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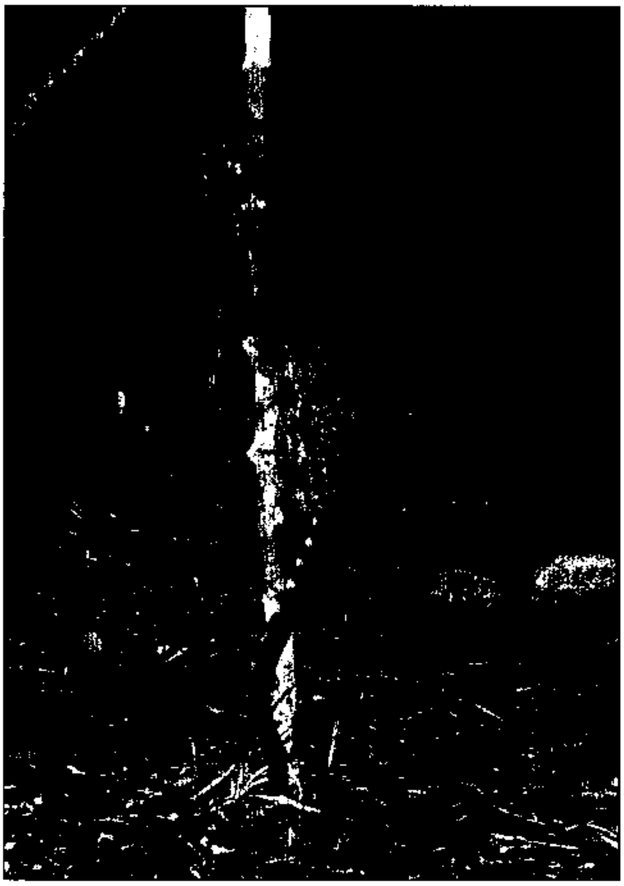

Zanzibar Servaline Genet Genetta servalina archeri

Zanzibar Bushy-tailed Mongoose Bdeogale crassicauda tenuis

Photos: Helle V. Goldman & Jon Winther-Hansen

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Small Carnivore Conservation

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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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First photographs of the Zanzibar Servaline Genet *Genetta servalina archeri* and other endemic subspecies on the island of Unguja, Tanzania

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In January 2003, a camera trapping survey in Jozani–Chwaka Bay National Park, Zanzibar, resulted in the first photographs of the Zanzibar Servaline Genet *Genetta servalina archeri*. This subspecies is endemic to the island of Unguja and has only recently been described. The three other documented indigenous small carnivores of the island were also photo-trapped: Zanzibar Bushy-tailed Mongoose *Bdeogale crassicauda tenuis*, Zanzibar Slender Mongoose *Herpestes sanguineus rufescens* and African Civet *Civettictis civetta schwarzi*. Both mongooses are endemic subspecies, while the population of African Civets on Unguja belongs to a subspecies also found on the adjacent coast of the mainland (Packenham, 1984; see also Ray, 1995). To our knowledge, no living specimens of these animals have been photographed in Zanzibar before.

With the limited resources of Zanzibar's environmental authorities focused on a small number of highly salient species, particularly Aders' Duiker *Cephalophus adersi* and the Zanzibar Red Colobus Monkey *Procolobus kirkii*—considered the two most important indicator species, the rest of Zanzibar's fauna has received comparatively little attention. Most international research and conservation efforts have been similarly oriented. Among Unguja's fauna is a largely overlooked guild which includes four indigenous small carnivores. The aim of our camera trapping survey was to document the small carnivore species present in Jozani–Chwaka Bay National Park. The larger objectives were to augment our very scanty knowledge of these animals and to contribute to their preservation in Zanzibar.

Study area

Unguja, the main island in the Zanzibar archipelago, lies about 6° south of the equator and 40 km from mainland Tanzania and has an area of approximately 1,600 km^2. The deeper soil zone of the western part of the island formerly supported moist forest, while in the east and much of the south thicket and dry forest covered the drier and less fertile "coral rag" zone–fossil coral incompletely overlain by a thin layer of poor soil. The island has been separated from mainland Africa for ca. 10,000-15,000 years, permitting the evolution of several endemic mammal subspecies (Moreau & Pakenham, 1941; Pakenham, 1984; Kingdon, 1989).

With about 524,000 inhabitants, Unguja has a rural population density of some 170 persons per km^2 (figures based on United Republic of Tanzania, 1991; Zanzibar Revolutionary Government, 1992). Rural Zanzibaris make their living from various combinations of cash crop and subsistence cultivation, livestock husbandry, charcoal and lime production, harvesting and selling fuelwood and building poles, hunting and fishing. Increasing in scale as the human population grows (by over 3% per year), many of these activities have seriously degraded the natural environment in parts of the island. Habitat destruction and hunting are two of the main threats to the island's wild fauna.

Zanzibar lies within the Eastern Arc and Coastal Forests "biodiversity hotspot", one of 25 "areas featuring exceptional concentrations of endemic species and experiencing exceptional loss of habitat" (Myers *et al.*, 2000, p. 853). Jozani–Chwaka Bay National Park, upgraded from a forest reserve at the beginning of 2003 and enlarged to 50 km^2, encompasses Unguja's only remaining natural, older-growth forest (Robins, 1976; Williams *et al.*, 1998; Box 5.5.4 in Rodgers & Burgess, 2000). It comprises a mosaic of other habitats as well, including coral rag thicket, bracken fields, saltmarsh grassland and mangrove forests. While people do illegally poach and cut wood within the boundaries of the park, Jozani's flora and fauna are probably under less human pressure than surrounding areas, which are afforded no legal protection or are under the control of local communities.

