SMALL CARNIVORE CONSERVATION

The Newsletter and Journal of the IUCN/SSC
Small Carnivore Specialist Group

IUCN
The World Conservation Union

Number 31 October 2004

Hose's Civet Diplogale hosei – *Photo: Yasuma Shigeki*

The production and distribution of this issue has been sponsored by
"Royal Zoological Society of Antwerp", Antwerp, Belgium
"Columbus Zoo", Powell, Ohio, USA and
"Wildlife Conservation Society/Living Institutions",
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The aim of this publication is to offer the members of the IUCN/SSC Carnivore SG, 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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http://iucn.org/themes/ssc/sgs/mvpsg/

Printed on recycled paper

ISSN 1019-5041

Editorial: The scope of *Small Carnivore Conservation*

It is now 15 years since the inaugural issue of *Small Carnivore Conservation*'s predecessor, *Mustelid and Viverrid Conservation*, was printed. In the interim, our knowledge of some small carnivores and their conservation status has improved greatly, the newsletter has embraced the procyonids (including, controversially, the Red Panda *Ailurus fulgens*) and, most dramatically, media have changed out of all recognition. In 1989, email and the internet were still in their infancy; now they are *the* media for news communication, information requests, ideas bouncing, and activity planning; and to an uncertain extent, for presenting established information. A growing range of journals publishes material about small carnivores. To ensure that *Small Carnivore Conservation* retains the strong position is has built, as a major forum for information about 'our' mammals, we are now taking stock of its history and presenting our views, as editors, on the newsletter's role. We welcome all feedback.

Understanding each species' geographical and ecological distributions and its abundance is the foundation for effective assessment of conservation status and formulation of conservation measures. Our species are mostly elusive and very challenging to study. Much effort is needed to gain sample sizes necessary for statistically robust research results. Thus, *most species of mustelid, viverrid or procyonid have never been the subject of a dedicated long-term study*. Many taxa in the tropics, where Viverridae and Procyonidae are most speciose, are known only by appallingly meagre anecdotal information, often decades old. Secondary compilations made the best use of the available information, but errors have been recycled and magnified by successive authors into accepted wisdom: e.g., the mistaken belief that Small-toothed Palm Civet *Arctogalidia trivirgata* was restricted to little-degraded forest and was overall rather rare. Generalised range maps have been inferred from only few specimens, themselves often lacking full locality data. For some tropical species, they are largely guesswork, even in respected sources such as Lekagul & McNeely's (1977) *Mammals of Thailand* or Corbet & Hill's (1992) *Mammals of the Indomalayan Region*. Various small carnivores are among the least known mammals of the world (excluding murids, bats and insectivores). Lowe's Otter Civet *Cynogale lowei*, known from only one specimen, the nearest congeneric (and perhaps conspecific?) population thousands of kilometers away; Hose's Mongoose *Herpestes hosei* and Bengal Mongoose *H. palustris*, also not found since discovery: living sympatrically with similar congeners, are they even distinct taxa? Brown-tailed Mongoose *Salanoia concolor*, the last of Madagascar's endemic carnivores to remain a secret. The pages of *Small Carnivore Conservation* have reported the increased understanding about other previous enigmas such as the other Madagascar viverrids, Nilgiri Marten *Martes gwatkinsii*, Spotted Linsang *Prionodon pardicolor*, and Brown Palm Civet *Paradoxurus jerdoni*. One of *Small Carnivore Conservation*'s most important functions is to cover the little-known species.

Small Carnivore Conservation is complementary to the many international mammalogical and conservation journals. These are not restricted to small carnivores, hence have stiff competition for space. Conversely, *Small Carnivore Conservation* can cast a wide net over "our" species and can, and should, publish the sort of speculative, provisional and anecdotal information nowadays eschewed by research journals.

Even single observations of perhaps a third of the small carnivore species are worth putting on record, simply to tie a certain locality, habitat and altitude to the species. For many more species (almost any Asian or Neotropical, and most African ones), precise information on day/night activity, social structure, habitat use, abundance, ability to live in proximity to a given level of human activity, local human uses, and indeed any facet of natural history, is desperately needed. Hence, for most species, *Small Carnivore Conservation* wishes to publish all such observations, of course indicating clearly where fact meets speculation. Because our

species are so difficult to research and natural habitats are being lost at enormous rates, especially in the tropics, even 'indicative observations' may never be 'superseded' by quantitative study before the habitat, and the animals, have gone. Hence it is imperative that they are recorded for the future: published on paper. The long-term mechanisms for archiving and access to internet material remain unclear: observations thus circulated now, may, in 20 years, be little more accessible than the observer's field notebook. Many sightings of little-known species are made by "other people": primatologists, bird or bat surveyors, and wildlife tourists have all reported critically important incidental records of elusive species in *Small Carnivore Conservation*. The editors encourage other such notes, and appeal to anybody who knows of unpublished information to do their utmost to ensure it is put on permanent record.

Camera-trapping is an increasingly rich field of distributional information, yet the results rarely receive the circulation they deserve. Usually employed for specific purpose, e.g. a single-species study, too often records of the other species are put aside. Yet the pictures, in an era of inexorable decline in specimen collection, are the next best: they are independently verifiable, unlike sight records. Moreover, the photograph is available for future use in clarifying geographical variation, and, after taxonomic reviews, may allow refinement of an original identification. Field characters, including posture, eye-shine and pelage, remain poorly known for many small carnivores, and camera trap results inform potential observers how a species looks in life. The recent growth in the number of instructive photographs printed in *Small Carnivore Conservation* will be maintained: chief among them will be field photographs of little-known species. As well as individual records, *Small Carnivore Conservation* is also keen to present camera-trapping programme results, e.g. across an entire country, assessing the small carnivore community at each site. More detail can be presented than is usual in journal papers. Indeed, such reviews can cover any technique, e.g. live-trapping, direct field observation, hunter/market surveys, holdings in national or provincial museums.

Traditionally, *Small Carnivore Conservation* has allowed rapid publication of interim research findings, particularly reporting results of conservation programmes. Challenges to conserving the most threatened or least known species are rarely unique. Hence, insights of field research methods, captive maintenance and other topics for, e.g. Black-footed Ferret *Mustela nigripes*, European Mink *Mustela lutreola* and Owston's Civet *Chrotogale owstoni*, have been circulated as speedily as possible. Another early function was the presentation of information about conferences, calls for assistance with research, and other newsy items. In this, it has largely been superseded by the internet, with its unrivalled speed of communication. Nonetheless, we remain enthusiastic to cover as much 'breaking news' as contributors feel appropriate, particularly where it will still be relevant years later.

A major role of *Small Carnivore Conservation* is to digest information published elsewhere. The 'recent literature' section is a never-ending and time-intensive task; readers can assist by drawing attention to obscure publications, and, wherever possible, by sending copies (paper or electronic) to the editorial address. The newsletter has been under-performing for languages other than Western European ones. One colleague submits material translated from Chinese, and we wish to increase coverage of other regions as English overviews and indeed, where merited and with appropriate permission, translated whole papers. Readers already possessing translations, and who would like others to benefit from this, are invited to contribute them! Reviews of books relevant to mustelids, viverrids and procyonids will continue to form a key part of the literature section; it would also be helpful to carry more summaries of key papers, particularly those in limited-circulation journals.

The taxonomic scope of *Small Carnivore Conservation* remains the same: contributions that are primarily about any species of Viverridae and Procyonidae, or any of the Mustelidae except otters. Other small carnivores, the otters, small cats and small canids, are covered by other SSC newsletters; although as before, *Small Carnivore Conservation* will continue to include records of these animals where they are an integral part of the contextual information for 'our' species. Any material pertinent to any of these species, be it their distribution, population, ecology, natural history, relations with humans, captive maintenance, conservation needs or successes, or anything else, is considered.

The editors, September 2004.

Observations of a live Hose's Civet *Diplogale hosei*

YASUMA Shigeki

Hose's Civet Diplogale hosei. *Photo: YASUMA Shigeki*

Hose's Civet *Diplogale hosei*, one of the least known carnivores in the world, is endemic to Borneo. It is primarily montane, although a recent record from Brunei came from only 450 m (Francis, 2002). Van Rompaey & Azlan (2004), in a recent review of the species, traced no known captives ever, and very few field sightings. There may be no previous photographs or film of a live animal, that of Dinets (2003) being too dark. Hence, habits remain almost unknown. This note documents one caught at Bukit Retak, Brunei, on 25 June 1997, at an altitude of ca. 1,500 m, and maintained in captivity until release on 8 September 1997. Bukit Retak lies deep within Ulu Temburong National Park, ca. 22 km to Francis's (2002) sighting in 1991 from near Bukit Belalong at 04° 31' N, 115° 10' E. Bukit Retak, the highest named peak in Brunei, reaches an altitude of 1,618 m. There is no road access, and helicopter offers the best mode of entry.

I stayed at Bukit Retak during 18 to 26 June 1997, with four rangers of the Brunei Forest Research Center. I requested the helicopter of the Brunei army to go to a small helipad at 1,400 m altitude, where a seismograph had been installed several years previously. Excepting a single record of a bat, the area had never been surveyed for mammals. The high altitude suggested that some animals typical of Sabah's mountains and of Gunung Mulu (Sarawak) might occur, e.g. Mountain Treeshrew *Tupaia montana*, Pygmy Fruit Bat *Aethalops alecto*, Long-tailed Mountain Rat *Niviventer rapit*, Mountain Giant Rat *Sundamys infraluteus*, and perhaps even Hose's Civet (at the time, I was unaware of C. Francis's sighting). Hence, I took a selection of mammal traps, and baited some with bananas, an effective bait for rats, and some with luncheon meat.

Bukit Retak was exceedingly wet. The ground, the rocks, the tree trunks were all covered with thick mosses saturated with large volumes of water. Traps had to be collected by crawling across the short woody vegetation, meaning that trousers and shirt were soon dripping wet. Forest above 1,000 m was wrapped in fog, with rain in the afternoon. It was also rather cold.

On the last day, when all but two traps had been collected, Mr. Aliffin, who walked ahead of me, cried out, "It is a musang. It differs from the common species". 'Musang' means civet in the Malay language (Harrison, 1953). I ran in a hurry, and seeing the dark animal in the trap, knew instantly "It is the Hose's Civet!", images from a pictorial book being imprinted on my mind.

The animal had entered a meat-baited trap. It looked gentle and depressed. I anaesthetised it to bring it back to the camp without damage, which active mammals may sustain from rubbing

against the cage metal. I weighed, measured, photographed and ear-tagged it. The nipples were large, suggesting it might be just around childbirth, but the underparts were not distended, and no foetus could be felt. After it recovered from anaesthesia, I gave it water, which it lapped well. I offered it all available foods: banana, cheese, tinned sardines, bread and corned beef. It ate most of these but did not even bring its mouth to the banana. This latter is perhaps surprising, given the readiness with which some other civets accept bananas; indeed, Malay Civet *Viverra tangalunga* and Common Palm Civet *Paradoxurus hermaphroditus* not infrequently enter banana-baited cage-traps.

