

Diversity and distribution of small carnivores in a miombo woodland within the Katavi region, Western Tanzania

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Abstract

The central Zambezi miombo woodlands represent an extended, unfenced ecosystem in Western Tanzania. Few biodiversity surveys have been conducted in this ecosystem, except in its National Parks. In 2007, we surveyed medium- and large-sized mammals in Mlele District, north of Katavi National Park, in an area managed by local communities. This survey was extended in summer 2012 to the neighbouring Rukwa Game Reserve. Transect surveys, camera-traps and opportunistic encounters detected 10 species of small carnivore out of the 14 potentially present in the combined area. Thus, the small carnivore guild was diverse, despite the area's low protection status. Bushy-tailed Mongoose *Bdeogale crassicauda* appeared much more common than expected, and at least two species of genet and six of mongoose occur.

Keywords: camera-trap survey, forest reserve, game reserve, transect survey

Diversité et distribution des petits carnivores dans une zone boisée de miombo au sein de la région de Katavi, en Tanzanie occidentale

Résumé

Les forêts de miombo représentent un vaste écosystème naturel et non-clôturé dans l'Ouest de la Tanzanie. Le nombre d'inventaires faunistiques réalisés dans cette région est réduit, à l'exception des Parcs Nationaux. En 2007, nous avons mis sur pied un inventaire des mammifères de taille moyenne et grande dans le district de Mlele, au nord du Parc National de Katavi, dans une zone gérée par les communautés locales. En 2012, cet inventaire a été élargi à la Réserve de Chasse de Rukwa. Une combinaison d'inventaires sur transects, par pièges-photographiques et par rencontres opportunistes nous a permis de détecter la présence de 10 espèces parmi les 14 potentiellement présentes dans cette région. La guildes des petits carnivores était donc diversifiée, et ce malgré un faible niveau de protection dans la zone d'étude. La Mangouste à queue touffue *Bdeogale crassicauda* semblait être plus commune qu'attendu et la présence d'au moins deux espèces de genettes et de six espèces de mangoustes a pu être confirmée.

Mots clés: inventaire par pièges-photographiques, inventaire sur transects, réserve de chasse, réserve forestière

Introduction

Extended areas of miombo woodlands – central Zambezi miombo woodlands (Burgess *et al.* 2004) – are still widespread in western Tanzania. The Katavi region supports over 19,000 km² of this ecosystem, under varying protection status, from National Park (Katavi), through Game Reserves, Forest Reserves and community managed areas such as Wildlife Management Areas or Beekeeping Zones, to village lands. There are no separating fences, so animals can roam across the entire ecosystem.

This still extensive natural ecosystem has had few mammal surveys, except in Katavi National Park and its immediate surroundings (Caro 1999a, 2011, Waltert *et al.* 2008). The few data for the rest of the area are from aerial surveys (Stoner *et al.* 2007) and, more locally, daytime transect counts using vehicles (Caro 1999b, 2008). These methods are adapted for larger mammal species, particularly in this kind of habitat, but the presence and distribution of many smaller or elusive species remains un-, or poorly, documented.

In 2007, we initiated a detailed survey of the mammal community of 900 km² within a forest reserve and beekeeping zone in the ecosystem's centre (Fig. 1). This survey was conducted in the framework of a community-based natural resource management project initiated in 2001, which focused on local communities' development of beekeeping activities

(Hausser *et al.* 2004). The objective was to develop a tool to evaluate the sustainability of such a community-based management approach by assessing the evolution in space and time of the diversity and distribution for one group of organisms, mammals. The survey was extended south of the beekeeping zone in 2012, covering the northern half of neighbouring Rukwa Game Reserve: an additional 1,200 km². This second step aimed to compare the results of a management system allowing communities to use natural resources, with one in which local communities have only very limited access. These surveys are intended to occur yearly, to assess temporal trends.

The present paper presents the surveys' data on the presence and distribution of small carnivores in the families considered by *Small Carnivore Conservation*: in Africa, Herpestidae, Mustelidae, Nandiniidae and Viverridae.

