SMALL CARNIVORE CONSERVATION

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

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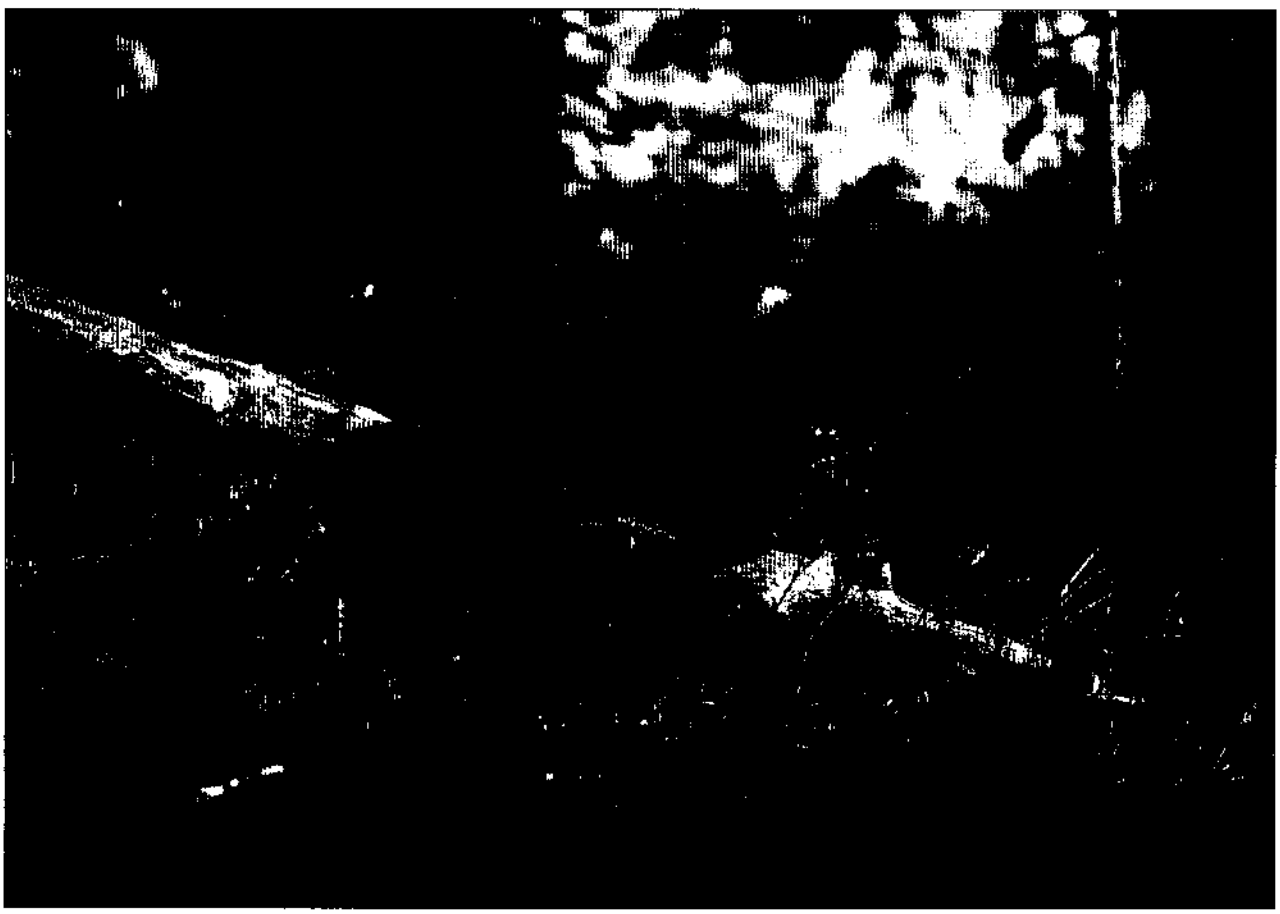

Adult female Wolverine Gulo gulo, *north east Finland – Photo: Jeff Cain*

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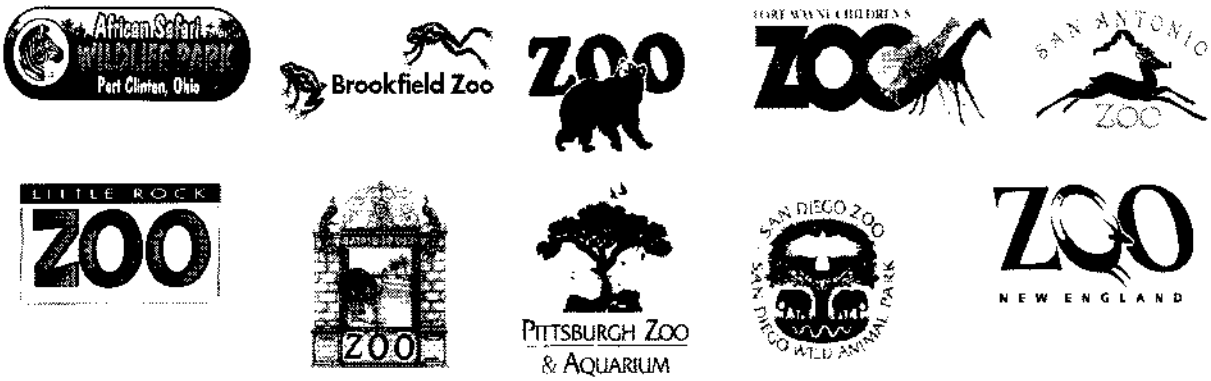

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The aim of this publication is to offer the members of the IUCN/SSC Carnivore SG, and those who are concerned with mustelids, viverrids, and procyonids, brief papers, news items, abstracts, and titles of recent literature. All readers are invited to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

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Editorial

Dear Specialist Group members and Small Carnivore Conservation readers,

As many of you already know, in Dec 2003 I have been appointed by the SSC Chair, David Brackett, as chair of our group.

My interest in small carnivore conservation, as it is the case for many of us, stems not only from my limited work on the ecology and behaviour of a few mongoose species, but especially from a child passion. The invitation to serve as chair was, quite obviously, a great honour for me.

I think our group needed some restructuring, and I started with improving internal communication by means of a dedicated mailing list, open to all members as well as to non-members. It is a great pleasure to see the list gaining momentum, starting interesting discussions both the internal life of the group and on more general themes related to conservation.

I acknowledge that not all group members can be reliably reached by e-mail, and we agreed that some of us will act as links to those, often extremely valuable, who are more difficult to reach.

At the same time, thanks to IUCN for web hosting, and to my own firm for other computing resources, I wrote a web site for the group. As a field zoologist, I do not have the skills necessary for preparing fancy layouts, but I hope you'll find it useful. Among other things, our Action Plans and several papers of interest are freely available from the web site. I consider this as a success, in that it greatly improves our visibility to the outside world, regularly attracting visitors; several of them subscribe to the mailing list and/or send me interesting suggestions and proposals.

Furthermore, after due consultation and discussion through the mailing list, we agreed in changing the name of the group; the change was recently accepted by the SSC. This choice has its shortcomings, correctly pointed out by some members, but I believe "Small Carnivore" will be far easier to understand and remember, and as such will help making the group better known and successful.

As a next step, we agreed in weeding out inactive members, accepting some new proposals, and actively seeking new members, in order to achieve a good taxonomic and geographic coverage. Your suggestions will be welcomed.

We also need better links with other groups dealing with mustelids, viverrids, herpestids, and procyonids, taking advantage of each other's advancements and achievements, and possibly setting up joint projects. All this requires fare more work than I forecast, and probably in the long run more than I can afford.

Your help is therefore crucial for the future of the group. Relevant tasks include:

- producing popular papers material, press releases and statements, both on long-standing issues (e.g. predation, hunting and trapping, invasive species, importance of surveys, etc.) and on "hot" issues (e.g. the SARS/civet one) and helping distributing it to appropriate media
- participating to conferences and symposia as delegates of the group, and more generally linking with other groups, keeping our SG informed about their activities and opportunities for collaboration
- managing the web site: there is little point in having a site, if it is not up to date; now that the site is set up, it is easy to update it with new information
- managing our membership database, ensuring the correctness of information and linking it with the central IUCN database
- last but not least, we need financial support, both for basic activities (including the Newsletter, probably the single most important achievement of the group) and for projects. In our present situation, even small donations would greatly help keeping the group alive. I am ready to endorse and support good ideas and projects, and I ask you to do your best raising interest in our activities.

Looking forward to further collaborate with you, I wish you a fruitful period, both in your professional activities and especially as members of the Small Carnivore Specialist Group.

Paolo Cavallini

The Cretan Stone Marten *Martes foina bunites*

Boris KRYŠTUFEK

In the IUCN Conservation Action Plan for the Conservation of Mustelids and Viverrids, Schreiber *et al.* (1989) listed the Stone Marten *Martes foina bunites* (Bate, 1906) from the Island of Crete as being possibly threatened on one hand and very little known on the other. This question was further discussed in a issue of *Small Carnivore Conservation* by Schreiber (1999). During my recent visit to Crete (April 26th to May 2nd, 2003), I collected further information on the Cretan Marten which, together with a compilation of published data and examination of museum specimens, allows a more synthetic review of the Stone Marten population living in isolation on the largest Aegean island.

Distribution

Information concerning the distribution of carnivores in Greece was very scanty until the mid-1980s when Prof. J. Matsakis initiated the project "A Survey of the Fauna of Greece". Anyhow, the distribution of mustelids on Greek islands remains largely undocumented (Catsadorakis *et al.*, 1999). The Atlas of European Mammals thus mapped the Stone Marten, as well as some other carnivores under the presumption as being widespread on Crete (Mitchell-Jones *et al.*, 1999). Similarly Sfikas (2002) states that the species is "*... present all over the island*", although he provides no evidence in support of this.

Actual knowledge on the distributional status of the Stone Marten on Crete is summarised in Fig. 1. Although the species was listed for the island already by Raulin (1869) and later by Barrett-Hamilton (1899), no exact locality was known by the end of the 19th century. During her four-and-a-half month visit to the island in the earlier part of 1904, Miss Dorothy Bate (Bate, 1905) collected five skins, now stored in The Natural History Museum London (BMNH) and with individual animals labelled as: near Canea (= Hania), Canea, Malaxa near Canea, and Katharo. Miller (1912) reports localities for the same series as Kontopalo near Kania, Kanea, Katharo, and Kontopalo. While elaborating material collected during the Balkan research expedition in 1942, Zimmermann (1952) had at his disposal a sample from Nida highlands and also reported "Weisse Berge" (= Levka Ori) as another place of occurrence. Niethammer & Niethammer (1967) report skins photographed in 1966 at the market in Sitia. Newer records are by Catsadorakis (1994) for Samaria National Park and by Schreiber (1999) for eastern Crete.

So far, the Stone Marten has been recorded from at least 21 localities which are widely scattered across the island. Since the majority of records are road casualties, one should not expect the scatter to reflect the actual distribution of the species, being rather an artefact of the network of fast roads (*cf.* also Schreiber, 1999). Because of this and considering the conclusion by Schreiber (1999) that the Stone Marten inhabits an extensive variety of habitat types, it is safe to conclude that the species is widespread in Crete.

