# SMALL CARNIVORE CONSERVATION

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

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Back-striped weasel (*Mustela strigidorsa*) in Phu Khieo Wildlife Sanctuary, Thailand - Photo: N. Suannarong

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


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# EDITORIAL

## A note from the new MVP SG Chair: Huw Griffiths

Following the recent resignation of Roland Wirth from his long-held position as Chair of the Mustelid, Viverrid and Procyonid Specialist Group, it is with great pleasure that I have accepted the position as his successor. While I am flattered to be asked to do so, I am acutely aware that I am not the best person for the job since there are many people who are more qualified for the post, and certainly many who could do the job more ably. Thus, while I have accepted the position as Chair, I will be pleased to stand aside should the group propose someone more suitable. I only hope that I can do as good a job as did Roland.

A member of the group for perhaps ten years, and associate editor of *Small Carnivore Conservation* since 1997, my background lies largely in the conservation and biogeography of Palaearctic mustelids – mainly Eurasian badger, and more recently (with Angus Davison and colleagues) *Martes*, *Mustela putorius*, *M. eversmannii* and *M. lutreola*. I also have a long-standing interest in the marbled polecat, *Vormela peregusna*. Despite this, I feel that my major task as Chair will be to encourage interest in tropical species, and most particularly in the viverrids. We still know alarmingly little about many of these fascinating animals, even though many are amongst our highest risk species.

The job of Chair comes with various obligations to the Species Survival Commission itself, but from the Group's point of view I am particularly keen to see:

- new members for the group, encompassing new areas of scientific and technical expertise and enhanced regional coverage,
- increased public promotion of small carnivore conservation issues – e.g. through a dedicated website,
- a more consolidated research ethic, including formal co-ordinated "work groups",
- the pursuit of funding for specific conservation-related projects,
- the placing of our newsletter *Small Carnivore Conservation* on a secure financial footing.

Clearly, none of these aims is achievable without assistance and consensus, so I invite all group members with comments / ideas / suggestions to contact me at the address below. The Group belongs to its membership, and I encourage you all to take a hand in shaping its future.

I would like to finish by thanking Roland Wirth for his sterling efforts over the last decade, and I hope that he will be willing to continue as a group member now that he is liberated from the more onerous administrative tasks.

29. Jan 2002

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# The Back-striped weasel *Mustela strigidorsa* Gray, 1853 in northeastern Thailand

Lon I. GRASSMAN Jr.[1], Kitti KREETIYUTANONT[2], and Michael E. TEWES[1]

The Back-striped weasel (*Mustela strigidorsa* Gray, 1853) is perhaps the most poorly studied living small carnivore today. Information on this elusive weasel exists only as sighting and distribution reports (Lekagul & McNeeley, 1988; Treesucon, 1989; Ratajszczak *et al*., 1991; Evans *et al*., 1994; Duckworth, 1997; Choudhury, 1997; Kanchanasakha *et al*., 1998; Choudhury, 2000).

We report on the capture of a back-striped weasel during an ongoing study of the carnivore community in Phu Khieo Wildlife Sanctuary (PKWS), Thailand (Fig. 1). Recent evidence in PKWS suggests that this weasel may not be as rare as previously thought.

On 29 December 2001 we captured a male juvenile back-striped weasel in a small carnivore box-trap baited with a live chicken (Fig. 2). The trap was located on a dirt road in a hill evergreen forest (850 m a.s.l. ), 30 m from a stream (16°24'N, 101°36'E). The animal was not anesthetized for critical examination, but we estimated the weight at 700 g with a total length of 25 cm. The teeth appeared very white and sharp with minimal wear. After photographs and video, the weasel was released.

The capture of this individual renewed our interest in ascertaining the status and distribution of this mustelid in PKWS. The distinct thin dorsal white stripe is diagnostic of a back-striped weasel, since no other small carnivore in Thailand has this trait. Subsequent interviews with sanctuary rangers and staff revealed that the back-striped weasel was positively identified on four other occasions in 2001. To avoid interview bias, there was no mention of the white stripe, but rather photos were shown of the Siberian weasel *Mustela sibirica*, Javan mongoose *Herpestes javanicus*, Burmese ferret-badger *Melogale personata*, and Yellow-throated marten *Martes flavigula*, in addition to the back-striped weasel. The common Javan mongoose and yellow-throated marten were identified as sighted most often, while the back-striped weasel was identified four times. The Siberian weasel, which looks very similar to the back-striped weasel, and is thought not to exist in PKWS, was not identified.

Three of the back-striped weasel sightings occurred around the Tung Kra Mung headquarters area, within 1 km of our captured individual. One of the Tung Kra Mung weasels, an adult, was photographed (see cover photo) drinking from a stream. An additional individual was seen in a low elevation hill evergreen forest (700 m a.s.l.) approximately 9 km northeast of Tung Kra Mung (E. Larney, pers. comm.).

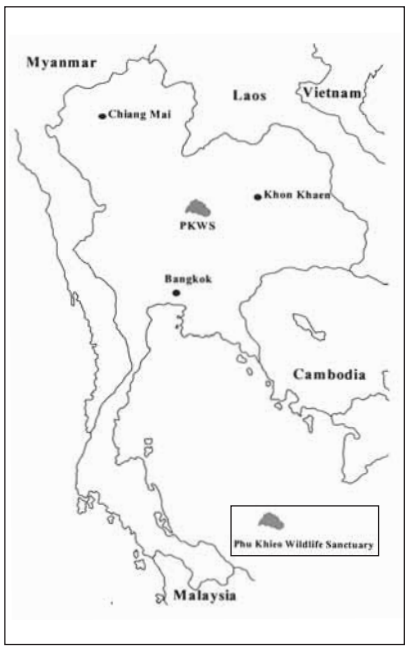


*Fig.1. Phu Khieo Wildlife Sanctuary, Thailand.*

The back-striped weasel is listed as Globally Vulnerable (IUCN, 2000) and extremely rare (Lekagul & McNeeley, 1988) and endangered in Thailand (TISTR, 1991; OEPP, 1997). However, the distribution of this weasel in PKWS and in Phu Luang Wildlife Sanctuary, 100 km north in Loei Province (Treesucon, 1989) may indicate that this species is more common than previously thought.

*Fig. 2. Young male Back-striped weasel in a box trap. Photo: Lon I. Grassman Jr.*

Distribution records from other countries indicate wide habitat use (Duckworth *et al*., 1999), but at presumably low densities. The lack of small carnivore research undertaken in the region may explain the paucity of sightings of this species. In addition, the small size and general similarity of the back-striped weasel to the common Javan mongoose may have led observers, with only a brief observation, to incorrectly assume the back-striped weasel to be a Javan mongoose or other small mammal. More field research is needed to quantify the status, distribution, and conservation of this species.

## Acknowledgments

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# Records of Little Known Small Carnivores from Thailand, Lao PDR and southern China

Robert TIZARD

## Introduction

Over the past five years I have had the opportunity to visit a number of remote and rarely visited sites in Thailand, Lao PDR and southern China. During these travels I have made several observations of rare and unusual wildlife. Not the least of these sightings has included a number of poorly known small carnivores including Spotted linsang *Prionodon pardicolor* and Back-striped weasel *Mustela strigidorsa.*

I have also received reports of recent observations of these carnivores by non-biologists working in the region. These are included herein as well as a museum specimen of Yellow-bellied weasel *Mustela kathiah* not included in a recent synthesis of small carnivore records from Lao PDR (Duckworth, 1997). The following paragraphs provide an account of my observations and those of others in response to Schreiber *et al*.'s (1989) appeal for all records of these little known species.

## Records

**Spotted linsang *Prionodon pardicolor***

A single individual was watched from a distance of less than five meters as it walked through thick grass near the park headquarters of Doi Inthanon National Park, Chang Mai Province, Thailand on 8 December 1995 at approximately 17h30. The habitat in this part of Doi Inthanon NP consists of moist secondary growth along water courses through a degraded mosaic of cultivation, scrub and pine plantations at ca. 1400 m altitude.

The animal was covered in small evenly spaced dark spots with the most striking feature when seen from above being the thick dark lines stretching down either side of its neck. The general fur colour was creamy white with a yellowish tinge. The long tail had evenly spaced bands of black and white approximately one inch thick each. As far as I can discern this is apparently the first recent record for Thailand. Van Rompaey (1995) cites no recent Thai records in his paper on the species.

A single animal was seen for sale at the side of the road between Mengla and Shangyong, Xishuanbanna Autonomous Region, Yunnan, PR China on 8 November 1997. This individual was being sold along with one Common palm civet *Paradoxurus hermaphroditus* and three Masked palm civets *Paguma larvata*. The individual was creamy white with a yellowish tinge, evenly covered in dark spots and again showed striking dark bars along the back of the neck stretching onto the shoulders. The tail was evenly banded, each band being approximately one inch thick. All the civets on display had been reportedly caught the previous night in the Xishuanbanna Biosphere Reserve using a gun and spotlight. The animals were put on display for sale in front of the reserve headquarters. Van Rompaey (1995) mentions only a single specimen from Yunnan citing Schreiber *et al.* (1989). The only other recently published Chinese record was reported by Yangsheng (1998) for Jiangxi province.

A third animal was found dead and photographed in the Oudomxay Market, Oudomxay Province, Lao PDR in February 2001 (F. Debruyne and A. Schoofs, *in litt*. 2001).

**Back-striped weasel *Mustela strigidorsa***

A single animal was encountered in the Nam Ha National Biodiversity Conservation Area in Loang-Namtha Province, northern Lao. The animal was observed in the late afternoon on 8 March 1997. It was in a moist stream valley in un-degraded evergreen forest at 720 m altitude. It was watched for several minutes as it foraged along a dead log, looking in cracks and crevices and moving up, under and around the log. It then disappeared into vegetation. The animal showed a thin cream line extending from the mid-nape to the first third of the tail and a yellowish cream chin and chest. Otherwise it was uniformly reddish brown in colour (Tizard *et al*., 1997).

A single animal was seen near the village of Ban Somphan Yao, Loang-Namtha Province, Lao PDR on March 25, 1998. It was found along a stream 5 minutes walk from the village while the observer was taking a bath. It was watched at a distance of less than 5 meters for several minutes. Once it noticed the observer it disappeared into undergrowth (S. Ling pers. com., 1998).

**Yellow-bellied weasel *Mustela kathiah***

A hitherto unpublished specimen (AMNH 87393) in the American Museum of Natural History that was not documented in Duckworth (1997, 1999) provides the only record for South Laos. It was caught on the Bolaven Plateau on 5 February 1932, by T. D. Carter on the Legendre expedition (see Legendre, 1932; Dickinson, 1970). Both skin and skull are preserved.

## Acknowledgements

I would like to express my gratitude to Stuart Ling, Filip Debruyne and Anne Schoofs for sharing their small carnivore records with me. I would also like to thank the Department of Forestry, Ministry of Agriculture and Forestry, Government of Lao PDR for supporting my work in Lao and southern China, notably Mr. Venevongphet, Mr. Chantaviphone Inthavong, Boonhom Sounthla, Kunmee Salivong and Boonsou Sovane. The Wildlife Conservation Society Lao Programme and the World Wide Fund for Nature Indochina program provided financial support for this fieldwork. Michael Rank was gracious enough to provide me with an English translation of the Jianxi Linsang record, William Duckworth provided constant encouragement to compile these sightings for publication, and Ian Tizard tracked down important references when I was far from any library.

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# First experiences with keeping and breeding Narrow-striped mongooses *Mungotictis decemlineata* in Berlin Zoo, Germany

Norbert ZAHMEL

When, in December 1997, Berlin Zoo received its first pair of Narrow-striped mongooses *Mungotictis decemlineata* from Madagascar, almost nothing was known about the biology and behaviour of this diurnal animal. Moreover, not even the latest literature gave much detail on the species' biology or information on its needs in captivity. This is not surprising, as this species of mongoose has never before been kept in a zoo outside Madagascar, even though everybody agrees that the exhibition of such animals allows zoos to make a significant contribution to conservation in general.

## The new home

In preparation for the arrival of the pair of *M. decemlineata* we "blindly" designed two separate cages for the two animals, following advice from every available source. The bottom line was to make enclosures that were completely safe against escape attempts by the new inhabitants. We sealed every possible gap greater than 3 x 3 cm with plastic-coated wire, corrosion-free tin plate or simple wooden slats. As we were aware of the marvellous climbing abilities of these mongooses we provided branches of different sizes inside the cages, so allowing the animals to use the whole cage in a three dimensional way. All objects were fixed as firmly as possible to avoid any accidents.