Study areas

The first study area, Mlele Beekeeping Zone (Mlele BKZ) lies north of Katavi National Park (Katavi NP) in the newly created Mlele district (Fig. 1). It is dominated by miombo woodlands, interspersed with few seasonally inundated swamps and grasslands totalling less than 5% of the area (Fig. 2). The area's two plateaux are separated by a steep escarpment. The north-east plateau lies at a mean altitude of 1,000 m and rep-

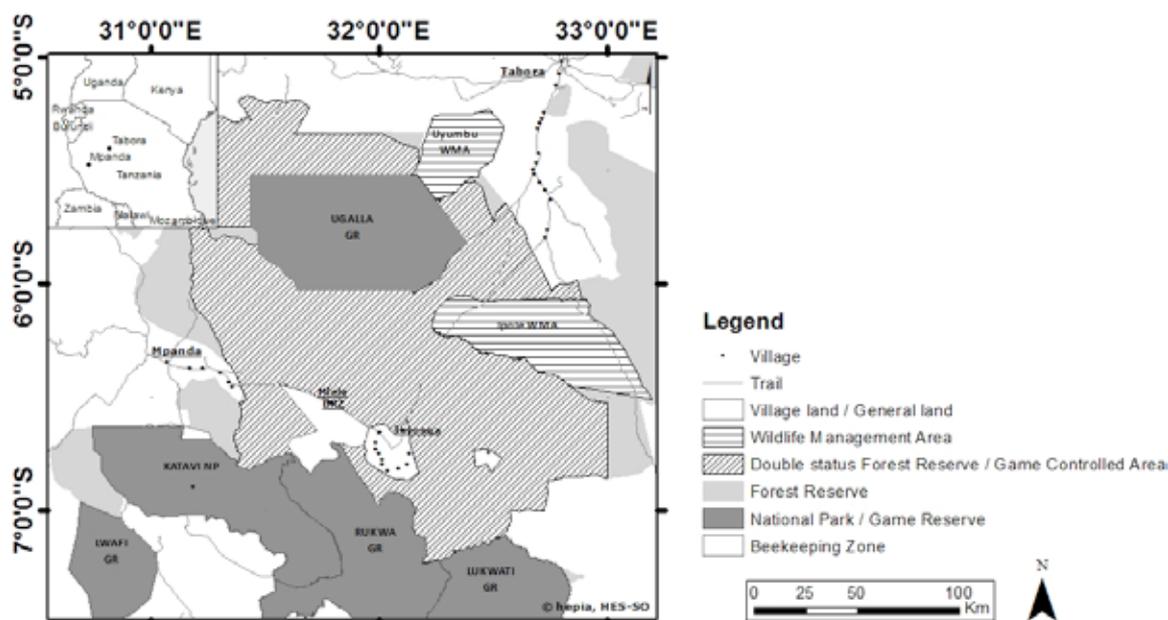


Fig. 1. Location of the study areas, Mlele Beekeeping Zone and the northern part of Rukwa Game Reserve, within the extended miombo woodlands of western Tanzania.

resents two-thirds of the area. The south-west plateau has a mean altitude of around 1,400 m.

The second study area, northern Rukwa Game Reserve (Rukwa GR-n), lies south-east of Mlele BKZ and east of Katavi NP (Fig. 1). Its landscape is much more rugged, with a higher plateau reaching over 1,600 m. A complex system of deep escarpments divides it into several canyons to the south and south-east.

The escarpments crossing both areas represent a side branch of the East African Rift. Both areas' seasonal climate gives a December–April wet season and a May–November dry season. Few water bodies are permanent: most of the area is under very dry conditions for several months.

Methods

The methods, detailed in Hausser *et al.* (in prep.), consisted of three monitoring techniques. During the project's first three years (2007–2009), transect surveys in four-wheel drive cars visited extensive portions of the five accessible road stretches of Mlele BKZ (Fig. 2) early in the morning and by night. This method was abandoned in 2011 because the two other techniques proved to be sufficient and because repeated car breakdowns, linked to rough road conditions, rendered the method costly. Secondly, in 2011–2012 for Mlele BKZ, and in 2012 in Rukwa GR-n, a grid of camera-traps covered half of each study area. The grids consisted of non-contiguous squares of 10 × 10 km, five in Mlele BKZ and four in Rukwa GR-n. These were each divided in smaller squares of 2 × 2 km (Fig. 3). In each of the larger squares, 12 intersections delineated by the smaller squares were selected randomly to set a camera-trap. In the field, we looked for visible signs of mammal activity in a radius of 50 m around the selected intersections to improve the probability to get pictures. Camera-traps were set for periods of 21 days. Some camera-traps set in the previous years to test the system were placed opportunistically along roads and trails.