Methods

Two baited TrailMaster camera traps, using infrared sensors, were deployed in the park for a total of 55 trap-nights during January 2003. To sample different habitats in a large portion of the park, the sets were moved often; by the end of the study the traps had been set up at 10 locations.

Survey effort was concentrated in the coral rag thicket because of the importance in documenting the wildlife in the more threatened habitat. The park's thicketed areas—proportionally much more extensive than the groundwater forest—appear to be under heavier human pressure in the form of illegal hunting and wood harvesting.

Results

The resulting 73 photographs of wild animals included representatives of seven species: one primate (*Cercopithecus mitis*), one rodent (*Paraxerus palliatus*), one insectivore (shrew sp.) and four carnivores: African Civet *Civettictis civetta schwarzi*, Zanzibar Servaline Genet *Genetta servalina archeri*, Zanzibar Bushy-tailed Mongoose *Bdeogale crassicauda tenuis* and Zanzibar Slender Mongoose *Herpestes sanguineus rufescens*. All seven species were photo-trapped in the coral rag thicket; three species were also photo-trapped in the groundwater forest. Of the viverrids

Zanzibar Servaline Genet Genetta servalina archeri *photo-trapped in Jozani–Chwaka Bay National Park. See Goldman & Winther-Hansen 2003 for this photograph in colour. Photo: Jon Winther-Hansen & Helle V. Goldman*

and herpestids, all but the African Civet were photo-trapped in both the thicket and the groundwater forest.

Each carnivore species was photo-trapped at two or more locations. The Zanzibar Servaline Genet was photo-trapped at four sites, the African Civet at two, the Zanzibar Slender Mongoose at two, and the Bushy-tailed Mongoose at three. Three camera trap locations produced photographs of multiple carnivore species. One site yielded photographs of the Zanzibar Bushy-tailed Mongoose and Zanzibar Slender Mongoose; another the African Civet and Zanzibar Servaline Genet. Another location yielded photographs representing all four carnivore species. In fact, three species came within a few hours of one another during a single night/early morning at this trap site. The two shortest intervals between recorded visits by different carnivore species were 38 minutes separating visits by the two mongoose species and 44 minutes dividing visits by a Zanzibar Servaline Genet and a Zanzibar Bushy-tailed Mongoose.

Three of these species were photo-trapped exclusively at night. Zanzibar Servaline Genets were photo-trapped between 19:56 and 03:24. Similarly, African Civets triggered the cameras starting at 20:09 and ending at 03:42. The third nocturnal small carnivore, Zanzibar Bushy-tailed Mongooses were photo-trapped throughout the night, starting at 19:31, about 30 minutes after darkness fell, and ending at 05:41, roughly half an hour before sunrise. (In January, the sun rises at about 06:15 and sets at about 18:45; it becomes light about 20 minutes before sunrise and it remains light for about 20 minutes after sunset. We defined night-time as the hours of darkness from 19:00 to 06:00 and day-time as 06:01–18:59.)

In contrast, Zanzibar Slender Mongooses set off the cameras only during daylight hours, from 06:26 to 18:53. A closer look at the timing of Slender Mongoose photographs reveals that of 31 pictures, only 5 were taken after 07:29 and before 17:00. This suggests a preference for early mornings and late afternoons. (For details of when animals were photo-trapped, see Goldman & Winther-Hansen, 2003.) In contrast to all other small carnivores, which were photo-trapped singly, a pair of apparently adult Zanzibar Slender Mongooses triggered the camera repeatedly one morning.

Discussion

These results compare favourably with the only other camera trapping work to have been undertaken in Jozani–Chwaka Bay National Park (then Jozani Forest Reserve) (Stuart & Stuart, 1997), in which two camera traps, set off by trigger pads, were left in the same positions during the duration of the three week effort. Scent lures rather than bait were used to attract animals to the trap. That effort produced photographs of only one small carnivore (the African Civet). A more recent biodiversity survey of the park, which did not employ camera trapping, recorded two (perhaps three: compare p. 48 and Appendix VII in Nahonyo *et al.*, 2002) of the island's indigenous small carnivores. This highlights the utility of camera trapping using infrared sensors, combined with a strategy of baiting the traps and shifting them to different locations in order to sample a large area and different habitats.

It is noteworthy that our survey did not produce any photographs of the two introduced wild carnivore species said to be present on Unguja (Moreau & Pakenham, 1941; Kingdon, 1977; Pakenham, 1984; Stuart & Stuart, 1998; Nahonyo *et al.*, 2002): the Banded Mongoose *Mungos mungo*, which is a mainland African species, and the Small Indian Civet *Viverricula indica*, of Asian origin. Weighing this against the quantity of photographs of the native small carnivores, the lack of Banded Mongoose and Small Indian Civet pictures suggests that these introduced species are less common than has been assumed, at least in the Jozani area.