To further decorate the new *Mungotictis* enclosures we chose to add the vegetation most appropriate for the animals. We decided to use some drought-resistant plants which are also very resistant to damage. These plants we brought into the inner enclosures, whilst roots, foliage and sand were also added as groundcover. Plant pots were surrounded with stones to make them more resistant to digging activities. The outsides of the enclosures were left in a natural state, i.e. containing bushes, ferns and grasses, so giving the mongooses some possible hiding places while being outside during the day.

Our main goal was always to prepare the cages so that they were as acceptable as possible to the newly arrived animals. However, we also had to choose a kind of decoration that was likely to match the interests and expectations of our visitors as well.

## The arrival of the two *M. decemlineata*

The two mongooses were a donation from the Tsimbazaza Zoo in the Madagascan capital Antananarivo, with whom Berlin Zoo has a cooperation agreement.

We had been informed that the two animals were both quite well known to each other and thus we decided to place them together in their new housing upon their arrival by plane. They immediately commenced species-specific behaviours: they started to dig, scratch and scrape at various points throughout the whole cage, to sniff around at those spots, and to continue with digging and scraping, etc. Similar to the behaviour known from racoons, coatis and short clawed otters, the mongooses used their front paws to grope for items that interested them. They did not, however, show much interest in each other, which proved to us that they were already well adapted to each other. This first phase of inspecting the new enclosure lasted for a few hours and we immediately noticed the self-assured manner and curious behaviour of these small carnivores. We found that shyness or anxiety, so often observed in newly-arrived carnivores, were completely unknown to these animals.

This also continued to be the case in the coming days as we started to enter the cages to clean them. The animals always showed much interest in the keeper's activities, never reacting with panic or shyness. I found this behaviour especially remarkable because although the two narrow-striped mongooses arrived at Berlin from Tsimbazaza Zoo, both were originally wild caught animals.

The animals were also easy from the point of view of diet. Every food offered to them was accepted immediately and without problem. We were thus able to serve them mice, chicks, various insects, eggs, lean beef or horsemeat, filleted fish (herring or mackerel), sweet fruits (apples, pears, bananas, peaches or grapes) and baby food. The only problem was associated with feeding them milk-sugar rich items, which caused a minor diarrhoea that lasted for a maximum of one day. We fed the animals once a day, six times a week. We always left them together whilst feeding and, thanks to the harmonious life of these individuals, there were never quarrels about food.

## The first birth

Three weeks after the pair's arrival in Berlin Zoo we observed that the female was gaining weight significantly. Since dominance over food resources was excluded as being a reason for this, we suspected that the female was pregnant. Because we lacked any experience of breeding this species we separated the two animals to avoid possible aggression between them. Following this, we constructed a box with different chambers and placed it in the cage of the female two weeks before we expected her to give birth. The size of the single entrance hole of the box was designed so that the female was able to block it easily with her own body. Later we found that, if different boxes were offered, the multi-chambered box was always selected. Neither she nor we placed any pads in the box.

In the afternoon of the 17th January 1998 the female was hidden in the box and, on the next morning, she was found to have given birth to a single juvenile. The following day the female again started to eat regularly, carrying the curled-up juvenile in her mouth to the feeding site. While feeding with remarkable speed, she always placed the cub besides her, after first ensuring that the surrounding area was secure. After finishing her meal she returned straight to the box with the juvenile and remained there until the next day. Any possible disturbances from us were reduced to the minimum within the first two weeks, i.e. only food and fresh water was provided regularly in this period.

The new-born juvenile weighed around 50 grams and the animal was already quite well developed. We observed that the first Berlin Zoo-born narrow-striped mongoose made its first attempts at walking on the second day of life. These became enhanced in the following days and, on the fifth day, the first attempts at climbing attempts were noted. The juvenile's development continued rapidly, leading it to take its first solid food after 12 to 14 days.

## Behaviour studies

The juvenile proved to be a male. After six months we decided to separate the full grown youngster from its mother and to let the male back into the female's enclosure. We found out that a helpful technique for catching the juvenile was to push it into the box, seal the entrance, and then transfer the whole box into a closed room where then the animal could be caught more easily by hand or with a net. This procedure helped to reduce stress on both the animal and the keeper.

For the first three days the two adults were allowed to touch each other, but were kept apart by a narrow fence. As they showed no aggression the fence was removed and the animals were left together. Later we didn't use this method, which was clearly unnecessary. In the first moments after reunification, the male *Mungotictis* showed a kind of appeasement behaviour, expressed by pointing his behind toward the female, while pressing his tail close to the ground. The female reacted with bites to the rump and tail-base of the male. In that moment the male escaped with some jumps, followed by the female, and the whole procedure started again. During these rituals the male never showed any sign of aggression and, in fact was, very devout throughout. The whole process lasted from between some minutes to several hours. Even on the first day after being reunited the animals sat just 50 cm away from each other and behaved very peacefully - even when feeding together for the first time.

However we observed that sometimes the female started marking something like a territory after both animals were reunited. She rubbed her chin and throat heavily sideways or in a playfull way up and down. Furthermore, she used her anal gland to mark various points, distributing the odour afterwards into the air by very brusque tail movements. The male meanwhile sat beside the female and appeared interested in her behaviour, but without showing any real reaction to it.

General excitement was shown by this mongoose species by their holding their tails vertically and additionally spreading the tail hairs in all directions. Often this is accompanied by a vocal sound comparable with an owl or hyaena-like long call: "Huuuuu Huuuuu Huuuuu". In moments of lesser excitement one could hear a soft "Wud Wud Wud". Other, sometimes rather similar voice expressions exist but, in my view, require further study before one could assign them to a specific behaviour.

## The first hand reared *Mungotictis decemlineata*

In summer 2000 we were, through various reasons, unable to separate the male narrow-striped mongoose from the pregnant female. Also, at this time, the female was not very experienced from the point of view of reproduction. The female delivered her juvenile in the box but with the male present in the same enclosure. Soon afterwards she started to chase the male away in such an aggressive manner that he completely retreated to the outer enclosure. It was then decided to separate the adults to protect the male against further attacks from the young mother. However, the concept failed somehow after two days and the very nervous female started to continually carry her offspring around the cage. The juvenile obviously became more and more weak through this, and it was decided to take it for hand rearing.

My wife and I took over this task. We separated the young from its mother just in time to find that it was already quite 'flabby' and hypothermic. I placed the juvenile in a padded box in a heated room (30°C) and warmed it slightly with an infrared lamp. I also massaged the tiny body to enhance the blood circulation. All those actions succeeded and the juvenile's condition started to stabilise. The cub then got its first substitute milk (brand = CAT-MILK) via a pipette. It drank 0.2 ml and was put back in the box after a second massage, continuing to stay under the infrared lamp. In the following three weeks the hand reared juvenile (a male as we found out in the mean time) was fed six times a day, with amounts of food increasing over the entire period. In the fourth week we reduced the number of feeds and, by the 50$^{th}$ day, the animal was receiving only two feedings per day. The young male was quite well developed and it was time to place him back in the Zoo, in a new cage, decorated in the usual style.

In the beginning the juvenile male was still anxious about unknown noises etc., and always went straight into his box at such times. His box was padded with textiles that he knew from the hand-rearing period at our home. After a while he adapted himself very well to the situation in the Zoo and soon showed the same curiosity and interest in different smells and objects as did the other mongooses of this species in Berlin Zoo.

We observed that the usual method of opening eggs - by slinging them through the hind legs against something - seems to be an innate behaviour as the hand-reared juvenile also used this method without having learned it from any other individual. Just the accuracy of matching the aimed item with the egg has to be enhanced through "learning by doing".

A further previously unreported behaviour was eating small prey. The young male killed young mice by biting them in the head before eating them. It was also of interest to see that he also knew the above described "appeasement behaviour".

This was also the case for vocalisations. The hand-reared young male knew, before having contact with any other mongooses, the excitement sounds as well as a rapid "Wit Wit Wit" performed by all *Mungotictis* as a greeting to each other or their keeper.

Because of the normal development of the juvenile male we decided to keep him with another male (four months older) until he was aged six months. Since narrow-striped mongooses are, I think, perhaps prone to stereotypic behaviour, we hoped to avoid such problems through bringing the two individuals together. Both animals were equally developed although differently sized, however, neither had reached sexual maturity. The introduction worked well and after three hours the two juvenile males were already playing together.

## Final remarks and recommendations

From the veterinary point-of-view we only had problems with ectoparasites in our group of *M. decemlineata*. These were the usual fleas and mites, which we always eradicated soon after their appearance. Further attention was paid to small, naked patches in their coats, especially on the heads, but it seems that the animals create these patches through their strenuous activity. Whether this is solely the case in captivity is not yet clear, however, these scouring patches sometimes became inflamed, so that medical treatment with appropriate ointment became necessary.

Bored mongooses tend to nibble on each other's coats, again creating bald patches. Such behaviour is definitely the result of boredom, but behavioural enrichment is very simple for narrow-striped mongooses - even a portion of new sand placed in a heap in the cage will keep them busy for hours. Another possibility is the distribution of mealworms throughout the whole enclosure instead of placing them all on one spot. One method currently practised is the filling of empty bamboo pipes with various foods before sealing them with a fig or something similar - such items will keep the animals busy for a very long time.

To summarise: Narrow-striped mongooses are highly attractive animals and very easy to keep, needing only warm housing (minimum = 15 °C). An appropriate outer enclosure is also good, as the animals like this very much and sunbathe extensively. However, any deficiency in enclosure security will be found very soon, and the mongooses will escape immediately; their marvellous climbing abilities make them very capable of such unwanted "walks".

Since the first arrival of a pair of *M. decemlineata* in Berlin Zoo in December 1997 we have successfully bred seven offspring of different genetic descent. Six of these animals survived and grew up, one being hand-reared. With a wider base of founder animals and the participation of other international zoos, all participants can perhaps significantly contribute to the conservation of this endangered endemic animal by building up a larger captive population. Nonetheless more data from the wild and sufficient *in-situ* action are urgent for the species as well.

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# Olingos, *Bassaricyon beddardi* POCOCK, 1921, in Brazilian Amazonia: Status and recommendations

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## INTRODUCTION

*Bassaricyon beddardi*, described by Pocock in 1921, is one of the least known and most elusive species of procyonids, with virtually no information on their ecology and natural history, and once classified as unknown (UK) in the Red Data List (IUCN, 1994). The only specimen collected was the holotype from British Guiana, in 1895. The species was first erroneously identified as a kinkajou, *Potos flavus*, later as a cacomistle, *Bassaricyon sumichrasti*, and finally as the olingo *B. beddardi,* due mainly to cranial features (Pocock, 1921). There are, however, specimens identified as *B. gabbi* by O. Thomas collected from Venezuela (BMNH-No. 56, from Mundiapo) and by W. F. Rosenberg from Colombia (BMNH-No. 55, from Chiquirí) deposited in The Natural History Museum, London. Although five olingo species are described, some authors consider these to be subspecies of *B. gabbii* (Eisenberg, 1989; Emmons & Feer, 1997) and there have been no recent revisions of this genus. Olingos are completely ignored by the scientific community, and unknown to local people who think they are kinkajous (*Potos flavus*), or night monkeys (*Aotus trivirgatus*) or, in certain cases, see them as a threat due to taboos introduced in the local community by immigrants.

The aim in this study is to highlight the need for a better knowledge of this species, and to disseminate the little information available, which may stimulate conservation organizations and decision-makers to support research and conservation programs.

## CLASSIFICATION

Five species of olingos have been described to date: *Bassaricyon gabbii* J. A. Allen, 1876, the type species, *B. alleni* Thomas, 1880, *B. beddardi* Pocock, 1921, *B. lasius* Harris, 1932, and *B. pauli* Enders, 1936. Emmons & Feer (1997) however, consider them all to be subspecies of *B. gabbii.* Eisenberg & Redford (1999) refer to the five species, but suggest that *B. pauli* and *B. lasius* may be subspecies of *B. gabbii*. Reid (1997) recognizes three species: *B.gabbii, B. pauli* and *B. lasius*, the last two being subspecies of the first. Russel (1995) considers *B. lasius* and *B. pauli* subspecies of *B. gabbii*, but *B. beddardi* as a subspecies of *B. alleni*.

