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Tanzania Programme Office (WWF-TPO)

Faunal Surveys of the remote Ng'ung'umbi plateau, part of the Ndundulu-Luhomero massif, Udzungwa Mountains, Tanzania

Supported by WWF-Sweden

Final Report - March 2011

Executive Summary

Following the discovery in 2004 of the new genus of primate, the kipunji *Rungwecebus kipunji*, in Ndundulu Forest in the Udzungwa Mountains of Tanzania, WWF-Tanzania has expanded its ongoing work in this area to improve monitoring, protection and awareness of this Critically Endangered monkey and its exceptionally rich forest habitat. Among the activities identified as urgent were faunal surveys of neighbouring forested areas, both to determine the distribution and abundance of kipunji, and to increase biological knowledge of other endemic and endangered species of the Udzungwa Mountains. As part of this continuing effort, this report documents the final results of a short-term project, carried out from July 2010 to February 2011, entitled, "Extended Census of *Rungwecebus kipunji* and Other Endemic and Endangered Species in Ndundulu-Luhomero, Udzungwa Mountains, Tanzania".

Between 2004-2009, surveys for kipunji had been carried out throughout Ndundulu, Nyumbanitu and Ukami forests, and on the southern and eastern slopes of Luhomero mountain. It was therefore decided to focus this project on the Ng'ung'umbi plateau, an area of montane forest and swamps contiguous with the forests of Ndundulu and Luhomero, as this represented the final under-surveyed area which could provide an extension of the known range of kipunji. The aims of this project were two-fold: 1) To survey Ng'ung'umbi forest for kipunji*;* and 2) To carry out inventories of the other higher vertebrate populations of the Ng'ung'umbi forests and highland swamps, with particular focus on endemic and endangered species. The overall objective is to enhance the ability of local natural resource managers and partners to plan for biodiversity conservation across the area.

During three expeditions in 2010-11, surveys were carried out using a combination of the following methods: diurnal primate surveys along recce transects and random survey walks, with effort specially focused on detecting kipunji; dung and other mammal sign counts along recce transects; and collection of bird data along transects and through opportunistic sightings and audio recordings. In addition, a camera-trap survey was carried out from December 2010 to January 2011, deploying 17 camera traps spaced 1 km apart in a grid system for a total of 639 trap-days.

In spite of many records of the other three diurnal monkey species present in these forests, including the endemic Udzungwa red colobus, no kipunji were either seen or heard during these surveys. Survey effort in this area, and indeed across the wider region in previous surveys, has now been adequate to conclude that kipunji are absent from the Ng'ung'umbi and Luhomero forests. They are now confirmed as restricted to an area of about 10 km^2 in Ndundulu forest, within the Kilombero Nature Reserve. The 2006 total census of about 100 individuals remains the best estimate of kipunji in the Udzungwa Mountains. These results reinforce the formal listing of kipunji on the IUCN Red List of Endangered Species as Critically Endangered, and stress the need for continued vigilance and conservation attention if this newly-discovered species is to have a chance of avoiding extinction.

However, our surveys confirmed the Ng'ung'umbi area as a refuge for an exceptionally rich mammal community, and extended the known range of several rare and endemic species. Key biological findings include:

- Healthy population of Abbott's duiker, the Endangered and Tanzania-endemic forest antelope
- Unusually rich forest antelope community comprising five species, including abundant suni and red duiker populations
- Presence of rare Udzungwa-endemic species: Udzungwa forest-partridge, grey-faced sengi, and Udzungwa red colobus
- Lowe's servaline genet, and a minimum three species of mongoose: bushy-tailed, marsh and slender
- Rich large mammal community, including buffalo, leopard and lion
- Important site for elephants – the highest density recorded in the Udzungwa Mountains

Disturbance and illegal activities are generally at a low level, because of the remoteness of the areas and its protective status within the Udzungwa Mountains Naitonal Park. However, our encounter on one of our expeditions with poachers carrying elephant tusks reflects an increasing problem both regionally and nationally. Given this area's importance to the Udzungwa elephant population in particular, continuous support to the UMNP to increase foot patrols by anti-poaching rangers in this area is recommended.

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Photographs and figures

Cover photo of elephant at Ng'ung'umbi by K. Nowak 2010.
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1. Introduction

1.1 Background information

This work was developed following discussions with WWF-Sweden, Udzungwa Mountains National Park (UMNP) and stakeholders in recognition of the importance of conserving kipunji *Rungwecebus Kipunji,* a monkey that was recently discovered in the Southern Highlands of Tanzania in Mt. Rungwe, Kitulo and Udzungwa (Jones et al, 2005; Davenport et al, 2006). This long-haired forest primate was discovered on Rungwe in 2003 by conservation biologists from the Wildlife Conservation Society (WCS) while in Ndundulu Forest, in the Udzungwa Mountains, the species was found in 2004 by an independent researcher, Trevor Jones. The species is very special and therefore requires effective protection, through research and monitoring. Currently the greatest threats to the Ndundulu population are its extremely small size, limited distribution, and our lack of understanding of the reasons for its precarious status (Jones, 2006; Davenport et al, 2008). Further research within the potential range of the kipunji in Udzungwa is urgently required.

