SMALL CARNIVORE CONSERVATION

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

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Malay Weasel – Mustela nudipes – *Photo: Siew Te Wong*

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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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Note from the editor

Dear readers,

I regret to announce that, due to ill health, this is the last Small Carnivore Conservation number that I will make. I sincerely hope that one of the other members, of which several have suggested improvements over the years, will take over and will not let an effort of 17 years terminate.

I am greatly indebted to William Duckworth who, over the years, not only spent much time and effort to improve the style of manuscripts sent in by non-English speaking authors but who also succeeded in stimulating numerous field researchers in submitting a paper to our publication. I also thank the many authors who have sent in manuscripts spontaneously and the funders and subscribers who kept us going. I am especially grateful to The Zoological Society of Antwerp who from the first number up till now has sent out our publication free of charge.

Best wishes,

Harry Van Rompaey
Editor-in-chief Small Carnivore Conservation

PS In the future, please send manuscripts directly to Mr. Jerry Belant (Jerry_Belant@nps.gov) who will forward them to Will Duckworth

Harry Van Rompaey

Harry and I met for the first time over 20 years ago. I read a paper Harry had published somewhere and I wrote to him. Soon after I spent an afternoon (the first of many) in Harry and Annie's wonderful house, experiencing their famous hospitality and Annie's no less famous food.

Of course, every time we met, we talked about what animal people tend to talk about: animals - and conservation. Harry was never very optimistic about where the world is heading– but always peppered his sceptical comments with a good dose of his unique Antwerp humour. So despite the sad state of the world, which we just had discussed, we didn't feel too depressed.

Occasionally we felt even better by dreaming that every person on this planet would pay back just a tiny percent of the pleasure s/he gets from the natural wonders of earth by doing *something* for conservation. That will remain a dream forever, as the people who actually do that, are few and far between. Well, Harry, of course, is one of those. He thought what he could do best and what he likes most, is collecting information about obscure and little-known carnivores (the animals he likes most) to make it available to those who could use it for conservation and science. ***Small Carnivore Conservation*** (initially ***Mustelid & Viverrid Conservation***) was born. Harry produced the journal single-handedly for almost 20 years in his spare time and with not a penny of renumeration (instead he sometimes used some of his own money to make sure the next issue would be out on time).

Harry decided even to continue with the newsletter when I, for reasons of workload with the two conservation NGOs I chair, decided to step back as chair of the MVP Specialist Group, and the group was 'headless' for a while. By that time ***Small Carnivore Conservation*** was already its own institution– it didn't need a Specialist Group for it to continue, it just needed Harry Van Rompaey ! Or, to look at the issue from a different angle: a key function of the group, collecting and distributing information of relevance to the conservation of small carnivores, was essentially unaffected by the turbulent waters around – thanks to Harry.

Unfortunately, as Harry has written above, due to ill health he hands over 'his baby' to others. It won't be easy for anyone to step into your shoes, Harry!

Before I close this little tribute to a man who has done so much to make this world a little better place for small carnivores, I need to stress that Harry does **not** know that we (William Duckworth and I) have agreed to produce this small note. Harry is too modest to like this. So forgive me, please, Harry !

Roland Wirth

The Malay Weasel *Mustela nudipes*: distribution, natural history and a global conservation status review

J. W. DUCKWORTH, B. P. Y.-H. LEE, E. MEIJAARD and S. MEIRI

Summary

The Malay Weasel *Mustela nudipes* inhabits only the Sundaic sub-region of South-East Asia and has never been studied in the field. Overall, it is recorded only rather rarely. Given major declines in many better-known Sundaic forest vertebrates, records were collated from as many sources as possible to re-evaluate its conservation status. The collation was not exhaustive, but allowed clear conclusions:

1. Malay Weasel has been recorded recently almost throughout its historical range (Borneo, Sumatra and the Malay—Thai peninsula) with the exception of several small areas with only limited recent survey; hence, no range contraction is suspected.
2. Occurrence was confirmed from Brunei, whence no major international collection contains a specimen.
3. The purely Sundaic distribution was confirmed, although the species extends further north in peninsular Thailand (to 10°N) than often believed.
4. Although several specimens from Java have been catalogued and some recent sources include Java in the range, the only specimen with an authoritative Javan locality turned out to be an Indonesian Mountain Weasel *M. lutreolina*. It is safe to assume that Malay Weasel does not inhabit Java.
5. Absence from Java and the distribution in mainland South-East Asia imply a restriction to areas lacking a marked dry season.
6. Malay Weasel inhabits a wide altitudinal range, from sea-level up to at least 1,700 m on Borneo and 1,300 m on Sumatra and the Malay—Thai peninsula, with many records from hill areas. Although the species's dependence on forests remains unclear, the highland records are significant because forest loss and degradation rates of the Sundaic highlands lag significantly behind those of the lowlands.
7. Records came from a wide range of natural vegetation types. Most were from lowland and hill dipterocarp forests, but this cannot be seen to indicate an altitudinal preference because these are the predominant natural habitats in the species's range and host most biological fieldwork. Tropical heath forest (*kerangas*), swamp forest, montane forest and montane scrub were also used.
8. Many records came from degraded areas, including in plantations of exotic trees, with two from urban or suburban settings. While it cannot yet be concluded that populations can persist independent of natural forest, the species is clearly not highly selective in the habitats it uses.
9. No observer reported seeing the species often; even at sites with the highest overall search effort, records were few. Yet the species has been found in most areas with substantial fieldwork.
10. Direct observation indicates that the species is not typically shy, while all methods combined (camera-traps, live-traps, location of road-kills) have low recording rates, indicating that Malay Weasels probably live at low density. The reason for the paucity of camera-traps records is unclear.
11. Contrary to previous statements, Malay Weasels are widely active by, and throughout the, day; indeed there is evidence for only occasional nocturnal activity.
12. Malay Weasels forage singly, on the ground, and in habits seem typical of non-aquatic congeners.
13. Although the effects on Malay Weasel of major ongoing habitat change are unclear, it is evidently less immediately threatened by forest loss than are many other Sundaic species. Within remaining habitat, no threats specific to it were detected, despite occasional killing as a poultry thief and for medicinal use, and undoubtedly some level of by-catch in snaring for other species. It should not be listed as internationally threatened.
14. The conservation priority for Malay Weasel is to study use of anthropogenic habitats to give a clearer predictive ability for future conservation status trends. Because it remains so little-known, it would benefit from studies of its general natural history.

Introduction

The genus *Mustela* includes about 17 species varying, in conservation terms, from perceived vermin (e.g. Stoat *M. erminea* and Least Weasel *M. nivalis* in at least parts of their native Holarctic distribution and, especially for Stoat, in its introduced range of New Zealand; (King, 1991; King *et al*., 1996; McDonald & Harris, 1999) to one species needing chronic support to avert its extinction (Black-footed Ferret *M. nigripes*; Reading *et al*., (1997). Several species remain very poorly known, e.g. Indonesian Mountain Weasel *M. lutreolina* (van Bree & Boeadi, 1978; Lunde & Musser, 2003; Meiri *et al*., *in prep*.), while another South-East Asian taxon, the 'Björkegren's Weasel' *M.* (*nivalis*) *tonkinensis* has not been found since the holotype was collected and is of disputed taxonomic status (Björkegren, 1941; Abramov*, in press*). Even for other weasels in South-East Asia, conservation status remains unclear, with recent records greatly extending historically known ranges (e.g. Yellow-bellied Weasel *M. kathiah* and Stripe-backed Weasel *M. strigidorsa*; Duckworth & Robichaud, 2005; Abramov *et al*., *in prep*.).

Malay Weasel *Mustela nudipes* is known historically from the Sundaic sub-region of South-East Asia: Borneo, Sumatra and the Malay—Thai peninsula (Chasen, 1940; Lekagul & McNeely, 1977; Corbet & Hill, 1992), but not, despite repeated statements of occurrence, from Java (see below). Its pelage varies in colour but despite earlier speculation (e.g. Chasen & Kloss, 1931) this shows no geographical basis, and the species is monotypic (Brongersma & Junge, 1942; Hill, 1960). Recent re-measurement of skulls indicates no geographical variation in size although few were measured from the Malay—Thai peninsula (SM, own data).

There are a fair number of historical Malay Weasel specimens o(Appendix 1 lists all specimens and historical records traced). Brongersma & Junge (1942) gave a synonymy and exhaustive bibliography of records and mentions of the species. Davis (1962) recorded that "nothing is known of [its] habits", and Lekagul & McNeely (1977) called it "little known". Like other South-East

Asian species of *Mustela*, it has never been studied alive. In recent years, many little-known medium-sized tropical mammal species have been detected through sight and camera-trap records (see Cutler & Swann, 1999) incidental to general surveys or specific studies of other species. Such records are not readily obtainable by third parties, and few camera-trap studies publicly document or disseminate results of non-target species, even though such data have significant information value for conservation (Kawanishi, 2001). Such dispersion of information hinders assessment of global or national conservation status and needs.

Malay Weasel was considered threatened in Malaysia by Ratnam *et al*. (1991), because of perceived rarity and restriction to good forest, but Meijaard *et al*. (2005) traced too little information to include it in a recent review on the effects of logging on Sundaic forest wildlife. The most recent global conservation action plan for small carnivores (Schreiber *et al*., 1989) did not consider Malay Weasel a conservation priority, but this should not instil complacency: there is little congruence between the Sundaic bird species listed as globally threatened or near-threatened in the contemporary edition of the global red-list of threatened birds, by Collar & Andrew (1988), compared with those so listed in the most recent edition, by BirdLife International (2001). This is because forest conversion, degradation and fragmentation in Sundaic South-East Asia, particularly of lowland areas, is proceeding at such a rate (e.g. BirdLife International, 2001; Holmes, 2000; Jepson *et al*. 2001; McMorrow & Talip, 2001; Lambert & Collar; 2002; Curran *et al*., 2004; Fuller, 2004; Aratrakorn *et al*., 2006; Kinnaird *et al., in press*) that Wells (1985) warned of "bird communities facing wholesale collapse through the mass conversion of natural forest to other uses". As this dire prognosis has been, and continues to be, validated by subsequent events, BirdLife International (2001) red-listed as Vulnerable or Near-Threatened all forest-dependent Sundaic endemic birds that are restricted to lower altitudes and for which there is no strong evidence of adaptability to degraded and fragmented forest, no matter how abundant those species are within their natural habitat. This approach should logically be applied to forest-dependent species endemic to Sundaland of groups other than birds. Hence, for these various reasons, and following the need stated by Franklin & Wells (2005) the present work collates records of Malay Weasel and assesses the species's current conservation status.

Methods

Modern records

Unpublished field records were traced through personal contact and correspondence with wildlife biologists and naturalists resident or spending long periods in the Sundaic region, especially those camera-trapping wildlife. These were supplemented with appeals on the e-mail list-serves of the IUCN/SSC Small Carnivore Specialist Group and the Oriental Bird Club (Oriental Birding). The latter targeted the many field 'birders' (there is no equivalent group of 'mammalers'), who, through dedicating much leisure time to seeking birds (especially rare and little-known species) in the field, become adept at field identification through cautious use of morphological and vocal characters. Birders formed the backbone of many current range and status assessments for South-East Asian birds in BirdLife International (2001), and many are increasingly interested in 'large' (= field-identifiable, *sensu* Dorst & Dandelot, 1970) mammals. Malay Weasel is likely to be well recorded by field birders because (*contra* previous studies) it is probably largely diurnal (see below). Being morphologically extremely distinctive (South-East Asia has no other white-headed bright orange mammal, let alone an obviously weasel-shaped one), sight records from observers of known general reliability were considered acceptable. However, following Meijaard (1997), listings in grey literature (e.g. management plans and consultancy reports) were not accepted unless there was primary detail of the records.

Electronic searches were made in the 'JSTOR', an internet-based journal archive database which covers several international journals pertaining to mammalogy and tropical ecology and biology. Key phrases used in the search were "Malay Weasel", "*Mustela nudipes*" and its synonym "*Gymnopus leucocephalus*". In addition, searches were made in relevant local and regional journals and newsletters that are not indexed in major journal search engines. These journals and newsletters include *Brunei Museum Journal*, *Journal of Wildlife and Parks* (Malaysia), *Malayan Nature Journal*, *Natural History Bulletin of the Siam Society*, *Pangolin*, *Sabah Museum Journal*, *Sabah Society Journal*, *Sarawak Museum Journal*, *Small Carnivore Conservation* and *Tropical Biodiversity*. This will not have traced all published records, but the capture of recent unpublished incidental records was the priority to lay the status baseline, because many of these will otherwise be lost to future researchers.

With each record particular attempt was made to determine altitude, because in the Sundaic region hill and montane forests are under much lower threat than are lowland forests (BirdLife International, 2001). For records outside tall forest, the distance to such habitat was assessed where possible, because individuals of even forest-dependent species may use non-forest habitats when dispersing or displaced by habitat perturbation; such records may even be frequent if the disturbed habitats are close to tall forest and form part of an individual's home range. Mere presence in disturbed and secondary habitats cannot be assumed to equate to a self-sustaining population there: a false security over a species's adaptability may be bred if these animals in fact represent wanderers or sink populations from natural habitats.

Historical records

To allow comparison with current range, data on museum specimens were collated. Collection managers were contacted, published lists of holdings (e.g. Majuakim, 1999; Kool & Yakup Nawi, 2005) checked, and internet databases searched of c. 50 museum collections, to derive for each specimen the locality, altitude, date, collector and any other relevant notes. Identity and provenance were investigated for each specimen apparently a geographical outlier. The museum search is certainly not complete with, for example, no time to source data concerning those specimens in Russian museums (A. Abramov, *in litt*. 2006).

Time considerations precluded a search for records published between Brongersma & Junge (1942) and the 1980s, although some electronically-available journals were searched as far back as the early 1900s. However, it is a fair assumption that any published records significantly extending the known geographic range would have been incorporated in faunistic reviews such as Lekagul & McNeely (1977) and Corbet & Hill (1992).

Records and Discussion

Appendix 2 lists all field records (most of which are recent) of Malay Weasel received, split by country/island. Fig. 1 maps the post-1989 records. Roberton & Bell (*in prep*.) traced no animals held in zoos anywhere in the world.

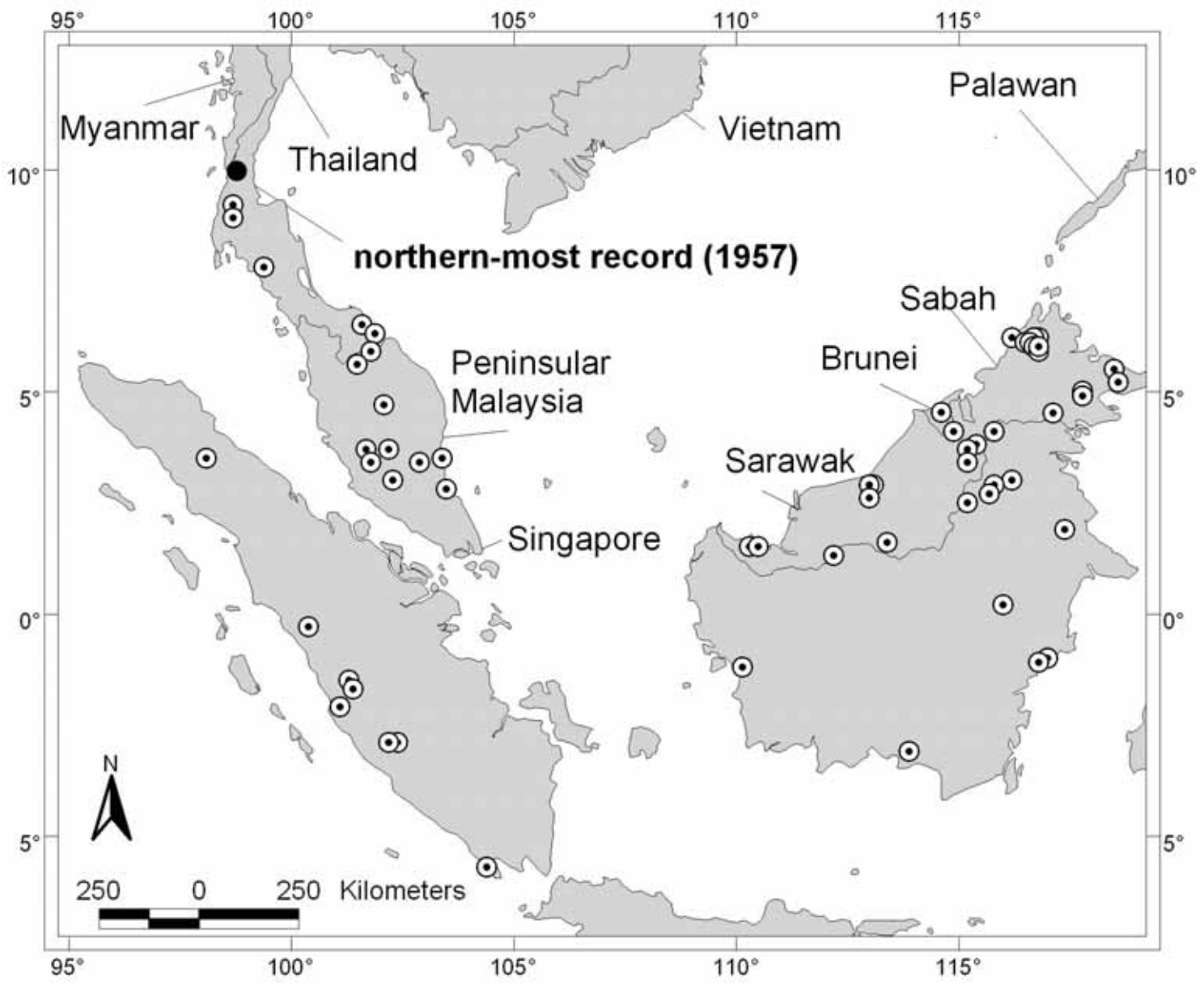

Figure 1. Locality records of Malay Weasel from 1990 onwards.

Geographical range

Recent records (most of those in Appendix 2; Fig. 1) come from almost throughout the historically-known range (Appendix 1): there is little suggestion of a range contraction, even if recent records are restricted to post 2000, i.e. well within the era of major habitat conversion. Records past and recent have been scattered across Borneo, Sumatra and peninsular Malaysia (Brongersma & Junge, 1942; Hill, 1960; Medway; 1969; 1977; Payne *et al*. 1985; Appendices 1, 2). The only major political unit with a historical specimen (in Lyon 1911) for which no modern record was traced is South Kalimantan province (Appendix 2). The limited recent survey in these provinces forestalls any inference from this. Also, no recent record was traced from most of eastern Sumatra, although there are several historical specimens (Appendix 1; e.g. Schneider, 1905; Hill, 1960). This part of the island has not received extensive conservation surveys recently, and much of what has occurred was in the area's globally important swamps, habitats perhaps suboptimal for this weasel. Although most dry-land forest has been cleared, significant patches do persist (e.g. Berbak national park and Way Kambas) and it would be premature to consider the species extinct in this region.

No historical specimen was traced from Brunei. Hence, recent records (Appendix 2) may be the first from the country.

Recent records expand the known Thai range, a country with only one pre-1955 record; nowadays it is easy to forget that, until recently, "mammals in [Thailand] remain relatively little known" (Thonglongya, 1974). All Thai records fall in the peninsula, confirming that the species is strictly limited to the Sundaic subregion. The only Thai record in Lekagul & McNeely (1977) is a 1909 specimen from Trang province (7°35´N, 99°45´E; Appendix 1; Hill, 1960), doubtless responsible for the species's northern limit in the generalised range maps in Lekagul & McNeely (1977) and Corbet & Hill (1992). Local people's reports, apparently of Malay Weasel, were listed by Boonratana (1988) for Khao Phanom Bencha National Park (8°13-19´N, 99°53-58´E) and Mu Ko Phetra National Park (6°45´-7°08´N, 99°23-49´E), but these should not be taken as verified presence (see Duckworth, 1997). Several subsequent records (Appendices 1, 2) indicate that the species is probably widespread in southern peninsular Thailand, and extend the range north to 10° (through a 1957 specimen from Ranong province). Even this northern margin, by comparison with the better-known northern limits of Sundaic birds (Round *et al*., 2003), would be fairly far south for a non-montane Sundaland endemic. Birds as a whole were much better collected than were small carnivores, but even so the historical records underestimated the northern penetration for many species (Round *et al*., 1982). Thus, the weasel may yet be found further north into peninsular Thailand and perhaps in adjacent

Myanmar (in Thaninthayi [Tenasserim] division); another Sundaic small carnivore, Banded Linsang *Prionodon linsang*, extends north to at least 15°29´N (Steinmetz & Simcharoen, in press).

The southernmost parts of Vietnam extend into the latitudinal range of Malay Weasel (Fig. 1). However, they lack any notable Sundaic affinity (e.g. Lunde & Nguyen Truong Son, 2001) and it is unsurprising that an extensive collation of small carnivore records (including specimens housed in-country) by S. I. Roberton (verbally 2006) found no evidence of the species in Vietnam.

Mistaken geographical range records

Most modern sources exclude Java from Malay Weasel's range (e.g. Lekagul & McNeely, 1977; Corbet & Hill, 1992), although others do list the island (Payne *et al*., 1985; Wozencraft, 2005); Melisch (1992) left the issue unresolved. Although Desmarest (1822) gave Java as the origin of the specimen upon which he named the species, this was very soon doubted. Following the statement of Vigors (1830), that "it is probable that the specimen sent by M. [onsieur] Diard from Batavia [=Jakarta, Java] had been originally imported from Sumatra", Robinson & Kloss (1919) fixed a new type locality as West Sumatra. Müller (1839-1840) had earlier drawn attention to the geographical sloppiness of some contemporary French zoologists, and pointed out that various capable naturalist-explorers had spent time on Java without finding this weasel, and that indigenous people appeared not to recognise it. The type (MNHN mounted skin CG 2001-355, skull A 1948 [I-1106]) was collected on "Java" in May 1821 by P. Diard (G. Veron, *in litt*., 2005); but Diard was also responsible, among other longstanding confusions, for the type localities of Pontianak (Borneo) for Northern Smooth-tailed Treeshrew *Dendrogale melanura* (Schlegel & Müller, 1843-1845), which occurs no closer to Borneo than Cambodia (Timmins *et al*., 2003); and Sumatra for Lesser One-horned Rhinoceros *Rhinoceros sondaicus*, although his specimen evidently came from Java (Rookmaaker, 1983).

Dammerman (1940) retained the possibility that Malay Weasel might inhabit Java, but Brongersma & Junge (1942) stated categorically that there were no claims from the island since the original. However, there are at least two other purported Javan specimens (Appendix 1).