As typical of the genus, *B. beddardi* Pocock 1921 has very small ears, with the inner side coloured dark brown peripherally, contrasting with the pale (or pinkish) central part. The neck is dark brown, except for a circular reddish furless spot in its lower side. The tail is pale beige, non-prehensile (the opposite of kinkajous, which are nor present in the area), with a dark brown tip, firmly contrasting with the rest. The venter of the body is pale beige, with some whitish or grayish patches of fur; in contrast, the dorsum is dark brown. This is the first record of olingos in the Brazilian Amazonia, made during a study in 1992 (Mendes Pontes, 1994), during which the Environment Office withheld permission for captures. Based on our field observations, which led to the description above, we strongly believe that these olingos are distinct from *B. gabbii*. This is supported by the fact that the closest record to our study area was that of Pocock (1921) for *B. beddardi* (Pocock´s olingo) in the British Guiana, although Ochoa *et al*. (1993) refer the olingos found in the Guyana region of Venezuela to *B. gabbii*.

## DISTRIBUTION

According to the literature (Emmons & Feer, 1997; Reid, 1997; Eisenberg & Redford, 1999) Pocock's olingo occurs in British Guyana, Venezuela and Brazil. Only the holotype from British Guyana has, however, been collected so far -by Pocock in 1895 (Pocock, 1921). Mendes Pontes (2000) and Mendes Pontes & Chivers (*in press*) have recorded a total of 33 sightings of Pocock´s olingo at sites in the State of Roraima, northernmost Brazilian Amazonia: Maracá Ecological Station, two farms outside southern Maracá, and in Caroebe Settlement, southernmost Roraima.

## POPULATION

The only estimate of population size made to date is that of Mendes Pontes (2000) and Mendes Pontes & Chivers (*in press*) at Maracá Ecological Station, Roraima, Brazilian Amazonia. During the year 1994 overall group density was 11.3 groups/km$^2$, with an individual density of 20.4 individuals/km$^2$, and a mean group size of 1.9 individuals/group. Biomass was 25.5 kg/km$^2$ (metabolic biomass of 19.1kg/km$^2$) (Mendes Pontes & Chivers, *in press*).

During the period 1997/1998 (Mendes Pontes, 2000), when ecological densities were collected separately for two distinct forest types, olingos represented densities of 6.1 groups/km$^2$ in Terra Firme forest, 4.1 groups/km$^2$ in Mixed forest, 7.8 individuals/km$^2$ in Terra Firme forest, and 4.1 individuals/km$^2$ in Mixed forest, respectively. Mean group size was 1.4 individuals/group in Terra Firme forest, and only solitary animals were seen in Mixed forest. Biomass in Terra Firme forest was 9.4 kg/km$^2$,(metabolic biomass 7.05 kg/km$^2$) and in Mixed forest, 4.9 kg/km$^2$ (metabolic biomass 3.7 kg/km$^2$).

The occurrence of olingos was also confirmed from farms immediately outside southern Maracá, and in the south of the State of Roraima, in Caroebe settlement (the latter, only from settlers' information), but their population is unknown. In some indigenous communities close to Maracá, olingos were also referred to, but locals were not sure if they were indeed olingos or night monkeys.

## STATUS

Olingos were initially classified as unknown (UK) in the Red Data List (IUCN, 1994), but since 1996 they were included in the lower risk category (LRnt). Since no studies were carried out on the species during this period, this change in the status category was most probably due to the rate of ever increasing destruction of their habitat through forest fragmentation, selective logging and burning. Glatston (1994) believes that if there are indeed 5 species of olingos, there is a good possibility that some of these are threatened.

## HABITAT

According to the literature olingos inhabit undisturbed tropical rainforests (Glatston, 1994; IUCN, 1995), or humid forests (Emmons & Feer, 1997), and have never been recorded in disturbed habitats or secondary vegetation. In this study, however, we recorded them in Maracá, a seasonally-dry forest, with a 7-month dry season, where the entire mammal community goes through yearly, and within-year population fluctuations, and the abundance of the

olingos was, in both years, among the highest of all diurnal and nocturnal arboreal mammals. They were also recorded in the forest remnants outside Maracá, an area which had been disturbed for decades by settlers and farmers. They were also referred to by locals as occurring in southern Roraima, in more typical Amazonian rainforest.

Olingos used the upper canopy most frequently, followed by emergent trees, and were only seldom seen in the lower layers of the forest. They were not recorded in the understorey or on the ground (Mendes Pontes, 2000; Mendes Pontes & Chivers, *in press*).

**ECOLOGY AND BEHAVIOUR**

Olingos are essentially nocturnal and arboreal, dwellers in the highest strata of the forest ( Emmons & Feer, 1997; Eisenberg & Redford, 1999; Kays, 2000; Mendes Pontes, 2000; Mendes Pontes & Chivers, *in press*). Mendes Pontes & Chivers (*in press*) found them in groups of up to six animals in 50% of sightings, showing that in contrast to *B. gabbii* (Emmons & Feer, 1997), they are not solitary animals. When not alone, however, they were most frequently recorded in pairs. We assume that these aggregations, or ephemeral parties, are determined mainly by feeding in a few large fruiting trees, such as figs, *Ficus matthewsii* (Moraceae) and *Mauritia flexuosa* (Palmae) (Mendes Pontes, 1997), or when traveling between these sources, as happened at the peak of the dry season.

Mendes Pontes & Chivers (*in press*) recorded more sightings of olingos on darker nights. The fewer records during bright nights, however, comprised larger groups of up to 6 individuals. Julien-Laferrière (1997) and Clarke (1983) explain this may be a strategy to avoid predation, "lunar phobia" (Morrison, 1978).

Olingos are frugi-faunivores (Mendes Pontes, 2001; Mendes Pontes & Chivers, *in press*) including in their diet fruits, invertebrates and small vertebrates (Emmons & Feer, 1997). Records of animal matter, however, are scarce (Emmons & Feer, 1997; Kays, 2000). Mendes Pontes & Chivers (*in press*) recorded olingos feeding on *Mauritia flexuosa* (Palmae)*, Pradosia surinamensis* (Sapotaceae) and *Licania kunthiana* (Chrysobalanaceae).

**PROTECTION**

No protection is given to olingos, and their habitat in Roraima State has been destroyed for decades without any significant conservation action from decision-makers, politicians, environmental institutions, or the community in general. Half of the settlers interviewed in southern Roraima knew that the olingos were the so-called "sole-throated" (different from the night monkey), and mentioned a superstition which they seem to be spreading in the region. This states that if a hunter is in the forest during the night, and unluckily falls asleep waiting for game, the olingo comes down from the trees, and attacks the hunter in the neck, sucking his blood 'til death'. Because of this taboo they are inclined to kill them on sight.

**OCCURRENCE IN PROTECTED AREAS**

Olingos may occur in any of the protected areas in Brazilian Amazonia, British Guyana and Venezuela (Glatston, 1994). The only records of olingos in protected areas, however, are Mendes Pontes (2000) and Mendes Pontes & Chivers (*in press*) in Maracá Ecological Station, State of Roraima.

**THREATS**

The main threats to the preservation of olingos are (1) lack of knowledge, especially on their classification, distribution and natural history, which seems to be leading to their neglect by scientific and environmental institutions, and the community in general; (2) deforestation (Glatston, 1994), selective logging and burning have diminished their area considerably in the State of Roraima, and in the Amazonia as a whole. In 1998, for instance, at least 20% of the whole forested area of the State of Roraima was destroyed by a man-induced fire, which even reached the north-west of the Maracá Ecological Station and only stopped with the onset of the rains (Mendes Pontes, *pers. obs.*); (3) lack of knowledge by local people, who may see them as a threat.

**RECOMMENDATIONS**

According to the preliminary information presented here it is necessary that (1) studies on their classification, distribution and natural history be carried out, (2) environmental education projects be carried out among local people regarding not only the olingo, but conservation in general, (3) professionals from environmental organizations charged with the protection of nature be appropriately trained on fauna and flora management, and (4) national and international conservation organizations start to invest on research aiming the better knowledge, and consequently, conservation of these little known small carnivores.

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# Current distribution and status of the European mink (*Mustela lutreola* L., 1761) in Spain

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## Introduction

The European mink is the most endangered small carnivore in Europe (Schreiber *et al*., 1989). Its historic distribution spreads from Spain and France to Ural mountains, and from Finland to the Black sea (Youngman, 1982). During the last century, this species has disappeared from a lot of European countries (Maran & Henttonen, 1995).

Now, there are only two populations of European mink, *Mustela lutreola*, in Europe, separated by a distance of 2,500 km. The eastern population inhabits on the former USSR (Tumanov, 1999) and there is possibly a small population in the Danube Delta (Gotea & Kranz, 1999). The western population is in France and Spain. Since the first records, in 1955 (Rodríguez de Ondarra, 1963), the distribution and evolution of European mink in Spain is known. Since 1990, the status, distribution and several biological aspects of European mink have been studied in Spain (Palazón, 1998) and, in the years 2000 and 2001, its current range was surveyed.

## Methods

To survey the European mink's distribution we used the trapping method. Besides, these data were complemented with other information (tracks, road killed and observed animals). In this study, 138 trapping stations were placed on 130 U.T.M. (10 x 10 km) squares. Iron box live-capture traps were used. Each trapping station consisted of ten traps, placed at 100-150 m intervals along rivers. The traps, with dimensions of 60 x 15 x 15 cm, were placed very close to water. Traps were baited with tinned sardines and eggs. During the mink mating season (April-July) traps were not placed.

When European mink were captured they were anaesthetised with a Ketamine/Xylazine combination. Weight and morphological measurements were taken when they were immobilised, as well as samples of blood and samples for parasitological, genetic and dietary studies.

## Results

In total, 79 European mink, four American mink, *Mustela vison*, and nine European polecats, *Mustela putorius*, were captured. Besides we compiled data on 21 European mink and eight American mink. The presence of European mink was detected at 58 trapping stations (42.0%) in 64 U.T.M. (10 x 10 km) squares. The European mink range covers the Basque country, Navarra, Rioja, the north of Burgos and the north of Soria. The area occupied is 22,500 km$^2$, which represents 4.5 - 5.0 % of Spain's territory. However, the true area occupied is smaller because the European mink lives in or near rivers. The total length of rivers inhabited by *Mustela lutreola* was 1,900 – 2,000 km, with a density of 0.25 - 1.25 mink along one kilometre of river; a total number of 900 - 1,000 mink was calculated.

During this study, the disappearance of the European mink in central Álava (Basque country) has been corroborated. Now, American mink occupy the same rivers that the European mink inhabited before 1995. That small American mink population lies in the middle of European mink's range.

