account is also well-referenced, and (unusually) done in such a way that citations don't clutter the text, and thus shouldn't dissuade non-academic readers.

This is very much a book on the American mink, a point that Dunstone makes very early in his text, *M. vison* having been subject of his own researches. Some readers may find the lack of coverage

of *M. lutreola* a little disappointing, but overall this doesn't detract from the text, and (for me) was more than adequately compensated for by the unpublished information on *M. Vison*. A rather unusual inclusion, but one of great relevance to the biology of mink, is a sub-section on diving. This includes information on physiological, behavioural, and sensory adaptations, and provides a real insight into the world of a semi-aquatic predator. This largely stems from Dunstone's personal interest in optimal foraging theory, but is an unusual, valuable, and interesting inclusion in a book such as this.

Other than the omission of a small number of citations in the reference list, I could find few things to complain about -and this is a very minor complaint. In short, *The mink* represents a well-written and interesting book on *M. vison* and, being reasonably priced, it is a worthwhile investment for anyone with an interest in the species.

(review by H. Griffiths)

Atlas of mammals in Britain

Arnold, H. R. 1993. *Atlas of mammals in Britain*. ITE Research Publication No. 6., London. HMSO for the Environment Research Council. 144 pp. (including references), with maps and many illustrations and graphs. £12.50.

In these days of highly applied research, it is refreshing to see such a piece of basic zoology as a new *Atlas of British mammals*. The work is a compilation of over 115,000 records collected over the last 35 years by the Biological Records Centre, and is a valuable contribution to the knowledge of the British fauna. The maps are accompanied by brief sections on biology, but more interestingly, also include breakdowns of the sources of the records. These are often plotted on a month-to-month basis, and when they derive from road casualties (as in the case of badgers) the results are themselves of use.

The maps themselves are composed of circular distribution plots placed over a national grid, which includes Ireland and all the off-shore islands. The plots are often discriminated by the age of the records from which they derive, and allow inferences to be made about distributional changes in recent years. It is unfortunate, however, that the Irish Biological Records Centre has closed, thus their data were not available. The result is that coverage of Ireland is poor.

Only a few mustelids are present in the British fauna, but all are covered (both native and introduced): Pine marten (*Martes martes*), Stoat (*Mustela erminea*), Weasel (*M. nivalis*), Polecat (*M. putorius*), feral Ferret (*M. furo*), American mink (*M. vison*), Badger (*Meles meles*), and Otter (*Lutra lutra*). The Raccoon, a procyonid which never formed a permanent population, is not mentioned. Just browsing through, I found a great deal of information on the mammals of my area, much of which I wasn't aware. This isn't just a compilation of distribution records, but includes a great deal of useful, interesting, and relevant data. Overall, this new atlas is a must for anyone interested in the mammalian fauna of Britain.

(review by H. Griffiths)

More books about badgers !

Cox, P. R. 1993. *Badgers on site*. Berkshire County Council (Dept. of Highways & Planning), Reading. 40 pp., some line drawings. ISBN 1851631682. £3.50

Anon. 1993. *Seminar on treatment and rehabilitation of badgers*. A one day meeting held in October 1992, hosted by the Wiltshire Badger Group. National Federation of Badger Groups, Tetbury. 24 pp. No ISBN. £1.50.

Just when you thought that everything that could possibly be written about badgers had been written, two more short books appear on badger conservation. In those countries where badgers are regarded either rather negatively or as pests, these must represent further testament to the craziness of the British (and probably the Dutch too!).

Cox's book deals with a subject that genuinely needs some coverage: badgers and civil engineering. British badger legislation can now place planners and land developers in a difficult legal situation. The book details the legal obligations facing them in areas where there are badgers, and how to reconcile the interests of both. Although only a brief account, Cox gives details of relevant badger legislation and the obligations placed upon developers by the law, and also shows how planning applications and development should be undertaken to avoid conflicts of interest. There is also basic information on badger field signs and ecology. Perhaps the most important section is that dealing with avoiding disturbance to badgers during construction projects, and how to minimise harm to the species from the results of civil engineering. This is not a "do-it-yourself" manual, however, and the book places much emphasis on taking specialist advice, and upon proper planning and consultation. Although strongly British in some sections, those dealing with the practical aspects of protecting badgers from road-traffic are of relevance in all European countries. Perhaps the only disagreement many of us would have with the content, is that Cox suggests the use of *Swareflex* reflectors to dissuade badgers from crossing new roads; the Dutch badger society 'Vereniging Das & boom' has investigated the use of these reflectors, and found them to perform very poorly indeed. Hopefully this book will not just be read by the many amateur badger conservationists, but also by employees of Highways and Planning Departments and civil engineering companies, both in the UK and elsewhere. If the book achieves any penetration of these markets, then it will do a great deal of good.

A rather less pleasing effort is the "*Treatment and Rehabilitation*" volume produced by the NFBG. The booklet includes the substance of (and discussions arising from) talks given at a workshop session of the same name, and held in 1992. Despite contributions on legal and veterinary aspects of rehabilitation, and interesting articles by Eunice Overend and Warren Cresswell, the end result is unsatisfactory. Despite a great deal of repetition between contributors, much is left unsaid that should have been included. Although several authors mention that some animals are best euthanatized, this is not emphasised strongly enough. Similarly, there is very little emphasis on obtaining appropriate specialist advice, and even less of an attempt at discouraging persons ill-equipped for rehabilitation work from undertaking it. Despite the statements of the contributors, one is left with the feeling that the rehabilitation of an injured badger can be done by anyone who has a dog basket, an old blanket, and a can of cat food.

There is a very real need for concrete guide-lines and advice on the care and rehabilitation of injured badgers, but this book fails to do this. I have witnessed some astonishing cruelty manifested as "care" by well-meaning but ill-informed individuals, and this book would seem to be a source of encouragement to them. The lack of formal publication details, plus numerous typographical errors, all add to the general impression of an amateurish, ill-considered, sloppy piece of work.

(reviews by H. Griffiths)

The carnivores of Natal

Rowe-Rowe, D. T. 1992. *The carnivores of Natal*. Natal Parks Board, Pietermaritzburg.

Distribution maps and species account are presented for 32 indigenous carnivore species that have been recorded in Natal. Each species account deals with current distribution and former distribution where known, status, habitat preferences and living requirements, social organisation, key life history features, threats, and importance to humans. Conservation importance is rated using a scoring system. Four species occur marginally in the extreme north-east, at the southernmost limit of their distribution (*Canis adustus, Civettictis civetta, Paracynictis selousi, Helogale parvula*). Two species (*Genetta genetta, Galerella pulverulenta*) reach the easternmost limit of their distribution in the drier upland grassland of western Natal. Four species (*Canis mesomelas, Genetta tigrina, Atilax paludinosus, Ichneumia albicauda*) occur throughout in all bioclimatic regions, and *Ictonyx occurs* in most regions. *Vulpes chama, Cynictis penicillata*, and *Proteles cristatus* occur mainly in drier upland grassland of the northwest. Four species (*Poecilogale albinucha, Herpestes ichneumon, Felis serval, Felis lybica*) are confined to moist midland and upland grasslands, as well as coastal grassland. Both *Galerella* and *Mungos mungo* occur throughout lowland woody vegetation, with the former extending into midland regions. *Lycaon pictus* (reintroduced) and *Mellivora capensis* are confined mainly to lowland bushveld regions. The most threatened species is *Poecilogale albinucha*: at risk owing to loss of habitat, use in traditional medicine, and predation by dogs.