Given the aim to assess status of many species of medium-sized and large mammals, camera-traps were set 60–100 cm above ground. The model used, the Cuddeback Capture, is easy to run, even for local people, relatively cheap, and produces pictures of fairly good quality. Thirdly, all opportunistic encounters with small carnivores, whether by car or on foot, were noted.

These techniques generated first results on the composition and distribution of the area's mammals, excepting fossorial, aerial and small (body mass <1 kg) species. All surveys reported here were conducted during the dry season, so some species using the area might have gone undetected. All species recorded during 2007–2010 are listed in Hausser *et al.* (in prep.).

Results

Surveys began in 2007 in Mlele BKZ, with a mean field presence of one month per year. Total survey effort was 1,589 camera-trap-days and five transects repeated five to six times each. In Rukwa GR-n we spent only two months in 2012, with an effort of 904 camera-trap-days.

Ten species of small carnivores, of the 14 potentially present (after TAWIRI 2009), were identified (Table 1). An eleventh, African Palm Civet *Nandinia binotata*, was seen too poorly for certain identification. Genet *Genetta* identification to species was difficult during direct encounters: they were seen only at night and usually hid quickly. Even one genet camera-trap picture defied identification.

Genets were both camera-trapped and encountered directly (on transects or opportunistically), always by night (Table 1). Two species of mongooses, Marsh Mongoose *Atilax paludinosus* and Bushy-tailed Mongoose *Bdeogale crassicauda*, were detected only by camera-traps and only at night. Common Dwarf Mongoose *Helogale parvula* and Common Slender Mongoose *Herpestes sanguineus* were found only by direct encounters, only by day. White-tailed Mongoose *Ichneumia albicauda* and Banded Mongoose *Mungos mungo* were often seen directly, but were also

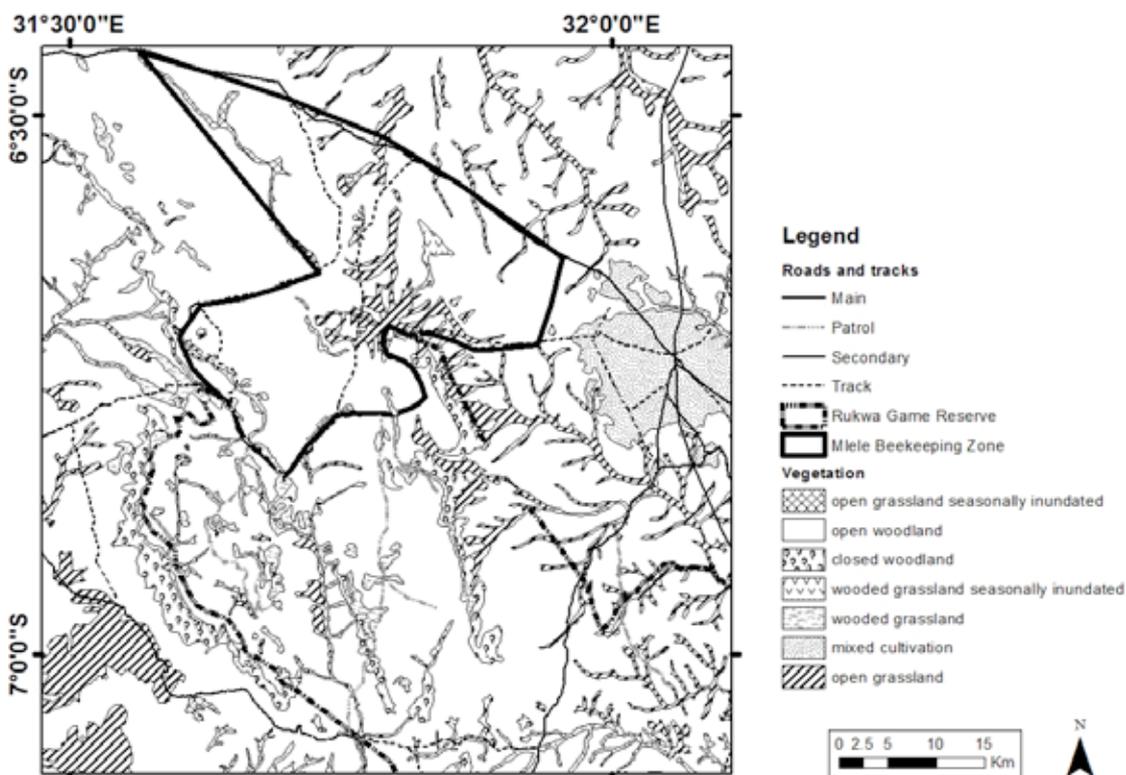


Fig. 2. Vegetation of Mlele Beekeeping Zone and the northern part of Rukwa Game Reserve, Tanzania. Open woodland = miombo.