One (BMNH 46.3.5.4; skin and associated skull) was purchased from the Leadbeater merchants in London by the Zoological Society, probably in the 1850s. The museum register records no locality, but 'Java' crept in somewhere, on both skin and skull. Presumably the merchants, seeing the type locality as Java, simply listed their specimen from there (D. M. Hills verbally, 2006); 'ornamental' addition of data on a specimen's origin was evidently relatively common in this era (Mearns & Mearns, 1998). This specimen bears a note in an unidentified hand as "probably the specimen described by Gray, P.Z.S. 1865: 119 as *Gymnopus leucocephalus* var."; yet Gray (1865) spoke of Borneo and Sumatra as this form's range, and so BMNH 55.12.24.217 (skin; with presumed associated skull BMNH 58.5.4.586), labelled "Probably the type of *Gymnopus leucocephalus* Gray Proc. Zool. Soc. 1865: 119", is more likely to be Gray's type, as deduced by Hill (1960) through comparison of pelage and morphometrics. This specimen also lacks locality data (with skin, skull or register); it was purchased by the British Museum, also from the Zoological Society's collection.

A *Mustela* skull labelled as a Malay Weasel held in the Berlin Museum für Naturkunde (MZB 48082) was collected in January 1935 from the Ijang Plateau, East Java. The locality is not in doubt, but on morphology it is in fact an overlooked specimen of *M. lutreolina* (Meiri *et al*., in prep.).

Hence, there is no plausible evidence of occurrence on Java, and W. C. Wozencraft (verbally, 2006) confirmed that the island was listed in Wozencraft (2005) through editorial error. Malay Weasel's absence from Java could indicate that it needs year-round high humidity and cannot persist in non-evergreen vegetation formations. During Pleistocene glacial periods, such non-evergreen vegetation, e.g. open woodlands, were much more extensive on Java than on Borneo and Sumatra (Bird *et al*., 2005). Several tropical rainforest mammals like orang-utans *Pongo* spp., Siamang *Symphalangus syndactylus* and Asian Tapir *Tapirus indicus* inhabited Java about 70,000 years ago but disappeared during the last glacial maximum (see Meijaard, 2003b). Evidence is insufficient to determine whether Malay Weasel showed a similar pattern, or simply never occurred on Java. Current absence from Java is consistent with its strictly Sundaic Thai range: off the peninsula, Thai forest is highly seasonal, even evergreen formations having marked dry seasons, and Sundaic bird species are almost absent (Round *et al*., 2003).

There was also a confused period when the species was considered to inhabit Palawan and some other Philippine islands, through Grevé's (1894) misreading of Everett's (1893) statements (Brongersma & Junge, 1942), but this notion has evidently been successfully squashed. Coincidentally, a subsequent specimen labelled from Luzon, the Philippines (Museum of Vertebrate Zoology, University of California, Berkeley, USA; MCZ 109781) was obtained by C. G. Sibley on 1 January 1945, but C. Conroy (*in litt*., 2006) clarified that this specimen was purchased in a market; it could have originated anywhere.

Altitudinal range

Most Malay Weasel records, past and recent, come from the lowlands, with several at sea level; many are also in the lower hills (Appendices 1, 2). This pattern, rather than indicating differential abundance, may simply reflect the predominance of observer effort (including time on roads) at lower and middle altitudes. Payne *et al*. (1985) mentioned occurrence of Malay Weasel up to 1,700 m on Gunung (= Mount) Kinabalu, Sabah. There are various other highland historical records (Appendix 1: also, Robinson & Kloss, 1919; Davis, 1962). Recent site records include at least six, from several different massifs, within 1,000-1,500 m, and three (all from Kinabalu) at 1500 m or over, with the highest from c. 1,700 m.

Habitat type and quality

Past assessments of Malay Weasel habitat have been too general to be informative, e.g. "forests" (Payne *et al*., 1985), while the usually exhaustive Lekagul & McNeely (1977) gave no speculation whatsoever. Comprehensive reviews of small carnivores on small islands covering the species's range (Meijaard, 2003a; Meiri, 2005) traced no records, suggesting that fairly large areas are needed to retain populations; this would follow if the population density is low (see below). The recent records (Appendix 2) come from all stages of human encroachment of habitat, from deep within extensive primary forest to sites remote from any old-growth forest, or even mature secondary growth. There are records from various plantation types (although all records with precise information were located close to primary forest), and two records even came from urban or suburban settings. Over three-quarters of recent records are from lowland and hill mixed dipterocarp forest; this proportion may simply reflect the large extent of such forests and concentration of wildlife survey within them. Records also come from tropical heath forest (*kerangas*), swamp forest, montane forest and, at even higher

altitude, montane scrub. Although Banks (1949) stated that Malay Weasel was "confined entirely to old jungle" and Ratnam *et al*. (1991) allowed it "a general requirement for good lowland forest", the current records suggest no restriction, within a climate of year-round high humidity, to forest of a particular type or condition, or even, apparently to forest itself. The generally low levels of wildlife survey in anthropogenic non-forest habitats (including plantations of exotics) mean that further information from sites remote from forest is a high priority: it is conceivable that the non-forest records here might all represent dispersing animals or sink populations. The absence from Java and non-peninsular Thailand (see above) indicates absence from areas lacking a marked dry season. We traced no recent records from south-eastern Borneo, where the climate is markedly drier than on the rest of the island; survey effort is too low to infer absence from this area, but confirmation of occurrence here would be of particular interest. The historical record from Cantung (formerly, Tjantung) in 1908 (Lyon, 1911; Appendix 1) was among the parts of Borneo with the lowest rainfall; however, dryness was doubtless moderated by the then extensive swamp forests.

Abundance

No site was traced where Malay Weasel was regarded as commonly seen. Today, few wildlife surveyors and researchers, even those who have spent years in the region, have seen the animal more than once or twice. There are several cases where the species has been found at a site only after very lengthy survey; e.g. at Krau, Malaysia, the weasel was not recorded in the early 1970s (Medway & Wells, 1971; Medway, 1972) but was added to the mammal list in the 1990s (DWNP, 1995, cited in Sahir Othman & Lim, 2000). Wherever it occurs, the weasel is seen at best infrequently.

Low sighting rates could indicate genuinely low densities (as suggested by writers from Banks [1949] to Wulffraat *et al*. [2006]), extreme shyness and/or some other behavioural trait rendering the species rarely seen. Although U. Treesucon (*in litt*., 2006) found in his 2-3 sightings that Malay Weasels were very shy, and disappeared as soon as they saw him, as did the sole ones seen by C. Chin, *in litt*. (2005; despite initial lack of vigilance) and S. Myers (*in litt*., 2006), several other observers (Franklin & Wells, 2005; C. R. Robson, *in litt*., 2006; J. W. K. Parr, *in litt*., 2006; H. S. Moeller, *in litt*., 2006) specifically commented on the animal's lack of awareness of nearby people. Indeed, J. Holden (*in litt*., 2006) had an animal walk right past him at close range as he hammered a camera-trap post into the forest floor; another time, a weasel walked up to investigate him. Banks (1980) considered that its decided smell of ammonia coupled with an appearance as a giant hairy caterpillar, "the yellow fur puffed out all round the body [is] a sort of warning to wantons", and its behaviour fits this speculation.

Camera-traps results should not be affected by shyness, but from the relatively high effort across Malay Weasel's geographic range in the last 15 years we have traced only a single record (Appendix 2, reproduced on this issue's cover). While some surveyors, many of whom are after much larger mammals such as Tigers *Panthera tigris*, set a horizontal detection beam rather too high for low-slung animals like weasels (e.g. Holden, in press), others, including S. T. Wong (*in litt*., 2006), aim cameras obliquely towards the floor and so photograph even small rodents; yet S. T. Wong has only camera-trapped one Malay Weasel in over 2000 photographs of wildlife, even though several other observers have seen the species recently in the same area (Appendix 2). Many other camera-trap studies in the species's range have failed to find it at all (e.g. van Schaik & Griffiths, 1996; Azlan, 2003; Franklin & Wells, 2005; Wulffraat *et al*., 2006; Holden, in press). A tropical Asian congener, Stripe-backed Weasel, also is also camera-trapped only rarely, even where other techniques suggest it to be not uncommon (Abramov *et al*., in prep.).

Perhaps Malay Weasel is not prone to venture into open areas, instead spending most time within field-layer vegetation: B. Hagen (1890: 96), who saw it several times, specifically noted it as sneaking through the shrubs. Such behaviour would inhibit direct sight records, and explain the low photographic capture rates, because most camera-traps are aimed at open areas (wildlife trails, stream edges, forest paths etc.). Consistent with this, J. Payne (*in litt*., 2006) pointed out that while he once saw one Malay Weasel run across a road, he has never seen the species dead on a road, compared with frequent road-kill civets (Viverridae) and Sunda Stink Badgers *Mydaus javanicus*, and speculated that this may indicate a reluctance to cross roads. The several sightings of road-kills and of animals running across roads (Appendix 2) might seem to contest this, but this weasel's bright colour means that it is likely to be noticed and remarked upon, even by people with no particular interest in small carnivores. It is likely that had records of all small carnivores seen on roads been collated, Malay Weasels would have formed a very small proportion of the total.

A general elusiveness or low density is indicated by Harrison's (1969) wide-ranging mammal collections during 1947-1957. He used several methods including traps (many kinds) and shooting. Yet, in the 10 years of research, only one individual of *M. nudipes* was collected. Set against this, Hoogstraal *et al*. (1969) were able to check seven Malay Weasels during the Malayan Tick Survey, an average number by comparison with other small carnivores. There is no evidence for markedly higher earlier densities a century or so ago, when natural habitats in the weasel's range were far more extensive, human populations far lower, and hunting much less severe: when leafing through many of the early reports of mammal collection expeditions to Sundaland, the low proportion collecting Malay Weasel is striking by comparison with those securing other diurnal mustelids such as Yellow-throated Marten *Martes flavigula* and otters. There seem to be no large series of specimens, and the closest allusion to it being numerous may be Hose's (1893: 27) statement that the species "is very rare in the Baram district [Sarawak, Borneo]...but it is more common near Kuching, where Dr Haviland obtained several fine specimens". Even though, for example, Schneider (1905) caught the species at all his seven collecting sites on Sumatra, this was over a three-year survey (1897—1899) and hence is consistent with today's situation, where the species has been found in many, even most, sites with high survey effort, but never commonly. However, A. Greiser Johns (*in litt*., 2006) never found Malay Weasel in all the years he spent surveying and re-surveying the Sungei Tekam area (West Malaysia) and considers it one of the few mammal species genuinely absent there. Nothing, in habitat terms, obviously distinguishes Sungei Tekam (4°00´N, 102°35´E; see Johns 1986) from many other sites that do hold the weasel.

An adequate assessment of the species's real abundance, and variation in status across its geographic, altitudinal and habitat range, is not possible from a collation of incidental records. It would probably require targeted *Mustela* trapping. What is clear is that even intensive surveys using camera-trapping or direct observation which do not find the species should not conclude it absent.

Diel activity pattern

The preponderance of recent daytime observations of Malay Weasel, against only two by night (Appendix 2; a further report of nocturnal activity, from Danum valley in Ahmad [2001], is a tabular

coding which lacks detail of individual records and has been excluded from Appendix 2), may reflect nothing more than the concentration of field effort by day. Precise timings give no suggestion of a crepuscular pattern, with many records from the heat of the day. Further data are needed to determine whether the weasel is cathemeral or effectively diurnal. Payne *et al*. (1985) mentioned activity by both day and night, whereas Lekagul & McNeely (1977) opined that it is generally nocturnal; neither presented supporting data. There have been sufficient spot-lighting surveys at sites known to hold the species to conclude that it is not readily found by night: e.g. in Danum valley, Sabah (which provided several day-time records), M. J. Heydon (*in litt*. 1996) surveyed for hundreds of hours by night and recorded most species of nocturnal Bornean mammal that are identifiable in the field (including four species of cat) but saw no weasels. However, if Malay Weasel's eye-shine is only weak (we traced no information on this) and the animal is prone to move unobtrusively within vegetation (see above), it might be rather difficult to find by spot-lighting.

Group size

Nearly all Malay Weasels were seen singly, although C. R. Robson (*in litt*., 2006) saw two scurrying and chasing together (Appendix 2). This accords with the generally solitary nature of *Mustela*, as based mainly on studies of temperate species, proposed by Powell (1979). A reported sighting from Berau, East Kalimantan, of an adult and young Malay Weasel (Engström & Pamungkas, 2002) in fact refers to Yellow-throated Marten (L. Engström, *in litt*., 2006).

Microhabitat and behaviour

All sightings specifying microhabitat were on the floor or around ground-level objects such as logs and rocks. There is no suspicion that the species climbs; its morphology supports Medway's (1969) assumption that it is ground-living, in common with most or all congeners. Brongersma & Junge (1942) speculated that it might be semi-aquatic (as are the European Mink *M. lutreola* and American Mink *M. vison*), based on one seen beside a stream and another slain with a paddle as it swam across the Bruny tributary of the upper river Mahakam (Jentink, 1898; van Balen, 1914); Banks (1931, 1980) had similar musings. However, plenty of carnivores are encountered close to streams (including many modern records of this species: Appendix 2) because they may both hunt in stream-side habitats and drink water (as noted by C. Chin, *in litt*., 2005; Appendix 2), and time has lent no support to the suggestion that it might be semi-aquatic.

Most sightings have been of animals running across roads, forest trails or landslides, and hence too brief to illuminate behaviour. Banks (1949) described it as having an "eerie, silent, caterpillar-tractor gait, fast without loitering, and most conspicuous weaving it way from side to side in the jungle....". Foraging animals were noted as running on the ground, sometimes jumping onto old, fallen, logs (U. Treesucon, *in litt*., 2006, S. Myers, *in litt*., 2006), and rummaging in leaves below a tree (C. R. Robson, *in litt*., 2006). C. R. Robson (*in litt*., 2006) saw one animal disappear into a hole, while E. Lading (*in litt*., 2006) saw one emerge from a crack, and P. D. Round (*in litt*., 2006) saw one pop out of a space beneath a boulder and then nip back in again. One in Sumatra darted along a river bank and disappeared into a root-mass overhanging the river (J. Holden, *in litt*., 2006). In 1908, W. L Abbott shot one as it was trying to enter a "cave" (Lyon, 1911).

Hence, in its use of the habitat and behaviour, it seems to be a typical non-aquatic *Mustela*.

Threats

No threats specific to Malay Weasel are obvious. It does not seem to be taken into captivity as a pet or ratter (e.g. E. L. Bennett [*in litt*., 2006] visited many long-houses in Sarawak and never saw one). It was identified by villagers in the Malinau area of central Borneo as of minor medicinal use (Sheil *et al*., 2003), specifically, from Bulungan (the same region), with uses as: food; burning fur to exorcise ghosts; medicine for children; skin for hat; and trophy. Out of the 18 villages that were interviewed for this study, five reported use of the species by at least one informant's household during the past year (Puri, 2001). An animal collected by a Kenyah hunter with dogs and spears in East Kalimantan had the orange fur burned as medicinal exorcism of evil spirits. The meat was not eaten because of its foul odour (Puri, 1997).

It is doubtless caught as by-catch in snaring operations for quarry mammal species (see Holden, in press). Equally, it is reported to raid village chickens (Jentink, 1898; van Balen, 1914; Allen & Coolidge, 1940), but killing by farmers would be unlikely to drive population-level declines given the distribution of farmed chickens relative to the overall available habitat. Moreover, it enjoys in some areas a positive rural perception, e.g. around Kerinci-Seblat national park, villagers welcomed the species as a predator of crop-pest rats (Franklin & Wells, 2005).

There is no suggestion that it is strongly susceptible to forest degradation through logging and other forms of encroachment. Indeed, the several recent records from highly degraded, even sub-urban, areas (Appendix 2) suggest that the species may not even be tied to forest. It seems most unlikely to need primary forest (although more records are needed for conclusive demonstration of this; see above). Given that so much Sundaic forest conversion took place in the last two decades, some extinctions set in train by this change will not yet have occurred (see Tilman *et al*., 1994, Brooks *et al*., 1999). Hence, longer-term data will be needed for complete security over this species; but such a caveat could, and probably should, be applied to almost any Sundaic forest vertebrate. There are few data to tell whether Malay Weasel might persist in plantations of exotics or in other entirely deforested landscapes: it seems quite possible that it will inhabit oil palm estates, such plantations in Sumatra supporting very high densities of some rat species, and consequently their python predators (Shine *et al*., 1999). Malay Weasel eats even quite large rodents (e.g. Franklin & Wells, 2005), although its diet has not been studied; a grass lizard was recorded by Jentink (1898), and Medway (1969) considered it strictly carnivorous, perhaps by inference from congeners, and despite Banks's (1931) suggestion that it might eat a bit of fruit. Although it was not found in oil palm plantations by Duckett (1976), a lack of records cannot imply absence, for a species so rarely seen even in heavily surveyed areas (see above). Of more concern, Leopard Cats *Prionailurus bengalensis* in such habitat die from haemorrhaging through eating rats poisoned by Warfarin and other anti-coagulant baits (Duckett, 1976), and this would presumably affect other mammalian predators such as this weasel.

Conclusions

On the basis of the records collated, there is no evidence that Malay Weasel should be considered of elevated conservation concern. However, it remains poorly known ecologically, and further information (particularly on its use of the oil palm and rubber plantations that now cover so much of its range) would be useful to make a more informed assessment. However, this is not a specific priority among small carnivore conservation in South-East Asia. Overall,

the call in McDonald & King (2000) for "fundamental ecological studies to be undertaken on most mustelids, so that well-informed decisions may be taken by future managers" remains entirely appropriate for this species.

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Museum	Specimen number	Location	Co-ordinates + altitude	Date	Collector/Source	Reference	Other notes
THAILAND							
TISTR	54-1399	Ban Bang Non, Amphoe Muang, Ranong province	10°00´N, 98°40´E; foothills	26 May 1957 or a little earlier	Boonsong Lekagul	SW	Dense forest
BMNH	55.1595	Khao Chong, Trang province	7°35´N, 99°45´E	9 Dec 1909	H. C. Robinson?	H60; SM	
TISTR	54-1400	Pattani province	c. 6°52´N, 101°12´E	May 1955	Prayun Khananurak	SW	
WEST MALAYSIA							
BMNH	0.2.4.6	Perak	c. 5°N, 101°E	?	?	SM	
ZRC	4.1215	Perak	c. 5°N, 101°E	1935	Purchased from a Japanese taxidermist	BPYHL	
Not located	?	Larut, Perak	c. 4°48´N, 100°45´E	Before 1846	?	Flower, 1900	In 1900, in the Taiping museum, Perak, Malaysia
Not located	?	Kuala Kangsar, Perak	c. 4°45´N. 100°56´E	Before 1846	?	Flower, 1900	In 1900, in the Taiping museum, Malaysia
ZRC	4.1216	Fraser's Hill, Pahang	3°43´N, 101°45´E; 1,220 m	14 Jun 1932	S. Navaratram	BPYHL	
USNM	489385	Bukit Laggong forest reserve, Kepong, Selangor	3°14´N, 101°38´E	10 Dec 1960	Lim Boo Liat & I. Muul	SM	
USNM	489386	Bukit laggong forest reserve	3°14´N, 101°38´E	11 Jun 1969	Lim B. L. & I. Muul	SM	
BMNH	85.8.1.68	Klang, Selangor	3°02´N, 101°27´E	18 Apr 1879	W. Davison	Flower, 1900; H60; SM	
ZRC	4.1217	Golden Hope estate, Kajang, Selangor	2°59´N, 101°47´E	4 Apr 1916	E.W. Prior	BPYHL; SM	
ZMB	5472	Melaka	c. 2°24´N, 102°51´E	Not known	A. Meyer	R. Asher, *in litt.*	
BMNH	79.11.21.617	Melaka	c. 2°24´N, 102°51´E	?	T. Cantor	SM	
BMNH	71.4.10.1	Melaka	c. 2°24´N, 102°51´E	?	?	H60; SM	
BMNH	24.12.2.2	Triny?, Melaka	c. 2°24´N, 102°51´E	?	?	SM	
SUMATRA							
ZMA	5381	Serbodja (Serbodjadi), Deli	4°22´N, 97°44´E	19 Jun 1914	L. P. Cosquino de Bussy	B&J; SM	
Not located	?	Unter-Langkat	c. 4°00´N, 98°20´E	1897-1899	G. Schneider	S05	
ZMA	2055	Deli	c. 3°45´N, 98°41'E	1917	L. P. Cosq. de Bussy	B&J; SM	
ZMA	2056	Deli	c. 3°45´N, 98°41'E	1917	L. P. Cosq. de Bussy	B&J; SM	
ZMA	2057	Deli	c. 3°45´N, 98°41'E	1917	L. P. Cosq. de Bussy	B&J; SM	
ZMA	2058	Deli	c. 3°45´N, 98°41'E	1917	L. P. Cosq. de Bussy	B&J; SM	
RMNH	d (skeleton), e (skin)	Deli	c. 3°45´N, 98°41'E	8 Apr 1885	through B. Hagen	B&J; SM	
BMNH	99.11.13.2	Near Deli	c. 3°45´N, 98°41'E	?	?	SM	
Not located	?	Deli	c. 3°45´N, 98°41'E	1897-1899	G. Schneider	S05	
RMNH	1128; g (skin), g (skull)	Kampong Baru, near Medan, Deli	3°35´N, 98°40´E	Not known	through F. C. van Heurn	B&J; SM	Purchased from a local taxidermist on 12 Dec 1920
ZRC	4.1220	Timbang Serdang, NE Sumatra	3°35´N, 98°40´E	1935	M. Boogaarts	BPYHL; SM	