Among the survey's most rewarding results were photographs of Zanzibar Bushy-tailed Mongooses *Bdeogale crassicauda tenuis*. Patchily distributed across south-eastern Africa, Bushy-tailed Mongooses exist at low densities in habitats ranging from open acacia woodland to lowland forest (Kingdon, 1977; Taylor, 1986, 1987; Schreiber *et al.*, 1989). Little is known about the biology and ecology of this elusive nocturnal mongoose and the causes of its rarity are not understood (Taylor, 1986, 1987; Stuart in Mills & Hes, 1997). Of the four recognized subspecies, one has endangered status in the IUCN Red List of Threatened Species: *B. c. omnivora*, which is probably confined to the diminishing Arabuko-Sokoke Forest in coastal Kenya (Schreiber *et al.*, 1989). Kingdon describes *B. c. tenuis* as "smaller and darker" than *B. c. crassicauda*, the nominate race (1977, p. 246). Based on molar dentition, he suggests that the isolated Zanzibar Bushy-tailed Mongoose "may be the most primitive form" of *B. crassicauda* (1977, p. 246). The diet of Bushy-tailed Mongooses is believed to consist mainly of invertebrates (Kingdon, 1977; Taylor, 1987; Stuart in Mills & Hes, 1997). On Unguja, *B. c. tenuis* is known for preying on large land snails, which it smashes against coral outcroppings, stones or tree trunks, where debris accumulates with repeated visits (Williams, 1951, p. 305). This feeding behaviour has been described as characteristic of some herpestids (Taylor, 1975).

Perhaps the most significant results of our study are the images of the Zanzibar Servaline Genet *Genetta servalina archeri*, a subspecies formally described in 1998 based on a specimen taken at Kitogani, 2.5 km SSE of the park (Van Rompaey & Colyn, 1998). Six photographs were produced from four locations, demonstrating the Genet's distribution in both the groundwater forest and the thicket within Jozani–Chwaka Bay National Park. These photographs constitute the first documentation of live Zanzibar Servaline Genets since a set of Servaline Genet tracks were observed at one location during a survey of the Jozani area in 1997 (Stuart & Stuart, 1998). More camera trapping is needed to determine the wider distribution of Servaline Genets on Unguja.

The pictures add not only to our knowledge of the Zanzibar Servaline Genet's distribution but also to what we know of its habitus. For example, the badly damaged skin upon which the formal description of the subspecies was based (Van Rompaey & Colyn, 1998) – a dry specimen, including a damaged skull, of unknown age acquired by Anthony Archer in 1995 – has a neutral, greyish background colour. As Gaubert *et al.* (2002a) note, coat colour can be influenced by how specimens have been prepared, among other factors. A forthcoming description of the subspecies (Van Rompaey & Colyn, in press) has been updated on the basis of the new photographs of the Zanzibar Servaline Genet, which show that the base colour of the pelt on the upper part of the body is ochreous (see front cover of this issue and Goldman & Winther-Hansen, 2003).

Five subspecies of Servaline Genets are recognized (Van Rompaey & Colyn, 1998, in press). Lowe's Servaline Genet *G. s. lowei*, 400 km south-west of Unguja in the Udzungwa Mountains on mainland Tanzania, is the Zanzibar Servaline Genet's geographically nearest relative (Kingdon, 1977; Van Rompaey & Colyn, 1998, in press). We speculate that *G. s. lowei*, with its similar appearance and colouration, may also be the Zanzibar Servaline Genet's closest phylogenetic kin. Servaline Genets are widely distributed west of Lake Victoria and across Central Africa's Congo Basin, but they exist in small, isolated pockets in East Africa outside of Uganda (Kingdon, 1977, 1997; Van Rompaey & Colyn, 1998). These enclaves occur at moist, forested mountains – and on Unguja. This suggests that East African Servaline Genets may be relicts of a once continuous population that inhabited a formerly wetter and more thickly forested East Africa. Kingdon has commented on the "peculiarities of [coastal East Africa] in harbouring forest species that have affinities with populations in equatorial regions far to the west" (1977, p. 247), suggesting colonization from the central and western regions of Africa (see also Kingdon & Howell, 1993). The presence of Servaline Genets – characterized as "a true forest form" (Kingdon 1977, p. 155) – in Unguja's drier thicket, as well as in acacia woodland south of the Ruwenzori Mountains (Van Rompaey & Colyn, in press) indicates that the species is not strictly confined to moist high forest, as Gaubert *et al.* (2002b) have recently determined for the congeneric *G. johnstoni* in West Africa.

The very recent scientific discovery of the Zanzibar Servaline Genet is puzzling. It is not a very small animal. Kingdon (1997) gives the weight of Servaline Genets as 1-2 kg, head and body length as 41-50 cm and tail length as 35-44 cm. And though Servaline Genets are shy and nocturnal, the notoriety on Unguja of a chicken-killing animal fitting the Servaline Genet's description indicates that it does make forays into settlements. Although earlier observers referred to the presence of a "genet" on Unguja (Burton, 1967 [1872], p. 198; Mansfield-Aders, 1967 [1920], p. 329; Ingrams, 1967 [1931], pp. 295 and 427), it seems that they actually had the Small Indian Civet in mind. Pakenham & Moreau (1941) and Pakenham (1984) compounded the confusion by assuming that the referent was the African Civet.

