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Javan Ferret Badger *Melogale orientalis* (Photo: Ganda Wahyatama)

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The aim of this publication is to offer the members of the IUCN/SSC Small Carnivore Specialist Group, and those who are concerned with small carnivores in families of Ailuridae, Eupleridae, Herpestidae, Mephitidae, Mustelidae, Nandiniidae, Prionodontidae, Procyonidae, and Viverridae, original papers, news items, abstracts, and titles of recent literature. All readers are invited to send material to:

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Occurrence and conservation status of small carnivores in two protected areas in Arunachal Pradesh, north-east India

Aparajita DATTA, Rohit NANIWADEKAR and M. O. ANAND

Abstract

The rainforests of north-east India harbour a diverse assemblage of mustelids, viverrids and herpestids, many of which are hunted. Yet, very little information exists on their ecology, distribution, abundance, and conservation status. A camera-trapping survey was carried out in two protected areas (Namdapha National Park and Pakke Wildlife Sanctuary) in Arunachal Pradesh between 2005 and 2007 as part of a wildlife monitoring programme. The two areas are believed to hold 13–15 species of forest-dwelling small carnivores, apart from three otter species. We recorded seven species in 2,240 trap-nights in Namdapha, and four species in 231 trap-nights in Pakke. Direct sightings and indirect evidence confirmed the occurrence of additional small carnivore species apart from those recorded during the camera-trap surveys in both areas. Photo-capture rates of four species recorded were high in Namdapha relative to those in three sites in South-east Asia. Capture rates of the Large Indian Civet *Viverra zibetha* were relatively high in Namdapha compared with other species, and this species, along with the Yellow-throated Marten *Martes flavigula*, appears to be common. Species such as the Binturong *Arctictis binturong*, Spotted Linsang *Prionodon pardicolor* and Stripe-backed Weasel *Mustela strigidorsa* were not recorded by camera-traps, although other evidences of their presence were recorded. Incidental or retaliatory hunting was recorded for most species; otters are highly threatened in Namdapha due to considerable hunting for skins which have high market value.

Keywords: camera-trapping, Eastern Himalaya, herpestid, hunting, mustelid, viverrid, wildlife monitoring

Introduction

Small carnivore species richness in the Indian subcontinent is centred in two major regions, the Eastern Himalaya and North-east Hills, and the Western Ghats (Sterndale 1884, Pocock 1939, 1941, Nowak 1999). There are 33 species of small carnivores (only the viverrids, mustelids and herpestids) in India (Corbet & Hill 1992), with more than 50% occurring in north-east India (Mudappa in press).

The high diversity of small carnivores in north-east India is due to the region lying at the confluence of three important biogeographical realms, with several species being unique to the region within India, although all have a wider distribution in South-east Asia. Within India, the Spotted Linsang *Prionodon pardicolor*, Binturong *Arctictis binturong*, Crab-eating Mongoose *Herpestes urva*, Hog Badger *Arctonyx collaris*, Stripe-backed Weasel *Mustela strigidorsa* and two species of ferret badgers *Melogale* spp. are all restricted to the north-east, while several other civets range into other parts of India, and the Yellow-throated Marten *Martes flavigula* and other mustelids into the western Himalaya. Small carnivore diversity is high in the state of Arunachal Pradesh not only due to the wide altitudinal range resulting in a high diversity of habitat types from lowland forests to alpine areas, but also contiguity of evergreen forest areas and their proximity to forests of South-east Asia rich in small carnivores.

Among the diverse small carnivore assemblage in north-east India, viverrids are the most species-rich. Many small carnivore species are hunted in this region, yet very little information exists on their status, distribution, abundance, and ecology throughout their range in north-east India (Choudhury 1997a, 1997b, 2003, Datta 1999) and South-east Asia, apart from general status reviews of small carnivores or single species in specific countries based on largely anecdotal information (e.g. Van Rompaey 1995, Duckworth 1997, Azlan 2003, Holden 2006, Long & Minh Hoang 2006). Much of the modern information comes from sighting records (e.g. Nettelbeck 1997).

Because most species are rarely sighted and several are nocturnal, camera-trapping is preferred to observational studies to document species richness and assess status, although it is inefficient for species that are largely arboreal and for some others e.g., apparently, weasels *Mustela* spp. (Duckworth *et al*. 2006, Abramov *et al*. 2008, Duckworth & Nettelbeck 2008). However, very few studies have used this method specifically to survey small carnivores (e.g. Mudappa 1998); most often, camera-trap surveys designed for other species have obtained additional information on richness and abundance of small carnivores (Grassman 2003, Kawanishi & Sunquist 2004, Johnson *et al*. 2006, Than Zaw *et al*. 2008). Many studies on small carnivores have used night walks along established trails to estimate encounter rates or densities, however these are time-consuming and labour-intensive and may have restricted spatial coverage.

Density and abundance estimates vary based on habitat type. In South-east Asian forests, estimates suggest high densities of 31.5/km² for eight civet species in undisturbed primary forest (Heydon & Bulloh 1996), although encounter rates for most species declined in logged forests. A few studies have used radio-telemetry to determine ranging patterns of small carnivores (Rabinowitz 1991, Joshi *et al*. 1995, Grassman 1998, Mudappa 2001, Grassman *et al*. 2005), while effects of habitat fragmentation have been studied in the Western Ghats of India (Mudappa *et al*. 2007).

The Namdapha National Park and Pakke Wildlife Sanctuary are two important protected areas in Arunachal Pradesh that are believed to harbour 13 species of forest-dwelling small carnivores, excluding the three species of otters. In addition, Namdapha also possibly holds the Yellow-bellied Weasel *Mustela kathiah* and the Stone Marten *Martes foina* in the subtropical, temperate and alpine areas (Ghosh 1987). The Small-toothed Palm Civet *Arctogalidia trivirgata* is also reported to occur in eastern Arunachal Pradesh (Choudhury 2003), but has not been confirmed. The Red Panda

Ailurus fulgens (often included with small carnivores), reported from subtropical and temperate forests above 2,000 m (Corbet & Hill 1992), also occurs in Namdapha.

In this paper, we report the diversity and photo-capture rates of small carnivore species that occur in the evergreen and semi-evergreen forests below 2,000 m asl based on camera-trapping surveys carried out from 2005 to 2007 and opportunistic sightings and indirect evidence at the two sites. We also discuss threats to the species, their conservation status and compare their capture rates with reports from other tropical forests in South-east Asia holding similar species assemblages.

Study sites

Namdapha National Park and Tiger Reserve

The study was conducted within the 1,985 km² Namdapha National Park (27°23′30″– 27°39′40″N, 96°15′02″–96°58′33″E; Fig. 1), in Changlang District of Arunachal Pradesh, north-east India. The site harbours some of the northernmost tropical rainforests in the world (Proctor *et al.* 1998) and extensive dipterocarp forests. The elevation ranges from 200 m to 4,571 m above sea level, resulting in high habitat diversity from subtropical broad-leaved forests, subtropical pine forests, temperate broad-leaved forests, alpine meadows and perennial snow. Though primary forests cover most of the park, there are extensive bamboo and secondary forests. The park lies within the Himalaya and the Indo-Burma global biodiversity hotspots (Myers *et al.* 2000, Conservation International 2005) at the junction of the Palaearctic and Malayan bio-geographic realms resulting in a highly diverse mammalian assemblage. At least 90 mammal species are reported, including nine species of felids, two bear species, two canids, about 20 viverrids, mustelids and herpestids (including all high-altitude species), one ailurid, 11 ungulates and seven primates (Ghosh 1987).

Several indigenous tribes and other communities reside in and around the park; those that are primarily dependent on the park for forest resources are the Lisu, Chakma, and the Miju Mishmi (Datta 2007). Hunting is the biggest threat to wildlife here, and is prevalent among all tribal groups. At least 34 species of mammals are hunted, as evinced by skins and skulls seen in villages in the area. While ungulates and primates are the main targets of subsistence hunting, there is also commercial hunting for Asian Elephant *Elephas maximus*, musk deer *Moschus*, bears

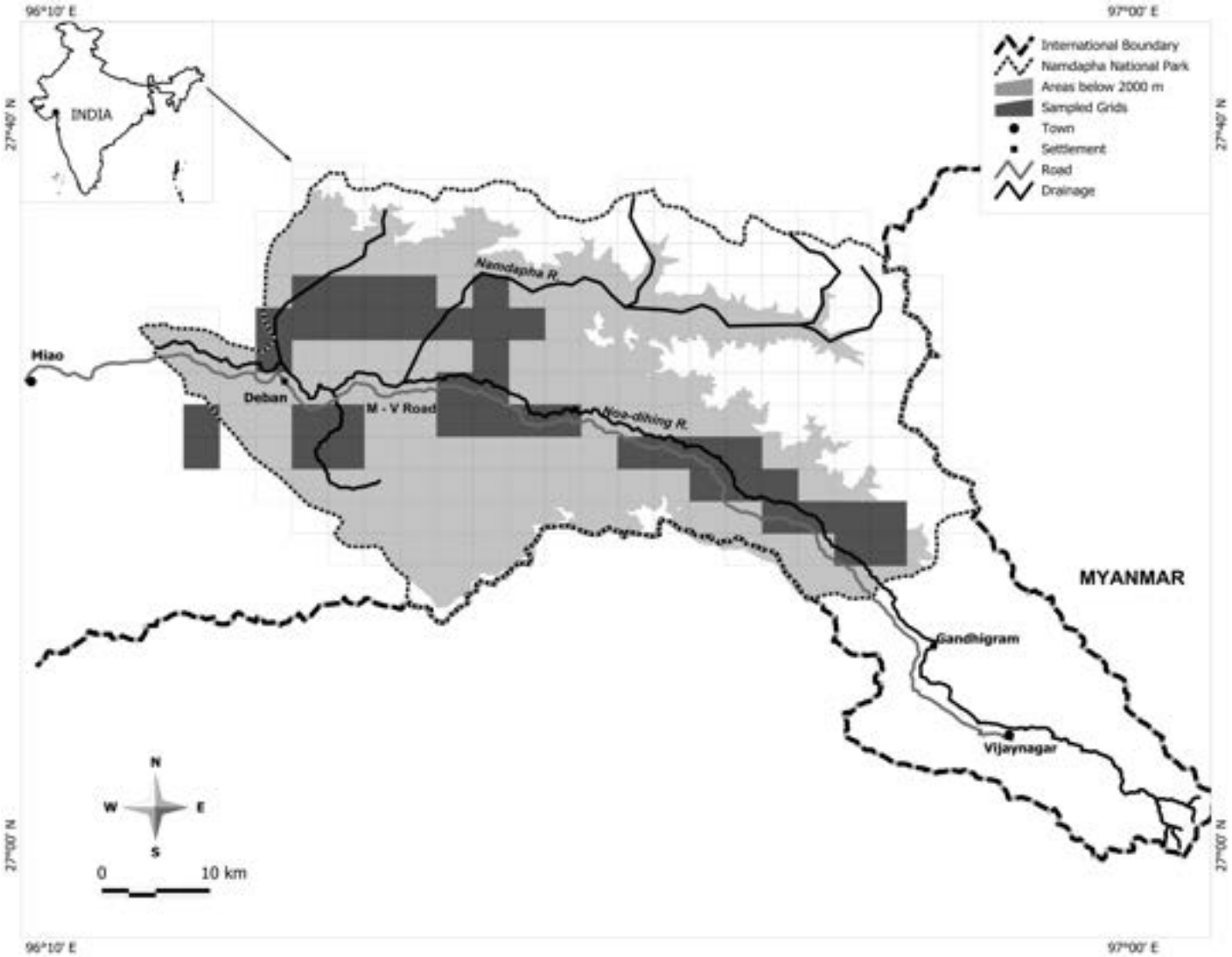

Fig. 1. Namdapha National Park, showing 3x3 km grid used for sampling. Areas shaded in light grey represent tropical forests below 2,000 m asl. Dark grey squares represent the 40 sampled grid-cells.

(Ursidae), otters (Lutrinae), Tiger *Panthera tigris* and other cats (Felidae; Datta 2002, 2007). Deliberate hunting incidents of most small carnivores are in retaliation to killing of poultry around villages. There are also records of accidental or opportunistic killing of these species when they are caught in snares or traps set for other animals. Hunters use guns, cross-bows and a variety of indigenous traps and snares.

Pakke Wildlife Sanctuary and Tiger Reserve

Pakke (= Pakhui) Wildlife Sanctuary (862 km², 26°54′–27°16′N, 92°36′–93°09′E) lies in the foothills of the Eastern Himalaya in the East Kameng District of Arunachal Pradesh bordering the state of Assam. It was declared a sanctuary in 1977, and has been recently declared a Tiger Reserve.

The park is surrounded by contiguous forests on most sides and bounded by rivers in the east, west, and north. The terrain is undulating and hilly, with altitude ranging from 150 m to about 2,000 m above sea level. The area has a tropical climate, with cooler weather from November to February. The vegetation of the reserve is classified as Assam Valley tropical semi-evergreen forest 2B/C1 (Champion & Seth 1968). The forests are multi-storeyed and rich in epiphytic flora, woody lianas and climbers with a high representation of Euphorbiaceae and Lauraceae (Datta 2001). Subtropical broad-leaved forests occur at higher elevations, while bamboo, rattans and palms are common near perennial streams. Along larger streams and rivers in the valley, there are patches of tall grassland.

At least 60 mammal species are reported from the park, including 7–8 species of felids, one bear and two canid species, 16 viverrids, mustelids and herpestids, seven large herbivores and four primate species.

Thirteen to fifteen villages and small settlements are located near the south-eastern boundary of the park adjacent to the Pakke river with an adult population of about 4,000 people (mostly belonging to the Nishi tribal community). Two small villages are located in the extreme northern end. Hunting, fishing, and collection of non-timber forest products by the Nishi and by villagers from adjoining Assam is prevalent mainly near the southern boundary. A vast portion in the central and northern part of the park is relatively inaccessible due to the dense vegetation, hilly terrain and the lack of trails. Consequently, few people venture into the interior. Hunting in the park appears to have declined since 2002 due to better protection by park authorities and greater awareness of the Nishi community (Datta 2007).

Methods

Camera-trapping

In a pilot survey in Namdapha National Park, eight camera-trap units (DEERCAM, passive infra-red sensors with Olympus Trip 505 cameras) were deployed at 44 trap locations from November 2005 to February 2006. Camera-trap units were placed at heights of 30–45 cm from the ground on animal trails and paths, near fruiting trees and animal wallows. All trapping effort was inside tropical evergreen forest. Trap locations were in altitudes ranging from 150 m to 1,300 m. Camera numbers, film roll numbers, location names, GPS-derived co-ordinates and altitude, habitat descriptions, set-up and removal dates, number of pictures taken during each session, and presence of animal signs were recorded. Cameras were active for 24 hours per day and trapping sessions lasted an average of 12 days (8–23 days) at 27 locations, while at 17 locations they were deployed opportunistically for 1–4 nights. Traps could not be deployed for a uniform number of days because of the logistic difficulties in reaching and accessing different sites with only three field staff and limited camera-trap units.

From October 2006 to January 2007, we carried out a more systematic camera-trap survey that focused on an area of 1,200 km², roughly encompassing the moist evergreen habitat below 2,000 m. In order to minimise sampling bias and maximise spatial coverage camera-trap units were deployed in a systematic manner in 40 randomly-selected grid-cells (3 km x 3 km) from a network of ~130 grid cells that were imposed on a map of areas less than 2,000 m above sea level.

We used 42 passive infra-red camera-trap units (38 DEERCAM-300 camera-trap units and four units made by the Centre for Electronic Design and Technology, Indian Institute of Science, Bangalore). In each of 40 sampled grid-cells, two or three camera-traps were deployed. Our survey was designed to capture a range of ground-living mammals, including large carnivores and ungulates; however traps were deployed along animal trails, streambeds, and ridgelines, in locations with evidence of animal movement and were also suitable for recording small carnivores. We recorded the GPS location, altitude and other habitat parameters at each trap-site. A group of highly skilled Lisu trackers assisted in identifying suitable locations for deploying camera-traps. At every location, one passive infra-red camera-trap was placed perpendicular to the expected direction of animal movement. We deployed traps at a height of 20–40 cm from the ground (mean 33 cm), which is fairly appropriate for capturing small carnivores. We maintained a minimum distance of 400–500 m between trap locations. However, on two occasions we placed traps at a distance of 200 m apart, due to inaccessible terrain and lack of suitable sites. The traps were operated continuously and were removed after a period of 15 days. The number of trap-nights was calculated from date of deployment until date of retrieval (if film was not used up) or until date of the final photograph.

Apart from the systematic grid survey, we also had additional trapping effort (124 trap-nights) in January 2007 in community forests to the east of the park (Vijaynagar) and in nine locations inside the park.

In Pakke Wildlife Sanctuary, the trapping effort was low due to limited availability of camera-trap units. Four camera-traps were deployed at 46 trap-sites in short sessions from December 2005 to May 2006. An additional session was carried out in September–October 2006 with five camera-trap units. Trap locations were at altitudes of 150–300 m. Procedures for deploying traps were similar to those followed in Namdapha. All units were set at a height of 30–40 cm from the ground and operated continuously. Trapping sessions lasted for up to five days in 31 locations while at the remaining 15, they varied between five and 25 days.

All camera-traps were located on the ground; therefore small carnivores that are more arboreal will not be captured as frequently as those that are more ground-living, and may even be entirely overlooked.

Data analysis

Photo-capture rates of small carnivore species were obtained, such as are often used as an index of relative abundance (RAI) defined as the number of days required to obtain a photo-capture of a species (Carbone *et al*. 2001). Only independent pictures of

a particular species are counted as valid. Independence of detections was defined, following O'Brien *et al.* (2003), as (1) consecutive photographs of different individuals of the same or different species, (2) consecutive photographs of individuals of the same species taken more than 0.5 h apart and (3) non-consecutive photos of individuals of the same species. Photo-capture rates from the current study were compared with those obtained from studies in geographically and climatically similar forests in three sites in South-east Asia which face lower or comparable hunting pressures (Grassman 2003, Kawanishi & Sunquist 2004, Than Zaw *et al.* 2008). In addition, small carnivore species richness based on camera-trap records was also available from two other sites (Johnson *et al.* 2006, Long & Minh Hoang 2006).

Results and Discussion

Table 1 lists the evidence used to determine presence, qualitative assessments of status and hunting pressure, and the reasons for hunting for each of the small carnivore species. All the camera-trap records are listed in the Appendix with details of date, time, location, altitude, habitat type, and topographic feature.

Species richness and relative abundance in Namdapha

We had a combined trapping effort of 2,240 trap-nights in Namdapha (2005–2007) with a total of 44 independent photos of seven species. Of the 17 species of small carnivores in the tropical forests of Namdapha, six species were recorded in 1,537 trap-nights during the systematic survey from November 2006 to January 2007. An additional 215 trap-nights in October–November 2007 yielded one more species (Table 2).

Three civets, the Masked Palm Civet, the Common Palm Civet, and the Large Indian Civet, were photo-captured, as was Crab-eating Mongoose. Ferret badgers were photo-captured in the wild in India for the first time. The two species of ferret badgers known to occur in this region are best differentiated based on dentition with specimens in hand (J. W. Duckworth verbally 2008). The Hog Badger, not recorded in the three-month intensive trapping survey, was recorded once in October 2007. The Yellow-throated Marten, the only small carnivore that is commonly sighted in the daytime, was also recorded on camera-traps.

Only nine of the small carnivores found here are strict rainforest-dwellers, whereas four (Common Palm Civet, Small Indian Civet, Yellow-throated Marten, and Small Asian Mongoose)

Table 1. Presence, status, hunting pressures on small carnivores in Pakke Wildlife Sanctuary and Namdapha National Park, Arunachal Pradesh.

Species	Namdapha	Pakke	Status	Hunting pressure	Reason for hunting
Red Panda *Ailurus fulgens*	Local reports, skin	Not present	Rare	Moderate	Skin, accidental
Yellow-throated Marten *Martes flavigula*	Camera-trap, sightings, skins	Several sightings	Very common	Occasional, low	Retaliatory, accidental (meat not usually eaten)
Stripe-backed Weasel *Mustela strigidorsa*	Skin, possible sighting	Partial skin? (in 1996)	Rare?	Occasional, low	Retaliatory, accidental
Ferret badger *Melogale* sp(p).	Camera-trap	Stuffed specimen in 1997 (Datta 1999)	Very rare	Occasional, low	Accidental?
Hog Badger *Arctonyx collaris*	Camera-trap, local reports, droppings	None	Uncommon	Moderate	Accidental, sport (meat not usually eaten)
Otters (Lutrinae); 2–3 species	2 sightings	Sightings, indirect signs, skin	Threatened in Namdapha	High	Skin for trade
Spotted Linsang *Prionodon pardicolor*	Skin	Reported by Choudhury (2003)	Rare?	Moderate	Retaliatory, accidental, decorative
Large Indian Civet *Viverra zibetha*	Camera-trap	Camera-trap	Common	Moderate	Retaliatory, accidental, decorative value
Small Indian Civet *Viverricula indica*	2 sightings	Camera-trap, sightings	Common (open habitats)	Moderate	Retaliatory, accidental
Common Palm Civet *Paradoxurus hermaphroditus*	Camera-trap	Camera-trap, sightings	Common (encroached habitats)	Moderate	Retaliatory, accidental
Masked Palm Civet *Paguma larvata*	Camera-trap, 2 sightings	Local reports	Common	Moderate	Retaliatory, accidental
Binturong *Arctictis binturong*	Sighting, local reports, droppings?	Sightings	Uncommon	Occasional, low	Accidental?
Small-toothed Palm Civet *Arctogalidia trivirgata*	Unknown	Unlikely to be present**	Unknown	Unknown	Unknown
Small Asian Mongoose *Herpestes javanicus*	None*	Sighting, captive animal	Common in open habitats	Occasional, low	Accidental
Crab-eating Mongoose *Herpestes urva*	Camera-trap, 2 sightings	Camera-trap	Common	Occasional, low	Accidental?