Museum	Specimen number	Location	Co-ordinates + altitude	Date	Collector/Source	Reference	Other notes
RMNH	a (skeleton), a (skin)	Tandung Morawa, Deli	3°33´N, 98°49´E	1882	through B. Hagen	B&J; SM	
ANSP	20233	Kutacane	3°30´N, 97°48´E; 200 m	1939	F. A. Ulmer	Miller, 1942	Obtained from locals
Not located	?	Bedagai river	3°30´N, 99°13´E	1897-1899	G. Schneider	S05; NJvS	
ZMA	5379	Assahan	c. 3°N, 99°E	1907	L. P. Cosq. de Bussy	V. Nijman, *in litt*.	
Not located	?	Danau Kota	0°25´N, 102°25´E	1897-1899	G. Schneider	S05	
Not located	?	Tanjung Butus	c.0°09S, 104°22E	1898	G. Schneider	S05; NJvS	
Not located	?	Japura	0°18´S, 102°20´E	1897-1899	G. Schneider	S05; NJvS	
AMNH	23089	Fort de Kock	0°19´S, 100°22´E	31 Mar 1904	?	SM	
BMNH	25.9.10.4	Fort de Kock	0°19´S, 100°22´E; 920 m	1 Sep 1925	E. Jacobson	H60; SM	
RMNH	1013; k	Fort de Kock, Agam, Padang highlands, West Sumatra	0°19´S, 100°22´E; 920 m	31 Jan 1918	E. Jacobson (coll. n° EJ397)	R&K; B&J; SM	
MZB	38	Padang Panjang	0°27´S, 100°25´E	1919	C. L van den Plas	Gono Semiadi	
Not located	?	Sungei Indragiri	c. 0°30´S, 103°30´E	1897-1899	G. Schneider	S05	
RMNH	991	Balum, Muara Labu, Padang highlands, West Sumatra	0°40´S, 100°57´E	Jul 1914	E. Jacobson (coll. n° 4379)	B&J; SM	
MZB	67	Padang Pariaman	0°45´S, 100°20´E	10 Apr 1921	Aziz Nasoetion	Gono Semiadi	
ZRC	4.1218	Mt Singgalang, Kotagadang, Padang highlands, W Sumatra	c. 0°55´S, 100°38´E; 1,000 m	1 Oct 1917	E. Jacobson (coll n° EJ385)	R&K; BPYHL	
ZRC	4.1219	Kotagadang	c. 0°55´S, 100°38´E; 920 m	Nov 1924	E. A. Jacobson	BPYHL	
Not located	?	Padang	c. 1°S, 102°E	1897-1899	G. Schneider	S05	
RMNH	4252, i (skin), i (skull)	Jambi, South Sumatra	1°30´S, 103°00´E	1936	J. T. Hamaker (coll n° 238/38)	Dammerman, 1940; B&J; SM	Via MZB (n° 3635); type of *M. hamakeri* Dammerman
BMNH	26.3.12.1	Lebong	2°59´S, 104°23´E	?	?	H60	
RMNH	33703	Lampong, South Sumatra	c.5°S, 105°E	1930?; <1942	Not known?	B&J; SM	ex-Sody Collection
ANSP	?	Lampong	c. 5°S, 105°E	Aug-Nov 1901	A. C. Harrison & H. M. Hiller	Stone & Rehn, 1902	
ZMB	64199	Telukbetung	5°27´S, 105°16´E	Not known	Schlüter	R. Asher, *in litt*.	
ZMB	64200	Telukbetung	5°27´S, 105°16´E	Not known	Schlüter	R. Asher, *in litt*.	
RMNH	33702	Telukbetung	5°27´S, 105°16´E	Nov 1924	von Zengen	B&J; SM	ex-Sody Collection
FMNH	268	Not known	Not known	Not known	Not known	MS	Ex Ward's Nat. Sci. Estab. (16961)
HNHM	?	Sumatra: no precise locality	Not known	1882	?	G. Csorba, *in litt*.	
HNHM	?	Sumatra: no precise locality	Not known	1882	?	G. Csorba, *in litt*.	
IRSNB	3603	Sumatra: no precise locality	Not known	before 1942	Rookmaker	G. Lengles, *in litt*.	
ZMA	15791	Sinkara	Not traced	Unknown	Ross	V. Nijman, *in litt*.	
USNM	267386	Adji (perhaps Aceh?)	Not known	Not known	Not known	SM	
NRM	A584655	Sumatra: no precise locality	Not known	Not known	Not known	JWD	Ex Uni. Stockholm Zool. Inst. (n° Z 4655)
NRM	A580149	Telukbetung	5°27´N, 105°16´E *or* 1°23´N, 100°36´E	Not known	Schlüter, a dealer	JWD	

Museum	Specimen number	Location	Co-ordinates + altitude	Date	Collector/Source	Reference	Other notes
BORNEO: MALAYSIA							
USNM	301102	Tenompok, Mt Kinabalu, Sabah	6°05′N, 116°33′E	1 Sep 1935	R. Traub	SM	
Not located	?	Kiau, Sabah?	6°02′N, 116°29′E?	?	?	A&C	See note 1
MCZ	36577	Mt Kinabalu, Sabah	6°00′N, 116°30′E	1 Jul 1937	J. Griswold	A&C	Via Vienna Museum
SMKK	NH 1226	Kg. Muruk, Ranau, Sabah	c. 5°55′N, 116°45′E	6 Feb 1971	?	JM	
SMKK	NH 1222	Kg. Lebodon, Tuaran, Sabah	5°51′N, 116°20′E	18 Jun 1971	?	JM	
SMKK	NH 1223	Kg. Lebodon, Tuaran	5°51′N, 116°20′E	25 Oct 1971	?	JM	
SMKK	NH 1224	Kg. Lebodon, Tuaran	5°51′N, 116°20′E	25 Oct 1971	?	JM	
SMKK	NH 1225	Kg. Lebodon, Tuaran	5°51′N, 116°20′E	25 Oct 1971	?	JM	
SMKK	NH 1218	Kg. Togudon, Penampang, Sabah	c. 5°51′N, 116°20′E	16 Oct 1971	?	JM	
SMKK	NH 1219	Kg. Togudon, Penampang	c. 5°51′N, 116°20′E	17 Dec 1971	?	JM	
SMKK	NH 1220	Kg. Togudon, Penampang	c. 5°51′N, 116°20′E	17 Dec 1971	?	JM	
SMKK	NH 1221	Kg. Togudon, Penampang	c. 5°51′N, 116°20′E	17 Dec 1971	?	JM	
SMKK	NH 1228	Penampang district, Sabah	c. 5°51′N, 116°20′E	17 Aug 1969	?	JM	
ZRC	4.1223	Betotan, Sabah	5°47′N, 117°52′E	4 Aug 1927	C. B. Kloss & F. N. Chasen	Chasen & Kloss, 1931; Davis, 1962; BPYHL	From “heavy forest”
SMKK	NH 1227	Mawao, Membakut	5°25′45″N, 115°47′15″E	7 Dec 1971	?	JM	
BMNH	99.12.9.28	Baram, Sarawak	c. 4°36′N, 113°59′E	15 Jun 1898	C. Hose	H60; SM	
MCZ	36719	Kalabakan river, Sabah	4°25′N, 117°29′E	6 Jul 1937	H. G. Deignan	A&C	Via Vienna Museum
Not located	?	Kalabakan river, Sabah	4°25′N, 117°29′E	1959	R. F. Inger	Davis, 1962; NJvS	
Not located	?	Sibuti river, Sarawak	c. 4°00′N, 113°43′E	before 1894	E. Cox	Hose, 1893; NJvS	
IRSNB	17261	Bario, Sarawak	3°45′N, 115°27′E	13 Oct 1971	King Léopold III & Gosse	G. Lengles, *in litt*.	
FMNH	88288	Bario, Sarawak	3°45′N, 115°27′E; 1,200 m	2 Nov 1947	T. Harrisson	Davis, 1958; MS	
FMNH	88289	Bario, Sarawak	3°45′N, 115°27′E; 1,200 m	12 Nov 1947	T. Harrisson	Davis, 1958; MS	
FMNH	88290	Pa Umor, Kelabit uplands, Sarawak	3°44′N, 115°31′E; 1,050 m	1 Jul 1948	T. Harrisson	Davis, 1958; MS; SM	
Not located	?	Pa Mein, Kelabit uplands, Sarawak	3°38′N, 115°31′E; 930 m	31 Nov (*sic*) 1922	E. Mjöberg?	Lönnberg & Mjöberg, 1925	
SMK	0170/9	Pa Mada, Kelabit uplands, Sarawak	3°35’N, 115°32’E	14 Mar 1970	Unknown	K&YN	
FMNH	88292	Pa Mada	3°35′N, 115°32′E; 1,120 m	1945-1949	T. Harrisson	Davis 1958; MS	
FMNH	88291	Pa Mada	3°35′N, 115°32′E; 975 m	1945-1949	T. Harrisson	Davis, 1958; MS	
SMK	0170/2	Gunung Dulit, Sarawak	3°15’N, 114°15’E	Oct 1891	C. Hose	K&YN	
Not located	?	Gunung Kalulong, Baram, Sarawak	3°14′N, 114°39′E	before 1894	C. Hose	Hose, 1893	Probably SMK 0170/2; Hose (1893) does not list Gn Dulit
SMK	0170/5	Lundu, Sarawak	1°45’N, 109°45’E	2 Aug 1924	Museum collector	K&YN	
FMNH	88607	Buya, 3rd division, Sarawak	1°43′N, 111°48′E	2 Nov 1955	T. Chavasse	MS; SM	

Museum	Specimen number	Location	Co-ordinates + altitude	Date	Collector/Source	Reference	Other notes
BMNH	55.738	Anyut Paku, Saribas, Sarawak	1°33´N, 111°13´E	19 Jul 1916	H. C Robinson	H60; SM	
Not located	?	Kuching, Sarawak	1°33´N, 110°20´E	Before 1894	Dr Haviland	Hose, 1893; NJvS	Several specimens
MCZ	36747	Kuching	1°33´N, 110°20´E	22 Feb 1904	L. Fook Chong	A&C	Via Vienna Museum
SMK	0170/1	Kuching	1°33´N, 110°20´E	2 May 1900	Unknown	K&YN	Purchased
SMK	0170/7	Kuching	1°33´N, 110°20´E	16 Jun 1900	Unknown	K&YN	Purchased
SMK	0170/8	Sungei Sadong, Sarawak	1°33'N, 110°45'E	'26 May 1958'	'E. Mjöberg'	K&YN	Date or collector in error
BMNH	55.740	Sungei Pelandok, Paku, Saribas, Sarawak	1°30´N, 111°30´E	1 Apr 1917	H. C Robinson	H60; SM	
SMK	0170/3	Mile 10, Penrissen, Kuching	1°25'N, 110°15'E	24 Apr 1896	Museum collector	K&YN	
SMK	0170/6	Gunung Penrissen, Sarawak	1°20'N, 110°15'E; 1,070 m	17 Feb 1924	E. Mjöberg	K&YN; Medway, 1977	
ZRC	4.1221	Bukar, Samarahan, Sarawak	1°16´N, 110°27´E	2 Nov 1919	Not known	BPYHL; SM	
Apparently lost	Not assigned	Sungei Sebangan region, Sarawak	1°15-35´N, 110°45´-111°00'E	1890-1893	F. S. Bourns	Timm & Birney, 1980	Referred to in field catalogue
BMNH	55.739	Entawa, Samarahan, Sarawak	1°07´N, 111°32´E	21 Nov 1919	H. C Robinson	H60; SM	
SMK	0170/4	Nadai Rikut, State unknown	Not located	6 Jun 1969	Not known	K&YN	
MSNG	2836	Unknown locality, Sarawak	Not known	1865	O. Beccari, G. Doria	G. Doria, *in litt*.	
MSNG	2838	Unknown locality, Sarawak	Not known	1865	O. Beccari, G. Doria	G. Doria, *in litt*.	
SMK	0170/10	4th division, Sarawak	Not known	Not known	Not known	K&YN	
BORNEO: KALIMANTAN							
RMNH	d (skin), c (skull)	Pontianak	0°02´S, 109°20´E	19th century	P. Diard	B&J	
RMNH	N 119; e	Dingai, East Kalimantan	0°35´S, 117°17´E	14 Dec 1896	A. W. Nieuwenhuis (coll n° 119)	Jentink, 1898; B&J; SM	In Bruny river (Long Bloeh), upper Mahakam river
AMNH	106065	Riam (Kotawaringin), Central Kalimantan	2°29´S, 111°25´E	27 Nov 1935	J. J. Menden	SM	
USNM	151878	Cantung (=Tjantung), South Kalimantan	3°03´S, 115°58´E	31 Jan 1908	W. L. Abbott	Lyon, 1911; SM	
RMNH	c (skin), f (skull)	Banjarmasin, South Kalimantan	3°20´S, 114°36´E	1845	C. A. L. M. Schwaner	B&J	
RMNH	b (skin), b (skull)	Banjarmasin	3°20´S, 114°36´E	Not known	C. A. L. M. Schwaner	B&J; NJvS	
BORNEO: unknown							
IRSNB	1704	Not known	Not known	by 1832	Henrici	G. Lengles, *in litt*.	
IRSNB	1704b	Not known	Not known	by 1832	Henrici	G. Lengles, *in litt*.	
ZMB	4575	Not known	Not known	Not known	Gerrard	R. Asher, *in litt*.	
USNM	269062	Not known	Not known	1937?	Not known	Miller, 1942?	Possibly Borneo or Sumatra
ZRC	4.1224	Unknown locality, Sabah	Not known	Not known	Not known	BPYHL	

Museum	Specimen number	Location	Co-ordinates + altitude	Date	Collector/Source	Reference	Other notes
SMTD	B16847	Not known	Not known	before 1900	Not known	C. Stefan, *in litt.*	Ex. Leipzig Uni. zool. coll.
Unknown locality							
MNHN	Skin: CG 2001-355; skull A 1948 [I-1106]	Not known, once stated to be Java; see text	Not known	May 1821	P. Diard	Desmarest, 1822; G. Veron, *in litt.*; SM	Type of *Mustela nudipes*
BMNH	46.3.5.4	Not known ("Java" on label)	Not known	Before 1865	via Leadbeaters dealers	H60; SM	Perhaps the basis for Gray's (1865) un-named Var.
UWBM	Skull 14709; skin 14722	'Dutch East Indies'	Not known	1930 or earlier	Lex Weygers	J. Bradley, *in litt.*	Believed to be from one animal
ZRC	4.1222	Unknown locality	Not known	Not known	Mr Loong Tak	BPYHL	
MVZ	109781	Purchased in Luzon, collection locality unknown	Not known	Purchased on 1 Jan 1945	C. G. Sibley (purchaser)	C. Conroy, *in litt.*	
MNHN	CG 1838-486	Stated to be Java or Borneo	Not known	1836-1837	Expedition La Bonite	G. Veron, *in litt.*	
BMNH	Skull 58.5.4.86; skin 55.12.24.217	Not known	Not known	Before 1865	Not known	Gray, 1865; H60; SM	Type of *Gymnopus leucocephalus*

An unclear association between published data or comments and a museum specimen is indicated in the relevant columns by a '?' sign.

Where data are believed not to exist, a cell contains "not known"; where they may exist, the cell contains a '?' sign.

Individual notes

1, Text mentions specimen from 'Kiau' but (as taken by Medway 1977) perhaps this is an error for 'Kina[balu]', as specimen is not otherwise mentioned and is not in MCZ.

Reference codes:

A&C, Allen & Coolidge, 1940; B&J, Brongersma & Junge, 1942; BPYH, B. P. Y.-H. Lee, personal examination; H60, Hill, 1960; JM, J. Majuakim, *in litt*., 2006: JWD, J. W. Duckworth personal examination; K&YN, Kool & Yakup Nawi, 2005; MS, M. Schulenberg, *in litt*., 2006; R&K, Robinson & Kloss, 1919; S05, Schneider, 1905; SM, S. Meiri personal examination; SW, S. Waengsothorn, *in litt*., 2006.

Museum acronyms:

AMNH, American Museum of Natural History, New York, U.S.A.; **ANSP**, Academy of Natural Sciences, Philadelphia, U.S.A.; **BMNH**, Natural History Museum, South Kensington, London; **FMNH**, Field Museum, Chicago, U.S.A.; **HNHM**, Magyar Neinzeti Muzeum / Hungarian Natural History Museum, Budapest; **IRSNB**, Institut Royal des Sciences Naturels, Brussels, Belgium; **MCZ**, Museum of Comparative Zoology, Harvard University, Cambridge, U.S.A.; **MVZ**, Museum of Vertebrate Zoology, Berkeley, California, U.S.A.; **MZB**, Museum Zoologica Bogoriensis, Bogor, Indonesia; **MNHN**, Muséum Nationale d'Histoire Naturelle, Paris; **MSNG**, Museo Civico di Storia Naturale "G. Doria", Genova (Genoa) Italy; **NRM**, Naturhistoriska Riksmuseet, Stockholm; **RMNH**, Rijksmuseum voor Natuurlijke Historie (National Museum of Natural History 'Naturalis'), Leiden, Netherlands; **SMKK**, Sabah Museum, Kota Kinabalu, Sabah, Malaysia; **SMK**, Sarawak Museum, Kuching, Sarawak, Malaysia; **SMTD**, Staatliches Museum für Tierkunde, Dresden, Germany; **TISTR**, Thailand Institute of Scientific and Technological Research, Bangkok; **USNM**, National Museum of Natural History, United States National Museum, Smithsonian Institution, Washington D.C.; **UWBM**, Burke Museum of Natural History and Culture, University of Washington, U.S.A.; **ZMA**, Zoologisch Museum, Universiteit van Amsterdam, Netherlands; **ZMB**, Museum für Naturkunde, Humboldt Universität zu Berlin; **ZRC**, Zoological Reference Collection, Raffles Museum for Biodiversity Research, Singapore.

Location	Co-ordinates + altitude	Habitat	Date(s)	Time of day	Observer, reference	Other notes
THAILAND						
Khlong Saeng WS, Surat Thani province	9°11´N, 98°39´E; lowland	Evergreen forest, near a stream	1999-2000	Daytime	B. Kanchansaka	One seen
Khao Sok NP, Surat Thani province	8°55´N, 98°38´E; 500 m	Tall forest, on a steep ridge-top	17 May 2004	Mid-morning	C. Davies	One seen in spiny palm understorey
Klong Thom, Khao Phra Bang Khram WS, Krabi province	7°50´N, 99°22´E; 80 m	40-50 year secondary forest, 1.5 km from primary evergreen forest	1991-1993	Daytime, before noon	Uthai Treesucon	2-3 single animals seen
Khao Phra Bang Khram WS	7°50´N, 99°22´E; c.100 m	Secondary monsoon evergreen forest	2003-2004	07h30	J. W. K. Parr	One seen
Budo, Narathiwat province	6°30´N, 101°38´E; c. 550 m	Mature hill-slope forest	13 July 2003	Daytime	P. D. Round	One seen
Charoen Pra Kiet WS, Narathiwat province	6°16´N, 101°53´E; lowland	Peat-swamp forest	1996	n/a	per B. Kanchansaka	One live-trapped
Hala Bala WS, Narathiwat province	5°55´N, 101°48´E; unknown	Evergreen forest	2004	n/a	per B. Kanchansaka	One live-trapped
WEST MALAYSIA						
Between Jeli (Kelantan) and Gerik (Perak)	c. 5°35´N, 101°30´E; not known	Trunk road through hill dipterocarp forest	4 Mar 2005	11h00	Ahmad Zafir Abdul Wahab	One seen, trying to cross the trunk road
Pergau, Kelantan	c. 5°27´N, 101°55´E; c. 200 m	Logged lowland dipterocarp forest on foothill slopes	Oct 1986	Daytime	G. W. H. Davison	One seen, crossing a logging trail
Merapoh, Taman Negara NP (western border)	4°41´00˝N, 102°03´50˝E; 150 m	Ecotone (hard) of primary lowland rainforest with oil palm plantation	1999	c. 15h00	K. Kawanishi	One on the ground in a brushy / grassy area; no canopy cover
Kuala Tahan, Taman Negara NP	4°23´N, 102°24´E; within 150-300 m	Primary lowland dipterocarp forest	within 1956-1973	n/a	Lim & Saharudin, 1990	One trapped
Fraser's Hill, Pahang	3°43´N, 101°45´E; c. 900 m	Road through hill forest	late Jul 2002	Daytime	C. R. Robson	Two animals, scurrying around by the roadside; oblivious to people
Fraser's Hill	3°43´N, 101°45´E; 1,250 m	Ridge-crest lower montane forest	1970s	Unknown	D. R. Wells	One seen
Krau WR, Pahang	3°43´N, 102°10´E; unknown	In or near little-disturbed dipterocarp forest	within 1990-1995	Unknown	Sahir & Lim, 2000	Cites DWNP (1995); no detail
Near Bukit Bangkong, south Pahang	3°30´N, 103°22´E; c. 10 m	Sandy, very degraded edge of peat-swamp forest	2003 or 2004	Broad daylight	G. Larke	One ran across a logging trail
Bukit Kutu WR, Selangor	3°27´N, 101°41´E; within 250-1,050 m	Primary lowland or hill dipterocarp forest	1975	n/a	Lim *et al.*, 1999a	One trapped
Upayapadu Concession, Pahang	3°26´50˝N, 102°18´32˝E	In or near peat-swamp forest	Feb 2004	Unknown	Per A. Greiser Johns	Sole record in extensive surveys of peat-swamp forests over four years (UNDP-GEF/FRIM 2004)
Tasek Chini NR, Pahang	3°25´N, 102°56´E; <75 m	Disturbed forest scattered with orchards, old rubber plantations and abandoned cultivation; some tall trees	1993 or 1994	n/a	Lim *et al.*, 1999b	One skull found
Genting highlands, Pahang	3°23´N, 101°47´E; c.1,000 m	Upper hill dipterocarp forest	May 1999	n/a	Lim & Chai, 2002	One trapped
Old Gombak road, c. 12 km north of Gombak, Genting highlands	3°21´N, 101°49´E; c. 300 m	Roadside vegetation adjoining secondary hill forest	May 1980	c. 10h00	A. Greiser Johns	One seen

Location	Co-ordinates + altitude	Habitat	Date(s)	Time of day	Observer, reference	Other notes
Highway 68, c. 12 km from Gombak	3°21´N, 101°50´E; c. 200 m	Disturbed hill forest	Apr 1987	n/a	A. Greiser Johns	Road-kill
Templar Park, Selangor	3°14´N, 101°39´E; <250 m	Patchy forest	16 Jan 1980	Daytime	C. R. Robson	One seen foraging.
Pasoh forest reserve, Negri Sembilan	2°59´N, 102°17´E; 75-150 m	A 6 sq. km isolate of virgin lowland dipterocarp forest, abutting c. 14 sq. km of forest selectively logged in 1955-56	within 1981-1987	Unknown	Kemper, 1988	Field sighting(s)
Pasoh forest reserve	2°59´N, 102°17´E; 75-150 m	As above	within 1968-1974	n/a	Lim *et al.*, 2003	One caught in a banana- baited wire-mesh live-trap
10 km from Pasoh forest reserve	c. 2°59´N, 102°17´E; lowlands	Oil palm and remnant forest patches	c. 1996	n/a	K. D. Bishop	Fresh road-kill
Rompin, Pahang	c. 2°49´N, 103°29´E; <100 m	Logged lowland forest in gently undulating terrain	Feb 1990	Daytime	G. W. H. Davison	One seen crossing a logging trail
South of Tanjung Agas, Negri Sembilan	2°20´N, 101°59'E; sea-level	Freshwater swamp forest	Mar or Apr 1986	03h00	J. Howes	One seen along the coastal road
SUMATRA						
Ketambe	3°48´N, 97°32´E; c.350 m	Primary dipterocarp forest	1973	Late afternoon	Rijksen, 1978; H. D. Rijksen	One seen beside the river
River Bohorok, 10 km upstream of Bukit Lawang, Gunung Leuser NP	3°34´N, 98°05´E; c.100 m	Steep-sloped primary dipterocarp forest	10 Mar 2005	11h00	E. Pollard	One ran across a landslide
Sinabung	3°10´N, 98°24´E; unknown	Grassy, rugged terrain; distance to forest unclear	1971	n/a	H. D. Rijksen	Roadkill
Karo highlands	3°00´N, 98°25´E; c. 900 m	Unknown	1970s	Daytime	N. J. van Strien	At least one sighting crossing a road
Near Bukittinggi, west Sumatra	c. 0°19´S, 100°22´E; 900 m	Urban	Within 1996-2005	n/a	Holden, in press; J. Holden	Road-kill; 5 km from the nearest patch of 'forest'
Tandai, Kerinci Seblat NP	1°32´S, 101°21´E; 700 m	Old logged forest	1995	Mid-morning	Holden, in press; J. Holden	One beside a river bank
Gunung Tujuh, Kerinci Seblat NP	1°40´S, 101°25´E; 1,300 m	Montane scrub	May 1997	Mid-afternoon	Holden, in press; J. Holden	One seen
Tapan valley, Kerinci Seblat NP	2°06´S, 101°08´E; 150 m	Primary forest	Jan 1996	Mid-morning	Holden, in press; J. Holden	One seen
Kerinci Seblat NP (South Sumatra section).	2°57´S, 102°24´E; 800 m	Primary hill forest	25 Apr 1994	17h50	Franklin & Wells, 2005; N. Franklin	One beside a small, fast, river
Kerinci Seblat NP	2°27´S, 102°08´E; 380 m	Mix of rainforest and overgrown rubber plantation	12 Apr 1994	17h30	Franklin & Wells, 2005; N. Franklin	One darted along a river bank
Way Canguk RS, Bukit Barisan Selatan NP, Lampung province	5°39´32˝S, 104°24´21˝E; <100 m	Degraded primary rainforest	17 Mar 2000	Mid-morning	S. Hedges	One, apparently foraging
BORNEO: MALAYSIA						
Kampong Monggis or Kampong Tumbalang, Sabah	6°13´N, 116°45´E or 6°08´N, 116°53´E; 700 m	Logged forest (c.25-30 previously)	Within 2002-2004	Daylight	K. Wells	One seen