That an animal of the Servaline Genet's dimensions and striking appearance remained undocumented up to eight years ago on a flat, relatively small and densely inhabited island is challenging to explain. The 68-year gap between the collection of the Lowe's Servaline Genet type specimen in the Udzungwa Mountains and its recent re-discovery in 2000 (Brink *et al.*, 2002; see also De Luca & Mpunga, 2002) is more comprehensible in light of the more difficult access to the location and the ruggedness of the terrain. Schreiber *et al.* (1989, p.3) point out that most viverrids, "particularly the tropical forms, are among the least known carnivores…it is not surprising that new subspecies and even species continue to be described". There is a clear need for more and better research on Zanzibar's less highly profiled fauna. There may well be other species that have yet to come to light on one or both of the main islands of the archipelago.

Referring to the richness and diversity of Africa's 67 species of carnivores, Taylor (1986) observes that at any one location there are usually three or four viverrid and herpestid species, in addition to other carnivores. Taxonomic assemblages of sympatric small carnivores with overlapping, catholic diets and generally similar trophic roles raise questions concerning the degree of each species' ecological specialization and the extent to which sympatric species compete or partition resources among themselves (Schoener, 1986; Taylor, 1986; Terborgh & Robinson, 1986). Fecal analysis of sympatric African small carnivores has yielded a wealth of information about dietary differences, including how these may change seasonally (e.g. MacDonald & Nel, 1986; Hutterer & Ray, 1997; Ray, 1998; Ray & Sunquist, 2001) Tracking radio-tagged individuals has revealed habitat preferences, ranging behaviour, and diel activity patterns (Ikeda *et al.*, 1982; Maddock & Perrin, 1993; Ray, 1997). These methods have complemented studies relying on direct observation, including those aided by night-viewing scopes (Rood & Waser, 1978; Waser, 1980) and feeding stations (Ikeda *et al.*, 1982). We propose that photo-trapping may help elucidate the spatial and temporal niche dimensions of ecological separation, as illustrated by our brief study.

The Zanzibar Slender Mongoose and the Zanzibar Bushy-tailed Mongoose have been placed on Appendix 1 of The Forest Resources Management and Conservation Act no. 10 of 1966, a list of species which are illegal to hunt (Zanzibar Revolutionary Government, 1997). African Civets, listed on Appendix 2, are accorded a lower level of legal protection, presumably on account of their non-endemic status. We have urged the environmental authorities to place the Zanzibar Servaline Genet on Appendix 1, which was published before *G. s. archeri*'s presence on Unguja had been fully documented. At least as important for the survival of this species and other wildlife is the conservation of the natural habitats which they require. This is the greatest challenge facing conservation authorities in Zanzibar.

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More badger TB politics

A previous update (Hancox, 2002) suggested that sadly this 30-year old saga would have to continue for some time yet. And the conclusion of the recent Inquiry in Parliament corroborated that view and even though the impact of foot-and-mouth disease has postponed a verdict until 2007. With the backlog of cattle testing and no movement control of untested cattle TB has spread far and wide so that bovine TB is out of control. Amazingly some farmers and vets are still questioning whether cattle-to-cattle transmission is important or not.

In evidence given to the Committee, Prof. Bourne said an analysis of past culls showed that they do not work. Minister Elliot Morley said culls seem to be based largely on folklore and he saw not a shred of evidence for culls outside trial areas, and mass culls have been ruled out as politically unacceptable.

So, taking these two aspects together, yet another Inquiry chaired by Prof. C. Godfray of Imperial College is to look into whether the Krebs/Bourne cull is so compromised that it should be scrapped. The £6.7 million saved per year would release some £30-35 million infinitely better spent on tried and tested cattle measures (Hancox, 2003).

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Committee Report HC 432 Appendices 6 & 7.

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The head colour pattern of the Eurasian badgers (Mustelidae, *Meles*)

Alexei V. ABRAMOV

Introduction

The Eurasian badger (*Meles*) is one of the most widespread Eurasian mustelids. Its range covers Europe, except for the northernmost regions, the Middle East (as south as Palestine and Mesopotamia), Central Asia, South Siberia, Mongolia, Tibet, Eastern Asia (from the Amur Region to Yunnan) and the Japanese Islands (except for Hokkaido).

Geographic variation of craniological and exterior characters of the Eurasian badger is significant. A great number of forms of different taxonomic rank, *viz.* species, subspecies, natio, aberratio, *etc.* has been described (for a review see Abramov, 2001). There are contradicting opinions regarding species composition of the genus *Meles*; different authors accept 1 to 3 species. I am of the latter opinion and distinguish the European Badger *Meles meles* (Linnaeus, 1758), the Asian Badger *M. leucurus* (Hodgson, 1847) and the Japanese Badger *M. anakuma* Temminck, 1844. This point of view is well supported by the clear differences between European, Asian and Japanese Badgers in proportions and size of the skull (Lynch, 1994; Abramov, 2001), dental characters (Baryshnikov & Potapova, 1990; Baryshnikov *et al.*, 2003), shape of the *os malleus* (Abramov & Baryshnikov, 1995), shape of the baculum (Baryshnikov & Abramov, 1997; Abramov, 2002), level of sexual size dimorphism in the skull (Abramov & Puzachenko, in press), parasitologic data (Abramov & Medvedev, 2003) and molecular data (Kurose *et al.*, 2001; Sato *et al.*, 2003). The European Badger *M. meles* is distributed throughout Europe (including Scandinavia) to the west of the Volga River (Russia), Caucasus, Iranian Plateau, Pamir-Alai Mtns, South and West Tien Shan Mtns; south to Israel; Iraq; Iran; and on Ireland, Britain, Crete, and Rhodes (Heptner *et al.*, 1967; Long & Killingley, 1983). The Asian Badger *M. leucurus* is distributed from the east of Volga River through south Siberia, Kazakhstan, and Middle Asia to China and Korea; reaching Tibet in the south. The Japanese Badger *M. anakuma* is restricted to the Japanese Islands of Honshu, Kyushu, and Shikoku. The distribution ranges of these species is shown in Fig. 1.