Historical distribution

Archaeological evidence, which is abundant in Crete, strongly suggests that the Stone Marten had not reached the island before the Early Neolithic. Namely, the earliest indisputable finds are from the Early Neolithic II (Jarman, 1996). While marten remains have also been collected in four caves which produced Pleistocene fauna (Gerani II, Mavromouri I and VII, and Liko), Gerani II also produced in the upper layers Neolithic archaeological material and some Holocene mammals (*Sus, Rattus, Oryctolagus*). In Liko cave, the

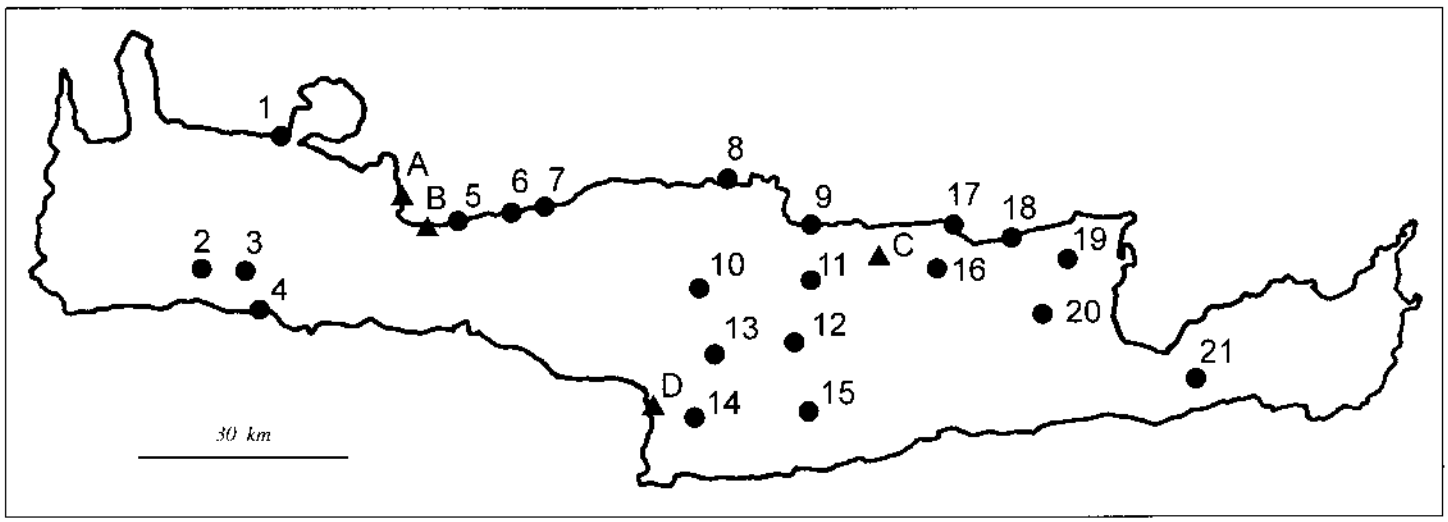

Fig. 1: Localities where the Stone Marten was recorded on Crete. Dots are recent records and triangles indicate the archaeological material.

Recent records: 1 – Kanea (= Hania); Kontopalo near Kania (= Hania); 2 – Weisse Berge (= Levka Ori); 3 – Samaria; Samaria National park: Omalos plateau; 4 – Agia Roumeli; 5 – between Gerani and Episkopi; 6 – Rethymno; 7 – Sfakaki, east of Rethymno; 8 – east of Sises, Iraklio; 9 – 3-4 km west of Iraklio; 10 – Nido highlands; 11 – Dafnes; 12 – Agios Varvara; 13 – Zaros; 14 – near Mires; 15 – Stoli; 16 – Karouzano; 17 – Hersonisos; 1 km south Hersonisos: near Piskopiano; 18 – Malia; 19 – 1 km and 4 km south-east of Neapoli, respectively; 20 – Katharo; 21 – Foothills of the Oris Thriptis Mts (on the way from Ierapetra to Gournia). Archaeological records: A – Liko cave; B – Gerani cave II; Mavromouri caves I and VII; Simonelli cave; C – Knossos (Early Neolithic II, Minoan period); D – Ayia Triadha (= Aghia Triadhma; Late Minoan).

Sources: Catsadorakis (1994): 3, 4; Jarman (1996): C; Miller (1912): 1, 20; Schreiber (1999): 9, 17, 19, 21; Sondaar et al. (1996): B, D; Steesma & Reese (1996): A, B; Zimmermann (1952): 2, 10; The 2003 survey: 5 – 8, 11 – 18.

marten comes from the upper layers, which also produced Holocene species (*Ovis/Capra, Rattus*; Steensma & Reese, 1996).

Crete is an ancient island, which has not been connected to the mainland since the Early Pliocene, 5 Myr BP (Dermitzakis, 1990), and must have attained its present form at the end of the Pliocene (Sondaar *et al.*, 1996). Its Pleistocene fauna is impoverished, unbalanced and abounds with endemics. Ancestors of the Pleistocene species thus most likely reached Crete by the sweepstake route when it was already an island. There is no evidence that any marten was amongst them. Endemic fauna became extinct in the early Holocene, with man's arrival on the island (Sondaar *et al.*, 1996). All recent terrestrial mammals, with the exception of the endemic shrew *Crocidura zimmermanni*, were introduced to Crete by humans. For the Stone Marten, Sondaar *et al.* (1996) believe it is unlikely that the animal reached the island by swimming or rafting, but was rather brought there by man.

Sondaar *et al.* (1996) questioned whether there was a single invasion of the Stone Marten followed by the evolution of the endemic race, or whether the process of adaptation and endemism was obscured by multiple invasions. Different intermediate stages between the mainland forms and the recent endemic type of the Cretan Stone Marten speak in favour of the latter hypothesis (Sondaar *et al.*, 1996). Besides, introductions were possibly even intermixed by local extinctions. Thus, Jarman (1996) found the Stone Marten in the Early Neolithic layers in Knossos, but the species was absent from the Middle and Late Neolithic material, and then reappeared in the Minoan period.

Steensma & Reese (1996) believe that "... *nearly all the material* [from Gerani, Mavromouri and Liko caves] *belongs to individuals which are intermediate in form between the Recent endemic species of Crete* [*i.e.* M. f. bunites] *and their Near Eastern relatives*." Eastern Mediterranean coasts, rather than the Balkan peninsula, were thus the most probable source of the Stone Marten colonisation of Crete.

Habitat

Stone Marten seemingly live on Crete in a broad variety of habitats, which were all exposed to a millennial human impact, mainly degradation. It was observed equally well along short grass pastures with spots of barren land (Schreiber, 1999), in dense patches of evergreen woodland, in a suburban environment, in maquis, both dense and degraded to phryagana, in olive plantations, etc. My observations accord with those by Schreiber (1999), including the conclusion that the marten is common in overbrowsed phryagana, which is the dominant vegetation type on the island.

Catsadorakis (1994) reports the Stone Marten for all of his geographic/vegetational entities of Samaria National Park, i.e. for maquis (*Pistacia lentiscus, Ceratonia siliquia, Juniperus phoenicea, Myrthus communis, Quercus coccifera, Olea europaea, Erica verticillata*), phryagana (*Poterium spinosum, Thymnus capitatus, Cistus villosus, Euphorbia acanthothamnos*), woodland (*Pinus brutia, Cupressus sempervirens, Acer orientalis*), alpine and subalpine belts (grasses, *Astragalus* spp., *Acantholimon echinus, Berberis cretica, Juniperus oxycedrus*), and for gorges. He found it to be relatively more common and more widespread than any other mammal covered by his survey, including the rat *Rattus rattus*.

Although the altitudinal range is poorly documented, the marten evidently goes from the seashore into the subalpine and alpine belts well over 1,500 m above sea level. Sfikas (2002) lists it for the mountainous zone that stretches between 800 and *ca.* 1,800 m above sea level.

Threats

The red data book of threatened vertebrates of Greece (Karandinos, 1991) does not include the Cretan Stone Marten. As mentioned above, Catsadorakis (1994) found the species to be common in the Samaria National park, and Sfikas (2002) states that "... *the population of* [the Stone Marten] *has increased extremely*" in the gorge of Samaria. It is not evident, however, on which grounds Sfikas' conclusion has been achieved (*cf.* also Schreiber, 1999). Keeping in mind the statement by Bate (1905) that "... *the Beech-Marten is common in the island, both in the low ground and in the hills*", a conclusion can be drawn that the species was common on Crete throughout the entire 20th century, although possible trends are a matter of speculation.

As far as one can speculate from road casualties, the Stone Marten is much more common on Crete than the Eurasian Badger *Meles meles* or the Least Weasel *Mustela nivalis*. Namely, during my 2003 survey I counted 18 martens but only three badgers (east of Rethymno; Kissamos, Kalidonia; and Ierapetra) and merely two weasels (near Agios Nikolaos and at Martha).

The entire Mediterranean ecosystem suffered tremendous changes in the last several millennia, and Crete was no exception in this respect (Grove & Rackham, 2001). Sfikas' (2002) conclusion that "... *the greater part of Crete's forests were still untouched during the Venetian occupation (1206-1669)*" is likely to be somewhat of a naive oversimplification. Much more probable seems to be Bottema's (1996) idea of "... *an enormous impact of mankind on the vegetation of Crete.*" Bottema further suggests that anthropogenic activity started as early as at the beginning of the 6th millennium B.C., while the Minoan culture (from *ca.* 3000 B.C. onwards) must have changed the vegetation fundamentally. It is thus plausible to conclude that the Stone Marten did not face much habitat deterioration during recent centuries, but rather thrived successfully in a degraded Mediterranean landscape for several millennia. While the Stone Marten's niche is squeezed in mainland Europe by the competitive exclusion with the Pine Marten *Martes Martes* (Delibes, 1983), it is likely to be relaxed on Crete in the absence of the congeneric competitor. As a matter of fact, the Stone Marten uses a broad array of habitats on the island (see above). Habitat degradation is thus an unlikely source of immediate threat for the further survival of the Cretan Stone Marten.

Sfikas (2002) states that most species on Crete are exposed to ruthless hunting. Schreiber *et al.* (1989) further report that all the mustelids on Greek islands are considered vermin and poisonous baits were still in use against the Cretan badger in 1980s. Even worse, an estimated 1,500 badgers are killed annually in Greece, despite the fact that the species has been completely protected all over the country since 1985 (Griffiths & Thomas, 1993). Although I have no data on the current hunting pressure and the annual bag as far as Stone Marten is concerned, both must have a long history. Jarman (1996), for example, states that "... *the marten was until recently exploited regularly for fur ...*" Hunting of Stone Martens is documented by Bate (1905) for the very beginning of the 20th century: "*It is killed in some numbers by the peasants, who bring the skins to the larger port-towns on the north coast, whence they are exported chiefly to Trieste.*" How far back the hunting is stretching its roots is a matter of speculation. It is well documented

that the badger was exploited on Crete as food source since the late Bronze Age (*ca.* 1100 B.C.) at the latest (Snyder & Klippel, 1996). Considering the fact that Charles (2000) reports clear evidence of the butchery of a Pine Marten in Mesolithic Britain, together with similar evidence for a badger, it is possible that the Stone Marten was exploited in a similar manner on Crete.

As suggested by Delibes & Amores (1986), unsustainable hunting for fur was the most probable cause of extirpation of the Stone Marten on the Balearic island of Ibiza. The species was presumably still common there around 1930 but vanished by around 1970. Hunting thus can pose a serious threat to a small and isolated marten population.

Schreiber (1999) paid attention to road casualties as a possible significant source of Cretan marten mortality. He counted five dead martens along 800 km of roads. Because of the rapid decomposition of carcasses under summer conditions of the Mediterranean climate, he believes all the five martens had been killed at most a few days before they were found. All the road casualties were along the modernised national road N 90 (roughly half of his survey) and none were found on side roads that were windy, narrow and sometimes bumpy. This would give *ca.* one marten killed per 100 km every few days. I counted eighteen dead martens along 1,800 km of roads. At least three martens were found freshly killed, thus victims of the previous night traffic. This would give an estimate of one kill per 600 km of road per night. However, since a significant part of my travel was on side roads, the number is possibly even higher. A very crude extrapolation suggests annual mortality of at least one Stone Marten per two kilometres of road. Considering that there are *ca.* 600 km of main roads on Crete (estimate deduced from Hellander & Oliver, 2002), *ca.* 300 martens might be killed on them annually. This would give *ca.* 3.6 martens per 100 km^2 (the surface area of Crete is 8,335 km^2). Compared to the annual bag in Slovenia (area 20,251 km^2), which amounted to 775 Stone Martens on average (i.e. 3.8 per 100 km^2; Kryštufek, 2000) between 1987 and 1990, the road mortality of Cretan Stone Marten appears to be high. In addition to unregulated hunting, the human-caused mortality might pose a threat to the island population.