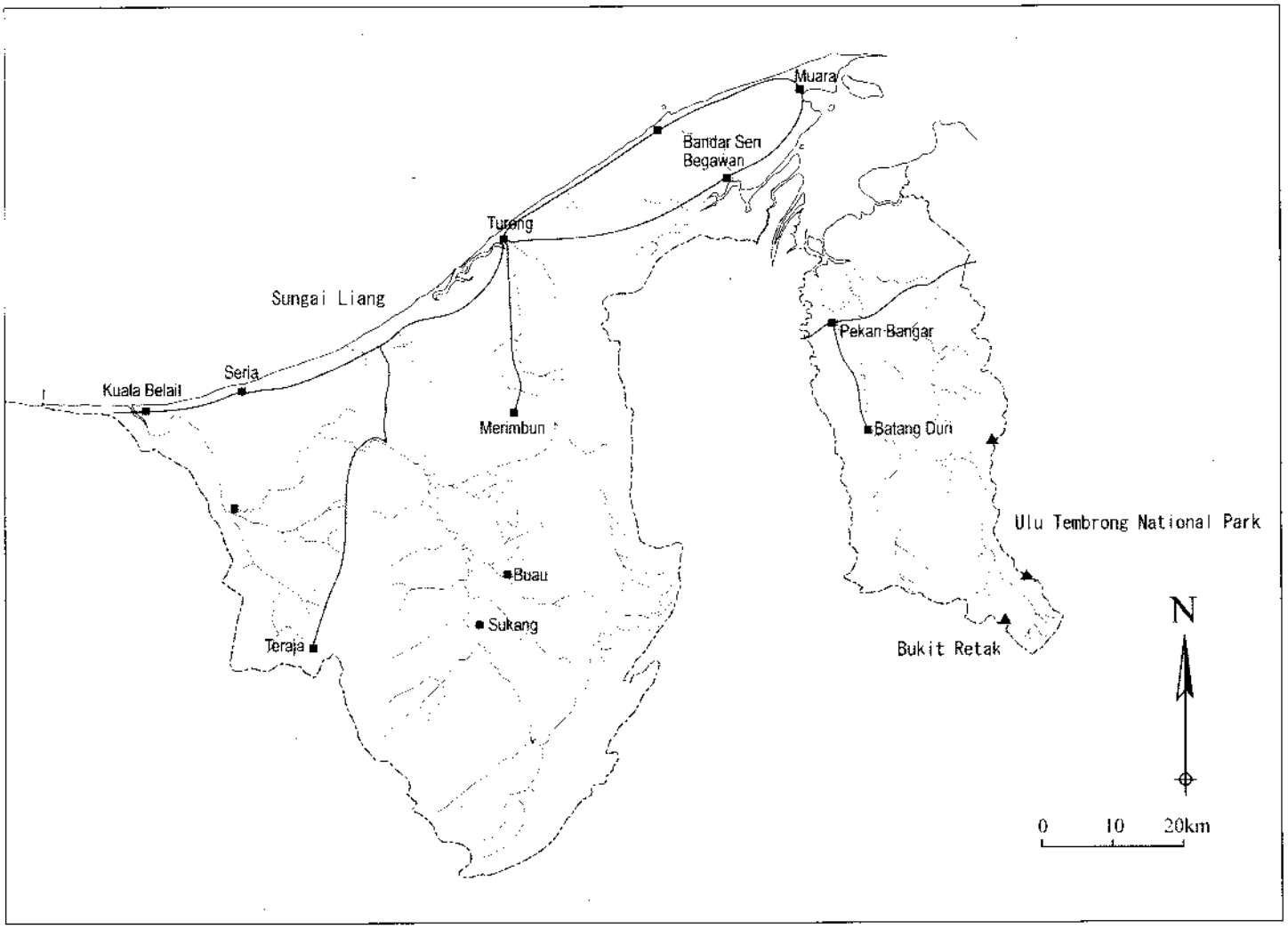
The individual was an adult female weighing 1,370 g, with head-and-body length of 484 mm, tail length of 346 mm, hindfoot length of 81 mm, and ear length of 36 mm. Teeth totalled 40, and it had a pair of nipples in the rear abdomen. The upperparts, from nose to tail-tip, and including the outer surfaces of the four limbs, were blackish brown, apparently considerably darker than either of the individuals discussed by Francis (2002). The cheeks and both sides of forehead were slightly brighter than the rest. The underside, from the chin to the tip of the tail, and the inner surfaces of all four limbs, were white or slightly brownish white. The face had sensory hairs exceeding 15 cm long. The rhinarium was a contrasting flesh colour. The two nostrils diverged somewhat so as to open to the sides; they protruded widely, opening like bugles. In overall appearance, the nose of Hose's Civet is outstanding, although vaguely reminiscent of a Moonrat *Echinosorex gymnura*. The under-surfaces of the feet were flesh-coloured, and the footpads brown. The feet were partly webbed, with patches of short hair between the footpads.

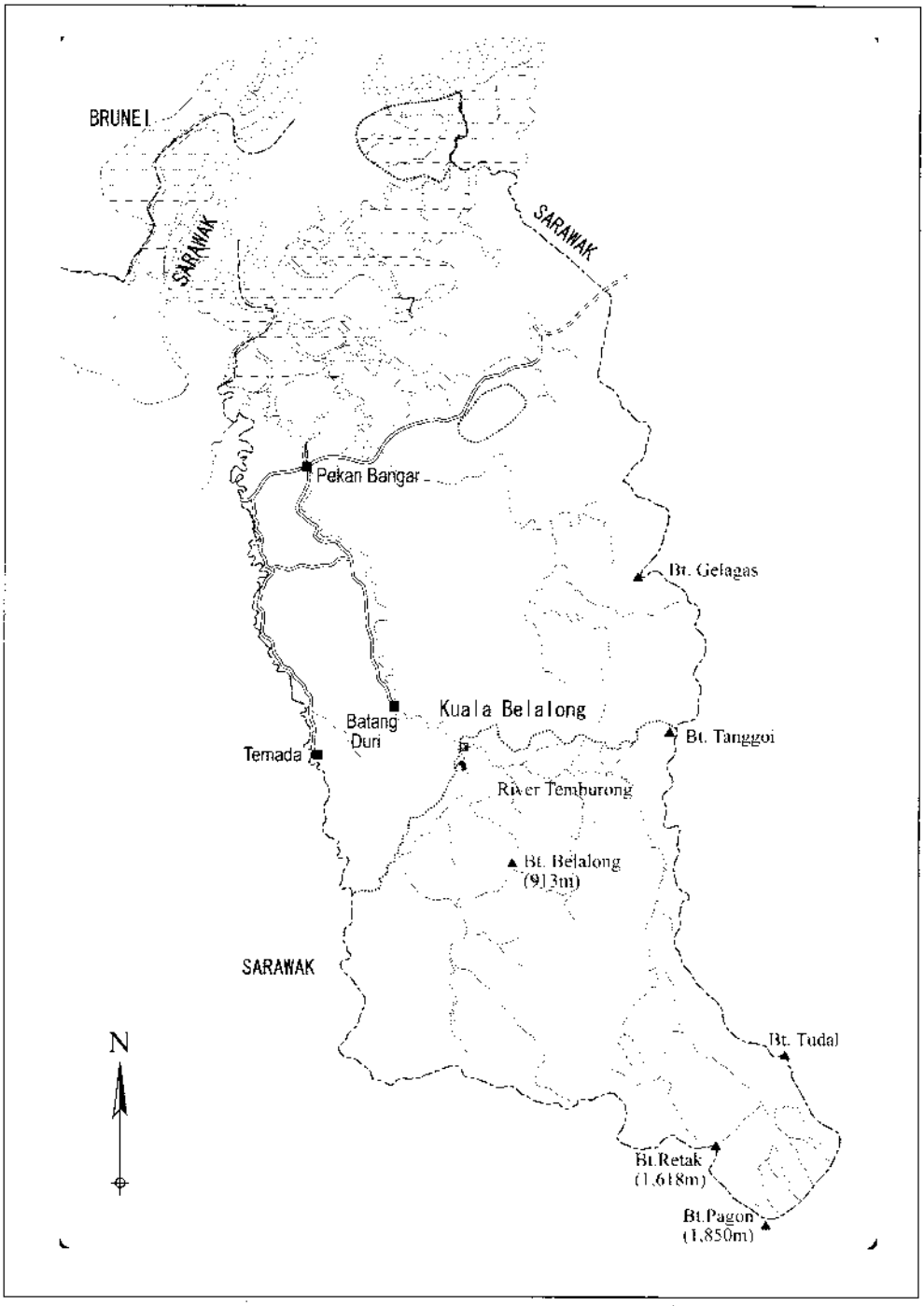
Given the aura of mystery surrounding this animal, I decided to take it back alive so as to observe its habits. We took it back to town by helicopter, and brought it to my house at Sungai Liang, situated at ca. 20 m a.s.l.

The cage measured 3 m x 4 m and was 2 m high; it contained many branches. On release inside, the Hose's Civet walked along the wire net several times, then hid in a cavity in a brick pile. Subsequently, it slept there, and an alternative hole, mounted arboreally, was not used at all. By contrast, Small-toothed Palm Civets *Arctogalidia trivirgata*, squirrels and rats invariably go straight to the highest hole. The first evening, I gave water, chicken and banana. Next morning, all remained. The next evening, I gave a shrimp and small fish, which were eaten completely. Thereafter, I frequently fed it fish. Usually it ate them directly by mouth, accompanied with much noise, but sometimes it bit from the fish held down by a forefoot. The civet ate neither big fish, nor those with big scales or spines. However, if I removed scales and spines, the civet ate such fish, except the head. Live freshwater fish introduced into the water tubs were taken and eaten. Shrimps were eaten at the beginning, but hardly at all thereafter. Chicken and luncheon meat (despite the latter's saltiness) was always eaten, but bananas, other fruit and boiled rice were not touched at all. I gave about 100 g of food once per day, a mix of small fish, chickens, luncheon meat, etc. If I gave more food than that, it was left. Water was changed daily.

I put water tubs at four places, for drinking; but at the start, the Hose's Civet defecated into them, even when their positions were changed. Presently, the civet decided upon a regular defecation

Map of Brunei





Map of Temburong District, Brunei

spot, and rarely defecated into the water tubs provided that they were not placed there. Nevertheless, it still defecated into a water tub about once every five days. The faeces smelled sufficiently strong to irritate everyone else in my house.

While I prepared food, usually the Hose's Civet lurked in the brick-pile. However, after a month, it started to poke out the tip of its nose slightly from the hole, and held it high to sniff the air. Occasionally it even put out its head. And when I went out of the cage, it came and ate as if it had been waiting impatiently. Provided I kept a distance from the cage, it took no notice of me, even if I was looking. However, with any other person, even if he waited many minutes, the civet remained in its hole. Its response to my approach was always gentle: it seemed the natural temperament of this animal.

In 2½ months of observation, I found that the civet stayed in the hole by day and emerged only at night. It did not climb in the branches. This suggests that Hose's Civet is nocturnal and ground-living, resting by day presumably in holes amid tree roots or rocks. In the forest, by night, perhaps it forages on small fish, shrimps, crabs and frogs near the streams, or catches insects and other small animals on the mossy ground. It seems unlikely that it swims and catches fish, otter-style: it would eat neither big fish nor those with big scales or spines. Moreover, there are no big fish in the streams of mountain forest.

The night before release, I put a transfer box (60 x 60 x 90 cm) into the cage, baited with food. After 4 hours journey by car, speed boat, car again and then small boat, at last we arrived at Kuala Belalong. Even though the boat had bounded vigorously on the water, the Hose's Civet was not excited; I have never seen such a composed animal before. I gave the civet some river water immediately upon arrival. On drinking it, the Hose's Civet suddenly changed demeanour, showing an intrepid motion I had never previously seen in it. It was difficult to avoid thinking that it sensed it was home: the Temburong river arises in Bukit Retak.

The Hose's Civet was released in the forest on the far side of the drawbridge of Kuala Belalong. Forest is unbroken over the 30 km from here to Bukit Retak, and there are no roads in the vicinity, eliminating the chance of the freshly released, and potentially disorientated, animal being hit by a vehicle. As the cage door was opened, the Hose's Civet remained sitting. When I opened the back door again and urged it out, it rose at last, came out of the box slowly, then left at a brisk pace. But, it stopped abruptly when only 5 m from the box, and returned slowly. It stopped at the front of the box, extended its neck and continually moved its head up and down for nearly two minutes. It seemed as if it was scenting, to decide the direction to take. Suddenly, it departed decisively, and did not return again.