In most taxonomic works, the peculiarities of coat colour (especially features of the facial mask) were used for characterizing the geographic variation of the Palaearctic badgers and for describing new forms. The present work reviews the head coloration and pattern of *Meles* and discusses its taxonomic significance.

Materials and methods

This study is based on 266 skins (including stuffed specimens) of badgers from a wide geographic area. The studied specimens are kept in the collections of following museums (see Table).

Also I have studied many photo files from the "Badgers on the Web" (http://www.badgers.org.uk) and numerous links therein (especially for Japanese and Korean websites).

Head colour pattern

The overall body coloration of western and northern European Badgers *Meles meles* is rather light, light grey or silvery, sides clearly lighter than the middle part of back. A wide black or black-brown longitudinal stripe on either side runs from the snout's tip over eye and ear (both covered from above and below). A pure white facial stripe is in between the two black bands, covering the back of the head and partly the neck (Fig. 2A). The snout, cheeks and tips of the ears are white.

Badgers from the Middle East are lighter (brownish) than European ones. A lighter coloration is also typical for the badgers from the Mediterranean. Such pale colour was the reason for describing several subspecies of the badger from Crete (*arcalus*), Rhodes (*rhodius*) and Spain (*marianensis*, *mediterraneus*). Nevertheless, the pattern of the snout's white and black stripes of the Middle East and Mediterranean badgers is the same as in other European ones. The European Badgers occurring in Asia Minor and the Caucasus (*canescens*, *minor*, *ponticus*), as well as those from Central Asia (Hissar-Alai, West Tien Shan and Pamir-Alai) (*severzovi*), are characterized by silver-grey body coloration and bright, contrasting facial stripes. Different colour variations of European badgers, *viz.* melanistic, albino and erythristic, have

Museums	*M. meles*	*M. leucurus*	*M. anakuma*
Zoological Institute, Saint-Petersburg, Russia (ZIN)	67	83	1
Zoological Museum, Moscow State University, Moscow, Russia (ZMMU)	22	27	
Institute of Animal Systematics and Ecology, Novosibirsk, Russia		10	
Russian Research Institute of Game Management and Fur Farming, Kirov, Russia	3	3	
Institute of Zoology and Genofunds of Animals, Almaty, Kazakhstan		4	
Kazakh Antiplague Research Institute, Almaty, Kazakhstan		5	
Institute of Zoology, Tashkent, Uzbekistan	13	15	
Institute of Zoology and Soil, Bishkek, Kirgizstan	2	4	
National Science Museum, Tokyo, Japan			5
The Kitakyushu Museum and the Institute of Natural History, Kitakyushu, Japan			2

been described. Extremely dark badgers have been seen, but the white facial stripes are normal in such animals (Neal & Cheeseman, 1996).

The Asian Badgers *Meles leucurus* have the light grey upperparts of the body tinged with sandy/straw-coloration, the sides slightly lighter, and the underside and legs black. A narrow blackish brown (sometimes brown) facial stripe runs over the eye (Fig. 2B), then gets narrower and runs above the ear. This stripe hardly reaches the hind side of ear, sometimes reaching only its anterior side. The light yellowish white median stripe is narrow and short; usually it does not reach the back of head and blends into the colour of neck and back already on the back of head. Such colour is typical for all studied skins of the Asian Badger from Siberia (*raddei, altaicus, sibiricus, aberrans*) and Middle Asia (*arenarius, tianshanensis, talassicus*). The badgers from North Mongolia have the same coloration. According to literature data (Allen, 1938; Pocock, 1941), the same coloration is characteristic for the badgers from different regions of China. Numerous Chinese forms (*leptorhynchus, chinensis, hanensis, siningensis, tsingtauensis, blanfordi*), of which many were described on the basis of only single specimens, differ only slightly in the intensity of body coloration.

A peculiar coloration is known for the badgers from Russian Far East (Primorie and Ussuri Territory), which were described as *amurensis* (syn. *schrenkii, melanogenys*). The overall pelage coloration is very dark, with brown predominating. The snout also is dark brown, and in some specimens facial stripes are almost not distinguishable (Fig. 2C), but when visible, the pattern of the facial mask is similar to that of the Siberian and Middle Asian badgers. The dark coloration, as well as a small size, are considered the main specific character of the badgers from Primorie. The badgers from North Korea are coloured in the same manner (ZIN C.25682, ZMMU S-59104).

The coat coloration of Asian Badgers (its intensity, but not the facial mask's pattern) varies widely. In the collection of ZIN, there is a specimen No C.54691 from Ussuri Territory (Suchan River) being very brightly coloured, similar to a European Badger. Nonetheless, the shape and pattern of facial stripes correspond to the Asian type. Dark coloured badgers (similar to those from Far East) are known from Transbaikalia, for instance, from the valley of Barguzin River (ZIN C.18209).