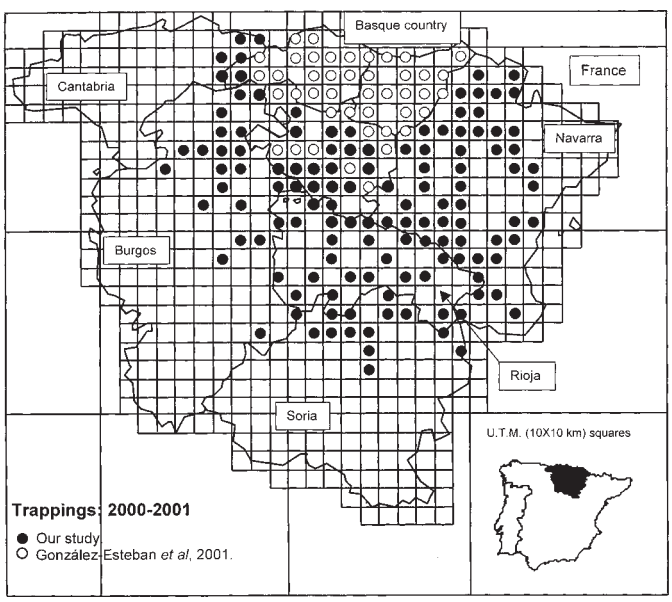


***Fig. 1**. Location of trapping stations in northern Spain. U.T.M. (10 x 10 km) squares.*

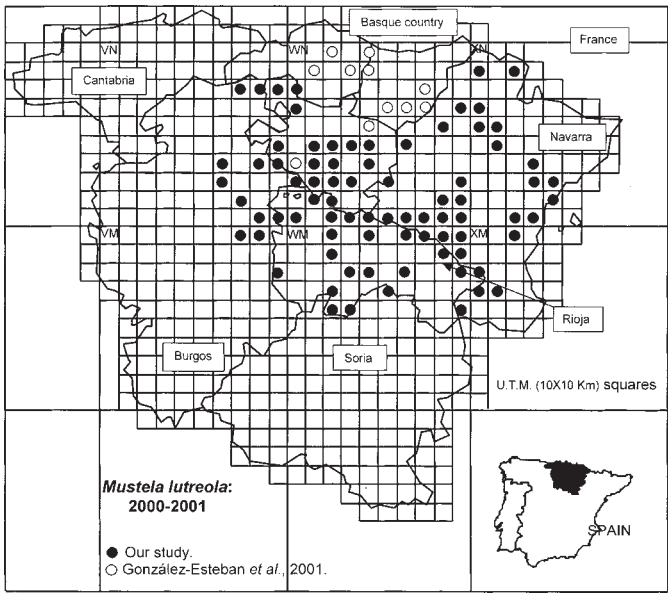


***Fig. 2**. Distribution of European mink in northern Spain. U.T.M. (10 x 10 km) squares.*

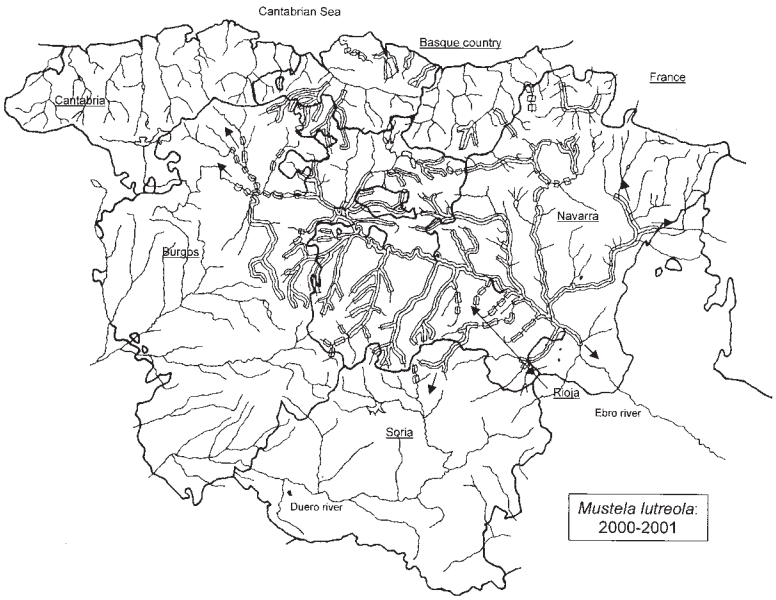


***Fig. 3**. Distribution of European mink in northern Spain. Rivers.*

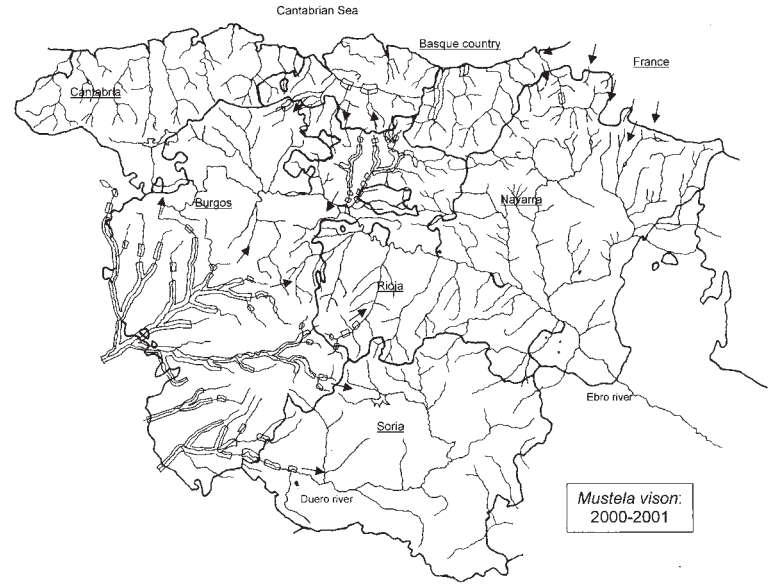


***Fig. 4**. Distribution of American mink in northern Spain. Rivers.*

A large population of American mink from central Spain is very close to the European mink's range. The aboriginal mink has disappeared from the upper stream of the River Najerilla (La Rioja), where an American mink has been caught.

The first American mink appeared (killed by road traffic) in Navarra. There mink surely proceed, from the population in the French Pyrenees, where it is very common in the other basin of Pyrenees. Although the northern Basque country was not surveyed by us, there are records of American mink (Rivers Deba, Urola and Nervión) (Aihartza *et al*. 1999; González-Esteban *et al*., 2001).

In contrast, the expansion of European mink to the east has been confirmed in some rivers from Navarra.

## Discussion

In a parallel study carried out in the Basque country, the methodologies used were photograph traps and later the capture of mink (González-Esteban *et al*., 2001): 98 photographic stations were installed. The presence of European mink was detected at 18 stations (18.4 %). The presence of two American mink and one polecat was also detected. Besides, in Álava (Basque country), where both methods were used, the presence of the European mink was not detected by means of photographs in 13 U.T.M. (10 x 10 km) squares. However, the use of trapping stations detected the European mink's presence in these same squares.

## The threats to the European mink population in Spain are:

- Small size of Spanish population (distribution and number of mink). The expansion of the southern American mink population in France to the west (Maizeret *et al*, 1998 and 2001), could separate the Spanish and French population and the genetic interchange could finish, losing the genetic variability and increasing inbreeding.

- Competition with American mink: more aggressive, big and with greater reproductive capacity (Maran *et al*, 1998a and 1998b). The first American mink arrived from the large population in the south-west. The appearance of a small American mink population inside the European mink's range has provoked the disappearance of the native species on the River Zadorra (historic range from 1950 of European mink). American mink represent a serious threat to the survival of *Mustela lutreola* in Spain.

- Loss and destruction of habitat. The habitat where European mink live is very transformed in Spain. Every year it is more difficult conserve and recover the riverine forest.

- Pollution of water. High levels of organochlorine pollutants (PCBs) in the muscles and livers of several mink from River Ega, Navarra (López-Martín *et al*., 1994).

- High unnatural mortality (killed by road traffic).

- Diseases such as Aleutian Disease Virus (ADV) (Mañas *et al.*, 2000).

- No legal, scientific and social initiatives on European mink conservation in Spain:
  - Insufficient legal protection in Spain and European Union. While the species is listed in France as "in danger of extinction, in Spain is listed as "vulnerable", one smaller category. No Action Plan in the European Union, where there are only two countries with European mink in a very small area.
  - Poor scientific knowledge on several aspects of conservation of native mink and American mink.
  - Poor or no existence of people's attitude towards that species and the need for its conservation.

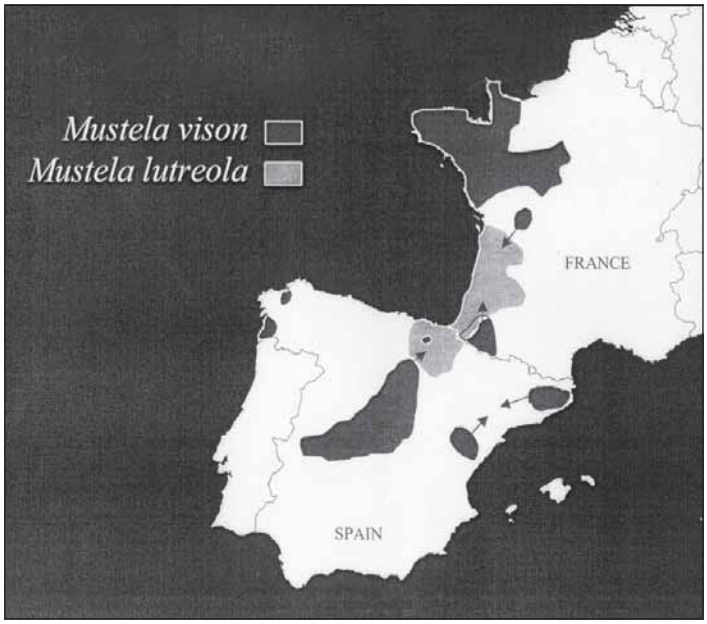


***Fig. 5**. Distribution of European and American mink in France and Spain.*

The other threats noted by Maran & Henttonen (1995): cold, scarce food, and illegal trapping don't seem important in Spain. During the year 2001, several conservation measures have been carried out in Spain:

- European mink Group and an Action Plan in Spain (1999-2000) are activated.

- The European Union has granted three Life Projects (2001-2004) to Álava, Castilla-Leon and Rioja to conserve the European mink where the more important goals are:
  - Prevent the spreading of American mink and its settlement on the Ebro basin.
  - Control of pathologies, pollution and genetic decay.
  - Protection of habitat: natural bank and aquatic vegetation.
  - Study the biology and ecology of European mink.
  - Contribute to a better social knowledge of the species and its problematic situation.
  - Checking the presence and spreading of European and American mink in the European mink range.

## The next future we must do

- A Life project on European mink conservation for Catalonia (2002-2005), Navarra and the rest of Basque Country.

- Breeding and reproduction of a stock of 20 European mink to avoid the disappearance of that species in the near future.

## Acknowledgements

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# Partial eradication of the American mink *Mustela vison* as a way to maintain the declining population of the European mink *Mustela lutreola* in a continental area. A case of study in the Lovat River head, NE Belarus

Vadim SIDOROVICH and Aleksej POLOZOV

The long-term study of the European mink's demise conducted in Belarus and adjacent regions of Russia suggested that the species' population decline was caused by the naturalisation of the American mink (Sidorovich, 1997, 2000; Sidorovich & Macdonald, 2001). Pronounced aggressive interference by American mink towards European mink of both sexes has been revealed (Sidorovich *et al*., 2000). Frequent encounters initiated by American mink strongly limit the quantity and quality of habitats available to European mink. Brooks of length up to 2 km and, in part, such small streams of length 2-10 km appeared to be the last, but poor quality, habitats accessible for persecuted European mink. Nevertheless, the data obtained suggest that in brook habitats female European mink cannot raise a litter successfully enough under conditions of prey shortage. When American mink attain high population densities the effects of aggressive interference and high cub mortality cause reproduction in the European mink population to stop and its density rapidly decreases. This situation seems to indicate an inability to conserve the native mink in a continental area.

The single sustainable way to rescue the European mink in the wild is perhaps its naturalisation on islands. Such conservation action was undertaken by Dr. Dmitry Ternovsky (Biological Institute in Novosibirsk, Russia) on the Kunashir and Iturup islands (the Kurily islands, Far East of Russia) in 1981-1989 (Ternovski & Ternovskaja, 1994). At present, another similar large-scale action is ongoing on the Estonian islands in the Baltic Sea (managed by Dr. Tiit Maran).

Nevertheless, an important question is raised. By undertaking special measures, is it possible to save endangered native species in a continental area? From an ecological point of view it seems this might be done by a partial removal of the American mink. This action should markedly reduce the frequency of aggressive encounters and substantially mitigate competition over resources between the European mink and the American mink. In this paper we present results of our experiment to maintain the European mink population at the head of the Lovat River, NE Belarus in 1998-2001. Maintenance mainly consisted of the selective killing of American mink and also the release of European mink that had been live captured in neighbouring areas.

## Study area, materials and methods

The study was carried out in an area of about 241 km$^2$ at the head of the Lovat River (55$^o$45' N, 30$^o$20' E), Gorodok district, Vitebsk region, NE Belarus. The Lovat River head (from its source in Lake Lovatetc to its mouth in Lake Mezha) placed on a rectanglar area stretched for 23 km in a N-S direction and 12 km in a W-E direction. The area has a rough glacial relief and is densely forested with mixed deciduous and coniferous woods, interspersed with a few small villages and fields. There are two types of small rivers in the area: small, fast flowing rivers between five and eight metres wide and 0.5-1.5 m deep, with high, steeply wooded banksides and little floodplains, and other small, slowly-flowing rivers between 7 and 25 m wide, 1-2.5m deep, with wide (200-1000 m) floodplains consisting of black alder swamps and reed and sedge marshes. In total the study area comprises of about 57 km of small rivers, 0.24 km/km$^2$ (Lovat, Servaika, Skljanka and Peschanka), 41 brooks (Prosimka, Borkovsky, Uzhovsky, Rudnjansky and others, pooled length ca. 93 km, 0.39 km/km$^2$) and 5 glacial lakes, as well as wetlands of various types and sizes located outside of the river valleys ( e.g. reed and sedge marshes, pools, black alder swamps and pine bogs).