Mammal species of the world

Wilson, D. E. & Reeder, D. M., eds. 1993. *Mammal species of the world: A taxonomic and geographic reference*. Second edition. Smithsonian Institution Press, Washington & London. 1206 pp. UK£ 63.50.

Eleven years after Honacki *et al.*'s 1982 edition of "Mammal species of the world", the second edition of this important publication has finally appeared. It is edited by D. E. Wilson and D. M. Reeder, and includes the work of 20 contributing authors, each one specialist in their respective groups. A total of 4,629 species are considered in its 1,206 pages (as compared with 4,170 in the edition by Honacki *et al.*). 172 new species have been described since the first edition, but this includes only a single carnivore: *Galidictis grandidieri* Wozencraft, 1986, a mongoose from SW Madagascar. Each species is provided with its scientific name, the author of the first description, a reference to that description, the type locality, distributional data, conservation status, and additional comments. The book also includes a comprehensive list of references and a detailed index.

As regards carnivores (including pinipeds), 271 species are treated, compared with 270 in the first edition. Since the first edition, the number of carnivore genera recognised has increased from 108 to 129. This increase reflects the numerous taxonomic changes suggested as mammalian taxonomy is constantly refined, and phylogenetic hypotheses are tested. Families of Carnivora covered by "Small Carnivore Conservation" and included here are: Viverridae (34), Herpestidae (37), Mustelidae (65), and Procyonidae (18). Pandas (two species in Ailurinae, including the Red panda) are treated as a subfamily of the bears (family Ursidae). This chapter was written by W. C. Wozencraft of the Smithsonian Institution in washington. In the main, European taxa are treated appropriately. However, Wozencraft does not mention the introduction into Europe of two herpestids: *Herpestes edwardsi* into Italy (see Small Carnivore Conservation 1990, 2:10), and *Herpestes auropunctatus* (regarded as conspecific of *H. javanicus* in "Mammals of the world") into Dalmatia (see "Small Carnivore Conservation" 1992, 7:16). *Martes martes* is stated to be a possible conspecific of *M. americana, M. melampus*, and *M. zibellina*, a suggestion that will probably not be appreciated by the majority of European mammalogists. *Mustela rixosa* is listed as conspecific with *M. nivalis*, and *M. putorius* as the ancestor of the domestic ferret. The badger (*Meles meles*) is only reported for the Greek islands of Rhodes and Crete (where these populations may represent endemic subspecies), although the species also occurs on Sifnos, Andros, and Tinos (Adamakopoulos *et al.*, 1991. *Biologia Gallo-hellenica* 18(1):107-126). The suggestion by Baryshnikov & Potapova that the genus is dispecific rather than monospecific is mentioned, but not considered further, whereas many people with an interest in the genus do now accept full specific ranking for the Japanese badger, *M. anakuma*. In the case of *Mustela erminea*, southern Pannonia is not mentioned as its southern distributional border (Miric, D. 1975. *Bull. Mus. Hist. Nat. Belgrade* 30(B):81-101), and neither is southern Europe mentioned within the distribution area of *Martes martes* (Krystufek & Petkovski. *Fragmenta Balcanica* 14 (13/306):117-129). Having said all this, diverse opinions exist with regard to taxonomic status, and it is not possible to please everybody!

As regards conservation status, *Gulo gulo, Mustela lutreola*, and *Vormela peregusna* are all listed as Vulnerable; all these species were included in "An Action Plan for the Conservation of Mustelids and Viverrids" (Schreiber *et al.* 1989, pp. 1-99). Of the other European taxa, *Martes foina intermedia* (Turkestan, Tienshan, Afghanistan, etc.) is mentioned as being included in Appendix III of the CITES agreement. The same applies to the Indian populations of *Mustela erminea*. It is a little surprising that the threatened status of British and central European populations of *Martes martes* are not mentioned, and the same applies to at least of some of the races of *Martes zibellina*. It also seems likely that *Mustela eversmanni* is threatened by agricultural changes in the Pannonian Plain.

Despite these comments, this book will be an invaluable source of information for anyone engaged in serious study of the taxonomy, evolution, distribution, or conservation of mammals. The price is also very reasonable for such a comprehensive and bulky work, and we believe that we can unhesitatingly recommend this book to the readers of "Small Carnivore Conservation".

(review by B. Krystufek & H. Griffiths)

Abstract

Cryoembryopreservation of carnivora embryos

The possibility to preserve embryos of the Ermine (*Mustela erminea*) successfully has been shown. The influence of the freezing program and the stage of embryo development on the survival of embryos was investigated. The freezed-thawed ermine embryos of the early stages of development were transferred to the right uterine horn of the recipient stoat and were cultured there for 26 days. Some of these embryos developed *in vivo* to the large delayed blastocysts.

Amstislavsky, S. Y., Maksimovsky, L. F., Ternovsky, Y. G. & Ternovsky, D. V. 1993. Cryoembryopreservation of Carnivora embryos: *Mustela erminea*. *Scientifur* 17(2):127-131.

Recent literature

Mustelidae

Aaris-Sörensen, J. 1992. *Graevlinger i Danmark; en handbog*. Fredericksberg; Foreningen til Dyrenes Beskyttelse i Danmark, 48 pp. (In Danish) (*Meles meles*)

Adamakopolous, P. *et al.* 1991. Les grandes mammifères de Grèce (Carnivores et Artiodactyles): situation actuelle, répartitions, habitat -les espèces menacées, perspectives de protection. *Biologia Gallo-hellenica* 18:107-126. (English abstract)

Amemo, J. M. & Soli, N. E. 1992. Immobilization of mink (*Mustela vison*) with medetomidine-ketamine and remobilization with atipamezole. *Vet. Res. Comm.*, 16(4):281-292.

Atkinson, R. M. 1993. Case reports on cardio myopathy in the domestic ferret, *Mustela putorius furo*. *J. Small Exot. Anim. Med.*, 2(2):75-78.

Backlin, B. M. & Bergman, A. 1992. Morphological aspects on the reproductive organs in female mink (*Mustela vison*) exposed to poly-chlorinated biphenyls and fractions thereof. *Ambio* 21:596-601.

Baryshnikov, G. F. & Averianov, A. O. 1990. Milk teeth of predatory mammals (Order Carnivora). Part 1. Family Mustelidae. *Trudy Zoologicheskogo Instituta AN SSSR* 212:73-119.

Beach, J. E. & Greenwood, B. 1993. Spontaneous neoplasia in the ferret (*Mustela putorius furo*). *J. Comp. Pathol.*, 108(2):133-147.