Ndundulu is one of the forests in the Kilombero Nature Reserve in Udzungwa Mountains (Udzungwas: 10,000km^2), lying northeast of Rungwe-Livingstone and supporting circa 1017 km^2 of fragmented forest. It is surrounded by three villages (Udekwa, Ifuwa and Wotalisoli) in Kilolo District, Iringa region. The forest is managed by the Forest and Beekeeping Division of the Ministry of Natural Resources and Tourism as part of the new Kilombero Nature Reserve (Marshall *et al*., 2007). It has recently been the site of an extraordinary number of discoveries of vertebrate species, including the kipunji (Jones *et al*., 2005; Davenport *et al*., 2006), a new species of elephant-shrew (Rovero *et al*., 2008), an endemic forest-partridge (Dinesen *et al*., 1994) and Tanzania's only population of Cassin's hawk-eagle (Jones, 2007). Ndundulu forest is contiguous with Luhomero forest within the Udzungwa Mountains National Park (UMNP), and all of these species should in theory be present also within the UMNP. However, until now, information is very limited. In particular, it is not known whether the kipunji or the Cassin's hawk-eagle – both of whose populations are so small that they may not be viable in the long-term (Harcourt, 2002) – are found in Luhomero.

We therefore proposed a technical survey of the Ndundulu-Luhomero massif to increase our biological knowledge of this extraordinarily rich area of the Udzungwa Mountains National Park. In particular, the survey will be concentrated on the remote and completely unsurveyed northern and north-eastern slopes of the Luhomero Mountain, within the UMNP (The proposed consultant surveyed the southern slopes of Luhomero independently in late 2008; the final analysis is pending and these results will also be summarized in the

final report – the important remaining area now is this large area of forest to the north of Luhomero peak). This area was chosen because it gave the best remaining hope of expanding the known range of the kipunji.

This census work is building on and contributing to the wider aims of WWF-Tanzania's WWF-Sweden supported Kipunji Project in this area, which has been running since start of 2007 – as described in several project reports including:

a) WWF-TPO (2007) *Ecological Research on kipunji* Rungwecebus kipunji *in Nyumbanitu - Western side of UMNP.* Unpublished report for WWF-Sweden and WWF-Tanzania.
b) WWF-TPO (2008) *Ecological Monitoring and Research on kipunji* Rungwecebus kipunji *in Ndundulu forest - Western side of UMNP.* Unpublished report for WWF-Tanzania and WWF-Sweden.

1.2 Overall Objective

The overall objective of the study is to extend census of previously unsurveyed areas of the Ndundulu-Luhomero massif in search of unknown populations of kipunji and other endangered and endemic vertebrate species to enhance the ability to plan for their conservation

1.3 Specific Objectives

The specific objectives or task of this consultancy work were to:-

1. Collect and document detailed information of the distribution of Kipunji in unsurveyed areas of the Ndundulu–Luhomero massif
2. Collect and document information on the distribution of several important vertebrate species of Udzungwa Mountains covering unsurveyed areas of the Ndundule –Luhomero massif

1.4 Expected Outputs For The Consultancy

(i) Detailed information about the distribution of *Kipunji* collected and documented through extended census (covering previously unsurveyed areas of the Ndundulu-Luhomero massif)

(ii) Detailed information about the distribution of several important vertebrate species of the Udzungwa Mountains (covering previously unsurveyed areas of the Ndundulu-Luhomero massif) gathered and documented.

2. Study Site and Methods

2.1 Study Site

The Udzungwa Mountains of south-central Tanzania ('Udzungwas': 10,000km^2, 300-2600m a.s.l.) are a mosaic of forest, miombo woodland, dry bush and grassland (Dinesen *et al*, 2001). Extremely biodiverse and rich in endemic and endangered species, they have in recent years become recognized as one of the most important areas for biodiversity conservation in East Africa (e.g. Myers *et al*, 2000; Burgess *et al*, 2007). The discovery of kipunji brings the total number of primate species in the Udzungwas to 12, including 3 endemic or near-endemic monkeys (Rovero *et al*, 2009).