Partial removal of American mink was done by selective trapping. We used cage and wooden box-traps adapted for the mink's size and mostly baited with mink anal gland secretion or/ and fish or crayfish. Part of the box-traps were provided with a separate bait compartment. Either a live laboratory white mouse or rat or a live-captured wild rodent was used as bait; these were provided with food and bedding. The captured European mink were released in their habitats, whereas the American mink were killed and their carcasses were used for the subsequent study of the population biology of this exotic and harmful species.

During the trapping sessions we tried to reach a removal rate that exceeded 70% of the American mink that inhabited the area. The removal rate consisted of our eradication efforts plus hunting of American mink by locals. Therefore, to obtain a pooled early hunting bag we communicated with all local hunters twice a year at least (approximately in December-January and March-April).

Under conditions of fairly low American mink population density (1-2 inds./10 km of river stretch), seven European mink (2 females and 5 males) were radiotagged. Radiotracking receivers were provided by Telonics Inc. (Mesa, Arizona), and neck-collars with transmitters were made by Biotrack Ltd. (Wareham, UK). The total number of radiolocations of the seven European mink was 5,992. The duration of a radiolocation was up to 15 minutes, or less in cases in which something was changed - e.g. either the type of activity, or coordinates, or type of habitat. An approximation of independent data was obtained by choosing at random one active fix and one inactive fix per day for each of the radiotagged European mink. In the cold season, in conditions of snow cover, radiotracking was combined with snowtracking.

During the winter, the two mink species were censused along small rivers and brooks by searching the banks and floodplains for tracks and other signs of activity. In winter, fresh mink tracks usually formed concentrations along the river, separated by distances of variable length in which tracks were either absent or only old tracks were found. Harsh winter conditions are characterised by low prey availability, during which mink are believed to disperse. Extensive winter trapping has shown the assumption is valid (Sidorovich & Macdonald, 2001). Wherever possible the sexes of individual mink were determined by examining the position of fresh marks: males leave urine marks on the snow in front of a scat, whereas females deposit both the scat and urine in the same place or sprinkle urine behind the scat. This allowed

further assessment of our assumption, as it is extremely unlikely that two individuals of the same sex would be found in the same place at the same time during the winter. Tracks of the two mink species were distinguished following the key of Sidorovich (1999). Quite often we identified the mink species from visual observation or live captures.

## Results

The main idea of this study was to test habitat use by the European mink and the dynamics of its density under the conditions when numbers of American mink were reduced as compared to the situation in the native mink population when naturalised mink densely populated the Lovat River head (Sidorovich & Macdonald, 2001). Having few mink transmitters available, we could not estimate a perhaps decreasing rate of aggressive interference from American mink towards European mink under low density naturalised mink conditions. Nevertheless, we assumed that during the eradication experiment either stability or positive dynamics in the number of native minks, as well as their more frequent use of small rivers and glacial lakes as habitats with higher carrying capacity, provided evidence of lower impact of the aggressive behaviour of the American mink and some restoration of the European mink population.

In Fig.1 the pooled number of American mink captured by locals (mainly by hunters) and exterminated by us during the whole period (1986-2001) of our study is given. It varied from 2 (in the beginning of the expansion) to 69 individuals. If we consider only the period (1991-2001) when American mink attained a high population density, the annual number of American mink captured was 22-69 (normally 22-39 and 51-69 in years when we undertook the deliberate removal of American mink). Taking into an account that by early winter the normal level of the American mink number

*Table 1. Differences in habitat use (% of radiolocations, n=5992) by European mink under conditions of reduced numbers of American mink compared to that when the American mink attained high population densities in the Lovat River head, NE Belarus, 1995-2001 (Data obtained by radio-tracking).*

### A. Males (active + inactive)

| Type of habitat | High density of American minks (n=4497/400) | Low density of American minks (n=3987/366) | G-test for independent data, P |
|---|---|---|---|
| Brooks up to 2 km | 22.4[A]/21.8[B] | 4.0/5.2 | 11.0, <0.01 |
| Brooks from 2 to 10 km | 28.6/37.5 | 14.1/17.4 | 7.5, <0.01 |
| Fast or moderately flowing, small rivers without a floodplain or with slightly swamped floodplains | 20.2/6.5 | 53.5/50.8 | 38.9, <0.01 |
| Slowly flowing, small rivers with overswamped floodplains | 5.0/8.3 | 13.8/9.7 | 0.1, >0.1 |
| Glacial lakes | 10.0/11.5 | 11.6/12.0 | 0.1, >0.1 |
| Pools | 3.4/3.8 | 1.1/1.6 | 0.9, >0.1 |
| Swamped forest | 2.0/0.1 | 0.3/0.5 | 0.1, >0.1 |
| Dry forest | 7.0/0.4 | 0.9/1.4 | 0.3, >0.1 |
| Fields | 0.6/0.3 | 0/0 | 0.1, >0.1 |
| Remote marshes | 0.3/0 | 0.7/1.4 | 0.6, >0.1 |

### B. Females (active + inactive)]

| Type of habitat | High density of American minks (n=2770/209) | Low density of American minks (n=2005/164) | G-test for independent data, P |
|---|---|---|---|
| Brooks up to 2 km | 16.1/15.3 | 1.7/1.2 | 14.3, <0.01 |
| Brooks from 2 to 10 km | 5.4/6.2 | 5.2/4.9 | 0.2, >0.1 |
| Fast or moderately flowing, small rivers without a floodplain or with slightly swamped floodplains | 60.7/58.9 | 61.6 /65.2 | 0.3, >0.1 |
| Slowly flowing, small rivers with overswamped floodplains | 7.1/11.5 | 24.3/18.4 | 1.6, >0.1 |
| Glacial lakes | 1.6/0.5 | 5.8/8.5 | 6.5, 0.05 |
| Pools | 0/0 | 0/0 | - |
| Swamped forest | 2.2/1.6 | 0.3/0.6 | 0.2, >0.1 |
| Dry forest | 6.9/6.1 | 0.2/0.6 | 3.8, 0.07 |
| Fields | 0.0/0 | 0/0 | - |
| Remote marshes | 0.0/0 | 0.9/0.6 | 0.1, >0.1 |

Denotation:
[A]) n is the number of radiolocations. The first number is the total number of fixes, the second is the number of independant fixes.
[B]) The first percentage was calculated from the total number of fixes, the second from the independent data alone.

in the Lovat Rriver head comprises 70-80 individuals, it is plausible that about 40% of them were exterminated by normal hunting in the cold season, and that about 80% of them were killed in the years when we tried to eradicate the exotic species.

The first eradication was done in 1993. This drastic measure was quite effective in preserving the European mink´s presence in the Lovat River head (Fig. 2). Otherwise, so we assumed, the native mink would have disappeared there until the winter of 1995-1996. Such a rapid rate of the European mink's extinction was recorded in the other river basins of northern Belarus. Later in 1998-2001, partial eradication of American mink was done again. This was not a continuous extermination of American mink. Nevertheless, the removal of American mink undertaken was enough to limit its density to a low level (approximately 1-2 inds/10 km of small river stretch) during the periods of the radiotracking study of European mink.

In Table 1, the data obtained in relation to habitat selection by the radiotracked European mink in the conditions of the reduced American mink number in 1999-2001 are given. By comparing these data with published ones (Sidorovich & Macdonald, 2001) characterising European mink habitat use under conditions of high American mink population density, the following noteworthy differences can be emphasised.

As follows from Table 1A, the main shift in habitat selection by male European mink was their more frequent use of small rivers (60.5 versus 14.8%, G=29.8, P<0.01), while brooks (mostly with poor food supply) were inhabited less often (22.6 versus 59.3%, G=17.1, P<0.01). In the conditions of the reduced American mink numbers, female European mink used small rivers 13% more frequently than when the American mink densely populated the study area (83.6 versus 70.4%), but the difference is not statistically significant. Also, they were more often present on glacial lake shores (8.5 versus 0.5%, G=8.6, P<0.01) and, in contrast, the poorest quality habitats, i.e. brooks (6.1 versus 21.5%, G=9.1, P<0.01) and biotopes remote from river banks such as forest and marsh patches (1.8 versus 7.7%, G=4.0, P=0.04) were less frequently inhabited.

## Discussion

Thus, from the results of the present study it follows that a partial eradication of American mink is a fairly effective measure to prolong the presence of European mink in a continental area undergoing the American mink expansion. The efforts undertaken in the Lovat River head seem to play an important role in some positive dynamics in European mink in the study area. At least, we succeeded to fix the European mink population at the low density level, whereas we assume that, without the partial eradication of American mink, the native mink population might have disappeared in the winter 1995-1996 (or few years later at best). In the conditions of the reduced American mink numbers we found positive trends in habitat selection by European mink. European mink used small rivers and glacial lakes much more frequently, i.e. habitats with higher carrying capacity compared to brooks (mostly characterised by poor food supply) which were largely used by European mink as the last habitats available before the eradication of American mink (Sidorovich & Macdonald, 2001). We suppose that the low density of American mink leads to a decrease in the frequency of aggressive encounters by naturalised mink towards the native mink that had been frequently registered when the American mink densely populated the area (Sidorovich *et al*., 2000).

Eradication of exotic mink, a drastic measure on the way to rescuing the European mink in a continental area, might be applied locally by the hiring of game wardens to live-trap both species of mink, but selectively killing American specimens and releasing European ones. To be successful, population densities of the naturalised mink should be decreased to a level of 1-2 individuals per 10 km of river stretch in autumn. If it is a limited area (600-1000 km$^2$) in eastern Europe, our experience suggests that about 80% of the American mink population should be removed annually. Three years after the American mink's arrival into the area it reached approximately 15-20 individuals per 100 km$^2$. The main impact on the American mink population should be done by late autumn, when hunting is normally held. Also, every year an early spring (March-mid April) selective killing of American mink is very helpful in its population control. While the expense of such a programme would be prohibitive on a wide scale, an inexpensive, rural trapper labour-force could make this feasible in certain special reserves. Indeed, conducting such work as an experiment on the Lovat River head, it was found that two experienced trappers could make a considerable impact on the American mink population throughout the quite extensive study area. We predict that this would enable the European mink population to maintain itself. We are fully aware, however, that such protection for the European mink will be effective only for as long as the trapping effort would be maintained.

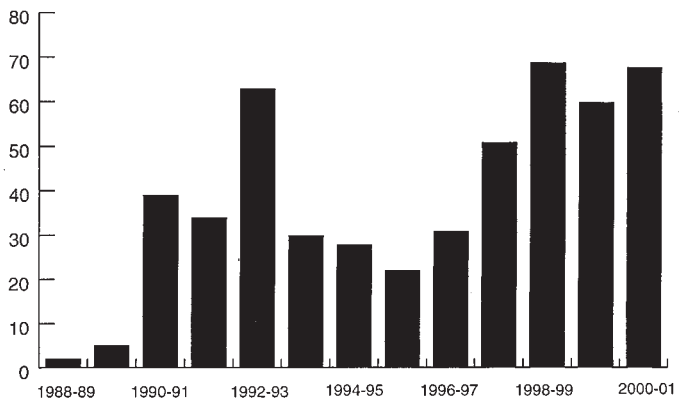


*Fig.1. Pooled number of the American mink removed (hunting bag of locals plus our eradication efforts) from the Lovat River head, Gorodok district, Vitebsk region, NE Belarus, 1998-2001.*

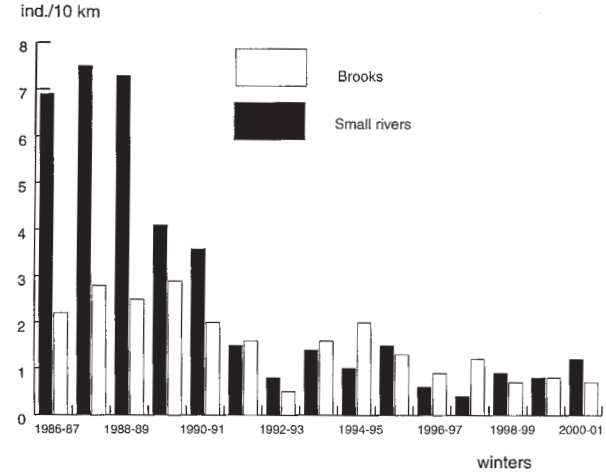


*Fig. 2. Dynamics of the European mink density (ind./10km of water courses) in the Lovat River head in the winters of 1986-2001*

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# An observation of Hose's Civet in Brunei

Charles M. FRANCIS

Hose's civet, *Diplogale hosei* (Thomas, 1892) is known only from the hills and mountains of northwestern Borneo, with reported records from Bukit Batu Song at 600 m, Gunung Kalulong, Gunung Dulit at 1200 m, and the Kelabit Uplands at 1100-1200 m in Sarawak; as well as the Crocker Range at 1200 m and G. Kinabalu in Sabah (Medway, 1977).