There was an opinion that two ecological forms of *Meles leucurus* occur in the Asian part of the range (Transbaikalia, Mongolia, Kazakhstan), *viz.* the "steppe badger" (large and light-coloured) and the "mountain-forest badger", which is smaller and dark-coloured (Radde, 1862; Bannikov, 1954). The present study does not support this opinion. It seems that any population of any subspecies of the Asian Badger may show dimorphic coloration, with both light- and dark-coloured animals, but these colour morphs are not segregated biotopically and occur together in the same habitats (Ognev, 1931; Stroganov, 1962; Heptner *et al.*, 1967).

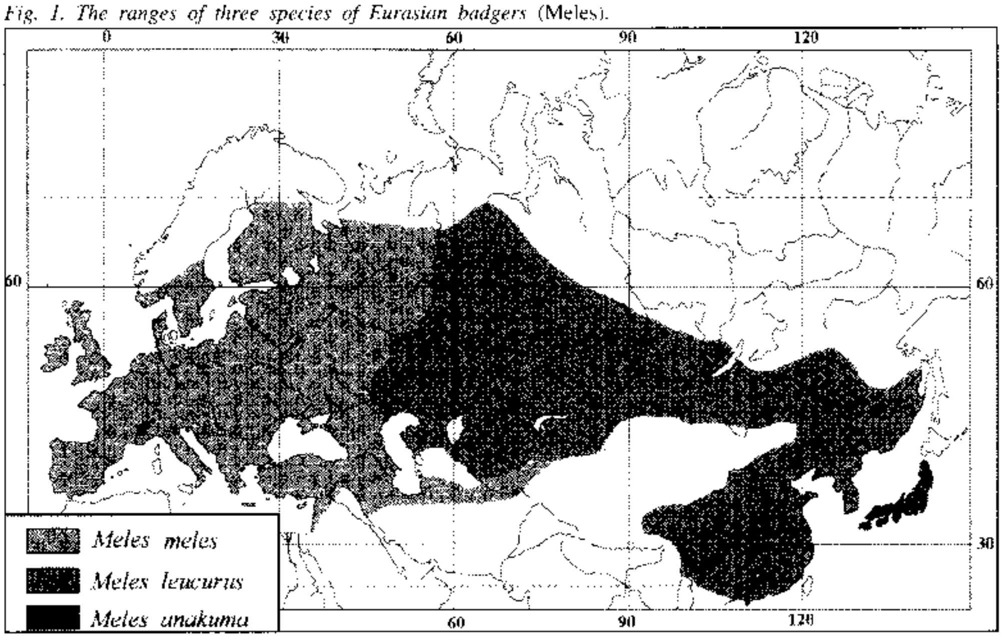
Some researches (*e.g.* Petrov, 1953; Heptner *et al.*, 1967; Baryshnikov & Potapova, 1990) have recorded that the body pelage coloration of the Japanese Badgers is also dark, being similar to that of badgers from the Far East. On this basis these badgers' forms were lumped into the group "*amurensis-anakuma*" (Heptner *et al.*, 1967; Heptner, 1968). Based on the coloration, Baryshnikov & Potapova (1990) assigned Japanese Badgers to the Asian Badger (*Meles anakuma*: *sensu* Baryshnikov & Potapova, 1990). However, the Japanese Badger is characterised by the light, yellowish upperparts and stout. Although brown facial stripes are well marked on the snout, usually they are short, not reaching the ear, and form dark "spectacles" around the eyes (Fig. 2D). The median facial stripe is yellow-straw coloured, short and ends up between the ears. All the specimens from Japan (Honshu, Kyushu) studied by me were coloured in the same manner, and also a similar pattern was described for Japanese badgers by Long & Killingley (1983).

These differences in facial pattern between the three badger species, as a rule, are easily seen and allow one reliably to assign any specimen to a particular form.

Differences in the facial pattern in *M. meles* and *M. leucurus* can be used for refining the limits of their distribution in sympatric zones. Such zones exist in West Tien Shan and in the European part of Russia (Kirov Province, Udmurtia, Tatarstan). Badgers occurring in the mountains of West Tien Shan (Karzhantau, Ugam, Pskem, Chatkal, Kuraminskii and Turkestan Mt. Ranges) have the facial mask typical for *Meles meles*, with black and white stripes, and the brightly silvery body coloration. The northern, central and eastern ridges of Tien Shan (Talass-Alatau, Kirgizskii, Ferganskii, Zailiiskii, Kungei-Alatau and Terskei-Alatau Mt. Ranges) are inhabited by the badgers having the head colour pattern of Asian type. Furthermore, they are characterised by the dark, brown-black body coloration, and their colour was used as a reason to describe a separate form from this region (*tianshanensis, talassicus*).

The colour pattern of specimens from Zhiguli Nature Reserve allows confirmation of the occurrence of the Asian Badger on the right riverbank of Volga River (Snegirevskaya, cited from Belyanin, 1981); the latter record was subsequently confirmed by craniological data (Baryshnikov *et al.*, 2003, Vekhnik & Abramov, in press).

Fig. 1. The ranges of three species of Eurasian badgers (Meles).