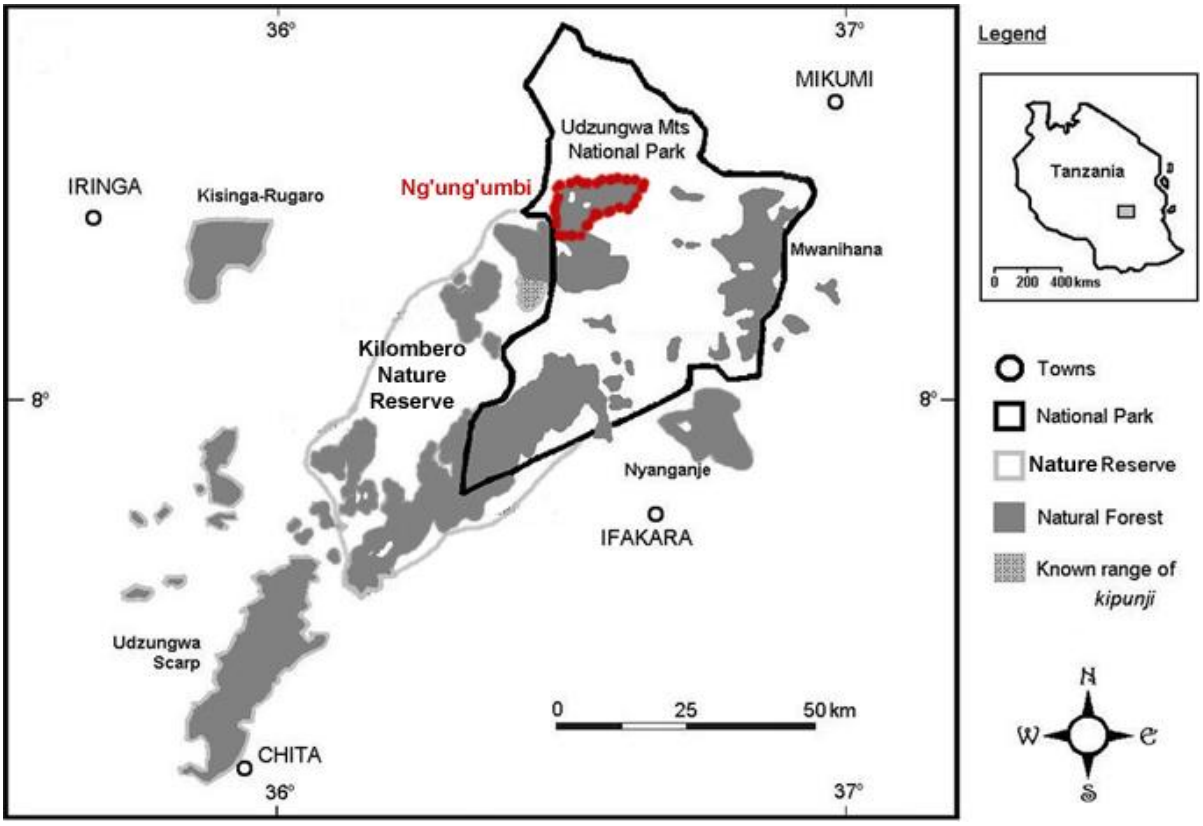

Figure 1. Map of major forests of the Udzungwa Mountains, showing position of Ng'ung'umbi study area.

Figure 2. Marsh of Ng'ung'umbi fringed with large elephant wallow.

Ndundulu-Luhomero is a remote, forest-covered massif (1,105-2,520 m asl) which has exceptional values of species richness and endemism, and has been the scene of several exciting discoveries in recent years (Dinesen *et al*, 1994; Stanley *et al*, 2005; Jones *et al*, 2005; Jones, 2007; Rovero *et al*, 2008). The contiguous forest (231 km^2) spans the boundary between the Kilombero Nature Reserve (KNR) and the Udzungwa Mountains National Park (UMNP) (see Marshall *et al*, 2007 and WWF-TPO, 2008 for more details on the management history of Ndundulu forest and the KNR). Ng'ung'umbi, the focus of this project, is a plateau area of montane forest which is connected to Ndundulu and Luhomero. The whole Ng'ung'umbi area, as defined by the forest boundary, covers about 75 km^2 (figure 4) and lies entirely within the UMNP, managed by Tanzania National Parks. With an altitudinal range from 1500 up to 2130 m asl, this unique area is characterised by a tentacular network of upland marshy valleys at about 2000 m asl. Surrounding these long meandering tentacles of swampy vegetation, which are typically 50-250 m wide and fringed with elephant and buffalo wallows, are rolling hills and spurs covered in a mosaic of montane forest and large patches of montane bamboo *Sinarundinaria alpina* (figure 2; cover photo). Trees of the montane forest include *Hagenia abyssinca*, *Ocotea usumbarensis*, *Cassipourea malosana, Olea capensi* and *Podocarpus falcatus.*

As elsewhere in the Udzungwa Mountains, there are two main seasons: a long dry season from June to November, and a variable rainy season from December to May. Precipitation has never been measured at Ng'ung'umbi, but is expected to be between 1000-1500 mm per year. The hottest period is December-January, and the coldest temperatures are May-June, when it may fall below zero degrees celsius at night.