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The Stone Marten *Martes foina milleri* on the Island of Rhodes

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As with the Cretan Stone Marten *Martes foina bunites*, the subspecies *M. f. milleri* that is apparently endemic to the Island of Rhodes (Ondrias, 1965) is very poorly known on the one hand and possibly threatened on the other (Schreiber *et al.*, 1989). Data are evidently even scarcer for the latter taxon, which, after formal recognition by Festa (1914), hardly received any attention at all. The "Atlas of European Mammals" assumed that the Stone Marten was widespread on the Island of Rhodes (Mitchell-Jones *et al.*, 1999) although such a perception was not at all supported by hard evidence. As a matter of fact, the only locality known seems to be the one published by Festa (1914): the type locality of *M. f. milleri*.

During my recent visit to the Island of Rhodes (April 26th to May 2nd, 2004), I collected information from road casualties, which enables further insight into the status of this little known island race of the Stone Marten.

Identity

Festa (1914) defined *M. f. milleri* by its small size, in which it resembles *M. f. bunites*. The two, however, are said to differ in a more extensive throat patch in the former, and also in its less yellowish colour of the underparts (Douma-Petridou, 1984). As evident from Table 1, both island forms are smaller than the mainland population from Akhaia (northern Pelopónnisos), but the differences are, however, mainly in terms of average (Table 1). In island biotas, the larger mammals (body mass > 100 g) tend to decrease in their size (Brown, 1995) and the Stone Marten evidently follows this rule. The lack of genetic investigation hitherto means that it is hard to decide whether such size differences have any genetic background.

The white throat patch (bib) tends towards reduction in the Cretan Stone Marten and is entirely lost in extreme cases (Miller, 1912), but some specimens show quite an extensive bib as well (Fig. 1; *cf.* also Lord, 2004). Although the bib is extensive in most martens from mainland Europe, tendency towards its reduction is also evident in some populations, as shown, e.g. by a sample from Mt. Istranca in European Turkey (Fig. 1). The extent of overlap between populations is thus quite broad. In spite of this, extremes of *M. f. bunites* stand well outside the range of the great majority of remaining samples, with the exception of another island population, namely from the Aegean Island of Naxos. My specimens from Rhodes did not show the extreme bib reduction as seen in the Cretan animals, nor did

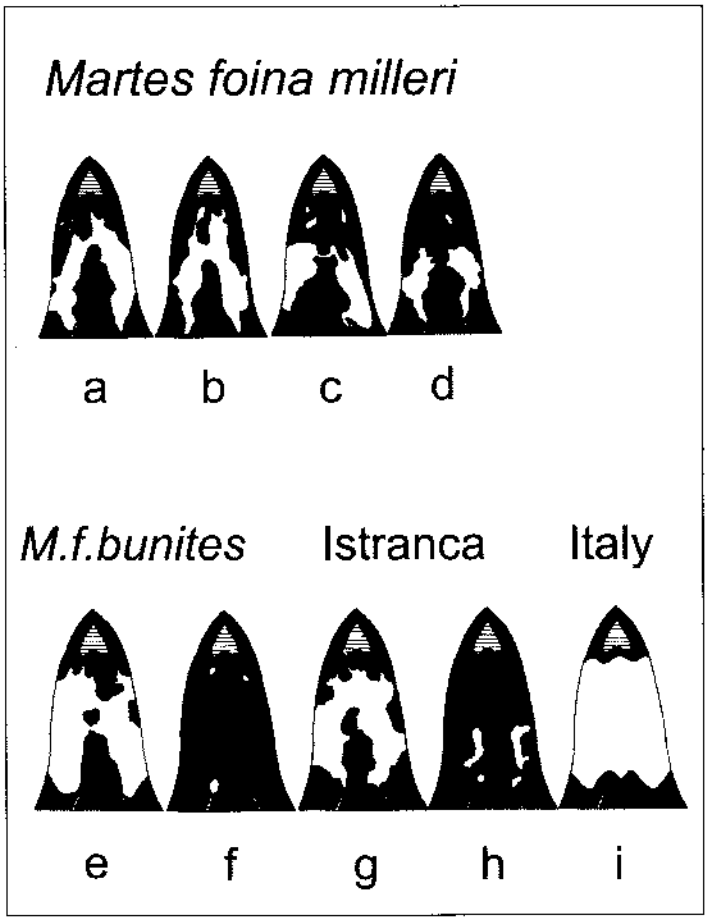


Fig. 1. Bib pattern variation in samples of the Stone Marten from Europe. With the exception of M. f. milleri, *only extremes are figured for the remaining samples.* Martes foina milleri *(Rhodes): a – Soroni; b – Gennadio; c – 4 km west of Apollona; d – 2 km south of Lardos.* M. f. bunites *(Crete): e – between Gerani and Episkopi; f - Kanea. Mt. Istranca: g, h – purchased in Demirköy. Italy: i – Firenze, Pozzolatico. Specimens (f) and (i) are from the collection of the Natural History Museum London.*

*Table 1. External dimensions of stone martens from the islands of Rhodes (*M. f. milleri*) and Crete (*M. f. bunites*), and from Akhaia, Greek mainland. Ranges are given for the Akhaian sample: n = 34 (males) and n = 19 (females), respectively. Abbreviations: m – male; f – female; ? – sex not known; TL – total length; HB – head and body length; TL – length of tail; HF – length of hind foot; E – ear length. All dimensions are in millimetres. Sources: [1]Festa (1914); [2]Natural History Museum London; [3]Zimmermann (1952); [4]Douma-Petridou (1984); the remaining data are of the author.*

	M. f. milleri				*M. f. bunites*						Achaia, Greece[4]	
Sex	m[1]	m	f	f	m[2]	m[2]	m	m	f	?[3]	m	f
TL	660	680	585	640		628	675	655	615	630	615-750	590-690
HB	440	455	370	425		403	450	440	420	395		
TL	220	225	215	215		225	225	215	195	235	215-270	215-255
HF	60.0	79.0	72.5	76.0	77.0	79.0	85.0	85.0	75.0	80.0	80-90	72-85
E	25.0	33.0	31.5	35.0	31.0	39.0	29.0	38.0	37.0	38.0	35-45	30-41

they reach such an extensive throat patch size that is found in some martens from the European mainland (Fig. 1).

Specimens from Rhodes are darker than those from Crete. The back is browner (markedly greyish in ssp. *bunites*), and the dark tips of guard hairs are more extensive. The same trend is evident also on the underside. The head and ears are also darker and browner. The tail is brown black distally. The bib of the two specimens is yellowish, which is atypical of the Stone Marten. In this respect, they more closely resemble the Pine Marten *M. martes*.

The only baculum of the Rhodean marten available to me differs from the condition seen in *M. f. bunites* and in the continental European form. The base is more robust, while the distal head and its perforation are smaller in the Rhodean specimen. Since the baculum's shape is fairly stable in my sample from Slovenia, some of the differences might be genuine and thus also of taxonomic value. Sample sizes, however, are by far too small to allow firm conclusions. The baculum is shorter in both island forms (length for Rhodes: 61.4 mm; Crete: 61.2 mm), but still within the range of a small sample of adult martens from Slovenia (range = 60.0 – 67.7; mean = 64.9 mm; N = 4). Since length of the baculum correlates positively with size in mustelids (Baryshnikov *et al.*, 2003), smaller size in island animals evidently reflects their smaller body size.

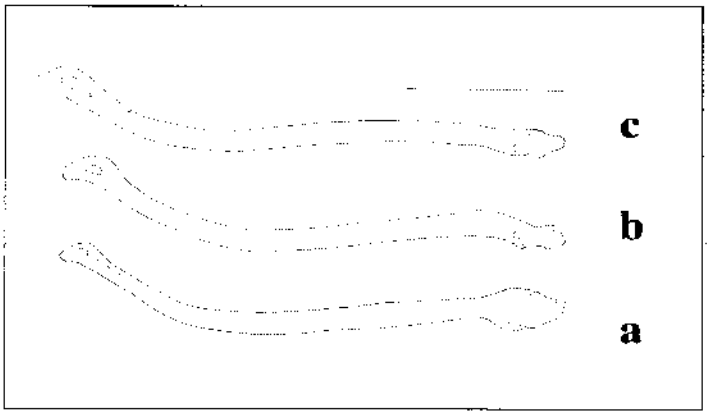
In conclusion, *M. f. miller* is a typical small island Stone Marten of fairly dark colour and moderately reduced bib, which is yellowish in some specimens instead of being white. Shape of the baculum is possibly also of some diagnostic value.

Distribution and habitat

Records are summarised in Fig. 3. Since they are fairly scattered, it is safe to presume that the animal is widespread on the island. Of the eleven specimens, which I managed to record, six were found along the coast, close to the sea level, and the highest evidence available so far is from the altitude of 350 m a.s.l. As regards habitat selection, six specimens were found in a suburban environment, two were from the Mediterranean mosaic of small fields and olive groves, interspersed with maquis, another two were from the border of a cultivated mosaic and an old pine forest, and the last one from an extensive bare and rocky landscape with hardly and cover.

The interior of the island of Rhodes is rugged and still surprisingly wooded. Although Mt. Attavyros, which is the highest point on the island (1,215 m a.s.l.), is deforested and bare, there are extensive old pine and cypress forests elsewhere, particularly on Mt. Profitis Ilias (altitude up to 641 m a.s.l.). In general, there is much more forest on Rhodes than on Crete, and habitats look very suitable for the marten.

Fig. 2. Baculum (in lateral view) in the stone marten from Europe: a – M. foina milleri *(Rhodes, Soroni); b* – M. f. bunites *(Crete, Malia); c* – M. f. foina *(Slovenia, Škofja Loka). The distal head is to the left. Scale bar = 2 mm.*



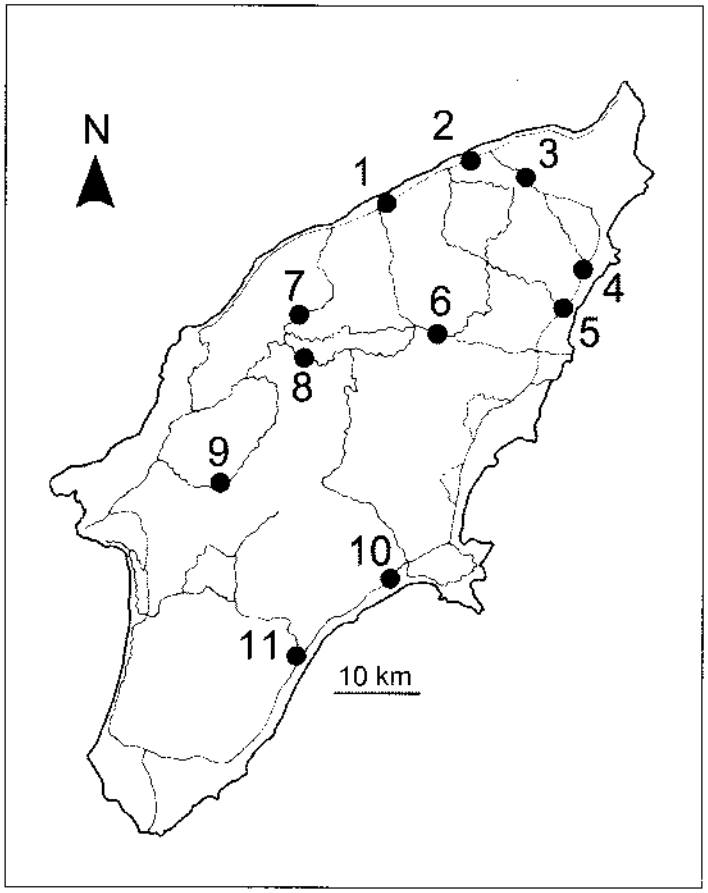


Fig. 3. Map of the Island of Rhodes with roads travelled during my survey and localities where stone martens were found. Records: 1 – Soroni; 2 – Paradissi; 3 – Pastida; 4 – 2km north-west and 3 km south of Faliraki, respectively; 5 – Afantou; 6 – 2 km west of Archipoli; 7 – 2 km south-west of Salakos; 8 – 4 km west of Apollona; 9 – Agios Isidoros (Festa, 1914); 10 – 2 km south of Lardos; 11 – Gennadio.