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First recent record of the Small-toothed Palm Civet *Arctogalidia trivirgata* from Vietnam

Alex V. BORISSENKO[1], Natalia V. IVANOVA[2] and Gert POLET[3]

Several mammal surveys undertaken in Cat Tien National Park (e.g. Ling, 2000; Murphy, 2001; Murphy & Phan Duy Thuc, 2002) have resulted in finding most of the common Indo-Chinese species of large and medium-sized mammals, yet a number of species are still being listed as "unconfirmed" or "possible", based on extrapolation of the general distribution range or reports of local people (Pham Nhat *et al.*, 2001). The Small-toothed Palm Civet *Arctogalidia trivirgata* (Gray, 1832), however, was omitted from these lists until 2003 (reported by Polet & Ling, *in press*), when four sightings of this species were made at a locality not covered during previous survey efforts. Recently the species has been recorded from Cambodia (Walston & Duckworth, 2003) while Duckworth (1997) reports the species to be widely recorded in south and central Laos.

All sightings took place in the southern sector of Cat Tien National Park (Nam Cat Tien, Dong Nai Province) in the vicinity of a rapid in the Dong Nai River (11°27' N, 107°26' E) ca. 2 km southwest of Da Co forest guard station (Fig. 1). The observation site is a lowland, covered by mature semi-evergreen *Lagerstroemia*-dominated seasonally flooded forest. This area is part of a ca. 20 km^2 patch of more or less intact riverine forest surrounded by variously disturbed secondary growth formations and adjacent to another area covered with more mature forest located in the vicinity of the park's headquarters.

Animals were observed during nighttime surveys conducted along roads passing through the park, using a bicycle. Mammal eye shine was detected with a LED headlamp; subsequently a powerful halogen spotlight was used to observe the animals. Whenever possible, observations were confirmed by making technical photographs with Minolta AF cameras with the aid of Minolta Program TTL-controlled flash.

The first sighting was made on 31 January 2003 at ca. 5:30 a.m. One animal was observed and photographed sitting on a small tree ca. 15 m above the ground near the road (see back cover). It did not appear to be feeding, and no fruit or flowers were observed on that tree or in nearby canopies. After being spotlighted and photographed the animal climbed down a thin liana and retreated into the forest away from the dirt road.

The second sighting was made on the following evening (1 February 2003). Two civets (assumed to be a male and a female) were found on the same tree interacting and emitting loud characteristic vocalizations, however, no mating was observed.

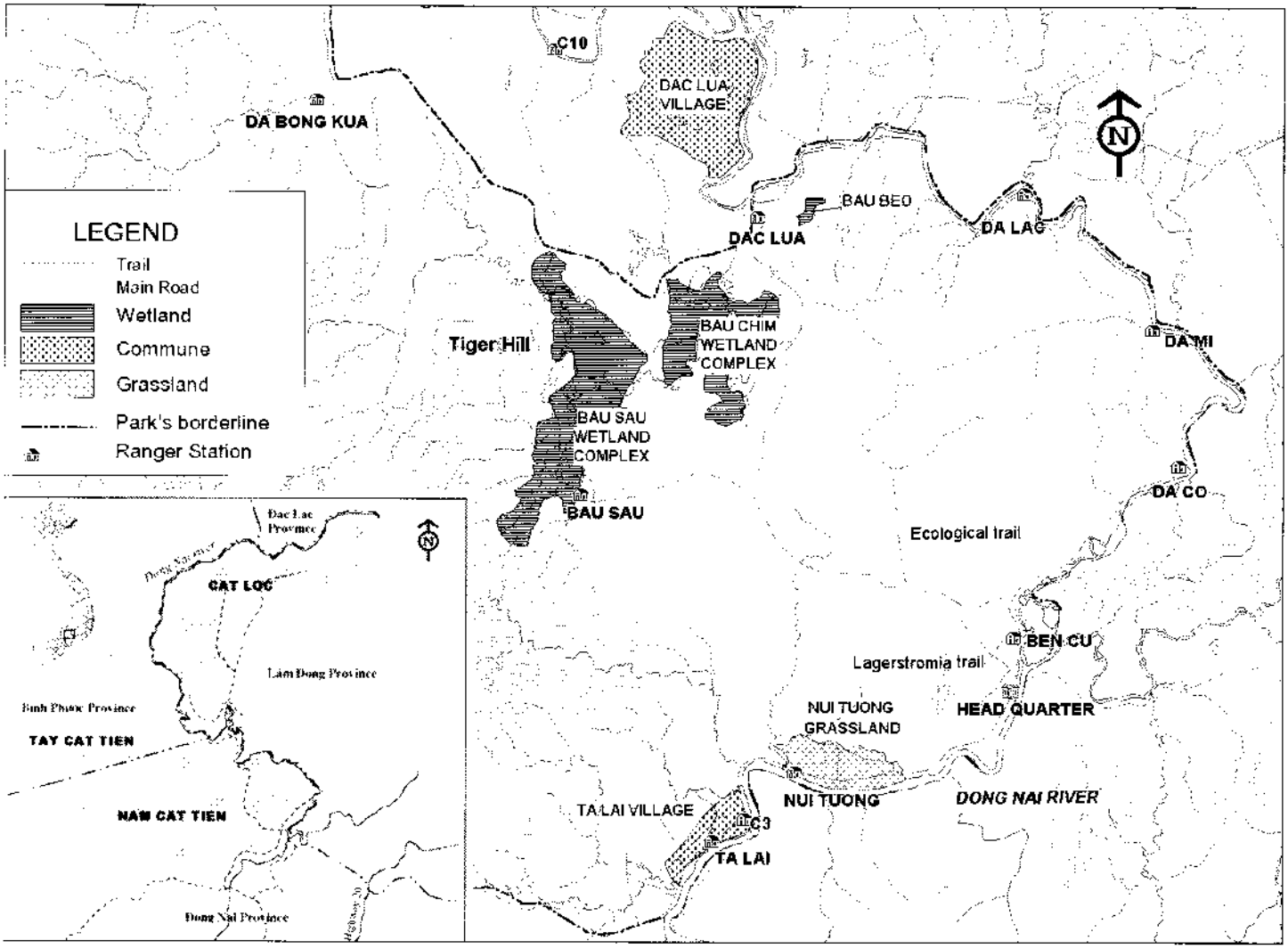

Fig. 1. Map of Cat Tien National Park, Vietnam.

From two subsequent observations made within a 30-minute interval (19:30 and 20:00) it appeared that the pair remained on the same tree throughout this period; however, they were gone by the time of the third pass (ca. 20:30). While examining the same place next morning it was noted, that one of the branches on the small tree was broken, suggesting that the animals may have returned there during the night. The animals did not show any signs of discomfort, despite that they were spotlighted for several minutes and photographed with a powerful flash during each pass. Duckworth (1997) in Laos also noted that the animals observed demonstrated tolerance to the presence of observers, the noise accompanying their approach, spotlighting and photographing.

The third sighting was made on 23 April 2003 at 22:47 near the road in the same forest, quite adjacent to the place of the first two sightings. One individual was sitting in the canopy of a tall tree ca. 50 m above the ground. It was identified by characteristic brown pelage and dark tail. Due to considerable distance, however, it was impossible to observe what it was doing in the canopy.

The fourth sighting was made on 29 April 2003 nearby the two previous localities. One individual was observed at the same spot within two consecutive time intervals (ca. 0:30 to 0:35 and subsequently 0:45 to 1:02 a.m.); it was sitting on a tree, and then descended into a thicket, where it started grooming and then continued moving slowly through the branches, allowing the observer to approach within ca. 5-6 m and take photographs of the animal.

Dates of these observations fit well with earlier observation in Laos between mid February and June which coincides with the main loud-calling season (Duckworth, 1997).

Several other attempts were made in April 2003 to observe the Small-toothed Palm Civet at the same locality (on evenings of April 2, 3, 5, 9, 12, 20, 22, 24, 25 and 28, 2003), however, they were unsuccessful. The overall spotlighting time at this site could be estimated as 15 hours (one sighting per 4 hours). This is more or less comparable with the 7-8 hours for one sighting estimated in Laos (Duckworth, 1997) where foot surveys (as opposed to using a bicycle) were held in comparable habitat (semi-evergreen forest along road).

All observed individuals possessed conspicuous pinkish-white markings on the ears, characteristic of the form *leucotis* (Corbet & Hill, 1992), brown dorsum with three dark longitudinal stripes, lighter-colored belly, and dark tail along most of its length, except for the basal part. The characteristic white stripe on the muzzle was not very prominent. Our observations of the Small-toothed Palm Civet made in Cat Tien National Park corroborate those made by Walston & Duckworth (2003) in Cambodia.

Due to the extensive conservation measures undertaken in Cat Tien National Park, the area where the sightings of the Small-toothed Palm Civet were made has not suffered from logging for at least two decades. In this particular part of the Park, there also seems to have been little or no hunting pressure for considerable time, particularly on canopy inhabitants, due to reasonably effective law enforcement. Indeed, the observation site appears to be quite rich in canopy wildlife. E.g., during the evening counts made on 1 February 2003, five Common Palm Civets *Paradoxurus hermaphroditus* and one Giant Flying Squirrel *Petaurista* sp. were spotted along the ca. 2 km segment of the road passing through this patch of mature forest. On the next morning vocalizations of at least two family groups of the Yellow-cheeked Gibbon *Nomascus gabriellae* were heard from the road.

Until recently there appear to be very few records of *Arctogalidia* in Vietnam (Dang Huy Huynh *et al.*, 1994), and recent records are unknown to exist for Vietnam. This may be due to the scarcity of mature forests suitable for nighttime transect surveys. But the species has been widely recorded in Laos (Duckworth, 1997) in secondary forests. Confinement of the Small-toothed Palm Civet to higher stories of the canopy explains why photo-trapping efforts deployed in Cat Tien National Park did not reveal this species earlier. Walston & Duckworth (2003) discuss in more detail how the species' nocturnal and strict arboreal lifestyle hamper its detection in mainstream biodiversity surveys, which have been conducted in Cat Tien National Park as well (Polet & Ling, *in press*). Also Duckworth (1997) notes that the species appears to often go undetected because of lack of people spotlighting and looking into the canopy at night, rather than because of lack of suitable habitat.

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Status of the Narrow-striped Mongoose *Mungotictis decemlineata* of Madagascar

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Introduction

The Narrow-striped Mongoose *Mungotictis decemlineata*, or *bokiboky* in Malagasy, is a small carnivore currently known to occur only in the dry deciduous forests of the Menabe region in western Madagascar. *Mungotictis* is Endangered (IUCN, 2002) and is threatened by the rapid loss of habitat through deforestation. Forest loss in the region of Menabe occurred at a rate of 32% between 1963 and 1993 as a result of agro-industrial projects and slash-and-burn maize cultivation (Tidd *et al.*, 2001), and this rate has since increased (J. Pinder, *in litt.* 2002). This article reviews the current status of *Mungotictis decemlineata* and discusses the immediate threats to its survival.

Relatively little is known about the ecology of this species. *Mungotictis* is a social animal that lives in family units. Groups of three to five adults may be observed together with juveniles during the dry season, which extends from June to October. During the warmer wet season, November to May, solitary males and groups of one adult with one juvenile are more commonly observed (Rabeantoandro, 1997). Albignac (1976) observed 'super groups' consisting of 9 to 13 individuals and noted a seasonal variation with these larger groups dividing into smaller 'sub-groups' during the wet season. Males seek contact with females from July to December. A gestation period of 90 to 105 days is generally followed by the birth of a single infant (Albignac, 1973). Razafimanantsoa (2003) observed mating in August and gestation periods of 74 and 106 days. *Mungotictis* densities are reported to vary from 0.25 to 2.9 animals per hectare (Rabeantoandro, 1997 ; Razafimanantsoa, 2003). Razafimanantsoa (2003) captured 20 adults and 6 subadults in an area of 90.3 ha. Eight of these animals lived permanently in the area as two separate groups of three and five individuals, with home ranges of 12.8 and 17.8 ha, respectively. Albignac (1976) found that small groups had home ranges of 30 to 50 ha and 'supergroups' had home ranges of 150 to 200 ha.