*Should be present, based on distributional range; **Because apparently never recorded north of the Brahmaputra

Table 2. Photo-capture rates for species recorded on camera-traps in Namdapha National Park from October 2006–January 2007 (calculated only from 1,537 trap-nights).

Species	Total photos	Independent photos	RAI_1	RAI_2
Yellow-throated Marten	10	5	307	0.32
Ferret badger	5	4	384	0.26
Large Indian Civet	12	11	140	0.72
Common Palm Civet	11	4	384	0.26
Masked Palm Civet	5	5	307	0.32
Crab-eating Mongoose	4	2	768	0.13
TOTAL	47	31	50	2.02

RAI_1: number of days required to get a single photo-capture, RAI_2: number of independent photos per 100 trap-nights.

Trapping sessions between November 2005 and January 2006 yielded six photograph of Common Palm Civet and two of Masked Palm Civet in 364 trap-nights.

Trapping effort of 124 trap-nights in January 2007 yielded one photograph each of Yellow-throated Marten, Large Indian Civet and ferret badger.

Trapping effort of 215 days in October-December 2007 yielded one photograph of Hog Badger and one of Masked Palm Civet.

are found in other habitat types, often in degraded open habitats close to habitation (Mudappa in press). The Small Indian Civet and Small Asian Mongoose were possibly not recorded because sampling was mainly within interior primary forests. Otters were not recorded because only a few trapping locations were close to streams. In addition, they are now rare due to high hunting pressure for skins. The more arboreal Binturong, Spotted Linsang, and the Small-toothed Palm Civet were not captured. nor was the Stripe-backed Weasel.

Capture rates of the Large Indian Civet were relatively high in Namdapha compared with other species; it, along with the Yellow-throated Marten, appears to be common.

Athreya & Johnsingh (1995) recorded three civet species (Binturong, Large Indian Civet, and Masked Palm Civet) in Namdapha during a survey for the Clouded Leopard *Pardofelis nebulosa* using baited camera-traps (fowl or dried fish) with an effort of 113 trap-nights. A camera-trapping survey for the Tiger in 1996–1997 recorded only the Large Indian Civet in 451 trap-nights (Karanth & Nichols 2000, unpubl. data); however cameras were set up higher above ground and located along broader trails during this study and therefore may have been unsuitable for capturing small carnivores.

Species richness and relative abundance in Pakke

Of 13 species of small carnivores suspected to inhabit the area, four were recorded with a limited trapping effort of 231 trap-nights spread over six months (Table 3).

Of the six civet species reported from Pakke, the Large Indian Civet, Common Palm Civet, and Small Indian Civet were camera-trapped. It is possible that species such as the Binturong and Spotted Linsang were not captured as they are more arboreal. In Pakke, the Crab-eating Mongoose (photo-captured in India for the first time) and the Large Indian Civet appear to be more abundant based on photo-capture rates, albeit from a limited trapping effort. The diurnal Yellow-throated Marten was not recorded on camera-traps, although it was sighted four times during trail walks in the daytime. This species is relatively common (Datta 1999).

Table 3. Photo-capture rates for species recorded in Pakke WS on camera-traps (231 trap-nights) during December 2005–May 2006 and September–October 2006.

Species	Total photos	Independent photos	RAI_1	RAI_2
Large Indian Civet	5	4	58	1.73
Small Indian Civet	1	1	231	0.43
Common Palm Civet	1	1	231	0.43
Crab-eating Mongoose	3	3	77	1.30
TOTAL	10	9	26	3.90

RAI_1: number of days required to get a single photo-capture, RAI_2: number of independent photos per 100 trap-nights.

During transect walks between September 2006 and May 2007, there were three further sightings in the daytime. The Binturong is reported to be crepuscular and more arboreal (Nowak 1999, Grassman *et al.* 2005), but feeds often in the daytime (Nettelbeck 1997). All three sightings of Binturong in Pakke were by day, feeding on figs (Datta 1999). In 2006, one was sighted on the ground crossing a stream in the daytime (Rohit Naniwadekar). The Common Palm Civet, Small Indian Civet, and Small Asian Mongoose were also sighted earlier (Datta 1999). A stuffed specimen of a Large-toothed Ferret Badger and the skin of an unidentified otter have been recorded earlier (Datta 1999). A pair of otters (possibly Oriental Small-clawed Otter *Aonyx cinereus*) was seen by day in September 2006 (Rohit Naniwadekar, Taya Tayum). However no evidence was found for Spotted Linsang or Stripe-backed Weasel, although a partial skin/tail was noted earlier in 1996 that could have been of the latter. Given the low trapping effort in Pakke, it is not possible to draw any conclusions on the status of most of these species; however, Large Indian Civet, Crab-eating Mongoose, and Common Palm Civet appear to be common in the area and the number of days required to capture all the three species was low.

Species richness and abundance: comparison with other sites

Capture rates of four species in Namdapha were generally higher than in tropical forest sites in South-east Asia (Table 4).

From comparisons with other studies, it appears that very high trapping effort is required to capture many small carnivore species in a given area. In Pakke with an effort of only 231 trap-nights, we captured four species, while in Namdapha; we captured six species with 1,537 trap-nights, while an additional species was captured after 215 more trap-nights. In Thailand, with 1,224 trap-nights, only five species were captured (Grassman 2003). In Laos, with 3,588 trap-nights, 11 small carnivore species were camera-trapped (Johnson *et al.* 2006), and eight were recorded in Vietnam in 6,337 trap-nights (Long & Minh Hoang 2006), although species-specific capture rates are not provided in the last two studies. In the Hukaung Valley, Myanmar, even after 8,836 trap-nights, only ten species were captured (Than Zaw *et al.* 2008). In Malaysia (where the small carnivore assemblage differs somewhat from that in north-east India), only nine small carnivore species were recorded in 14,054 trap-nights. In all these studies, only about half or much less than half (22–62%) of the total small carnivore species assemblage, predicted to be within the camera-trapped area, were captured. Variation in species recorded and capture rates may reflect real differences in abundance among sites but it is difficult to make conclusions, given that most of these studies were

Table 4. Photo-capture rate (number of trap-nights required to get a single photo-capture of a species) derived from camera-trap surveys in Namdapha National Park and three other protected areas in South-east Asia.

Location	**Namdapha NP, India**	**Taman Negara NP, Malaysia**	**Phu Khieo Wildlife Sanctuary, Thailand**	**Hukaung Valley, Myanmar**
Reference	**Present study**	**Kawanishi & Sunquist 2004**	**Grassman 2003**	**Than Zaw et al. 2008**
Trap-nights	1537	14054	1224	8836
Yellow-throated Marten	384	2008	1224	492
Ferret badgers	384	NA	-	-
[a]Hog Badger	-	NA	408	4418
[b]Linsang	-	14054	-	2945
Large Indian Civet	140	2008	68	442
Large-spotted Civet	NA	-	-	8836
Small Indian Civet	-	-	-	1767
Common Palm Civet	384	3513	306	353
Masked Palm Civet	307	2342	-	8836
Binturong	-	4685	408	1473
Crab-eating Mongoose	768	NA	-	233
[c]Total species recorded	**6**	**9***	**5**	**10**

[a]Hog Badger was recorded in a later trapping session with additional 215 trap-nights in Namdapha in October 2007 (RAI = 1,752).
[b]Banded Linsang *Prionodon linsang* in Malaysia, Spotted Linsang at other sites.
[c]Although some species are shared among the sites, there are differences in species assemblages across these sites.
*Includes Banded Linsang, Banded Civet *Hemigalus derbyanus*, and Malay Civet *Viverra tangalunga* that do not occur in north-east India.

designed primarily for Tigers and other large carnivores. In addition, a few of these represent data from multiple trapping sessions carried out over several years. However, despite these differences among sites, there appears to be a positive correlation (although not statistically significant) between camera-trapping effort and the number of species recorded (Fig. 2). However, the number of species captured appears to reach an asymptote with very high effort. It would be useful to compare the proportion of the total small carnivore species assemblage that is captured in a given area with a trapping effort systematically for small carnivores, and assess other factors such as hunting pressure and habitat quality. This would enable a better understanding of how much trapping effort is required to maximise species captures in a given area.

Direct sightings and indirect evidence of small carnivores in Namdapha

Stripe-backed Weasels are often considered to be rare, but Abramov *et al*. (2008) concluded that they are possibly simply "inconspicuous denizens of chronically under-surveyed regions". There was one potential sighting in 2005 (Charudutt Mishra) and one skin was recorded from a Lisu village inside Namdapha in December 2006. An old skin was also recorded in the museum at Miao maintained by park authorities (Datta 1999). The Binturong, not recorded on camera-traps at either site, was sighted by field assistants in the daytime in October 2007 in Namdapha. The Spotted Linsang is another rarely recorded species. It is solitary, nocturnal, and reported to be equally at home on trees and the ground (Van Rompaey 1995). One skin was recorded from a Lisu village outside Namdapha in December 2005. The animal had been killed in retaliation for killing poultry. Another skin was seen wrapped around a machete worn by a tribal in Miao in 2002. An otter was sighted in October 2007 in a small perennial stream, although the species could not be identified. An otter, possibly an Oriental Small-clawed Otter, was sighted near Deban in June 2007 (Umesh Srinivasan & Japang Pansa). The Crab-eating Mongoose was sighted on three occasions, once in November 2005 near a river bed (Umesh Srinivasan), once in November 2006 near a perennial stream (M.O. Anand) and once in October 2007 (Aparajita Datta, Akhi Nathany). On the last occasion, the animal was walking along a forest trail and continued for some distance, and disappeared downhill after becoming aware of our presence. This sighting was not near any water source. There were three other sightings of small carnivores on various visits but the animals disappeared quickly into the undergrowth before identity could be confirmed. The Yellow-throated Marten has been sighted eight times since 2003, with four sightings during the trapping survey (October 2006–January 2007). Of the eight sightings, four were close to habitation and in degraded forest. Five sightings were also close to river beds or along large streams. During earlier visits (1996–1999), the species was also sighted four times (Datta 1999). The Masked Palm Civet was once sighted on a tall emergent tree (located by eyeshine with a flashlight) during a night

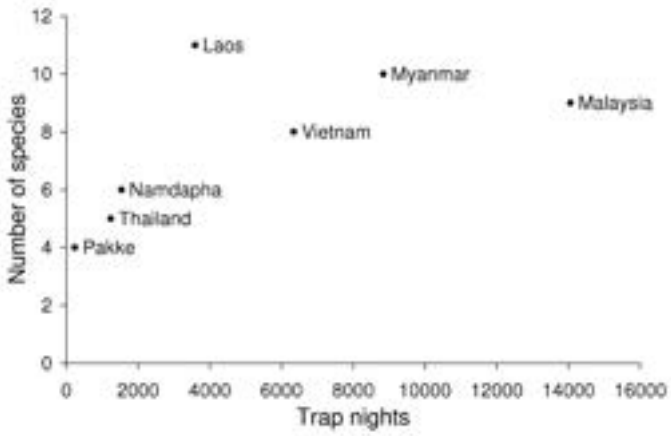

Fig. 2. Scatter plot of camera-trapping effort and number of small carnivore species recorded at seven sites in south and south-east Asia. (r_s = 0.75, n = 7, ns).

walk in May 2003, and once in an early afternoon in November 2007 as it was traversing a liana across a forest trail. This animal was photographed. Although we have never sighted the Hog Badger, it is reportedly common according to some Lisu hunters; and droppings, apparently of the species, were seen several times. The Small Indian Civet was sighted twice at night from vehicles, both times in degraded forest and close to habitation.

Cultural and economic significance of small carnivores

In Namdapha, hunters kill small carnivores usually in retaliation for killing of poultry, or as by-catch in traps and snares set for other animals. Most species are not targeted for any particular use, although if killed, the meat is eaten. In November 2006, remains of civet species were seen in a Chakma hunter camp inside Namdapha. The meat of some civet species is valued, especially of the Binturong and other palm civets, and these are hunted, even with cross-bows and guns. The Large Indian Civet appears to be mainly targeted for the perineal scent gland which is believed by the Lisu to have medicinal properties in treating sudden illness, epilepsy, and fever. The Yellow-throated Marten is believed to bring bad luck if seen, and its meat is also not eaten, although it is killed in retaliation. The dried skin is reportedly hung up to scare away birds from crop fields. The Hog Badger is another species which is killed without any reason, though the meat is usually not eaten. Some species like the Stripe-backed Weasel and Spotted Linsang may be naturally rare because even some hunters are not familiar with the species or have seen them only occasionally.

Skins/skulls of most species (most civets, Yellow-throated Marten, Stripe-backed Weasel and Spotted Linsang) were seen with hunters in village households. Although we saw no direct or indirect evidence of hunting for Binturong, Hog Badger, or ferret badgers in Namdapha, hunter reports indicate they are killed. However, the only small carnivores that are under severe threat from high commercial hunting pressures are otters, for their skins: these fetch US $ 250–300 (2004–2006 prices).

In Pakke, civets are hunted for meat, medicine, and for decorative value. The tails are often used to decorate headgear worn by Nishi men. A stuffed Large-toothed Ferret Badger and skins of Large Indian Civet and otter were seen with hunters (Datta 1999). A Binturong skin was gifted by the Nishi community to a dignitary in an official function in 1997 along with other wildlife trophies (A. Datta pers. obs.). Apart from otters and some of the civet species, most species are killed mainly in retaliation or as bycatch.

Table 5 lists the local names used by the Nishi (western Arunachal Pradesh) and the Lisu and Wancho (eastern Arunachal Pradesh) for some of the small carnivores. Lisu and Wancho names were validated by direct sightings, skins, specimens and photographs, while Nishi names were only assigned with photographs and verbal descriptions.

Conservation status

The most commonly seen species appears to be the Yellow-throated Marten, but this could be because it is diurnal. Among the civets, the Large Indian Civet appears to be more common in the rainforests based on camera-trapping; however the Common Palm Civet and the Small Indian Civet are also quite common especially in degraded forests, while the Masked Palm Civet was captured less often, possibly because it is more arboreal. The Crab-eating Mongoose appears to be fairly common based on camera-trap records and occasional sightings. The Binturong appears to be relatively rare as it was not recorded on camera-traps during these surveys and only occasionally sighted. In addition, arboreal species, if present, will have gone undetected because all our traps were located on the ground.

Table 5. Local names of small carnivores among three tribes of Arunachal Pradesh.

Common name	Lisu	Wancho	Nishi
Red Panda	Wubi	NA	NA
Yellow-throated Marten	Jela	Langku	Sorchi
Stripe-backed Weasel	Namsolo	?	?
Ferret badgers	Hainwe	?	?
Hog Badger	Mwe-ayi-wu	Gang-bak	?
Otters	Ngwala	Jagam	Seram
Spotted Linsang	Jula	?	?
Large Indian Civet	Shiodu	Kookung	Seeng
Small Indian Civet	Payi	?	Seeng
Common Palm Civet	Payi-maca	Tham	Seeng
Masked Palm Civet	Payi-anna	Tham	Seeng
Binturong	Payi-gulo	?	Seeng
Small Asian Mongoose	Namsolo?	?	?
Crab-eating Mongoose	?	Ju-chayi	?

NA, not present in area; ?, may be present but no name established.
Sources for tribal names:
Lisu: Akhi Nathany, Adu-ili-me Yobin, Ngwa-akhi Yobin, Khiyohey Yobin and other members of the Lisu community. The generic name for civets in Lisu is Payi.
Wancho: Japang Pansa, Head Mahout, Forest Department staff, Namdapha National Park
Nishi: Tana Tapi, Divisional Forest Officer, Pakke WS, Arunachal Pradesh Forest Department.

The species that were recorded only rarely or not at all are the Small-toothed Palm Civet, ferret badger, Spotted Linsang, and the Stripe-backed Weasel. Both the linsang and weasel appear to come close to human habitation because villagers reportedly killed them when they came to raid poultry. The Spotted Linsang (skins, direct sightings) has been reported in the past from several localities in Arunachal Pradesh (Katti *et al.* 1990, Chakraborty & Sen 1991 in Mehao Wildlife Sanctuary in Dibang Valley district, Singh *et al.* 1996 in Mouling National Park in Upper Siang district, Choudhury 2003 in Pakke WS). The species has been recently sighted in Eagle Nest Wildlife Sanctuary (Shashank Dalvi verbally 2008). We cannot comment on the occurrence of the Small-toothed Palm Civet in the area as methods considered more appropriate for this species, such as spotlighting, were not used. Its distribution is reportedly on the south bank of the Brahmaputra and it is reported from the eastern parts of Arunachal, upper Assam, Nagaland, and Manipur (Choudhury 2003). While we obtained camera-trap records for the ferret badger, the species could not be identified and the status of both species is uncertain. The four camera-trap records from Namdapha are the first photos of wild ferret badgers from India. There are no sighting records of either species, while indirect evidence is limited to one skin (Chakraborty & Sen 1991) and one stuffed specimen (Datta 1999) only, which were identified as Large-toothed Ferret Badger. The species has been reportedly recorded in localities in Assam, Arunachal Pradesh, and Meghalaya, although no further information is provided on these records (Choudhury 2003). A freshly killed ferret badger was found on a road that passes through the Gorumara National Park in north Bengal in July 2007 and a photograph is available on the India Na-

ture Watch website (Gourav Purohit on www.indianaturewatch.net/displayimage.php).

Although evidence of incidental or retaliatory hunting was recorded for most species these species do not appear to be threatened through anthropogenic factors. By contrast, otters are highly threatened in Namdapha due to considerable hunting for their skin which has high market value. Although otters were recently sighted on two occasions, otter signs are not seen along most of the larger rivers and streams. Fresh otter signs (tracks, spraints) were seen only along one undisturbed smaller perennial stream in October 2007. Hunters from Myanmar as well as local hunters reportedly set traps for otters in most of the area and traders from outside buy these skins.

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Appendix. Camera-trap records of small carnivores in Namdapha NP and Pakke WS from 2005 to 2007 (Namdapha NP: November 2005 to February 2006 = 364 trap-nights, October 2006 to January 2007= 1,537 trap-nights, October 2007 to December 2007 = 215 trap-nights; Pakke WS: 231 trap-nights).