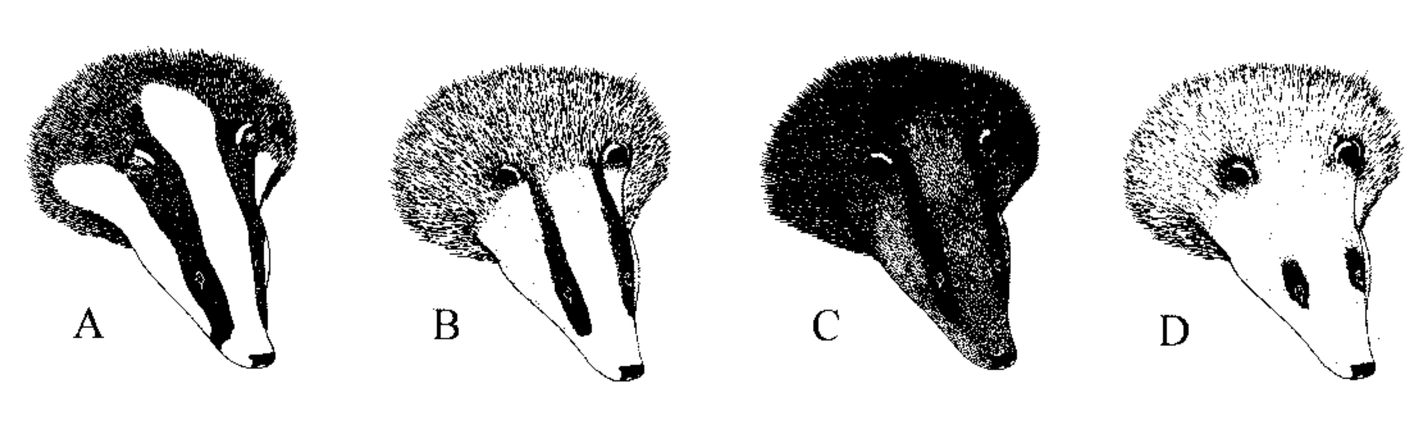


Fig. 2. The head colour pattern of the Eurasian badgers: A – the European Badger Meles meles, *B – the typical Asian Badger* Meles leucurus, *C – the Far-Eastern form of Asian Badger* Meles leucurus amurensis, *D – the Japanese Badger* Meles anakuma.

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The diversity and conservation of mustelids, viverrids, and herpestids in a disturbed forest in Peninsular Malaysia

Mohd. AZLAN J.

Introduction

Little is known on the distribution of mustelids, viverrids, and herpestids in Peninsular Malaysia because species conservation is concentrated much on charismatic and flagship species, especially on large mammals. A total of 21 species have been recorded from all three families in Peninsular Malaysia (Medway, 1983). All the species from the family Mustelidae, Viverridae, and Herpestidae except Malay Civet *Viverra tangalunga* and Common Palm Civet *Paradoxurus hermaphroditus* receive a total protection status in the Wildlife Protection Act, 1972 (WPA 1972). Anyone found killing these animals will be liable to a fine not exceeding five thousand ringgit (Aprox.USD 1,300) or to a term of imprisonment not exceeding three years or both. *V. tangalunga* and *P. hermaphroditus* receive a protection status where upon conviction of killing these animals a fine not exceeding three thousand ringgit (USD 790) or to a term of imprisonment not exceeding three years or to both will be imposed. However, in many rural areas of Peninsular Malaysia civets are considered a pest because they prey on small livestock and raid fruit orchards. Section 55 of the WPA 1972 allows farmers to shoot any wild animal that causes damage to their property, providing reasonable efforts have been to frighten the animal away.

Despite the threats from local farmers, it is believed that habitat destruction would cause both a severe decline in mammalian species throughout their range (Stevens, 1968; Seidensticker, 1986), and a loss of genetic diversity (Soule, 1987; Terborgh, 1992). It is therefore important to understand the diversity of small carnivores in disturbed habitat in order to provide baseline data for monitoring long-term changes, and for comparison with other forested areas elsewhere in Malaysia.

Materials and Methods

Study site

The study was conducted in Jerangau Forest Reserve (20-538 meters a.s.l.), a secondary forest, that was logged in the 1970s, and which surrounds an oil palm estate, in the State of Terengganu (04° 55.5' N, 103° 05.7' E). We have covered an approximate area of 170 km^2, which includes the oil palm estate with an area of approximately 2,000 ha. Past logging history has resulted in disturbed forest with dense undergrowth, with dense stands of the invasive ferns *Dicranopteris* sp. and *Gleichenia* sp. in abandoned log yards and along old logging roads This study area receives an average annual rainfall of 2,000mm, and consists mainly of selectively logged hill dipterocarp and lowland dipterocarp forest.

Direct observations and commercially made Cam Trakker brand camera trap units (manufactured by Camtrak South, 1050 Industrial Drive, Watkinville, GA 30677, USA) were undertaken. Cam Trakker combines a fully automatic 35mm camera with a passive infrared heat-in-motion detector. The heat-in-motion sensor operates on a horizontal plane, thus it is important that it is aimed parallel to the ground. When animals move along the trail, a silent switch engages the camera, which takes a photograph. The time delay between photographs was set to a minimum of three minutes.

The cameras were deployed in 24 different locations. All camera units were mounted on trees, at least 2.5m to 3.5m from the path or trail, with the infrared beam set approximately 50cm from the ground. Most of the trails and paths were old logging roads with thick undergrowth of secondary trees and shrubs.

All the cameras were checked every month to reload new film rolls. However there were several instances where the films had been fully consumed before checking, so there were gaps in the record. The same camera locations were retained throughout the duration of the study, from February 2000 till October 2001.