Mungotictis are primarily insectivorous, supplementing their diet with vertebrates (Rabeantoandro, 1997) including small mammals, reptiles and birds. Larger prey items such as mouse lemurs *Microcebus* may be co-operatively hunted by groups (Albignac, 1976). Specialisation on insect larvae in soil and decomposing wood may help *Mungotictis* survive during the dry season when the availability of other food items is limited. Their diet becomes more varied in the wet season (Albignac, 1976). *Mungotictis* use tree cavities, up to 10 m above the ground, for night shelters during the wet season and switch to burrows and abandoned ant hills in the dry season (Albignac, 1976).

Status

Mungotictis is found in western Madagascar within the regions known to the Malagasy as 'Menabe central' and 'Menabe sud' and referred to in this text as central and southern Menabe. Central Menabe extends from south of the Tsiribihina River to north of the Morondava River while southern Menabe extends from south of the Morondava River to north of the Mangoky River (Fig. 1). There are two currently recognised subspecies, *M. d. decemlineata* and *M. d. lineata*. The latter is only known from a single immature specimen (Gray, 1848) from an unspecified locality in Madagascar. Although the assumption is that *M. d. lineata* is very rare, perhaps occurring in the Toliara region of southwestern Madagascar, there is no evidence to date to support this (Hawkins *et al.*, 2000). All knowledge of this species is from *M. d. decemlineata* that exists in central and southern Menabe in what are believed to be two distinct sub-populations (Hawkins *et al.* 2000).

Narrow-striped Mongoose Mungotictis decemlineata.

The current known status and distribution of *Mungotictis* is based on village surveys and live-trapping studies conducted in central and southern Menabe (S. Goodman *in litt.*, 2002; Razafimanantsoa, 2003; Woolaver *et al., in prep).* The most recent estimate for central Menabe was between ca. 2,000 and 3,400 mature adults in an area of 900 km^2 (Woolaver *et al., in prep).* Animals within this region were distributed throughout the largest area of connected forest in the west (Fig. 1) but were absent in the smaller forest fragments to the east. In southern Menabe, the population was estimated at between c. 6,400 and 8,650 mature adults within an area of 1,871 km^2 (Woolaver *et al., in prep).* Villagers reported the presence of *Mungotictis* in most of the fragmented forest throughout southern Menabe (Fig. 1), with animals being rarer in the smaller forest fragments in the east. Of considerable interest is a report that *Mungotictis* may be found in the forest immediately south of the Mangoky River (Woolaver *et al., in prep).* This represents the first evidence of the existence of *Mungotictis* south of the Mangoky River, and suggests that knowledge of the world distribution is still not complete.

Threats and recommendations

The rapid loss and fragmentation of forest habitat is the most immediate threat to the survival of *Mungotictis*. *Mungotictis* was found to be rare or nonexistent in isolated fragments of forest throughout the Menabe region (Woolaver *et al., in prep*). In both central and southern Menabe deforestation is occurring at a rapid rate, and will continue to decrease the already limited range of this species. Conservation organisations must increase co-operative

efforts with local villages to reduce the rate of slash-and-burn agriculture of the remaining dry deciduous forest of the Menabe.

Commercial cutting, in addition to modifying the structure and composition of the natural forest (Deleporte *et al.*, 1996), may be having an impact on the surrounding forest that extends beyond the immediate period and locality of commercial activity. In particular, the building of new roads increases the level of human disturbance and accelerates illegal cutting within the surrounding forest, particularly by non-local villagers requiring trees for construction and the building of pirogues. An increase in human activity brings with it an increase in activity by roaming domestic dogs which are suspected to have had a significant negative impact on other terrestrial endemics in the Menabe region, including the Malagasy Giant Jumping Rat *Hypogeomys antimena* (Sommer *et al.*, 2002). Domestic dogs represent a potential source of predation on *Mungotictis* and an evaluation of their impact should be a priority. Of further concern is a report that *Mungotictis* is being hunted for food in southern Menabe (Goodman & Raselimanana, 2003) which would increase the rate of decline. In order for *Mungotictis* to survive it will require areas which are properly protected from commercial cutting and unregulated use by local and non-local villagers.

More information is still required on the status of this species in southern Menabe. Research should be carried out to determine more precise population estimates and trends of *Mungotictis* in the remaining forest fragments of southern Menabe. Emphasis should be placed on determining the extent of the threat posed by hunting of *Mungotictis* for food.

The mystery still remains regarding the full distribution and taxonomic status of *Mungotictis*, in particular whether *M.d. lineata* is a distinct taxonomic unit and, if so, if its range is south of the Mangoky River. If this population-subspecies indeed exists, and is facing pressures similar to those of *M. d. decemlineata* in the Menabe, then it may be at an even greater risk of extinction. It is considered critical that research be carried out to determine if such a population exists.

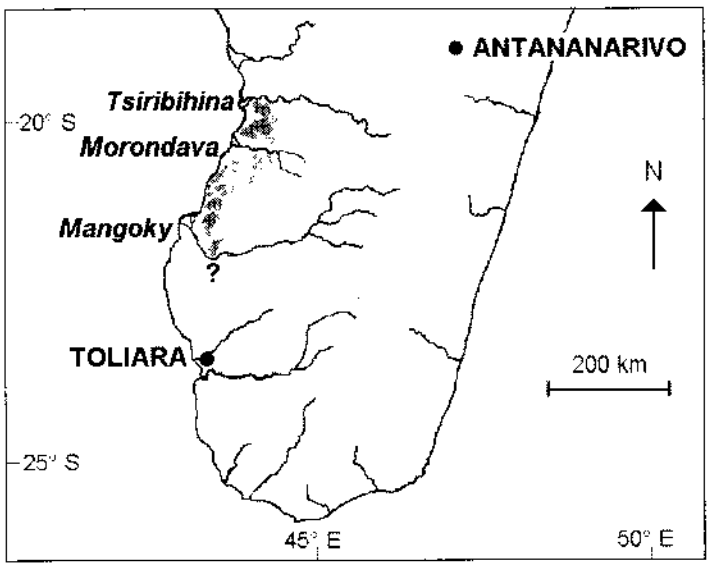

Fig. 1. Map of southern Madagascar showing the current known distribution of *Mungotictis decemlineata* in grey. Names of rivers are italicised. Central Menabe extends from south of the Tsiribihina River to north of the Morondava River. Southern Menabe extends from south of the Morondava River to north of the Mangoky River. The question mark refers to villager reports of *Mungotictis* south of the Mangoky River in 2002 (Woolaver *et al., in prep*).

IUCN classification

In 2002, the total population of *Mungotictis decemlineata* was estimated at <10,000 mature individuals (IUCN, 2002). Recent field research estimated that numbers may be as low as 2,000 mature individuals in central Menabe and 6,400 in southern Menabe (Woolaver *et al., in prep*). This supports the IUCN estimate of <10,000 but the estimate could be refined downward to <8,500. The species extent of occurrence and the quality of the forest in which it lives continue to decline rapidly.

Mungotictis decemlineata is currently classified as Endangered based on criterion B1+2bc from the 1994 IUCN guidelines (IUCN, 1994). The most recent research estimated a larger area of occupancy and extent of occurrence than had been previously thought (Woolaver *et al., in prep*). The new estimated extent of occurrence (central Menabe + southern Menabe = 10,253 km^2), and an inferred further decline of extent of occurrence, area of occupancy, habitat quality, and number of mature individuals qualifies for criterion B1b (i,ii,iii,iv) at the Vulnerable level using the more recent IUCN guidelines from 2001. The population estimate of ca. 8,500 mature individuals qualifies for C1 at the Vulnerable level.

Arguably, this suggests that *Mungotictis* no longer merits the criterion B1+2bc at the Endangered level. However, the estimates of extent of occurrence and population size in southern Menabe are tentative and liberal (Woolaver *et al. in prep*). It is very likely that a more thorough study of this population may refine the species' extent of occurrence to <5,000 km^2 triggering criteria B1b (i,ii,iii,iv) at the Endangered level. In addition, the high rate of forest loss in the Menabe, the unknown impact of hunting on this species in southern Menabe, and the uncertainty of the status of *M. d. lineata* are reasons against any downlisting. The most recent assessment of Malagasy Carnivora using RAMAS Red List software re-classified *Mungotictis decemlineata* as Critically Endangered (Dollar, 2000).

Therefore, the authors strongly recommend that *Mungotictis decemlineata* remain as Endangered until more is known about the status of populations south of the Morondava and Mangoky Rivers.

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Throat patch variability on Cretan Beech Martens

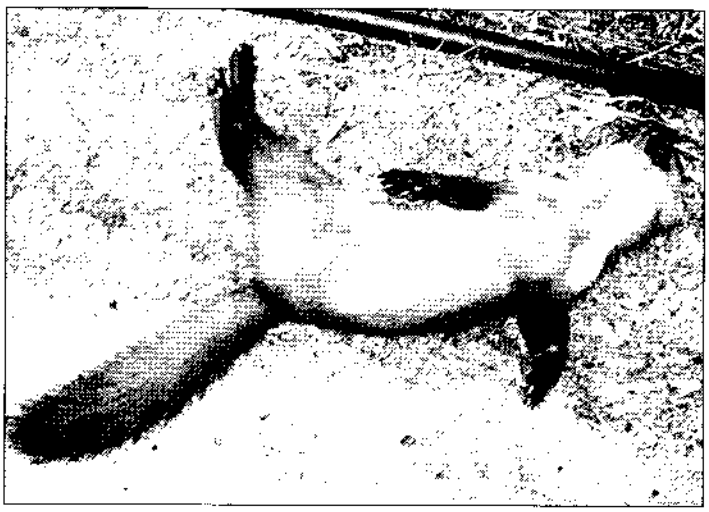
Whilst on route to the north coast, along the main road from Paleochora, western Crete, I found a freshly killed Beech Marten *Martes foina* on the roadside. (North of Kantanos near Floria on the 9th of June 2003).

Upon examination of the animal I was surprised at the large size of its throat patch. All three, "over the years" versions of the popular Collins field guides, to the mammals of Europe, indicate that the Cretan Beech Marten, *Martes foina bunites*, has only a small throat marking. Van Der Brink (1967) states that Beech Martens found on Crete have no white patch or only a very small one, while Macdonald & Barrett (1993) describe that population as having only a small greyish patch. Corbet & Ovenden (1980) make a similar claim.

The specimen found near Floria, as the photograph shows, had a large, white patch similar to that described by Macdonald & Barrett (1993) for the continental European Beech Marten (i.e. pure white or greyish throat bib divided by a dark stripe into left and right parts). Approximately four kilometres on near Mesavlia I found a second dead marten. That animal, obviously smaller than the first, also had a large white bib.

Hence, contrary to what is indicated by the field guides, these observations suggest that Beech Martens on Crete have a variety of throat patterns. Schreiber (1999) confirms this, describing variability as the most conspicuous distinguishing feature of *M. f. bunites*. In addition, another variation is given for this race of a throat patch reduced to two white lateral stripes.

Schreiber (1999) also states that the throat patch size of the Cretan Beech Marten hardly ever reaches the extent observed in the nominate race, *Martes foina foina*. This suggests that the specimens found near Floria were notably unusual.



Beech Marten road kill found near Floria, Crete.