Location	Co-ordinates + altitude	Habitat	Date(s)	Time of day	Observer, reference	Other notes
Tuaran, Sabah	6°11´N, 116°14´E; 150 m	Not recorded	25 Dec 2004	n/a	S. Yasuma	Roadkill
Kinabalu park, Sabah	6°11´N, 116°40´E; 1,600 m	Montane forest	7 Jun 2001	Daylight?	D. Massie	One seen by tourist cabins
Kinabalu park	6°11´N, 116°40´E; 1,600 m	Small gully by entrance road	29 Feb 2000	10h00	S. Myers	One seen by park hostel
Kinabalu park	6°11´N, 116°40´E; 1,550 m	Emerged from a thicket and crossed a car-park	19 Mar 2000	Daylight	H. S. Moeller	One near Park headquarters
Silau-Silau trail, Kinabalu park	6°11´N, 116°40´E; 1,500 m	Streamside gulley	19 Mar 2005	11h00	D. Hoddinott	One seen
Kinabalu park	6°05´N, 116°31´E; c. 1,700 m	Montane forest	Nov 1996	10h00	K. D. Bishop	One seen eating a large skink
Kinabalu park	6°05´N, 116°35´E; 1,370 m	Primary montane forest edge	4 Jun 1997	12h30	K. D. Bishop	One ran across the Kota Kinabalu road, near Mt Kinabalu entrance
Poring Hot Springs, Sabah	6°03´N, 116°42´E; 700 m	Primary forest	16 Mar 1996	c.08h00	T. Carlberg	One crossed a forest trail
Poring Hot Springs	6°03´N, 116°42´E; 700 m	Primary forest	Within 2001-2003	Daylight	K. Wells	One seen
Poring Low, Sabah	6°03´N, 116°42´E; c.700 m	Mature forest dominated by tall dipterocarps	No details	No details	Emmons, 2000	No details
Ranau, Sabah	5°55´N, 116°45´E; 700 m	Not recorded	28 Dec 1999	n/a	S. Yasuma	Roadkill
Sukau, lower Kinabatangan, Sabah	5°30´N, 118°30´E; 0-100 m	Inundated riverine forest to logged-over lowland dipterocarp forest	Jan 1990—Dec 1991	Daylight	R. Boonratana; Boonratana & Sharma, 1997	Several sightings of singles
Tabin WR (western border), Sabah	5°12´N, 118°37´E; c.500 m	Between mixed dipterocarp forest (c.25 years post- selective logging) and a large 15-year-old oil palm plantation	early 2000	07h00	H. Bernard	One crossed a dirt road, near human habitation
Ulu Segama forest reserve, Danum valley, Sabah	5°00´21˝N, 117°50´11˝E; 290 m	Selectively logged forest (in 1989); regenerating well; with *Macaranga hypoleuca* stands	15 Aug 2000	07h23	Siew Te Wong	Camera-trapped (two photos of one animal)
Danum valley, Sabah	4°57´N, 117°48´E; c. 250 m	Old-growth forest	c. Dec 2004	Unknown	K. Wells	One seen
Danum valley	4°57´N, 117°48´E; lowlands	Not specified	No details	No details	Emmons, 2000	No details
Danum valley	4°57´N, 117°48´E; 150 m	Primary tall dipterocarp forest, slightly hilly terrain	28 Jul 2005	06h00	K. D. Bishop	One ran across the Hornbill Trail, Borneo Rainforest Lodge
Bakapit, Sabah	4°57´07˝N, 118°34´46˝E; not known	Logged forest	1982	Daytime	J. Payne	One seen running across a logging road
Agathis camp, Maliau Basin conservation area, Sabah	4°44´40˝N, 116°58´34˝E; 210 m	Logged forest. c. 200 m from primary forest	Jun—Aug 2000	Late afternoon	Juul-Nielsen, 2000; H. Juul	One seen
Ulu Melinau, Gunung Mulu NP, Sarawak	4°08´N, 114°55´E; 50 m	Lowland riparian mixed dipterocarp forest; not disturbed since before 1890	1988	Daytime	M. Meredith	One seen
Near the Sarawak Chamber, Gunung Mulu NP	4°06´N, 114°53´E; 150 m	Primary mixed dipterocarp forest on Mulu Formation shale and sandstone	27 Dec 1991	Mid morning	H. Hazebroek	One by a 1 m diameter fallen bough
Pulong Tau NP, Bario, Sarawak	3°47´N, 115°26´E; 1,380 m	Mixed dipterocarp forest	27 Jul 2005	09h35	Engkamat Lading	One jumped from a hole in a slope into streamside bushes
Long Lellang water catchment, Baram, Sarawak	3°42´N, 115°13´E; c.1,400 m	Primary mixed dipterocarp forest; c.1.5 hrs' trek from the nearest hill padi farm	2003	10h30	C. Chin	One went to stream, drank, saw the observer, and fled

Location	Co-ordinates + altitude	Habitat	Date(s)	Time of day	Observer, reference	Other notes
Sebuloh area, upper Baram, Sarawak	3°25´N, 115°11´E; 600 m	Hill dipterocarp forest, unlogged, some old swidden	30 Oct 2004	Daytime	per. M. Meredith	One seen by Ms Norhayani Jalaweh
Sarawak Planted Forests, Tubau, Bintulu Division, Sarawak	2°55´43˝N, 113°05´14˝E; <500 m	Acacia plantation (3-4 yr) adjacent to natural forest	2005	19h14 (still daylight)	B. Giman	One ran across skid road
Sarawak Planted Forests	2°55´30˝N, 113°03´00˝E; <500 m	Acacia plantation (7 yr) adjacent to natural forest	2005	Daytime	B. Giman	One ran across skid road
Bukit Sarang conservation area, Sarawak	2°39´15˝N, 113°03´12˝E; <500 m	Mosaic of limestone, peat-swamp and riverine forest	2005	Daytime	B. Giman	One along river bank
Samunsam WS, Sarawak	1°56´N, 109°36´E; 0-25 m	Primary lowland tropical forest with some very old regenerated agriculture	1984-1986	Daytime	E. L. Bennett	Various field sightings; ~no night-searching
Near Kapit, Sarawak	1°39´N, 113°24´E; 250-380 m	Hill mixed dipterocarp forest, selectively logged four years previously	During Sep-Nov 1991	Unknown	Dahaban *et al.*, 1996	One seen
Kuching, Sarawak	1°33´N, 110°20´E; lowlands	Suburban; adjacent to a <50 ha forest patch	2005	n/a	M. Gumal	Road-kill. No extensive forest within 15 km
Near Universiti Teknologi MARA, at Jalan Meranek, Kota Samarahan, Sarawak	1°26´45˝N, 110°26´31˝E; <150 m	Disturbed ?tropical heath forest; clearings and settlements along the road	10 Jan 2005	11h00	J. Hon	One crossed a road
Sebarik area, Ulu Jengin, Batang Ai, Sarawak	1°17´N, 112°11´E; 200 m	Old secondary (swidden >30 yrs previously) hill dipterocarp forest	6 Aug 1992	Daytime	Kaya Lajan per. M. Meredith	Sole sighting in 335 km of transects (Meredith, 1995)
BORNEO: BRUNEI						
Tanajor, c. 20 km south of Sungei Liang, Serian	c. 4°32'N, 114°30'E; c. 100 m	Secondary fringe to primary forest	c. 9 Aug 1997	n/a	H. Juul	Road-kill; now a skin and skeleton in Brunei Forestry Museum
Sungei Melunchor, Tasek Merimbun, Tutong district	4°35´N, 114°41´E; not recorded	Not recorded	29 Jun 2002	n/a	M. Yasuda; Hj Bahrin Hj Bolhassan	Single, cage-trapped (oil palm bait); skin in Brunei Museum
BORNEO: KALIMANTAN						
Krayan, northern Kayan Mentarang NP, East Kalimantan	4°06´36˝N, 115°48´00˝E; c. 850 m	Old secondary lower montane forest	Within 1995-2005	Unknown	S. Wulffraat	Field sighting
Bulungan RS, East Kalimantan	3°00´N, 116°10´E; 200 m	Lowland dipterocarp forest	Sep or Oct 1998	Daytime	Hedges & Dwiyahreni, 1998	Field sighting of one animal
Lalut Birai RS, Kayan Mentarang NP, East Kalimantan	2°52´35˝N, 115°49´10˝E; 500-550 m	Lower mountain ridges with hill dipterocarp forest	1997 & 2002	Dusk (all records)	Wulffraat *et al.*, 2006; S. Wulffraat	Three singles seen (twice in 1997) in eight years of research
Lurah River [a tributary of the Bahau River], Kayan Mentarang NP	2°41´N, 115°41´E; 650-700 m	Hill dipterocarp forest	Within 1995-2005	Not recorded	S. Wulffraat	One seen
Long Peliran, on a tributary of the Bahau River, East Kalimantan	2°31´12˝N, 115°14´38˝E; c. 250 m	Secondary forest behind village	1990	n/a	Puri, 1997	Hunted animal, seen in village

Location	Co-ordinates + altitude	Habitat	Date(s)	Time of day	Observer, reference	Other notes
Km 44, Berau—Samarinda, East Kalimantan	1°53´N, 117°23´E; not recorded	Logged-over forest	Apr 2005	Once each, daylight and darkness	Djoko Susatmoko	Two singles seen, crossing a major dirt road (Trans-Kalimantan highway)
PT Limbang Ganeca, East Kalimantan.	0°12´N, 115°57´E; <200 m	Logged over forest (logged 4-6 years previously)	17 Aug 1998	c.08h00	C. Gönner	One seen by Nunuk Kasyanto
Bukit Soeharto, East Kalimantan	1°02´S, 117°02´E; 100 m	Degraded lowland forest	18 Oct 1990	n/a	S. Yasuma	Roadkill, c. 45 km from Balikpapan, on the highway to Samarinda
Bukit Soeharto	1°02´S, 117°02´E; 100 m	Degraded lowland forest	1990s	n/a	S. Yasuma	Field sighting, c. 50 km from Balikpapan, on the highway to Samarinda
Sungai Wain protection forest, East Kalimantan	1°06´05˝S, 116°49´32˝E; c.120 m	Small block of good-quality lowland dipterocarp forest	7 Dec 2002	Early evening	per G. Fredriksson	Sole sighting in 5+ yrs' fieldwork; identification provisional
Cabang Panti RS, Gunung Palung NP, West Kalimantan	1°08´S, 110°47´E; lowlands	Typically alluvial and sandstone forest near rivers	1980s—1990s	Daytime	Blundell, 1996; L. Curran	Several singles seen, most along Air Puteh
Sungai Sebangau catchment, Central Kalimantan	2°19´S, 113°54´E; sea-level	Selectively logged (<10yrs) peat swamp forest	Jul or Aug 2002; Sep 2004	Unknown	S. Husson; Page *et al.*, 1997.	Two singles seen

Abbreviations in site names:
NP = national park; NR = nature reserve; RS = research station; WR = wildlife reserve; WS = wildlife sanctuary.
Payne *et al.* (1985) also listed a locality of Sandakan, Sabah (5°45´N, 118°00´E), perhaps a recent field record; no specimen has been traced from the site.

Taxonomic remarks on two poorly known South-east Asian weasels (Mustelidae, *Mustela*)

Alexei V. ABRAMOV

Mustela is the largest genus in the family Mustelidae. Species of *Mustela* inhabit most of the world, including Europe, North Africa, Asia, North and South America, and, by human introduction, New Zealand. The genus *Mustela* has been treated by different authors as containing 14-17 species (Corbet, 1978; Corbet & Hill, 1980, 1992; Wozencraft, 1993; Macdonald, 2001). In my opinion (Abramov, 2000) this genus contains 17 species: *erminea*, *frenata*, *nivalis*, *subpalmata*, *altaica*, *kathiah*, *lutreola*, *putorius*, *eversmanii*, *nigripes*, *sibirica*, *itatsi*, *lutreolina*, *africana*, *felipei*, *nudipes*, *strigidorsa*. The American Mink I regard as in a distinct monotypic genus: *Neovison vison* (see Abramov, 2000).

As well as well-known and well-examined Palaearctic species such as *M. erminea*, and *M. putorius*, the genus *Mustela* includes some enigmatic and controversial forms, including two from South-East Asia.

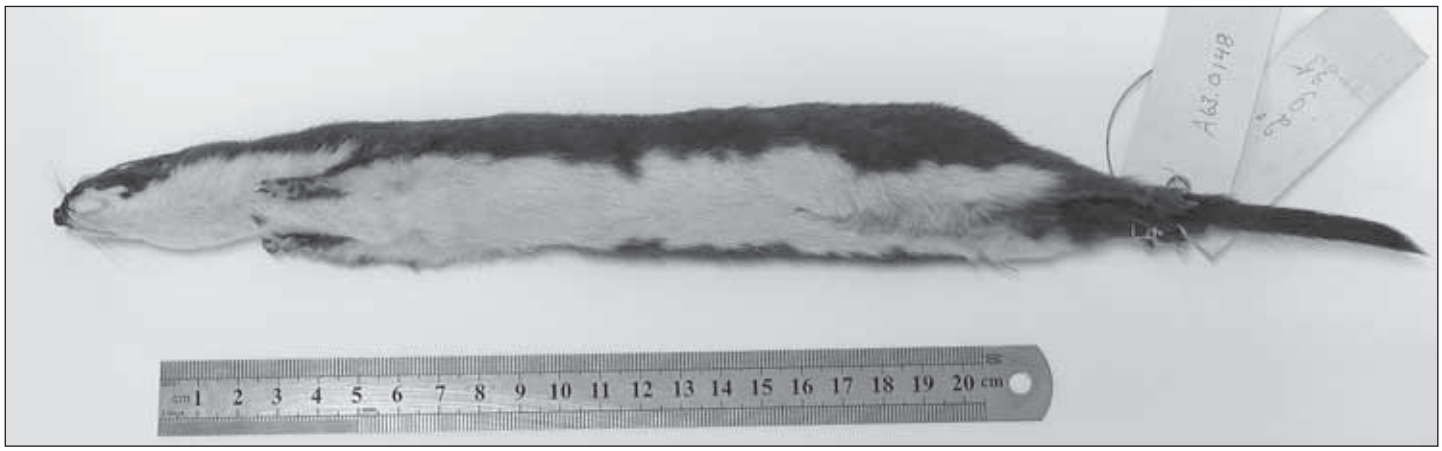
'Tonkin Weasel *Mustela tonkinensis*'

Mustela tonkinensis was described from northern Tonkin, Vietnam, by the well-known Swedish traveler Bertil Björkegren (1941). The specimen was collected on 4 January 1939 in or near Chapa (= Sa Pa, Lao Cai Province, Vietnam). The precise locality of origin of this specimen is unknown. On this (second) visit to Vietnam, Björkegren collected mammals and birds around Sa Pa from 17 December 1938 to 20 February 1939. Sa Pa is a settlement situated in the Hoang Lien Son Mountains, near to Fan Si Pan peak (3,143 m), highest peak of the Indochina Peninsula. During this time Björkegren collaborated with the 7th Indochinese expedition of Jean Delacour and shared the collected specimens. Björkegren wrote "... In spite of being forced to give Delacour half of our collection, or more correctly Mr. Greenway of the Boston museum, I will see it that we will not be losers" (cited from Eames & Ericson, 1996). James C. Greenway participated in Delacour's expedition from November 1938 to March 1939. The specimens collected by him in this expedition went to the Museum National d'Histoire Naturelle (Paris, France) and the Museum of Comparative Zoology (MCZ, Cambridge, USA). In particular, three specimens of *Mustela* collected by Björkegren in Sa Pa went to the Museum of Comparative Zoology: one specimen of *M. strigidorsa* (MCZ 38189) and two specimens of *M. kathiah* (MCZ 38195, 38196). Other *Mustela* specimens from Sa Pa went to the Swedish Museum of Natural History (Stockholm, Sweden): *M. strigidorsa* (A.596187), *M. kathiah* (coll. No.232), and the holotype of *M. tonkinensis* (A.63.0148, complete skull and skin of adult male). Based on the remarks in the collecting diary of Björkegren, it is possible to suppose that the specimen of *tonkinensis* may come from Greenway's material collected at Mi Ti ("two days journey from Chapa", see also Eames & Ericson, 1996). Mi Ti (= Séo Mý Ty; 22°15'N, 103°54'E) is a small Hmong settlement situated 30-35 km southwestward of Sa Pa. There are no reliable data that this specimen was collected by Björkegren himself: the external measurements were taken from the stuffed skin (according to the notes in Björkegren's collecting diary). However, the well-prepared stuffed skin of *tonkinensis* and complete skull are evidence that a professional preparator, not a local hunter, skinned this specimen.

Opinions concerning the taxonomic position of the 'Tonkin Weasel' vary. Björkegren (1941) believed that the species described by him was most closely related to *M. stoliczkana*, not to *M. kathiah* or *M. sibirica*. *Mustela stoliczkana* was described by Blanford (1877) from Kashgaria (north-western China), and is now regarded as a synonym of *M. nivalis* (e.g. Wozencraft, 1993; Abramov & Baryshnikov, 2000). Most authors placed Björkegren's weasel within the species *M. nivalis* (Corbet & Hill, 1992; Wozencraft, 1993; Dang Huy Huynh *et al*., 1994; Abramov & Baryshnikov, 2000). Other authors (Ellerman & Morrison-Scott, 1951; Heptner *et al*., 1967) doubted such a placement and supposed that it, most likely, belongs to *M. kathiah*. Some authors believe that *tonkinensis* deserve the rank of a separate species (Kuznetsov & Rozhnov, 1998).

This is a medium-sized weasel with long tail relative to *M. nivalis*. According to the description, the body length is 200 mm, the tail length is 90 mm. I measured the specimen and got slightly different data: a body length of 243 mm, a tail of 92 mm (see also Abramov & Baryshnikov, 2000: 381). The upper parts of the body are brown. The lower surface of the body (throat, chest and belly)

Fig. 1. The type specimen of Mustela tonkinensis. - *Picture from* http://www.frettcheninfos.de/Arten/Mustela%20formosana.htm



is white. The colouring of the fur is 'vulgaris'-type (Fig. 1). The 'vulgaris'-type is characterised by an indented demarcation line between the areas of brown and white colour, in both the neck and trunk regions (Frank, 1985; Abramov & Baryshnikov, 2000). In skull size, *tonkinensis* is closer to the group of small subspecies of *M. nivalis* (condylobasal length of skull is 36.2 mm). This form is characterised, like *M. n. pallida* from the mountainous area of Central Asia (Tien-Shan, Pamir-Alai), by a rather narrow skull (Abramov & Baryshnikov, 2000).

Until now there is no information concerning the biology of this enigmatic and presumably rare form. It is possible to suppose that 'Tonkin Weasel' inhabits the high Hoang Lien Son Mountains, in the subalpine zone. Séo Mý Ty is situated at 1,600 m a.s.l., and surrounded by high mountains (2,100-2,400 m) covered by *Fokienia*-dominated forest.

Least Weasel *M. nivalis* is a specialist predator of small mammals, especially rodents (e.g. voles, mice). When small rodents are scarce, *M. nivalis* may consume other small vertebrates, insects, or worms. Least Weasel was introduced to New Zealand in the 19th century and it still survives in very low numbers. The local conditions do not favour it, because voles are absent there. New Zealand *M. nivalis* eat introduced House Mice *Mus musculus*, insects and small lizards (King *et al*., 1996). Food conditions for *tonkinensis* in north Vietnam highlands might be somewhat similar to those in New Zealand. The possible food sources of 'Tonkin Weasel' are Père David's Vole *Eothenomys melanogaster*, Eurasian Harvest Mouse *Micromys minutus*, insects, lizards and those small birds that nest on the ground. The voles and mice are found only in high altitudes of the Hoang Lien Son Mountains. The various rats (*Leopoldamys*, *Niviventer*, *Rattus*) inhabiting the lower Hoang Lien Son Mountains would be quite large prey for *tonkinensis*. There is no reason from morphology to consider that 'Tonkin Weasel' would be any better a climber than other *Mustela* species, meaning that small arboreal or scansorial mammals (e.g. *Tupaia*, *Tamiops*, and *Chiropodomys*) would not often be accessible prey. It is possible to suggest that if the 'Tonkin Weasel' still exists, it should be closely connected with distribution and abundance of Père David's Vole *Eothenomys melanogaster* in the high altitudes of the Hoang Lien Son Mountains.

'Taiwanese Weasel' "*Mustela formosana*"'

This new form of weasel was recently discovered in the high mountainous area of Taiwan (Lin & Harada, 1998). The first information about this new mammal was published in the abstracts of Euro-American Mammalogical Congress, which was held in Santiago de Compostela (Spain) in 1998:

> 436. A new species of *Mustela* from Taiwan
>
> A new species of Mustela from the central mountains of Taiwan is described. Two specimens of this species were compared with M. erminea from Japan. Until now only three records had been found from the habitat of bamboo cane (Yshania niitakayamensis) grassland of the Mt. Houhan, 3200 m elevation. The karyotype of this new species has 2n=42, and NF=68, while that M. erminea from Japan has 2n=44, and NF=64. The new species is also distinguishable from the Japanese species by the lower mandible height, narrower zygomatic breadth and the lighter black tip of tail. The new species of Taiwan is certainly one of the southernmost M. erminea species group in the world. Occurrence of this species in Taiwan is the result of deglaciation and subsequent evolution of an isolated population from a northern ancestor.