2.2 Survey Methods and Data Analysis

2.2.1 Kipunji Survey Walks

This method was first tested and found to be effective in detecting kipunji in Ndundulu during 2005-6 (Jones, 2006), and has been repeated on other subsequent surveys for kipunji (WWF-TPO 2007, 2008). At each site, teams of observers survey concurrently for kipunji along separate pre-planned routes using 1:50 000 topographic maps (Tanzania Surveys and Mapping Division, Series Y742), compass, handheld GPS unit (Garmin 60Cx) and binoculars. New areas are surveyed each day, adjacent to the area covered the previous day. Survey routes are not linear but follow wildlife trails as much as possible, and are selected to strike a balance between surveying as large an area as possible, and attempting to survey each area thoroughly, considering the elusiveness of the target animals. An average day's survey route is along a loop starting and finishing at camp of approximately 5-7 km in length. Each observer-pair walks slowly and quietly scanning the understorey and canopy for monkeys, and listening for vocalisations. 1-2 km^2 are covered per hour, between 0650 and 1830 hours; surveying is generally paused between 1230 and 1430 hours, and whenever heavy rain occurs, as kipunji have been observed to usually be inactive at these times. Whenever a monkey individual or group is detected, the observer remains until s/he is confident s/he has confirmed all of the primate species present. For all primates encountered, the following data are recorded: species, minimum group size, age and sex, and location (UTM co-ordinates). All primate vocalisations heard are also recorded. With this method, distances covered are estimated using GPS coordinates obtained en route, plotted subsequently onto the topographic maps.

A total of 22 km were walked throughout the study area (figure 4).

2.2.2 'Recce' transects

Secondly, we employed a form of 'recce transect' method used consistently by the consultant at several sites around the Udzungwas (Jones, in prep.). The method records relative densities of the sign of several elusive medium to large mammal species (generally weighing >2 kg), as well as encounters with primates, which can be compared between sites.

Each transect begins at a randomly selected point at a minimum distance of 200m from camp (to avoid bias from human disturbance to animal activity). The start and end locations of each transect is recorded in a GPS, and the entire transect is also track-logged (using a Garmin 60Cx hand-held GPS, which is mostly effective even under a tall closed canopy). Three people are required to carry out the transect (plus an armed ranger, if necessary).

Everyone walks quietly and slowly, at a mean speed of approximately 400m/hr. The "Commander" wears a hipchain and leads the line, and the recorder and one assistant walk a few metres behind, scanning for, recording and measuring all data points. At the start of the transect, the Commander ties the biodegradable thread from the hipchain to a tree and begins walking in the pre-specified compass direction. The thread that s/he trails behind becomes the centre line of the transect (from which perpendicular distances to data points are measured). The recorder and assistant walk together along the line, looking for dung piles and other data points.

The Commander is instructed to follow the pre-determined compass direction, thus s/he walks constantly checking the compass against landmarks ahead. However, no cutting of vegetation is permitted. If an obstacle such as a thicket, large tree trunk or rock is encountered which cannot be easily passed without cutting vegetation, the Commander is allowed to deviate from the course by up to 45^{o} before returning to the correct line of direction after the obstacle has been passed. If a greater deviation is required, the line is cut and the transect suspended, then resumed ahead as soon as it is possible to continue in the correct direction. In this way, and because the hipchain thread degrades and disappears completely within three months, no sign is left in the forest that a transect has been done. (Although in the short-term, the thread which is left behind can have the effect of scaring illegal hunters away from that area.)

For each data point, the following information are recorded:

(1) distance from the start of the transect (obtained from the hipchain);
(2) whether the data point is to the left or the right of the line;
(3) perpendicular distance from the centre of the line to the data point (using tape measure or laser rangefinder);
(4) species
(5) type of data, e.g. dung, visual or auditory detection of animal, animal hole, feeding sign, spoor

The primary data points which were systematically recorded were dung of large mammals, detection of mammals (seen or heard), and large mammal holes. Any dung of species not recorded on transect but observed off transect were also noted, and geo-referenced. Other signs such as footprints and feeding signs were also noted opportunistically, on and off transect, as evidence of presence of species for which dung was not encountered, perhaps because the species was rare or in low density (e.g. carnivores).

Since 2005, the kipunji-focused biological surveys and monitoring conducted by WWF-Tanzania Udzungwa Program have covered the forests of Ndundulu-Luhomero, Nyumbanitu

and Ukami in northern Udzungwa (WWF-TPO 2007, 2008; this report). Within this area, the consultant has employed this recce transect method systematically at 8 sites throughout these three forests (Jones, in prep), as shown in Table 1 and Figure 3. To provide some context and allow comparison with other sites across the study region, we have presented the recce transect results from Ng'ung'umbi together with the equivalent results from the other 7 sites.

Table 1. The eight forested areas of northern Udzungwa Mountains sampled during 2007-2010 using the recce transect method described here. Adapted from Jones, in prep.

Forest	Size (km^2)	Closed canopy (km^2)	Altitude	Date of survey	No.	Site	Status	Number of recce transects	Total length (m)
Nyumbanitu	56.5	27.9	1,074-2,600	Sept 07	1	Nyumbanitu E	NR	20	17,550
				Sept 07	2	Nyumbanitu W		6	5,200
Ukami	7.2	5.4	902-1,651	Sept 07	3	Ukami	NR	12	9,150
Ndundulu-Luhomero	230.6	161.1	1,105-2,520	Nov 08	4	Vikongwa	NR	12	12,053
				Nov 08	5	Ndundulu N	NR	12	11,020
				Oct 08	6	Luhomero E	NP	12	12,071
				Oct 08	7	Luhomero W	NP	10	10,124
				Jul 10	8	Ng'ung'umbi	NP	7	9,740