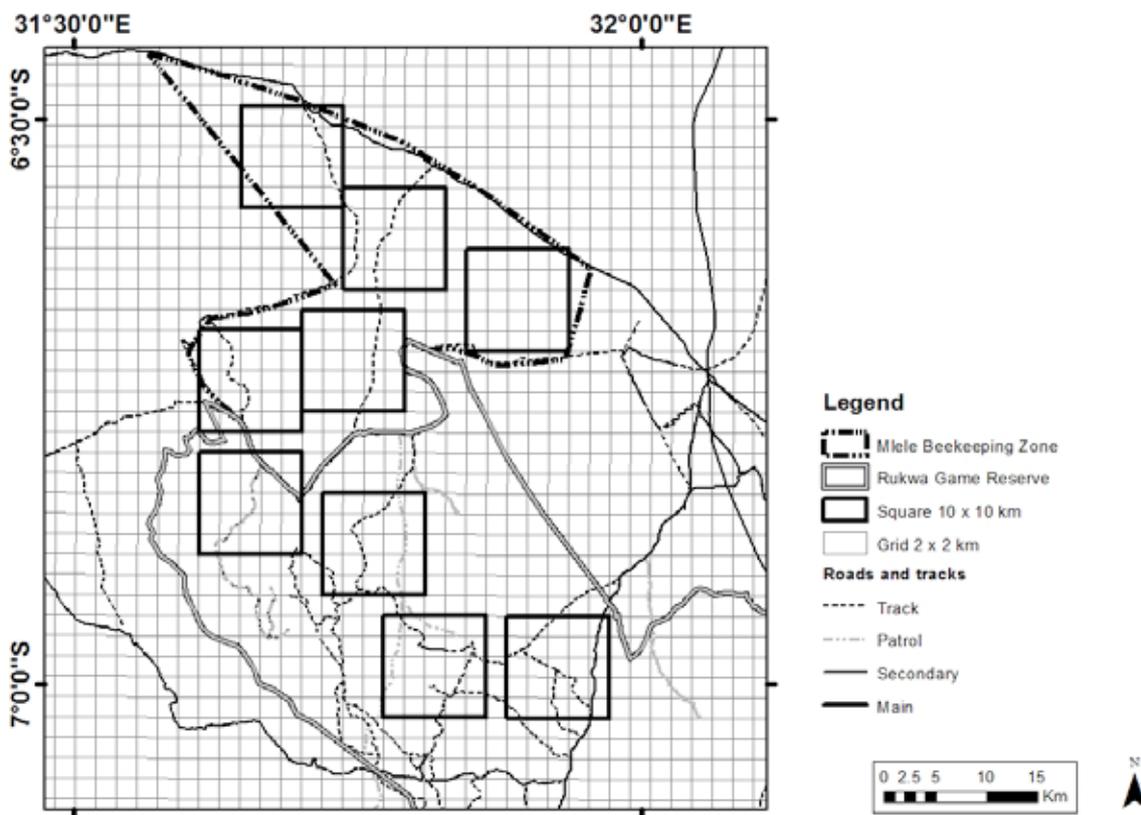


Fig. 3. The camera-trap grid system in Mlele Beekeeping Zone and the northern part of Rukwa Game Reserve, Tanzania.

Table 1. Small carnivore species potentially present in Mlele Beekeeping Zone and the northern part of Rukwa Game Reserve, Tanzania (after TAWIRI 2009), detailing those observed during 2007–2012 surveys.