Results

All the photographic results are targeted on terrestrial animals, as no cameras were deployed near streams to prevent camera malfunction due to flooding. Therefore, animals that are either arboreal or are associated to aquatic habitat will be underrepresented in the results. The most frequently encountered species during the night walks was the Common Palm Civet, *P. hermaphroditus*, which was observed on telephone cable lines and oil palm trees (Palmaceae : *Elaeis guineensis*).

All the photographs were identified to the species level except for *Herpestes* spp. because they were too small to be distinguished to species in the photographs. A total of 3,314 exposures were recorded, of which only 2,226 were of wildlife. A total of 71 photographs were recorded for both mustelids and viverrids (approximately 3.2% of the total animals photographed). These families have the highest diversity of species recorded throughout the study period. I have also collected a road kill of the Eurasian Otter *Lutra lutra*, which brings the total species recorded, to nine. The diversity of mustelids, viverrids, and herpestids in this study area represents approximately 42% of the total species recorded for Malaysia by Medway (1983). *Viverra tangalunga* was the most frequently captured viverrid, while mustelids were only represented by *Martes flavigula*. (Fig. 1).

Discussion

The major limitation to this study was the inability to sample the arboreal and aquatic mustelids and viverrids comprehensively. Moreover, the fact that four of the eight species

Fig. 1. Relative encounter rates of mustelids, viverrids, and herpestids from camera traps in Jerangau Forest Reserve.

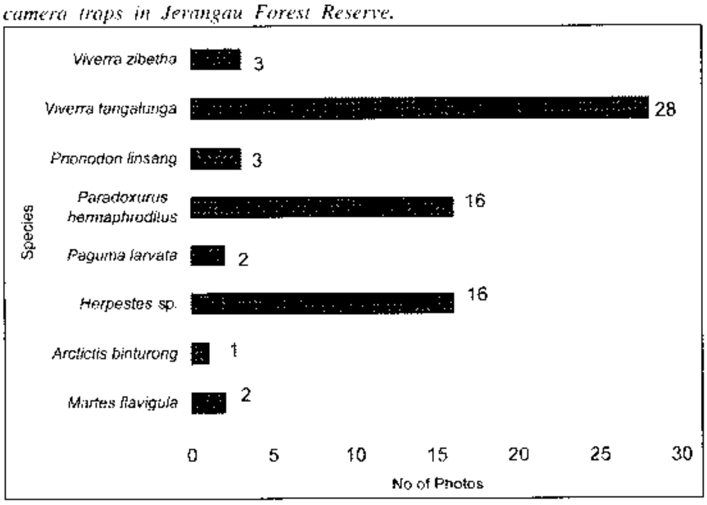

Fig.2. Banded Linsang Prionodon linsang *photo-trapped by an infrared-sensored camera in Jerangau Forest Reserve, Peninsular Malaysia.*

Fig.3. Malayan Civet Viverra tangalunga *the most frequently photo-trapped viverrid in Jerangau Forest Reserve, Peninsular Malaysia.*

Fig.4. Common Palm Civet Paradoxurus hermaphroditus *photographed during the night surveys around Jerangau Forest Reserve, Peninsular Malaysia.*

were recorded only 1-3 times each suggests that there could well be further ground-dwelling species present. However, it provides baseline data on the diversity and relative abundance of these families in a disturbed habitat. Using camera trapping to study these secretive and nocturnal animals, suggests that it could be an ideal tool for further study to determine their behavior patterns. For example, from the result we could confirm that *P. hermaphroditus* spends a substantial amount of time on the ground, even though activities have been recorded as arboreal (Medway, 1983; Payne, *et al.*, 1985). It would also be possible to look into their activity patterns by analyzing the time and date recorded at each photograph, if adequate data representing each species were available.

The family Viverridae was represented by five genera (*Arctictis, Paguma, Paradoxurus, Prionodon,* and *Viverra*) in the study area. A study conducted by Ratnam *et al.* (1995) in Temengor Forest Reserve, a disturbed habitat revealed the presence of five species: *Prionodon linsang, Paguma larvata, Hemigalus derbyanus, Paradoxurus hermaphroditus* and *Arctogalidia trivirgata*. The difference in the viverrid diversity may be due to various factors including variation in sampling methods, duration of study and the suitability of this mixed habitat forest to support a great diversity of viverrids. Of the eight small carnivores recorded only *M. flavigula* and *Viverra zibetha* are not considered common (Medway, 1983).

Even though forest conversion to oil palm estate may have provided abundance of oil palm fruit, small vertebrates and invertebrates as a major food source for some of these species, its threat to wildlife could be devastating if precautions are not taken seriously. Forest fragmentation and isolation creates easy access for illegal hunters, who may shoot any wildlife that moves. There have even been cases where domesticated animals have been killed using shotguns for no reason by some of these frustrated hunters. In addition to this, I have also observed many road-kills around the study area, particularly *P. hermaphroditus*.

Mustelids, viverrids, and herpestids that occur in Peninsular Malaysia receive protection both internationally and locally. Nonetheless, it is important to educate and create awareness among the local communities, especially on issues involving conflict. Farmers need to be educated in intensive poultry farming, where proper fencing and guarding may be necessary to prevent civets from preying.

A comprehensive study will be required to understand the population dynamics, minimum viable population in disturbed habitat, and ecological function of small carnivores in tropical rainforest, especially their role as seed dispersers. Such information will provide input to the conservation strategies for these species in this region.

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