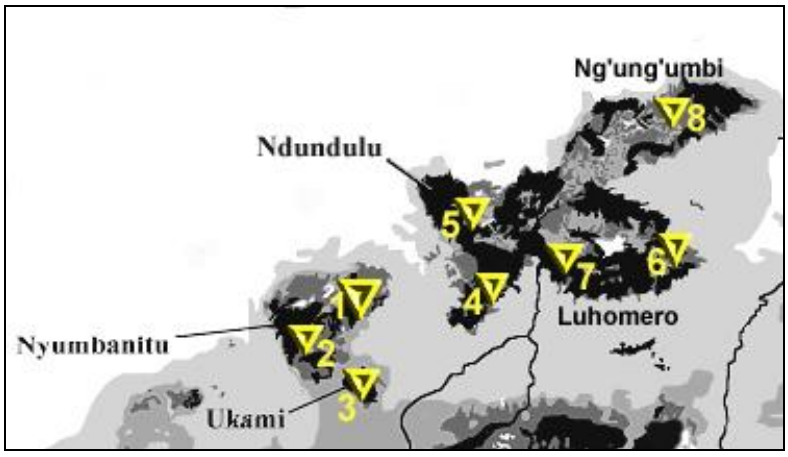

Figure 3. Map of eight sites sampled 2007-2010 (Jones, in prep) and reported on here. All sites lie within the northern Udzungwa focal region of WWF-Tanzania's ongoing kipunji-focused work (WWF-TPO, 2007, 2008; this report). Site numbers correspond to Table 1.

During the July/August 2010 expedition, one constraint on survey time was the thick mist which covered the marshy valleys and surrounding forest from 6am until 10am-12pm most mornings, reducing visibility to <5m and making walking dangerous, considering the presence of elephants and buffalo. Nevertheless, 7 recce transects totalling 9.74 km were sampled (figure 4), during which 512 dung and other sign of 16 mammal species were recorded.

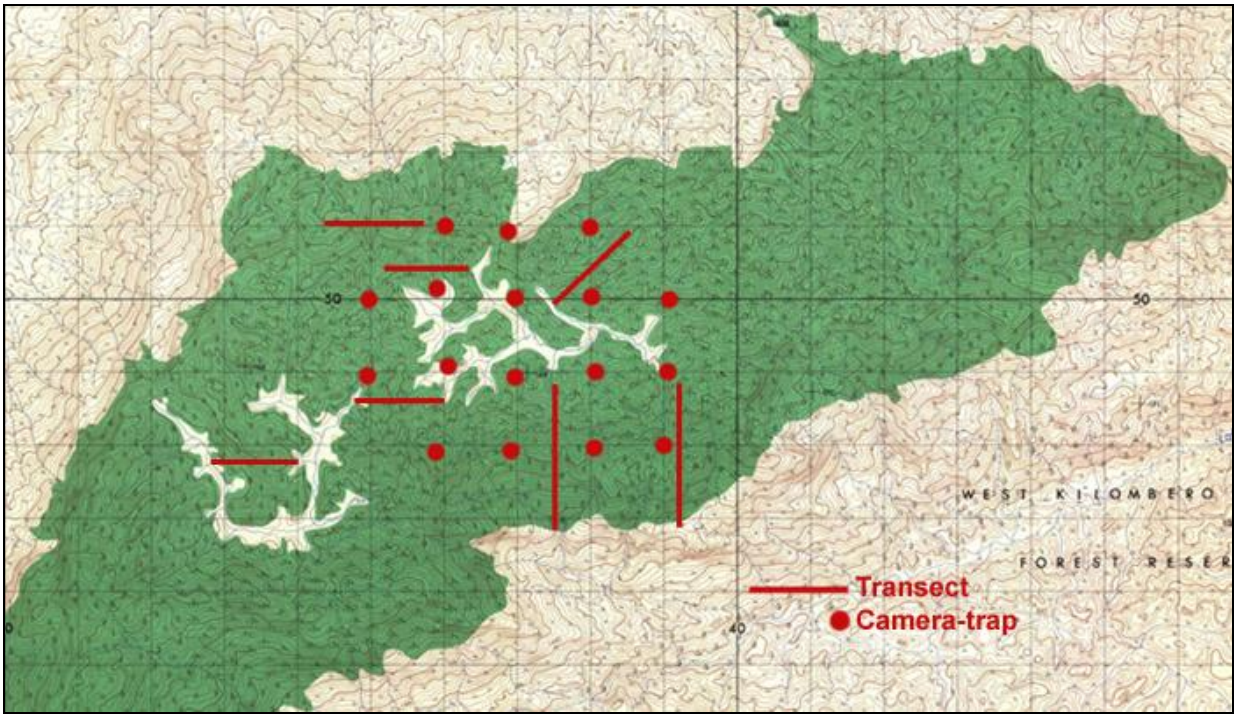

Figure 4. Ng'ung'umbi study area, showing recce transects walked (July-August 2010) and placement of camera-traps (November 2010-January 2011).