As may be seen from the cited text, no scientific name was proposed for this weasel in this publication.

Abramov & Baryshnikov (2000) in their taxonomic revision of Least Weasel *Mustela nivalis*, pointed out that 'Taiwanese Weasel' is probably more close to the *M. nivalis* than it is to *M. erminea*. They referred to this form as "*Mustela nivalis* subsp. n." (see Abramov & Baryshnikov, 2000: 398):

> *Mustela nivalis* subsp. n.
>
> (Lin & Harada, 1998. Abstr. Euro-Amer. Mammal Congr., Santiago de Compostela, Spain: 263).
>
> *Type* not designated. Terra typica: Mt. Houhan (at a height 3200 m), Taiwan.
>
> *Diagnosis.* Not large weasel, tail rather long (probably about 30-40%). Colouring of «vulgaris»-type.
>
> *Distribution.* Two specimens from central mountain of Taiwan are known only.
>
> *Remarks.* This form was described from Taiwan Island as a new (not named) species of *Mustela* (Lin & Harada, 1998). These authors believed the new form is close to *M. erminea.* We have possibility to study colour photographs of this animal kindly given to us by Dr. T. Oshida (Hokkaido University). Exterior and coloration of this new form is according to *M. nivalis*. Our opinion is confirmed by karyological data (2n=42, NF=68) (Lin & Harada, 1998).

The placement of 'Taiwanese Weasel' within *M. nivalis* was confirmed by the genetic studies of Hosoda *et al*. (2000). The genetic position of this form has also been clarified with the mitochondrial cytochrome *b* gene and nuclear ribosomal RNA gene markers. In this study, the authors compared with *M. nivalis* specimens from Germany, European Russia, Russian Far East, Korea, Japan (Hokkaido and Honshu) and Taiwan, and found that 'Taiwanese Weasel' did not differ essentially from the other *M. nivalis* populations.

However, recently the name "*Mustela formosana*" has been applied for the 'Taiwanese Weasel'. This name appears on some Internet sites and also in a few, largely popular, publications, such as Duff & Lawson (2004: 218) in their checklist "*Mammals of the world*". This form is mentioned as "*Mustela formosana* Taiwan Mountain Weasel—Lin & Harada, 1998" and reference for "Lin & Harada, 1998" is the abstracts of Euro-American Mammalogical Congress (1998). However neither appropriate description, nor scientific name was proposed in this publication (see above).

Fig. 2. The Taiwanese weasel - Picture, kindly provided by Dr. T. Oshida (Japan).

Prof. Lin Liang-kang (2000) detailed the history of finding '*Mustela formosana*' and a description of it in the electronic publication. However this description also does not make the name *formosana* available. According to the current International Code of Zoological No-

menclature (ICZN, 1999) text or illustrations distributed solely by means of electronic signals (e.g. by means of the World Wide Web) do not constitute published work (Art. 9.8). According to the Article 16, every new name published after 1999 (from 1 January 2000), must be explicitly indicated as intentionally new (marking by appropriate abbreviations such as "sp. nov.", "new species", etc.). Every new specific and subspecific name published after 1999, must be accompanied in the original publication by the explicit fixation of a holotype, or syntypes, for the nominal taxon (Art.16.4.1), a statement of intent that they will be (or are) deposited in a collection, and a statement indicating the name and location of that collection (Art.16.4.2). So, evidently, the 'Taiwanese Weasel' still lacks an available scientific name. Because "*Mustela formosana*" has never fulfilled the criteria for availability, its usage to date does not prejudice somebody making this name available by appropriate typification and publication. This would be the least destabilising course of action, if a name is considered to be needed for this population.

According to data of Lin Liang-kang (2000) '*M. formosana*' is small-sized weasel. Head and body length is 160 mm, tail length is 70 mm. The coloration of this form is similar to that of *M. nivalis* (see Fig. 2). The demarcation line between brown upper part of body and the white under part is of the 'vulgaris-type' (Fig. 2B).

Lin Liang-kang reported that sightings of the 'Taiwanese Weasel' have mostly been in high areas of Mt. Hohuan and its ridge. The weasel inhabits the alpine zone above 2,500 meters a.s.l. Probably the main prey of 'Taiwanese Weasel' there can be the Taiwan Vole *Microtus kikuchii* and the Formosan Wood Mouse *Apodemus semotus*.

In conclusion, both the mentioned forms, *tonkinensis* and '*formosana*', look similar, and I believe they represent southern isolates of the widely distributed Holarctic species *Mustela nivalis*.

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European Mink *Mustela lutreola* as a host of the *Spirometra erinaceieuropaei*

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This short note concerns the helminthofauna of the European Mink *Mustela lutreola.* This predatory species is at risk of being the next extinct mammal in Europe, so understanding all aspects of its ecology is important for its conservation. *Spirometra erinaceieuropaei* (Rudolphi, 1819) is a typical species of the genus *Spirometra* (Skrjabin *et al*., 1940), and is a cosmopolitan helminth with large numbers of intermediate, supplementary and final hosts from various taxonomic groups of animals. Up to 1977 (Kozlov, 1977), *Mustela lutreola* had not been registered as a host of *S. erinaceieuropaei* anywhere in the world (Kontrimavichus, 1969). Kontrimavichus (1969) concluded that the European Mink helminth fauna was not adequately investigated. However, at the same time this helminth species was regularly found in American Mink *M. vison*, which was acclimatised in Belarus in 1953-1955. The first finding of this helminth species from European Mink was in Belarus (Shimalov *et al*., 1987; Sidorovich & Bychkova, 1993; Sidorovich *et al*., 1997).

Among 18 helminth species characterised for the European Mink in Belarus, the commonest was larval form of *S. erinaceieuropaei* (Anisimova, 2004). This species was recorded from 71.4% of investigated European Minks (n=56). The incidence of *S. erinaceieuropaei* changes seasonally; 100% infestation was found in animals caught in autumn, whilst in spring it was lower (80%). As previously reported (Anisimova & Odintsova, 2000) the increasing level of *S. erinaceieuropaei* infestation in recent years occurs not only in the European Mink, but in all other mustelid species, other carnivores and even Eurasian Wild Pig *Sus scrofa*. The intensity was from a single worm to some dozens per host animal.

It is really difficult to judge a parasite's pathogenicity and what is the critical level of infestation that can lead to death. Some individuals of the European Mink were caught in natural landscapes of the Central Forest State Nature Biosphere Reserve (Russia) in 2000 to participate in several reintroduction programs in other territories. We kept animals in the cages and fed them with frogs. Soon after capture most European Minks were infested by sparganoses infection, the source of which was probably frogs. The minks grew thin because of high quantity of helminth larvae. A number of helminths were extracted by skin operation on living animals, but nevertheless nearly all the European Minks died from sparganoses infection. An autopsy showed that the main helminth species was *S. erinaceieuropaei.*

The photos show that the *S. erinaceieuropaei* were located into muscles and under skin of the European Mink.

A general tendency of parasite evolution is to lower their pathogenicity to the host and, hence, to exist therein as long as possible. However, parasites can interfere with other unfavourable factors and lead to a rapid decrease in host numbers.

Although it is not absolutely clear what is the main cause of the decline and gradual disappearance of the European Mink from west to east, there is no doubt that *S. erinaceieuropaei* is a strong pathogenic helminth, especially in the larval form, which strongly influences the host and can lead to death.

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Intestinal parasites and diseases among the Small Indian Civet *Viverricula indica* (E. Geoffroy St Hilaire)

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Introduction

Even though the Small Indian Civet *Viverricula indica* is listed in Schedule II (Part II) of the Indian Wildlife (Protection) Act, 1972 and is illegal to keep them under captivity, there are several households in Kerala where civets are maintained for extraction of their perineal gland secretion. The civet owners are not interested in maintaining breeding colonies, as they may not yield the glandular secretion during pregnancy and lactation. To compensate for dead and old ones, they trap new ones from the wild, thus perhaps putting pressure on the wild populations of the civet (Balakrishnan, 2002; Balakrishnan and Sreedevi, in prep.). Several of them die under captivity due to various diseases in addition to the stressful conditions under which they are trapped and transported. The present report deals with the common intestinal parasites and diseases of the Small Indian Civet under free-living and captive conditions in Kerala, India, so as to provide necessary instructions to the civet owners for better husbandry and management practices of civets as a sustainable wildlife resource (Xavier, 1994; Sreedevi, 2001).

Materials and methods

Because civets maintain civetries within their territorial limits, scats can be easily found and recognized in the natural civet habitats. To study the presence of parasites, scats of captive and free-living civets were collected. Five fresh faecal samples from the wild and 23 samples from captive civet holdings in different localities were used for this purpose. Faecal samples were analyzed for protozoan, helminth and nematode parasites. Protozoan parasites were studied using the saline preparation method. One drop of saline (0.9%) was placed on a glass slide and a bit of faecal matter was stirred on it with the help of a tooth-pick. It was then mounted with a cover slip and examined under a microscope. A centrifugal flotation method was followed to detect the protozoan, helminth and nematode cysts and ova. A faecal suspension was prepared by mixing one part of the faeces with ten parts of distilled water, stirred and centrifuged for 45-60 seconds at 2500 rpm. The supernatant was poured off and 2-3 ml of distilled water was added. A few drops of this suspension were placed on a glass slide and examined under a microscope for the presence or absence of the above parasites.

Veterinary physicians and surgeons examined captive civets with various disease symptoms for information and treatment. Relevant tissue samples of civets found dead were subjected to histopathological observations. Paraffin sections of such tissues were prepared at 6µm, stained with haematoxylin and eosin and examined under a microscope. Information was also gathered from local people and from newspaper reports on an incident of rabies after civet bite.

Results

- **Parasites in faecal matter**
  Table 1 shows the results of observations of protozoan, helminth and nematode parasites in the faecal samples of Small Indian Civets collected from different localities. The scats collected from Kodassery contained ova of the helminth parasite, *Strongyloides* sp. and rhabditiform larvae. The rectum of a dead specimen collected from Vadakkancherry was heavily infested with *Ascaris* sp. Scats collected from Trichur, Chalakkudy and Thaikkatussery contained protozoan and nematode parasites and those scats collected from Arimbur contained hookworms of the species *Ancylostoma duodenale*. None of the samples collected from the wild had protozoan parasites. Those samples collected from Idavani were free from parasites.

- **Diseases**
  Apart from the common ailments such as parasitism, scabies, fungal infections, injuries and viral diarrhoea, serious disease conditions such as mammary adenoma, feline infectious enteritis, endodermal sinus tumour and rabies were observed in some of the Small Indian Civets studied.

- **Mammary adenoma**
  A rare case of mammary adenoma was observed in a female civet under captivity (Fig. 1). This civet gave birth to three young on 9 July 1995. One kitten died on the fifth day after parturition and

Table 1. Observations of parasites in the faecal samples of the small Indian civets.

Site of sample collection	Sex of the specimen	Absence (a)/Presence (p) of parasites		
		Protozoan	Helminthine	Nematode
Kodassery*	Male	a	p	a
Vadakkencherry	Male	a	a	p
Idavani*	Female	a	a	a
Idavani*	Female	a	a	a
Trichur	Female	p	a	a
Chalakkudy	Female	p	a	a
Thakkattuserry, Vallachira	Male	p	a	a
Arimbur, Trichur	Male	p	p	a

*Free-living natural populations; others are captive

Fig. 1. A female Small Indian Civet affected by mammary adenoma; see the wound in the ventral abdominal area.

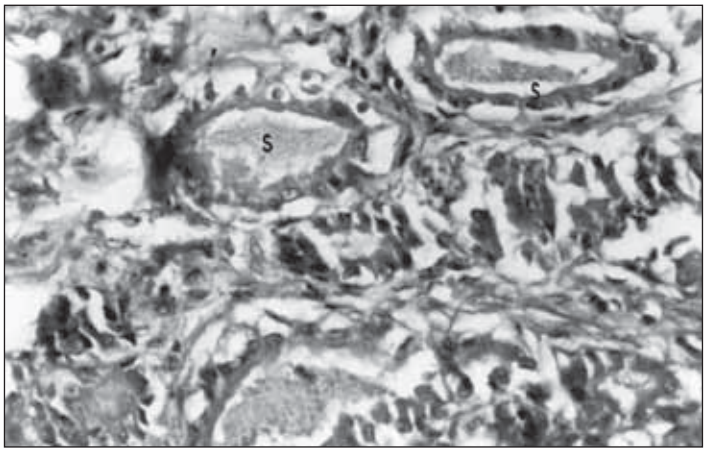

Fig. 2. Cross section of the ovary of a civet with an endodermal sinus tumour. Schiller-Duval bodies (S=granular structures), characteristic of the disease are seen. 200x, haematoxylin and eosin).

another one on 10 August 1995. The sign of tumour appeared on the right pectoral teat after one week of the death of the second kitten. The third kitten was feeding from the two pelvic teats. The tumour erupted like a wound and spread over 3-4 cm around the teat. Though the veterinary surgeon recommended surgical removal of the teat, a paste of *Annona squamosa* leaves, which is known as a remedy for tumour in animals as per the traditional ottamooli treatment system in South India, was applied on the wound for two weeks. It was completely healed by the tenth day of treatment. Another case of mammary adenoma was observed in histopathological slides of a female civet obtained dead under captivity in October 1996. Analyses have revealed that the animal was in a state of chronic mastitis.

- **Feline infectious enteritis**
  The first attack of feline infectious enteritis was observed in a captive male civet on 5 November 1994. It vomited once and was disinclined to feed. There was also loose motion. It did not take even a drop of water and died on the third day of symptoms. Autopsy revealed that the disease was infectious enteritis. A second animal kept in the adjacent enclosure showed the same symptom after one week. Veterinary physician injected Gentamycine, but the animal died after eight days. A third animal died with the same symptom on 3 December 1994. A fourth animal showed the same symptom on 6 January 1995; it was also subjected for antibiotic injection, but died on the eighth day.

- **Endodermal sinus tumour**
  This is a special case of disease observed in civets. Swelling the intestinal region, off feed and general fatigue were the symptoms observed in a female civet. The veterinary surgeon, who examined the animal suspected digestive problems and administered medicines, but it died on the fourthday of the illness. The autopsy report revealed swelling in visceral region, and the intestine was infected with hookworms. Examination of histopathological slides of the preserved ovary showed Schiller-Duval bodies (Fig. 2), characteristic of endodermal sinus tumour.

- **Rabies**
  A civet bit a woman on her leg on 11 December 1995. Local people killed the civet at once and reported in the Mathrubhoomi newspaper with photographs on 12 January 1996. The woman died in the first week of January 1996 at Trichur Medical College due to rabies. Investigations have proved that the civet was infected with rabies. This incident took place in a seashore village, where natural day refuges for civets were not available.

Discussion

Protozoan, helminth and nematode parasites are common in faecal samples of captive civets in Kerala. Civets in natural habitats were less infested with helminth parasites than the captive ones. In fact, specimens from the wild appeared healthy and devoid of diseases. This may be due to the natural food in the wild condition, very different from that supplied regularly to captive civets. Wild animals probably have better resistance, it being lost or considerably deteriorated under captivity. It may be possible to maintain healthy captive populations if they are provided regularly with natural food items in sufficient quantity (Balakrishnan and Sreedevi, in prep.).

Common ailments such as parasitism, gastritis, viral diarrhoea and deficiency diseases are common among captive Small Indian Civets (Xavier, 1994). Further, the information presented in this paper show that both free-living and captive Small Indian Civets are infected with certain major diseases, which are not reported in the case of civets earlier. It is suspected that the civet responsible for transmitting rabies may have contracted the infection from domestic dogs during its long-distance foraging activities. This civet must have come from another village some 3-4 km away, where there is bushy undergrowth that can be used as a refuge. It is common that the domestic dogs in these villages are let free during night and they attack any other animal which may pass through their territories. Mammary adenoma and endodermal sinus tumours were studied in detail in human beings (Coulson, 1987), but not reported in any civet. The observation that *Annona squamosa* is an effective cure against mammary adenoma in civet has also its root from treatment of human mammary adenoma in traditional medical practices.

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Recent publication

European Mink

Marie-des-Neiges de Bellefroid & René Rosoux (2005) *La Vison d'Europe.* Collection Approche n°38, Berlin, Evail Nature, Paris, 96p.

Within European carnivores, the European mink *Mustela lutreola* is one of the least known but also one of the most endangered. Marie-des-Neiges de Bellefroid and René Rosoux, who have been working a lot on the European otter *Lutra lutra* in western France in recent years have also been involved on the European Mink, mainly in France, Here they have compiled an up-to-date and complete review on the European mink, in French, including some of their own data.

The first part of the book is devoted to the story of the species. What is strange, at least in the western part of its distribution, is the apparent ignorance of its presence before the mid 19th century, when even French scientists knew it from Eastern Europe but not in their own country. Suddenly, in the end of the 19th and beginning of the 20th century, it was found to be present over nearly half of France. Even more strange is its discovery in Spain only around 1950. For these authors, the Western and Eastern distributions must have staid apart, with a large gap in between, without connections during historical times.

Then besides the discription of the species, there is a complete presentation of its habits. A point to mention is the apparent large size of the movements of male European minks, sometimes over 10km, up to 70km in one case: not very different of the movement of the otter, which is 10 times the mink's body size. This may due, now, to the low density of the species.

Of course, there is a long discussion on the reason of its rapid and global regression in range. Many hypothesises have been proposed, which, as often may each hold a part of the truth. Modification of landscapes, drying up of many wetlands, 'pest' trapping, diseases brought by feral American minks *M. vison* escaped from fur farms, direct competition with this alien species, poisons used against rodents: the list is long. The authors here seem to favour the disease hypothesis, pointing at a farm mink parvovirus. The genetic discovery that the Spanish-French population is very homogeneous is also a surprise and might explain a common susceptibility to the virus, if this hypothesis is true. A few words on the French national action plan are also given.

This European mink is a truly enigmatic species but the saddest point is that it may disppear taking with it all the question, before any solid answer has been discovered.

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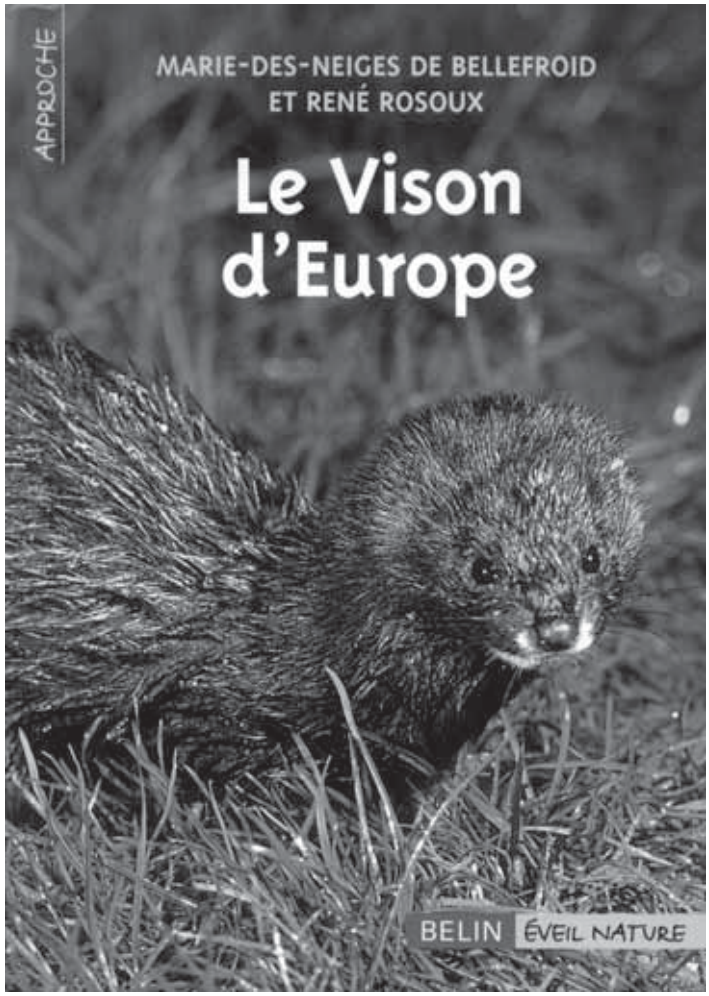


Observations of Banded Linsang *Prionodon linsang* at the northern edge of its range, with a review of recent northerly records

Robert STEINMETZ[1] and Saksit SIMCHAROEN[2]

Introduction

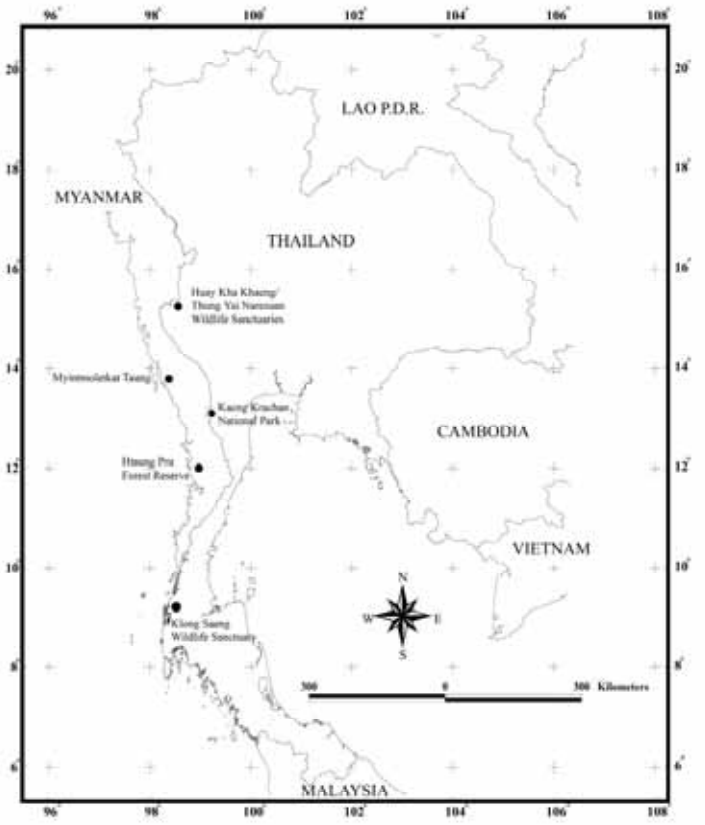
The Banded Linsang *Prionodon linsang* is widespread but rarely encountered within its range (Lekagul & McNeely, 1977; Medway, 1983). The species occurs in southern Myanmar, Thailand, peninsular Malaysia, Sumatra, Java, and Borneo (Van Rompaey, 1993). Here, we document recent observations of Banded Linsang towards the northern edge of this distribution. We then briefly discuss the biogeographical context of these rare observations based on a review of literature.