Although reported by Tom Harrison to be common in moss forest in the Kelabit Uplands (cited in Medway, 1977) there are few recent records from anywhere in its range, and the species is currently listed as Vulnerable by IUCN on the basis of its restricted range and extensive habitat loss within that range.

Here I report on a 1991 sighting of a Hose's civet in what is now the Ulu Temburong National Park in Brunei, and also provide some details of a specimen collected in 1983 from Sabah that was illustrated in Payne & Francis (1985) (see back cover).

The Royal Geographical Society, U.K. and the Universiti Brunei Darussalam jointly organized a 15-month expedition, starting in 1991, to a newly established research station at Kuala Belalong in the Temburong region of Brunei. The habitat in this region consists of mature mixed dipterocarp forest on a network of very steep-sided river valleys and high ridges (Cranbrook & Edwards 1994). I joined this expedition from 7-14 March 1991, primarily to carry out a survey of bats. Most nights during my stay there, I walked along trails for periods of 1-3 hours, with a hand-held torch and a 55 Watt spotlight (operated on a 6V lead acid motorcycle battery), to check bat traps and search for nocturnal mammals.

On the evening of 11 March 1991, I based myself at the Pondok Busiri camp (04° 31' N, 115° 10' E) along the ridge trail that runs south and east from the Kuala Belalong research station to the summit of Bukit Belalong. While walking north along the ridge from this small camp at about 22:00, I spotted the eyeshine of a civet that was walking along the ground on the ridge top trail (altitude about 450 m). The batteries in my torch were weak, so I used the spotlight to get a better look. Unfortunately this was too bright for the civet, given the close range, and it quickly left the trail and disappeared down the side of the ridge. However, I had a brief but good view of a bicoloured civet with a long tail, mid-brown upperparts and white underparts. It walked quite low to the ground, appearing very elongate with its tail stretched out behind it.

It closely resembled in shape and pattern the illustration of Hose's civet by Karen Phillipps in Payne & Francis (1985) except that the back was more of a mid-brown, and less grey. That illustration was based on an animal trapped during a collecting trip for birds and mammals with several participants from the Western Foundation of Vertebrate Zoology and the Sabah Wildlife Department, including myself. The civet was snared overnight on 27-28 June 1983 at Rinangisan (05º 29'N, 116º 03'E), the highest point on the road from Kimanis to Keningau, at an altitude between 1,100 and 1,300 m, in the Crocker Range, Sabah. Unfortunately, it was injured in the snare, and had be be put down, but the freshly dead animal was used as the basis for the illustration in the book, prior to being prepared as a specimen, which was later provided to the Sabah Museum. As such, the colours in the illustration, and the shape, were quite faithful to the live animal.

Given the paucity of reports of this species, it is not known whether the difference in pelage colour between the Brunei individual and the Sabah specimen represents geographical variation, or simply individual variation.

Although there can be little doubt that there has been extensive loss of habitat for all forest dependent animals in Borneo, the loss of hill and montane forest has been proportionately somewhat less than that of lowland forest. The apparent scarcity of this civet may be a function of relatively few nocturnal surveys in submontane and montane forests, rather than rarity.

Further surveys in appropriate habitat would be valuable to determine its true status, as well as to improve understanding of its specific habitat requirements. Surveys could be conducted by walking trails at night with a headlamp or spotlight or, perhaps more effectively, by setting automated camera traps along trails, which would not only provide documentation of each observation, but could also provide valuable information on the status of other medium to large sized terrestrial animals in these forests.

## Acknowledgements

I thank the organizers of the RGS/UBD expedition to Belalong for arranging logistics and permits, Lord Cranbrook for encouraging me to participate in the expedition, and W. Duckworth for suggesting I write up this observation.

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# Use of Eurasian badger (*Meles meles*) setts and latrines in an area of the Italian Prealps (Lombardy, Italy)

Monica MARASSI and Carlo M. BIANCARDI

## Abstract

Twelve badger setts were detected and duly checked for two years, in an area of 58 km$^2$, in the Lombardy Prealps (Lecco County). Sett density (1.6 setts/10 km$^2$) is low, but similar to values recorded in other submountain and mountain areas. All the setts were located under coverage by high trees; the great part of them in the submountain belt, between 400 and 800 m a.s.l. The setts were homogeneously distributed on the limestone and morainic subsoils that characterise the study area. Sett use has been detected recording (during every inspection) the ratio between the number of entrances that had been used and the number of entrances that had not. The results, as expected, show greater activity in spring and summer. Latrine use, versus other defecation sites (ODS), shows a statistically significant trend towards larger latrine use (which means greater marking activity) during the months immediately after births when there is a peak in mating activity. Territorial behaviour accords with the Anti-Kleptogamy Hypothesis (AKH).

*Key-words:* badger, sett use, marking activity, Anti-Kleptogamy Hypothesis, Italy

## Introduction

The Eurasian badger, *Meles meles* (L., 1758), is a widely distributed mustelid which lives in social groups. Badgers dig underground setts which are used as daily resting sites; the sett represents a profitable investment for badgers, so much so that they rarely abandon one: some badger setts have been known for centuries and still occupied (Neal & Cheeseman, 1996). Badgers setts are commonly classified into four categories (Main, Annexe, Subsidiary and Outliers) depending on their size and their use (Thornton, 1988; Neal & Cheeseman, 1996). If such a classification is useful in situations of high density populations, such as in the British Isles and other areas of north and central Europe, in low density areas it may be difficult to realise the differences between the sett types (e.g. Virgós & Casanovas, 1999; Revilla *et al*., 2001).

Badgers live in groups (clans) and share a territory, which is marked with latrines - one or more open pits dug by the animal and filled with their faeces and, sometimes, a secretion from the anal glands. Latrines may also be scent-marked with a whitish fatty secretion from the subcaudal gland (Kruuk, 1978; Kruuk *et al*.,

**Table 1: Setts in the study area**

| N. | SETT | MUNICIPALITY | ALTITUDE (asl) | INCLINATION | TREE COVERAGE | CATEGORY | N ENTRANCES | ORIENTATION | GEOLOGY | VEGETATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | GISAZIO | PERLEDO | 690 | 20° | 4 | MAIN | 9 | W | MORAINIC | MIXED BROADLEAF WOOD |
| 2 | GISAZIO 2 | PERLEDO | 720 | 30° | 4 | ANNEXE | 1 | NW | MORAINIC | MIXED BROADLEAF WOOD |
| 3 | ALBIGA | PERLEDO | 860 | 30° | 4 | MAIN | 8 | W | LIMESTONE | BEECH WOOD |
| 4 | ALBIGA 2 | PERLEDO | 880 | 10° | 4 | ANNEXE | 1 | W | LIMESTONE | BEECH WOOD |
| 5 | AGUEGLIO | PERLEDO | 1100 | 20° | 5 | MAIN | 4 | W | LIMESTONE | BEECH WOOD |
| 6 | SAIOLI | LIERNA | 370 | 10° | 4 | SEASONAL | 1 | SW | MORAINIC | MIXED BROADLEAF WOOD |
| 7 | CAMPELLI | ABBADIA LARIANA | 700 | 10° | 5 | MAIN | 3 | SW | LIMESTONE | MIXED BROADLEAF WOOD |
| 8 | ZUCCO ROCCA | ABBADIA LARIANA | 530 | 5° | 4 | SEASONAL | 1 | S | LIMESTONE | EX-CULTIVATED LAND |
| 9 | LINZANICO | ABBADIA LARIANA | 360 | 5° | 4 | SEASONAL | 5 | W | MORAINIC | EX-CULTIVATED LAND |
| 10 | VIGGIO | MANDELLO DEL LARIO | 570 | 20° | 4 | SEASONAL | 2 | SW | LIMESTONE | EX-CULTIVATED LAND |
| 11 | CA' BIANCA 1 | MANDELLO DEL LARIO | 520 | 20° | 4 | SEASONAL | 1 | NW | LIMESTONE | MIXED BROADLEAF WOOD |
| 12 | CA' BIANCA 2 | MANDELLO DEL LARIO | 480 | 15° | 4 | SEASONAL | 1 | NW | LIMESTONE | MIXED BROADLEAF WOOD |

| Table 2: Dimensions of entrances | | | | |
|---|---|---|---|---|
| | Min | Max | Mean | 95% CI of mean |
| | (cm) | (cm) | (cm) | (cm) |
| Height | 15 | 50 | 27 | 24 to 30 |
| Width | 19 | 65 | 30 | 27 to 33 |

1984). Latrines are located at strategic places, often near paths or at the perimeter of the territory (Neal & Cheeseman, 1996). Badger clans are defined as "spatial groups" (Macdonald, 1983), but the benefits for group living are not easy to find: individuals do not cooperate in food searching, and females do not cooperate in rearing the young (Woodroffe & Macdonald, 1993). Sharing a sett within a territory seems to be the only reason for living together. The Resource Dispersion Hypothesis (RDH: Macdonald, 1983) and the Constant Territory Size Hypothesis (CTSH: Lindström, 1986) explain territorial and group-living behaviour as a strategy to defend food resources. On the other hand, for the Anti-Kleptogamy Hypothesis (AKH: Roper *et al.*, 1986) badger territorial behaviour is based on the defence of the breeding females. One of the AKH's predictions is that scent marking activity increases during the breeding period.

In mountain areas, where the density of badgers is low, the study of badger setts and latrine use may allow us to better understand differences in social and territorial behaviour between high and low density populations, and to formulate hypothesis for further investigations.

## Study area

Badger setts had been found in an area of 58 km$^2$ in the Lombard Prealps, in the territory of Lecco County. The study area lies between the eastern coast of Lake Lario (Lake Como) and the massif of the Grigne. Altitude ranges between 200 - 1300 m ASL. The territory is included in the municipalities of Perledo (46°01'N, 9°30'E), Lierna (45°96'N, 9°30'E), Mandello del Lario (45°92'N, 9°32'E) and Abbadia Lariana (45°90'N, 9°33'E).

Large woods grow in the lowest vegetation belt, where chestnut trees (*Castanea sativa*) have replaced most of the original species: downy oak (*Quercus pubescens*) and hop hornbeam (*Ostrya carpinifolia*). Woods are mixed, with cultivated or ex-cultivated land and also fields with fruit-trees that are now growing wild. The higher vegetation belt is characterised by beech (*Fagus sylvatica*) woods.

The massif of Grigne consists of very hard Triassic limestone, dolomite and crumbly marl. The slopes are covered by Quaternary morainic alluvium (Amm. Prov. Como, 1995).

## Methods

Setts were located through local gamekeepers and earlier interviews with local inhabitants. During our survey we found only 12 setts because of dense undergrowth and steep slopes. We considered a "main" sett to be one at which we were able to find activity signs over the whole year, however, in one case we classified an "annexe" sett because it was found <150 m from a main sett and several badger paths joined them. All the other setts were classified as "seasonal". Data were collected on vegetation and on the the various soil types.

To estimate activity each sett was visited at monthly intervals during a two-year survey period, during which all the entrances were checked. During each visit the entrances were baited with one or two short twigs. The removal of the twigs, together with other signs of badger passage, allowed us to count the entrance being "used".

Defecation sites were located by walking all over the study area and, during each survey, we recorded the number of pits and the number of dung samples in each pit. We considered as "Latrines" all samples collected from dung pits used more than once throughout the year, and we noted samples collected in single pits or outsiude pits as "Other Defecation Sites". Badger scats were analysed to study feeding behaviour (Marassi & Biancardi, in preparation).