Conservation status and threats

Conservation status of the Stone Marten on Rhodes is virtually unknown. As far as I can conclude from road casualties, the animal is fairly common on the island. In any case, it was the most frequently accounted mammal. During my six-day survey, I covered 1,430 km on the 468 km of the island's roads, which means that each road was travelled three times on average. Daily I surveyed between 175 and 217 km of roads. Since some roads were travelled more than once during a single day, total daily drives were from 202 to 286 km. In total, I recorded eleven dead martens along the island's 468 km of roads, i.e. approximately one specimen per 40 km. Only three animals were casualties from the previous night, while the remaining carcasses were found in various stages of decomposition. Repeated observations of several carcasses over a period of three to four days induced me to a crude estimate that bodies remained recognisable up to perhaps two weeks in fairly cold spring days. Following this speculation I conclude that, on average, approximately one marten was killed nightly along 600 km of roads.

As already mentioned, three carcasses were fresh. Total length of daily surveys without repeated travels on the same road was 1,190 km. This gives an estimated one dead marten nightly per 400 km. The two approaches thus resulted in similar estimates.

My survey covered the great majority of tar roads of Rhodes, which allows a tentative estimate of the annual kill on the island by traffic of ca. 350 martens (= 25 martens per 100 km^2 annually; surface area of Rhodes = 1,404 km^2). This estimate is much higher than the one for Crete (3.8 martens annually per 100 km^2; Kryštufek, 2004). Since Rhodes mainly lacks fast roads along which the bulk of killed martens were found on Crete (Schreiber, 1999; Kryštufek, 2004), the discrepancy is even much more obvious. My survey was conducted before the peak of the tourist season, when the traffic was still modest. Cars are hired to tourists just everywhere on Rhodes and traffic is tremendously busy an all of the island's roads between June and September. It is reasonable to assume that road casualties also increase during the summer period. If so, my estimate is presumably smaller, even, than the actual mortality. Mortality on roads thus most likely influences densities of the Stone Marten, but the actual impact is hard to be deduced from a single and fairly short survey.

Acknowledgements

I thank David Veselič for help with figures.

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Recent publication

Russian carnivores

Tumanov, I. L. 2003. [*Biological characteristics of carnivore mammals of Russia*]. St. Petersburg: Nauka. 448 pp.

Adaptive characteristics of predatory mammals of Russia are considered on the basis of long-term field and experimental research. Food specialization and seasonal change of foods, daily activity and moving, terms of coupling and fertility, development and growth rate of juveniles of predatory species are elucidated in detail. Particular emphasis is placed on the analysis of the ecological-physiological and morphological adaptations of systems and organs and also relationship of functional state of predators and their populations on helminth infection. The ways of adaptation of predatory mammals to different environmental conditions are shown on the basis of study of specificity of energy exchange, thermo-regulations (chemical, physical, and ecological) and structural transformation patterns related to them. The book is intended for ecologists, zoologists, ecologists-physiologists and also specialists in rational nature management and game husbandry.

This book will make a large number of zoologists regret that they cannot read Russian. The good news is that all nine chapters and the conclusion have short English summaries. The 158 tables and 69 figures have legends both in Russian and English. The same goes for the 16 black & white and 16 colour photographs.

Confirmation of the Greater Grison *Galictis vittata* (Carnivora: Mustelidae) in Guatemala, Central America

Timothy J. McCARTHY[1] and Sergio G. PEREZ C.[2]

The serial publication, *Mammalian Species*, provides literature reviews for species of mammals and generally discourages the inclusion of unpublished data in these accounts. Recently, Yenson & Tarifa (2003) reviewed the literature for the Greater Grison *Galictis vittata* and also referred to unpublished specimen records in museum collections. Unfortunately, the museum specimens were not identifiable by museum acronyms and catalog numbers. The locality and specimen data were not reported. Consequently, the undecipherable dots on a map over different countries remain undocumented.

We report those data from Guatemala for clarification. Ibarra (1959) first observed the "hurón" in Guatemala from southern Petén, at a locality about 55 km southwest of Sayaxché, and in eastern Izabal, ca. 25 km northeast of Morales. There are no specimens of *Galictis* in the collections of the Museo Nacional de Historia Natural and the Museo de Historia Natural, Universidad de San Carlos. There are two unreported Guatemalan specimens that were secured by Luis de la Torre from the Pacific slope in 1948. These are stored in the Division of Mammals, Field Museum of Natural History (FMNH). De la Torre collected a young adult female (FMNH-64460) on 13 May at Finca Santa Cristina, ca. 4050 ft. about 10 km south of Yepocapa, Departamento de Chimaltenango, as the locality. It represents a dry study skin and skull. A second specimen (FMNH-64618) is unsexed and represents a flat, tanned skin only. The skin appears to have been a trophy that de la Torre secured from a local hunter. The feet are missing and it apparently was nailed in the flat position to dry. De la Torre secured the skin in late September at Finca Palmeras, Departamento de Escuintla, and we assume the animal was collected nearby. Field notes are not available for details about these localities or the specimens.

We investigated these two localities of de la Torre to confirm with topographic maps of the Instituto Geográfico Nacional (IGN) and the Diccionario Geográfico de Guatemala. Finca or Hacienda Santa Cristina was located on an IGN 1:50000 topographic map (no. 2059 III, Alotenango) and determined as 6.4 km S, 3.4 km W Yepocapa, (14°27'05"N, 90°59'15"W; 1.040 m). Finca or Hacienda Santa Cristina was not located in the Diccionario Geográfico. Finca Palmeras does not appear on the maps or in the dictionary. We believe Colonia Palmeras, now inside the town limits of Escuintla, is the same Finca Palmeras, but absorbed by urban sprawl. The name "Palmeras" is a unique place name in Guatemala, associated with Escuintla (14°18'N, 90°47'W; 340 m), which is also known as "La Ciudad de las Palmeras". Still, the actual locality of the *Galictis* skin remains unknown.

The overall coloration of the female skin is lighter than the unsexed skin. The dorsum of the former is grayish-brown overall with blackish brown legs, face, and ventrum, while the latter has a blacker coloration with less white expressed in the white-tipped hairs. Selected field and cranial measurements for the female are: total length, 610; tail length, 121.7; hindfoot length, 80.7; greatest length of skull (premaxillary-lambdoidal crest), 83.1; zygomatic breadth, 49.4; mandibular length (symphysis-condyle), 50.35; coronoid process height, 22.6.

Greater Grison Galictis vittata.

Specimen documentation for *G. vittata* in northern Central America is limited to Belize (1), Guatemala (2), and Honduras (1); no specimens are reported for El Salvador and Nicaragua (McCarthy *et al.*, 1991).

Acknowledgments

We thank L. de la Torre, L. R. Heaney, R. J. Izor, B. D. Patterson, and others of FMNH for access and study of specimens. We acknowledge many in Guatemala, including the late J. A. Ibarra and our colleagues of the past Comisión Nacional del Medio Ambiente and the current Consejo Nacional de Areas Protegidas.

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The possible role of Oriental civets in the recent SARS epidemic

François MOUTOU

Introduction

The recent SARS (Severe Acute Respiratory Syndrome) epidemic, associated with a new coronavirus (SARS CoV), raised a lot of questions in different fields, from public health, virology and epidemiology to zoology. After a brief summary of the events, the zoological aspects will be evaluated.

The disease started in November 2002 in southern China, Guangdong province, and had spread around the world since the beginning of February 2003. The first epidemiological studies revealed that some of the early index cases were people involved with animal and food activities, like wild animal traders on markets or cooks working in restaurants specialised in wildlife food (Yu *et al.*, 2003). After unofficial data have been circulating, the first publication of the isolation and identification of SARS-like CoV strains from wild animals sampled on a Shenzhen market, Guangdong, had been available at the beginning of September (Guan *et al.*, 2003). The virus is clearly related to SARS virus albeit different. As the positive animals have been collected on a market, the question of the origin of the virus and of its real reservoir remains open. More data have been discussed since then but not so many have been linked to scientific publications. Many species, not only mammals, have been suspected to be involved in the epidemiology of the disease. However, the small carnivore hypothesis, in fact the civet hypothesis (see below), is still the best documented and should, at least, be explored.

The three "positive" species mentioned by Guan *et al.* (2003) are the Masked Palm Civet (*Paguma larvata*), the Raccoon Dog (*Nyctereutes procyonoides*), and the Chinese Ferret Badger (*Melogale moschata*), three species from three families and two sub-orders of Carnivora.

The Masked Palm Civet, which has been more often sampled than others, may play a special role for the following reasons:

- A SARS-like CoV has been isolated from this species from different animals on different occasions.
- This species has been eaten for a long time in southern China but its consumption has really been increasing a lot these past years. It is eaten for food, but also as prevention against common cold and flu, especially between October and March. The possibility of an importation of the virus from a neighbour country through wild animal trade has recently been addressed (Bell *et al.*, 2004).
- To sustain such a demand, farms of Masked Palm Civets have been created, some of them holding a few hundreds or even thousands of animals. These farms of civets may be quite recent. Their history and farming practices should be investigated.

The original version of this document was prepared for a mission to China, which took place from 10 to 22 August 2003, after a short trip to in Beijing in June, and was completed afterwards. The aim of the mission was to review the studies oriented towards the search of the animal reservoir of SARS CoV and to stimulate further research in this direction. A new mission took place in May 2004 (Beijing and Hubei provinces). References used are both systematic reviews (Corbet & Hill, 1992; Wilson & Reeder, 1993; McKenna & Bell, 1997; Nowak, 1999) and fauna surveys (Marshall, 1967; Medway, 1969; Harrison, 1974; Lekagul & McNeely, 1977; Berhanu, 1984; Payne *et al.*, 1985; Prater, 1988; Woodford *et al.*, 1995; Kingdon, 1997; Zhangh, 1997; Kanchanasakha *et al.*, 1998; Sheng *et al.*, 1999; Abebe, 2000). An important database for original information may be found in *Small Carnivore Conservation* issues. English species names are mainly following Gunther (2003).

Civet trading and farming in PR China

As wildlife farming is increasing in China, different questions arise:

- which are the species concerned ?
- which are the regions the more concerned ?
- what is known about the figures and statistics of this activity (situation and trends) ?
- how is this farming organised, i.e. large units, backyards family units, both ?
- what are the main reasons of this farming (meat, fur, traditional medicine, mixed) ?
- how are trade and marketing of the animals and of the products ruled ?
- what is the importance of its economical and social impacts ?
- are there any regulations implemented, monitoring and surveys performed, by whom ?

A paper published in *Mustelid & Viverrid Conservation* by Tan (1989) certainly deserves and updated version. It stated that civets from *Viverra* and *Viverricula* genera will be bred in captivity and even farmed for musk production. Hangzhou zoo is said to be a leader in this field. At the same time, *Paguma larvata* is said to be largely sold in Guangdong and Guangxi markets, and exported by the thousands to Hong Kong, as it is considered a 'delicacy'. Its local name, *guo-zi-li*, can be translated by 'fruits cat' or 'flowers fox'. Small carnivores as a whole are also said to be traded for their fur which is used in garments and for writing brushes.

In this context, it is interesting to note that Marshall (1967) does not mention the Masked Palm Civet in her list of mammals found on Hong Kong markets. This could confirm the hypothesis that *Paguma larvata* trade and consumption are quite recent at such a scale. In the same reference, the Raccoon Dog is mentioned on Hong Kong markets and is presented as being already largely farmed over mainland China for fur and meat.