Species ¹	Scientific name	Species detected	Number of sites ² Mlele BKZ / Rukwa GR-n	Method ³	Activity pattern observed
Miombo Genet	<i>Genetta angolensis</i>	YES	3/4	C, Tn	Night
Rusty-spotted Genet	<i>Genetta maculata</i>	YES	1/-	C	Night
Common Genet	<i>Genetta genetta</i>	NO	0	-	-
Common Dwarf Mongoose	<i>Helogale parvula</i>	YES	17/-	T, O	Day
Banded Mongoose	<i>Mungos mungo</i>	YES	6/-	C	Day & night
Common Slender Mongoose	<i>Herpestes sanguineus</i>	YES	1/-	T, O	Day
Egyptian Mongoose	<i>Herpestes ichneumon</i>	NO	0	-	-
White-tailed Mongoose	<i>Ichneumia albicauda</i>	YES	4/1	C, T, O	Day & night
Marsh Mongoose	<i>Atilax paludinosus</i>	YES	7/1	C	Night
Bushy-tailed Mongoose	<i>Bdeogale crassicauda</i>	YES	6/2	C	Night
Honey Badger	<i>Mellivora capensis</i>	YES	5/5	C, O	Day & night
Zorilla	<i>Ictonyx striatus</i>	NO	0	-	-
African Civet	<i>Civettictis civetta</i>	YES	3/5	C, O	Night
African Palm Civet	<i>Nandinia binotata</i>	Probable	[1]/-	Tn	Night

¹ Otters are not considered as potentially present because there are no permanent water bodies in our study areas.

² The number of sites represents the number of camera-trap locations and the number of direct sightings separated by at least 100 m.

³ C = camera-trap, T = day-time transect, Tn = night-time transect, O = opportunistic encounter.

camera-trapped, by both day and night. Honey Badger *Mellivora capensis* and African Civet *Civettictis civetta* were mostly camera-trapped, but there were some direct encounters: at night for African Civet, and, once, by day for Honey Badger.

Detection locations of each species (Fig. 4) give some broad information about their distribution, but need cautious interpretation: only two months were spent in Rukwa GR-n versus nine in Mlele BKZ. This big difference in sampling effort resulted in more observations in Mlele BKZ, except for African Civet (Table 1).

Discussion

Camera-trap models and survey techniques not specially adapted for small carnivores found a fairly complete small carnivore guild: 10 species from a predicted 14 species present in the area. Other species may be present: a probable African Palm Civet – a species of uncertain distribution in western Tanzania (Stuart & Stuart 2006, Wilson & Mittermeier 2009) – was seen in 2007, and several genets were not identified to species.

Additional species would plausibly be recorded by camera-trapping more focused on small carnivores, which would: mount them lower to the ground (20–40 cm; Sarmiento *et al.* 2010, 2011, Ancrenaz *et al.* 2012); place some beside roads, trails, latrines and termite hives; use lures; and use more sensitive detectors. For instance, we never camera-trapped Common Dwarf Mongoose, despite several direct observations. The species may be too small and not mobile enough to be readily detected by our camera-trap system; and 2-km grid-cells exceed its usually small home range (<1 km²; Gilchrist *et al.* 2009).

Our survey unveiled a surprisingly high carnivore species richness. Pettorelli *et al.* (2010) surveyed carnivores in 11 Tanzanian sites, including eight of protection status higher than (six national parks and Ngorongoro Conservation Area) or similar to (one game reserve) our study areas. They recorded 4–16 species of carnivores per site: only three had 10 or more

species. We recorded 17 carnivore species in Mlele BKZ: the ten above plus African Wild Dog *Lycaon pictus*, Side-striped Jackal *Canis adustus*, Lion *Panthera leo*, Leopard *Panthera pardus*, Serval *Felis serval*, African Wild Cat *Felis sylvestrus* and Spotted Hyena *Crocuta crocuta*. Yet Mlele BKZ is an area with the lowest protection status (IUCN management category VI).

Bushy-tailed Mongoose, which we recorded in both our study areas, in eight different sites, deserves special mention. It was considered uncommon by Kingdon (1997), De Luca & Mpunga (2005), Wilson & Mittermeier (2009), TAWIRI (2009) and C. Foley (*in litt.* 2012), but Pettorelli *et al.* (2010) pointed out that it can be more widespread: they recorded it in 31 locations across five study areas. Similarly, there were very few previous observations of Miombo Genet *Genetta angolensis* in our area (TAWIRI 2009).

The detected species seem mostly quite widespread across both study areas. No influence on any species's distribution was obvious from the proximity of Katavi NP to the west, or of village lands to the north-east. However, information was too thin to be sure no such effects exist. Direct evidence of poaching (Fig. 5) included several traps set for illegal capture of Wild Cat and genets, dispersed over Mlele BKZ. African Civet was detected more often in Rukwa GR-n despite much lower sampling effort there than in Mlele BKZ; but this species might naturally be more common in southern Rukwa GR-n because of the presence of more permanent water bodies and of more extended swamp areas (see Kingdon 1997).