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Some information on Trés Marías Islands Raccoon *Procyon insularis*, with a description of tracks

Vladimir DINETS

Fig. 1. Trés Marías Islands Raccoon Procyon insularis. *Photo: V. Dinets.*

Trés Marías Islands Raccoon *Procyon insularis* Merriam, 1898 is confined to a group of four large and many small islands approximately 100 km from the coast of Nayarit, Mexico. This archipelago has two more endemic species and a few endemic subspecies of mammals (Novak, 1999), as well as numerous endemic species and subspecies of birds, reptiles, and invertebrates, and some of the best diving sites on the Pacific coast of Mexico.

The raccoon originally occurred on the two largest islands, but now is believed to be extinct on Maria Magdalena (subspecies *P. i. vicinus*), and to number less than 250 mature individuals on Maria Madre (*P. i. insularis*). It is listed as threatened by the Mexican government, and as Endangered by the IUCN (Zeveloff, 2003). If the population estimate is correct, this species is the rarest carnivore in the Americas.

Maria Madre Island is volcanic, 145 km^2 in size, with central mountains rising to about 600 m. From the air, it seems to be less than 20% forested, with dry tropical forest covering some of the upland areas above 150-250 m, and humid tropical forest limited to a few ravines on the steep western slope just below the summit. Human settlements are mostly confined to the eastern coast, but a road runs along the entire length of the shoreline, except for two remote beaches in the north.

Since the early 20th century, the islands served as a penal colony, with a human population in the low thousands. In April 2003, the government declared its plan to close the colony, turn the islands into a nature reserve, and allow resort development. However, according to local residents, many of the inmates refused to leave the colony, and the future of the project is still uncertain.

The islands are not well explored scientifically, mostly due to access difficulties. Until 2003, they were served by a weekly boat, but the service reportedly became irregular in 2003.

On November 1, 2003, I used a Russian driver's license to rent a small plane, flew to the northwestern part of Maria Madre, landed on a beach, and spent a day and a night there, hiking along the western coast and up into the mountains.

Autumn is the nesting season for Olive Ridley *Lepidochelys olivacea*, a small sea turtle that breeds along the coast from Sinaloa to Costa Rica. Its nests are relatively shallow and attract many predators. Another species, the Leatherback Turtle *Dermochelys coriacea* also nests at that time, but its nests are too deep for most predators to dig up. During a 10-km hike along the island beaches, 2 ridley tracks, 1 leatherback track, 1 raccoon track, and 2 feral dog tracks were counted. During a 20-km walk along similar beaches near Volcan Ceboruco on the mainland, 6 ridley tracks, 6 Common Raccoon (*P. lotor*) tracks, 1 White-nosed Coati (*Nasua narica*) track, 2 Gray Fox (*Urocyon cinereoargenteus*), and more than 30 feral dog tracks were counted, and one Coyote (*Canis latrans*) was seen. This is not necessarily an indication of low raccoon density on Maria Madre, because there is a possibility that the species is largely confined to the forested mountains of the interior, and/or the vicinity of human settlements on the eastern coast.

The Trés Marías Islands Raccoon tracks (Fig. 2), found in the intertidal zone near Punta Camaronchico, were the same size as the tracks of a large adult Common Raccoon (Fig. 3), but the foreprint was noticeably wider in shape: 75 mm long and 73 mm wide, including claws. Foreprints of Common Raccoon are about 75 x 68 mm in northern races (Whitaker, 1996; Dinets & Rotshild, 1997) and 55 x 50 mm in southern races (Reid, 1997). The stride was slightly longer: 35-45 cm, as compared to 20-40 cm for Common Raccoon under similar conditions (Dinets & Rotshild, 1997).

At dusk, a pair of raccoons (Fig. 1) was located and videotaped in a tree in a small patch of dense riparian forest lining a creek, near the shore about halfway between the northern tip of the island and a lighthouse in the central part of its western coast. The animals seemed to be relatively tame, and allowed close approach (to within 15 m from the tree, with the raccoons being about 5 m above ground). After approximately a minute of calmly watching the observer, they disappeared in dense thickets below. The animals were pale-brown in color, with some gray on the underparts and golden tint on the tails, and seemed to be somewhat larger-headed than Common Raccoons. No vocalizations were heard during the encounter.

Fig. 2. Tracks of the Trés Marías Islands Raccoon Procyon insularis *Photo: V. Dinets*

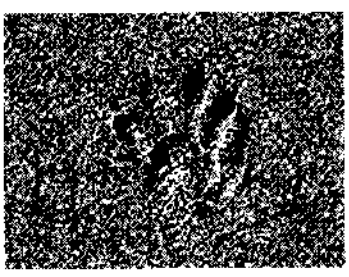

Fig. 3. *Tracks of the Common Raccoon* Procyon lotor *Photo: V. Dinets*

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Trophic niche overlap of three carnivores in a mountain area north of Varese (Lombardy – Italy)

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Abstract

The diet and trophic niche overlap of three species of carnivores, the Eurasian Badger *Meles meles*, the Red Fox *Vulpes vulpes* and the Pine Marten *Martes martes*, were analysed in an area of the Italian Prealps (Alto Luinese, Varese, Lombardy).

The composition differed, but the three diets were characterized by a relevant frequency of occurrence of fruits, which was the main cause of the high overlap among the three trophic niches. However, the higher values of the Horn's and Pianka indices were reached between badgers and foxes, and between foxes and martens. The volume in total diet of fruits and vegetables progressively decreased changing from badger to fox and then to marten, and the same occurred for the volume in total diet of invertebrates (insects and earthworms). The fraction of vertebrate preys, on the other hand, progressively increased from the lower value in badger diet to the higher in marten one, passing through the intermediate value in fox diet.

Key-words: *Meles meles*, *Vulpes vulpes*, *Martes martes*, diet, trophic niche overlap, Italy

Introduction

Numerous data concerning the diet of three species of carnivores living in the Alto Luinese area (the northernmost area of the town of Luino, in the Province of Varese, Lombardy, Italy)- the Red Fox (*Vulpes vulpes*), the Eurasian Badger (*Meles meles*) and the Pine Marten (*Martes martes*)- have been collected over more than ten years of research (Biancardi *et al.*, 1995; Biancardi & Rinetti, 2002; Campanozzi, 2001). Red Foxes are the most widely present carnivores in Lombardy (Vigorita *et al.*, 2001), where they live both on the plains and on hills and mountains up to 3,000 m a.s.l. Eurasian Badgers are also extensively present in our region as well as in the research area (Biancardi & Rinetti, 1998; Vigorita *et al.*, 2001). On the other hand, Pine Martens, which have been located in the northern part of the Lombard territory, are in general not frequently reported below 1,000 m of altitude (Vigorita *et al.*, 2001). However, in the "Alto Luinese" area they are present also at a lower altitude (Biancardi & Rinetti, 2002). This work, which is the result of long years of research, compares the diet and the trophic niche of these three carnivores in order to define the relationship between the use of the trophic resources available throughout the year and the use of the habitat and, as a result, the distribution of these three species in the study area.

Material and Methods

The territory of the "Comunità Montana Valli del Luinese"- consortium of municipalities of the Luinese vales- extends over 211 km² between the east coast of Lake Maggiore and the Swiss border. Luino is the main town in this area (46°00'N, 08°77'E) of the province of Varese. The altitude ranges between 200 and 1,600 m a.s.l. (Mt. Lema being the highest peak) with a sub-coast temperate climate (Mennella, 1967) and average temperatures between +2.8°C in January and +20.9°C in July. Rainfall is copious, above all in spring and late summer, averaging 1,469 mm per year (Spinedi, 1992).

Large broad-leaved woods are common in this study area where Sweet Chestnuts (*Castanea sativa*) have replaced the climax (*Querco-betuletum insubricum*) association also as a result of human intervention. Pubescent Oaks (*Quercus pubescens*) are also present on drier slopes while Beeches (*Fagus sylvatica*) prevail on colder slopes and more humid vales. The only conifers are present due to limited reforestation actions dating back to the 1960s and 1970s, while the higher vegetation areas consist of meadows and pastures on which sheep breeding has now been abandoned.

The diet of the three species under observation has been established by the analysis of samples of faeces (Biancardi *et al.*, 1995; Biancardi & Rinetti, 2002; Campanozzi, 2001). Quantitative (volumetric fractions) and qualitative (frequency) data have been obtained on the various components of the diet. Volumetric estimates have been obtained through the method proposed by Kruuk & Parish (1981). The affinity of the different diets has been tested with Spearman's rank correlation coefficient, by grouping the components in nine great food categories used in the reference works (Biancardi *et al.*, 1995; Biancardi & Rinetti, 2002; Campanozzi, 2001). On the other hand, the indices of the trophic niche overlap of Horn and Pianka have been calculated according to Krebs's (1989) indications, with a higher level of details and taking into consideration the differences between the components of the diet inside the food categories.

Results and discussion

Table 1 shows the frequencies and the volumetric percentages of the various food categories. The analysis of these figures clearly shows the importance of fruits in all the three species considered. For Eurasian Badgers and Red Foxes fruits were the most important category, both as frequency of occurrence and volume, while for Pine Martens fruits followed the most important category of mammals. The Eurasian Badger diet was distinguished by only limited predation on Vertebrata and, vice versa, by a large component of Arthropoda together with fruits. In the Red Fox diet, on the other hand, mammals came second in abundance. The differences between frequencies and volumetric percentages were statistically significant except for one category, the vegetable one, which included (excluding fruits and cereals) grassy material, roots, seeds, etc. Also the predation on reptiles between Red Foxes and Pine Martens and the one on birds between Red Foxes and Eurasian Badgers did not show statistically significant differences.

The highest and most meaningful values of the Spearman's rank correlation coefficient were obtained by comparing the diets of Eurasian Badgers and Red Foxes, and those of Red Foxes and Pine Martens, while there was no correlation between the diets of Eurasian Badgers and Pine Martens (Table 2).

Differences appeared in a detailed analysis of the components of the diet, such as the presence of medium-large size

Table 1. Frequency of Occurrence (FO) and estimated Volume (V) of the food categories in the diet of Eurasian Badger, Red Fox and Pine Marten

	Eurasian Badger		Red Fox		Pine Marten	
	FO%	V%	FO%	V%	FO%	V%
Fruits	95.0	64.2	72.2	51.9	58.8	21.0
Cereals	4.6	3.0	-	-	-	-
Other Vegetables	56.4	5.1	48.1	11.5	41.2	2.2
Arthropods	82.6	22.4	27.8	8.5	39.2	3.7
Earthworms	24.3	-	13.9	0.7	-	-
Mammals	5.1	1.4	42.7	24.4	91.9	53.8
Birds	10.6	3.7	9.1	2.1	49.3	14.2
Reptiles	-	-	5.0	0.7	5.4	0.9
Other food	2.3	0.1	2.0	0.5	8.8	3.2

mammals (ungulates) only in Red Fox diet or the absence of earthworms in Pine Marten diet. However, there were also interesting analogies. For a correct interpretation of the data collected, we need to point out that, together with a seasonal presence of cherries, figs, grapes and currants, chestnuts were always present from the "Fruits" category, as a resource in the diet of these three species of carnivores. This reflects the availability of this fruit nearly all year round, since it can be preserved in the litter. It is worth remembering that although chestnuts contain a great quantity of glucides in the form of starch, they have a high content in proteins and lipids, which confer a high energetic contribution. In the Eurasian Badger diet, chestnuts, which were present throughout the year except in August, was the main trophic resource with an annual frequency of occurrence FO = 76.2% (Biancardi *et al.*, 1995). Chestnuts appeared in the Red Fox diet especially in the winter and spring months (annual FO = 20.5%, spring FO = 38.4%) (Campanozzi, 2001). Finally, chestnuts were frequently eaten by Pine Martens in the cold months (annual FO = 11.5%, winter FO = 33.3%) (Biancardi & Rinetti, 2002). Therefore, chestnuts represent a reliable and good quality trophic resource for Eurasian Badgers, Red Foxes and Pine Martens in the "Alto Luinese" area, thanks to their unbroken availability throughout the year.