Belant, J. L. 1992. Field immobilization of American martens (*Martes americana*) and Short-tailed weasels (*Mustela erminea*). *J. Wildl. Dis.*, 28(4): 662-665.

Bentil, D. E. & Murray, J. P. 1993. Modelling bovine tuberculosis in badgers. *J. Anim. Ecol.*, 62:239-250.

Bergman, A. *et al.* 1992. Influence of commercial polychlorinated biphenyls and fractions thereof on liver morphology in female mink (*Mustela vison*). *Ambio* 21:591-595.

Blackwell, P. 1992. Convex hulb of selected subsets of a poison-process. *J. Appl. Probability* 29:814-824. (*Meles meles*)

Bravo, C. & Bueno, F. 1992. New data on the distribution of the American mink (*Mustela vison*) in central Spain. *Ecologia* 6:161-164. (In Spanish, English summary)

Brzezinski, M., Jedrzejewski, W. & Jedrzejewska, B. 1993. Winter home range and development of polecats *Mustela putorius* in Bialowieza Primeval Forest, Poland. *Acta Theriol.*, 37:181-192.

Caladrese, E. J., Aulerich, R. J. & Padgett, G. A. 1992. Mink as a predictive model in toxicology. *Drug Metab. Rev.*, 24:559-578.

Clevenger, A. P. 1993. The European pine marten (*Martes martes*) in the Balearic Islands, Spain. *Mamm. Rev.*, 23:65-72.

Clevenger, A. P. 1993. Pine marten (*Martes martes* Linné) comparative feeding ecology in an island and mainland population of Spain. *Z. Säugetierk.*, 58:212-224.

Clevenger, A. P. 1993. Pine marten (*Martes martes* L.) home ranges and activity patterns on the island of Minorca, Spain. *Z. Säugetierk.*, 58:137-143.

Clevenger, A. P. 1993. Spring and summer food habits and habitat use of the European pine marten (*Martes martes*) on the island of Minorca, Spain. *J. Zool.*, 229(1):153-161.

Corboz, L., Ossent, P. & Guber, H. 1993. Local and systematic infections due to bacteria of group EF-4 in cats, dogs, and in a badger -bacteriological and pathological results. *Schwiz. Arch. Tierheilk.*, 135:96-102.

Cox, P. R. 1993. *Badgers on site*. Berkshire County Council (Dept. Highways & Planning), Reading. 40 pp.

Cresswell, W. J. *et al.* 1992. To breed or not to breed: An analysis of the social & density-dependent constraints on the fecundity of female badgers (*Meles meles*). *Philos. Trans. Roy. Soc. London B Biol. Sci.*, 338(1286):393-407.

Criel, D. 1993. Steenmarter in Antwerpen. *Zoogdier* 4(1):36. (In Dutch)

Crum, J. A. *et al.* 1993. The reproductive effects of dietary heptachlor in mink (*Mustela vison*). *Arch. Environm. Contamin. & Toxicol.*, 24(2):156-164.

Dalimi, A. & Mobedi, I. 1992. Helminth parasites of carnivores in northern Iran. *Ann. Trop. Med. Parasitol.*, 86(4):395-397.

Damgaard, B. M. & Hansen, S. W. 1992. Hematological and plasma chemical characteristics in Beech marten (*Martes foina*). *Comp. Biochem. Physiol.*, 102(A):721-725.

Doncaster, C. P & Woodroffe, R. 1993. Den site can determine shape and size of badger teritories: Implications for group-living. *Oikos* 66(1):88-93.

Engel, E. 1993. Untersuchungen zum Verhalten von Steinmardern (*Martes foina*) unter Gefangenschaftsbedingungen. *In*: 67th Hauptversammlung der Deutsche Gesellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen. Verlag Paul Parey, Hamburg (Abstract)

Fervain, S. F. & Lopes, M. A. 1992. A note on the behaviour of the weasel *Mustela africana* (Carnivora, Mustelidae) from Amazonas, brazil. *Mammalia* 56: 482-483.

Figala, J. & Tester, J. R. 1992. Seasonal changes in locomotor and feeding activity patterns in the Stoat (*Mustela erminea*, Carnivora) in captivity. *Acta Soc. Zool. Bohemoslovacae* 56(1):7-13.

Foreyt, W. J. & Lagerquist, J. E. 1993. Internal parasites from the marten (*Martes americana*) in eastern Washington. *J. Helminthol. Soc. Washington* 60(1):72-75.

Formicheva, I. I. 1992. IGG allotypes of the domestic mink -genetics, expression and evolution. *Experim. Clin. Immunogenet.*, 8:185-218.

Grakov, N. N. 1993. Pine marten and its harvest in Russia. *Lutreola* 2:7-13.

Griffin, J. A. 1993. Description of an outbreak of bovine tuberculosis in County Donegal suspected to be badger-related. *Ir. Vet. J.*, 46:78-82.

Griffin, K. A. & Gilbert, F. F. 1993. Heart rate of Fishers (*Martes pennanti*) during exercise. *J. Mamm.*, 74:285-290.

Griffiths, H. I. 1993. The Eurasian badger, *Meles meles* (L., 1758) as a commodity species. *J. Zool.*, 230:340-342.

Griffiths, H. I., Griffiths, C. A. & Thomas, D. H. 1993. *The badger* Meles meles *(L., 1758): An assessment of the population status, conservation needs and management requirements of the species in the western Palaearctic. A report to the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats*. Council of Europe, Strasbourg. 97 pp.

Hamer, M. 1993. Kill a badger, save a cow? *New Sci.*, 138:12-13.

Hancox, M. 1992 Delayed implantation and the evolution of sociality in the mustelids. *Ratel* 19:99-102.

Hancox, M. 1993. Badgers and tuberculosis: reappraisal. *School Sci. Rev.*, 74:130-131.

Hancox, M. 1993. Captive badger longevities. *Int. Zoo News* 40/5(246):38-39.

Hancox, M. 1993. Sociobiology and captive breeding/conservation in European badgers. *Ratel* 20(5):153-155.

Hansen, S. W. & Damgaard, B. M. 1993. Behavioural and adrenocortical coping strategies and the effect on eosinophil leucocyte level and heterophil-lymphocyte ratio in Beech marten (*Martes foina*). *Appl. Anim. Behav. Sci.*, 35(4):369-388.

Harris, S., Cresswell, W. J. & Cheeseman, C. L. 1992. Age determination of badgers (*Meles meles*) from tooth wear: The need for a pragmatic approach. *J. Zool.*, 228(4):679-684.

Hartung, J. 1993. Befunde an Rotfüchen und Steinmardern aus ein Abbalgestation. *Beitr. Jagd- & Wildforschung* 18:92. (English summary)

Heran, I. 1992. Some comparisons of skeletal proportions in Mustelidae (Mammalia). Pp. 79-85 *in*: I. Horacek & V. Vohralik, eds. *Prague studies in mammalogy*. Charles University press, Prague.