Tanzania is one of few African countries with a Small Carnivore Conservation Action Plan (TAWIRI 2009). It assessed the status conservation priorities and research needs of 28 species of small and medium-sized carnivores. Our study delivers new information on the distribution of several of these species in western Tanzania, as well as some information about their threats, particularly poaching. Continued monitoring of small carnivores and other mammals in the study area is planned.

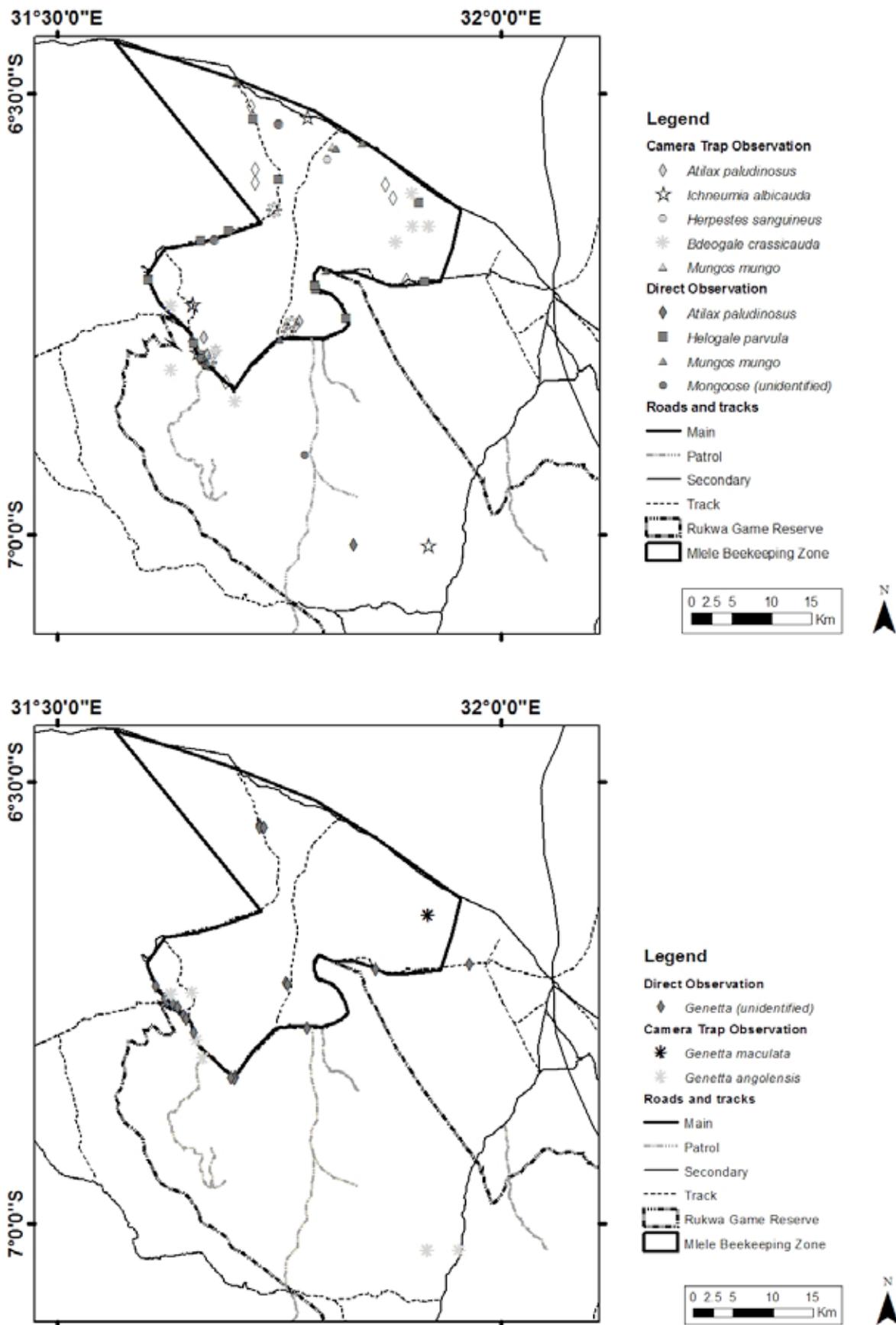


Fig. 4. Location maps of small carnivores in Mlele Beekeeping Zone and the northern part of Rukwa Game Reserve, Tanzania; (above) mongooses (Herpestidae); and (below) genets *Genetta*.