The niche overlap indices, which took into consideration also the differences inside the nine food categories, showed a relevant overlap between the Eurasian Badger and the Red Fox and between the Red Fox and the Pine Marten trophic niches, while there is little overlap between the Eurasian Badger and the Pine Marten (Table 3). Actually, this result points to a sort of "gradient" between a diet based on vegetables and Invertebrata, with a small rate of Vertebrata (Eurasian Badgers), and one in which the rates of vegetables and Invertebrata are reduced and the Vertebrata rate increases (Red Foxes) up to a diet with little contribution of vegetables and Invertebrata and a larger rate of Vertebrata (Pine Martens), as shown in Fig.1.

This mid-position of the Red Fox seems not to be universal: in some regions, for example, Red Foxes fed almost exclusively on small mammals, Lagomorpha and birds. In these cases Red Foxes can appear less generalist than *Martes* sp. (Goszczynski, 1986). Compared with the variability of the range of the trophic niche of Red Foxes (Cantini, 1991), Pine Martens generally present a more fixed and typically carnivore-oriented food spectrum (De Marinis & Masseti, 1995; Marchesi & Mermod 1989).

Also the Eurasian Badger diet can become more "specialized" in some areas: in these cases the staple food consists of earthworms or, in some cases, of cereals (Kruuk, 1989). Some situations can therefore occur in which Eurasian Badgers and Red Foxes present very little overlap of trophic niches as they are concentrated on different trophic resources (Canova & Rosa, 1993; Kauhala *et al.*, 1998) or, vice versa, there can be situations of high trophic niche overlap in which, as in this research work, both species show a more generalist propension (Ciampalini & Lovari, 1985).

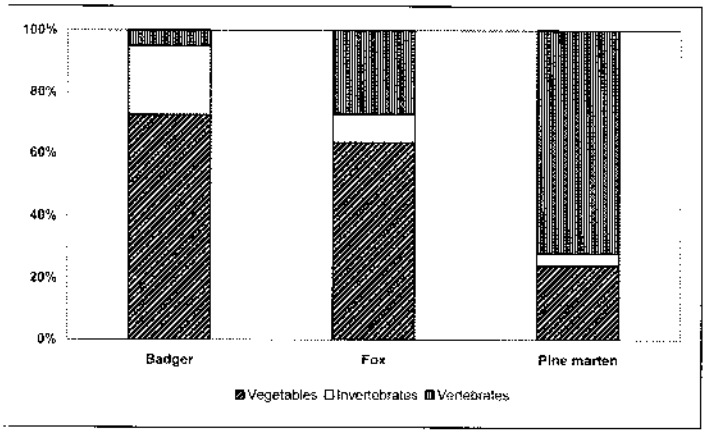
*Table 2. Spearman rank correlation coefficient (r_s) for the relationship between the Frequencies of Occurrence (FO) and the estimated Volumes (V) of the diet of Eurasian Badger, Red Fox and Pine marten. (p = significance level; * = significant values)*

	FO		V	
	r_s	p	r_s	p
Eurasian Badger vs. Pine marten	0.41	0.273	0.51	0.198
Eurasian Badger vs. Red Fox	0.80	0.010 *	0.61	0.079
Red Fox vs. Pine marten	0.70	0.052	0.76	0.028 *

Table 3. Trophic Niche Overlap: Horn's Index and Pianka Index

	Horn's	Pianka
Eurasian Badger vs. Pine marten	0.53	0.32
Eurasian Badger vs. Red Fox	0.80	0.76
Red Fox vs. Pine marten	0.79	0.67

Fig. 1. Volume percentage of vegetables, invertebrates and vertebrates in total diet of Eurasian Badger, Red Fox and Pine Marten.



Having considered all this, we can conclude that, in our study area, Eurasian Badgers, Red Foxes and Pine Martens share a lot of food resources, which they however use in different ways. The original aspect of this trophic behaviour is represented by the extensive exploitation of the "Fruits" category, which is not generally associated in literature with an Alpine and Pre-alpine environment. This choice is certainly to be related to the peculiar environmental and anthropic conditions of the "Insubrica Region". In fact, the mild climate due to the presence of Lake Maggiore, which mitigates its degree of continentality, and favours mild winters and fresh summers, enables the growth of fruit trees. Moreover, the desertion of the typically traditional agricultural activities of a mountain region and the ongoing depopulation have created an opportunity for the exploitation of this resource, which is easily available both in chestnut woods and in formerly tilled and as well as in small tilled patches of land near hamlets.

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Observations on wild Wolverines *Gulo gulo gulo* in north east Finland

Jeff CAIN

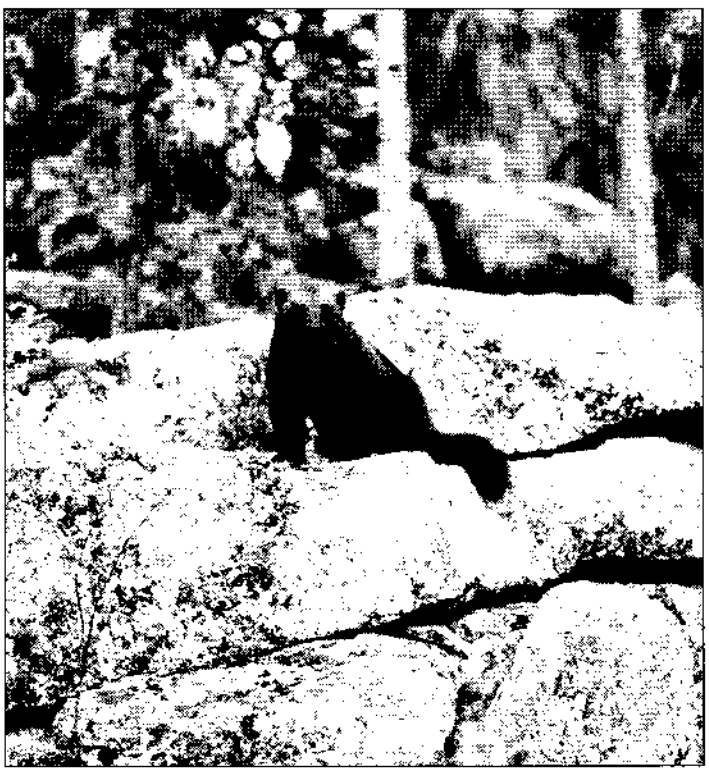
The Wolverine *Gulo gulo* is generally a solitary species and is notoriously difficult to observe, particularly at close range. Consequently there have been few documented accounts of wolverine social and parental behaviour from the ground.

In mid September 2003, I spent a total of 107 hours over a 9-day period inside an observation hide (2.1 x 1 m) located in old-growth boreal forest in the Kuhmo-Hukkajarvi region on the Finnish/Russian border. The region supported an estimated 15 Wolverines from a total Finnish population estimated at only 125 individuals. In Finland, Wolverines are listed as vulnerable and are fully protected under the wildlife act of 1982. The hide overlooked a small lake that was flanked on one side with high granite boulder slopes. Day and night temperatures averaged 25°C and 1°C, respectively. To attract Wolverines to the hide area, food baits (pig fat/bone) were randomly concealed under deep moss and earth, wedged amongst rocks and secured to trees.

After a 64-hour wait I observed an adult Wolverine during the night (04:10 h). To follow the Wolverine's movements I used an infra-red monocular. The animal was a large male. It climbed up steep rock faces, ran across narrow logs and through forest clearings with speed and confidence. It was apparent that Wolverines possess excellent night vision. The Wolverine was constantly alert and often reared up on hind legs to test air currents and visually scan the surroundings. It was very vocal and I often relocated its position due to the loud throaty coughs it near-continually made. It rapidly found the hidden baits using an exceptional sense of smell. To accurately pinpoint the food cache the Wolverine moved its head up and down, and sniffed the air with its mouth closed. Excavated baits were either consumed on site or carried to the forest. The Wolverine scent-marked pine saplings, tree stumps and logs, small rocks and exposed earth mounds using ventral scent-marking and urination. Bait sites were marked only after the food had been removed. The male repeatedly targeted one flat rock for ventral marking. Despite heavy rainfall, the sweet musky odour was still clearly detectable on the rock's surface. Ventral marking posture was characterised with a raised tail and the lowering of the abdominal region in conjunction with a rubbing motion that lasted on average 6 seconds. Scented areas were always sniffed at prior to leaving. The male defecated on two occasions near the empty bait sites. Scats were also found along bear trails, in open marshland and amongst the boulder slopes. Wolverines did not use defined latrine sites, and scats were left uncovered. Fresh scats were pale grey, odourless and contained splintered bone fragments. One scat was full of undigested outer skins and seeds of crowberries that had stained the scat dark blue. Weathered scats were powder-white and brittle.

The following evening (18:09 h) I observed an adult female Wolverine digging out a bait and hastily carrying it up towards the slopes. Shortly afterwards the female reappeared with two large kits (about seven months old, male and female). The female was very vigilant and responded immediately to any noise such as bird alarm calls. The Wolverine's hearing was acute. An alert posture included a raised head, ears forward, tail low and an intense stare in the direction of the disturbance. At 18:15 h, the Wolverines suddenly vanished over a ridge. At 18:16 h an adult male Wolverine was observed foraging on the marsh. The male moved with extreme caution and circled the hide, urinating on four occasions, before approaching the tree bait. The Wolverine reacted to a noise I inadvertently made with a rasping snarl, ears flattened, a fear grimace; and it retreated with a pronounced stiff legged gait. The

Adult male Wolverine Gulo gulo. *Photo: Jeff Cain.*



Adult female Wolverine Gulo gulo. *Photo: Jeff Cain.*

Male kit Wolverine Gulo gulo. *Photo: Jeff Cain.*

Male kit Wolverine Gulo gulo. *Note the strong paws. Photo: Jeff Cain.*

alarmed Wolverine stopped within 60 m and slowly returned to the bait. As the male fed, the female and two kits were observed intently watching the male's movements. The female left the kits on the scree and ran down to the lake edge and searched for baits coming within 4 m of the male. Both kits were totally focused on the female's activities. The behaviour of the female near the male was tense and wary. By contrast the male appeared indifferent and continued feeding. The adult Wolverines displayed a mutual tolerance despite the close proximity of food. No obvious behavioural or vocal interactions occurred. The pair had probably been in contact previously and the male most likely sired the kits (notably, the kits had similar pelt markings to the male).

The juvenile Wolverines playfully interacted on a few occasions. The kits also amused themselves, and I observed the male kit lying on its back kicking up clumps of moss with its hind paws. When the female brought food to the kits, the male kit emitted fast coughs and postured aggressively with an elevated tail, back fur raised and rushed forward. The female left the food and calmly walked away. The female did not actively defend a food source from the kits even when feeding. The male kit was larger and more robust than both his sibling and the adult female. Three Wolverines (female and kits) remained in the hide area for a further three days and nights. The adult female and the male kit were close companions and the pair often played, groomed and foraged together. Wolverines greeted with a touch of noses. The female initiated all direct movements, choose the route and led the trail. The female kit was difficult to observe and remained on the rock slopes avoiding open areas. The female kit ventral marked on one occasion. The male kit sometimes made short solitary forays and regularly scent-marked low objects and vegetation with ventral rubbing and urination. The male kit marked the same sites that had been previously used by the adult male. The kit also scent-marked in the presence of the adult male. When the male kit foraged alone, the adult female monitored its movements and adjusted her position to maintain visual contact.

The Wolverines were attracted to the sight and sound of Ravens *Corvus corax* and the corvids were also interested in Wolverine activities. On one occasion I watched two excited Ravens following a Wolverine travelling through the forest. I often noted that the female left the kits with a decisive and direct line of travel. The boulder habitat provided an excellent site for the female to leave the kits. The slopes offered a prime lookout position and had numerous refuge routes such as rock crevices, overhangs and mature trees. The kits stayed on the high ground when the female was away and were generally inactive.