## Results

As shown in Table 1, setts are actually small: half of them had only one entrance and the biggest had nine. These 37 entrances were measured (Table 2). In order to calculate the density of setts we considered the two annexe setts as being part of the main sett, also considered as a single sett were the two seasonal but quite near setts of "Cà Bianca 1" and "Cà Bianca 2". Thus we calculated a density of 1.6 setts/10 km$^2$.

The major part of the setts were located in the submountain belt, between 350 - 800 m, in mixed-broadleaf woods or in formerly cultivated land, now abandoned and reconquered by the wood. The three setts above 800 m were found in beech woods. Tree coverage is always very high and, in every habitat, badgers can find

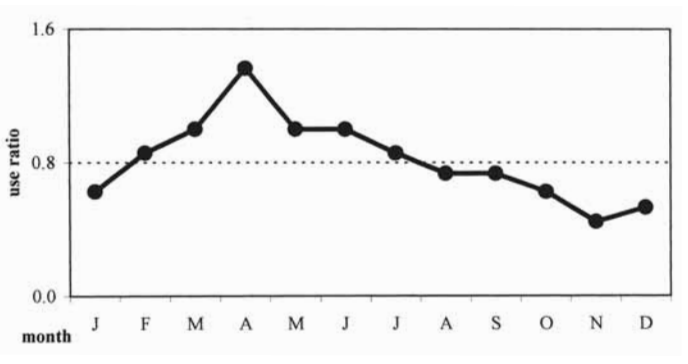


*Fig.1. Use of main setts in different seasons*

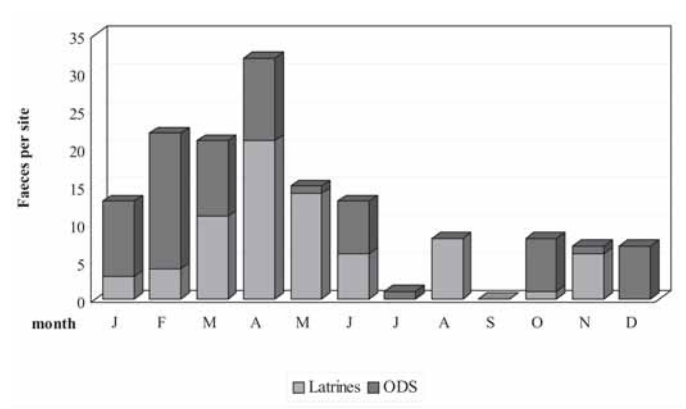


*Fig. 2. Seasonal fluctuations in latrine use*

many food resources related to human activities: fruit-trees, market gardens and vineyards.

The predominant type of soil in the study area is limestone and almost 70% of setts were located on this kind of substratum. The remaining setts were in morainic terraces. Geological factors influence the shape of sett entrances. Limestone is very hard to dig but gives good drainage, so badgers make use of natural fissures and local patches of softer material, giving sett entrances an irregular shape. Morainic or marl strata are easy to excavate and the entrances are oval-shaped.

Badgers prefer sloping land because this is well-drained and facilitates the removal of excavated soil; 65% of setts were on steep slopes with an angle of inclination of 10-20 degrees. The aspect of the setts does not differ from the pattern of the study area, where the great part of the mountain slopes are west orientated.

We tried to understand the use of main setts in different seasons, so we calculated the ratio between used and disused entrances in every month. The pattern (Fig. 1) shows a maximum in spring, which is connected with the mating period and the first appearance of cubs. We recorded the minimum in the use ratio during the cold season, however, the differences in the number of entrances used are not statistically significant ($G = 6.77$; d.f. = 11; $p > 0.1$).

Seasonal fluctuations in latrine use were evaluated by comparing the number of faeces in latrines and the number of scats in ODS each month (Fig. 2). The hypothesis that latrines are used more frequently than ODS in some seasons is confirmed ($G = 15.44$; d.f. = 1; $p < 0.01$).

## Discussion

The calculated density of setts in our study was rather lower than that in Great Britain and Ireland, as reported by many authors (e.g. Cheeseman *et al.,* 1981; Kruuk & Parish, 1982; Feore & Montgomery, 1999), but similar to the lower densities generally reported from the continent (e.g. appendix 1 in Kowalczyk *et al*., 2000). Data from the Alpine region were collected by Monnier (1993) for Switzerland (Canton of Neuchâtel: 0-2.2 setts/10 km$^2$) and by Biancardi & Rinetti (1998) in another prealpine area (Valli del Luinese, Varese: 1.1 setts/10 km$^2$).

Small setts, their distribution and density suggest a low badger population density and small family groups, but we need more evidence to confirm this hypotheses; it is possible that other badger setts remain hidden in dense undergrowth or other inaccessible places.

Soil type seems not to affect the distribution of badger setts in these prealpine environments, where the food availability may instead be most important (Biancardi & Rinetti, 1998).

Latrine use, which suggests a low marking activity as expected in low-density populations, increases in spring, just after the births of the cubs. This peak in territorial marking behaviour can be correlated to mating activity, rather than to feeding resource, as suggested by the Anti-Kleptogamy Hypothesis.

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# Morphological data and husbandry notes for Owston's palm civets and Large Indian civets

Linda KING

Owston's palm civet *Chrotogale owstoni* and the Large Indian civet *Viverra zibetha* were two species of The Lac Xao Wildlife Center in Lac Xao, Bolikhamxay Province of Lao PDR. The center was a captive breeding facility that has since been abandoned. The geographic origin of individuals is unknown, although at least several of the Owston's palm civets were provided by a woman from Ban Nape who caught them in her banana crops. Between September 1997 and July 1998 morphological data and weights were recorded during immobilization events or necropsies. Weights are reported for 14 *C. owstoni* and general morphological data are included by the mean and one standard deviation on eight *C. owstoni* and three *V. zibetha* (Table 1).

Two Owston's palm civet females came to the center pregnant in March of 1998. However, due to transport restraint injuries they miscarried. Another pregnant female arrived at the center during March; however her escape made it impossible to determine if she would have delivered successfully. The Owston's were fed bananas, papaya, watermelon, sweet potatoes, minced raw chicken, shrimp, tadpoles and frogs. Preference was shown for frogs, bananas and chicken, respectively. It has been suggested that this species may be an earthworm specialist (Nowak 1999). However, we never fed earthworms at the center. The large Indian civet's diet included bananas, papaya, watermelon, pumpkin, frogs, chicken, eggs and crabs. Nowak (1999) reported that remains of crabs were found in the stomach of two large Indian civets from China, however, the civets at the center did not have a preference for crabs and had a tendency to leave them untouched. Joshi (1995) reported that large Indian civets deposit scat in large latrines. The Laotian staff reported that the large Indian civet tends to defecate in the same spot, usually a deep hole. Consequently, hunters often catch them by waiting beside a discovered latrine.

All animals were vaccinated for rabies and feline panleukopenia shortly after arrival. New arrivals were treated for endo-parasites if needed and fecal samples were examined on a four-week rotating basis thereafter. Nowak (1999) reported that Owston's palm civet accepts and cohabits non-aggressively with new members of the group. The Lao Owston's were also relatively non-aggressive and were housed easily with other members regardless of sex.

*"Owston surgery". Photo copyright:Mark Kostich*

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*Table 1. Summary statistics for body measurements (mm) and weight (kg) for adult Owston's palm civets and adult male large Indian civets. Total length and tail length were excluded for two amputees of Owston's palm civet.*

| | Total length (mm) | Tail length (mm) | Hind foot (mm) | Ear length (mm) | Girth (mm) | Weight (kg) |
|---|---|---|---|---|---|---|
| **Owston's palm civet** | | | | | | |
| ean, | 038, | 30.3, | 5, | 0, | 90.1, | 4<br>.61 |
| tandard deviation, | 45, | 6.6, | .6, | .3, | 5.6, | .471 |
| **arge Indian civet** | | | | | | |
| ean, | 340, | 40, | 20, | 7, | 70, | 1<br>.91 |
| tandard deviation, | 30, | 3, | , | 1.5, | 6.5, | .49, |

# The small Indian mongoose; probably one of the most successful small carnivores in the world?

Sugoto ROY

## Introduction

The small Indian mongoose *Herpestes javanicus* is common in its broad native range, which it shares with other carnivores (Corbett & Hill, 1992). It is perceived as an efficient hunter, especially of rats and other agricultural vertebrate pests (Prater, 1965), and as a result, it was introduced as a biological control agent to many islands around the world (Hinton & Dunn, 1967). The species is now a pest in most of its introduced range where it threatens the native and indigenous fauna. I studied the ecology of the species on Mauritius (Roy, 2001) where it was introduced in the early 1900s and this article examines why this small carnivore is so successful in both its native and introduced range. In the literature many authors distinguish between *H. javanicus* and *H. auropunctatus*, with most introduced populations originating from the latter. Most workers currently believe however, that the two are the same species until further research is carried out, and so for the purposes of this article, *H. javanicus* will be used to describe the species.

## Diet

The diet of *H. javanicus* has been reported as being remarkably broad, ranging from fruits, birds and reptiles and their eggs, and small mammals (Baldwin *et al.*, 1952; Pimentel, 1955; Gorman, 1975; Nellis & Small, 1983; Hoagland *et al.*, 1989). The species will also eat carrion (Creekmore *et al.*, 1994), and has been observed salvaging edible material from the dung of large vertebrates (Haque, 1990). *H. javanicus* is also highly opportunistic and will go to great lengths to unearth animals such as tenrecs *Tenrec eucaudatus* (introduced to Mauritius from Madagascar) from aestivation dens (Roy, 2001). Despite being described as a poor climber, it has been observed climbing trees and raiding birds' nests (pers. obs.). Perhaps most surprisingly, *H. javanicus* has been observed attacking the young of large ungulates such as deer and goats, feeding on soft body tissues around the face (Seaman & Randall, 1962), and has been seen to attack the young of other small carnivores such as feral cats (Haltenorth & Diller, 1996).

As well as having a broad diet, it also varies its diet in order to maximize on seasonal and spatial variation in food availability. On Mauritius, the species was found to eat more insects during the wet season, and more reptiles during the dry season (Roy, 2001). This ability to take advantage of seasonal gluts in food availability is a feature common to many small carnivores (Joshi *et al.*, 1995; Lodé, 2000).

Its feeding habits make it extremely adaptable, able to fulfill its energetic needs from a wide range of sources, capitalizing on ephemeral sources of food. This gives the species a competitive advantage over other species, and allows it to maintain high populations.

## Habitat requirement

To compliment its dietary habits, H. javanicus has broad habitat requirements. It is found in grasslands, agricultural habitats, woodlands, boulder fields, and riverine forest up to high altitudes (Pimentel, 1955; Hoagland *et al*., 1989; Vilella, 1989). The main constraint that this species has is that it is intolerant of low temperatures (Baldwin, 1954). A radio tracking study of the species on Mauritius found that the species favored woodland and scrub regions over other habitat types, while an indirect population census study found that over larger spatial scales, mongoose preferred riverine and dense forest. One of the reasons for this was the availability of den sites in these areas. I found that fallen trees and holes in tree root systems were the most favored den sites, though the species is able to excavate its own dens if soil conditions are suitable (Prater, 1965). This is not unusual as many small carnivores are found to be den site limited (Halliwell & Macdonald, 1996).

Its broad habitat requirements, therefore, enable the species to occupy large areas of its native range. It also enables the species to easily colonize new areas to which it is introduced, something that history has told us is true.

## Reproduction

The small Indian mongoose is a flexible breeder. It has a litter size of up to 4, and has an extended breeding season over most of the year in much of its native and introduced range, within which it can have 2 to 3 litters a year (Baldwin *et al.*, 1952; Pearson & Baldwin, 1953; Pimentel, 1955; Prater, 1965; Gorman, 1976; Everard & Everard, 1985). In Mauritius it was found that mongooses timed their breeding to avoid the driest times of the year (Roy, 2001). With this flexibility the species is able to take advantage of periods when environmental conditions are at their best, ensuring improved chances of survival for their young. Like many solitary carnivores, the female is often left to rear young alone (Sandell, 1989). She also becomes incredibly defensive of her young.