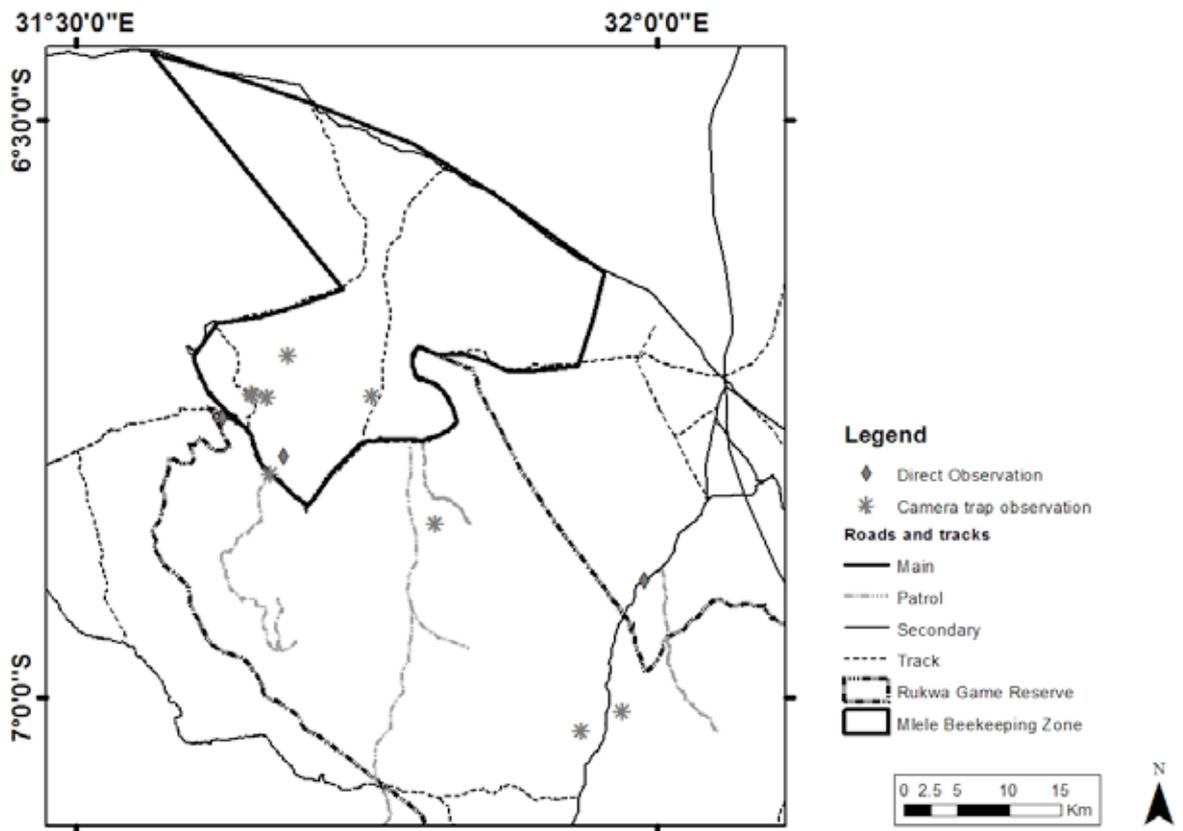
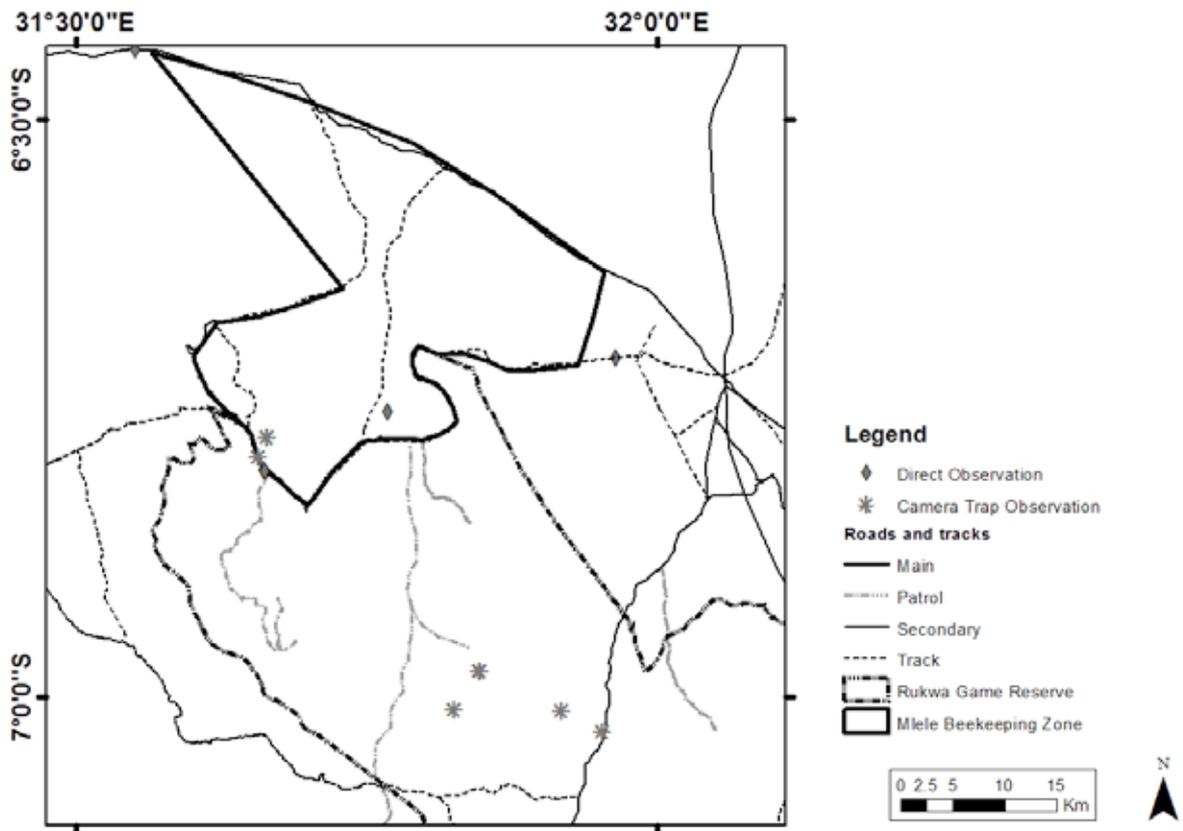