Hofmann, T. & Stubbe, M. 1993. Zur Nahrungsökologie des Dachses *Meles meles* (L., 1758) in Mitteldeutschland. *Beitr. Jagd- & Wildforsch.*, 18:107-109. (English summary)

Jansen, S. 1993. De vergeten dassen van Noord-Brabant. *Zoogdier* 4(1):29-30. (In Dutch)

Jedrzejewski, W. & Jedrzejewska, B. 1993. Predation upon rodents in Bialowieza Primeval forest, Poland. *Ecography* 16:47-64. (*Mustela nivalis*)

Jedrzejewski, W., Jedrzejewska, B. & Brzezinski, M. 1993. Winter habitat selection and feeding habits of Polecats (*Mustela putorius*) in the Bialowieza National park, Poland. *Z. Säugetierk.*, 58(2):75-83.

Jensen, H. E. *et al.* 1992. Disseminated histoplasmosis in a badger, *Meles meles* in Denmark. *Apmis* 100:586-592.

Jonsson, J., Lund, B. O. & Brandt, I. 1993. Adrenocortolytic DDT-metabolites: studies in mink, *Mustela vison*, and otter, *Lutra lutra*. *Ecotoxicol.*, 2:41-53.

Kaplan, J. B. & Mead, R. A. 1992. Evaluation of extenders and cryopreservatives for cooling and cryopreservation of spermatozoa from the western Spotted skunk (*Spilogale gracilis*). *Zoo Biol.*, 11(6):397-404.

Kemp, B. *et al.* 1993. The effect of slimming on embryo survival rate and the number of corpora lutea at 25 days of pregnancy of minks (*Mustela vison*). *Reprod. Domest. Anim.*, 28(2):73-76.

Kugelschafter, K., Rothe, H. & Wiermaier, K. 1993. Zur lokalen Ausbreitung der sogenannten Automarder-Schäden (*Martes foina* Erxleben, 1758). *In*: 67th Hauptversammlung der Deutsche Gesellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen: 40. Verlag Paul Parey, Hamburg. (Abstract)

Lodé, T. 1993. Diet composition and habitat use of sympatric polecat and American mink in western France. *Acta Theriolog.*, 38(2):161-166.

Lodé, T. 1993. The use of space by Polecats (*Mustela putorius*) in western France. *Rev. Ecol. Terre Vie* 48(3):305-322.

Lucherini, M. & Crema, G. 1993. Diet of urban Stone martens in Italy. *Mammalia* 57(2):272-277.

Ludwig, B. 1993. Zu Häufigkeit und Bedeutung des Abdominalreibens beim Baummarder (*Martes martes* L., 1758). *In*: 67th Hauptversammlung der Deutsche Gesellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen: 42. Verlag Paul Parey, Hamburg. (Abstract)

Maciejowski, J. *et al.* 1992. Comparison of two mink selection methods. *Anim. Sci. Pap. & Rep.*, 9:39-46.

Mann, F. A. *et al.* 1993. Reference intervals for insulin concentrations and insulin: Glucose ratios in the serum of ferrets. *J. Small Exot. Anim. Med.*, 2(2):79-83.

Meade, L. 1992. New distributional records for selected species of Kentucky mammals. *Trans. Kentucky Acad. Sci.*, 53(3/4):127-132.

Mertin, D., Suvegova, K. & Oravcovar, E. 1993. Various intensity of mink feeding during reproduction. *Zivocistva Vyroba* 38:161-166.

Milenkovic, M. 1990. A new finding of the Steppe polecat, *Mustela eversmanni* Lesson, 1827 in Yugoslavia. *Arch. Bioloskih Nauka Beograd* 42(3/4):251-257.

Miric, D. 1992. Arten der Untergattung *Lutreola* Wagner, 1841 in Jugoslawien. *Glas. Prirod. ckog Muz. u Beograd* 47B:261-264.

Moutou, F., Le Dantec, D. & Madier, M. 1991. Le Baireau. *Vie Sauvage* 88:1-20.

Mulder, J. 1993. Das (even) gered uit kanaal. *Zoogdier* 4(1):34-35. (In Dutch)

Murie, J. O. 1992. Predation by badgers on Columbian ground squirrels. *J. Mamm.*, 73(2):385-394. (*Taxidea taxus*)

Müsens, G. J. & Broekhuizen, S. 1993. *Migratie bij Nederlandse dassen* Meles meles *(L., 1758)*. IBN-rapport 003. Instituut voor Bodem- en Natuuronderzoek, Wageningen. 33 pp. (In Dutch)

National Federation of badger Groups. 1993. *Seminar on treatment and rehabilitation of badgers*. A one day meeting held in Devises, Oct. 10th, 1992. Hosted by Wiltshire Badger group. NFBG, Tetbury (Glos.). 24 pp.

Neil, M. 1992. Supplementary dietary water to mink in lactation and early kit growth. *Swedish J. Agr. Res.*, 22(3):125-129.

Ooi, H. K., Inaba, C. & Kamiya, M. 1992. Experimental evaluation of mink and *Apodemus speciosus* in the *Echinococcus multilocularis* life-cycle in Hakkaido, Japan. *J. Wildl. Dis.*, 28:472-473.

Page, R. J. 1993. X-ray method for determination of the age of live badgers (*Meles meles*) in the field. *Mammalia* 57(1):123-126.

Palley, L. S. *et al.* 1992. Parvovirus-associated syndrome (Aleutian disease) in two ferrets. *J. Amer. Med. Assoc.*, 201(1):100-106.

Petrini, K. 1992. The medical manaement and diseases of mustelids. *AAZV-AAWV Annu. Proc.*, 1992:116-135.

Prenda, J. & Grandolorenicio, C. 1992. Biometric analysis of some cyprinid bones of prey fishes to estimate the original lengths and weights. *Folia Zool.*, 41:175-185. (*M. vison*)

Ranson, R. N., Butler, P. J. & Taylor, E. W. 1993. The central localization of the vagus nerve in the ferret (*Mustela putorius furo*) and the mink (*Mustela vison*). *J. Autonom. Nerv. Syst.*, 43:123-138.

Reason, P., Harris, S. & Cresswell, P. 1993. Estimating the impact of past persecution and habitat changes on the numbers of badgers *Meles meles* in Britain. *Mamm. Rev.*, 23(1):1-15.

Reig, S. 1992. Geographic variation in Pine marten (*Martes martes*) and Beech marten (*M. foina*) in Europe. *J. Mamm.*, 73:744-769.

Roper, T. J. & Christian, S. F. 1992. Sett use in badgers (*Meles meles*). Pp. 660-669 *in*: I. G. Pride & S. M. Swift, eds. Wildlife Telemetry: Remote monitoring and tracking of animals. *Proc. 4th European Conf. Wildl. Telemetry*. Ell. Horwood Ltd., Chichester.

Roper, T. J. & Lüps, P. 1993. Disruption of territorial behaviour in badgers *Meles meles*. *Z. Säugetierk.*, 58:244-251.

Rosatte, R. C. 1992. Trap-vaccinate-release and oral vaccination for rabies control in urban skunks, raccoons, and foxes. *J. Wildl. Dis.*, 28(4):562-571.