Area	Latitude (N)	Longitude (E)	Altitude (m)	Location type[1]	Forest type[2]	Topographical feature[3]	Time	Date
Yellow-throated Marten								
Namdapha	27°23.74′	96°49.07′	~1,100	AT	Prim	Plat	16h03	17 Dec 06
Namdapha	27°26.46′	96°40.74′	790	AT	Prim	MS	Daytime	Dec 2006
Vijaynagar USF	27°17.17′	96°55.66′	1350	AT	Sec	Plat	10h19	1 Jan 07
Namdapha	27°31.89′	96°34.69′	1130	AT	Prim	MS	11h46	3 Dec 06
Namdapha	27°32.82′	96°32.76′	690	AT	Prim	Plat	08h34	29 Nov 06
Ferret badger sp(p).								
Namdapha	27°27.63′	96°35.83′	510	SB	Sec	Val	18h49	8 Dec 06
Namdapha	27°20.35′	96°53.46′	1040	SB	Prim	Plat	Night	Dec 2006
Namdapha	27°32.94′	96°26.51′	670	SB	Prim	Plat	21h23	*6 Dec 06
Vijaynagar USF	27°17.07′	96°55.57′	1320	AT	Sec	MS	00h49	*29 Dec 06
Hog Badger								
Namdapha	27°27.017	96°23.933	810	AT	Prim	Plat	Night	Oct 2007
Large Indian Civet								
Namdapha	27°31.89′	96°34.69′	1130	AT	Prim	MS	16h42	2 Dec 06
Namdapha	27°31.77′	96°34.86′	1060	SB	Prim	MS	21h16	22 Nov 06
Namdapha	27°24.88′	96°46.37′	990	AT	Prim	Plat	03h04	15 Dec 06
Namdapha	27°32.72′	96°29.41′	930	AT	Prim	SS	05h08	12 Jan 07
Namdapha	27°26.54′	96°24.15′	1150	AT	Prim	Plat	16h11	20 Dec 06
Namdapha	27°31.99′	96°25.51′	580	AT	Prim	Plat	21h08	25 Oct 06
Namdapha	27°33.13′	96°24.02′	480	AT	Prim	Plat	Night	Nov 2006
Namdapha	27°27.67′	96°18.66′	460	AT	Prim	MS	Night	12 Nov 06

Area	Latitude (N)	Longitude (E)	Altitude (m)	Location type[1]	Forest type[2]	Topographical feature[3]	Time	Date
Namdapha	27°27.92′	96°18.84′	680	AT	Prim	MS	Night	3 Nov 06
Namdapha	27°32.24′	96°25.70′	600	AT	Prim	Plat	01h03	13 Nov 06
Namdapha	27°32.92′	96°29.22′	1020	AT	Prim	MS	Night	20 Nov 06
Pakke	26°57.45′	92°59.83′	~200	SB	Prim	Val	02h13	17 May 06
Pakke	26°57.33′	92°58.24′	~200	AT	Prim, DF	Val	021h11	15 May 06
Pakke	26°57.33′	92°58.24′	~200	AT	Prim, DF	Val	01h23	18 May 06
Pakke	27°02.38′	92°48.99′	~200	SB	Edge	Val	Night	22 Apr 06
Small Indian Civet								
Pakke	Not known	Not known	~400	AT	Prim	Plat	02h03	Oct 2006
Common Palm Civet								
Vijaynagar USF	27°16.61′	96°53.28′	~1,000	AT	Sec	MS	Night	Dec 2005
Namdapha	27°23.74′	96°49.07′	1130	AT	Prim	Plat	Night	Jan 2006
Namdapha	27°26.35′	96°40.61′	890	AT	Prim	Ridge	Night	22 Nov 06
Namdapha	27°27.47′	96°36.29′	50	SB	Sec	Val	04h03	7 Dec 06
Namdapha	27°27.63′	96°35.83′	480	SB	Sec	Val	Night	Dec 2006
Namdapha	27°24.19′	96°45.55′	1010	SB	Prim	MS	23h00	11 Dec 06
Pakke	27°1.17′	93°1.00′	not known	AT	Prim	MS	20h11	Sep 2006
Masked Palm Civet								
Namdapha	27°23.26′	96°48.97′	1020	AT	Prim	Plat	Night	Nov 2005
Vijaynagar USF	27°16.61′	96°53.28′	~1,000	AT	Sec	MS	Night	Dec 2005
Namdapha	27°27.63′	96°35.83′	510	SE	Sec	Val	23h45	6 Dec 06
Namdapha	27°22.47′	96°52.09′	1440	SB	Prim	Plat	4h34	31 Dec 06
Namdapha	27°26.37′	96°26.39′	1070	AT	Prim	Ridge	Night	24 Nov 06
Namdapha	27°32.86′	96°33.66′	1030	AT	Prim	Ridge	02h00	22 Nov 06
Namdapha	27°24.82′	96°45.91′	740	AT	Prim	MS	22h53	8 Dec 06
Namdapha	27°23.34′	96°51.74′	1420	SB	Prim	MS	Night	Dec 2007
Crab-eating Mongoose								
Namdapha	27°27.63′	96°35.83′	480	SB	Sec	Val	Daytime	Dec 2006
Namdapha	27°20.33′	96°53.34′	1050	AT	Prim	Plat	Night	28 Dec 06
Pakke	26°57.43′	92°59.67′	~200	Dry SB	DF	Val	15h12	7 Feb 06
Pakke	26°57.79′	92°59.47′	~200	SB	DF	Val	Daytime	Mar–Apr 06
Pakke	26°58.73′	92°55.14′	~200	SB	DF	Val	11h23	25 May 06

USF = Unclassified state forest (essentially, community forest)

*****Only part of animal visible, but reasonably confident of correct identification.

[1]AT = animal trail; SB = stream-bed.

[2] Prim = primary; Sec = secondary; DF = dense forest.

[3] Plat = plateau; MS = moderate slope; SS = steep slope; Val = valley.

History and status of American Marten *Martes americana* at Isle Royale National Park, Michigan, USA

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Abstract

Once common at Isle Royale National Park (IRNP), the American Marten *Martes americana* may have been extirpated during the early 20th century. We compiled historical and recent records to assist in evaluating its status there. Ten records were reported between 1873 and 1929 representing a minimum of 20 American Marten individuals. No observations were recorded between 1930 and 1990. From 1991 to 2006, 28 reports were received, including tracks, sightings, faeces, and photographs. We assessed the plausibility of a remnant population persisting undetected for 60 years by extending the historical record forward for American Marten by about 20 years. We further assessed the potential for recolonisation considering American Marten ecology and scientific investigations that have occurred at IRNP. Whether an undetected remnant population has experienced a bottleneck brought about by over-trapping or a recent immigration event has occurred, the importance of this isolated population increases with regards to scientific inquiry and conservation considering the mission of the National Park Service (NPS). NPS policy states the following with respect to animal population management: "preserve and restore the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native animal populations and the communities and ecosystems in which they occur; restore native animal populations in parks when they have been extirpated by past human-caused actions; and minimize human impacts on native animals, populations, communities, and ecosystems, and the processes that sustain them". Understanding historical prevalence of American Marten at IRNP, as we have outlined here, will inform and guide future management and research of this species within the park.

Keywords: genetic bottleneck, historical records, immigration, recolonisation, remnant population

Introduction

The geographic distribution of American Marten *Martes americana* before European settlement extended from Alaska across most of Canada, New England, the Alleghenies, the Great Lakes region, the Rocky Mountains south to New Mexico, the Sierra Nevadas and the Cascades (Fig. 1). Today, through localised survival, reintroductions and natural dispersal, American Marten still occurs over much of this range despite elimination from its former southern periphery through habitat loss related to settlement activities (logging, severe post-logging fires, and land clearing) and trapping (Clark *et al*. 1987). Within the upper Great Lakes Region, numerous efforts to reintroduce this species have succeeded and with the exception of Wisconsin, the American Marten can be trapped as a furbearer in those states and provinces bordering Lake Superior.

Until recently, American Marten was thought to be extirpated from Isle Royale National Park (IRNP), Michigan, USA (Johnson *et al*. 1982). American Marten was apparently common at IRNP around the turn of the 19th–20th centuries and anecdotal evidence suggested this population may have been extirpated shortly after 1905 (Mech 1962). Charles C. Adams (1909) led an ecological survey on IRNP for the University of Michigan–Museum of Zoology in 1904 and 1905. He reported that "during the past season [1904] Chas. Preulx took eleven martens along the Desor trail". Shortly thereafter, other members of this ecological expedition reported American Marten as "seen" (skins or live specimens; Wood 1914). In the 19th century, widespread trapping occurred within the Great Lakes region and on IRNP. At this time, trappers working IRNP targeted not only American Marten, but also American Beaver *Castor canadensis*, Coyote *Canis latrans* (currently extirpated), Canadian Lynx *Lynx canadensis* (currently extirpated) and American Mink *Neovison vison*, because the island was not sufficiently large to trap any one species economically (Tim Cochrane, Grand Portage National Monument, Grand Portage, MN, pers. comm., 2007).

We summarised available data to provide an understanding of both historical and recent distribution and prevalence of American Marten at IRNP. Ultimately, this effort was intended to elucidate aspects of genetic isolation, abundance and life history on IRNP, and coincides with our current investigation into genetic origin.

Study Area

Established as a national park in 1931, IRNP lies on a northeast–southwest aspect in northwestern Lake Superior (48°N, 89°W), about 24 km from Ontario, Canada, 80 km from the Keweenaw Peninsula of Michigan and 35 km from Grand Portage, Minnesota, with access limited to private boat, and ferry or seaplane service. The main island of this wilderness archipelago is 72 km long and 14 km wide, and is surrounded by about 400 smaller islands. The landform of IRNP includes a series of ridges and valleys comprised of glaciated basaltic and conglomerate rock. Isle Royale has undergone several periods of glaciation (Huber 1973), ending with retreat of the Wisconsin glacier and the island's emergence some 9,400 years ago (Flakne & Cole 1995).

The mammalian fauna inhabiting IRNP includes Moose *Alces alces*, Gray Wolf *Canis lupus*, Red Fox *Vulpes vulpes*, North American River Otter *Lontra canadensis*, American Mink*,* Short-tailed Weasel *Mustela erminea*, American Beaver, Muskrat *Ondatra zibethicus,* and six species of bats. Potential prey species of American Marten on IRNP are American Red Squirrel *Tamiasciurus hudsonicus*, Snowshoe Hare *Lepus americanus* and North American Deer Mouse *Peromyscus maniculatus*.

The northeastern third of IRNP is boreal forest; dominant

Fig. 1. Historical and current world range of American Marten (reproduced from Williams et al. 2007). Triangle symbol indicates the location of Isle Royale National Park.

tree species include White Spruce *Picea glauca*, Balsam Fir *Abies balsamea*, Paper Birch *Betula papyrifera*, Quaking Aspen *Populus tremuloides*, and Northern Mountain-ash *Sorbus decora*. The southwestern third of IRNP is a northern hardwood–white pine association composed of Sugar Maple *Acer saccharum*, Yellow Birch *Betula alleghaniensis*, and White Pine *Pinus strobus*. Between these two climax forests, successional stands of Paper Birch, Quaking Aspen, White Pine, and Jack Pine *Pinus banksiana* occur—the result of fires and windthrow. A fire, fuelled largely by tree branches remaining from logging, burned 19% of the main island in 1936 (National Park Service 2004a). The valleys between parallel ridges contain northern bogs in every successional stage from young to senescent (Linn *et al*. 1966).

There is a marked variation in temperatures, increasing with distance between the Lake Superior shore-line zone and inland areas (<0.5 km inland and >60 m above lake level) of IRNP (Linn 1957). Mean monthly seasonal temperatures range from -9 °C in January to 15.8 °C in July. Mean annual precipitation is 75 cm, ranging from 54 cm to 107 cm. Forty percent of annual precipitation falls as snow (Stottlemyer *et al*. 1998). Lake Superior rarely freezes entirely between IRNP and the mainland (Canadian Ice Service 2007).

Since 1991, IRNP has averaged 20,752 visitors annually (National Park Service 2007). This visitation occurs from May to October. Due to hazardous weather conditions, the park is closed to the general public from November to April, with only a few research personnel on the island in winter months. About 66% of visitation occurs during July and August (National Park Service 2004b). Historically, census data from 1880, 1900 and 1910 recorded 56, 99, and 82 people living on Isle Royale, respectively (Elizabeth Valencia, IRNP, pers. comm. 2008).

Methods

Historical distribution was assessed by reviewing existing published and unpublished literature, field notes of investigators, transcribed oral histories, and historical records within IRNP archives and files. Any information related to Marten was summarised and included observer, date, location of observation, type of observation (e.g., direct observation, observation of sign), and a general description of the observation. American Marten distribution was further explored by soliciting additional information from researchers working at IRNP. In mapping locations of observations, where specific coordinates of observations were not reported, coordinates were estimated by taking the mid-point along a hiking trail where the observation occurred, a straight line between two reference points, or estimating the geographic centre of an area with known boundaries within ArcGIS 9.2 (Environmental Systems Research Institute, Redlands, California, USA).

We categorised records as historical (before 1930) or recent (after 1990). Historical records were further subdivided into those widely known before this effort and records not previously summarised. In addition, evidence of American Marten presence was documented during a survey to estimate mustelid distribution on IRNP (Romanski & Belant, unpublished data, 2007).

Results

Historical records

Scientific investigations regarding mammalian fauna at IRNP over the past century did not mention the presence of American Marten and generally agreed that the population was likely to have disappeared during the early 1900s (Mech 1962, Shelton 1966, Johnson 1969, Peterson 1974) based on the paucity of information following the ecological expedition by the University of Michigan–Museum of Zoology during 1904–1905 (Adams 1909). Adams and colleagues documented their trapping efforts for American Marten and reported a minimum harvest of 12 animals during the 1904–1905 season. N. A. Wood, a member of this expedition, later reported the existence of American Marten at IRNP in a checklist of Michigan mammals (Wood 1914). Efforts to trap American Marten in the winter of 1916–1917 were documented as well, but no harvest was reported, suggesting few, if any individuals were present on IRNP (Martin 1988).

Six widely-overlooked historical records further document American Marten presence as late as 1929 (Fig. 2, Appendix). The earliest was a type-written account of an interview with William Jeffery, who worked at Island Mine from 1873 to 1874 at age 11 as a 'bellows boy'. In the interview he recalled trappers capturing mostly Beaver and American Mink, and also thought that American Marten was present. Three additional records were from the daily journal of trapper Blyden Hawver who camped at Lake Desor during winter of 1912–1913. Hawver described observing tracks on two occasions. Additionally, he unsuccessfully attempted to kill an American Marten with his revolver while pursuing the animal as it ran among fallen trees. Although Martin (1988) referenced the trapping efforts of W. H. Foster in the winter of 1916–1917, he failed to mention the take of one American Marten (Foster 1917). In 1929, before establishment of IRNP, Frank Oastler conducted a survey of the social, natural, and physical features of IRNP for the purpose of determining whether Isle Royale met the requirements of "National Park Standards" and listed "Eastern Marten" as inhabiting the island (Oastler 1929).

Reintroduction

Martin (1988) recommended the American Marten as suitable for reintroduction at IRNP based on the following: neighbouring populations in the forests of northwestern Ontario and north-

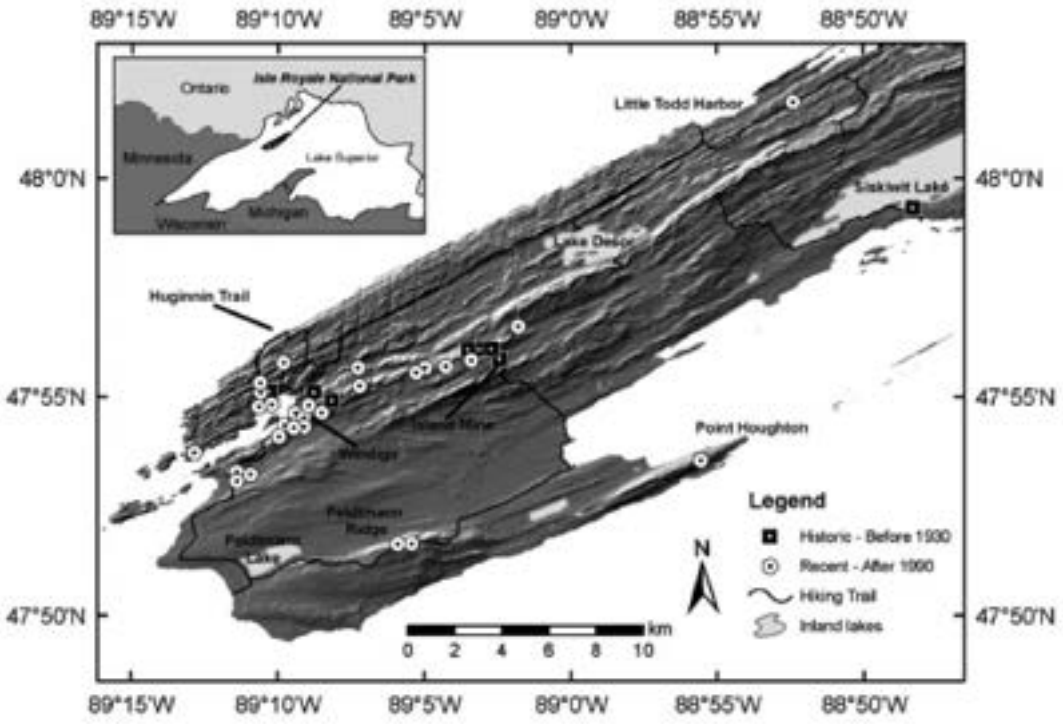

Fig. 2. Distribution of American Marten observations, Isle Royale National Park, Michigan, USA.

eastern Minnesota had recovered from near extirpation, the latter caused by over-trapping and human-initiated habitat change; population concentrations 50 km distant had been found in eastern Cook County, Minnesota; there was general agreement between researchers that suitable habitat is widely available at IRNP; and "strong" ecological evidence to suggest that resident Red Squirrel and Snowshoe Hare populations could serve as a prey base and presumably served as such prior to the early 20th century. Martin (1988) estimated that 15–30 territorial males and an equal number of females could be supported on IRNP. His estimate was based on the land area encompassing mature conifer or mixed vegetation forest types (275–325 km²) as reported by Krefting *et al*. (1970), home range size as determined by Mech & Rogers (1977) in northeastern Minnesota, and a continuation of forest succession trends in the absence of significant wildfires and other disturbances. Martin suggested that Lake Superior was a significant physical barrier to immigration from neighbouring populations.

Starting in July 1966 a series of correspondences involving the IRNP Superintendent, National Park Service biologists, U.S. Fish and Wildlife biologists, university scientists, and the Ontario Department of Lands and Forests documented the process of a reintroduction attempt which ultimately ended in a phone message on 27 October 1967 from the Ontario Department of Lands and Forests indicating that only six American Martens were trapped as opposed to the desired six of each sex. The park was scheduled to close operations for the winter the following day, the effort was suspended, and no Martens were transported to IRNP for release (National Park Service 1967). We have not located information regarding further attempts to reintroduce American Marten to IRNP.

Recent records

Recent records (n = 28) contained mostly observation of tracks, faeces collection, and sightings. The first of these occurred on 26 January 1991 when researchers and park staff participating in the long-term Wolf/Moose study observed and measured tracks of what was believed to be American Marten 2.4 km from their research station in Windigo. One member of this group, Jo Thurber, stated that she had observed similar tracks the previous winter (Kangas 1991). Researchers and park staff continued to observe tracks during winter, nearly annually, over the next fifteen years. On 21 September 1993, Thomas Rogers, a park visitor, captured two photographs of an American Marten perched in a tree alongside the trail between Todd Harbor and Little Todd Harbor, 24 km northeast of Windigo (Fig. 3). The sighting, which occurred on 16 February 2001 and was centrally located within the Huginnin Trail loop north of Windigo, accurately described the characteristics of American Marten pelage (orange throat patch and reddish brown fur as opposed to the darker fur of Mink, the only species that could possibly be confused with an American Marten in a direct sighting; Kangas 2001) and the photographs are clearly identifiable. Faeces were collected opportunistically between 2001 and 2004 and genetically analysed to discriminate for *Martes*; *M. americana* is the only species of the genus inhabiting IRNP. R. O. Peterson (Michigan Technological University, Houghton, Michigan, USA, pers. comm. 2004) reported 10 of the 12 samples submitted identified positive for American Marten, including at least two from an area of the park known as Feldtmann Ridge. Three additional sightings occurred between May 2004 and June 2005, one on Feldtmann Ridge, another along the trail crossing Grace Creek (Peterson & Vucetich 2005) and the remaining one at 5 km west of Windigo (Erin Grivicich, Isle Royale National Park, USA, pers. comm. 2005). Finally, on 27 June 2006, we recovered a female American Marten carcass on a trail 2 km northeast of Island Mine following a visitor report. The carcass contained only hind legs, tail and a portion of the chest cavity, and was probably killed by a Gray Wolf as determined by dental puncture wounds in the chest cavity (Romanski & Belant unpublished data).

Between April and June 2006 we opportunistically collected >60 potential American Marten faeces as part of an investigation to determine distribution of each species of Mustelidae on IRNP. In contrast to observations reported above, these samples are distributed throughout IRNP, extending northeast to Lane Cove, 50 km from Windigo.

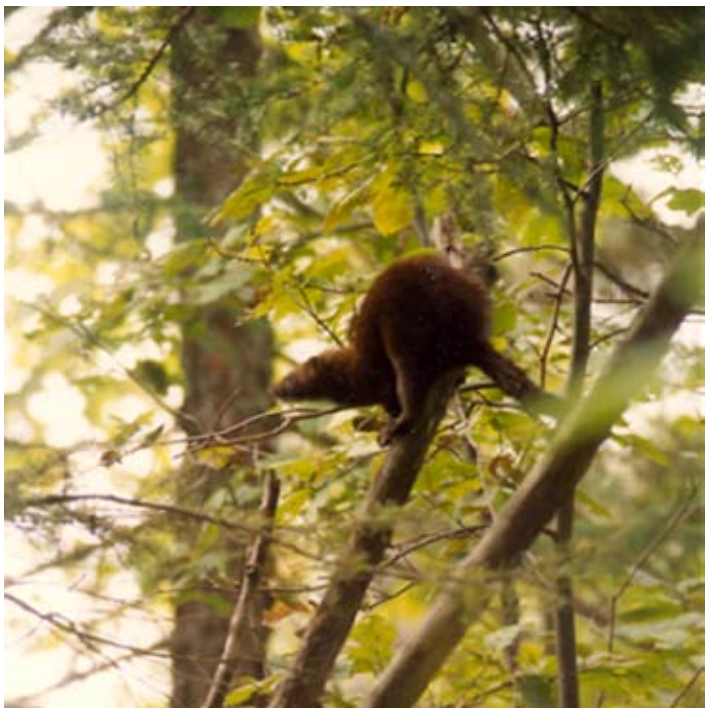

Fig. 3. Photograph of American Marten taken along the hiking trail between Todd Harbor and Little Todd Harbor, Isle Royale National Park, 1993 (photograph by Thomas Rogers).

Discussion

There are three possibilities which may explain the present population of American Marten at IRNP. This population is either remnant, recently immigrated, or the result of a reintroduction. The three possibilities vary in the degree of likelihood of having occurred, and each for different reasons. We offer information on the potential for each of the possibilities below.