Fig. 4 (continued). Location maps of small carnivores in Mlele Beekeeping Zone and the northern part of Rukwa Game Reserve, Tanzania; (above) African Civet *Civettictis civetta*; (below) Honey Badger *Mellivora capensis*.

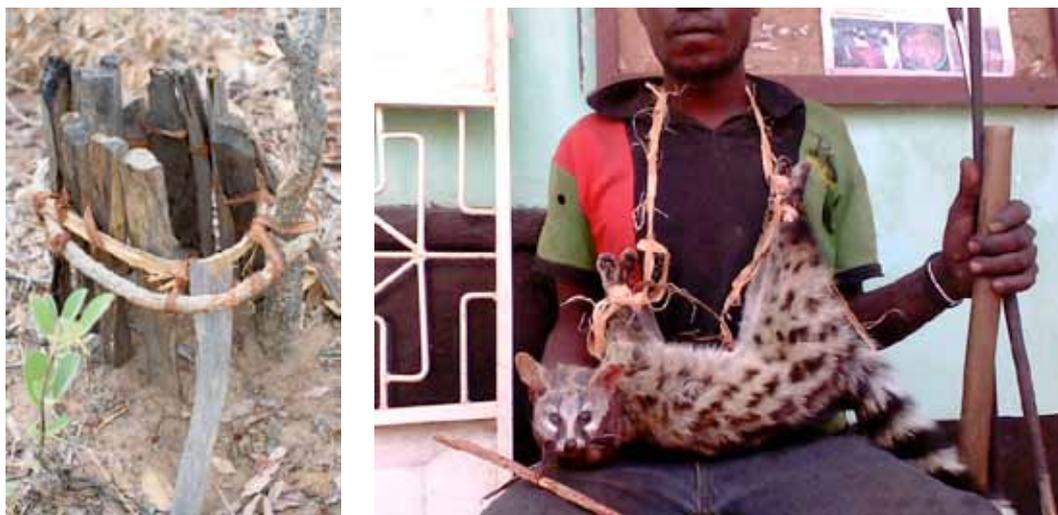


Fig. 5. Poaching evidence in Mlele Beekeeping Zone, Tanzania: left, a trap set up for Wild Cats *Felis sylvestrus* and genets *Genetta*; right, a Miombo Genet *Genetta angolensis* killed with a spear by a poacher.

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