Rose, J. & Sterner, M. 1993. The role of the adrenal glands in regulating onset of winter fur growth in mink (*Mustela vison*). *J. Exp. Biol.*, 262:469-473.

Rouvinene, K. *et al.* 1992. Accumulation of dietry fish fatty acids in the body fat reserves of carnivorous fur-bearing animals. *Ag. Sci. in Finland* 1(5):483-489. (*Mustela putorius*, *M. p. furo*, *M. vison*)

Schmidt, R. & Apfelbach, R. 1993. Das olfaktorische Epithel des Frettchens (*Mustela putorius furo* L.) und einige formaldehyde bedingte pathologische Abweichungen. *In*: 67th Hauptversammlung der Deutsche Gesellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen: 61. Verlag Paul Parey, Hamburg. (Abstract)

Schneider, R. R., Hunter, D. B. & Waltner-Toews, D. 1992. Nursing disease in mink: Individual-level epidemiology. *Prev. Vet. Med.*, 14(3/4): 167-179.

Schneider, R. R., Hunter, D. B. & Waltner-Toews, D. 1992. Nursing disease in mink: Ranch-level epidemiology. *Prev. Vet. Med.*, 14(3/4):181-194.

Schneider, R. R. & Hunter, D. B. 1993. A survey of the causes of mortality in adult mink, with emphasis on the lactation period. *Can. Vet. J.*, 34:103-108.

Schneider, R. R. & Hunter, D. B. 1993. Mortality in mink kits from birth to weaning. *Can. Vet. J.*, 34(3):159-163.

Seidl, A. & Kugelschafter, K. 1993. Verhalttensbeobachtung zum Aufzuchtverhalten einer Baummarderfähe (*Martes martes* L.) unter behegebedingungen. *In*: 67th Hauptsammlung der Deutsche Gsellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen: 65. Verlag Paul Parey, Hamburg. (Abstract)

Seo, K. D. *et al.* 1993. Spermatogenic activity in the male mink prior to breeding season. *Korean J. Anim. Sci.*, 35(1):24-31. (In Korean)

Sherbourne, S. S. & Bissonette, J. A. 1993. Squirrel middens influence marten (*Martes americana*) use of subnivean access points. *Amer. Midl. Nat.*, 129:204-207.

Sidorovich, V. E. 1993. Reproductive plasticity of the American mink *Mustela vison* in Belarus. *Acta Theriol.*, 38(2):175-183.

Simonsen, V. *et al.* 1992. Genetic polymorphism of esterase in plasma of American mink (*Mustela vison* L.). *Anim. Genet.*, 23:553-555.

Stubbe, M. *et al.* 1993. Beitrage zur Verbreitung und Populationsökologie des Dachses *Meles meles* (L., 1758) in Europa. *Beitr. Jagd- & Wildforsch.*, 18:93-105. (English summary)

Takser, M., ed. 1993. Ferrets in a seabird colony. *Seabird Group Newsl.*, 64:8.

Tranbenkova, N. A. 1992. Trichinellosis in wild and domestic animals in the Kamchatka region. *Meditsinskaya Parazitologiya i Para zitarnye Bolezni* 2:18-20. (In Russian)

Tumanov, I. L. 1993. Some eco-physiological features of the weasel (*Mustela nivalis* L.). *Lutreola* 2:1-6.

Tumanov, I. L. & Rozhnov, V. V. 1993. Tentative results of release of the European mink into the Valaam Island. *Lutreola* 2:25-27.

Van den Berge, K. 1993. Das en vos beter beschermd in Vlaanderen. *Zoogdier* 4(1):38. (In Dutch)

van Zyl de Jong, G. G. 1992. A morphometric analysis of cranial variation in Holarctic weasels. *Z. Säugetierk.*, 57:77-93.

Vigh, B. & Vigh-Teichmann, I. 1992. Two components of the pineal organ in the mink (*Mustela vison*): Their structural similarity to submammalian pineal complexes and calcification. *Arch. Histol. Cytol.*, 55(5):477-489.

Virchow, D. *et al.*, 1992. First evidence of plague (*Yersinia pestis*) in Nebraska is found in Panhandle predators. *Trans. Nebraska Acad. Sci.*, 19:49-55.

Wanberg, S., Olesen, C. R. & Hansen, H. O. 1992. Influence of dietary sources of fat on lipid synthesis in mink (*Mustela vison*) mammary tissue. *Comp. Biochem. Physiol. A Comp. Physiol.*, 103(1):199-204.

Weber, D. 1992. Einige Daten zu Grösse und Kondition Schweizerisches Iltisse *Mustela putorius* L. *Säugetierk. Mitt.*, 34:1-9.

Whelton, H. J. & Power, S. B. 1993. The use of badger bacula as a method of age determination in a badger population infected with tuberculosis. *Biol. Envir. Proc. R. Ir. Acad.*, 93B:45-47.

Wiertz, J. 1993. Fluctuations in the Dutch badger *Meles meles* population between 1960 and 1990. *Mamm. Rev.*, 23(1):59-64.

Williams, T. D. *et al.* 1992. Disease management in the Black-footed ferret (*Mustela nigripes*) reintroduction program in Wyoming. *AAZV-AAWV Annu. Proc.*, 1992:10-11.

Wolsan, M. 1993. Definitions, diagnoses, and classification of higher-level taxa of the mustelids (Carnivora: Arctoidea). *In*: 67th Hauptvesammlung der Deutsche Gesellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen: 81. Verlag Paul Parey, Hamburg. (Abstract)

Wood, W. F., Fisher, C. O. & Graham, G. A. 1993. Volatile components in defensive spray of the Hog-nosed skunk, *Conepatus mesoleucus*. *J. Chem. Ecol.*, 19:837-841.

Woodroffe, R. 1993. Alloparental behaviour in the European badger. *Anim. Behav.*, 46:413-415.

Woodroffe, R. & Macdonald, D. W. 1992. Badger clans -demographic groups in an antisocial species. *J. Zool.*, 227:696-698.

Yakhontov, E. L. 1993. Catalogue of mustelid collection (Carnivora; Mustelidae) of Zoological Museum of Moscow Lomonosov State University. Part 2. *Mustela sibirica* Pallas. *Lutreola* 2:28-31.

Zhao, Z. 1992. Studies on mercury poisoning in marten (*Mustela vison*). *Sinozoologia* 9:81-86.

Zhou, Z. Y., Nordstoga, K. & Bjerkas, I. 1992. Extraglomerular lesions in kidneys of mink with ecephalitozoonosis. *Acta Vet. Scand.*, 33:33-41.

Viverridae

Abe, S. *et al.* 1991. Establishment in the wild of the mongoose (*Herpestes* sp.) on Amami-oshima Island. *Honyurui Kagaku* 31(1):23-36.

Abe, S. *et al.* 1992. Food habits of feral mongooses (*Herpestes* sp.) on Amami-Oshima Island. *Snake* 24(1):90.

Ashraf, N. V. K., Kumar, A. & Johnsingh, A. J. T. 1993. Two endemic viverrids of the Western Ghats, India. *Oryx* 27(2):109-114.