Remnant population

For American Marten at IRNP to have gone undetected for at least 60 years, the population needed to exist at only very low levels to have avoided detection by humans. A number of factors could have exerted themselves in concert both spatially and temporally for a remnant population to have maintained persistently low numbers of individuals. These include: life history characteristics, prey and density dependence, interspecfic interactions, site fidelity and disease. Additionally, the likelihood of an American Marten being observed is linked to human presence, perception, and activity at IRNP.

American Marten exhibits a life history with small litters and large spatial requirements relative to actual body size, and live as long as 14 years in the wild, an unusually long life for their small body size (Strickland & Douglas 1987). Females generally breed at 1 year with their first litter produced at 2 years; mean litter size is three (Buskirk 2002). During food shortages, females have displayed delayed reproductive maturation and reduced ovulation rates (Thompson & Colgan 1987). Although no information exists on the reproductive characteristics and diet analyses are underway (Romanski & Belant unpublished data), at IRNP the simplified prey base indicates at least the potential for limited calorific intake affecting reproductive success. A K-style life history would by definition prohibit American Marten from increasing rapidly after population declines and environmental change. At IRNP, over-trapping and a fire which burned 19% of the main island in 1936 (National Park Service 2004a) may have affected population or distribution and growth.

Fryxell *et al.* (1999) demonstrated that a mixture of prey dependence and density dependence, provisionally attributed to agonistic intraspecific interactions, had a stabilising effect on American Marten and its prey in Algonquin Park, Ontario, Canada. At IRNP, the limited number of prey species, prey population cycles, and low reproductive potential may limit or stabilise population growth. Johnson (1969) measured biomass of Deer Mouse, Red Squirrel, and Snowshoe Hare on IRNP as 117, 719, and 788 grams per hectare, respectively. This represents about five Deer Mice, four Red Squirrels, and <1 Snowshoe Hare per hectare. However, Snowshoe Hare biomass was estimated during a cyclic low. Thompson & Colgan (1990) speculated that American Martens encountered smaller prey at a minimal cost while foraging primarily for larger prey. American Martens on IRNP may compensate for the lack of available microtine (= mouse or vole) biomass by exploiting larger prey atypical by comparison with that of mainland populations, potentially decreasing fitness and population growth. Although Cumberland *et al*. (2001) negatively correlated American Marten fecundity and abundance with small mammal abundance (mice, voles and shrews), this has yet to be analysed at IRNP where total numbers of available prey species are reduced. Seasonality of diet may contradict the importance of a limited microtine biomass, given that Thompson (1986) demonstrated 85% calorific intake from large prey during winter and 50% of calorific intake from small mammals in snow-free seasons. However, IRNP has five mammalian secondary consumers (Red Fox, American Marten, American Mink, River Otter, and Short-tailed Weasel) whose food sources overlap to varying degrees and the increased potential for exploitation competition may only serve to exacerbate the effects of a diminutive prey base.

Cause-specific mortality of American Marten at IRNP warrants further investigation. The one known example of an American Marten presumably killed by a Gray Wolf occurred along the hiking trail network. Buskirk (2002) suggested that human travel corridors (e.g., road, trails) could facilitate movements by competitors or predators of American Marten. Buskirk (2002) estimated that predation of American Marten facilitated by predator travel along these corridors was an important source of mortality for a population in the Black Hills National Forest, South Dakota, USA. Of 22 American Martens monitored during a 4–year study in Oregon, USA, 18 were killed by mammalian or avian predators (Bull & Heater 2001). In contrast, only four of 35 American Martens died from interspecific competitors in northern Michigan (Belant 2007), 200 km southeast of IRNP. What effect interference competition through aggression or direct killing by Gray Wolf, Coyote, Red Fox, River Otter, or birds has had on American Marten at IRNP is unknown.

From 1986 to 2006, reintroduced populations of American Marten in the Nicolet National Forest of northern Wisconsin, USA, maintained low numbers of individuals when compared with the number of individuals stocked, and exhibited release site fidelity and/or a homing instinct (Williams *et al*. 2007). Estimated at 150–200 individuals in 1986, this population measured 221 $\pm$ 61 individuals in 2006 and remained concentrated within 20 km of the original release site. This propensity for site fidelity combined with probable low abundance is likely to have reduced opportunities for observation on IRNP.

Within the region, epidemics of canine distemper have occurred and IRNP may not have remained unaffected. Fredrickson (1990) demonstrated that canine distemper was highly virulent to American Marten. If American Marten inhabited IRNP at this time, canine distemper could have affected the population. Between 1980 and 1982, the population decline of Gray Wolves from 51 to 14 was likely attributable to canine parvovirus (Peterson and Vucetich 2002). The potential for disease epidemics to dramatically affect the mammalian fauna at IRNP has been demonstrated despite its isolation.

That a remnant population went undetected on IRNP for six decades seems improbable; however, there are several potential explanations for how it could have done so. With the exception of information presented by Adams (1909), historical record validity could be questioned (McKelvey *et al*. 2008) and may have led previous authors to disregard these accounts had they seen them. We suggest that at least some of these accounts are valid because the American Marten was distributed throughout this portion of North America during this period and the species is easily identifiable. The absence of records for American Marten between 1917 and 1929 may be related in part to the value of its pelt. Seton (1929) reported that an American Marten pelt was worth about US$200 in the early 1920s. This equates to US$2,300 in 2006 when using the Consumer Price Index. Johnson (1969) stated that Adolph Murie, who studied Moose on IRNP, interviewed trappers in 1929 who said American Marten was "extinct". In this same year, Oastler (1929) reported the American Marten as present. For a trapper to report directly or indirectly to potential competitors that American Marten inhabited IRNP at this time would not have been fiscally responsible. Trappers working IRNP are likely to have targeted Beaver as well, worth US$75 per pelt, and for which an extensive illegal trade during this period is well documented (Wolff 1981). Interestingly, during the 1920s and 1930s, there was a similar paucity, and paralleling degree of uncertainty, of information regarding Beaver presence at IRNP (Shelton 1966).

Between 1929 and 1991, numerous scientific investigations occurred on IRNP, none of which directly investigated mustelids. The long-term Wolf/Moose study was the only investigation that occurred during winter; therefore, we will limit our discussion to this study. Based on recent observations (Appendix), personnel during a study at this season would have had the greatest opportunity for an observation. John Vucetich (Michigan Technological University, USA, pers. comm. 2008) estimated an average of 20 (range = 15–30) winter-killed Moose, for which selected remains were collected annually during January and February, for the previous 50 years. Given that American Marten will scavenge (Strickland & Douglas 1987), it is interesting that it went unobserved, if present. Personnel of this study traversed IRNP throughout winter, typically during the day. American Marten activity is low during late winter (Zielinski 2000), and probably coincides in time of day with prey activity (Cumberland *et al*. 2001). At IRNP this would be crepuscular to coincide with Snowshoe Hare and Red Squirrel activity. Activity patterns of study personnel and American Marten probably did not overlap extensively. Additionally, snowfall can readily obscure and hide tracks, decreasing detection. Finally, American Marten tracks are similar to American Mink in size, stride and gait patterns (Elbroch 2003), making identification more difficult. If it be presumed that American Marten did not inhabit IRNP, the preconceived notion all scientists operated under from 1930 to 1990, then an American Marten track may have been simply taken as that of a Mink. It was not a trained scientist who made the first recent observation of American Marten but rather a law enforcement officer for the National Park Service who had naturalist skills and whose previous work assignment provided exposure to American Marten (Kangas 1991).

Immigration

Although conditions were not favourable for immigration by American Marten, it probably occurred in the past as evidenced by its historical presence on IRNP. Adams (1909) and Shelton (1966) offered speculation on how different members of IRNP's fauna may have arrived. Adams (1909) suggested rafting as a means of transport for smaller terrestrial species, walking across the ice for the larger species (including American Marten), and swimming for aquatic species. Shelton (1966) also included intentional or unintentional transport by humans.

The shortest distance across Lake Superior between IRNP and an offshore island of Ontario, Canada is 20 km; and the distance from IRNP to the mainland is 35 km. Thermal and energetic requirements of American Marten are likely to preclude survival of a 20 km swim across Lake Superior, suggesting ice as the only plausible mechanism for immigration. However, Buskirk (2002) suggested overhead cover as the primary limiting factor for American Marten, both for the species' geographic distribution and selection of home ranges. American Marten avoids large openings, and home ranges generally contain >60% forest cover (Chapin *et al*. 1998). Drew (1995) demonstrated that individuals seldom travel in forest openings and when they do, it is in a linear manner. These characteristics suggest an immigration event across the intermittent winter ice of Lake Superior to be nearly impossible.

Reintroduction

We surmise that the 1967 reintroduction attempt was not revisited. A three-year small mammal survey begun in 1966 would have encompassed American Marten had there been another attempt at reintroduction (Allen 1966, Johnson 1969). Both intentional and unintentional introduction of mammalian species have occurred on IRNP, and included the Norway Rat *Rattus norvegicus*, Whitetailed Deer *Odocoileus virginianus*, and Red Fox (Shelton 1966; Elizabeth Valencia, Isle Royale National Park, USA, pers. comm. 2008). It is entirely possible that American Marten had been purposely transported to IRNP by a private individual. Numerous examples documenting human-caused introductions of wildlife have been documented (Demarias *et al*. 1998, Fitzgerald & Gibb 2001).

Conclusion

Whether a remnant population persisted or recolonisation occurred remains unresolved after comprehensive examination of historical and recent evidence regarding American Marten at IRNP. Zielinski & Kucera (1995) suggested one of the most sensitive measures of the integrity of natural ecosystems is whether populations of consumers, like American Marten, occur in an area and can be sustained there. As stewards of natural resources, the National Park Service, including IRNP, desire to make informed decisions regarding these resources to ensure population viability and ecological integrity in perpetuity. Our current investigations of American Marten status, distribution, genetic origin, and diet begin to address these concepts.

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Much of the historical information would not have been readily attainable without the valued help of Tim Cochrane and Elizabeth Valencia. Previous investigators at IRNP provided excellent resources for review and in some instances prudent discussion. In particular, Rolf Peterson and John Vucetich provided numerous field records, faecal samples and insights regarding American Marten. The logistical, administrative and financial support of IRNP staff was crucial to this effort. Specifically, Larry Kangas, whose initial verification of the current existence of American Marten on IRNP provided the impetus of this work. The support of Jean Battle, Division Chief of Natural Resources Management, is greatly appreciated. Field personnel involved in faeces collection included Cindy Glase, Katy Goodwin, Deb Goodwin, Beth Kolb, Abram Schneck, and Dieter Weise.

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Appendix. Historical records and recent observations of American Marten at Isle Royale National Park.

Location	Coordinates		Date(s)	Sign or evidence	Observer, reference	Other Notes
HISTORICAL						
Island Mine*	47°55′38″	89°02′19″	1873–1874	unknown	Jefferey, William	Thought Martens were present but could not be sure
Desor Trail	47°55′33″	89°05′46″	Winter 1904–1905	trapped	Adams 1909	Chas Preulx trapped 11 Martens along trail
Washington Creek	47°55′40″	89°08′57″	Winter 1904–1905	trapped	Adams 1909	Hollinger trapped one near creek
Ridge N of Beaver Island	47°55′23″	89°10′21″	Winter 1904–1905	trapped	Adams 1909	Hollinger trapped one at this location
Desor Trail*	47°55′33″	89°05′46″	8 December 1912	tracks	Hawver, Blyden	Saw two sets of tracks, on trail from Desor to Windigo
Desor Trail, wihin 3 km of Windigo*	47°54′52″	89°08′01″	31 December 1912	sign	Hawver, Blyden	"Saw good sign of Marten but they are all over this end of the route."
Desor Trail*	47°55′06″	89°02′32″	18 January 1913	observed	Hawver, Blyden	Chased Marten from windfall to windfall with revolver
Unknown			1914	observed	Wood 1914	Member of University of Michigan Museum of Zoology Expedition in 1904–1905 (Adams 1909) reported live specimens and/ or fresh skins

Location	Coordinates		Date(s)	Sign or evidence	Observer, reference	Other Notes
Island wide trapping effort based out of Siskiwit Lake*	47°59′19″	88°48′19″	Winter 1916–1917	trapping	Foster 1917	W. H. 'Ping' Foster led crew for State Michigan & set traps for Coyote, Canadian Lynx, Red Fox, American Mink and American Marten; took only one Marten
Unknown*			1 October 1929	present	Oastler 1929	On page 8 Oastler listed "Eastern Marten" in a list of animals on Isle Royale
RECENT						
Windigo Area, up Greenstone Trail	47°55′01″	89°08′03″	26 January 1991	tracks	Kangas 1991	Followed fresh tracks for several hundred yards, provided track measurements
Windigo Area	47°54′41″	89°09′09″	January–February 1992	tracks	Peterson 1994	Tracks observed near Windigo
Between Todd Harbor and Little Todd	48°01′31″	88°52′42″	21 September 1993	photographs of live animals	Peterson 1994	Two photographs taken of an individual, by Thomas Rogers, park visitor.
Washington Harbor	47°54′58″	89°10′02″	20 January 1996	tracks	Peterson 1996	Larry Kangas observed a set of tracks nearby
Grace Creek	47°53′05″	89°11′01″	Winter 1997	tracks	Peterson 1997	Graham Neale observed one set of tracks
Windigo Area	47°54′41″	89°09′09″	Winter 1998	tracks	Peterson 1998	Several tracks observed
Point Houghton	47°53′25″	89°55′55″	Winter 1998	tracks	Peterson 1998	Larry Kangas observed tracks
Windigo Area	47°54′41″	89°09′09″	Winter 1999	tracks	Peterson 1999	Tracks observed
Windigo Area middle of Sec. 20, R38W, T	47°55′36″	89°09′41″	Winter 2001	observation	Kangas 2001	Spotted one marten in the snow at 15–20 m.
Windigo Area, Sec. 28 SW	47°54′38″	88°09′47″	Winter 2002	tracks	Peterson & Vucetich 2002	
Feldtmann Ridge	47°51′12″	89°08′14″	14 October 2003	faeces	Peterson & Vucetich 2005	More than one faeces sample came back from DNA analyses as positive for *M. americana*
Grace Creek Drainage, Sec. 06 SW 1/4, NE 1/4	47°53′05″	89°11′01″	Winter 2004	tracks	Kangas 2004	
Windigo Area, Sec. 28 SW	47°54′51″	89°10′16″	Winter 2004	tracks	Kangas 2004	
NW of Beaver Island, SE corner of Sec. 30	47°54′51″	89°10′16″	Winter 2004	tracks	Kangas 2004	
North of Windigo, Across Washington Harbor, Sec. 29, NW 1/4, NE1/4	47°55′20″	89°09′38″	Winter 2004	tracks, faeces	Kangas 2004	Possible den site, numerous fresh and old tracks at base of stump, fresh faeces collected when site revisited a day later
Windigo Area, Feldtmann Ridge, West Huginnin Cove Trail			February 2001–May 2004	faeces	R. O. Peterson pers. comm. 2004	12 faeces collected are screened for American Marten, 10 are positive
Lower Grace Creek Drainage, Sec. 6	47°53′03″	89°11′19″	May 2004	observation	Peterson & Vucetich 2005	Reliable observations of American Marten were recorded in 2004-2005
Greenstone Trail, Sec. 24	47°55′46″	89°04′10″	Winter 2005	observation	Peterson & Vucetich 2005	
West of Windigo, on the northern shoreline of Washington Harbor	47°53′42″	89°12′50″	June 2005	observation	E. Grivicich 2005 pers. comm.	Erin Grivicich observed an individual along the shoreline of the harbour from his boat
Greenstone Trail, Between Windigo and Island Mine	47°55′15″ 47°55′33″ 47°55′42″ 47°55′15″ 47°54′52″ 47°54′08″	89°07′12″ 89°05′16″ 89°04′15″ 89°07′12″ 89°08′55″ 89°09′59″	2–6 February 2006	tracks	Romanski & Belant unpublished data	Six different reports of fresh tracks over this 8 km section of trail
1.6 km E of Island Mine Junction on Greenstone Ridge Trail	47°56′45″	89°01′44″	27 June 2006	carcass	Romanski & Belant unpublished data	Female apparently killed by Gray Wolf is recovered

*Historical records or information not previously reported.

Feeding ecology of the African Civet *Civettictis civetta* in the Menagesha–Suba State Forest, Ethiopia

BEKELE Tsegaye, AFEWORK Bekele and Mundanthra BALAKRISHNAN*

Abstract

The population and food habits of the African Civet *Civettictis civetta* were investigated in the Menagesha–Suba state forest, Ethiopia, during August 2005–March 2006. In a 300 ha intensive study area, 34 civetries were found. Analyses of fresh civet droppings from five civetries revealed the presence of 13 items. Undigested parts of food items were present in varying frequencies between different civetries. The most common food items were hair and bone, fruits of *Ficus* and *Maytenus*, millipedes, centipedes and insects. Civet diet varied seasonally, probably reflecting item availability. There were no signs of millipedes, centipedes or snails in the dry-season intake. Seeds of *Olea europaea* were absent during the wet season. Frequency of defecation was higher during the wet than the dry season.

Keywords: defecation, diet, population estimate, seasonality

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የአፍሪካ ጥርኝ አመጋገብ ብዛትና አመጋገብ ዘዴ በመናገሻ ሱባ ደን ክኒሐሴ 20 እስከ መጋቢት 21 ቀን 1998 ጥናት ተካሄዷል። በ300 ሄክታር መሬት ስፋት ላይ በተካሄደው ጥልቅ ጥናት 34 የመፀዳጃ ቦታዎች ሊገኙ ችለዋል። በተለያዩ አምስት አይነ ምድር ላይ በተደረገ ጥናት አስራ ሦስት የተለያዩ የምግብ አይነቶች በተለየ የመጠን ደረጃ ተገኝተዋል። በብዛት የተገኙ የምግብ አይነቶች ፀጉርና አጥንት እንዲሁም የተለያዩ ፍራፍሬዎችና ትሳትሉች ናቸው። የጥርኝ አመጋገብ ዘዴ እንደወቅቱና እንደአገናኘቱ ይለያያል። በበጋ ጊዜ ትሳትሉች የመጠቀም ባህርይ አልታየም። ለምግብነት የወይራ ፍሬዎች በክረምት ጊዜ አይጠቀሙም። የአይነምድር መጠኑ በክረምት ጊዜ ከበጋው ይጨምራል።

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Introduction

The African Civet *Civettictis civetta* (Schreber, 1776) comprises a distinct monospecific genus distinguished from *Viverra* by the much longer molar teeth and far broader lower carnassials. It is well known for its perineal gland secretion, a waxy substance known as 'civet', which has a pleasant odour when diluted. This is responsible for its longstanding and extensive use in the perfume industry (Dannenfeldt 1985, cited in Ray 1995). Both sexes possess perineal glands, the secretion of which is used for scent marking (Ralls 1971, Eisenberg & Kleiman 1972). Males' perineal glands are slightly larger than those of females, and males produce stronger and better quality secretion (Ray 1995).

Civetone is extracted from the 'civet' and used in the perfume industry as a fixative, favoured for its ability to be impregnated with the essence of flowers or other aromas. 'Civet' is persistent: natural 'civet' releases an odour for several years. 'Civet' from Small Indian Civet *Viverricula indica* is much used within India in Ayurveda traditional medicinal practices (Sreedevi 2001, Balakrishnan & Sreedevi 2007a, 2007b), but there is a high demand for African 'civet' as a fixative in the international perfume industry. As the 'civet' mainly comes from rural Ethiopia, this natural renewable resource has a major potential in the economic development of the nation in addition to that of the local people (Estes 1991, Ray 1995, EWCO 1999). Therefore, there is a need for a clear understanding of African Civet's basic natural history and ecology.

Civets live both in forest and in open country near human settlements, but they require vegetation cover of at least tall grasses or thickets to provide safety during the day. They are said to be most abundant in forested or partly forested mosaics and cultivated areas. They also occur in dry, open country where dense cover grows along water courses, around rocky outcrops and in broken land with gullies. While depending upon thick cover for resting, African Civets are often seen trotting along established roads and pathways (Estes 1991, Kingdon 1997). They look regularly for food from households around their habitats, and when doing so they fall prey to dogs and are killed by people, both for meat and in retaliation against their apparently raiding gardens, poultry, and lambs (Kingdon 1977).

Civets are trapped from the wild and kept in captivity in Ethiopia to extract 'civet'. In order to facilitate the collection of musk, the civets captured are housed in tiny cages for easy handling (Estes 1991, Jackson 2003). Several thousand civets are kept captive in Ethiopia and in other parts of Africa (Kumera Wakjira 2005). There are 229 farmers legally registered and licensed, who are handling 3,790 civets in Ethiopia. There are also several unregistered farmers involved in civet farming in Ethiopia. Many civets die within the first three weeks of capture through severe stress and physical assault during capture and transportation (Pugh 1998).

The present paper deals with the population and feeding ecology of the African Civet in the Menagesha–Suba State Forest, Oromia region, Ethiopia. An earlier contribution (Bekele Tsegaye *et al.* 2008) documented aspects of scent marking by civets at this site.