Methods

From 2004 to 2006 the first author conducted about 30 hours of night-spotting at five locations in Thung Yai Naresuan Wildlife Sanctuary (hereafter, Thung Yai), western Thailand (Fig. 1). Two methods were used, often within the same night: slow walking (< 1 km/hour) along trails or streams, and sitting at promising locations (e.g., fruiting trees, stream bank).

In Huay Kha Khaeng Wildlife Sanctuary (contiguous with Thung Yai to the east, Fig. 1), the second author conducted camera-trap studies from 1995 to 1999, and 2004 to present. The study employed 130 cameras, placed mostly along trails at 100 m to 1000 m elevation, in a 1000 km^2 study area covering each of three major forest types in the sanctuary (semi-evergreen, mixed deciduous, and dry dipterocarp forest).

Fig. 1. Recent records of Banded Linsang Prionodon linsang *in the Tenasserim region of Southeast Asia. The present records from Thung Yai Naresuan and Huay Kha Khaeng Wildlife Sanctuaries represent the northern edge of the species distribution.*



Results

One direct observation and two photographs of Banded Linsang were obtained. The first author observed a Banded Linsang at 23h00 on 19 April 2006 while sitting along the perennial Sesawo stream (15° 20´ N, 98° 47´ E) in Thung Yai. The animal was observed under torch light for two minutes as it walked quickly and silently along the stream bank. Its eyes appeared small and red under torchlight. The animal was initially spotted from four meters as it emerged from vegetation into an open area along the stream. This afforded an unobscured view. Though the first author had never seen a Banded Linsang in the wild, its coloration, markings, small size, and body shape (e.g., long, low, sinuous) were immediately identifiable, based on familiarity with photographs and illustrations of the species.

The animal did not appear perturbed by the torchlight and never looked directly at it. The animal walked to within 1.5 m of the author, stopped and sniffed the air for about 15 seconds (appearing uncertain, and perhaps sensing the author), then turned around and returned the way it came. Its path was along a small faint trail that appeared to be a natural route through streamside vegetation. The observation occurred at 700 m elevation, in semi-evergreen forest that formed a thin riparian strip (20 to 50 m wide) through extensive grassy mixed deciduous forest.

In Huay Kha Khaeng, two photographs of Banded Linsang were obtained, both at night. The first, a (presumed) female with two young, was in montane evergreen forest along a stream at 950 m elevation (15° 27´ N, 99° 19´ E). This photograph was taken by hand by the second author in 1998 during a night walk. The second photograph, from a camera-trap, was a single animal in mountainous mixed deciduous forest at 800 m elevation, in 2005 (15° 29´ N, 99° 20´ E).

The animals we observed had dark brown elongated patches irregularly arranged along the back, neck, and sides, resembling the photographed animal in Lekagul & McNeely (1977: 574). However, the forebody spots of Spotted Linsang *P. pardicolor* sometimes run together into bands, especially along the sides of the neck (Tizard, 2002; W. Duckworth, pers. comm. 2006); this characteristic could lead to misidentifications. Although these species are not known to co-occur, there are so few records from the northern margin of Banded Linsang's range or the southern margin of Spotted Linsang's (Van Rompaey, 1993, 1995; Tizard, 2002) that it cannot be determined whether the two species overlap in range, are parapatric, or are separated by a gap where neither species occurs. The forebody bands of the animals observed in Thung Yai and Huay Kha Khaeng were patches and not contiguous spots, and the dark dorsal bands were

separated by pale lines running transversely but not longitudinally between them. These characteristics distinguish the animals we observed as Banded Linsangs and not Spotted Linsangs.

Distribution and rarity

The distribution of the Banded Linsang in mainland (i.e. non-peninsular) Southeast Asia was mapped as being limited to the Tenasserim–Dawna mountain range that straddles the border between Thailand and Myanmar by Corbet & Hill (1992). The present observations from Thung Yai and Huay Kha Khaeng are the northernmost records of the species within this limited range, and include the first published direct sightings of the species in Thailand. Banded Linsang was listed previously for Thung Yai by Nakhasathien *et al*. (1987) but they provided no supporting evidence, site location, or habitat. Elsewhere in its range, Banded Linsang uses a wide range of forest types and elevations that include lowland evergreen rainforest as well as secondary and disturbed forest (Lim, 1973). The present sighting record from Thung Yai – in semi-evergreen gallery forest within an extensive (hundreds of km^2) fire-dominated mixed deciduous forest ecosystem – adds to this list of habitat types.

Both recent and historical records in the Tenasserim region are from locations south of Thung Yai/Huay Kha Khaeng. There are three other recent camera-trap records of the species in Thailand, all from evergreen forests south of 13° 19´ N (Fig. 1): Klong Saeng Wildlife Sanctuary (9° 20´ N, 98° 25´ E) (Kanchanasakha *et al*., 1998; Boontua, 2004), and Kaeng Krachan National Park (12° 50´ N, 99° 08´ E) (Kekule, 2004). Historical specimens are from Pattani Province in far southern Thailand (about 6° 30´ N) (Humphrey & Bain, 1990). A Banded Linsang report for Phu Miang-Phu Thong Wildlife Sanctuary in Thailand (17° 54´ N) (Prakobboon, 1979, cited in Humphrey & Bain, 1990, and elsewhere) is dubious – the location is 250 km north of its known range. The record may mistakenly refer to Spotted Linsang *P. pardicolor* whose southern distribution was mapped as approaching this protected area (Corbet & Hill, 1992), but in fact remains unknown (see above). Like the Banded Linsang, the distribution and ecology of Spotted Linsang is little known in Thailand (Lekagul & McNeely, 1977; Van Rompaey, 1995; Tizard, 2002).

In Myanmar, Banded Linsang was recently photo-trapped in Htaung Pru Forest Reserve (11° 45´ N, 99° 07´ E) and Myintmoletkat Taung area (13° 30´ N, 98° 38´ E) by Lynam (2003). Both areas (Fig. 1) are below 700 m elevation. The species was not recorded in 15 other, more northerly, sites in Myanmar that were surveyed by the same method (Lynam, 2003). Historical records from Myanmar are apparently only from the Tenasserim region, both the south around Bankachon (10°09'N, 98°36'E), and the north around Moulmein (16°30, 97°38'E) (Pocock, 1939). The Moulmein record would be the furthest north for the species, but should be considered only a provisional, albeit quite likely, location. Firstly, there is inconsistency in description of the site, with Blanford (1878) saying that the specimen was obtained east of Moulmein, but Blanford (1888) and Pocock (1939) giving west of Moulmein. Secondly, at this era, towns (such as Moulmein) could be used as locators for specimens collected far away in the hinterland, which latter lacked (to European minds) useable locality names.

In a review of the literature, Van Rompaey (1993) concluded that the Banded Linsang was uncommon or rare throughout its range. This conclusion is supported by the generally low encounter rates in recent camera-trap surveys in several areas. For example, in Gunung Leuser National Park in Sumatra, the Banded Linsang was the rarest of 21 mammal species camera-trapped (Griffiths & Van Schaik, 1993).

The Banded Linsang's rarity appears to be especially pronounced at the northern edge of its range. For example, in Huay Kha Khaeng the Banded Linsang was the only viverrid not recorded (from those expected based on presumed range) in a two-year small carnivore camera-trap study that covered seven habitat types and accumulated 5,410 nights of effort (Conforti, 1996). Similarly, in eastern Thung Yai, Banded Linsang was not photographed in a three-year camera trap study in two major forest types (P. Duangkae, *pers. comm*.). Finally, the species is not known from Um Pang Wildlife Sanctuary (A. Pattanavibool, *pers. comm*.), which is adjacent to Thung Yai to the north (about 16° N) and represents the northernmost extension of the Tenasserim–Dawna mountain range.

The Banded Linsang is considered to be generally arboreal (Lekagul & McNeely, 1977). This habit (which has not been confirmed by field study of wild animals) may partly account for low capture rates by ground-level cameras. Linsangs are also somewhat ground-living, however, and they forage and even raise young on the ground (Lim, 1973; Lekagul & McNeely, 1977). Thus, camera-trap encounters are likely to roughly reflect presence and relative abundance. Nocturnal spot-lighting may be more suitable for assessing presence and abundance of the species because tree canopies can also be checked, but too little work has been done in its range to make useful comparisons. Many camera-trap studies, including that conducted by the second author in Huay Kha Khaeng, are focused on larger mammals, particularly Tigers *Panthera tigris*. Cameras are generally set about 40 cm above the ground in such studies; this may be too high to reliably detect the smallest carnivores.

Biogeographical speculations

The global range of the Banded Linsang is predominantly within the Sundaic biogeographic subregion (Corbet & Hill, 1992). Its range extends northward into the Indochinese subregion along the long Tenasserim–Dawna mountain range, as documented here. The Indochinese region differs from the Sundaic region in its strongly seasonal climate and lower annual rainfall. These latter conditions are ameliorated along the Tenasserim–Dawna range, however, presumably facilitating the northward extensions of Sundaic fauna such as the Banded Linsang. Other species with largely Sundaic ranges, such as Asian Tapir *Tapirus indicus*, have similar distributions (Steinmetz *et al*., *in prep*.).

Why does the northern distribution of Banded Linsang and some other Sundaic species coincides with the northern end of the Tenasserim–Dawna mountain range? Comparing the ecological conditions of Thung Yai, Huay Kha Khaeng, and surrounding areas (where the Banded Linsang is apparently absent) may help answer this question. Western Thung Yai (location of one the present sighting records) receives 2000 to 2400 mm of rain annually (van de Bult, 2003). Huay Kha Khaeng lies in the rain shadow of the Tenasserim–Dawna mountains and receives about 1550 mm annually. Moisture levels (from cloud cover, rainfall, and reduced transpiration) are generally higher and more consistent with increasing elevation in tropical regions (Leigh 1975). The Banded Linsang may be sensitive to such moisture gradients and their topographical variations, perhaps through indirect effects of rainfall or moisture levels on food resources. This may explain why in Huay Kha Khaeng Banded

Linsang has been found only at relatively high elevations (> 800 m). The apparent absence of the Banded Linsang from Um Pang Wildlife Sanctuary to the north of Thung Yai is difficult to attribute to gross differences in habitat types or other physical features such as dispersal barriers. Um Pang Wildlife Sanctuary is contiguous with Thung Yai, has a similarly long dry season from November to April, and shares a similar forest mosaic of evergreen and deciduous forest types. It may be that annual rainfall, which diminishes to 1400 mm in Um Pang, is below some threshold of ecological significance to the species. However, focused surveys, particularly in montane areas, might reveal the presence of the species at higher elevations in Um Pang Wildlife Sanctuary.

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A record of Stripe-backed Weasel *Mustela strigidorsa* from Mae Wong National Park, Thailand

Charles DAVIES

I saw a single Stripe-backed Weasel *Mustela strigidorsa* at roughly 16h30, on Saturday 24 June 2006, near Chong Yen Campsite in Mae Wong National Park, Thailand, at an altitude of about 1,350 m, 16°00' N, 99°10' E.

Mae Wong National Park is part of the large Western Forest Complex of Thailand, which is mid-way north along the border with Myanmar. Other contiguous, protected areas in this forest complex include Umphang, Thung Yai Naresuan, and Huai Kha Khaeng Wildlife Sanctuaries. Chong Yen campsite is easily accessible via a paved road, 30 km from Mae Wong Park Headquarters, and is a popular weekend camping spot. Much of the area was cleared and formerly cultivated by hill tribes, who have not lived in the area for some years, and the area is now regenerating as a mosaic of forest and tall grassland/scrub. The forest here is lush montane forest, and wild bananas *Musa* spp. grow along the steep gullies. Other common mammals include Pallas's Squirrel *Callosciurus erythraeus*, Northern Treeshrew *Tupaia belangeri* and Western Striped Squirrel *Tamiops mcclellandii*. Large mammals are not seen regularly, but I have seen Red Muntjac *Muntiacus muntjak* and groups of Stump-tailed Macaque *Macaca arctoides* in this area, and have heard langurs occasionally (almost certainly Phayre's Langur *Trachypithecus phayrei*). The forest is rich in montane/lower montane birds, many of which are uncommon elsewhere in Thailand, e.g. Rufous-necked Hornbill *Aceros nipalensis*, Burmese Yuhina *Yuhina humilis*, and Coral-billed Scimitar Babbler *Pomatorhinus ferruginosus*; all of these are uncommon or frequent in the immediate vicinity of Chong Yen.

I saw the weasel as I was standing on a steep, muddy slope near a small stream. It approached me to within a few inches, and appeared to have been attracted by a shiny, metallic minidisk player that I had set down next to my foot (after trying unsuccessfully to attract a nearby calling Rusty-naped Pitta *Pitta oatesi* using playback). After sniffing the minidisk player a couple of times, the weasel opened its mouth and made a 'bark', which sounded like a fairly high-pitched human sneeze. It then walked off and, as it did so, I could hear it bark again from the forest floor a few meters away.

The weasel was about a foot long, including the tail. Compared with the illustration in *Large mammals of Thailand* (Parr, 2003), it appeared greyer brown, and the pale stripe along the spine appeared narrower. There may also have been a very faint banding effect on the tail.

There are few previous records of Stripe-backed Weasel from Thailand. Abramov *et al*. (in prep.) traced only those from Nan province (Lekagul & McNeely, 1977), Phu Luang Wildlife Sanctuary (Treesucon, 1989), Phu Khieo Wildlife Sanctuary (Grassman *et al*., 2002). Overall it is a little-known species prioritised in the IUCN/SSC *Action Plan for the Conservation of Mustelids and Viverrids* (Schreiber *et al*.,1989) for the gathering of further information. Mae Wong is slightly south of the otherwise southernmost Thai record of this weasel, although it is known from further south in Myanmar (Abramov *et al*., in prep.).

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Ectoparasitic charge of small carnivores and its sanitary implications

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Ectoparasites are broad indicators of an animal's sanitary status and may be of importance in disease transmission processes. Fleas and ticks are commonly seen on mammals and a single small animal, such as a shrew, can host three or four large ticks, but while these may transmit viruses and other infections they seem not have any direct adverse effects (Churchfield, 1990). However, little attention has been paid to ectoparasites in small carnivores, even though there has been a great deal of research on these animal's endoparasites (Millán et al. 2004). In this work we analyze the ectoparasites of three species of free ranging carnivores from Biscay: the European Mink *Mustela lutreola*, the American Mink *Mustela vison* and the Common Genet *Genetta genetta*. Animals were live-trapped during an extensive study of mink species' distribution in the area, and captured animals where explored for ectoparasites during handling. For each animal, we set the number of individual parasites into five abundance categories (Minimam: 0-5, Low: 5-15, Medium: 15-30, High: 30-45, Very High >45) and recorded their location on the body of the animal. We took samples of ectoparasites in the field using tweezers: 3-5 individuals were taken form each infested animal, and afterwards they were stored individually in Eppendorff tubes that were kept frozen until identification.

In total, from October 2004 to January 2005, we captured 36 animals, of which 13 were American Mink, 6 European Mink and 17 Common Genets. We took 74 samples from them, all ticks (Table 1). Ticks were mainly located in the upper part of the back, neck and ears (especially in the tragus in genets), and occasionally in the face. No lice or fleas were found. In addition we found a leech on one European Mink. 23 % of genets had ticks, 69% of American Mink and 100 % of European Mink. Considering only parasitised individuals, European Mink hold more parasites than the other carnivores ranking High (30 to 45) as a mean, while American Mink ranked Low (5 to 15) and Common Genet ranked Minimal (less than 5). Genets had significantly fewer parasites than the other species (X^2_3=28.06; p=0.0054), but between mink species differences were not significant X^2_3=6.658; p=0.0836). The collected 70 specimens corresponded to two species: *Ixodes hexagonus* and *I. acuminatus*, in addition, four specimens could not be identified because they were damaged during the extraction and handling, however three of them were certainlyof the genus *Ixodes* . *I. hexagonus* was most abundant and occurred in both mink species, whilst *I. acuminatus* occurred in all three species, and was the only species found in genets, existing a relationship between them (X^2_3=26.747; p<0.001).

Contrasting with our data, Dunstone (1993) found that minks commonly carry light infestation of external parasites: ticks, mites and fleas. Normally, tick infestations involved one or two engorged individuals embedded in or around an ear, on the head, or between the shoulder blades, but occasionally as many as six were found (Dunstone, 1993). Evidently, these are the body parts which animals cannot reach with the mouth and clean themselves. Therefore, the high frequency of appearance in minks suggests the social grooming as a rare behavior, which would be as expected in solitary mustelids (Lodé, 1996). Interestingly, Dunstone (1993) reported that tick infestation tends to be monospecific, with *I. hexagonus* found in minks in Ireland and *I. ricinus* in minks from Britain. In opposition, Page & Langton (1996) report four different tick species infesting American Mink in Britain, that were, in order of frequency, *I. hexagonus*, *I. canisuga*, *I. ricinus* and *I. acuminatus*, the mean infestation being of 4.7 ticks for animal. In the same way, Powell (1993) reported a single species of tick (*I. cookie*) in the Fisher *Martes pennanti*, where it seems to be uncommon.

The frequency of apparition of ticks in genets was minimal in all individuals but two, which were both females; both had cubs, as deduced by their swollen breasts. Interestingly, *I. acuminatus* occurred only at immature stages (larvae and nymphs) in these two genets, while only in mature stages in mink species. Both, *I hexagonus* and *I acuminatus* are burrow-inhabiting species, found in dens and resting sites of mammals, where they wait for the host to come back, usually parasitising the same host across its different stages (Gilot & Aubert 1985; Sonenshine 1993). Although mink species change den often, there is a degree of reuse (Zabala *et al*. 2003) that renders them vulnerable to burrow-inhabiting species. In the same way, Common Genets do not rest in the same den for long periods, generally changing it every few days; breeding females may occupy the same day for several consecutive days (Zubero-

Table 1: Ticks found in wild carnivores. The unidentified ticks found pn a European Mink and two from American Mink were Ixodes *sp(p)genus: damage prevented identification to species.*

Tick Species	Unidentified	*Ixodes hexagonus*			*Ixodes Acuminatus*			Total
		Larvae	Nymph	Adult	Larvae	Nymph	Adult	
European Mink	1	4	5	5	0	0	5	20
American Mink	3	0	26	10	0	0	6	45
Common Genet	0	0	0	0	1	8	0	9
Total	4	4	31	15	1	8	11	74

goitia *et al*., 2001). This would explain why in genets, infestation was found only in lactating females. In addition, the lack of ticks in genets, even in hardly reachable areas of the body, suggests that social grooming may be regular.

Finally, regarding the biosanitary implications, both mink species share tick species that can act as a vector of illness between them. This last poses an interesting research issue in the transmission of illness between the native and alien species.

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Recent publication

Mammal Species of the World

Wilson, D. E & Reeder, D. A. 2005. *Mammal Species of the World. A taxonomic and geographic reference.* Two Vol. set. 3rd edition. 2,000 pages.US$ 125 hardcover. Baltimore, MD: The John Hopkins University Press.

This is the classic reference book on the taxonomic classification and distribution of the more than 5,400 species of mammals that exist today. The 3rd edition includes detailed information on nomenclature and, for the first time, common names. Each concise entry covers type locality, distribution, synonyms, and major reference sources. The systematic arrangement of information indicates evolutionary relationships at both the ordinal and the family level.

This indispensable reference work belongs in public and academic libraries throughout the world and on the shelf of every biologist who works with mammals.

Vison infos

Under this name a new newsletter has been published by Diren Aquitaine, 95 rue de la Liberté, 33073 Bordeaux cedex, France.

It contains all sorts of information chiefly on the European Mink. Thusfar four numbers has been published, all in French (the latest in January 2006).

Small carnivores in Central Sumatra

Jeremy HOLDEN

The Sundaic subregion of South-East Asia comprises the Thai--Malay peninsula, Borneo, Sumatra, Java and Bali, a region of very high mammalian species richness and endemicity (Corbet & Hill, 1992). It is currently suffering high levels of deforestation, particularly in the Indonesian lowlands (Jepson et al. 2001; Holmes 2000). Sumatra (excluding associated islands such as the Mentawai archipelago) supports 20 species in the families Mustelidae, Viverridae and Hesperidae (Corbet & Hill, 1992), and was listed as one of seven global priority areas for the conservation of these families by the international action plan for these groups (Schreiber et al. 1989). Despite this recognition, there is no up-to-date review of the conservation status of each species of small carnivore on Sumatra. The following compilation discusses records of all species recorded during 10 years of field research on the island. The majority of records were made through photo-trapping in and around the Kerinci Seblat National Park. It follows a recent collation of small cat records made over the earlier parts of the same period (Holden, 2001).

Study Area

The Kerinci Seblat National Park (1°07'-3°43'S, 100°59'-102°89'E) is one of the largest protected areas in Southeast Asia, covering 13,300 km2. The terrain consists predominantly of hill and upper hill forest with montane forest and even some alpine scrub at the higher elevations. Most of the accessible lowland forest has been excised from the protected area, to be either logged or converted into oil palm plantations. The remaining forest cover follows the Bukit Barisan range that runs down western Sumatra. However, areas of lowland forest remain, adjacent to the park borders, and until recently there was even an area of lowland swamp forest near Tapan on the western side. Despite its huge size and central importance to the protected area system in Southeast Asia, Kerinci Seblat National Park has been little studied biologically.

Methods

Between April 1996 and October 2005 a small team sponsored by Fauna & Flora International conducted biodiversity surveys throughout Kerinci Seblat National Park. During initial surveys in a new area the standard survey techniques, interviews with local people, first-hand sightings and secondary signs, such as footmarks, were used to assess species presence or non-detection. In areas demonstrating a high biodiversity, infra-red photo-traps became a major component of more extensive surveys to establish what mammal species were present. Over the full survey period, photo-traps worked for approximately 132,000 hours. Images were made representing species from each of the mammal families found within the park, from bats to elephants.

Photo-trap placements were usually set for the larger charismatic species such as Tiger *Panthera tigris*, but placements were also made specifically for the smaller species covered in this report. Experimentation in Sumatra, as well as programmes conducted in Vietnam and Cambodia, suggest that small carnivores are most often photographed when they are the target species. The arboreal civets, for instance, were usually only photographed on cameras set specifically to capture such species: sensors were set low along unusually steep-sided ridge paths where arboreal animals found it difficult to move through the canopy.