Avenant, N. L. & Nel, J. A. 1992. Comparison of the diet of the Yellow mongoose in a coastal and a Karoo area. *S. Afr. J. Wildl. Res.*, 22(4):89-93.

Baker, C. M. 1992. *Atilax paludinosus. Mamm. Species* 408:1-6.

Baker, C. M. 1992. Observations on the postnatal behavioural development in the Marsh mongoose (*Atilax paludinosus*). *Z. Säugetierk.*, 57(6):335-342.

Barchan, D. *et al.* 1992. How the mongoose can fight the snake: The binding site of the mongoose acetylcholine receptor. *Proc. Natl. Acad. Sci. USA* 89(16):7717-7721.

Baxter, R. M. 1993. Banded mongoose predation on a shrew -*Crocidura f. flavescens*. *Mammalia* 57:145-146.

Carnio, J. & Taylor, M. 1988. In search of the Liberian mongoose (*liberiictis khuni*): Another species that may need captive propagation. *Proc. World Conf. Breeding Endan. Species Capt.*, 5:605-611.

Cavallini, P. 1992. *Herpestes pulverulentus. Mamm. Species* 409:1-4.

Cohen, C. & Winter, D. 1992. Water mongoose at Strandfontein. *Promerops* 204:8.

Corke, D. 1992. The status and conservation needs of the terrestrial herpetofauna of the Windward Islands (West Indies). *Biol. Conserv.*, 62(1):47-58.

Creel, S. R. *et al.* 1991. Spontaneous lactation is an adaptive result of pseudopregnancy. *Nature (London)* 351(6328):660-662.

Creel, S. R., Wildt, D. E. & Monfort, S. L. 1993. Aggression, reproduction, and androgens in wild Dwarf mongooses: A test of the challenge hypothesis. *Amer. Nat.*, 141(5):816-825.

Dang Zun Hun & Le Suan Kan. 1991. Population of some mammals in the sclerophylous evergreen tropic forests near Konhkanyng (South Vietnam). *Zool. Zhurnal* 70(2):114-118. (In Russian)

Decker, D. M., Ringelberg, D. & White, D. C. 1992. Lipid components in anal scent sacs of three mongoose species (*Helogale parvula, Crossarchus obscurus, Suricata suricatta*). *J. Chem. Ecol.*, 18(9):1511-1524.

de Groot, P., Carnio, J., Faigal, F. X. & Mandrak, N. 1992. Conservation of the Liberian mongoose: Does *Liberiictus khuni* occur in the Côte d'Ivoire? and what we can learn from GIS analysis. *AAZPA Natl. Conf.*, P. 560.

Domont, G. B., Perales, J. & Moussatche, H. 1991. Natural anti-snake venom proteins. *Toxicon* 29(10):1183-1194.

Dücker, G., Jämmrich, S. & Mühlen, W. 1990. Marking behavior in cusimances (*Crossarchus obscurus* F. Cuvier, 1825). *Zool. Beitr.*, 33(3):331-344. (In German)

El-Kammah, K. M., Hoogstraal, H. & Camicas, J. L. 1992. Notes on African *Haemaphysalis* ticks: XI. *Haemaphysalis paraleachi* (Ixodoidea: Ixodidae) distribution and hosts of adults. *Internat. J. Acarol.*, 18(3):205-212.

Everard, C. O. & Everard, J. D. 1992. Mongoose rabies in the Carfibbean. *Ann. N. Y. Acad. Sci.*, 635:356-366.

Ginsburg, L. *et al.* 1991. The vertebrates from the lower Miocene of Barbotan-les-Thermes. *Ann. Paleontol.*, 77(3):161-216. (In French)

Hamdine, W. *et al.*, 1993. Feeding ecology of the genet (*Genetta genetta* Linné, 1758) in Djurdjura National Park, Algeria. *Mammalia* 57(1):9-18. (In French, English summary)

Harada, M. & Torii, H. 1993. Karyological study of the Masked palm civet *Paguma larvata* in Japan (Viverridae). *J. Mamm. Soc. Jpn.*, 18(1):39-42.

He, C. & Braunitzer, G. 1990. Carnivora: The primary structure of hemoglobin from the Masked palm civet (*Paguma larvata*, Viverridae). *Biol. Chem. Hoppe-Seyler* 317(10):1015-1020.

Henderson, R. W. 1992. Consequences of predator introductions and habitat destruction on amphibians and reptiles in the post-Columbus West Indies. *Carribean J. Sci*, 28(1/2):1-10.

Hoogstraal, H., El-Kammah, K. M. & Camicas, J. L. 1992. Notes on African *Haemaphysalis* ticks: XVI. *Haemaphysalis subterra* new species: A new member of the *leachi* group (Ixodoidea: Ixodidae). *Internat. J. Acarol.*, 18(3):213-220.

Lange-Badré, C. & Mathis, C. 1992. Données nouvelles sur les Géodontes Proviverrinés des zones MP 16 et MP 17 phosphorites du Quercy. *Bull. Mus. Natl. Hist. Nat. Ser. 4. Sci: Terre* 14:161-184.

Linhart, S. B. *et al.* 1993. Evaluation of baits for oral rabies vaccination of mongooses -pilot field trials in Antigua, West Indies. *J. Wildl. Dis.*, 29:290-294.

Lopezoria, L. & Castell, C. 1992. Comparative genet survival after fire in woody mediterranean species. *Oecologica* 91:493-499.

Loung, R. Z. *et al.* 1992. Malignant interstitial (Leydig)-cell tumor in a Formosan Gem-faced civet. *J. Chin. Soc. Vet. Sci.*, 18(2):93-96.

Machida, N. *et al.* 1992. Canine distemper virus infection in a Masked palm civet (*Paguma larvata*). *J. Comp. Pathol.*, 107(4):439-443.

Maddock, A. H. & Perrin, M. R. 1993. Spatial and temporal ecology of an assemblage of viverrids in Natal, South Africa. *J. Zool.*, 229(2):277-287.

Miquel, J. *et al.* 1992. On the helminth faunas of the carnivores in Montseny Massif (Catalonia, Spain): I. Parasites of Viverridae and Mustelidae. *Vie & Milieu* 42(3/4):321-325.

Nakakuki, S. 1993. The bronchial tree, lobular diversion and blood-vessels of the Masked palm cat (*Paguma larvata*) lung. *J. Vet. Med. Sci.*, 55:425-429.

Palacios, F., Gisbert, J. & Garcia-Perea, R. 1992. Has the Egyptian mongoose *Herpestes ichneumon* survived in the northeastern Iberian Peninsula? *Säugetierk. Mitt.*, 34:69-91.

Palomares, F. 1993. Opportunistic feeding of the Egyptian mongoose, *Herpestes ichneumon* (L.) in southwestern Spain. *Rev. Ecol. Terre Vie* 48:295-304.

Palomares, F. 1993. Immobilization of Common genets, *Genetta genetta*, with a combination of ketamine and xylazine. *J. Wildl. Dis.*, 29(1):174-176.