Study Area

Menagesha–Suba Man-made and Natural Forest Conservation and Development Centre is one of the oldest parks in Africa. It dates back to the 15th century, when the forest was designated as the

'crown forest' of the country. Emperor Zera Yacob (1434–1468) ordered the planting of trees obtained from Wof-Washa Forest, between Ankober and Debre Sina. Emperor Menelik II developed the first national forest policy for Ethiopia in the late 1890s. He set aside state forest reserves, including the Menagesha–Suba forest. The officially protected area of the forest was 9,248 ha but only about 2,500 ha of the original forest now remain with a further 1,000 ha under plantation (a mixture of native and exotic species). The rest consists of settlements, farmland and grazing areas.

The Menagesha–Suba State Forest is located 45 km west of Addis Ababa on the south-west facing slopes of Mount Wachacha, within 8°54′–9°04′N, 38°30′–39′E (Fig. 1). This is an extinct volcano. The crystalline cone, Dhamocha, peaks at 3,385 m asl. Below the summit is an intensively farmed crater of fields of barley, beans, and potatoes at the sides of the mountain slope down to the Becho plains at 2,200 m to the south. On the east are foothills at around 2,400 m. Annual rainfall in the area is around 1,500 mm with major precipitation from June to September. The present study extended from August 2005 to March 2006. August to October comprises the wet season and November to March the dry season. Temperature of the area ranges from 9.5°C to 22.5°C, with a mean of 16°C. The vegetation of the area was summarised in Bekele Tsegaye *et al.* (2008).

Methods

African Civets have specific latrine sites known as 'civetries' (Estes 1991). They scent-mark environmental sign-posts in their territories, latrine sites, and movement routes (Randall 1979, Hutchings & White 2000). Civetries were sought throughout a 300 ha area out of the Menagesha–Suba state forest. Civet use was assessed by checking for fresh droppings every day on 19 civetries (S1–S19) in the intensive study area. Detailed observations were carried out at five civetries, selected on the basis of distance from each other to avoid the possibility of overlapping. These sites were Afaf, Boroftu, Mamma, Asgori and Camp site (Amist bet). Afaf is located within mixed man-made and natural forests in the southeast of the study area. Boroftu is at the southern end of the forest, which is also located in the mixed man-made and natural forests. This is closer to farmland than other sites. Mamma is in the centre of the study area within natural forests, away from farmland and villages. Asgori is near the Suba village, where the workers of the forest live, lying between forest and farmland. The Camp site is close to the state forest office. It has mixed vegetation of man-made and natural forests, and is away from the farmland. Observations during night were made at the sites of civetries, with the help of a flashlight and night vision-scope.

Civet use of civetries was estimated by daily count of fresh dropping at each civetry. The size of the droppings was used to differentiate adult and young animals. Feeding habits were studied by examination of fresh droppings at civetries. Each observed civetry was visited on at least 15 days per month. Fresh dropping samples were analysed by identifying undigested parts of the food such as hair and/or bone, seeds, leaves, and insect cuticles. Some contents in droppings could be identified by direct observation, whereas others were identified, after washing and by observation under a stereo microscope. Pairs of food items difficult to distinguish from each other in the droppings, being partially digested and mixed up, e.g. millipedes and centipedes, and Wheat *Triticum sativum* and Barley *Hordeum vulgare*, were treated together. Old droppings were distinguished from fresh ones by markings laid over them with leaves or twigs by the observers.

The data collected were analysed using SPSS (14.0 version) software.

Results

Density of civetries

During the present investigation, 34 civetries were located in the intensive study area of 300 ha. Figs 2 & 3 show the nature of droppings at civetries and differences in the size of droppings of adult and young ones.

Feeding

Table 1 shows a list of items recorded in the civet droppings with the frequency and percentage of occurrence. There were 13 common food items as observed at civetries during this study. In addition to the food items, a few samples contained plastic shopping bags. In total, there were 591 occurrences of the 14 items across the civetries. The site-wise observations on the items observed

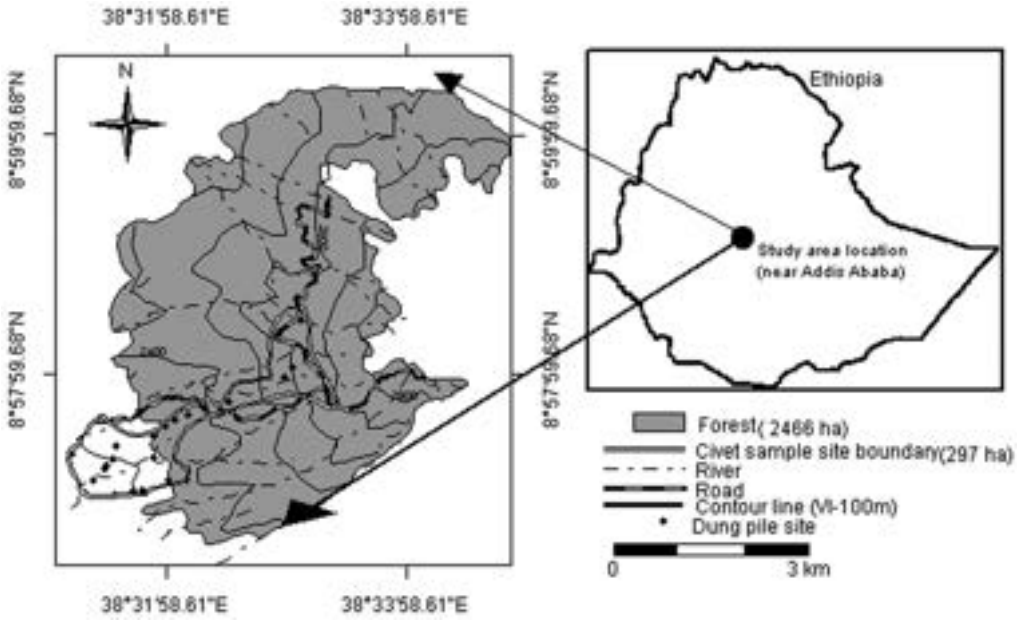

Fig. 1. Map of the Menagesha–Suba state forest in Ethiopia and the sites of the present investigation.

Fig. 2. One of the civetries in the study area. Note presence of large numbers of intact seeds and parts of grass along with droppings.

Fig. 3. The differences in the size and nature of droppings of adult civet (right) and young civet (left).

and the percentage of occurrence are given in Table 1. The frequency of food items observed in the droppings of civets varied among the civetries.

In the Afaf site, 14 items were identified. Among these, hair and bone, fruits of *Maytenus* and *Ficus*, millipedes / centipedes and insects were at higher frequency, while *T. sativum* / *H. vulgare*, maize *Zea mays*, and food with plastic were the least consumed items. In the Boroftu site, 12 food items were identified. Plastic materials and banana were absent. The most frequently encountered item was hair / bone, followed by fruits of *Ficus*. Twelve food items were identified at Mamma site: the more frequently observed were hair / bone, fruits of *Maytenus* and *Ficus*. Plastic material and *Zea mays* were absent throughout the study period in this site. The least observed food items were bird claw, banana, and *T. sativum* / *H. vulgare*. At the Asgori site, 14 food items were identified. Hair / bone were frequent. Millipede / centipede and fruits of *Maytenus* were also observed often. The least consumed items were *T. sativum* / *H. vulgare*, bird-claw, *Zea mays*, *Cyprus rigidifolius,* and food with plastic materials. At the Camp site, 13 food items were identified, but *T. sativum* / *H. vulgare* was absent. The more frequently observed item was hair / bone: at 22.7%, this was the highest percentage of the level of consumption of any food recorded at any site. The next highly consumed food items were millipedes, centipedes, and insects. The least consumed items were maize and food with plastic materials.

The food items at the sample sites have close similarity. In all sample sites, hair / bone, insects and millipede / centipede were frequent while bird claw, plastic material, banana, and *T. sativum* / *H. vulgare* were scarce. Seeds of *C. rigidifolius* were uniformly observed throughout the study period at all latrine sites. The food items recorded at various civetries revealed significant similarity ($\chi^2 = 8.28$, $df = 4$, $P < 0.05$).

Seasonality in food habits of the civets

The data on food items of civets as observed during the wet and dry seasons are given in Table 2. The most frequently observed food items in the civet droppings during the wet season were millipede / centipede, insects, and hair / bone. *Olea* was absent from wet-season droppings. The least-consumed items during this season were *T. sativum* / *H. vulgare,* and food with plastic.

During the dry season, almost a quarter of droppings consisted of hair / bones, followed in frequency by fruit of *Olea* and

Table 1. Food items of the African Civets in the Menagesh-Suba state forest based on the analyses of droppings in five civetries.

Food items	Parts eaten	Total records	%	% of observations of each of the items at the five sites				
				Afaf	Boroftu	Mamma	Asgori	Camp site
Snail	Whole	41	6.93	4.2	7.2	6.6	5.3	10.6
Millipede & centipede	Whole	67	11.34	10.5	9.9	12.4	10.6	12.9
Insects	Whole	57	9.65	10.5	8.1	9.9	8.3	11.4
Bird claw*	-	16	2.71	3.2	1.8	0.8	4.5	3.0
Hair & bone	-	106	17.94	16.8	19.8	15.7	14.4	22.7
Zea mays	Fruits/seeds	19	3.21	2.1	9.0	-	4.5	0.8
Triticum sativum/ Hordeum vulgare	Seeds	12	2.03	1.1	4.5	0.8	3.8	-
Cyprus rigidifolius	Leaves	34	5.75	3.2	7.2	5.8	4.5	7.6
Maytenus	Fruits	57	9.65	13.7	2.7	15.7	10.6	6.1
Olea europaea	Fruits	43	7.28	6.3	9.0	7.4	6.1	7.6
Ficus	Fruits	67	11.34	12.6	12.6	14.9	9.8	7.6
Banana	Fruits	16	2.70	3.2	-	0.8	5.3	3.8
Leaves & fibres	-	47	7.95	10.5	8.1	9.1	7.6	5.3
Plastic**	-	9	1.52	2.1	-	-	4.5	0.8
Total	-	591	100	100	100	100	100	100

*Probably from waste deposited by villagers or of preyed birds.

** Probably eaten with human food waste covered in plastic bags thrown around by villagers and visitors.

Table 2. Food items of African Civets during wet and dry seasons as observed from civetries.

Food items	Wet season		Dry season	
	Frequency of observation	%	Frequency of observation	%
Snail	41	11.6	-	-
Millipede & centipede	67	19.0	-	-
Insects	54	15.3	3	1.3
Bird claw*	10	2.8	6	2.5
Hair & bone	46	13.1	60	25.1
Zea mays	18	5.1	1	4.0
Triticum sativum/ Hordeum vulgare	4	1.1	8	3.3
Cyprus rigidifolius	18	5.1	16	6.7
Maytenus	37	10.5	20	8.4
Olea europaea	-	-	43	18.0
Ficus	25	7.1	42	17.6
Banana	5	1.4	4	1.7
Leaves & fibres	7	2.0	9	3.8
Plastic**	20	5.7	27	11.3
Total	352	100	239	100

*Probably from waste deposited by villagers or of preyed birds.
** Probably eaten with human food waste covered in plastic bags thrown around by villagers and visitors.

Ficus. The least-consumed food items were insects and *Zea mays*. Snails and millipedes /centipedes were absent during the dry season. Seasonal differences in overall diet were statistically significant ($\chi^2 = 21.6$, $df = 1$, $P < 0.001$).

Frequency of defecation during wet and dry seasons

During the wet season, fresh droppings were present on the civetries on 75.1% of days, and absent on 24.9% of days. During the dry season, fresh droppings were observed only on 57.3% of the days and were absent for 42.7% of the days. The higher frequency of defecation by civets during the wet than the dry season was statistically significant ($\chi^2 = 21.6$, $df = 1$, $P < 0.05$).

Discussion

Population status

The Menagesha–Suba State Forest area has a good population of *C. civetta*, as shown by the many civetries (34) found within 300 ha. The examination of droppings in this area suggests that adults outnumbered young: assuming that the different age classes defecate approximately at equal frequency, the ratio between young and adult was 1: 2.1. This indicates a healthy breeding status (Ermias Admasu *et al*. 2004). Droppings of young civets were observed throughout the study period. They showed progressive increase in size at individual civetries, and the smallest-sized droppings were observed at sites in different months, including late in the present study at civetries where there had been no young droppings observed in previous months. Thus, it seems that the African Civets in the study area breed throughout the year.

Feeding

Fourteen classes of items were identified in droppings. African Civets are already known to eat diverse food items (Smithers 1986). Civets evidently consumed plastic with food waste thrown out by people: both villagers and visitors were observed to throw away food remains in plastic carrier bags. Other types of plastic materials found scattered in the surroundings were not detected in the civet droppings.

Pieces of bones / mammalian hair constituted the highest proportion of the civet droppings. The study area has a good population of rodents (Afework Bekele 1996) and these contribute a major portion of civet food. A recent investigation of the Small Indian Civet in Kerala, South India, revealed the presence of rats, small birds, frogs, crickets, centipedes, millipedes, beetle, and shells of snails in the stomach contents of wild civets, in addition to plant food resources such as seeds, berries, fruits, and grass (Balakrishnan & Sreedevi 2007b). Invertebrates such as insects, millipedes, and centipedes also formed the food of African Civets as shown by the analyses of droppings during the present investigation. These items in the food of civets form the source of protein as indicated earlier (Pugh 1998, Yilma Delelegn 2000). The consumption of invertebrates was high throughout the study period. Vegetable composition in African Civet food was mainly of fruits, except grass, leaves, and fibres in some of the droppings. Undigested parts of grass and fibres were present in the droppings of civets throughout the study period. Such plant materials were relatively more numerous during the period of food scarcity. The fibres observed in the civet droppings might have been eaten along with fruits gathered from the ground. Such food items may also contribute to the mineral requirements of civets.

Fruits of various plants were available in the study area during most of the study period. Fruits of *Ficus* were a major food item for an extended time. Those of *Maytenus* were also available for a longer time compared with other fruits. The grass *C. rigidifolius* was observed in all civetries in similar proportion throughout the study period. Consumption of grass might facilitate digestion or might have medicinal value. Other civets are known to predate on ground-living birds (Sreedevi 2001, Balakrishnan & Sreedevi 2007a, 2007b). During the present investigation, bird claws were occasionally seen in the droppings of civets, but such items might have been consumed from kitchen waste, disposed of by the villagers and the forest officials living around.

The Afaf site is near to the village, located between natural and man-made forests. Civets in this area have access to both village and the forest, and the number of food items of civets identified in this area was high, compared with other sites. All food items identified during the present study were present in the feces of civets in this site.

Seeds of *Ficus*, when present in droppings, were mostly not in combination with other food items suggesting that when *Ficus* is fruiting, it contributes most of the food of civets.

The Boroftu site is away from any village and no plastic materials or banana were found in droppings here. As it is within a *Cupressus* plantation, few *Maytenus* fruits were consumed. Although this site is nearer to farmland, the intake of readily available crops such as *T. sativum* / *H. vulgare* was low, suggesting that African Civets do not prefer such food if other food items are adequately available. There was no maize farm nearby, yet maize occurrence in the droppings exceeded that of those crops growing close by. This suggests that African Civets have a high preference for maize among the farm crops, and they wander long distances to eat this food. Civets in Boroftu also showed high consumption of protein-rich food items such as invertebrates, birds, and small

mammals as recorded from the droppings.

The civets in the Mamma site had the highest level of consumption of fruits of *Maytenus* and *Ficus*. This site is in the centre of the natural forest. The density of these fruit-bearing trees is high in the surrounding forest area. As access of civets in this site to the farmland and villages is lower, consumption of farmland resources is lower as revealed from the absence of maize in their droppings. Hence, the foraging range of civets may be under 5 km, because the nearest village is 5 km away.

In the Asgori site, more kitchen waste was present than in other sites. The high frequency of plastic material and banana peel in civet faeces in this site indicates that they scavenge such wastes from people. This is not a banana growing area. Even though this site is near to farmland, consumption of *T. sativum* / *H. vulgare* was limited, again suggesting that they are not preferred food items of the civet. Too little maize was grown nearby to comment on whether it was favoured.

At Camp site, the level of consumption of animal food was high and plant food was relatively low. Despite the fact that it was the locality of human residence and of the state forest office, plastic materials were scarce in the droppings of civets in this locality. It could reflect the proper care of waste disposal as looked after by the forest authorities. The staff living in the area used waste removal services, rather than simply throwing away their rubbish in the surroundings. As this site was away from farmland, farm crops were absent in the droppings of civets in this site.

There were several common food items present in the droppings of all civetries studied. Food with hair and bone, insect, millipedes, and centipedes were in high proportion. The proportion of some food items such as *C. rigidifolius* was low in all sample sites. This grass was defecated in a cylindrically rolled shape or with other food items without being digested. In most cases, the green colour of the grass was also retained.

Low levels of consumption of maize do not imply a low preference by civets: large maize farms were far away from the present study area, so civets were probably unable to eat this item readily. Indeed, the amount of maize in faeces suggested that it was actually a preferred food. Information gathered from the local people and civet owners also support this view (Kebede Sifu *et al*. 1996, Jemal Mohammed 1999). The low consumption of *T. sativum* / *H. vulgare* could, by contrast, genuinely reflect low preference for them, given their ready availability.

The economic importance of the African Civet was not explored in the Menagesha–Suba area. As revealed from personal discussions, the local people have no experience in using 'civet'. Crop damage by civets in this area was also low. The predominant crops in this area are grouped under less preferred food item of civets. However, there was occasional trapping of civets by local people in snares set to trap African Crested Porcupine *Hystrix cristata* and Bushbuck *Tragelephus scriptus* in farmland.

Food with hair / bone was common during both the seasons, which shows that African Civets predate small mammals throughout the year. Among the plant foods, *Olea* and *Ficus* have highest proportions in the droppings. Millipedes / centipedes and insects were the major food items of civets during the wet season.

Defecation

The frequency of defecation seemed to be higher during the wet season than during the dry season. During the dry season, fruits were comparatively less consumed than during the wet season. Water was scarce during the dry season. These factors may explain why dry season defecation was lower than that of the wet season. The higher frequency of defecation during the wet season may imply higher intake of food. The pattern of defecation is associated with food availability, and African Civets can fast up to 15 days in the absence of food (Estes 1991, Kingdon 1997).

Even after removal of the dung piles from the civetries, they deposit faeces at the original sites (Macdonald 1985). Civetries may serve as centres of information exchange, given that more animals might visit a given civetry than defecate at it. It is also likely that there are more civetries at territorial boundaries. In addition to territorial and communication functions that the civetries provide, these sites were found to be rich microhabitats for seedlings of various fruiting trees in the surroundings, suggesting that African Civets also act as seed dispersers (Hillman 1993, Ray 1995, Nowak 1999).

Conclusions

African Civets are traditionally known for the use of their perineal gland secretion, known widely as 'civet' in perfume industry. The major international source of 'civet' is the African Civets in Ethiopia, and this is one of the major sources of foreign exchange for the country. Recently, WSPA (2000) urged the perfume industries in the developed parts of the world not to buy 'civet' from Ethiopia, taking into account the deplorable conditions of captive civets in Ethiopia. This could have a major adverse effect on the trade of this nation, as 'civet' is an excellent natural resource, which can also be a renewable resource if the civets are properly maintained in breeding pairs and managed on a scientific basis. Understanding natural food will allow better maintenance in captivity, with breeding populations to reduce the potential pressure on natural populations (Balakrishnan 2000, Balakrishnan & Sreedevi 2007b). In addition to the present investigation in the Menagesha–Suba State Forest, we are also gathering information from other civet habitats in Ethiopia on their natural feeding behaviour and food preferences. Our observations have revealed that there are over 60 food items consumed by African Civets in different parts of Ethiopia, based on the availability (unpublished observations). When we have detailed information on the civets' natural food habits across different seasons and from various area, the Ethiopian civet farmers can have this information to provide their captive civets a combination of natural food items, which would help them to develop breeding colonies. We have also located several natural scent-marking sites of the African Civets, from where the secretion can be collected. If this method can be developed, 'civet' can be made available on a sustainable basis, even without keeping civets in captivity.

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New locality records of the Crab-eating Mongoose *Herpestes urva* in Peninsular Malaysia as revealed by camera-trapping

D. Mark RAYAN and W. M. SHARIFF

Abstract

The Crab-eating Mongoose *Herpestes urva* has previously been recorded in three states in Peninsular Malaysia. Since 1990, there have been no new records of this species there. We present two new locality records in two states obtained from three separate photo-captures of *H. urva* through camera-trapping surveys in Gunung Basor Forest Reserve, Kelantan, and Bintang Hijau Forest Reserve, Perak, in 2005 and 2006, respectively.

Keywords: Herpestidae, small carnivores, logged forest, Kelantan, Perak

Rekod baru Bambun Makan Ketam *Herpestes urva* di Semenanjung Malaysia seperti yang didedahkan melalui kaedah kamera-perangkap

Abstrak

Bambun Makan Ketam *Herpestes urva* pernah direkodkan di tiga buah negeri di Semenanjung Malaysia. Sejak tahun 1990, tiada rekod baru didapati untuk spesis ini daripada Semenanjung Malaysia. Kami membentangkan dua rekod baru *H. urva* di dua buah negeri yang diperolehi melalui kaedah kamera-perangkap iaitu di Hutan Simpan Gunung Basor, Kelantan dan Hutan Simpan Bintang Hijau, Perak; pada tahun 2005 dan 2006.