Recently, according to Wang (1998), it appears that the two *Viverra* species in China (the Large-spotted Civet *V. megaspila* and the Large Indian Civet *V. zibetha*) are on the verge of national extinction. The Large-spotted Civet was said to be 'very rare' and the Large Indian Civet was said to have lost 90% of its numbers (from an estimated figure of 200,000 in the 1950s to 20,000 in the 1980s, and even fewer today). Both Kunming Institute of Zoology and Hangzhou Zoo did keep animals, but this has not been continued and no record of captive breeding was noted. *Viverricula indica* and *Paguma larvata* are not listed in the *Red Data Book*, so their status in the wild may be better. Today only the latter seems

to be bred in farms. During the missions only *P. larvata* was seen and no information could be gathered on any other species of civet.

Exact figures for civet farming are not easy to obtain, as 'farms' can be specific units of a few hundreds up to a thousand animals, or backyard cages with just a few individuals. Recent data give 400 farms and 60,000 civets bred in China, with just four large units in Guangdong province, and more large units in other provinces (S. Zhan, *pers. comm.*). However, the Forestry Department of the same province was referring to 1,400 'farms' holding wildlife species. A published reference announces 660 farms with 40,000 animals for China (Jiang *et al.*, 2003).

On Guangzhou wholesale markets, in August 2003, other fur animals seen were Red Fox (*Vulpes vulpes*), Raccoon Dog (*Nyctereutes procyonoides*), American Mink (*Mustela vison*) and Nutria (*Myocastor coypu*), as well as domestic dogs and cats.

A Chinese book, printed in 2001 (ISBN 7-5025-3202-1/ S.91, http://www.cip.com.cn), found in Beijing 15 June 2003, is clearly a guide to farm fur animals. This book includes at least (from drawings): otter (?), marten (*Martes* sp.?), fox, Raccoon Dog, badgers, domestic dog, domestic cat, large and small civets, Masked Palm Civet, rabbit, hare, squirrel, Chinchilla, Nutria, beaver, mink, hamster (?), and rat (?).

An important question, in any case, but especially for *P. larvata,* is to know from where are the animals coming from when people start a breeding unit. Are the animals caught in the wild, and if so, where? Or are they bought on a market? Or both? The distribution of the Masked Palm Civet inside and outside China is large. As much as nine subspecies have been recognised within China, from the Himalayas to Taiwan (Zhangh, 1997). A better knowledge on distribution and intraspecific variation is needed. For that purpuse, both molecular and morphological studies have been initiated by the team of Géraldine Veron (Museum National d'Histoire Naturelle, Paris), with the collaboration of Shuyi Zhang team (Institute of Zoology, Chinese Academy of Sciences, Beijing) The last point should be to know more about farming of *P. larvata*, its history and current extent. The description of a unit of 400 animals in Guangdong province does not answer all questions. Many parts of *P. larvata* physiology or pathology are not yet well known (Jiang *et al.*, 2003).

Visit of a civet farm

Global context

The farm visited is located in the Shanwei Overseas Chinese District, and was established in March 2002 by a Taiwanese investor. The company is specialised in the breeding, farming, and slaughtering of civets for both domestic and international markets. In addition, the company is also involved in the plantation, processing, and trading of Chinese herbal medicine and fruits, as well as the processing and concentration of tea bags containing Chinese herbal medicine, also for domestic and international markets.

All civet-breeding stocks have been purchased from the Guangzhou wildlife wholesale markets for planned breeding programs, since March 2002. This means that origin, age, status (wild or farmed) of the animals are not known.

A unique recipe of civet feed incorporating Chinese herbal medicines has been formulated, and is said to improve the civets' behaviour by reducing their aggressiveness, rate of sickness and death, and increasing the birth rate. It is made in the farm, which holds about 400 civets. The plan was not to sell animals until the farming capacity reaches 10,000 animals in a 3-year period with a total investment of RMB (yuan) 10 million (about US$ 1,215,000 at 2003 rates). The company's additional aim was to sell tamed civets with different fur colours for the pet market, mainly for export to the Southeast Asia area. This seems to be already under way in Taiwan.

It is not known what happened to this farm after the decision of Guangdong province authorities to destroy many wild animals in the province, in markets and in farms, in January 2004. Another farm of 300 animals was visited in May 2004, in Hubei province, but will not be described here. This farm started in 1999, from locally trapped wild animals.

The farm

There are six rectangular technical buildings, only one containing civets. There are gates to enter the farming building and wires on the openings, including those for natural ventilation. No special smell was noticed, although it is clear that the building had been cleaned before the visit. The workers were wearing white suits, gauze mask and boots.

The cages were first of wood, but some civets destroyed them and escaped. Now they are made of wire, about 1 m above ground, droppings and urine falling on the concrete ground. Their size is approximately 1 x 0.5 x 0.4m. Two can be put in connection, with an opening between (family groups). Animals in cages stacked right next to each other are in contact. Smaller cages are given to young animals, 0.5 x 0.5 x 0.4m approximately.

There are three double rows of cages, two pathways with an open drainage in the middle between. Total length is about 6 x 40m. The rows are in fact twice 20m long, with a gap in the middle, facing two lateral openings of the building.

The food is home made: cereals, beans, plus 10 herbs cooked in pellets for adult, in powder for juveniles. The pellet machine was in the building facing this one. Juveniles are weaned between 1 and 2 months old, supplemented with fruits when they get used to the powder. The food is distributed in inverted bottles, filled by the bottom. Each cage has one such bottle and another for water.

The civets

Civets are four per cage: one male, three females. There are no external secondary sexual characters, so animals have to be manipulated for sexing. There are two mating seasons a year: February and October. Pregnancy is 56 days. After mating, females are isolated in a cage of their own for pregnancy and birth. This is possible without too much handling, because of the cage's design. Tail handling is also used. The workers are regularly bitten and some animals escape. The first young were born last year (June 2002, we saw some of them in one cage) and between April and June 2003. About 8 or 10 are present in 4 or 5 cages, still with milk teeth. We saw 2 young in most cages, but litters can go from 1 to 6.

There are metallic tags on the cages with date of birth and a few Chinese characters. Animals are not identified individually. We did not see any written documentation or logbook.

No diseases or health problems have been reported, no treatments given, no anti- parasite drugs, no antibiotics, reportedly because of the good food including the herbs. It is even said that

they are now in a better health status than when they arrived. Nothing happened here during the SARS epidemics, to animals or human beings.

An adult male can weigh up to 8 kg. Each could be sold 1,000 yuans (about US$ 120), a female 300 to 400 yuans (about US$ 37-49). Prices could be higher for pets. Here, in this region, they are still sold for food. Even the skin is eaten, and the fur or hair are said not to be used.

The animals became excited at the beginning of the visit, moved in their cages, and growled with sounds like short coughs (alarm calls); then they calmed down. Civets can climb on the wire of the cages, up-side down. Most of them were quite calm after a short time, not obviously suffering from anything. One juvenile was apparently blind, with both eyes white (born like that?), and much smaller than its cage mate. One had three legs, the missing one bitten off by an animal from next cage. Different colours and patterns, possibly due to natural variation, were clearly present. Marks were only on the face, even if the white line on the forehead was sometimes extending on to the nape. Black patches on the head extended more or less on the sides of the neck, and sometimes a black cape was also present on nape and shoulders. The body was without markings, as was the tail, which was as long as the body and well furred. The ends of the legs and of the tail were dark. Body colour varied from grey to orange, from cream to dark.

A young (one year old?) civet not fed by its mother was suckled by a female domestic dog. It was quite tame, being kept in a cage outside the building, with a small chain around its neck. Handled, it was looking peaceful, trying sometimes to bite but not aggressively. The long tail was clearly being used for balance or for support.

Conclusion

From the available data, the real wild reservoir of the SARS-like CoV is still not known. Unpublished data seem to indicate that virus strains or Polymerase Chain Reaction (PCR) and serological positive results may be coming from different animal species. However, only Guan *et al.* (2003) gave solid evidence that three carnivore species may play a role in the virus epidemiology. New samplings were performed by the same team during fall 2003, apparently on the same civet species, on Raccoon Dogs and on different badger species. PCR positive results have been obtained and strains are under isolation and identification.

The recent increase in the trade of *Paguma larvata* (farming, marketing, eating) gives it a special importance, at least as a contact species with human beings. It is still too early to know if its importance may go further.

During December 2003 and January 2004, a few human SARS cases were detected in Guangdong province, but the contamination does not seem to resemble what happened in early 2003. The differences discovered between animal and human strains were analysed by Guan *et al.* (2003). There is a 29 nucleotides deletion in the human SARS virus strains that traced over the world in 2003.The animal strains so far isolated do not have this dletion, like the few human strains discovered at the end of 2003 and at the beginning of 2004. This is why the viruses isolated from civets are better called SARS-like CoV. One of the questions is to understand the relationships between the deletion and the high transmissibily and severity of the "short" strain. Another is to try to figure out if the deletion happened before or after a jump from animal to human. The real SARS virus is the one with the dletion; the others may just be SARS-like or pre-SARS virus strains. A research programme will try to understand if the Masked Palm Civet is or is not the real reservoir of these viruses.

Acknowledgements

This report had been prepared before and completed after a "Joint Government of the Peoples' Republic of China - Food and Agriculture Organization - World Health Organization - Office International des Epizooties mission to China on animal reservoir of the SARS Coronavirus (CoV) and potential transmission to humans, 10-22 August 2003". I wish to thank all the colleagues present in the group for their support and help.

The May 2004 mission was realised under a Chinese and European funding within a European project on SARS epidemiology and animal reservoir research. (EC grant 511063 EPISARS and Programme de Recherche en Réseau France-Chine)

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Territorial behaviour between male Common Genets

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The Common Genet *Genetta genetta* represents an isolated African element in the European fauna (Schauenberg, 1966). This author suggested that genets arrived on the continent through the Gibraltar land bridge, before its flooding. However, other authors (Calzada, 1998) suggested that this species might have been introduced by Arabians to Spain.

Nowadays, its European distribution spreads only over Spain and France, although the range seems to be increasing and some individuals have been found in Belgium, Switzerland and Germany (Blanco, 1998). This small distribution has limited the studies on the species and has left it as one of the lesser known European carnivores. Studies have been carried on in few localities, notably Doñana, in southern Spain, one of the most regular sites of scientific studies about genets (see Palomares, 1993; Palomares & Delibes, 1988; 1991; 1994). The rest of the literature is scarce and spread, and only few works have investigated home range, habitat selection and other behaviours using radio-tracking techniques (Palomares & Delibes, 1988, 1994; Camacho *et al.*, 1992; Zuberogoitia *et al.*, 2002). Common Genets in Doñana show a clear territorial system in a pattern typical of small carnivores (see Palomares & Delibes, 1988, 1994), but little is known about it in other areas.

However, during a study at the Urdaibai Biosphere Reserve (UBR: see Zuberogoitia *et al.*, 2002 for further details), we gathered some data that contradict this statement. During the study we monitored two male genets at the same time in the same area for 13 months (Table 1). MG1 and MG2 shared the same areas with a high overlapping level: 17.52 % and 83.96 % of their respective home ranges.

The pattern of seasonal home range was quite different in each male. MG1 increased its home range in summer and autumn, while MG2 increased its home range in winter (Table 2). We never found both genets in the same point at the same time, so we could not determine dominances. However, MG1 had a lot of scars on its face, ears and legs, while MG2 had none. Both genets showed a strong preference for oak forests, during both activity and resting periods (Zuberogoitia *et al.*, 2002). The availability of this vegetation type was 13.1% of the home range for MG1 and 56.6% of the home range for MG2. However, the two genets showed different habitat selection for the other vegetation types (*see* Zuberogoitia *et al.*, 2002).