Four areas were chosen for photo-trapping programmes, each of which ran for a minimum of six months. The four areas represented different habitat types and altitude zones that typify Kerinci Seblat National Park: Tapan Valley 125–450 m; Tandai 500–900 m; Sipurak 600–1,000 m; and Gunung Tujuh 1,800–2,400 m. In the Tapan Valley the study area consisted of four locations accessed from the main Sungai Penuh–Tapan road. Most of the area surveyed was lowland hill forest constituting the buffer-zone forest bordering the park with moderate human disturbance. Tandai represented old logged forest in a state of regeneration. Some pockets of primary forest remained and the area was contiguous with undisturbed forest above 1000 m. Sipurak represented pristine primary forest at moderate altitude with minimal human incursion. Excluding Sumatran Rhinoceros *Dicerorhinus sumatrensis* (which is reported as present in adjacent areas), Sipurak has an intact species complement of mega-fauna, and is as close to the original undisturbed ecosystem as is possible to find in Kerinci Seblat National Park. The Gunung Tujuh location represented the highest areas in the park where the largest mammals are still found. Although the forest itself is in an undisturbed state, the prey base had been severely depleted by over-hunting of deer and Southern Serow *Naemorhedus sumatrensis.*

Small carnivore records were also obtained during the course of general survey work in locations where photo-traps were not used, including urban areas and the alpine zones on Mount Kerinci (3805 m), the highest peak in western Indonesia.

Species Accounts

Table 1 lists all the species of carnivore recorded from the central Sumatran area, including Felidae, Ursidae and Canidae for comparison.

Indonesian Mountain Weasel *Mustela lutreolina*

A group of four animals was observed in July 1995 during daylight hours at 3,000 m on Mount Kerinci. The habitat type was alpine *Vaccinium* scrub a few hundred meters above the tree line. The four animals were moving along the ground in a train fashion. They showed no fear of the observer and came to within a meter of my position. All appeared to be of a similar size and had a dark slate-coloured pelage. This species never appeared on photo-traps, presumably because it passed beneath the sensors undetected, so it is difficult to assess its real status. It occurs only on Sumatra and Java and has always been poorly known (van Bree & Boeadi, 1978); Lunde & Musser (2003) traced only three specimens from Sumatra (and nine from Java). These were all from the south-west of the island, and so finding the species in Kerinci is not unexpected. This altitude is rather higher than the range of 1,000-2,200 m given by van Bree & Boeadi (1978), but such an extension is unsurprising for such a little known species.

Malay Weasel *Mustela nudipes*

Malay Weasel also never appeared on the photo-traps, perhaps also because of its size, but appears to be quite common. Sight records were made from a variety of altitudes in and around Kerinci. Individuals were seen in primary forest in Tapan at 150 m; old logged forest in Tandai at 700 m, and scrub on Gunung Tujuh at 1,300 m. A road kill victim was also seen in an urban setting near Bukittinggi in West Sumatra .All sight records were made during the day and were remarkable for the animals' boldness and lack of fear.

Yellow-throated Marten *Martes flavigula*

This marten is very common in Kerinci and has been photo-trapped in every location in which cameras were set. Direct field sightings are also frequent. Records come from 200 m – 2,400 m. This species is usually photographed in pairs. As the forests that run down the western side of Sumatra are fairly contiguous, there seems no reason not to assume that it is found all along the western side of the island.

Hog Badger *Arctonyx collaris*

The Hog Badger is very common at higher elevations in Kerinci. During 25,000 hours of photo-trapping on Gunung Tujuh at altitudes between 2,000-2,400 m it was photographed regularly. Most records were made at night, but an individual was also photographed at midday, and a second animal observed during daylight hours. The only other location in which it was found was in Tandai at 700 m where footprints were seen. However, photo-traps working in this area for 50,000 hours did not record Hog Badger, indicating that it is not a common species in this habitat. Among local informants only those that were familiar with the high altitude forests knew the animal, referring to it as Babi Batang. The Museum Zoologicum Bogoriense has no Sumatran specimen and considers it rare (Suyanto pers. comm.).

Sunda Stink Badger *Mydaus javanensis*

This small badger was never photo-trapped but was observed at night along a logging track in Tandai. Another individual often raided the kitchen of the Tiger Protection and Conservation Unit mess in Bangko to the east of Kerinci The local rangers were familiar with its defensive tactics and left it unchallenged. Payne et al. (1985) considered that in Borneo it was predominantly in secondary disturbed areas, which fits with the records made in Kerinci.

Smooth-coated Otter *Lutra perspicillata*

Within the Kerinci area this species was recorded only once, from West Sumatra province where appeared on photo-traps set at

Table 1. Carnivores recorded in the central Sumatra area, 1996-2005.

Species		Altitude	Habitat	Distribution
CANIDAE				
Dhole	*Cuon alpinus*	100-1000 m	Primary & secondary forest	Kerinci-Seblat, Muara Jambi
URSIDAE				
Sun Bear	*Helarctos malayanus*	50 – 2000 m	Primary & Secondary forest	Kerinci-Seblat
MUSTELIDAE				
Indonesian Mountain Weasel	*Mustela lutreolina*	3000 m	*Vaccinium* scrub on volcano	Kerinci-Seblat
Malay Weasel	*Mustela nudipes*	100-1600 m	Forest & rural	Kerinci-Seblat
Yellow-throated Marten	*Martes flavigula*	100-2400 m	Primary forest	Kerinci-Seblat
Hog Badger	*Arctonyx collaris*	700-2400 m	Primary hill forest	Mountainous areas in Kerinci
Sunda Stink Badger	*Mydaus javanensis*	500 m	Secondary forest & rural	Lowlands of central Sumatra
Smooth-coated Otter	*Lutrogale perspicillata*	50-200 m	Small forest streams	West and Eastern lowlands
Oriental Small-clawed Otter	*Aonyx cinerea*	50-2000 m	Rivers & lakes	Kerinci-Seblat
VIVERRIDAE				
Malay Civet	*Viverra tangalunga*	50-200 m	Forest & rural	Eastern Sumatra
Banded Linsang	*Prionodon linsang*	100-2400 m	Primary forest	Kerinci-Seblat
Common Palm Civet	*Paradoxurus hermaphroditus*	50-250 m	Forest & rural	Across central Sumatra
Masked Palm Civet	*Paguma larvata*	100-2400 m	Primary & secondary forest	Across central Sumatra
Binturong	*Arctictis binturong*	500-2300 m	Primary & secondary forest	Across central Sumatra
Small-toothed Palm Civet	*Arctogalidia trivirgata*	900 m	Primary hill forest	Kerinci-Sebalat
Banded Civet	*Hemigalus derbyanus*	100-800 m	Primary forest	Only in Western lowlands
FELIDAE				
Leopard Cat	*Prionailurus bengalensis*	50-900 m	Forest & rural	Across central Sumatra
Fishing Cat	*Prionailurus viverrina*	50-100 m	Lowland swamp forest	West Kerinci, Muara Jambi
Asian Golden Cat	*Catopuma temminckii*	100-2000 m	Primary & secondary forest	Kerinci-Seblat
Marbled Cat	*Pardofelis marmorata*	100-2400 m	Primary forest	Kerinci-Seblat, Sibolga area
Clouded Leopard	*Pardofelis nebulosa*	100-2300 m	Primary & secondary forest	Kerinci-Seblat
Tiger	*Panthera tigris*	50 – 2400 m	Primary & Secondary forest	Kerinci-Seblat

200 m in primary forest laced with small streams. The photograph showed the otter travelling through the forest about 500 m from the nearest watercourse. A second record was made from the Muara Jambi area on the eastern side of the island in heavily degraded swampy forest at 50 m.

Small-clawed Otter *Aonyx cinerea*

This is the commonest otter in Kerinci, found along most streams and lakes surveyed. One group is resident on Lake Tujuh, a water-filled volcanic crater at 1,995 m. This lake has only two small species of fish and the otters appear, judging by the contents of their spraints, to feed predominantly on crabs.

Malay Civet *Viverra tangalunga*

The only records for this species were from the lowlands around Muara Jambi where a skull was collected from a road kill and one animal was observed (D. Martyr pers. comm.). On the basis of extensive photo-trapping efforts failing to capture this species it seems safe to assume that it is not found within Kerinci Seblat National Park, where photo-trapping took place to the lowest possible locations.

Banded Linsang *Prionodon linsang*

The linsang was photo-trapped infrequently in all four of the study sites, from lowland primary forest at 150 m to montane cloud forest at 2,400 m. The low number of photographs is not surprising considering its small size and presumed arboreal habits. One individual was observed by spotlight foraging on the ground in Sipurak; probably never having encountered a human before, it approached and sniffed my boot.

Common Palm Civet *Paradoxurus hermaphroditus*

The Common Palm Civet appears to be common only in cultivated habitat (e.g. three dead examples were seen along a 10 km stretch of road in the western lowlands in one day) but it has never appeared on photo-traps set in the Kerinci forests, although one was seen in forest 100 m from a village. Local people in West Sumatra collect the faeces of this species when the animal has fed on coffee beans, separating and drying the beans to create high grade coffee known as kopi luwak. This civet lived in the roof of our town house in the regional capital Sungai Penuh.

Masked Palm Civet *Paguma larvata*

This is the commonest forest civet, ranging from the lowlands to the highest forested areas. Photographs were made at 2,400 m and scats probably from this species were seen at even higher elevations. An individual was also observed in our Sungai Penuh kitchen. It is commonly caught in snares set for Red Muntjac *Muntiacus muntjac* and Serow.

Binturong *Arctictis binturong*

Binturong has been recorded from 700 m to 2,500 m. Although sightings are frequently made in the high canopy during the day, it also appeared a number of times on photo-traps at night. One was photographed eating fallen jackfruit. The bones of a snared binturong were collected from a Serow snare set at 2,500 m. There are local reports of Binturongs straying into villages to raid chicken coupes. It is know locally as Balun Ijuk in reference to its broom-like appearance.

Small-toothed Palm Civet *Artogalidia trivirgata*

This species was never photo-trapped so it is impossible to assess its status in Kerinci. A skull was found in primary forest at 800 m, proving that the species is present. It appears to be completely arboreal, and as pointed out by Walston & Duckworth (2003) this makes it easily overlooked by conventional survey methods.

Banded Civet *Hemigalus derbyanus*

The few records made of this species come only from lowland primary forest along the western flank of Sumatra. In Kerinci the highest altitude record comes from 150 m where the species was photo-trapped twice. North of Kerinci in Sibloga, on the west coast, an animal was photo-trapped at 800 m. Photo-trap records perhaps suggest that it is not common even where it does occur, although this might simply indicate that it is forages through the forest rather than along trails. Moreover, local people seldom recognise it when questioned about small carnivore presence. Due to habitat loss in the lowlands of the west coast, this is the only viverrid, other than Sunda Otter Civet *Cynogale bennettii* (see below), that might be considered threatened in Sumatra.

Species not recorded

Eurasian Otter *Lutra lutra*, Hairy-nosed Otter *Lutra sumatrana*, Small Indian Civet *Viverricula indica*, Sunda Otter Civet, Short-tailed Mongoose *Herpestes brachyurus* and Collared Mongoose *Herpestes semitorquatus* are all previously known from the Sumatran mainland (Corbet & Hill 1992), but were not recorded by these surveys (a mongoose seen crossing a road in Bengkulu at night (10 m asl) was Malay Civet-sized with a longish bushy tail, but was not identified to species). Most of these species are associated with standing water, as is Flat-headed Cat *Prionailurus planiceps*, also not recorded (Holden, 2001). Otter Civet records of Sumatra come mostly from the flatter lowlands of the east and south (Veron et al. 2006), and there may be a similar explanation for the lack of records of the other species. The Collared Mongoose is represented on Sumatra by an endemic race *H. s. uniformis,* for which Schreiber et al. (1989) traced only two records, one from near Kerinci: at Ayer Taman, Gunung Pasaman, Ophir District, West Sumatra. However, this was at only 300 m (Robinson & Kloss, 1919), well below the main altitudes of the present surveys.

Conservation notes on small carnivores in central Sumatra

Data collected by the Tiger Protection and Conservation Units (unpublished) show the small carnivores suffer very marginally as bytake in deer and, especially Serow trapping, but that none of the above species is being targeted by hunters. The type of rugged terrain frequented by Serow is also the kind of habitat where arboreal animals are most often forced to retreat to the ground, which probably accounts for the frequency of trap records from these areas. In West Sumatra farmers are lenient towards chicken-coop-raiding civets because the faeces are collected for kopi luwak. Given the predominantly mountainous nature of Kerinci Seblat National Park it is unlikely that habitat loss will seriously threaten any of the above species with the exception of Banded Palm Civet, which prefers the lowland primary forest that is most at risk.

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Stripe-backed Weasel *Mustela strigidorsa* for sale as traditional medicine in Lao PDR

T. E. HANSEL and R. J. TIZARD

On 21 March 2004, two Stripe-backed Weasels *Mustela strigidorsa* were found for sale in a traditional medicine stall at the Vientiane morning market, Lao PDR. Both were reportedly collected in Oudomxay province by relatives (which would generally include close friends) of the seller, captured while raiding the relative's chicken house. The seller advised that the species was strong medicine for back-ache and that it, or part(s) thereof, was administered boiled in a tea. The specimens were dried with pelage still largely intact, allowing easy identification. The asking price of c. US$ 4.50 per animal shows them to be of relatively high value. Oudomxay is within the known Lao range of this species; it occurs to the south-east (Evans *et al*., 1994) and north-west (Tizard, 2002).

Since the mid-1990s both authors living primarily in Lao PDR, visited numerous medicinal stands, but previously saw no weasels of any species in trade. None of Ratajszcak & Cox (1991), Evans *et al*. (1994), Duckworth (1997), Duckworth *et al*. (1999), Grassman *et al*. (2002) or Tizard (2002) refered to the species in trade. Moreover, Schreiber *et al.* (1989) did not mention medicinal trade as a threat to any species of mustelid or viverrid worldwide. However, significant trade, at least in pelts, does or did exist in China. In total c. 3000–4000 fur pelts were harvested annually in the 1970s in China (Sheng Helin, 1998). In 1973, 50 skins were purchased in Nanning, Guangxi, and a more recent trade record from China is that skins/dried corpses were seen 2–5 times in a survey of wildlife trade along the Yunnan-Vietnam border in June–August 1997; the source was said to be Yunnan (Li & Wang, 1999).

Much of the widespread, high-volume trade of wildlife in Lao PDR is sold to China (Nooren & Claridge, 2001). Trade is apparent in almost all markets and roadside stalls; high-value animals, e.g. Tigers *Panthera tigris* and turtles, are sold covertly while open sale of more common species such as songbirds and amphibians is ubiquitous. These Stripe-backed Weasels in trade could be just opportunistic sale of an unusual animal, but trade monitors should be aware that the species is traded in China and could occur from time to time in neighbouring countries. It is unclear whether such a trade for pelts and traditional medicine might add significantly to the presumed threats facing this enigmatic and little-known creature, and further information is needed.

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Recent records of and notes on the conservation of small carnivores in Quang Nam province, central Vietnam

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Introduction

Quang Nam province lies within the Central Annamites landscape (Baltzer *et al*. 2001) of the Annamite Range Moist Forests Ecoregion (Olson & Dinnerstein, 1998) between 14°57'22'' and 16°04'28'' north, and 107°13'35'' and 108°42'06'' east (Fig. 1). Covering 10,405 km^2 (Department of Land Administration, 2000), Quang Nam is divided into 15 districts and two towns (Fig. 1). Thirteen of these 15 districts have natural forest cover which accounts for 5,097 km^2 or 49% of the province (Long, 2006).

Quang Nam has a humid, tropical climate. There is a hot, dry season from April to August, a hot, wet season from September to December and a mild, dry season from January to March. The mean annual temperature is 25.4°C with mean monthly temperatures that range from 21.5°C in January to 28.5°C in July (Anon, 2003). Humidity varies throughout the year but averages 85.5% annually (Anon, 2003). The average annual precipitation is 3,033mm, but the majority of this falls between September and December (Anon, 2003).

The topography of Quang Nam is characterised by a general highland-to-lowland gradient running from west to east. The province is bordered to the north by the Bach Ma-Hai Van Mountains, which are an eastward running spur of the main Annamite ridge that itself forms the western boundary of the province. The Kon Tum Plateau has its northern reaches in southern Quang Nam. The highest peak, Ngoc Linh (2,598 m), and its associated mountain chain create the southern border of the province.

Being bordered by mountains on three sides and the coast on the east, the majority of the province is comprised of a single catchment, the Thu Bon. This large river combines in central Quang Nam with the main Thu Bon catchment (3,350 km^2) draining the southern part of the province, including the Ngoc Linh area. The Vu Gia system (5,500 km^2) drains the western and northern districts, through the Cai and Bung rivers respectively, and joins the Thu Bon in Dai Loc district. A small drainage system; the Tam Ky (800 km^2), is located in the south-east of the province and drains the coastal zone around Thanh Binh, Tam Ky and Nui Thanh districts (Fig; 1).

Figure 1 Map of Quang Nam showing districts, forest cover and rivers

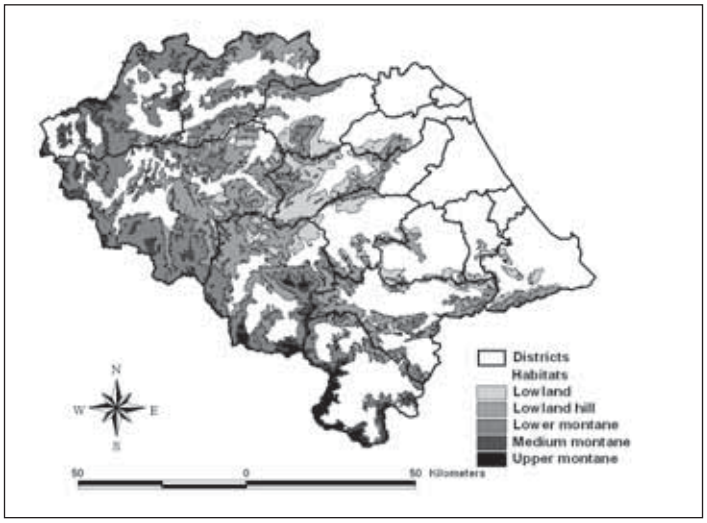

Figure 2 The habitats of Quang Nam

The forests of Quang Nam are moist tropical evergreen and can be categorised into five major natural habitat types based on altitude; lowland (0-300 m), lowland hill (300-700 m), lower montane (700-1,200 m), medium montane (1,200-1,500 m) and upper montane (>1,500 m) (see Long *et al*. 2005; Fig; 2) following the classification of Tordoff *et al.* (2003).

The forest estate of Quang Nam is currently managed by district-level authorities, forest management boards and State Forest Enterprises with overall protection of forests and biodiversity falling under the jurisdiction of the province's Forest Protection Department (FPD). In practice, district authorities implement little to no forest management and State Forest Enterprises are solely concerned with timber extraction. One provincial-level nature reserve, Song Thanh, is found in the west of the province spanning southern Nam Giang and western Phuoc Son districts. Song Thanh was established in 1999 and has a core zone of 932 km^2 but a ranger force of only 29. However, it has been implementing a management plan since December 2004. A Watershed Protection Management Board is responsible for forest protection and management around the Phu Ninh reservoir, Phu Ninh district, in the southeast of the province. The forest in this area is a mixture of secondary formations with only small areas of natural, primary forest on the hill tops with non-native plantations in the lower areas.

Recent documented biological surveys of the province began in 1993, but many focused on species-specific topics including Saola *Pseudoryx nghtinhensis* (Quang Nam - Da Nang FPD, 1996), Asian Elephant *Elephas maximus* (Walston *et al.* 1997; Thai Truyen, 1998; Heffernan & Truong Duc Muoi, 2000; Nath &Trinh Viet Cuong, 2000; Ngo Van Tri, 2000), Tiger *Panthera tigris* (Tran Quoc Bao, 1999), primates (Vu Ngoc Thanh, 1999; Ha Thang Long, 2000; Vu Ngoc Thanh *et al*., 2001) and turtles and terrapins (Le Thien Duc and Trinh Le Nguyen, 2001).

Date	District	Commune	Camera-traps (trap nights)
30 Mar – 11 Apr 2002	Nam Giang	Tabhing	0
14 Apr – 28 Apr 2002	Que Son	Que Ninh	497
10 Jul – 12 Jul 2002	Nam Giang	Tabhing	236
14 Jul – 16 Jul 2002	Nam Giang	Tabhing	178
07 Sep – 15 Sep 2002	Tay Giang	A'Vuong	1271
20 Sep – 29 Sep 2002	Dong Giang	Macooih	0
06 Mar – 20 Mar 2003	Que Son	Que Lam	0
08 Apr – 12 Apr 2003	Que Son	Que Loc, Que Long, Que Hiep	0
07 May – 15 May 2003	Phuoc Son	Phuoc Xuan	1481
16 Jul – 24 Jul 2003	Phuoc Son	Phuoc Thanh	0
14 Aug – 20 Aug 2003	Phuoc Son	Phuoc Hiep	0
09 Sep – 13 Sep 2003	Bac Tra My	Tra Bui	0
26 Mar – 03 Mar 2004	Phuoc Son	Phuoc Xuan	0
06 Apr – 14 Apr 2004	Dong Giang	Macooih	0
16 Feb – 25 Feb 2004	Nam Giang	La Ee	1154
04 Jan – 14 Jan 2004	Nam Giang	Dak Pring	623
28 Feb – 05 Mar 2005	Tay Giang	A'Vuong	897
12 Mar – 16 Mar 2005	Que Son	Que Lam	0
21 Apr – 29 Apr 2005	Nam Giang	Zouih	0
02 Aug – 07 Aug 2005	Tien Phuoc	Tien Lanh	0
16 Aug – 20 Aug 2005	Que Son	Que Phuoc	0
05 Sep – 14 Sep 2005	Nam Giang	Dak Pring	0

Table 1. Survey dates, location and effort.

The IUCN/SSC *Action Plan for the Conservation of mustelids and viverrids* (Schreiber *et al*. 1989) highlighted Vietnam as a priority area for small carnivore surveys through its global importance for small carnivore conservation yet lack of available, up-to-date, data. This paper therefore contributes to this recommendation. The records presented here are collated from surveys conducted through the WWF MOSAIC project which was initiated in March 2002 and is on-going. Prior to this work, only three documented surveys had occurred that covered a range of taxa; these being a feasibility study for the Phu Ninh Watershed Protection Area (Anon, 1993), a preliminary assessment of western Quang Nam (Wikramanayake, 1997) and a feasibility study of the proposed Ngoc Linh Nature Reserve (Tordoff *et al.* 2000).

The first of these surveys recorded *Lutra sumatrana*, *Martes flavigula*, *Melogale moschata*, *Arctonyx collaris*, *Paguma larvata*, *Paradoxurus hermaphroditus*, *Viverra zibetha* and *Viverricula indica.* However, the validity of the data presented in this report is difficult to assess and the authorship of the document is unclear, hampering identification clarification. Moreover, some records are dubious, such as a record of Raccoon Dog *Nyctereutes procyonoides* from far south of its recorded distribution (Dang Huy Huynh *et al*., 1994). Data from this report are therefore not regarded as reliable and not discussed further here.