Vocalisations between the Wolverines were heard on several occasions. During one observation the adult female was foraging alone near the hide and the male kit rested on the rock scree. The female uttered three loud, short grunts. The kit instantly ran down to join the female. The pair moved into the forest with the female leading the trail. The following evening the adult female rushed over a ridge in response to a succession of short rapid coughs by one or both of the unseen kits. The female used the same bouncing gait that the adult male had used when suddenly alarmed near the hide.

I had the opportunity to observe a Wolverine's reaction to a sound imitating a distressed rodent call. The male kit was on the rock slope about 400 m from the hide and reacted to the noise with an alert posture. The Wolverine started to stalk carefully downhill with an almost feline appearance, keeping its body and head low to the ground and using all available cover to conceal itself. The kit disappeared amongst the rugged terrain, but I heard movement at the back of the hide. Shortly afterwards I observed the male back on the slopes. The predatory technique that this young Wolverine displayed indicated that Wolverines could have the ability to secure live prey via a stealth approach.

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Ecology and conservation of the Palawan Stink Badger *Mydaus marchei* Huet, 1887

Peter WIDMANN and Indira WIDMANN

Introduction

The genus *Mydaus* only comprises two species and is restricted to Sundaland. The Malay Stink Badger *Mydaus javanensis* is recorded from Sumatra, Java, Borneo and the Natuna Islands (Nowak, 1991; Payne *et al.*, 1985). One of the world's least known badger species is the Palawan Stink Badger *Mydaus marchei*. It is endemic to the Palawan island group, which is situated between Borneo and oceanic Philippines (Heaney *et al.*, 1998). Politically, Palawan is a Province within the Philippines. However in biogeographical terms, the island group forms a part of the Sundaic Subregion with close affinities to Borneo. The last land connection to Borneo was disrupted about 165,000 years ago, due to rising sea water levels (e.g. Heaney, 1986). Since this time, the Palawan population of stink badgers has presumably been isolated from the Bornean population.

Pantots, as stink badgers are called locally, occur in Palawan Island, Busuanga and Calauit. They are not found on some of the smaller outlying coral islands, like Rasa and Malinau Islands in the Sulu Sea (ca. 8 km² each), and also not on the larger land-bridge island Dumaran (ca. 55km²).

Taxonomy

Mydaus marchei differs from *M. javanensis* by smaller ears, a shorter tail and larger teeth (Nowak, 1991). Both species have even been separated on generic level, the former being named *Suillotaxus marchei* (Lawrence, 1939). A different taxon, *M. schadenbergii*, was described for the Calamian island group north of Palawan. Now it is considered as a synonym for *M. marchei* (Long & Killingley, 1983; Wozencraft, 1993). However, Corbett & Hill (1992) raised doubts whether separation on species level is justified, considering the variability of *M. javanensis*. Morphometric measurements of both species overlap and according to Long & Killingley (1983), the only external character to distinguish both forms is not consistent: the white dorsal stripe 'usually' reaches the rump in *M. javanensis*, whereas it does so 'rarely' in *M. marchei*. They state that *M. javanensis* is usually darker than its relative from Palawan.

Seven different individuals observed in the wild, however, appeared to be black or very dark brown in the light of a flashlight or the headlights of a car. The dorsal cream-colored fur patches of five of these individuals (two could only be seen from behind) extended from the top of the head down almost to the shoulders, similar to the live animal shown in Fig. 1. None of the observed animals had patches extending beyond the shoulders. One specimen from Busuanga Island in the National Museum Manila shows roughly the same extent of the patch, but less distinct. Another specimen without location has only a small and indistinct 'crown' patch on the head (Fig. 2).

Both species seem to differ in behavior and habitat selection. The Malay Stink Badger reportedly forages in groups of two or three (Yasuma, 1994) and inhabits montane areas, often higher than 2,100 m (Long & Killingley; 1983; Whitten *et al.*, 1996). The Palawan Stink Badger was so far only observed to roam around solitarily. Furthermore is it common in the lowlands up to at least 300 m altitude. However, no information is presently available on the altitudinal distribution of this species in submontane and montane habitats of Palawan.

Fig. 1: Palawan Stink Badger emerging from its den on the campus of the Palawan State College for Technology, Aborlan, Palawan. Note the pig-like snout, the dark general fur coloration and the extent of the cream-colored dorsal patch. Photo: Peter Widmann.

Ecology

Little is known about the ecology of the Palawan Stink Badger. It occurs in a wide variety of habitats. It was observed in lowland primary and secondary forest, in shrub- and grasslands, freshwater swamp forest and even within settlements. In Iwahig Penal Colony, Puerto Princesa, a stink badger could be observed at the landward edge of mangrove.

The authors were lucky to discover a den within only twenty meters from the guesthouse at the campus of the State Polytechnic College of Palawan in Aborlan, where one badger could readily be observed and photographed (Fig. 1). The den was situated in a drainage pipe in the immediate vicinity of a rarely frequented dust road. It seemed to be inhabited by only one individual, which usually left its shelter between 18:15 and 18:35 hours, seemingly undisturbed by people, traffic, and even bright flashlight. Kruuk (2000) observed one animal digging an 'instant den' in the dam separating two paddy fields. After about five minutes of digging the den was deep enough that the animal was completely out of sight.

Dogs or cats do not usually seem to bother *M. marchei*, presumably because of its potential to excrete a nauseating chemical from its anal glands which is reported even to sometimes make humans faint (Long & Killingley, 1983). Stink badgers reportedly do not use their chemical defense regularly, but occasionally feign death and then try to escape in a supposedly unexpected moment. Local people several times raised our attention to distinct odors which reportedly originated from Pantots.

Like in other badgers, the main diet of the Palawan Stink Badger consists of worms and soil arthropods. Kruuk (2000) recorded freshwater crabs, and several insects, among them mole crickets and small beetles which are dug out in pits, usually 1-6 cm deep. We found feeding places with superficially disturbed soil covering up to 0.5m² each along small rivulets. Kruuk (2000) described similar feeding places in rice paddies covering 1-2 m²,

which he found similar to those of Bearded Pig *Sus barbatus oi·enobarbus*.

M. marchei prefers areas with soft soil for foraging. This is the case in most habitats with prevailing woody vegetation, but not in pure grasslands where extensive root systems makes digging difficult. During the dry season the badger was observed patrolling along small streams where the soil remained damp. Kruuk (2000) recorded the species to forage in paddy fields.

Besides worms and arthropods, fruits are also consumed. Overripe mangoes and fruits of *Nauclea orientalis* were taken when experimentally exposed near the den. Figs *Ficus* sp., as well as two species of wild mangosteen *Garcinia benthami* and *G. parviflora* were rejected. In one occasion, a churned area of ca. 3 m² under mass-fruiting *Guioa pleuropteris* was found. However, it remained unclear, if the badger was after the fruits, or the likewise abundant insects (mainly beetles).

Only limited data on the reproductive biology are available. A juvenile was collected on November 10 and a young on March 6 (Long & Killingley, 1983).

Conservation

The Palawan Stink Badger is listed as 'Vulnerable' by IUCN (2002) based on the criteria 'Extent of occurrence estimated to be less than 20,000 km² or area of occupancy less than 2,000 km², and estimates indicating a severely fragmented [population] or known to exist at no more than ten locations and a continued decline, inferred, observed or projected in area, extent and/or quality of habitat' (IUCN, 2002). However, *M. marchei* is not restricted to primary forests, an ecosystem which is declining very fast in Palawan. It seems that relatively high population densities can occur in secondary forests and shrublands, and the badger is even known to thrive in cultivated areas (Grimwood, 1976). Therefore we concur with Kruuk (2000) that *M. marchei* does not qualify under the category 'Vulnerable'.

The species is usually not hunted by a Tagbanua ethnic community in southern Palawan, because of its pungent smell (Lacerna & Widmann, 1999). However, some members of the Pala'wan ethnic people regularly stalk it with dogs and know to remove the anal glands to allow human consumption as food (Widmann, unpubl. data). Yet, this seems not to be a significant drain of the population.

Predation by or competition with domesticated animals seems not to play a significant role in the population dynamics of Palawan Stink Badgers. However, Long & Killingley (1983) state that 'native civets and cats' feed on stink badgers.

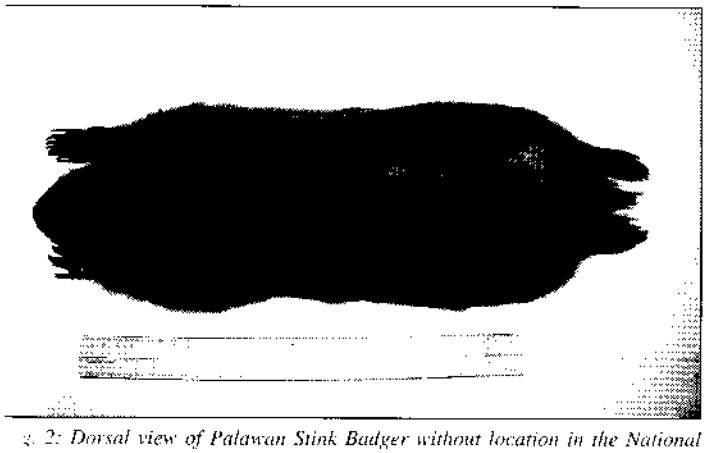

Fig. 2: Dorsal view of Palawan Stink Badger without location in the National Museum. Note the small and indistinct 'crown' patch on the head. Photo: Peter Widmann.

Although the Palawan Stink Badger probably has not suffered from conversion of primary to secondary forest or shrubland, the further alteration to grassland or permanent agriculture may pose a threat to the survival of the species. Kruuk (2000) reported the species in paddyfields in Aborlan municipality which are imbedded in shrubland and tree plantations. We failed to spotlight the species in more extensive areas under rice cultivation with only few 'hedgerows' left in the neighboring municipality of Narra.

The increase of car traffic during night-time may negatively affect the species due to its indifference to this kind of threat. Road kills were observed between Puerto Princesa City and Narra. Also other wildlife like the Palawan Pangolin *Manis culionensis*, the Palawan Porcupine *Hystrix pumilus*, Common Monitor Lizard *Varanus salvator*, and several species of snake.

It is not known in how far stink badgers are affected by diseases of domestic animals. Rabies is particularly widespread and common in Palawan, particularly among stray dogs.

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Hose's Civet, *Diplogale hosei*

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Hose's Civet *Diplogale hosei* (Thomas, 1892) may well be, together with Lowe's Otter Civet *Cynogale lowei* and the Malabar Civet *Viverra civettina*, one of Asia's least known viverrids (Fig. 1). From a specimen collected in 1891 by C. Hose on Mt. Dulit in N. Borneo, Thomas (1892a) created a new species, giving a short description, followed in the same year (1892b) by a more extensive description accompanied by a colour plate of the animal and drawings of the skull.

Fig. 1. Although the photo is not clear this is probably Hose's Civet Diplogale hosei *photo-trapped in Lanjak Entimau Wildlife Sanctuary, Sarawak, Borneo. Photo: Mohm. Azlan J.*

Taxonomy

Thomas (1892a) described the new species as *Hemigale hosei*, changed into *Hemigalus hosei* by Trouessart (1898-1899). Thomas (1912) found the different shape of the muzzle and palate, the double-rooted P^1, and other differences in the teeth, as well as the essential difference in the pattern of colouration the chief reasons for distinguishing *Diplogale* from *Hemigalus*. Chasen (1940) returned the species to genus *Hemigalus* without comment, and Ellerman & Morrison-Scott (1955) deemed *Diplogale* 'valid as a subgenus'. The genus *Diplogale* was recognized by Pocock both in 1915 and 1933. Davis (1958) found that the Kelabit series of specimens confirmed Pocock's view and that the morphological differences between *derbyanus* and *hosei*, together with the characteristic high-altitude distribution of *hosei*, indicated more than specific distinction.