2.2.3 Analysis of transect results

In most cases, data presented are species-specific, with one exception, the forest antelopes. This is because collaborative study in the Udzungwas over recent years is showing that field identifications of forest antelope dung piles to species level, even by experienced researchers and local fieldworkers, are unreliable (Bowkett *et al*, 2009; Bowkett & Jones, unpubl. data). Thus we have pooled dung piles from all the forest antelope species at each site and make inter-site comparisons of density at the level of the guild.

Results for each species or taxon are presented either as encounter rates (e.g. with primate groups, or aardvark holes), or where possible depending on the quality of the data, as estimates of density (e.g. of dung piles).

Encounter rates

For each species or group of species, encounter rates are the basic unit used as a relative index of density. Encounter rate is computed as the mean number of encounters (observed from the line) per km of transect walked. Thus they do not adjust strip width where there is varying visibility from the line (e.g. due to thicker herb layer vegetation which may conceal dung piles), but are a rough estimate of density whose precision depends on uniformity of visibility and encounters, as well as sample size.

While not ideal, encounter rates can be very useful in enabling comparisons of relative abundance between sites for selected species, especially rare species where sample sizes are always low unless prohibitively high effort is undertaken at each site.

DISTANCE density estimates

A more precise unit of comparison between sites, where it can be obtained, is the estimate of density as calculated using the software DISTANCE (http://www.ruwpa.st-and.ac.uk/distance/). After inputting all data points along the transects together with their perpendicular distances from the line, DISTANCE estimates the effective strip-width sampled can then compute several estimates of density, using a variety of models on a subset of the data (depending on the distance from the line at which one chooses to "truncate" the data). Akaike's Information Criteria are used to select the most appropriate model with the best fit to the data. Thus a more accurate measure than encounter rate, the selected densities can then be compared between sites. However, a minimum sample size of 60 is recommended for estimating densities in DISTANCE, below which variance can become so high that the estimate ceases to be useful.

2.2.4 Camera-trapping

A camera-trapping survey was carried out to investigate the presence of rare and nocturnal mammals not easily sampled along transects, and to confirm the presence/absence of elusive species such as kipunji. 17 Cuddeback Capture digital heat-and-motion automatic camera-traps were deployed between 28th November 2010 and 10th January 2011. We used "trap-day" as our basic unit of time, meaning a full 24-hour period that each camera was running, starting at midnight. 15 cameras worked continuously while two appeared to stop working halfway through the survey period, giving an estimated total from the 17 cameras of 639 trap-days.

We placed the cameras according to a pre-conceived sampling grid design with the cameras 1km apart (fig. 4). Estimated coverage of the camera-trapping survey was 24 km^2, or approximately 32% of the Ng'ung'umbi forested area, covering all habitats from forest edge to interior, and is thus expected to pick up most if not all mammal species which are present in Ng'ung'umbi, and detectable with camera-traps.

Photographs were analysed according to trap-site, species, and date and time of capture (Rovero *et al*, 2005). "Captures" refer to the number of times each species was photographed. We did not score any instances where an individual was captured by the same camera within the same trap-day. This time interval compromises between the likelihood of multiple scoring of the same individual and the likelihood of missing individuals. In the small number of cases where there were two or three individuals captured together, a photograph received two or three scores respectively. With a few exceptions, we could not distinguish between individuals with certainty, therefore different captures do not imply different individuals. "Capture rate", our basic sampling measure, is the number of captures divided by the number of trap-days per site.

To attempt to convert capture rates into a true index of relative abundance is fraught with problems (Rowcliffe & Carbone, 2008) and beyond the scope of this report. Rather, for each species, we present the capture rate pooled from all cameras, together with the number of cameras on which it was captured, as crude but still useful indicators of relative density and geographical occupancy, respectively.

2.2.5 Bird Surveys

Random bird walks were undertaken between mammal transects, and all birds seen and heard were noted. Audio recordings of calls and songs were also made using a Marantz PMD 660 Solid State Recorder and Sennheiser ME-66 microphone combination, and species identification verified later against the consultant's library of bird calls from the Udzungwas. Camera-traps set primarily for mammals also captured a small number of bird species.

3. Results and Discussion

3.1 Kipunji and other primates

Figure 5. The three diurnal primate species recorded during this study, from left to right: Udzungwa red colobus *Procolobus gordonorum*, Angolan colobus *Colobus angolensis* and Sykes' monkey *Cercopithecus mitis moloneyi* – plus, at right, kipunji *Rungwecebus kipunji*.

No kipunji were detected in Ng'ung'umbi either on survey walks, transects, or opportunistically, over all three visits during 2010-11. This was in spite of extra effort by three experienced kipunji observers (TJ, A. Mndeme & R. Laizzer) focused in areas of habitat judged to be most suitable for kipunji. The other three species of diurnal forest monkey which are found in most Udzungwa forests, were present: the Udzungwa-endemic Udzungwa red colobus *Procolobus gordonorum*, Angolan black-and-white colobus *Colobus angolensis* and Sykes's monkey *Cercopithecus mitis*. In the area of Ndundulu forest where kipunji is present, it is known to associate regularly and occasionally form mixed-species groups with each of these species (Jones, 2006), therefore all groups encountered were checked carefully for the presence of kipunji individuals. A total of 35 encounters with monkey groups or individuals were made over the three visits.