Kata kunci: Herpestidae, karnivora kecil, hutan yang telah dibalak, Kelantan, Perak

Introduction

Three species of mongoose can be found in Peninsular Malaysia: the Short-tailed Mongoose *Herpestes brachyurus*, Javan Mongoose *H. javanicus* and Crab-eating Mongoose *H. urva*. Presumed to be an introduction, the Indian Grey Mongoose *Herpestes edwardsii* is now thought to be extirpated from Malaysia (Francis 2008). Both *H. brachyurus* and *H. javanicus* are fairly widely distributed, whereas *H. urva* is patchily distributed and generally uncommon in Peninsular Malaysia (Lim 1991a).

Since its initial documentation in 1970, only six records of *H. urva* have been obtained throughout Peninsular Malaysia. The species can be found on mainland Asia, ranging from Nepal to Southern China, and south to Peninsular Malaysia (Van Rompaey 2001). Ulu Gombak, Selangor (3°21′N), represents the southernmost limit of its distribution (Wells & Francis 1988, Wells 1989). Previous records of this species in Peninsular Malaysia are given in Table 1. The last record was in 1990, suggesting that either this species occurs at very low densities or there has been insufficient recent research on small carnivores in Peninsular Malaysia. Although the latter is a common scenario in most Southeast Asian countries, recent camera-trapping studies have shed some light on the distribution and behaviour of small carnivores (e.g. Su Su 2005, Long & Minh Hoang 2006, Than Zaw *et al*. 2008). Here we present opportunistic records of *H. urva* from camera-trapping surveys that predominantly targeted Tiger *Panthera tigris*.

Study sites

Two camera-trapping surveys of different sampling intensities were conducted in two forest reserves in northern Peninsular Malaysia. Both Gunung Basor Forest Reserve (GBFR) and Bintang Hijau Forest Reserve (BHFR) are designated as Permanent Reserved Forests, and have been selectively logged previously. GBFR is located in the state of Kelantan encompassing about 400 km², whereas BHFR is located in the state of Perak and covers 1,181 km². Both GBFR and BHFR are hilly, with altitudes ranging between 150–1,860 m, with different floristic zones from lowland dipterocarp and hill/upper dipterocarp forest to lower montane forest.

Methods

For our camera-trapping surveys, the commercially-made CamTrakker® camera-trap units (CamTrakker, Watkinsville, GA, USA) were used. Each unit consists of a fully automatic 35 mm camera combined with a passive infrared motion detector that senses heat-in-motion. Suitable camera-trap locations were identified by the presence of signs of animals along suitable forest paths such as wildlife trails or old logging roads. The camera-trap units were mounted on trees at a height of approximately 50 cm from the ground, suited to photo-capture medium to large-sized mammals.

Results

Three opportunistic records of *H. urva* were obtained from two surveys. The main characteristics visible in the animals on the photographs that enabled us to identify them as *H. urva* are the thick bushy tail, the shaggy appearance from the long guard hairs and the pale white stripe on the neck-side extending to the shoulder. None of *H. javanicus*, *H. edwardsii* or *H. brachyurus* show

Table 1. Previous records of H. urva *in Peninsular Malaysia.*

Date	Locality	Habitat type	Elevation	Notes	Source
7 November 1970	Ulu Gombak, Selangor	NA	150 m	Adult female caught	Wells & Francis 1988
March 1974	Fraser's Hill, Selangor[1]	NA	NA	One individual sighted	Saharudin & Refaee 1990
17 March 1987	Mata Ayer Valley, Perlis	Semi-deciduous forest	10 m	Three individuals sighted	Wells & Francis 1988
June 1989	Ulu Yam Forest, Selangor	NA	NA	Adult female caught	Lim 1991a, referring to Yaacob 1989
25 May 1990	Sungai Dusun, Selangor	Secondary forest bordering wildlife reserve	NA	Adult female caught	Saharudin & Refaee 1990
2 June 1990	Fraser's Hill, Pahang[1]	Montane evergreen forest	> 1,400 m	One individual sighted	Lim 1991b

[1]Fraser's Hill lies in both the states of Selangor and Pahang; NA – Not available

these characteristics. No other mongoose species was photo-trapped during either survey.

From a trap effort of 2,664 trap-nights, 27 species were recorded in GBFR within October 2004–July 2005 (Darmaraj 2007) and from this, two records or independent photos of *H. urva* were obtained. The first photograph was taken on 11 March 2005 at 08h11, which captured two individuals walking along a forest trail (Fig. 1). The second photo was taken 20 days later, at 12h46. One individual was photographed on this occasion, travelling in the same direction as the two in the prior photo (Fig. 2). Both photos were taken at the same camera-trap location, situated along a forest trail 790 m above sea level. The distance of the camera-trap location to the nearest stream was approximately 100 m, with several other streams present within a radius of 500 m.

In BHFR, out of trap-effort of 173 trap-nights, a total of 11 species was recorded from December 2006 to January 2007 and from this, one photo of *H. urva* was obtained, on 30 December 2006 at 12h29 (Fig. 3). The camera-trap location was situated on an old logging road at 400 m above sea level. Similar to GBFR, the distance of the camera-trap location to the nearest stream was approximately 100 m. Details of these new locality records in GBFR and BHFR are given in Table 2, whereas the distribution of previous locality records and new locality records from this study are shown in Fig. 4.

Fig. 1. Two Crab-eating Mongooses (one partially obstructed) walking along a forest trail.

Fig. 2. Crab-eating Mongoose walking along the same trail, on a different occasion.

Fig. 3. Crab-eating Mongoose looking towards the camera-trap, situated along an old logging road.

Discussion

Herpestes urva was first discovered in Peninsular Malaysia by Dr Lim Boo Liat in 1970: a specimen was deposited in the Institute of Medical Research (reg. n° IMR-87197). Since then there have only been the five additional records (Lim 1991b, Van Rompaey 2001) listed in Table 1. Of these, four came from the state of Selangor, and one each from the states of Perlis and Pahang. Although Wells & Francis (1988) stated that this species is thinly distributed in the southern part of its range, Saharudin & Refaee (1990) mentioned that this species is probably present in other states of Peninsular Malaysia, albeit undiscovered as yet. The findings from our survey seem to support their premise by adding new locality records in two states of the northern region of Peninsular Malaysia.

Herpestes urva is not restricted to primary forests and occurs in a variety of habitats, particularly near water sources (Wells 1989, Lim B. L. 1991a, Lim K. K. 1991b, Van Rompaey 2001). It is also known to occur up to 2,000 m above sea level, though it has been rarely found at such high elevations (Van Rompaey 2001).

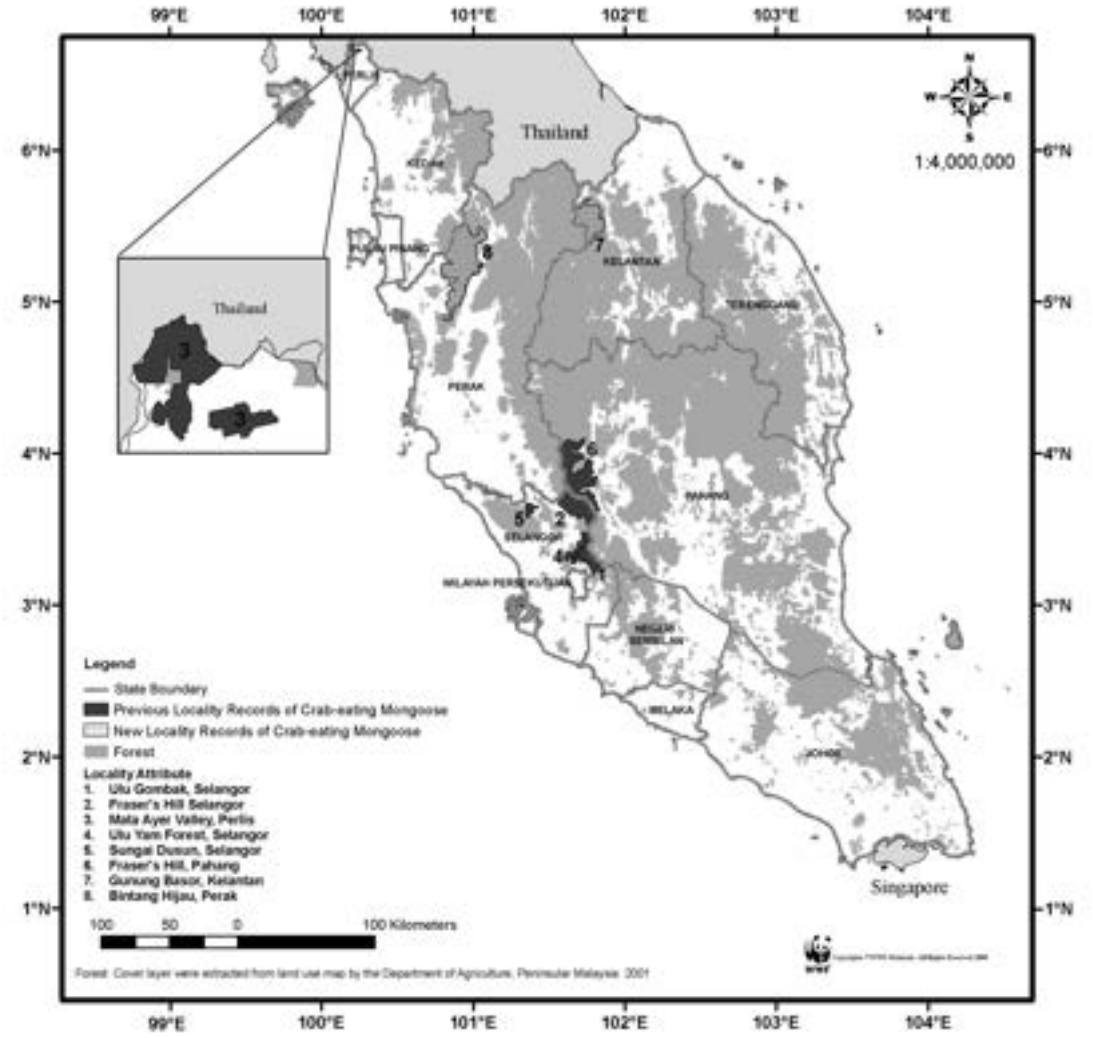

Fig. 4. Distribution of new and previous locality records of H. urva *in Peninsular Malaysia.*

According to Wells (1989), *H. urva* in Peninsular Malaysia has been recorded from lightly to heavily disturbed forests, as well as semi-evergreen and evergreen forest, up to 150 m above sea level. Following this, however, Lim (1991b) observed one at Fraser's Hill at over 1,400 m. Our findings support that this species does not appear to have an elevational preference and that it may have an affinity towards riparian habitats.

Our detections of *H. urva* in daylight hours also corroborates the statement of Long & Minh Hoang (2006) that Corbet & Hill (1992), and others, based on inferences in Pocock (1941) may have mis-classified this species as nocturnal. Results from camera-trapping in Myanmar (Than Zaw *et al*. 2008) strongly imply that *H. urva* is diurnal, with 44 out of 46 camera-trap photos taken during daylight hours, and two around dusk. According to Than Zaw *et al*. (2008), other surveys in the region also substantiate the diurnal activity pattern of *H. urva*. It seems likely that *H. urva* is diurnal in Peninsular Malaysia as well. Nothing much is known of the social organisation of *H. urva*, except that it is often observed in small groups (Duckworth 1997, Van Rompaey 2001, Than Zaw *et al*. 2008). Our camera-trap pictures show one record of two individuals and two records of single individuals. The recent advancement of monitoring tools such as video-traps could potentially provide better information on group size within forest mammal species than is available from static camera-traps.

Our detections of *H. urva* highlight the usefulness of camera-trapping in detecting elusive or rare animals, especially in dense forest (Griffiths & Van Schaik 1993). In other countries such as Tanzania, records from camera-traps significantly have extended the known range of the endangered Jackson's Mongoose *Bdeogale jacksoni* (De Luca & Rovero 2006). Future studies using camera-traps will certainly enhance knowledge of distribution and abundance of small carnivores throughout Southeast Asia, especially with the growing camera-trap use (Trolle & Kery 2003, Silver *et al*. 2004, Maffei *et al*. 2005, Kelly *et al*. 2008) and refinement of methodology and data analyses (Linkie *et al*. 2007, Rowcliffe & Carbone 2008, Tobler *et al*. 2008, Trolle *et al*. 2008). Finally, we

Table 2. New locality records of H. urva *in Peninsular Malaysia.*

Date	Time	Locality	Habitat type	Latitude	Longitude	Elevation
11 March 2005	08h11	GBFR	Disturbed dipterocarp forest	3°49′53″	103°35′30″	790 m
31 March 2005	12h46	GBFR	Disturbed dipterocarp forest	3°49′53″	103°35′30″	790 m
30 December 2006	12h29	BHFR	Disturbed dipterocarp forest	5°05′18″	100°56′45″	400 m

encourage other researchers carrying out species-specific camera-trapping studies to make available ancillary data or to publish these findings to supplement existing autecological information on non-target species.

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The 2008 IUCN red listings of the world's small carnivores

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Abstract

The global conservation status of all the world's mammals was assessed for the 2008 IUCN Red List. Of the 165 species of small carnivores recognised during the process, two are Extinct (EX), one is Critically Endangered (CR), ten are Endangered (EN), 22 Vulnerable (VU), ten Near Threatened (NT), 15 Data Deficient (DD) and 105 Least Concern. Thus, 22% of the species for which a category was assigned other than DD were assessed as threatened (i.e. CR, EN or VU), as against 25% for mammals as a whole. Among otters, seven (58%) of the 12 species for which a category was assigned were identified as threatened. This reflects their attachment to rivers and other waterbodies, and heavy trade-driven hunting. The IUCN Red List species accounts are living documents to be updated annually, and further information to refine listings is welcome.

Keywords: conservation status, Critically Endangered, Data Deficient, Endangered, Extinct, global threat listing, Least Concern, Near Threatened, Vulnerable

Introduction

The *IUCN Red List of Threatened Species* is the most authoritative resource currently available on the conservation status of the world's biodiversity. In recent years, the overall number of species included on the IUCN Red List has grown rapidly, largely as a result of ongoing global assessment initiatives that have helped expand its coverage both geographically and taxonomically (Rodrigues *et al*. 2006). The *2008 IUCN Red List of Threatened Species* holds species-based information on more than 45,000 individual species, including assessments for many never before assessed, such as all reef-building corals. The 2008 IUCN Red List also provides a complete reassessment of the Class Mammalia, marking the first time that all mammals have been globally assessed since 1996 (see IUCN 1996). Such reassessments are vital because IUCN Red List assessments lapse after 10 years – indeed some 3,300 mammal species assessments have been flagged as 'out-of-date' since 2006 – and because re-evaluation permits determination of the changing status of biodiversity over time (Butchart *et al*. 2006).

In contrast to the 1996 assessment for mammals, a significant advance for 2008 is the move towards 'comprehensive' assessments, in which each species-level assessment is underpinned by a detailed set of peer-reviewed supporting documentation. Textual information was collected about the distribution, population, habitat and ecology, threats, and conservation measures for each species. In addition a digital map of current known limits of distribution was created for each species in a Geographic Information System. General information was derived from the literature, refined at workshops and via correspondence by expert knowledge, and later cross-checked for consistency. The result is a documented and peer-reviewed assessment for all mammals of the world.

The current paper reports briefly on the results of the 2008 IUCN Red List for small carnivores. The term 'small carnivore' is used herein to define the subset of the Order Carnivora that falls under the remits of the IUCN/SSC Small Carnivore Specialist Group (SCSG) and the IUCN/SSC Otter Specialist Group (OSG). Family-level taxonomy within these groups has been relatively unstable, and the analysis used the following families: Ailuridae (Red Panda *Ailurus fulgens*; one species), Eupleridae (endemic to Madagascar; nine species), Herpestidae (mongooses; 34), Mephitidae (skunks and stink-badgers; 12), Mustelidae (weasels, martens, otters, badgers and allies; 59), Nandiniidae (African Palm-civet *Nandinia binotata*; one), Prionodontidae ([Asian] linsangs; two), Procyonidae (raccoons, coatis and allies; 14), and Viverridae (civets, including oyans [= 'African linsangs']; 33). The data reported on herein are freely and publicly available via the 2008 IUCN Red List website (www.iucnredlist.org/mammals).

The processes and the methodologies used in the assessment of the world's mammals are detailed elsewhere (Schipper *et al*. 2008). Specifically, as concerns small carnivores, the nine species of Malagasy carnivores (Eupleridae) were reviewed at a workshop held in Antananarivo, Madagascar, in April 2005, as part of a larger workshop to assess the status of the island's entire mammal fauna. European and Asian small carnivores were assessed at a workshop held in Cuc Phuong National Park, Vietnam, over 3–7 July 2006, where all species were evaluated by more than 20 participants. Although the status of the mainland African species was also considered during this workshop, the latter were subjected to a process of additional expert consultation between 2006 and 2008, with documentation compiled in partnership with the forthcoming *Mammals of Africa* (Kingdon & Hoffmann in press). Additional information on the small carnivores of Europe and the Mediterranean countries was collected through initiatives to undertake regional IUCN Red Lists for mammals of these two regions. Finally, New World species were evaluated via expert consultation during 2006–2008, and a mini-workshop held in Zamorano, Honduras, on 30 January 2008, to review the assessment results.

Threat status of small carnivores

Presented here is a brief synopsis of the results of the 2008 IUCN Red List for small carnivores; a more detailed analysis and discussion of the findings and their implications for conserving small carnivores is in preparation and will appear elsewhere. Small carnivores are ecologically diverse, including species that spend time on land, in freshwater and/or in the sea; ranging from entirely arboreal to entirely ground-dwelling; and occupying a range of habitats from desert to moist tropical forests to taiga, and from below sea level to more than 4,000 m asl.

As with mammals in general, small carnivores are not equally distributed around the world, being more concentrated in tropi-

cal areas. The greatest number of species occur in the Afrotropical realm (57 species/30%): 48 occur on the mainland, and nine live only in Madagascar. The second highest richness is the Indomalayan realm (47 species/26%), followed by the Neotropical realm (33 species/18%), the Palaearctic realm (16 species/16%) and the Nearctic realm (18 species/10%). Percentages exceed 100% because a number of species inhabit more than one realm. No native small carnivores are known from the Antarctic, Australasian or Oceanic realms.

Of the 165 species assessed (Appendix 1), two (Sea Mink *Neovison macrodon* and Giant Fossa *Cryptoprocta spelea*) are extinct (EX), one (Malabar Civet *Viverra civettina*) is Critically Endangered (CR), ten are Endangered (EN), 22 Vulnerable (VU), ten Near Threatened (NT), 15 Data Deficient (DD), and 105 Least Concern (Figure 1). Therefore, some 22% of the small carnivores for which sufficient information was available to make a reliable assessment of extinction risk were categorised as threatened (CR, EN and VU). However, given that around 9% of small carnivores are listed as Data Deficient, the actual percentage of species that are threatened could lie anywhere between 20% and 30% (if, respectively, none or all DD species are in fact threatened).

In general, populations of small carnivores were assessed as decreasing (40%) or unknown (35%), with fewer being stable (22%) and only 2% (three species) increasing.

Threats and criteria for listing

Although some species of small carnivore thrive in human-dominated landscapes (such as Northern Raccoon *Procyon lotor* and Hooded Skunk *Mephitis macroura*), most do not. They are increasingly impacted by habitat conversion, overexploitation (hunting; intentionally or as by-catch), contamination (especially in freshwater), and disease.

The IUCN Red List Categories and Criteria (2001) facilitates the evaluation of each species against quantitative thresholds for population decline, geographic range size, small populations and decline and very small or restricted populations. This makes it possible to compare species using the same standards and methods. However, the precision and accuracy of the species assessment is often driven by the state of knowledge for the species: the more that is known, the better the criteria can be applied. Therefore, the species accounts in the 2008 IUCN Red List are 'living documents' and further information on all species is welcomed. Full documentation for the categories and criteria used are available at http://www.iucnredlist.org/info/categories_criteria2001.

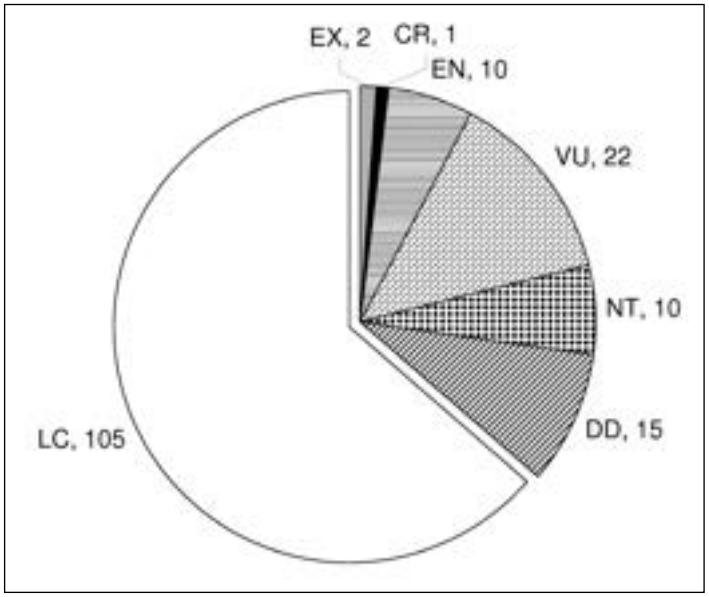

Figure 1. Summary of IUCN Red List results for small carnivores, by categories. Letters refer to categories and number to the number of species in each category.