Holotype: Male, skin and skull. Cat. No. BMNH-1892.2.7.1 (London), Mt. Dulit, 1,200 m a.s.l., N. E. Borneo, 30 September 1891, C. Hose.

Local names

Tani (in Dusun, Sabah, Banks, 1931), Toni (in Kadazan, Sabah, J. Harrison, 1964) and Musang hitam pudar (in Malay, Sabah, J. Harrison, 1964).

Distribution

Hose's Civet has thus far only been collected from and observed in Sabah, Sarawak, and Brunei, all in N. E. Borneo (Fig. 2).

Sarawak, Malaysia:

Mt. Batu Song (Hose, 1893); Mt. Dulit (BMNH-0.2.2.7, 1892.2.7.1, 99.12.9.21); Bario, Kelabit Plateau (FMNH-74275; MS Kuching-0183/1948); Mt. Kalulong (BMNH-1950.88; 51.188); Pa Amur, E of Bario (FMNH-88298; Davis, 1958); Pa Dali, SE of Bario (Davis, 1958).

Sabah, Malaysia:

Mt. Salekan (RMNH-34568); Mt. Kinabalu (BMNH-94.6.8.2; NMB-1025670); Tenom, 55 miles SW of, Crocker Range (BMNH-71.30.77); Rinangisan, Crocker Range (SM-NH 2631; Francis, 2002); Mount Kinabalu National Park (unconfirmed sighting, Dinets, 2003).

Brunei:

Belalong; Marabok (ZMBerlin-14292); Pondok Busiri Camp, Ulu Temburong National Park (unconfirmed sighting, Francis, 2002).

Identification

General colour above uniform dark smoky brown or black, the bases of the body hairs whitish. Sides of muzzle at the roots of whiskers white. Cheek below eye and a patch above and behind it grizzled brownish white. Ears thinly haired, pure white on their inner aspect, edges in marked contrast to black crown. Chin white; chest, belly, and inner sides of limbs proximally smoky yellowish grey. Rest of the limbs and whole of tail black (Thomas, 1892b).

Pocock (1933) found the hinder part of the throat, the breast and belly varying from dusky greyish brown to clean white.

Banks (1931) remarked: "the shape and size and particularly the long neck resembling *Hemigalus derbyanus* could make it pass for a melanism of this species were it not for the white markings. It has the same whorl on the shoulders and the same black ridge down the neck as in *derbyanus*; sometimes white hairy ears as opposed to the grey sparsely covered ones, the nasal stripe broadening out on the forehead: the vestigial eye stripe and particularly the white on the muzzle at the base of the whiskers differentiate it from *derbyanus*".

Davis (1958) found in the four Kelabit specimens little colour variation; they agreed with the earlier descriptions being dark brown, the Pa Dali specimen being paler than the two from Pa Amur, and the Bario specimens being slightly rufescent.

The white whiskers are very long, reaching back behind the ears (Banks, 1931). The feet are partly webbed with patches of hair between the footpads (Payne *et al.*, 1985). K. Phillipps (*in litt.*), who saw a freshly killed animal (one of the animals discussed in Francis, 2002), stated "it has a surprisingly large snout, somewhat like that

Character	Holotype	N	X	Min	Max
GSL	96.9	4	95.9	92.6	97.5
CBL	94.1	3	94.4	91.4	96.5
ROL	38.2	7	34.4	31.6	36.2
PAL	50.0	7	46.9	43.9	49.6
MAX	37.6	7	37.3	35.4	39.9
TYM	13.9	3	15.0	14.1	16.1
CAN	16.8	7	16.0	14.0	17.2
ROB	20.7	7	20.6	19.2	21.9
IOB	18.4	7	17.8	16.0	19.1
PAB	24.1	7	24.6	22.8	26.3
ZYG	44.9	7	45.4	38.5	48.5
BRB	30.3	6	30.6	29.8	32.2
MAS	29.2	4	29.5	27.7	30.4
BRH	24.0	5	24.8	24.0	26.1
MAL	68.3	7	66.2	60.5	69.5
MAN	41.0	7	39.7	35.4	42.3
CMH	23.8	7	22.4	18.6	25.3

Table 1. Cranial measurements (in mm) for Diplogale hosei. *Holotype: adult male, BMNH-1892.2.7.1. N, number of specimens; X, mean; Min, minimum; Max, maximum; GSL, etc., see: List of characters and acronyms in Small Carnivore Conservation 23:12.*

f *Cynogale*".

"Evidence for the perfume glands, similar to those described n the male *Hemigalus* by myself and in females by Mivart, is to be ound in some of the made-up skins" (Pocock, 1933:1000).

HB: 472-540 mm T: 298-335 mm HF: 74-78 mm (Payne *et l.*, 1985; 3 specimens) Ear: 39 mm Weight: Ca. 1,500 g. Skull easurements are given in Table 1.

Habitat and status

Lower montane mountains and mature mixed dipterocarp orest. Collected/observed between 450 m (Francis, 2002) and ,700 m (Dinets, 2003). The largest series of *Diplogale* ever ollected from one locality consists of four specimens collected by T. Harrison between 1945 and 1949 on the Kelabit Plateau in N. Sarawak. This caused him to consider *Diplogale* to be common above 1.100 m in the Kelabit uplands, particularly in moss forest Medway, 1965). On the other hand, J. Harrison (1964), writing on the mammals of Sabah, stated: 'I know nothing of this animal, which appears to be rare".

Either Hose's Civet is very rare or the mountain-systems of northern Borneo have not yet been thoroughly explored, or both, as more than a century after its discovery only ca. 17 specimens could be traced in museum collections and there is no record of *Diplogale* being collected after 1983.

Ethology

Next to nothing is known on the habits and food of Hose's Civet. T. Harrison (Medway, 1965) found it largely terrestrial in habit, but one of his specimens was listed as "In jungle (treetops)". Other labels state: "Snared in Jungle" and "Single".

The long facial whiskers and hairs between the footpads suggest it may specialize in foraging for small animals in mossy boulders and streams (Payne *et al.*, 1985) and one of the collectors (T. Harrison) notes said: "Food: insects, ants" (Davis, 1958).

Payne et al. (1985) stated it is probably nocturnal. Both sightings (Francis, 2002: Dinets, 2003) were nocturnal and on the ground, respectively at 22:00h and 03:00h. A spot-lighted animal walked parallel to a trail and approached the observer to as little as 5m (Dinets, 2003).

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Gazetteer

Belalong, Brunei: 04°33'N, 115°09'E; Bario, Kelabit Plateau, Sarawak: 03°40'N, 115°20'E; Mt. Batu Song, Sarawak: 03°44'N, 114°49'E; Mt. Dulit, Sarawak: 03°25'N, 114°00'E; Mt. Kalulong, Sarawak: 03°13'N, 114°40'E; Mt. Kinabalu, Sabah: 06°00'N, 116°32'E; Lanjak Entimau Wildlife Sanctuary, Sarawak: 01°65'N, 112°28'E; Marabok, Brunei: —; Pa Amur, Sarawak: 03°44'N, 115°13'E; Pa Dali, Sarawak: 03°34'N, 115°35'E; Mt. Salekan, Sabah: —; Tenom, Crocker Range, Sabah: 05°24'N, 116°06'E; Rinangisan, Crocker Range, Sabah: 05°29'N, 116°03'E; Ulu Temburong, Brunei: 04°26'N, 115°16'E.

Museum abbreviations

BMNH: The Natural History Museum, London, UK; **FMNH**: Field Museum of Natural History, Chicago, IL, USA; **MS**: Muzium Sarawak, Kuching, Sarawak, Malaysia; **NMB**: Naturhistorisches Museum Bern, Bern, Switzerland; **RMNH**: Naturalis, Leiden, The Netherlands; **SM**: Sabah Musem, Kota Kinabalu, Sabah, Malaysia; **ZM**: Zoologisches Museum, Berlin, Germany.

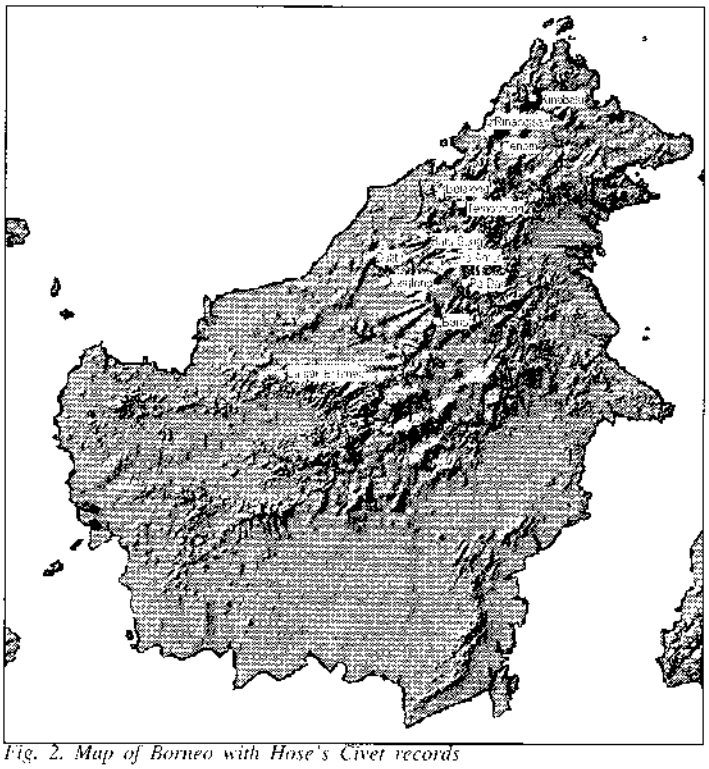

Fig. 2. Map of Borneo with Hose's Civet records

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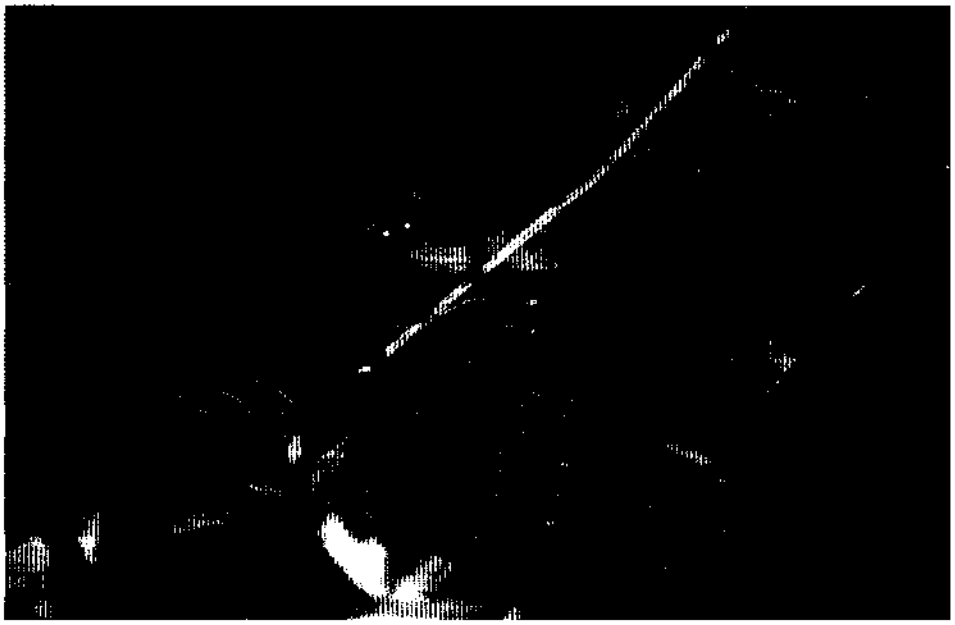

Small-toothed Palm Civet Arctogalidia trivirgata *in Cat Tien National Park, Vietnam.*
Photo: Alex V. Borissenko & Natalia V. Ivanova

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