Palomares & Delibes (1994) found that in Doñana adult genets of the same sex seemed to be territorial, because little home-range overlap was observed. Territoriality patterns are usually explained after two different hypotheses: as a way of ensuring reproductive access to females or as a way to monopolize areas with plenty of resources (Gittleman *et al.* 2001; Lodé *et al.*, 2003; Zabala & Zuberogoitia, 2003). In our case, MG1 had a bigger home range so he could include more females in his territory, although there is also the possibility of the home range being large due to a low habitat quality. This would lead him frequently to use alternative habitats. However, although the proportion of home range covered by oak forest was lesser than for MG2, this male, MG1, had a much larger absolute area of oak forest within its home range. On the other side, MG2 had a smaller home range, so the number of females could be lower too, but his home range was almost totally covered by oak forest, a high quality habitat. Besides, during the second winter, MG1 used frequently MG2's core area and the latter expanded his home range, settling far away. This behaviour could be explained in two different ways: MG1 came into MG2's core area when the latter had gone to other sites looking for females, or MG1 expelled MG2 out of his territory. A problem for the second hypothesis is that MG2 came back regularly and both shared the same sites. However, if we consider it as territorial behaviour determined by access to females we would have more problems. In fact, in the study area, females have two reproductive periods, in winter and in summer, as it occurs in other regions (Zuberogoitia *et al.*, 2001). Therefore, if one of the studied male genets were dominant, his territory should be maintained during the mating and non-mating seasons, and this is not the case.

For carnivores in general, changes in territoriality patterns have been documented in different density conditions. High densities produced changes in territoriality of Stoats *Mustela erminea* (Robitaille & Raymond, 1995) and Red Foxes *Vulpes vulpes* (Blanco, 1988). Other authors proved that some species, like European Polecat *Mustela putorius*, Least Weasel *Mustela nivalis* or Stoat *Mustela erminea*, may increase their home range and

	MG1	MG2
Trapping date	17th February 1999	19th February 1999
Last monitoring day	7th March 2000	28th March 2000
Days radio-tracked	110	114
Number of locations	574	444

Table 1. Trapping and monitoring data of the two male genets (adapted from Zuberogoitia et al., 2002)

Table 2. Home-range area (km²) during winter, spring, summer and autumn of 1999 and winter of 2000 for two adult male genets in Urdaibai Biosphere Reserve.

	Winter 99	Spring 99	Summer99	Autumn 99	Winter 00	Total
MG1	0.38	2.56	5.80	8.31	0.88	10.16
MG2	1.81	0.95	1.01	1.81	2.75	2.12

	Winter 1999	Spring	Summer	Autumn	Winter 2000	Total
MG1	0.00%	11.33%	0.17%	10.83%	89.77%	17.52%
MG2	0.00%	30.53%	0.99%	49.72%	28.73%	83.96%
Overlapping area km^2	0.00	0.29	0.01	0.90	0.79	1.78

Table 3. Overlapping between two male genets during seasons and total in Urdaibai Biosphere Reserve.

decrease the territorial aggressiveness, and even show a non-territorial behaviour, during low availability of resources (Weber, 1989; Jedrzejewski *et al.*, 1995; Robitaille & Raymond, 1995). However, this last seems not to be the case at the UBR, where genets increased and decreased their home ranges throughout the year but in different patterns, which is not consistent with a consequence on changes in resource availability. In our case a lack of strong territorial behaviour or a decrease of territorial behaviour due to the high genet density (see Zabala *et al.*, 2001) would be the more plausible explanation. Although our observations are based only on two males and should be regarded with caution, our results agree with Blanco (1988) and Robitaille & Raymond (1995), pointing out the high density condition as a determinant factor of territorial behaviour scaling in small carnivores. Only in this way it is possible to explain the differences between Doñana's gennets and Urdaibai gennets.

Acknowledgements

This study was funded by the departments of Research and Environment of the Basque Country Government through the project PU-1998-8. We wish to thank I. Garin, J. R. Aihartza, S. Lekerika, A. Espartza, U. Goiti, I. Gonzalo, L. F. Campos, and J. J. Torres for field assistance.

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Malaysia Carnivore Project

A field project has been set up within Krau Wildlife Reserve on Peninsular Malaysia to investigate the ecology of small carnivore species and to study the genetic diversity, biogeography and systematic status of Malaysian viverrids. A variety of methods is being employed including live-trapping and radio-tracking. DNA samples are being collected for analysis at the Paris Natural History Museum. The initial phase of this project began in July 2004 and will end in October 2004. Fieldwork will continue next year if further funding can be obtained.

Further details of this project can be found at www.carnivoreproject.org.

For additional information email Andy Jennings (smallcarnivores@yahoo.com) and Géraldine Veron (veron@mnhm.fr).

Andy Jennings and Géraldine Veron

MALAYSIA CARNIVORE PROJECT

The importance of small carnivores in forest bushmeat hunting in the Classified Forest of Diecké, Guinea

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Introduction

The population of Sub-saharan Africa has for several decades had serious difficulties in obtaining animal protein. Local populations, in general have resolved this problem by hunting wild animals.

A number of studies has drawn attention to the importance of the wild fauna as a source of animal protein. In 1974 Asibey mentioned that 75% of the population of Ghana depended on 'wild animal protein' and that the wild fauna made up 62% of the animal protein of the rural population. In 1979 he also established that 26 g of game were consumed per inhabitant per day in the Côte d'Ivoire (CEE, 1995). In Guinea Ziegler (1997) showed that bushmeat sold at the market of Faranah (Haute Guinée, 30,000 inhabitants) made up a biomass of ca. 131 tons a year, involving 21 savannah species of mammals.

More recently, a study was made of bushmeat hunting in the classified forest (C.F.) of Diecké by the 'Projet de Gestion des Ressources Rurales (P.G.R.R.) with the aim of conserving the biodiversity of the forest resources and environment. The project initiated a study to define the composition of bushmeat hunting in the forests regarding the fauna (species killed, biomass obtained, hunting pressure and impact on the fauna) as well as regarding the local population (capture techniques, hunting efforts, commercialisation, and importance of the hunt in daily activity).

The results of this study, carried out during one year in three villages of the F.C. of Diecké, show the importance of the hunting pressure and its rewards. Hunting is done with guns, traps or manual catching. Traditional hunting tends to disappear in favour of earning capacity. Night hunting with electric torch, forbidden, non-selective and particularly devastating, is common practice with all hunters with firearms. The conclusion of the study has shown that

1. Daily pressure of firearms hunting equals 27.21 man.hours for 24 hours i.e.hunting pressure is 100% of the time.
2. Total trapping is 70,484 trap/nights (i.e. during a period of nine months hunters set out a number of traps that cumulated with the number of nights used equals 70.484 trap/nights). Hunting with firearms during nine months resulted in an annual biomass of 5,269.22 kg i.e. an average of 540 g fresh meat per man.hour. The 70,484 traps resulted in a harvest of 420,955 kg fresh meat i.e. an average of 5.97 g per man/night and 138.38 g meat per man.hour.

The results of this study are published in the GFA Terra Systems Report (2002): "Premier recensement des activités cynégétiques en forêt classée de Diecké". We thought it interesting to present parts of the report dealing with the observations on the small carnivores consumed by the villagers.

Study area

The forest massif of Diecké is situated at the extreme south-east of Guinea (07°22' – 07°39'N, 08°47' – 09°06'E). It covers 59,143 ha and is bordered by Côte d'Ivoire, Liberia, and Sierra Leone. Although it belongs to the Guinean-Congolese botanical region and is one of the last remnants of the large Guinean forest, there are only a few primary forest islands left while the secondary forest is more or less degraded if not destroyed.

Human density

The F. C. of Diecké has about 25,000 inhabitants distributed over 29 villages. But the situation of the human population in this border region is subject to important variation due to troubles in bordering countries. Since 1995 tens of thousands refugees have expanded the few refugee camps in the region. This rapid growth of human population in the immediate proximity of the F.C. of Diecké is an important threat for the wild fauna.

Mammal fauna

The West African forest block is recognized for its important biodiversity and the presence of numerous endemic species but the fauna of the Guinean forest is, in general, little known. Among the large mammals there are actually twelve Artiodactyla among which the Forest Buffalo *Syncerus caffer nanus*, Bushbuck *Tragelaphus scriptus*, Bongo *Boocerus euryceros*, six species of Cephalophinae, among which the rare endemics Jentink's Duiker *Cephalophus jentinki* and Striped-backed Duiker *C. zebra*, and also the Pygmy Hippopotamus *Choeropsis liberiensis*. Primates are represented by five Cercopithecidae among which the Diana Monkey *Cercopithecus diana*, Putty-nosed Monkey *C. nictitans*, Spot-nosed Monkey *C. petaurista*, three Colobidae, the Black-and-White Colobus *Colobus polykomos*, Olive Colobus *C. verus*, and Red Colobus *Piliocolobus badius*, two Lorisidae, the Potto *Perodicticus potto* and Dwarf Galago *Galagoides demidoff*, and one Pongidae the Chimpanzee *Pan troglodytes*. The larger carnivores are the Leopard *Panthera pardus*, African Golden cat *Profelis aurata*, and African Civet *Civettictis civetta*. Among the species supposed to be present 17 are considered locally as Vulnerable of which 16 are totally or partially protected by the Convention of Washington.

Methods

The study was continued the whole year without interruption in two villages on the border of the F.C. of Diecké where the villagers hunted regularly in massif itself. The villages Yonssona (07°33'N, 08°48'E) and Gboïmou (07°30'N, 09°04'E) are respectively situated to the east and to the west of the forest massif. The village of Korohouan (07°26'N, 08°59'E), situated south of Gboïmou was also included in the study because its inhabitants hunted not in the F.C. but in its immediate vicinity. Thus, the region covered by the study contained results from the massif as well as from the periphery (400-500 m a.s.l.).

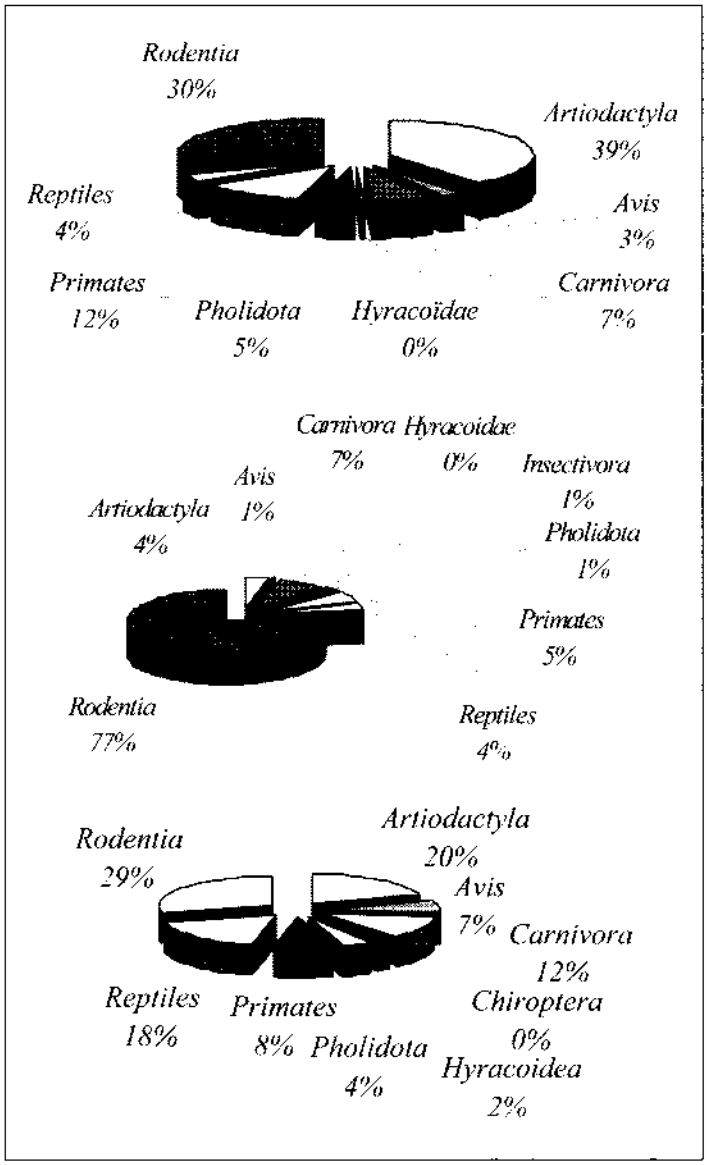
All animals taken by the hunters were counted and, if possible, weighed by one of the authors (SD). All the heads were bought from the hunters and the skulls prepared in order to determine species, sex, and for the ungulates and primates the age

class (MC). Identification of the genets was done by Philippe Gaubert of the Musée National d'Histoire Naturelle, Paris. The total of the results having been published in the GFA Terra Systems Report (2002) we will only give the principal data on the small carnivores.