Palomares, F. 1993. Faecal marking behaviour by free-ranging Common genets *Genetta genetta* and Egyptian mongooses *Herpestes ichneumon* in southern Spain. *Z. Säugetierk.*, 58:225-231.

Palomares, F. & Delibes, M. 1992. An evaluation of techniques for capturing and radio-collaring Large grey mongooses. *S. Afr. J. Wildl. Res.*, 22(3):76-79.

Palomares, F. & Delibes, M. 1992. Immobilization of Egyptian mongooses, *Herpestes ichneumon*, with a combination of ketamine and xylazine. *Z. Säugetierk.*, 57(4):251-252.

Palomares, F & Delibes, M. 1993. Resting ecology and behaviour of Egyptian mongoose (*Herpestes ichneumon*) in southwestern Spain. *J. Zool.*, 230:557-566.

Palomares, F. & Delibes, M. 1993. Social organisation in the Egyptian mongoose -group size, spatial behaviour and inter-individual contacts in adults. *Anim. Behav.*, 45:917-925.

Palomares, F., Delibes, M. & Recio, F. 1992. Hematology and serum biochemistry of the Egyptian mongoose, *Herpestes ichneumon*. *J. Wildl. Dis.*, 28(4):659-661.

Ramachandran, K. K. 1991. Recent evidence of Brown palm civet from Silent Valley National Park. *Kerala For. Res. Inst. Newsl.*, 26:10.

Rasa, O. A. E. *et al.* 1992. Reproduction in the yellow mongoose revisited. *S. Afr. J. Zool.*, 27(4):192-195.

Rook, L., Ficcarelli, G. & Torre, D. 1991. Messinian carnivores from Italy. *Boll. Soc. Paleontol. Ital.*, 30(1):7-22.

Sanmartin, M. L. *et al.* 1992. A scanning electron microscope study of *Toxocara genettae* Warren, 1972 (Ascaridae), wit data on morphometric variation. *Folia Parasitol. (Prague)* 39(4):355-367.

Stoeva, S., Kleinschmidt, T. & Braunitzer, G. 1991. The primary structure of the hemoglobin from the Aardwolf (*Proteles cristatus*, Hyaenidae). *Biol. Chem. Hoppe-Seyler* 372(6):393-400.

Suarez-Hernandez, M. *et al.* 1991. Effectiveness of health education in the surveillance of rabies in mongooses. *Revista Cubana Hig. Epidemiolog.*, 29(2):120-1238.

Torii, H. 1993. Food habits of the Masked palm civet (I) Contents analysis of the feces collected in Hamakita. *Bull. Shizuoka Pref. Forest. & Forest Prod. Res. Inst.*, March:9-15. (In Japanese, English summary)

Wenhold, B. A. 1991. The ethology and social behavior of the Yellow mongoose, *Cynictis penicillata*. M.S. thesis, Univ. Pretoria (South Africa).

Xiang, P. 1989. Hand breast-feeding and taming of Small Indian civet. *Chin. Wildl.*, 1989(5):25-27. (In Chinese)

Zhang, D. *et al.* 1991. A study of the erythrocytic immune regulation of *Viverra zibetha* and *Viverricula indica*. *Acta Theriol. Sinica* 11(3):200-203. (In Chinese)

Mustelidae and Viverridae

Monfort, A. Première liste commentée des mammifères du Rwanda. *J. Afr. Zool.*, 106(2):141-151.

Rozhnov, V. V., Kuznetsov, G. V. & Pham Trong Anh. 1993. New data on the distribution of small carnivores in Vietnam. *Lutreola* 2: 14-15.

Procyonidae

Averbeck, G., Laursen, J. & Stromberg, B. 1992. Two dogs found with a patent infection of *Baylisascaris procyonis* (the common raccoon ascarid). *J. Minn. Acad. Sci.*, 57(1):7.

Belant, J. L. 1992. Homing of relocated Raccoons *Procyon lotor*. *Can. Fld. Nat.*, 106: 382-384.

Bruggeman, E. P. 1992. Rabies in the mid-Atlantic states - Should Raccoons be vaccinated? *BioScience*42(9):694-699.

Burger, J. & Gochfeld, M. 1993. Effect of group size on vigilance while drinking in the Coati, *Nasua narica* in Costa Rica. *Anim. Behav.*, 44(6):1053-1057.

Chausseil, M. 1992. Evidence for color vision in procyonids: Comparison between diurnal Coatis (*Nasua*) and nocturnal Kinkajous (*Potos flavus*). *Anim. Learn. Behav.*, 20(3):259-265.

Endres, K. M. & Smith, W. P. 1993. Influence of age, sex, season and availability on the den selection by raccoons within the Central Basin of Tennessee. *Amer. Midl. Nat.*, 129(1):116-131.

Feigley, H. P. 1992. The ecology of the Raccoon in suburban Long Island, New York and its relation to soil contamination with *Baylisascaris procyonis* ova. Ph.D. dissertation, State Univ. N. Y. Coll. Environ. Sci. & For. 154 pp.

Fischman, H. R. *et al.* 1992. Epizootic of rabies in Raccoons in Maryland from 1981 to 1987. *J. Amer. Vet. Med. Assoc.*, 201(12):1883-1886.

Gehrt, S. D., Spencer, D. L. & Fox, L. B. 1990. Raccoon denning behavior in eastern Kansas as determined from radio-telemetry. *Trans. Kansas Acad. Sci.*, 93(1/4):71-78.

Glatston, A. R. 1988. Ten years after: The history of the Red Panda Studbook. *Proc. World Conf. Breeding Endang. Species Capt.*, 5:53-66.

Glatston, A. R. 1992. An outline of husbandry and management techniques for the Red panda. Pp. 133-143 *in*: J. Partridge, ed. *Management guidelines for bears, pandas, and raccoons*. Ass. Brit. Wild Anim. Keepers, Bristol.

Goldberg, M. M. *et al.* 1992. Diffuse unilateral subacute neuroretinitis - epidemiologic documentation of *Baylisascaris* infestation of the raccoon population in northern California. *Investig. Ophtalmol. Vis. Sci.*, 23:743. (Abstract)

Guillemot, J.-P. *et al.* 1992. Somatosensory receptive field properties of corpus callosum fibres in the Raccoon. *J. Comp. Neurol.*, 321(1):124-1323.

Hadidian, J., Manski, D. A. & Riley, S. 1991. Daytime resting site selection in an urban Raccoon population. *Natl. Inst. Urban Wildl. Symp. Ser.*, 2:39-45.

Hagen, D. J., VanDruff, L. W. & Batcheller, G. R. 1991. Movement and behavior of relocated urban Raccoons. *Natl. Inst. Urban Wildl. Symp. Ser.*, 2:249-250.

Hamir, A. N., Moser, G. & Rupprecht, C. E. 1992. Morphologic and immunoperoxidase study of neurologic lesions in naturally acquired rabies of Raccoons. *J. Vet. Diagnostic Invest.*, 4(4):369-373.