Of the 33 species identified as threatened (CR, EN and VU), 23 (69%) are listed using the A Criterion (population decline), seven (20%) using the B Criterion (geographic range size), three (8%) using the C Criterion (population size and decline; one of which is also listed under B), one (3%) using the D Criterion (very small or restricted population), and none using the E Criterion (quantitative analysis).

Of the 23 species identified as threatened based on population decline, only one listed the decline as reversible and having ceased: Sea Otter *Enhydra lutris*. Nineteen species were listed using data from the past (over a three-generation time-span defined per species) and six species were listed using projected future declines (three used both past and future). Of all these 23 species, 95% are declining because of a reduction in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality, while 60% are assessed as declining from actual or potential levels of exploitation.

The future of small carnivores

Some small carnivore species have proven resilient and adaptable to various threats. Some have recolonised areas from which they were extinguished or have recovered from low populations when threats were reduced. Thus, if threats can be reduced significantly, many species currently threatened are likely to recover. An example is Black-footed Ferret *Mustela nigripes*, formerly Extinct in the Wild (EW) which is now, following a massive conservation effort to reintroduce populations in its native range, categorised as Endangered (EN).

Small carnivores may be faring slightly better than mammals overall: 22% of the small carnivore species for which a category was assigned other than DD were assessed as threatened (CR, EN and VU), compared with 25% for all mammals. Overexploitation can be devastating, as was the case with the now extinct Sea Mink. As suitable habitats decline (most notably in Southeast Asia), exploitation may result in additional localised extirpations leading, in aggregate, to losses of species.

Emerging threats that could affect small carnivores include contagious disease and climate change. Among the most susceptible to numerous threats are the aquatic and semi-aquatic species, partially due to their restricted, often linear, distribution along rivers and water bodies (where humans also frequent) and because freshwater systems themselves are threatened by contamination, eutrophication, overexploitation (of prey and even water itself) and, increasingly, water shortage and/or flooding. Among small carnivores, otters are most threatened, with seven (58%) of the 12 species for which a category was assigned identified as threatened (CR, EN and VU).

Acknowledgements

Assessing the conservation status of all the world's mammals was an enormous undertaking as shown by the list of acknowledgements in Schipper

et al. (2008); we repeat our thanks to all these bodies and individuals here. Specifically for the small carnivores, most of all we thank the many workshop participants and correspondents who assessed these species. The Old World small carnivore workshop was hosted by IUCN in collaboration with the IUCN/SSC Small Carnivore Specialist Group, the Carnivore & Pangolin Conservation Program, and the Institute of Applied Ecology, Rome. Particular thanks are due Scott Roberton and Tran Quang Phuong for their help with the local logistics; Wes Sechrest, Mike Hoffmann, Jan Schipper, Noura Bakkour, Beth Polidoro, Hank Shugart, Monica Rulli and Gianluca Catulo facilitated. Participants at this meeting included: Alexei Abramov, Amy Dunham, Annette Olsson, Anwaruddin Choudury, Mohd Azlan J., Barney Long, Belden Giman, Budsabong Kanchanasaka, the late Chris Wozencraft, Nguyen Xuan Dang, Divya Muddapa, Jason Hon, Michael Lau, Philippe Gaubert, Pralad Yonzon, Rob Timmins, Scott Roberton, Than Zaw, Wang Ying-xiang and Will Duckworth. Madagascar mammals, including the small carnivores, were assessed with support from the CI-Madagascar Center for Biodiversity Conservation, and we are grateful to Leon Rajaobelina and Frank Hawkins for facilitating this support and to Harison Randrianasolo for helping with logistics. Frank Hawkins, Joanna Durbin, and Luke Dollar, among others, provided useful input, and Frank Hawkins kindly reviewed the final assessments and supporting documentation. An impromptu evaluation of the proposed assessments of New World small carnivores was made during an IUCN Red List workshop in Honduras, and we would like to especially thank those who contributed: Alfredo Cuaron, Louise Emmons, Jose Gonzalez-Maya, Kris Helgen, Tim McCarthy, Fiona Reid, Ramael Samudio and Robert Timm.

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Appendix 1. The 2008 IUCN Red List for small carnivores.

Taxon[1]	English Name	Category	Criteria
Family AILURIDAE			
Ailurus fulgens	Red Panda	VU	C1
Family EUPLERIDAE			
Cryptoprocta ferox	Fossa	VU	A2cd
Cryptoprocta spelea	Giant Fossa	EX	
Eupleres goudotii	Falanouc	NT	A2cd
Fossa fossana	Fanaloka	NT	A2cd
Galidia elegans	Malagasy Ring-tailed Mongoose	LC	
Galidictis fasciata	Broad-striped Mongoose	NT	
Galidictis grandidieri	Giant-striped Mongoose	EN	B1ab(i,ii,iii,v); C2a(ii)
Mungotictis decemlineata	Malagasy Narrow-striped Mongoose	VU	B1ab(ii,iii,v)
Salanoia concolor	Brown-tailed Mongoose	VU	B1ab(ii,iii)
Family HERPESTIDAE			
Atilax paludinosus	Marsh Mongoose	LC	
Bdeogale crassicauda	Bushy-tailed Mongoose	LC	
Bdeogale jacksoni	Jackson's Mongoose	NT	A2cd
Bdeogale nigripes	Black-footed Mongoose	LC	
Bdeogale omnivora[2]	Sokoke Bushy-tailed Mongoose	VU	A2c
Crossarchus alexandri	Alexander's Cusimanse	LC	
Crossarchus ansorgei	Ansorge's Cusimanse	DD	
Crossarchus obscurus	Common Cusimanse	LC	
Crossarchus platycephalus	Cameroon Cusimanse	LC	
Cynictis penicillata	Yellow Mongoose	LC	

Taxon[1]	English Name	Category	Criteria
Dologale dybowskii	Pousargues's Mongoose	DD	
Helogale hirtula	Somali Dwarf Mongoose	LC	
Helogale parvula	Common Dwarf Mongoose	LC	
Herpestes brachyurus	Short-tailed Mongoose	LC	
Herpestes edwardsii	Indian Grey Mongoose	LC	
Herpestes[2] *flavescens*	Kaokoveld Slender Mongoose	LC	
Herpestes fuscus	Brown Mongoose	VU	A2c
Herpestes ichneumon	Egyptian Mongoose	LC	
Herpestes javanicus	Small Asian Mongoose	LC	
Herpestes naso	Long-nosed Mongoose	LC	
Herpestes[2] *ochraceus*	Somali Slender Mongoose	LC	
Herpestes[2] *pulverulentus*	Cape Grey Mongoose	LC	
Herpestes[2] *sanguineus*	Slender Mongoose	LC	
Herpestes semitorquatus	Collared Mongoose	DD	
Herpestes smithii	Ruddy Mongoose	LC	
Herpestes urva	Crab-eating Mongoose	LC	
Herpestes vitticollis	Stripe-necked Mongoose	LC	
Ichneumia albicauda	White-tailed Mongoose	LC	
Liberiictis kuhni	Liberian Mongoose	VU	A2cd
Mungos gambianus	Gambian Mongoose	LC	
Mungos mungo	Banded Mongoose	LC	
Paracynictis selousi	Selous's Mongoose	LC	
Rhynchogale melleri	Meller's Mongoose	LC	
Suricata suricatta	Meerkat	LC	
Family MEPHITIDAE			
Conepatus chinga	Molina's Hog-nosed Skunk	LC	
Conepatus humboldtii	Humboldt's Hog-nosed Skunk	LC	
Conepatus leuconotus	American Hog-nosed Skunk	LC	
Conepatus semistriatus	Striped Hog-nosed Skunk	LC	
Mephitis macroura	Hooded Skunk	LC	
Mephitis mephitis	Striped Skunk	LC	
Mydaus javanensis	Sunda Stink-badger	LC	
Mydaus marchei	Palawan Stink-badger	LC	
Spilogale angustifrons	Southern Spotted Skunk	LC	
Spilogale gracilis	Western Spotted Skunk	LC	
Spilogale putorius	Eastern Spotted Skunk	LC	
Spilogale pygmaea	Pygmy Spotted Skunk	VU	A2c
Family MUSTELIDAE			
Aonyx capensis	African Clawless Otter	LC	
Aonyx cinereus[3]	Asian Small-clawed Otter	VU	A2acd
Aonyx congicus[2]	Congo Clawless Otter	LC	
Arctonyx collaris	Hog Badger	NT	
Eira barbara	Tayra	LC	
Enhydra lutris	Sea Otter	EN	A1a
Galictis cuja	Lesser Grison	LC	
Galictis vittata	Greater Grison	LC	
Gulo gulo	Wolverine	NT	
Ictonyx libycus[3]	Libyan Striped Weasel	LC	
Ictonyx striatus	Zorilla	LC	
Lontra canadensis	North American Otter	LC	
Lontra felina	Marine Otter	EN	A3cd
Lontra longicaudis	Neotropical Otter	DD	
Lontra provocax	Southern River Otter	EN	A3cd
Lutra lutra[2]	Eurasian Otter	NT	
Lutra maculicollis	Spotted-necked Otter	LC	
Lutra sumatrana	Hairy-nosed Otter	EN	A2cd

Taxon[1]	English Name	Category	Criteria
Lutrogale perspicillata	Smooth-coated Otter	VU	A2acd
Lyncodon patagonicus	Patagonian Weasel	DD	
Martes americana	American Marten	LC	
Martes flavigula	Yellow-throated Marten	LC	
Martes foina	Stone Marten	LC	
Martes gwatkinsii	Nilgiri Marten	VU	B1ab(iii,iv)
Martes martes	European Pine Marten	LC	
Martes melampus	Japanese Marten	LC	
Martes pennanti	Fisher	LC	
Martes zibellina	Sable	LC	
Meles anakuma	Japanese Badger	LC	
Meles leucurus	Asian Badger	LC	
Meles meles	Eurasian Badger	LC	
Mellivora capensis	Honey Badger	LC	
Melogale everetti	Bornean Ferret Badger	DD	
Melogale moschata	Small-toothed Ferret Badger	LC	
Melogale orientalis	Javan Ferret Badger	DD	
Melogale personata	Large-toothed Ferret Badger	DD	
Mustela africana	Amazon Weasel	LC	
Mustela altaica	Altai Weasel	NT	
Mustela erminea	Ermine	LC	
Mustela eversmanii	Steppe Polecat	LC	
Mustela felipei	Colombian Weasel	VU	B1ab(ii,iii)
Mustela frenata	Long-tailed Weasel	LC	
Mustela itatsi	Japanese Weasel	LC	
Mustela kathiah	Yellow-bellied Weasel	LC	
Mustela lutreola	European Mink	EN	A2ce
Mustela lutreolina	Indonesian Mountain Weasel	DD	
Mustela nigripes	Black-footed Ferret	EN	D1
Mustela nivalis	Least Weasel	LC	
Mustela nudipes	Malay Weasel	LC	
Mustela putorius	European Polecat	LC	
Mustela sibirica	Siberian Weasel	LC	
Mustela strigidorsa	Stripe-backed Weasel	LC	
Mustela subpalmata	Egyptian Weasel	LC	
Neovison macrodon	Sea Mink	EX	
Neovison vison	American Mink	LC	
Poecilogale albinucha	African Striped Weasel	LC	
Pteronura brasiliensis	Giant Otter	EN	A3cd
Taxidea taxus	American Badger	LC	
Vormela peregusna	Marbled Polecat	VU	A2c
Family NANDINIIDAE			
Nandinia binotata	African Palm-civet	LC	
Family PRIONODONTIDAE			
Prionodon linsang	Banded Linsang	LC	
Prionodon pardicolor	Spotted Linsang	LC	
Family PROCYONIDAE			
Bassaricyon alleni	Allen's Olingo	LC	
Bassaricyon beddardi	Beddard's Olingo	LC	
Bassaricyon gabbii	Gabbi's Olingo	LC	
Bassaricyon lasius	Harris's Olingo	DD	
Bassaricyon pauli	Chirique Olingo	DD	
Bassariscus astutus	Ringtail	LC	
Bassariscus sumichrasti	Cacomistle	LC	
Nasua narica	White-nosed Coati	LC	
Nasua nasua	South American Coati	LC	

Taxon[1]	English Name	Category	Criteria
Nasuella olivacea	Mountain Coati	DD	
Potos flavus	Kinkajou	LC	
Procyon cancrivorus	Crab-eating Raccoon	LC	
Procyon lotor	Northern Raccoon	LC	
Procyon pygmaeus	Cozumel Raccoon	EN	B1ab(ii,iii) + 2ab(ii,iii)
Family VIVERRIDAE			
Arctictis binturong	Binturong	VU	A2cd
Arctogalidia trivirgata	Small-toothed Palm Civet	LC	
Chrotogale owstoni	Owston's Civet	VU	A2cd
Civettictis civetta	African Civet	LC	
Cynogale bennettii	Otter Civet	EN	A2ce
Diplogale hosei	Hose's Civet	VU	A2c+3c
Genetta abyssinica	Ethiopian Genet	LC	
Genetta angolensis	Miombo Genet	LC	
Genetta bourloni	Bourlon's Genet	NT	A2cd
Genetta cristata	Crested Genet	VU	A2cd
Genetta genetta	Common Genet	LC	
Genetta johnstoni	Johnston's Genet	VU	A2cd
Genetta maculata	Central African Large-spotted Genet	LC	
Genetta pardina	West African Large-spotted Genet	LC	
Genetta piscivora	Aquatic Genet	DD	
Genetta poensis	King Genet	DD	
Genetta servalina	Servaline Genet	LC	
Genetta thierryi	Hausa Genet	LC	
Genetta tigrina	South African Large-spotted Genet	LC	
Genetta victoriae	Giant Genet	LC	
Hemigalus derbyanus	Banded Civet	VU	A2cd+3c
Macrogalidia musschenbroekii	Sulawesi Palm Civet	VU	A2c
Paguma larvata	Masked Palm Civet	LC	
Paradoxurus hermaphroditus	Common Palm Civet	LC	
Paradoxurus jerdoni	Brown Palm Civet	LC	
Paradoxurus zeylonensis	Golden Palm Civet	VU	B1ab(i,iii,v)
Poiana leightoni	Leighton's Linsang	DD	
Poiana richardsonii	African Linsang	LC	
Viverra civettina	Malabar Civet	CR	C2a(i)
Viverra megaspila	Large-spotted Civet	VU	A2cd+3cd
Viverra tangalunga	Malay Civet	LC	
Viverra zibetha	Large Indian Civet	NT	
Viverricula indica	Small Indian Civet	LC	

[1]Genus and species limits and spellings mostly follow Wozencraft (2005), selected to be a readily available, widely used, source.
[2]Divergences from Wozencraft (2005), to align the present list's limits with those of Kingdon & Hoffmann (in press), and to consider *Lutra nippon* conspecific with *L. lutra*.
[3]Divergences from Wozencraft (2005), reflecting that *Aonyx* and *Ictonyx* are masculine genera and these species' names are thus correctly *A. cinereus* and *I. libycus*, not *A. cinerea* and *I. libyca*.

Yellow-bellied Weasel *Mustela kathiah* records from Mizoram, India

Nimesh VED and S. LALRAMNUNA

Abstract

This note presents two records of Yellow-bellied Weasel *Mustela kathiah* from Mizoram, North-east India. These appear to be the only confirmed recent reports of this mustelid in the state.

Key words: Yellow-bellied Weasel, Mustelidae, Saiha, North-east India

Mizoram India atanga Yellow-bellied Weasel *Mustela kathiah* hmuhchhuah chhinchhiahna

Chanchin Tlangpui

He thuziak tawi hian India hmarchhak a awm, Mizoram atanga hmuhchhuah Yellow-bellied Weasel *Mustela kathiah* chhinchhiahna pahnih chungchang a sawi a ni. Hei hi, he state-a hetiang mustelid chungchang sawina nemngheh neih hnaivai awmchhun niin a lang.

Thumal Pawimawh: Yellow-bellied Weasel, Mustelidae, Saiha, North-east India

Introduction

The Yellow-bellied Weasel *Mustela kathiah* has a relatively wide Asian range, occurring from northern India east through the Himalaya, much of southern China and northern South-east Asia (Corbet & Hill 1992). A hill-dwelling species, it is found between 1,000 m and 2,000 m elevation; in winter it may come down to lower than 1,000 m (Choudhury 1997, 1999). Very little is known about its biology and ecology (Hussain 1999). Small mustelids investigated to date show high habitat plasticity, but the habitat requirements of tropical *Mustela* populations remain effectively unknown, and it may be rash to extrapolate conservation needs from those of primarily Holarctic species (Abramov *et al*. in press). Apparently no *Mustela* species has ever been studied in South-east Asia and Yellow-bellied Weasel's habitat use remains little known in that region (Duckworth & Robichaud 2005). Hence, this note places on record its occurrence in an area far from other recent detailed records.

North-eastern India, comprising the states of Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Meghalaya and Tripura, forms part of a rich biogeographic unit and is among the biodiversity "hotspots" of the world (Choudhury 1999, Myers *et al*. 2000). The Yellow-bellied Weasel is known by very few records in north-eastern India historically: Sangrachu and Mokokchaung in the Naga Hills were the only localities known to Pocock (1941). It has been recorded from Arunachal Pradesh, Nagaland, Meghalaya, Assam and Manipur (Choudhury 1999), and there is one historical specimen from Mizoram: a skin and skull of a female collected in the Lushai Hills, Sangao, on 16 February 1953 by W N Koelz, and held in the Field Museum, Chicago, USA; specimen n° 75807 (Choudhury 2001; L. R. Heaney *in litt*. 2008). Elsewhere in north-east India, a fresh skin was seen with a local in Sape village, Sarli circle in Lower Subansiri district, Arunachal Pradesh (Kumar 1999), and a killed specimen was on sale at Kohima market, Nagaland, as food in 1997 (Choudhury 2000); its current status in Assam is unclear (Choudhury 1997). Beyond Indian political boundaries too, to the east of Mizoram, it has been recently recorded in Laos, Thailand, and Myanmar (e.g. Duckworth & Robichaud 2005, Than Zaw *et al*. 2008).

Mizoram (21°57′–24º30′N, 92°15′–93º29′E) is located in the extreme southern part of north-eastern India, and has a geographical area of 21,081 km² (0.6% of India's geographical area). Mizoram has three major forest types, Tropical Wet Evergreen, Tropical Moist Deciduous and Subtropical Pine Forests, and is rich in wild flora and fauna, both in variety and abundance. A perusal of secondary literature and consultations with biologists, forest department personnel and others in the state familiar with its conservation values revealed that while in general the biological and conservation values were relatively poorly researched throughout the state, south Mizoram was particularly in the proverbial rain shadow of conservation attention. A total of 42 species of mammals were recorded from recent wildlife surveys. Of these, 34 species were detected directly during the survey, while the other eight were recorded through interviews with hunters and examination of trophies, animal remains and pets (Datta-Roy *et al*. 2007). The survey does not mention the Yellow-bellied Weasel.

We work towards designing and implementing a conservation education and awareness programme in Saiha region in South Mizoram in partnership with the forest department of Mara Autonomous District Council.

Records

We saw a freshly dead Yellow-bellied Weasel at Tuipang (22º 31′33″ N, 93º 02′40″ E; the headquarters of Tuipang block in Saiha district; about 1,250–1,300 m asl) on 17 June 2008. The weasel had been caught in a trap set in the *jhum* (shifting cultivation) fields earlier during the day and was dead before we saw it. These non-baited traps, known as 'mangkhawng', are made using small logs and placed on the edge of crop fields. This particular trap that caught the weasel was about 2.0–2.5 km from the town in a mosaic of old, new, and current shifting cultivation plots with some village supply and safety reserves. The animal was recognised by the people and is locally referred to as 'sarivaithun' or 'zuhri'. It is an aggressive animal and stays in tree holes (Pu P. Sangkhuma verbally July 2008). It eats rats and is not eaten by the local com-

munity on account of its pungent smell, so is instead thrown away (Pu Lambu and Pu J. Biakmawia verbally June 2008). It is therefore a by-catch in the traps primarily set for catching squirrels, rats, and civets. These traps are laid for procuring meat and at the same time get rid of crop pests. We were able to take close photographs of the weasel body, which was wet with rain (Fig. 1). The specimen however remained unsexed.

In Aizawl (capital of Mizoram) we saw a preserved specimen of the Yellow-bellied Weasel at the Mizoram State Museum on 18 July 2008. This stuffed specimen (serial number 419) was referred to as 'sarivaithun'. With permission from the museum curator we were able to take photographs of the specimen. According to the museum authorities the specimen was taken from 'Chite lui' (23º 45′N, 92º 43′E), a river (*lui* in Mizo) near Aizawl city, in August 1993.

Fig. 1. Recently trapped Yellow-bellied Weasel Mustela kathiah, *Tuipang, Mizoram, 17 June 2008.*

Concluding remarks

The Yellow-bellied Weasels in the trap and the museum, and the awareness of the locals pertaining to the species, including local names, confirm the presence of this mustelid as resident in the state.