Small carnivores taken as bushmeat in the F.C. of Diecké

A total of 152 small carnivores were taken by the hunters: Marsh Mongoose *Atilax paludinosus* (16), Cusimanse *Crossarchus obscurus* (32), Slender Mongoose *Herpestes sanguineus* (8), *Genetta sp.** (23, comprising Johnston's genet *G. johnstoni*, Pardine Genet *G. pardina*, Bourlon's Genet *G. bourloni*), Two-spotted Palm Civet *Nandinia binotata* (59), African Civet *Civettictis civetta* (12), Ratel *Mellivora capensis* (1), and Spot-necked Otter *Lutra maculicollis* (1). None of the Felidae was collected by the hunters.

Fig. 1. Total of the captures in % per order in the three villages: Yonssono (N=1.057), Gboïmou (N=357), and Korohouan (N=431)



Species	Yonssono	Gboïmou	Korohouan
Atilax paludinosus	7	4	5
Crossarchus obscurus	8	10	14
Herpestes sanguineus	1	4	3
Genetta spp.	11	5	7
Nandinia binotata	40	2	17
Civettictis civetta	7	2	3
Mellivora capensis	1	-	-
Lutra maculicollis	-	-	1
Total	75	27	50

Table 1. Number of each species of small carnivore taken by the three villages

Part of the small carnivores in the totality of captured game

Analysis of Fig. 1 for each of the villages shows the importance of the number of small carnivores killed. In Yonssono, the majority are Artiodactyla (39%) and Rodentia (30%), Primates and Carnivora counting for 12% and 7% respectively. In Gboïmou where the villagers systematically hunt in the agricultural zone outside of the F.C. it is clear that the fauna is considerably scarcer as the catch consists mainly of Rodentia (77%) and only of 7% Carnivora, 4% Artiodactyla, and 5% of Primates, chiefly small species as *Galagoides demidoff* and *Perodicticus potto*. This shows that the larger mammal fauna has virtually disappeared. In Korohouan, where the majority of the game comes chiefly from the agricultural zone it seems that the largest part of the game is divided between Rodentia (29%), Artiodactyla (20%), and Reptilia (18%). Primates and Carnivora represent respectively 8% and 12% of the catch. These different percentages from the three sites show the difference of faunal resources in function of the study sites.

Records of small carnivore species

Table 1 shows the numbers of each small carnivore species taken per village.

In Yonssono all captured carnivores are Herpestidae and Viverridae with the exception of one mustelid *Mellivora capensis*. The most frequent catch is *Nandinia binotata* representing 53% of the total. Genets represent 15% and *Crossarchus obscurus* 11%. Both *Atilax paludinosus* and *Civettictis civetta* follow with 9%.

In Gboïmou mongooses *Crossarchus obscurus*, *Herpestes sanguineus* and *Atilax paludinosus* with 67% represent the majority of the carnivores caught with *Crossarchus obscurus* the most important (37%). Genets *Genetta* spp. make out 19% and *Atilax paludinosus* and *Herpestes sanguineus* each 15% and *Nandinia binotata* and *Civettictis civetta* each 7%.

In Korohouan the three mongoose species make up 44% of the catch with *Crossarchus obscurus* alone responsible for 28% of the carnivores. With 34% *Nandinia binotata* is the most frequently caught carnivore. *Genetta* spp. represent 14%, *Atilax paludinosus* 10%, and *Civettictis civetta* and *Herpestes sanguineus* each 6%. Only one mustelid *Lutra maculicollis* was captured.

With the exception of the Ratel and Spot-necked Otter the carnivore catch is composed of the same species in the three villages; only the proportion differs. *Nandinia binotata*, arboreal

* Only adult genets or specimens with skins were identified, consequently in the tables they are listed as *Genetta* sp.

and nocturnal, is strongly represented in the Yonssono catch (54%), less in Korohouan (34%), and nearly negligible in Gboïmou (7%). *Herpestes sanguineus*, chiefly diurnal, is chiefly caught at Gboïmou (37%), moderately at Korohouan (28%), and far less at Yonssono (11%).

	Hunt in daytime			Hunt at night		Trapping	Total
	Hunt with dogs	Firearms	Other	Firearms	Others		
Kg	-	25.8	0.2	94.15	-	42.6	162.52
%	-	15.9	0.12	57.9	-	26.2	100.00

Table 2. Biomass (kg and %) of small carnivores taken by different hunting methods in Yonssono.

These differences in proportion between the three villages reflect the methods of capture, the importance of the state of conservation of the forests in the study area, as well as the human pressure on the natural environment. The hunters of Yonssono exploit chiefly the classified area next to their village; they hunt with firearms, at night as well as in daytime, and also use traps. Their catch consists mainly of 'larger' mammals: Artiodactyla, larger Rodentia (e.g. Brush-tailed Porcupine), and Primates. The hunters of Korohouan are active in the F.C. but also in the immediate neighbourhood of the village. They also use frearms at night and by day and traps and obtain nearly as many large as small game. The hunters of Gboïmou hunt to the west of the classified area and nearly only by trapping. Their catch consists chiefly of Rodentia; Artiodactyla and Primates are nearly absent.

Biomass

Most of the captured animals were weighed which made it possible to evaluate the biomass of all species as well as the carnivores. Fig. 2 with the data for Yonssono is given as an example.

The hunters of Yonssono obtained game with a biomass of 6,061.29 kg in twelve months, i.e. ca. 505.1 kg per month. Those of Gboïmou 442.07 kg in nine months, i.e. 49.11 kg/month and those of Korohouan 1,843.24 kg in six months, i.e. 307.2 kg/month. Artiodactyla is the order in general the best represented in terms of biomass, counting for 74% in Yonssono, 68% in Korohouan, but only 34% in Gboïmou. Rodentia with 49% represent the largest biomass in Gboïmou, whereas they count for only 13% in Yonssono and 11% in Korohouan. Primates and small carnivores represent only a small part of the biomass, respectively 7% and 2% in Yonssono. 3% and 8% in Gboïmou, and 5% and 4% in Korohouan.

The differences in biomass of small carnivores for the three villages are a result of the difference in hunting practice (Table 2).

In Yonssono nocturnal hunting with a torch lamp results in the highest biomass of small carnivores taken, i.e. 57,9 % of the total small carnivore biomass. Hunting with firearms by day only resulted in 15,9% of the biomass.

Potential loss of bushmeat due to the capture of young animals: the case of Yonssono

The fact that hunters from the three villages captured an important number of subadult and even very young animals made us try to calculate the potential loss of lost bushmeat. All species considered the loss for Yonssono is ca. 38,36%. According to the order considered, the loss varies between 24,96% and 52,96%. This waste of animal protein is chiefly a consequence of non-selective hunting techniques.

Civettictis civetta and *Nandinia binotata* make out 38,21% and 38,19% respectively of the biomass loss in Yonssono. A more selective method to hunt small carnivores would allow to make only two-thirds of the captures for the same total biomass (Table 3).

Destination of the bushmeat

We observed a clear difference in destination of the bushmeat between Yonssono, Gboïmou, and Korohouan.

In Yonssono only 49% of the bushmeat is destined for local consumption in contrast with Gboïmou (96%) and Korohouan (77%). The rest is sold mainly in the centre of N'Zérékoré which

Fig. 2. Biomass taken in Yonssono (N=1.057) in percentage per Order

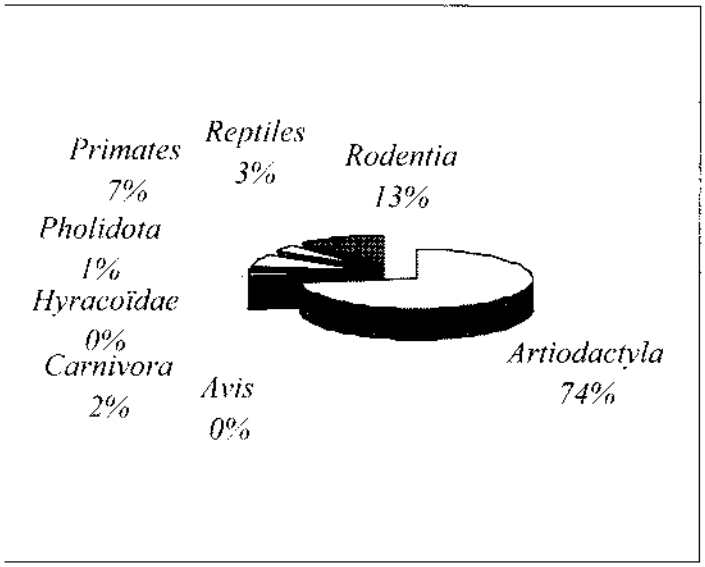
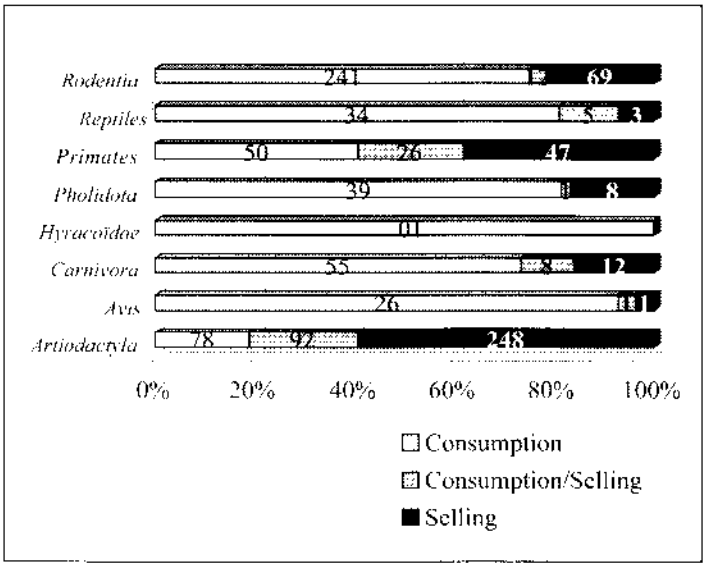


Fig. 3 gives the percentage of destination of bushmeat in Yonssono (N=1.057); 55 of the 75 captures of small carnivores were locally consumed.



Species	N	Real biomass	Average weight	Potential weight	Potential biomass	Lost biomass(%)
Atilax paludinosus	7	16.6	2.37	2.7	18.9	12.16
Crossarchus obscurus	8	5.17	5.17	0.65	8	35.37
Herpestes sanguineus	1	0.2	0.2	0.7	0.7	71.42
Mellivora capensis	1	8.3	8.3	11	11	24.54
Nandinia binotata	40	66.75	1.67	2.7	108	38.19
Civettictis civetta	7	43.25	6.18	10	70	38.21

Table 3. Real and potential biomass of bushmeat in Yonssono

shows that hunting in Yonssono is for a large part commercial, compared with chiefly 'subsistance hunting' in Gboïmou and 'mixed' in Korohouan.

Distribution by order of the destination of the bushmeat in Yonssono

As the commercialisation of bushmeat is important in Yonssono only this village is treated here. Rodents, reptiles, pangolins, small carnivores, and birds are chiefly destined for local consumption (between 60% and 90% according to the species). Only 41,12 % of the primates and 18,66 % of the artiodactyls are for local use. For commercialisation the largest species are preferred whatever order they belong to. Duikers are the main prey representing 60,5% of the sold bushmeat (Fig. 3).