Hamir, A. N., Raju, N. & Rupprecht, C. E. 1992. Experimental oral administration of canine adenovirus (type 2) to Raccoons (*Procyon lotor*). *Vet. Pathol.*, 29(6):509-513.

Hanni, K. D. & Millar, J. S. 1993. Fall molt and lipid storage in Raccoons (*Procyon lotor*). *Can. J. Zool.*, 71(3):634-637.

Hanson, W. L. *et al.* 1993. Collateral ventilation and pulmonary arterial smooth muscle in the coati *J. Appl. Physiol.*, 74:2219-2224.

Jacobs, G. H. & Deegan, J. F. II. 1992. Cone photopigments in nocturnal and diurnal procyonids. *J. Comp. Physiol. A Sens. Neural Behav. Physiol.*, 171(3):351-358.

Julien-Laferriere, D. 1989. Utilization de l'espace et des resources alimentaires chez *Caluromys philander* (Marsupulia, Didelphidae). Comparaison avec *Potos flavus* (Eutheria, Procyonidae). Thèse de doctorat. Université de Paris 3. 186 pp.

Julien-Laferriere, D. 1993. Radio-tracking observations on ranging and foraging patterns by Kinkajous (*Potos flavus*) in french Guiana. *J. Trop. Ecol.*, 9:19-32.

Hill, R. E. Jr., Beran, G. W. & Clark, W. R. 1992. Demonstration of rabies virus-specific antibody in the sera of free-ranging Iowa Raccoons (*Procyon lotor*). *J. Wildl. Dis.*, 28(3):377-385.

Keeling, N. G., Roelke, M. E. & Forrester, D. J. 1993. Subcutaneous helminths of the Raccoon (*Procyon lotor*) in southern Florida. *J. Helminthol. Soc. Washington* 60(1):115-117.

Kitchener, A. 1992. Systematics and taxonomy of pandas and raccoons. Pp. 109-111 *in*: J. Partridge, ed. *Management guidelines for bears, pandas, and raccoons*. Ass. Brit. Wild Anim. Keepers, Bristol.

Krüger, H.-H., Hohmann, U. & Festetics, A. 1993. Zur Raummnutzung der Waschbären (*Procyon lotor*). *In*: 67th Hauptversammlung der Deutsche Gesellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen: 37. Verlag Paul Parey, Hamburg. (Abstract)

Pohl, B. 1993. Visuelles Lernvermögen und Transfer des Begriffes "gleich-ungleich" bei Waschbären (*Procyon lotor*). *In*: 67th Hauptversammlung der Deutsche Gesellschaft für Säugetierkunde: Kurzfasingen der Vorträge und Posterdemonstrationen: 51. Verlag Paul Parey, Hamburg. (Abstract)

Reddacliff, G. L., Halnan, C. R. & Martin, I. G. 1993. Mosaic 35X/36XY karyotype and intersex in a Red panda (*Ailurus fulgens fulgens*). *J. Wildl. Dis.*, 29:169-173.

Ritke, M. E. & Kennedy, M. L. 1993. Geographic variation of sexual dimorphism in the Raccoon, *Procyon lotor*. *Amer. Midl. Nat.*, 129:257-265.

Robel, R. J., Barnes, N. A. & Fox, L. B. 1990. Raccoon populations: Does human disturbance increase mortality? *Trans. Kansas Acad. Sci.*, 93(1/4):22-27.

Roloff, G. J. 1990. The influence of weather and season on Raccoon (*Procyon lotor*) movements and activity in central Kentucky. M.S. thesis, East Ky. Univ. 115 pp.

Rupprecht, C. E. *et al.* 1992. Consideration of inactivated rabies vaccines and oral immunization of wild carnivores. *J. Wildl. Dis.*, 28:629-635.

Semel, B. & Nicolaus, L. K. 1992. Estrogen-based aversion to eggs among free-ranging Raccoons. *Ecol. Appl.*, 439-449.

Standley, S. 1992. The Ring-tailed coati. Pp. 143-149 *in*: J. Partridge, ed. *Management guidelines for bears, pandas, and raccoons*. Ass. Brit. Wild Anim. Keepers, Bristol.

Stanyon, R. *et al.* 1993. A standardised g-banded karyotype for the Raccoon (*Procyon lotor*) compared with the domestic cat. *Boll. Zool.*, 60:41-45.

Taulman, J. F. & Williamson, J. H. 1993. A simple apparatus and technique for anesthetizing Raccoons. *Amer. Midl. Nat.*, 129(1):210-214.

Torrence, M. E., Jenkins, S. R. & Glickman, L. T. 1992. Epidemiology of Raccoon rabies in Virginia, 1984 to 1989. *J. Wildl. Dis.*, 28(3):369-376.

Uhaa, I. J. *et al.* 1992. Benefits and costs of using an orally absorbed vaccine to control rabies in Raccoons. *J. Amer. Vet. Med. Assoc.*, 201(12):1873-1882.

Yonzon, P. B. 1989. Ecology and conservation of the Red panda in the Nepal Himalayas. Ph. D. dissertation, Univ. Maine (Orono), 169 pp.

General

Berrigan, D. *et al.* 1993. Phylogenetic contrasts and the evolution of mammalian life histories. *Evol. Ecol.*, 7:270-278.

Broekhuizen, S., Hoekstra, B., van Laar, V., Smeenk, C. & Thissen, J. B. 1992. *Atlas van de Nederlandse zoogdieren*. Stichting Uitgeverij van de Koninklijke Nederlandse Natuurhistorische Vereniging, Utrecht.

Greenwood, A. G. 1992. Veterinary considerations. Pp. 143-149 *in*: J. Partridge, ed. *Management guidelines for bears, pandas, and raccoons*. Ass. Brit. Wild Anim. Keepers, Bristol.

Subscriptions

Subscription for 1994 (two numbers planned) is 600 Belgian francs (approx. 20 US$ or 10£ or 30DM).

United States residents please send a cheque for US$ 20 to:

Don Moore
Exec. Director Thomson Park Conserv.
P.O. Box 8182
Watertown, NY 13601
USA

Please note **IUCN/MV & PSG** in the 'memo' section at cheque bottom !

★ ★ ★

United Kingdom residents please send a cheque for £10 to:

Paul Robinson
Southport Zoo
Princes Park
Southport, Merseyside PR8 1RX
UK

Please make cheques payable to **Paul Robinson** !

★ ★ ★

Germany residents please send a cheque for DM30 to:

Roland Wirth
Franz-Senn-Straße, 14
81377 München
Germany

★ ★ ★

All other subscribers please send, if possible, a Eurocheque for 600 Belgian francs (no banking costs deducted!). On other cheques or when in foreign currency, please add 30% to cover currency converting and banking costs and send to:

Harry Van Rompaey
Jan Verbertlei, 15
2650 Edegem
Belgium

The aim of the Newsletter is to promote communication between all interested in mustelid, viverrid and procyonid conservation and to stimulate conservation related activities for the species involved. In order to do so we should be financially independent.
Any assistance in the form of donations, sponsorship, and subscriptions is most welcome.