Furthermore, a comparison of mean encounter rates with diurnal primates across 8 sites within the greater study area indicates that Ng'ung'umbi has a typical density of monkeys in comparison to the other sites:

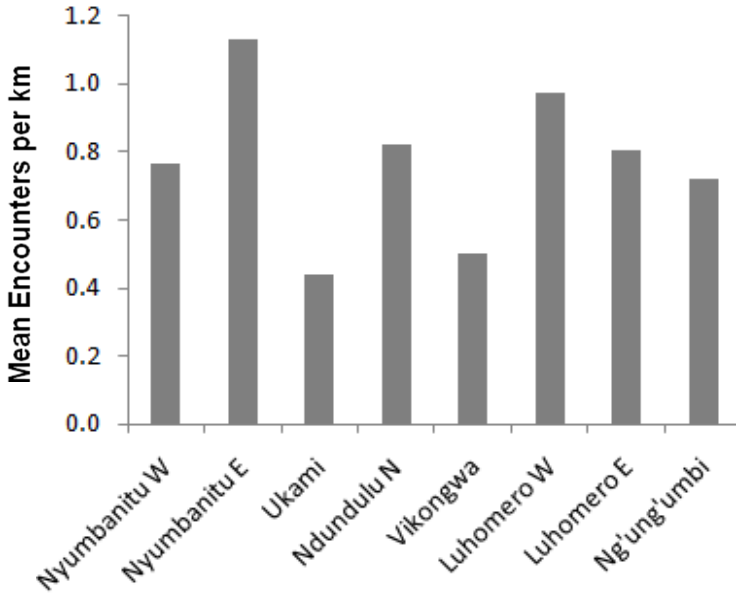

Figure 6. Mean encounter rates (encounters per km walked) with groups of all diurnal primates combined, across 8 sites in the northern Udzungwa forests (n = 21-42). At all sites this community comprises 3 species (Udzungwa red colobus, Angolan colobus and Sykes' monkey), except Vikongwa (in Ndundulu) where it also includes a fourth species, kipunji.

3.1.2 Kipunji distribution and abundance

These results strongly suggest that **kipunji are absent from the Ng'ung'umbi plateau**. This conclusion is also supported by a lack of reports from previous surveys of the area (though these data are limited and date from before the "discovery" of kipunji; Jones & Rovero, 2003). Historical presence of kipunji in these forests is plausible but if so, given the current lack of either eyewitness reports or fossil evidence, it is impossible to say how long ago they became extinct here.

This confirmed absence from Ng'ung'umbi, as well as from Nyumbanitu, Ukami, northern Ndundulu, and all of Luhomero (Jones, 2006; WWF-TPO 2007, 2008; Davenport *et al*, 2008; Jones, unpubl. data), means that the known range of the Udzungwa kipunji population remains an area of approximately 10 km^2 centred on the Vikongwa valley of southern Ndundulu forest (fig. 7).

A best estimate of total abundance of kipunji in the Udzungwa Mountains therefore remains at 93 individuals (WWF-TPO, 2008).