Hunting is culturally sanctioned and widely practiced in Saiha region. It impacts wildlife including weasels in a negative fashion. Select myths and beliefs that exist in the local society exacerbate the pressure on wildlife. We therefore believe that regular communications focusing on natural values occurring in region are pertinent towards wildlife conservation in these remote forested lands. These communications need to be sensitive to local cultural values and mores and undertaken with students in schools and also locally relevant institutions like youth associations and village council members that form an integral part of these societies.

Acknowledgements

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A road kill of the Ethiopian Genet *Genetta abyssinica* along the Addis Ababa–Dira Dewa Highway, Ethiopia

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Abstract

A road-killed specimen of the little-known Ethiopian Genet *Genetta abyssinica* was collected on 22 January 2004 on the Addis Ababa – Dira Dewa highway, about 2 km from the boundary of the Awash National Park, Ethiopia (about 1,000 m asl). It is deposited at the Zoological Natural History Museum, Addis Ababa University.

Keywords: Acacia shrub, Awash National Park, Zoological Natural History Museum

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በመኪና አደጋ የተገደለ ብዙም ያልታወቀ የኢትዮጵያ ሽለምጥማጥ ጥር 13 ቀን 1996 ከአዲስ አበባ ድሬደዋ በሚወስደው መንገድ ላይ በአዋሽ ብሔራዊ ክልል ሁለት ኪሎ ሜትር ወሰን አካባቢ በግምት 1000 ሜትር ከወለል በላይ ወድቆ ተገኝቷል። ቆዳውም በተፈጥሮ ቅርስ መዘክር አዲስ አበባ ዩኒቨርስቲ ተቀምጧል።

ቁልፍ ቃላት ፣ግራር ፣አዋሽ ብሔራዊ ክልል ፣ያጋጣሚ መረጃ ፣የመዘክር ስብስብ

The Ethiopian Genet *Genetta abyssinica* (Rüppell, 1836) is one of the least-known species of genets, believed to be rare. Yalden *et al*. (1980, 1996) traced only about 10 previous records of the species, and considered the veracity of some of them doubtful (either to locality, or identity as this species). Taken at face value, they suggested an altitudinal range extending from sea level to 3,400 m, but seemed to concur that the species lives in more open, non-forested locations. Díaz Behrens & Van Rompaey (2002) presented a series of records from the montane habitats (including forest) of the Abune Yosef massif of Ethiopia's northern highlands. The latest synthesis of Papeş & Gaubert (2007), traced a total of 21 specimens patchily distributed from open grasslands in Eritrea and frontier regions to deciduous shrubland – montane forest in Ethiopia. Populations of the species were predicted to suffer from great fragmentation, with most historical records situated in now-unsuitable habitats such as croplands. For such a little-known species, considered a candidate for listing as Data Deficient by the 2006 IUCN / Small Carnivore Red List Workshop (P. Gaubert in litt. 2008), any further confirmation of geographical range and habitat therefore remains important.

The present observation of the road kill of an Ethiopian Genet was on 22 January 2004 on the Addis Ababa–Dira Dewa highway between the 190 and 191 km sign-posts from Addis Ababa. This location is between Metehara town and the Amareti main gate of the Awash National Park, around 2 km from the park's boundary, at about 1,000 m asl. The closest human settlements (scattered huts) are around 1 km from the site of this observation. The surrounding vegetation is *Acacia* shrub, and the area is heavily grazed by herds of livestock (cattle, camels, and sheep).

The skin was collected, tanned, and deposited at the Zoological Natural History Museum, Addis Ababa University, Ethiopia (specimen accession number: ZNHM – AAU M2008 – 108). The specimen was severely damaged when found. The head was crushed and the tips of the limbs were amputated. However, the

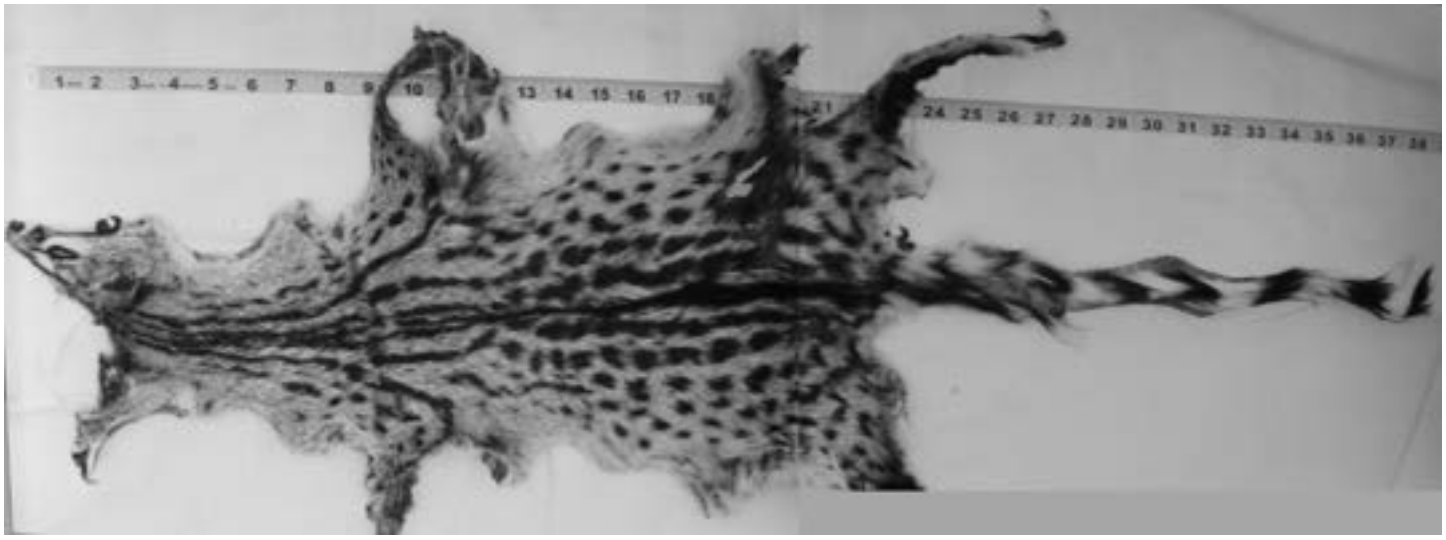

Fig. 1. The processed skin of the Ethiopian Genet Genetta abyssinica *road kill (scale in inches). Total length of the specimen (from snout to the tip of the tail) is 103 cm and the length of the tail is 43 cm.*

Fig. 2. The Acacia shrubland habitat around the site of observation of the road kill.

tail was almost intact with clear pattern of seven distinct rings and the black tip. The five longitudinal black stripes on the back and the elongated spots on the lower flanks were also visible (Fig. 1). These features are diagnostic for the species (Kingdon 1997, Díaz Behrens & Van Rompaey 2002, Gaubert *et al*. 2005, 2008). The total length of the specimen (snout–tail-tip) was 103 cm, of which the tail was 43 cm.

Awash National Park has an area of 756 km², and is located at around 8°51′N, 40°01′E, about 210 km east of Addis Ababa in the northern part of the Rift Valley at the point where the rift widens out into the Afar Depression. Even though Yalden *et al*. (1980) were sceptical of a sight-record of this species from Awash by Stott (1974), Yalden *et al*. (1996) revised their judgement in the light of Schlawe (1980). Papeş & Gaubert (2007) reported a specimen from Lake Metahara (AMNH 81048), close to the location of the present road-kill. The present finding confirms the persistence of the species in and around Awash National Park. Most of the area in the park and surroundings lies at around 1,000 m above sea level (range: 970–2,000 m), and it has eight major vegetation categories: grassland, open grassland, shrub–grasland, shrubland, bushland, woodland, dense tree canopy, and wooded grassland (Almaz Tadesse 1997).

Other species of genets have measured home ranges of a few square kilometers (Waser 1980, Ermias Admasu *et al*. 2004). Hence, it is possible that the genet reported in this note lived in *Acacia* shrubland, the habitat (Fig. 2) close to the site of the observation, but it cannot be excluded that it was a dispersing animal from another habitat. Because there have been no detailed studies of the Ethiopian Genet, we propose to undertake camera-trapping and radio-telemetry of it in Ethiopia.

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Further notes on Javan Ferret Badger *Melogale orientalis* at Gunung Gede Pangrango National Park, Java

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Abstract

Little has been published on the ecology or conservation status of the Javan Ferret Badger *Melogale orientalis*. Confiding individuals were found scavenging at each of several picnic-sites checked along the tourist trails of Gunung Gede Pangrango National Park on the night of 8–9 June 2008. This seems to be an established pattern of behaviour at this well-protected site. Clarification of the species's overall conservation status requires observations from other areas.

Keywords: altitudinal distribution, conservation status, habituation, protected area tourism, scavenging

Catatan tambahan tentang Teledu Jawa *Melogale orientalis* di Taman Nasional Gunung Gede, Jawa

Abstrak

Masih sangat sedikit publikasi tentang status ekologi atau konservasi dari satwa Teledu Jawa *Melogale orientalis*. Beberapa ekor deluk ditemukan sedang mencari makan di beberapa tempat piknik di sepanjang jalur wisata di Taman Nasional Gunung Gede Pangrango pada tanggal 8–9 Juni 2008. Cara seperti ini tampaknya sudah menjadi pola prilaku tetap di kawasan konservasi ini. Klarifikasi dari status konservasi secara menyeluruh dari jenis ini masih memerlukan pengamatan di tempat-tempat lain.

Kata kunci: distribusi ketinggian, status konservasi, habituasi, pariwisata kawasan lindung, mencari mangsa

The Javan Ferret Badger *Melogale orientalis* (cover photograph of this issue), endemic to the islands of Java and Bali (Indonesia), seems never to have been studied in depth in the field. Of the three congeners, only Small-toothed Ferret Badger *M. moschata* has been the focus of ecological research (Wang & Fuller 2003, Zhou *et al*. 2008 and references therein). Published information relates mostly to incidental specimen records and a few sightings, and Riffel (1991) considered the species "virtually unknown with respect to ecology and conservation status". Since then, Suyanto (2003) reported that one was trapped at Gunung Halimun National Park during a 1990s rodent survey and considered it to be "rare" there, but during a camera-trapping survey in the Cikaniki area of that park, using cameras baited with chickens, five ferret badgers were photographed during November–December 1997, making them the third most frequently photographed mammal (Yoneda *et al*. 1998a). In December 1997, one was radio-collared there, but was only followed for two days (Yoneda *et al*. 1998b). Brickle (2007) presented two sightings of ferret badgers from Gunung Gede Pangrango National Park, Java, in 2006. He has subsequently seen the species there 2–3 further times and heard regularly of other people doing so. Sightings are usually of animals scavenging around the several camping and picnic spots along the park's trail network.

We went specifically to look for badgers at Gunung Gede on the night of 8–9 June 2008. To maximise chances of seeing them (and other carnivores), tinned fish was taken for bait. Towards dusk we separated and sat at two picnic sites, one either side of the hot springs (6°45′42″S, 106°58′59″E; 2,000 m altitude). From 20h15 to 03h05 we worked our way down the main tourist path, spotlighting for mammals, back to the entrance (1,360 m), pausing for half-an-hour (around midnight) at the trail fork (1,600 m; where the summit and hot spring path separates from the waterfall path) and where the remainder of the fish was spread out. The distance covered was 3¾ km, and the trail runs almost entirely through primary montane forest.

Ferret badgers appeared at both dusk-watch sites, one at one site and three at the other. At both, the animals first appeared shortly after dark, around 18h15, and made repeated forays from the surrounding undergrowth into the picnic-site. They foraged by rooting through the leaf litter, leaving bare areas where almost all leaves had been case aside. They showed little interest in the fish bait, although some was eaten at both sites. They were unconcerned by human presence, approaching within 15 cm of us; they sometimes seemed somewhat discomforted by the very bright (500,000 cp) illumination. At the site with three animals, the badgers, despite being close to each other, were not obviously interacting, but gave an appearance of indifferent proximity. They entered and left the picnic area singly or as two together. The age/sex make up and relationship of these three animals could not be determined; one seemed smaller than the other two. Wang & Fuller (2003) found extensive overlap of home range both within and between sexes in Small-toothed Ferret Badger, and it seems that this may also occur in Javan Ferret Badger. At the trail-fork, a single ferret badger was observed making repeated short visits into the picnic area, with no special interest in the fish (although it did feed eagerly at a pile of boiled rice), and showing little or no concern at our presence. The only carnivore seen while we walked down the trail was a further single ferret badger just after we left the entrance gate, apparently foraging along a stream bank. All the animals were entirely on the floor, despite an abundance of walls, trees and other objects on which to climb (some of which would surely hold picnic rubbish from time to time).

Observing six ferret badgers at four sites spread along this trail, over the entire altitudinal range covered (1,360–2,000 m),

suggests a healthy population. That scavenging animals were seen at all three picnic sites investigated indicates that this is common behaviour at Gunung Gede. Moreover, shortly before our visit, round dusk on 27 May 2008, a group led by Ganda Wahyutama (*in litt*. 2008) saw five ferret badgers at yet another picnic site just above the hot spring site (2,230 m altitude) in two groups, apparently consisting of an adult and juvenile in one group, and an adult and two juveniles in an another group (this issue, front cover photograph). One of these juvenile badgers took dry biscuits directly from the observers' hands. Such habituation is not unexpected, because Small-toothed Ferret Badgers also live in close proximity to people (Wang & Fuller 2003).

It is not wise to extrapolate from ferret badger status at Gunung Gede to Java as a whole, because the site is rather atypical. It is the principal outdoor recreation area for Jakarta and Bogor, receiving approximately 50,000–100,000 visitors per year, with as many as 1,000 people a day passing through these picnic grounds on peak weekends. The surplus food left by visitors makes easy foraging for the ferret badgers, and in other ways visitors are benign from a small carnivore perspective: they hike, camp, picnic, play music and so on, but any form of hunting or even active molestation of animals is exceptionally rare. Dogs are not allowed in the park. Habitat extent and condition is stable within the national park's 150 km². Gunung Gede has been like this for decades, giving plenty of time for animals to adapt to an environment of negligible threat. However, while ferret badgers appear secure in Gunung Gede, a species-level conservation assessment requires data from sites spread across the island and more representative in terms of human pressures.

Brickle (2007) referred to Sunda Stink-badgers *Mydaus javanensis* also scavenging regularly from visitors along Gunung Gede's trails. A review of the information on which this was based, primarily unpublished birdwatchers' trip reports, suggests that this identification should be considered unproven, as there appears to be some confusion in visitors' minds between the two badger species. However, this stink-badger is known from Gunung Gede, e.g. one was seen by spotlight shortly after dusk on 8 July 1989 by Wilkinson *et al*. (1991).

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First record of the Large-toothed Ferret Badger *Melogale personata* in Bangladesh

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Abstract

A Large-toothed Ferret Badger *Melogale personata* was captured alive in Maulvi Bazar district, northeastern Bangladesh, on 31 March 2008. Diagnosis was based on the large P4 which was about one-third the length of the upper cheek teeth with an outer concave edge and the upper P1 which was disproportionately small compared with upper P2. The known geographic range of this species includes eastern India, Nepal, Myanmar, Thailand, Laos and Vietnam. This account represents the first record of the Large-toothed Ferret Badger in Bangladesh.

Keywords: distribution, geographic range, Maulvi Bazar District

সারসংক্ষেপ: বাংলাদেশের দক্ষিণপূর্বে অবস্থিত মৌলভীবাজার জেলায় মার্চ ৩১, ২০০৮ এ একটি ফেরেট ব্যাজা (*Melogale personata*) নামের স্তন্যপায়ী প্রাণী ধরা পড়েছে। এর ৪ নং পেষণ দাঁতটি দৈর্ঘ্যে উপরের পাটির দাঁতের এক তৃতীয়াংশ। উপরের পাটির ১ নং পেষণ দাঁতটি ২নং দাঁতের চাইতে অসামঞ্জস্যপূর্ণভাবে ছোট। প্রাণীটির বিস্তৃতি ইতোপূর্বে ভারত, লাওস, মায়ানমার, থাইল্যান্ড ও ভিয়েতনামে উল্লেখ করা হয়েছে। এ প্রবন্ধে বাংলাদেশে 'বড়-দাঁত ফেরেট ব্যাজা' প্রাপ্তি নিশ্চিত করা হলো।

মূলশব্দ: বিস্তৃতি, ভৌগলিক সীমানা, মৌলভীবাজার জেলা

Also known as the Burmese Ferret Badger or Tree Badger, the Large-toothed Ferret Badger *Melogale personata* (Mustelidae) has been confirmed to occur in India, Nepal, Myanmar, Thailand, Laos, and Vietnam (O'Donel 1917, Hinton & Fry 1923, Osgood 1932, Pocock 1941). Extreme southern China and Peninsular Malaysia have been included in its geographic distribution (Hussain 1999, Wozencraft 2005), but these authors did not provide specific information on which this was based. Field guides and checklists of mammalian fauna in Bangladesh did not include the Large-toothed Ferret Badger (Khan 1985, Ghazi *et al.* 2006), and we are unaware of any records from the country.

A male Large-toothed Ferret Badger was captured in a tea garden by local labourers, who hunt animals for food, at the Sirajnagar Tea Garden of Maulvi Bazar district in northeastern Bangladesh on 31 March 2008 (Fig. 1). The Sirajnagar Tea Garden is about 20 km northeast of Maulvi Bazar district town, near the Indian states of Assam (about 30 km NE) and Tripura (about 20 km east). Maulvi Bazar itself lies at 24°15′N, 91°53′E . The animal is presently kept in a private zoo of Mr Sitesh Ranjan Dev of Sreemangal town, about 35 km southwest of the capture location.

This animal was originally presumed to be a Small-toothed (or Chinese) Ferret Badger *M. moschata*, based on an earlier photograph and the reported distribution of this species in the border area with India. On further inspection, we concluded the specimen was *M. personata*. Diagnosis of this individual was based on the large P4 which was about one-third the length of the upper cheek teeth with a concave outer edge. In addition, upper P1 was disproportionately small compared with P2 (Fig.2). In contrast, Small-toothed Ferret Badger, which overlaps broadly in distribution with Large-toothed Ferret Badger (e.g. Pocock 1941), possesses a P4 about one-quarter the length of the molariformes with a slightly concave outer and a P1 that is only slightly smaller than

Fig. 1. Large-toothed Ferret Badger, Maulvi Bazar district, Bangladesh, 2008.

Fig. 2. Dentition of Large-toothed Ferret Badger showing large P4 with concave outer edge and disproportionately small P1 relative to P2, Maulvi Bazar district, Bangladesh, 2008.

P2 (Pocock 1941, Storz & Wozencraft 1999).

This Large-toothed Ferret Badger was estimated to weigh 2 kg. Total length of this individual was 51 cm (20 inches), with a body length of 33 cm (13 inches) and tail length of 18 cm (7 inches). Overall height was 20 cm (8 inches). Pocock (1941) reported a weight of 1.7 kg (3.75 pounds) for a female. Males are reportedly slightly larger than females and may exceed a weight of 1.8 kg (4 pounds; Long & Killingley 1983). Total lengths of four Large-toothed Ferret Badgers (two female, two male) ranged from 55 to 63 cm (21.5–24.7 inches); tail lengths ranged from 18 to 23 cm (7.0–9.2 inches; Pocock 1941).

There are several reports of the Large-toothed Ferret Badger from India near Bangladesh. Menon (2003), based on unspecified sources, mapped its distribution in northeast India to include Manipur, Nagaland, Arunachal Pradesh, and Assam. Jha (1999) reported it, without primary detail, in Sikkim. Two specimens and one sighting are reported from Jalpaiguri, West Bengal, India (O'Donel 1917, Agrawal et al. 1992, Chakraborty & Bhattacharyya 1999). It is reported sympatric with the Small-toothed Ferret Badger in northeast India (Pocock 1941, Long & Killingley 1983).

The 3rd Schedule of the Bangladesh Wildlife (Preservation) (Amendment) Act of 1974 includes animals (e.g. Hog Badger Arctonyx collaris) which shall not be hunted, killed or captured. However, as Large-toothed Ferret Badger was not previously known for Bangladesh, it is not included in this Act. In India, it is listed in Schedule 1, Part 1, of the Indian Wildlife (Protection) Act of 1972 (WPSI 2002). It is not listed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2008) and the IUCN Red List presently describes this species as Least Concern, meaning this species is not globally threatened or near threatened (IUCN 2007). This classification is under review, given the rather few recent records of verifiable identity from throughout its range.

This record of the Large-toothed Ferret Badger increases the number of mammal species recorded in Bangladesh to 114 (see Islam et al. 2000). The several reports of this species in areas surrounding Bangladesh suggests that it may have a greater distribution and presence in this country than currently known. Additional surveys and documentation of the Large-toothed Ferret Badger, and small carnivores in general, in Bangladesh are necessary to understand the distribution and status of this species.

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Camera-trap pictures from the Namdapha mammal monitoring project (see page 1 of this issue). Clockwise from bottom left: Hog Badger, Common Palm Civet, Crab-eating Mongoose, Large-Indian Civet, Masked Palm Civet, and Yellow-throated Marten

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