Protection status

On a national level, only two small carnivores are protected: *Profelis aurata* (complete protection) and *Lutra maculicollis* (partial protection), the latter being locally close to extinction. *Mellivora capensis*, *Nandinia binotata* and *Profelis aurata* are also considered as locally threatened. The other species have no clearly defined protection status.

Acknowledgement

We thank Philippe Gaubert for identifying the *Genetta* species.

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Small carnivores in new wildlife sanctuaries in Assam in north-east India

Anwaruddin CHOUDHURY

Recently three new wildlife sanctuaries have been notified in Assam, India in June 2004 (Fig. 1). All these are known for small carnivores in addition to many other species.

Amchang Wildlife Sanctuary, 79 km², is located near Guwahati, the capital city of Assam. This area was recommended for the first time for protection of its isolated **Asian Elephant** *Elephas maximus* population (Choudhury, 1985) then for its **Gaur** *Bos gaurus* and proximity to a growing metropolis (Choudhury, 2002). Small carnivores recorded so far are, **Large Indian Civet** *Viverra zibetha*, **Small Indian Civet** *Viverricula indica*, **Common Palm Civet** *Paradoxurus hermaphroditus*, **Indian Grey Mongoose** *Herpestes edwardsii*, **Small Indian Mongoose** *H. auropunctatus*, **Crab-eating Mongoose** *H. urva*, **Eurasian Otter** *Lutra lutra*, and **Smooth-coated Otter** *Lutrogale perspicillata*. Three small reserve forests, namely, Amchang, South Amchang and Khanapara constitute this sanctuary. Amchang is easily accessible from Guwahati city.

Barail Wildlife Sanctuary, 326 km², is located in Cachar district of southern Assam. This area was recommended for protection of its overall biodiversity with special focus on primates (Choudhury 1989a,b). Small carnivores recorded so far are, **Binturong** *Arctictis binturong*, **Large Indian Civet**, **Small Indian Civet, Common Palm Civet, Masked Palm Civet** *Paguma larvata*, **Spotted Linsang** *Prionodon pardicolor*, **Indian Grey Mongoose**, **Small Indian Mongoose**, **Crab-eating Mongoose**, **Eurasian Otter** and **Smooth-coated Otter**. Hilly and mountainous, the main vegetation type is tropical wet evergreen (rain forest) in the lower elevations and subtropical broadleaf in the higher areas.

Dihing-Patkai Wildlife Sanctuary covers 111 km² of Upper Dihing (west block), Joypur and Dirak reserve forests in Tinsukia and Dibrugarh districts of eastern Assam. This area was recommended for protection of primates, of which seven species are found (Choudhury, 1989b) then for its population of **White-winged Duck** *Cairina scutulata* (Choudhury, 1996). Small carnivores recorded so far are, **Binturong**, **Large Indian Civet, Small Indian Civet**, **Common Palm Civet, Masked Palm Civet, Small-toothed Palm Civet** *Arctogalidia trivirgata*, **Indian Grey Mongoose, Small Indian Mongoose**, **Crab-eating Mongoose**, **Eurasian Otter**, **Smooth-coated Otter** and **Oriental Small-clawed Otter** *Aonyx cinereus*. Low hilly with flat plains, the main vegetation type is tropical wet evergreen rain forest.

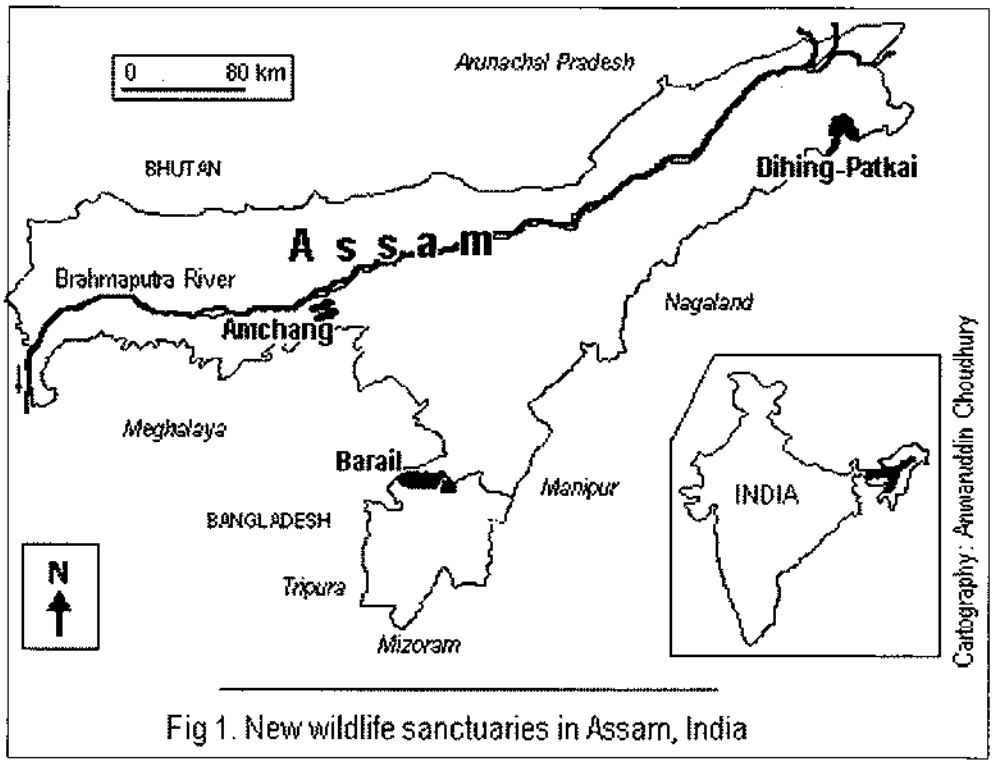

Fig 1. New wildlife sanctuaries in Assam, India

Acknowledgements

A large number of forest officials and local villagers have helped during the survey and identification of these sites as potential sanctuaries. I thank them. Special thanks are due to Pradyut Bordoloi, the Environment & Forest Minister of Assam without whose intervention, these areas would not have become sanctuaries.

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A photograph of a remarkable *Viverra* from Vietnam

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Using remote photography (TrailMaster TM1500 Active Infrared Trail Monitor), a civet (see back cover) was photographed near a stream at approximately 22°16'40"N, 105°28'20"E in the Na Hang Nature Reserve (Vietnam) on 4 October 1998 at an altitude of approximately 940 m a.s.l. The animal is clearly a civet of genus *Viverra*, as shown by the posture, proportions, neck markings and tail bands. The body pelage is striking, showing large brown blotches ringed in black, on an almost white background. Two species of the genus are known from Vietnam, *V. zibetha* and *V. megaspila* (Corbet & Hill, 1992). Examination of over a hundred skins and living specimens of these species by colleagues and myself revealed no individual showing any significant resemblance to the photographed animal in terms of body pattern.

Dr Pham Trong Anh suggested that the photographed animal was the newly described civet species *Viverra tainguensis* Sokolov, Rozhnov & Pham Trong Anh, 1997. This was said, in the original description, to have distinctive "semi-lunar" spots on its upperparts, giving a more strongly marked appearance than those authors felt to be typical of *V. zibetha*. However, the taxonomic validity of *V. tainguensis* was strongly questioned by Walston & Veron (2001), based upon the lack of credible diagnostic characters (including the supposed spotting pattern) in the type description; however, no re-examination of the holotype was undertaken. In any case, the boldness of markings on this photographed animal far exceeds that on two purported specimens of *V. tainguensis* (one being the paratype) shown to J. W. Duckworth (*in litt.* 2004) by Pham Trong Anh in 1997-1998.

The tail pattern indicates that the animal is more likely to be *V. zibetha* rather than *V. megaspila*, because of the complete pale rings spaced the length of the tail. *Viverra megaspila*, which it resembles superficially in its haunch markings, always shows a black stripe the length of the upper surface of the tail. *Viverra zibetha* shows great individual and seasonal variation in its pelage colour and pattern (Pocock, 1939; Walston & Veron 2001), but nonetheless, if this photographed animal is indeed a form of it, then it shows an extreme pelage variation to a degree previously unsuspected in that species. Moreover, it indicates that the statement in Duckworth (1994) that "in South-east Asia north of the isthmus of Kra, any *Viverra* with bold dark markings on the upperparts is probably *megaspila*, be they spots or bars" is not completely reliable and observation of tail pattern is essential for field identification of *Viverra megaspila*.

The Na Hang Nature Reserve, covering about 27,520 ha, and comprising two distinct non-contiguous areas (Tat Ke and Nam Trang-Ban Bung), is located in the Na Hang District of Tuyen Quang Province, over 22°16'-22°31'N, 105°22'-105°29'E. The reserve, comprising mainly forest over limestone hills and mountains (c. 70%) and some mixed evergreen and semi-evergreen broadleaf/bamboo forest, has a unique floral diversity. Primary forest is, however, restricted to the steep karst mountains (Boonratana & Le, 1994; Boonratana, 1999).

Acknowledgements

I wish to acknowledge my colleagues Pham Trong Anh, William Duckworth, Rob Timmins, and Joe Walston for their input and comments. The photograph was obtained during a project funded by IUCN Netherlands and implemented by FFI (Indochina).

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Killing civets for meat and scent in India

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The Small Indian Civet *Viverricula indica*, known for scent, and the largely arboreal Common Palm Civet *Paradoxurus hermaphroditus* are primarily nocturnal species. Dead specimens were found with local tribes during a visit to Coimbatore, Tamil Nadu and Agra, Uttar Pradesh in India between 1998 and 2003.

Under the Indian Wild Life (Protection) Act, 1972 all civets (except the Malabar Civet which is listed in Schedule I) are listed in Schedule II (Part II). It is unusual to see local tribes killing civets for meat and scent. I was told that they use traps made locally and sometimes they also use locally made arms to hunt them. The civets are captured late evening or early morning while they come to feed. These tribes have been catching civets on the outskirts of villages, adjoining to cities for many years. They also have been engaged in selling illegally obtained secretion collected from the scent glands of the Small Indian Civet (see photo). The scent extracted from the civets is used by devotees while praying in the temples, particularly at the Sri Venkateswara Thirumala temple in Tiupathi, Andra Pradesh, south India.

Common Palm civets are found commonly near towns and villages. In cities like Delhi there have been several cases of civets entering residential houses and offices located at airports as a result of occupying/disturbing their natural habitats. Therefore local NGOs are engaged in animal rescue and rehabilitation.

If killing of civets for meat and extraction of scent continues, the species may soon face a decline in population in the region. As we have almost lost the Malabar Civet *Viverra civettina* in India.

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Badgers and TB: Rethink needed

Badger culling in areas 'in reaction' to herd breakdowns with TB was stopped in November 2003, supposedly because it made cattle TB 27% worse (Donnelly, 2003). This view fed into the new Strategy on TB Consultations, and interestingly has not been challenged by the EFRA Parliamentary Committee, or the Godfray Independent Scientific Review (Hancox, 2004b), or by other scientists (Roper, 2003; Harris, 2004).

This is rather surprising, since there are three flaws in this claim. Two thirds of the 2,047 badgers were culled in the last 4 ½ months so would not have had time to cause a cattle effect. Using DEFRA data they would have amounted to ca. 1 infectious badger/6km², so swamped by the 20% increase in cattle-to-cattle TB spread. But perhaps most importantly, the Godfray and Bourne statistical analyses assume that herd breakdowns are independent i.e. follow Poisson distribution. And yet clearly, repeat and contiguous herd breakdowns occur in clusters in hotspots (maps in Krebs review p. 58, 91) and are emphatically linked or non-independent. That is why the average 27% in fact ranges from minus 2 to plus 65%, which includes Nil effect, and which Godfray says may be chance (Hancox, 2004a and b). Bourne hence admits that any badger cull effect may be a few percent at most, and if it is 1 infectious/6 km², then no badger cull or vaccine strategy will ever be practical, meaningful or cost-effective. Each infectious badger has cost £ 38,000!

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