Wikramanayake (1997) presented observations of *Arctonyx collaris*, *Lutra lutra*, *Melogale* sp., *Mustela* sp., *Paguma larvata*, *Paradoxurus hermaphroditus*, *Viverricula indica*, *Viverra zibetha*, *Prionodon pardicolor*, *Arctogalidia trivirgata* and *Herpestes urva* and recorded *Arctictis binturong* through interview. However, locality data are only provided to the level of district, and no evidence is given as to how *Lutra lutra* could be identified in the field, so further discussion of these records is not made in this manuscript.

Methods

Field surveys were conducted as part of general biodiversity surveys to aid systematic conservation planning, although some surveys in 2005 were focused on primates. As such, surveys consisted primarily of diurnal, slow walks along existing human or animal trails between 05h00 and 17h00 and were usually conducted from a single base camp. A variety of habitats was searched at each site. Night surveys were conducted only in limited locations due to the constraints of vegetation, terrain or weather. A total of between four and nine CamTrakker™ camera-traps were deployed at eight sites with varying effort (see Table 1).

Species accounts

Yellow-bellied Weasel *Mustela kathiah*

A single camera-trap record of this species was obtained from A'Vuong commune, Tay Giang district (Fig. 3). A single animal was photographed walking along a tree trunk growing almost horizontal out of a steep sided slope in primary lower montane forest at 1015 m and 15°59'51.6"N, 107°33'48.8"E. The photograph was taken at 13h19 on 30 January 2003.

The distribution of this species in Indochina was recently reviewed by Duckworth & Robichaud (2005) showing it to be a montane species with an unclear southern distribution limit; the present record is near the current known southern limit. The species is widely distributed throughout northern Indochina, but its conservation status remains difficult to assess due to the scarcity of records. Given its montane distribution, however, it is not likely to be at immediate risk.

Fig. 3. Yellow-bellied weasel *Mustela kathiah*

Fig. 4. Small-toothed Ferret Badger retrieved from a snare in Maccoih commune.

Yellow-throated Marten *Martes flavigula*

The most frequently observed species of small carnivore in Quang Nam with three sightings, but as yet no records from camera-traps (Table 2). Animals from Quang Nam exhibit a yellow throat and neck, but this coloration does not extend far down the back in contrast to the pattern often seen in northern Indochina. On both the authors' direct observations, pairs of martens were seen in steep forest with the animals being very active in lower branches and on the ground. Such behavioural observations are similar to those recorded in Lao (Duckworth, 1997). Both observations were obtained from primary forest in areas with priority primate populations for the province, possibly reflecting pockets of forest which escaped intensive hunting with guns during the 1960s to 1990s.

Hog Badger *Arctonyx collaris*

Tordoff *et al.* (2000) recorded this species from the proposed Ngoc Linh Nature reserve based on animal remains examined. An observation by the authors was made in A'Vuong commune, Tay Giang district on 12 September 2002, at 07h10 in primary lower montane forest at 930 m at 16°00'02.4"N, 107°33'47.5"E. On 4 August 2005, an FPD ranger, Nguyen Ngoc Anh, observed a single animal foraging during the early morning daylight hours at 640 m in disturbed, primary hill forest at 15°30'7.6"N, 108°10'57.7"E in Tien Lanh commune, Tien Phuoc district. A widespread species in Vietnam (Roberton, in prep.), it is surprising that only three records of Hog Badger have been obtained. This could suggest a patchy distribution or a local decline in the species due to heavy snare and log-fall trap pressure on terrestrial species or the ease of hunting a diurnal species by hand, gun or with the use of dogs. However, there appears to be little demand for the species either for food or medicine in Vietnam, so hunting of the species would appear to be primarily as by-catch.

Small-toothed Ferret Badger *Melogale moschata*

A single animal was recovered from a hunters' trap in Macooih commune, Dong Giang district, by Vu Ngoc Thanh on 11 April 2004 (fig. 4). The animal was collected at between 700 and 800 m in primary lower montane forest and is housed in the Vietnam National University Museum in Hanoi (specimen number 1057). Ferret badgers have been camera-trapped from between 625 and 1,015 m on a number of occasions from three locations and appear locally common (see Table 3). The two species of ferret badgers in Vietnam cannot be readily identified by sight, however, and their respective distributions are not clearly understood. Other ferret badger records from Quang Nam therefore are not recorded to species level because there was no in-had examination to check dentition: this would be a sensible caution throughout Indochina.

District	Commune	Lat	Long	Altitude	Time	Date	Notes
Nam Tra My	-	-	-	-	-	1999	Tordoff *et al.*, 2000
Dong Giang	Macooih	15°48'25"	107°40'06"	740 m	Day time	23 Sep 2002	2 animals observed
Phuoc Son	Phuoc Xuan	15°34'02"	107°47'11"	425 m	07h20	01 Apr 2004	2 animals observed

Table 2. Yellow-throated Marten records.

District	Commune	Lat	Long	Altitude	Time	Date	Species
A'Vuong	Tay Giang	15°59'51.6"	107°33'48.4"	1,015 m	23h14	01 Jan 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'30.1"	107°45'29.9"	785 m	22h38	06 Jun 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'30.1"	107°45'29.9"	785 m	22h41	06 Jun 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'30.1"	107°45'29.9"	785 m	20h57	07 Jun 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'30.1"	107°45'29.9"	785 m	17h59	30 Jun 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'30.1"	107°45'29.9"	785 m	20h35	30 Jun 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'30.1"	107°45'29.9"	785 m	21h16	30 Jun 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'23.5"	107°45'06.9"	625 m	Night time	24 Jul 2003	*Melogale* sp.
Phuoc Son	Phuoc Xuan	15°31'23.5"	107°45'06.9"	625 m	Night time	05 Aug 2003	*Melogale* sp.
Dong Giang	Macooih	15°47'55.8"	107°40'10.6"	700-800 m	-	11 Apr 2004	*M. moschata*

Table 3. Ferret badger records

Fig. 5. Large Indian Civet from A'Vuong commune.

Fig. 6. Masked Palm Civet from A'Vuong commune.

Otters

The Eurasian Otter *Lutra lutra* was observed in 1999 from the proposed Ngoc Linh Nature Reserve (Tordoff *et al*., 2000). However, no details of how the species was identified were provided so, due to the difficulty of identifying otter species under field conditions, this record is treated here as provisional. No other otter sightings have been made although spraints and tracks not confidently identifiable to species level have been found. The three spraint sites (see Table 4) were all found on the main course of upper reaches of forest rivers and in all locations a series of spraint sites were observed at regular intervals along the river. All spraints consisted primarily of crab remains with numerous faeces present, representing repeat visits. Spraint sites were typically on large rocks in the river, but by the bank with faeces deposited in depressions on the top of the rock. These characteristics closely fit those of the Oriental Small-clawed Otter *Aonyx cinerea* according to Kruuk *et al.* (1993), however they are only provisionally assigned to this species here.

A set of tracks tentatively ascribed to the Smooth-coated Otter *Lutrogale perspicillata* were observed and photographed by Jeremy Holden in December 2005 in Que Phuoc commune (see Table 4). The tracks were large and the observer is familiar with tracks of *L. perspicillata*, from Sumatra. The tracks were seen almost 1 km from the closest river on a forest track in a drying puddle. The disturbed primary lowland forest was on undulating forest with swampy streams and many *Licuala* palms. The tracks indicated that a single animal had travelled across the trail in both directions over the previous few days. A footprint of an unidentified otter was seen by the side of Ta Po stream in Zuoih commune on 28 April 2005.

Large Indian Civet *Viverra zibetha*

Two camera-trap records of this species were obtained, the first from La Ee commune in Nam Giang district at 19h14 on 10 June 2004, at 720 m in primary lower montane forest at 15°35'57.1"N, 107°22'37.3"E. The second was from A'Vuong commune in Tay Giang district at 01h18 on 26 June 2005 (Fig. 5), at 590 m in primary hill forest at 15°59'10.1"N, 107°37'47.4"E. Following Walston & Veron (2001) the nominal taxon *V. tainguensis* is not considered here to be identifiable. As such, the camera-trap images presented here have not been eliminated as possibly representing *V. tainguensis*, should it in fact prove to be a valid taxon.

Spotted Linsang *Prionodon pardicolor*

Three records of Spotted Linsang were obtained from two locations in Quang Nam. The first location was at 1,015 m in primary lower montane forest in the north of the province, where a single camera-trap produced two photographs of the species (Table 5 and see back cover). The second location was in disturbed primary lowland hill forest where an animal was observed one afternoon high in

District	Commune	Lat	Long	Altitude	Date	Species	Notes
Nam Tra My	-	-	-	-	1999	[*Lutra lutra*]?	Tordoff *et. al*. 2000
Nam Giang	Tabhing	15°35'26.9"	107°39'20.6"	360 m	31 Mar 2002	[*Aonyx cinerea*]?	Spriant
Que Son	Que Phuoc	15°43'37.7"	107°54'30.8"	210 m	18 Apr 2002	[*Aonyx cinerea*]?	Spraint
Phuoc Son	Phuoc Xuan	15°30'41.9"	107°46'32.9"	600 m	07 May 2003	[*Aonyx cinerea*]?	Spraint
Que Son	Que Phuoc	15°40'47.7"	107°53'35.8"	320 m	24 Dec 2005	*Lutrogale perspicillata*?	Tracks
Nam Giang	Zuoih	15°45'10.3"	107°35'22.8"	465 m	28 Apr 2005	*Lutra* / *Lutrogale* sp.	Tracks
Que Son	Que Phuoc	15°40'34.5"	107°53'56.9"	275 m	Dec 2005	*Lutrogale perspicillata*	Tracks

Table 4. Otter records.

District	Commune	Lat	Long	Altitude	Time	Date
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	22h31	19 Oct 2002
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	02h51	18 Jan 2003
Dong Giang	Macooih	15°48'46.9"	107°40'04.9"	550 m	15h02	09 Apr 2004

Table 5. Spotted Linsang records.

Table 6. Common Palm Civet records.

District	Commune	Lat	Long	Altitude	Time	Date
Nam Tra My	Tra Do'n	15°10'40.5"	108°02'23.7"	1,640 m	23h48	23 Mar 1999
Nam Tra My	Tra Do'n	15°10'40.5"	108°02'23.7"	1,640 m	04h39 + 04h40	26 Mar 1999
Que Son	Que Ninh	15°43'58.2"	107°54'13.7"	220 m	-	24 Apr 2002
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	01h10	29 Oct 2002
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	Night time	19 Feb 2003
Phuoc Xuan	Phuoc Son	15°31'23.5"	107°45'06.9"	625 m	23h01	11 May 2003
Nam Giang	La Ee	15°36'11.7"	107°22'10.6"	1,035 m	00h45	01 May 2004
Nam Giang	La Ee	15°35'55.9"	107°22'53.1"	1,015 m	22h55	30 Jul 2004
Nam Giang	Zuoih	15°42'17.9"	107°33'22.8"	185 m	21h00	22 Apr 2005

Table 7. Masked Palm Civet records.

District	Commune	Lat	Long	Altitude	Time	Date
Nam Tra My	Tra Do'n	-	-	-	-	03 Apr 1999
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	01h05	15 Oct 2002
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	19h02	22 Oct 2002
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	22h36	02 Nov 2002
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	22h19	22 Jan 2003
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	21h49	25 Jan 2003
Tay Giang	A'Vuong	15°59'51.6"	107°33'48.4"	1,015 m	Night time	20 Feb 2003
Phuoc Son	Phuoc Xuan	15°31'30.1"	107°45'29.9"	785 m	19h33	28 Jun 2003
Nam Giang	La Ee	15°36'31.1"	107°22'45.3	1,000 m	-	22 Feb 2004
Nam Giang	La Ee	15°36'11.7"	107°22'10.6"	1,035 m	03h11	15 May 2004
Nam Giang	La Ee	15°36'11.7"	107°22'10.6"	1,035 m	03h50	15 May 2004
Nam Giang	La Ee	15°36'11.7"	107°22'10.6"	1,035 m	20h48	08 Jul 2004
Nam Giang	Dak Pre	15°33'55.6"	107°31'43.5"	590 m	21h48	25 Jul 2005

the canopy of a dead tree as it ran at speed into dense canopy. The species is known to use a range of habitats (Van Rompaey, 1995) but has been sparsely recorded in Vietnam (Roberton, *in prep*.), and there are few records from Lao (Duckworth *et al.* 1999).

Common Palm Civet *Paradoxurus hermaphroditus*

Four camera-trap locations have recorded this species: Ngoc Linh proposed Nature Reserve (Tordoff *et al.*, 2000) and A'Vuong, Phuoc Xuan and La Ee communes, the first of these producing two photograph-events (see Table 6). Two juveniles were observed in a tree hole in secondary lowland evergreen forest in Que Ninh commune at 220 m. The species has been recorded in a range of primary and secondary habitats over an altitude range of 220-1,035 m. Observations include one dead animal caught in a snare in La Ee commune on 22 February 2004 at 15°36'32.5"N, 107°22'43.7"E, at 1000 m. Two animals were observed on a dirt road running along the Boung River in Zuoih commune, Nam Giang district at 21h00 on 22 April 2005.

Masked Palm Civet *Paguma larvata*

The most commonly recorded small carnivore species in Quang Nam. All records of Masked Palm Civet except one came from camera-traps (Fig. 6) and occurred at night (Table 7). All records were from primary forest, but this may not be a true indication of the species's habitat use, because the habitat type itself was the focus of camera-trapping efforts. All records were of single individuals, but one camera-trap in A'Vuong commune obtained pictures of three animals including a male and a juvenile. A single dead animal was found in a snare in La Ee commune at 15°36'31.1"N, 107°22'45.3"E, at 1,000 m on 22 February 2004.

Duckworth (1997) suggested that this is a montane species in Lao because all records were from over 500 m. The results from Quang Nam are consistent with the species also showing such a pattern in Vietnam, but caution should be taken as the majority of camera-trapping effort was above 500 m, so this biases interpretation of results. It has been recorded below this altitude in Vietnam, although it appears more common above 500 m (Roberton, *in prep*.).

Small-toothed Palm Civet *Arctogalidia trivirgata*

While widely recorded in south and central Lao (Duckworth, 1997), the Small-toothed Palm Civet had not been recently recorded from Vietnam until 2003 when it was observed in Cat Tien National Park (Borissenko *et al.*,2004). Moreover, historically few records are documented (Dang Huy Huynh & Pham Trong Anh, 1974; Dang Huy Huynh *et al.* 1994).

On 9 April 2004 a single adult was observed between 19h02 and 19h28 at 770 m in primary lowland hill forest. The animal was observed from a distance of less than 5 m by torch light and appeared undisturbed by the observers. It was feeding in dense foliage in small trees some 7 m above the ground. The conspicuous white ear markings were clearly seen as were three dark longitudinal stripes along the dorsum. The venter was paler than the dorsum and the tail was darker at the tip than at the base. These characteristics are

Table 8. Crab-eating Mongoose records.

District	Commune	Lat	Long	Altitude	Time	Date
Que Son	Que Ninh	15°43'37.7"	107°54'30.8"	210 m	07h02	28 Jul 2002
Nam Giang	Tabhing	15°42'02.8"	107°42'00.8"	580 m	Day time	Jun-Sep 2002
Namg Giang	La Ee	15°36'16.3"	107°22'11.9"	1,030 m	08h30	Apr-May 2004
Nam Giang	Dak Pre	15°32'35.7"	107°32'21.9"	940 m	08h29	27 Aug 2004

similar to those reported for animals in southern Vietnam (Borissenko *et al*. 2004) and Cambodia (Walston & Duckworth, 2003), and place this animal within the northern *leucotis* group of races (Van Bemmel, 1952).

The record came from Macooih commune in Dong Giang district at 15°48'24.2"N, 107°39'39.4"E. Although the animal was observed in primary forest, it was on the edge of heavily logged forest and adjacent to a recently constructed forest trail used for vehicle access to the area's steep slopes, to enable slope stabilisation testing as the area is above the constriction site for a large hydropower dam projected to produce 704.5×10^6 Kwh annually. This is consistent with the proposal that the species can withstand some level of habitat degradation, as shown by Duckworth (1997). The lack of records of this species does not necessarily mean that the species is rare in Quang Nam. Walston & Duckworth (2003) argued that due to the species' strictly arboreal and nocturnal habits, it is very hard to detect with the use of camera-traps and is best found by active spotlighting; a method used little in Quang Nam to date.

Binturong *Arctictis binturong*

Remains of a Binturong were reported by Tordoff *et al*. (2000) from the proposed Ngoc Linh Nature Reserve, but no other details are provided. An adult male Binturong was released from a snare in Dak Pring commune, Nam Giang district, on 10 January 2005 at 15°28'46.8"N, 107°35'43.3"E. The animal was trapped at 1,025 m in primary lower montane forest. This area is the least disturbed and most remote area of forest in Quang Nam, representing the core of Song Thanh Nature Reserve.

Owston's Civet *Chrotogale owstoni*

A single camera-trap record of Owston's Civet was obtained from Song Thanh Nature Reserve (Fig. 7). The photograph was taken at night on 30 August 2003 at 625 m in primary hill forest in Phuoc Xuan commune, Phuoc Son district, at 15°31'23.5"N, 107°45'06.9"E. The camera-trap was set on a small animal trail running along a ridge, but off the top of the ridge, on the steep adjacent slopes. The location had an open understorey with numerous *Licuala* palms and scattered saplings. A single animal was observed at 22h00 on 25 April 2005 at 15°44'3.1"N, 107°36'49.3"E, at 430 m. The animal was catching frogs close to a small stream in bamboo-dominated lowland forest in relatively flat terrain.

The low capture rate of this species is comparable with the only other long-term camera-trapping programme in the Vietnamese Annamites: that conducted in Pu Mat National Park (SFNC, 2000). These results are in stark contrast to the relative frequency of capture in the Hoang Lien Mountains in the far north of Vietnam where the species was the most commonly photographed carnivore during camera-trapping there (S. Swan *pers. comm*.). Owston's Civet remains very little understood (Veron *et al*. 2004; Long *et al*., *in prep*.) so these two records represent a significant contribution to existing knowledge on the species, especially as they originate from the south of the species' range, from which particularly few data exist.

Small Asian Mongoose *Herpestes javanicus*

A single animal was reported from the proposed Ngoc Linh Nature Reserve some time between 6 March and 2 May 1999 during surveys as part of the feasibility study for establishing the protected area (Tordoff *et al.*, 2000). No further details are provided.

Crab-eating Mongoose *Herpestes urva*

Four camera-trap records of this species have been obtained (Table 8) ranging from secondary lowland riverine forest at 210 m to primary lower montane forest at 1030 m. All records were obtained during daylight hours. Although this species was stated by Lekagul & McNeely (1977) and Corbet & Hill (1992) to be nocturnal, these statements may have been based solely on Pocock (1941) who merely inferred that it might hunt mainly by night. Other recent studies throughout Indochina, including camera-trap records (Pham Trong Anh, 1992; Duckworth, 1997; Van Rompaey, 2001; Duckworth, & Robichaud, 2005; S. Roberton, *pers. comm*.) found the species to be active diurnally.

Fig. 7. Owston civet *Chrotogale owstoni.*

Fig. 8. Snared Masked Palm Civet in La EE commune.

Fig. 9. Log-fall trap.

Threats

Small carnivore, specifically civet, meat is a popular dish in Quang Nam and is readily available in the numerous restaurants illegally selling wildlife meat. The demand for wildlife meat is driven by the growing middle and upper classes in urban centres which see an invitation to a dinner of wildlife meat as a symbol of high status. This demand is locally driven with over 74 wildlife restaurants identified in Quang Nam alone (Roberton *et al*. 2005), most selling civet meat.

The trade in civet meat results in high trapping pressure throughout the forests of Quang Nam. In one instance, a trap encounter rate of 13.2 traps per km was calculated over a distance of 31.5 km. Trapping takes two major forms, the snare (Fig. 8) and the baited log-fall trap (Fig. 9), although hunting with guns has been recorded on a few, limited, occasions. Otters are reportedly caught using lines of hooks laid in the river within which they are entangled. Snares are usually associated with a drift fence and they are found on almost every ridge path walked, as are log fall traps although these are not associated with drift-fences. Although local communities do hunt, their primary purpose is crop protection: most hunting is by professional hunters to supply the illegal trade in wildlife meat for local restaurants.

Forest loss is not nowadays a major problem in central Vietnam, however, a recent upsurge in infrastructure development, specifically roads and hydropower dams, is fragmenting natural habitat and improving access into previously remote areas of forest. Moreover, during construction, the large influx of workers into mountainous areas increases local demand for wildlife meat, driving even more intensive hunting.

Illegal logging is widespread and, although poses little direct threat to small carnivores, it can facilitate direct threats as loggers often hunt for subsistence during their time in the forest, thereby increasing hunting pressure. Gold mining is a major issue in Quang Nam with numerous legal and illegal mines operating inside the forest. As with loggers, miners usually hunt for subsistence when in the forest, and gold mining also poses major direct threats to freshwater systems increasing water turbidity and realising toxic chemicals including mercury and cyanide. The majority of river systems in western Quang Nam have goldmines on them, and this may have serious consequences for aquatic species such as the otters.

Discussion

Quang Nam holds a representative sample of the small carnivores expected to be present in the Central Annamite Mountains, including some rarely recorded species such as Yellow-bellied Weasel, Owston's Civet and Small-toothed Palm Civet. Further clarification is required on the species community of the weasels and otters, and the high montane area of the Ngoc Linh massif deserves further investigation, especially with the use of camera-traps.

The otters are under enormous threat from mining, hunting and hydropower dam construction. Few otter records were obtained, despite most surveys using rivers for access. A status and threat assessment of the otters should be a priority if conservation actions are to adapt to these emerging threats.

By far the largest threat to the small carnivores of Quang Nam is the ubiquitous distribution of ground-level traps and the intense pressure this form of hunting exerts on wildlife populations. Trap removal and monitoring exercises by the Forest Protection Department and other enforcement agencies are critical to the maintenance of current levels of biodiversity in Quang Nam. The hunting is driven by the urban demand for wildlife meat and a two-pronged approach to this trade is required; 1) law enforcement targeting retail outlets and traders, and 2) long-term behaviour-changing awareness campaigns targeting the urban population (see Long *et al.* 2005; Quang Nam People's Committee, 2005, for further details).

The forest cover of Quang Nam is now reasonably stable and the province already has one large nature reserve and a watershed protection area. A further nature reserve is proposed for the Ngoc Linh massif and two landscape protection areas are proposed in northern Tay Giang and western Que Son districts. These should ensure forest cover is retained; the key to the survival of small carnivores in Quang Nam, therefore, is the removal of hunting and the illegal trade in wildlife that is driving it.

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