The species' ability to adapt its breeding season to environmental conditions has meant that *H. javanicus* has successfully colonized most of the land area of the islands to which it has been introduced. It has also "evolved". A comparative study of the morphology of *H. javanicus* in its introduced and native range has found that the former has a greater variation in skull size and increased sexual dimorphism than the latter. These changes have occurred within the space of a century, as most introduced populations date back to the early 1900s (Simberloff *et al.*, 2000).

## Social and spatial organization

The social structure of mongoose populations reflects the plastic nature of other aspects of its nature. The species can live at extremely varying densities, ranging from less than 10 to several 100 animals/km$^2$ (Tomich, 1969; Hoagland *et al.*, 1989). On Mauritius, animals were not found to be territorial which agrees with the findings from other studies (Gorman, 1979). Other authors have even described the species as nomadic, having no fixed territories (Spencer in Gorman, 1975). Mongooses do fight with each other, but in some situations are highly tolerant of each other. Up to 11 animals have been seen feeding at a deer carcass, for example (C. Jones, pers. comm.).

*H. javanicus* is also capable of showing large population movements. On Mauritius, indirect census studies have shown that

significant proportions of a population in sugar cane move to other habitat types during the harvesting season when the cane is burnt. Mongooses were also seen to move towards riparian areas during dry seasons, presumably to find water or prey concentrated near water during this time. The ability of mongoose populations to move between habitat types and exhibit such adaptability in their spatial and social organization allow mongoose populations to quickly colonize new or newly available areas. Populations in Mauritius have the ability to quickly recover after culling has taken place to protect breeding colonies of native birds.

## The niche of the small Indian mongoose, and speculations for the future

*H. javanicus* is a diurnal carnivore, and in its native range this would make it vulnerable to predation by diurnal predators, especially raptors. In its introduced range, which mostly consists of tropical islands, there are few predators capable of killing and eating it. Its one main competitor and potential predator here is the feral cat, and as this species is mostly nocturnal, the mongoose temporally avoids competition by its diurnal habits. This could explain why its distribution on Mauritius does not seem to be influenced by the distribution of feral cats (Roy, 2001). There is a paucity of information in the literature on the ecology of the species and its interactions with other carnivores in its native range. Studying the species in its native range would not only allow us to better understand and generate further hypotheses in the growing field that is carnivore community ecology, it would allow us to understand the ecology of the small Indian mongoose from a positive perspective. As it stands, the small Indian mongoose is a serious pest, blamed for countless extinctions around the world, even in the short time that it has become a world traveler. It is also a species to be admired, however, for the qualities that make it a problematic pest also make it one of the world's most successful small carnivores.

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## The great British badgers and bovine tuberculosis debate

As a former member of the UK government's Consultative Panel on this thirty year old "Highly complex and emotive issue"; it is nice to be able to report that the saga may have run out of any rational justification. The Bern Convention and legal challenges having failed, nevertheless the "Science" is flawed, so it is down to politics. The Bourne/Krebs "Scientific" badger cull may be resolved early. Progress in 'politics and science' (!) happens by serendipity, and the foot and mouth epidemic here has had two unforeseen effects: -cattle TB testing and the Krebs/Bourne badger cull trial are still on hold. Thus, the cattle TB crisis will be exacerbated, and it seems that DEFRA (formerly MAFF) are in doubt as to whether the badger cull can be worth restarting. A 100 dairy herds lost from the north Devon triplet, over half the farmers in west Cornwall not cooperating with the trial, and animal activists have disrupted culls in at least five triplet areas (Devon, Cornwall, Glos./Hereford, Wilts.; the Sussex study was partly invalidated by such action).

Accordingly, two matters need urgent attention: resumption of annual cattle tests, and to finally end the badger cull which was flawed from the outset (11,12,16).

**Cattle testing**. The low point in cattle TB was in 1979 with 89 herds and 600 cases confined to tiny southwest "hotspots". Last year saw 1,031 herds and 9,000 cases, back to 1960s levels with spread to midlands areas TB-free for 40 years via mistested/ untested/untraced cattle (14,17). Great Britain in hence already in breach of EC Directives as to level of testing/incidence. With implications for trade and public health (10,11,15). It is absurd that England and Wales still have not banned unpasteurised milk, in line with Scotland and Ireland. It is a waste of time the Food Standards Agency are about to re-investigate meat/abbatoir safety already exhaustively studied (4,5). It is unbelievable that the Bourne ISG team are still trying to work out if cattle-to-cattle TB transmission is important (1), since annual testing is the gold standard under EC Directives after over a century's experience (13,17).

**Bourne badger cull compromised beyond repair.** Badger culling should have ended long ago (3,18,19) for four main reasons: scientific, economic, ethical, political.

A. **Science flawed**. The rationale and justification for badger culls lies in three claims:

- Badgers are the main reservoir of TB, causing 80-90% of herd breakdowns, particularly in the high density southwest badger population.
- Transmission is from badger to cattle, not vice versa.
- Badger culls "work" in solving cattle TB.

In fact all three claims are false, and it is dubious even on common sense grounds that badgers could be more important than the natural self-maintaining bovine host. Or if as alleged, TB is 80% via the respitory route in both badgers and cattle that it could realistically pass in either direction. Great Britain had a textbook TB scheme which nearly eradicated TB before the "first" TB badger 1971 (14,17); likewise N. Ireland where badgers are regarded as a spillover host from cattle and not culled unlike Irish Republic.

The two pivotal flaws in these three claims are, that due to the long incubation of TB and an only 80% accurate skin test, there has always been an "undisclosed" reservoir of latent TB "carrier" cattle which are non-reactors (false negatives) and seemingly not passing on TB; and secondly, badger TB is initially dietary in origin. It takes a year or so for cattle to get to the infectious stage, which is why annual tests work. But in attributing source of TB, if it is not obviously cattle, badgers get blamed instead (8, 11, 13, 14, 17). And just as child TB used to start in throat lymph nodes (tonsils) from unpasteurised milk, badger TB starts in the submandibular lymph nodes, and badgers merely pick up TB from seeking worms and beetles under point source infected cow pats... just as pigs as " dirty feeders" also pick up TB (6, 7, 9,13). This comes from MAFF's Wodchester Park study, which has also shown that cattle transfer TB: three new clans with TB after 1986-1989 inner farms outbreaks (2). Ironically MAFF noted that "infection in local cattle herds appears to have occurred at the beginning of the observed epidemics in badgers rather than at the peak in prevalence" (25). Furthermore there were simply too few "excretor" badgers to be responsible there, 49 over 10 years (25), or 58 out of 188 with TB (23). Computer simulation models which all ignore any spillover from cattle are hence meaningless (2,13,24).

The poor quality of "MAFF science" is also shown by their failure to learn from classic studies on cattle TB (4,5,20) including their own 1972 study (22). The study (21) of husbandry factors hence half re-discovers such obvious factors, and amusingly Prof. Phillips said they used my ms (13) but then didn't even cite it as not peer reviewed!

As to culls "working", the 1986 report found they did not as did two further analyses (18,19). Synchronised cattle testing and the eventual weeding out of the "undisclosed" latent carriers was what solved cattle TB in the four "proof" cases of Holsworthy, Dorset (Steeple Leaze), Thornbury, and Offaly (11,14).

Thus, all three claims are upon closer scrutiny shown to be wrong. It is rather depressing that 'scientific process' is unable to get beyond 'accepted wisdom' under these circumstances. Further study is only 'acceptable' if it doesn't stray too far from the 'official view', and new research aims to support current policy rather than in seeking new insights. The Bourne study might eventually reach the right viewpoint in 2005, but the transmission studies are likely to be too short term. And the badger cull " answers" are already blinding obvious if anyone asks the right (politically incorrect) questions. For example there were some 700 cattle TB breakdowns in Wales up to 1996 ("mostly due to badgers"), but MAFF's own data found only 46 TB badgers out of 2,363 sampled there since 1972. Higher numbers AFTER cattle breakdowns could be shown to be proportional to the severity of the cattle TB (11, 14). Will Bourne ask this simple question as regards data already held?

B. **Economics**. The 1986-1987 studies showed that badger culls were a waste of money, never likely to be cost-effective (3,18,19). The cost-benefit analysis hardly needs repeating (1). Each TB badger from the Bourne cull has cost £35,000!

C. **Ethical**. The aim of badger culls IS in fact area eradication, in Ireland even using cruel snares. And so claiming it is not (e.g. with the Irish Republic's closed season of July-September) area eradication is illogical. The English closed season supposedly to avoid catching lactating sows is too short: February-April. MAFF admitted catching 180 lactating sows over five years by accident, representing some 450 orphan cubs. Sows may still be lactating into June, so cubs will be at risk. MAFF's own computer simulation studies show whether lactating sows are released or not doesn't matter -even though sow-to-cub pseudo-vertical transmission is supposed to be important (24).

D. **Politics**. Leaks in Hansard and the farming press revealed that the 1986 Dunnet review (3) had been watered down politically, but it nevertheless showed that badger culls were a waste of money and should cease (3). A view that has been reiterated (18,19). Many independent scientific observers said the Bourne cull would be an inconclusive 'dog's dinner' due to all the confounding factors (11,12,16). Elliot Morley as Shadow Agriculture Minister told me in 1995 that culls should end but might have to be phased in so as not to upset farmers who have been told for 30 years that badgers are THE problem. With the Bourne trial badly compromised, it is high time to end the farce, as Prof. McInerney said "In the last analysis the problem of badgers and bovine tuberculosis is fundamentally a political one".

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# MARTES

The *Martes* Working Group, formed in 1993, is concerned with the conservation and management of martens, sable, and fisher.

## OBJECTIVE

The Group's primary objective is to facilitate communication among people with a common interest in research, conservation, and management issues for the following species:
Pine marten – *Martes martes*
American marten - *Martes americana*
Japanese marten – *Martes melampus*
Sable – *Martes zibellina*
Stone marten – *Martes foina*
Yellow-throated marten – *Martes flavigula*
Fisher – *Martes pennanti*

## KEY ACCOMPLISHMENTS

I. Three international symposia on the biology and conservation of species of the genus *Martes.*

II. Publication of three books:

- Buskirk, S. W., A. S. Harestad, M. G. Raphael, and R. A. Powell, eds. 1994. Martens, sables, and fishers: biology and conservation. Cornell University Press, Ithaca, New York. 484 pages.

- Proulx, G., H. N. Bryant, and P. M. Woodard, eds. 1997. *Martes*: taxonomy, ecology, techniques, and management. Provincial Museum of Alberta, Edmonton, Alberta. 474 pages.

- Harrison, D., and A. Fuller, eds. 2002. *Martes* in managed landscapes: *In Press.*

III. Publication of an annual newsletter on current events, on-going research from around the world, and recent publications.

IV. Maintenance of a website to foster communication among members: **http://www.laurentian.ca/martes/**

V. Preparation of a 4th international symposium scheduled for 2004 in Portugal.

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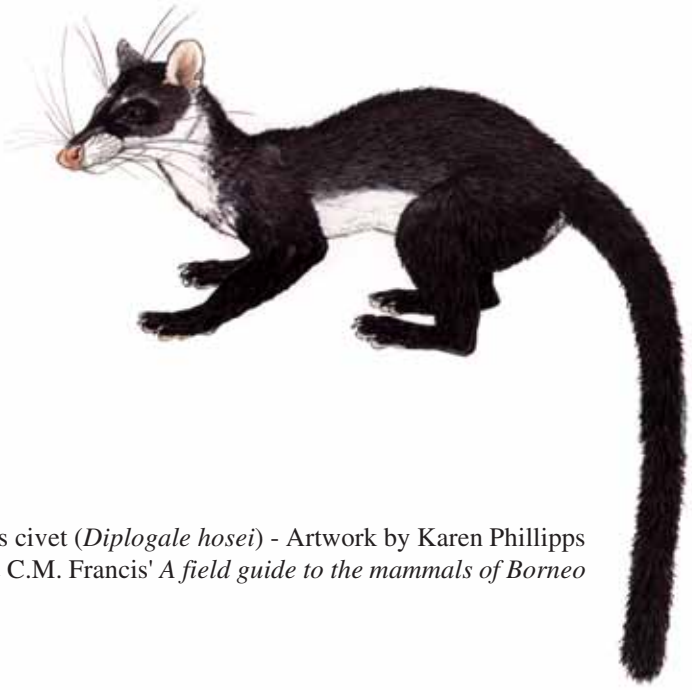

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