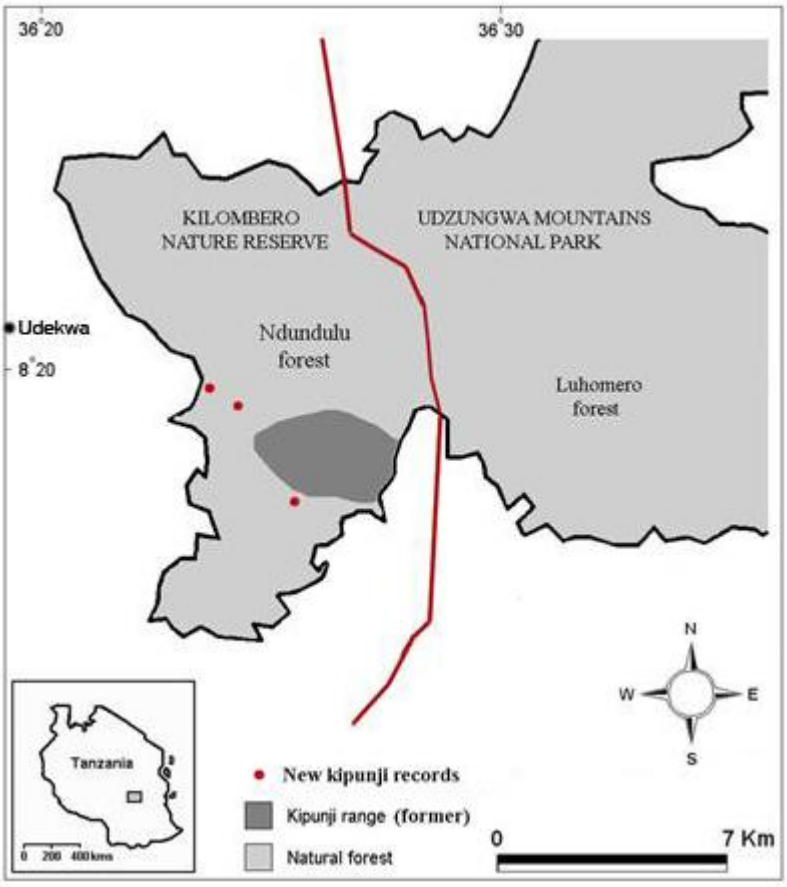

Figure 7. Known distribution of kipunji in Ndundulu forest, 2010: formerly known kipunji range (Jones, 2006; Davenport et al, 2008) updated with range extension from newer sightings (WWF-TPO, 2008; Jones, unpubl. data).

These results reinforce the recent formal listing of kipunji on the IUCN Red List of Endangered Species as Critically Endangered (Davenport & Jones, 2008), and stress the need for continued vigilance and conservation attention if this newly-discovered species is to have a chance of avoiding extinction.

3.2 Other mammals

3.2.1 Recce transects

A total of 16 mammal species (live encounters and/or sign) were recorded along the 9.74 km of systematic transects, including the three diurnal primate species (see 3.1 above), 5 species of forest antelope, and 4 carnivore species (see Appendix 1 for full list). Of the eight

northern Udzungwa sites sampled (Table 1, figure 3; Jones, in prep.), the transects at Ng'ung'umbi yielded the joint highest number of species (with Ukami and Luhomero East).

In order to give an overall picture of biomass at Ng'ung'umbi relative to each of the other sites, we have pooled the data from all medium to large mammal species recorded along the transects. These species represent *all the primary consumers* at each site, which usually comprise >90% of all mammalian biomass in African forests (White, 1994). Moreover, this subset of mammals includes all the species usually detected using this transect method, since it *excludes* all secondary consumers or carnivores, usually in very low density and their dung or spoor undetected. Thus this 'primary consumer index', though a little crude considering it is derived from dung piles, live animals and aardvark burrows combined, gives a reasonable picture of relative overall abundance of mammals, and mammalian biomass, between sites (figure 8). Overall variation between sites is minimal, and Ng'ung'umbi scores as one of the richest sites in terms of density of primary consumers, and therefore mammalian biomass.

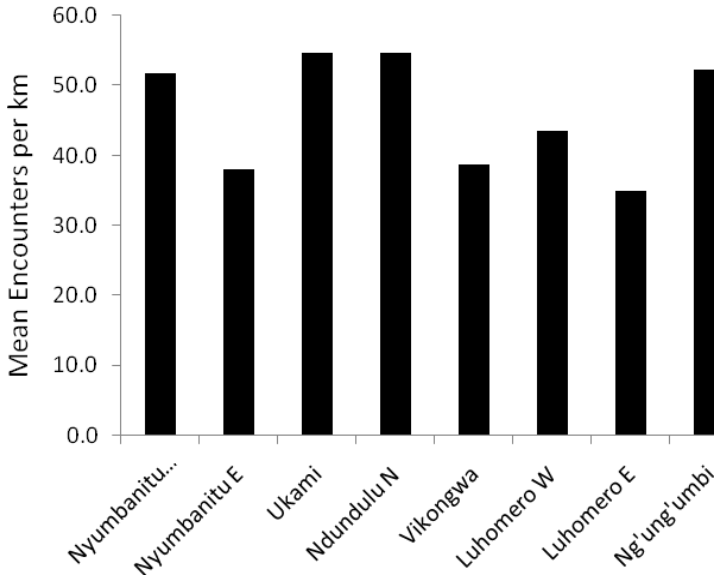

Figure 8. 'Primary Consumer Index' as represented by the overall encounter rate of signs and sightings of primary consumers at each site, comprising wherever present:

(i) Dung piles of elephant, bushpig, buffalo, suni, blue duiker, red duiker, Abbott's duiker and bushbuck; latrines of tree hyrax
(ii) Active aardvark holes
(iii) Sightings of diurnal primates: Udzungwa red colobus, Angolan colobus and Sykes' monkey (plus kipunji in Vikongwa)

The following are comparisons of densities (of either dung piles, latrines or holes) across the same 8 sites, for selected mammal species which were recorded at Ng'ung'umbi.

Tree hyrax

(a) **(b)**

Figure 9: (a) Tree hyrax *Dendrohyrax arboreus* (from Ndundulu forest, 2007) and (b) portion of a typical tree hyrax latrine in the Udzungwa Mountains.

Although primarily arboreal, tree hyrax *Dendrohyrax arboreus* are easily detected using the transect method employed here because wherever they are present, dung piles accumulate to form extensive latrines around the foot of denning trees within their home range (Figure 9). Because of the size of these latrines, which can be up to 10 m across, it is very difficult, time-consuming and imprecise to try to determine the centre of the latrine for the purpose of measuring perpendicular distance from the line. Thus instead, every latrine (a lone dung pile also equals a latrine for this analysis) was recorded as an encounter wherever it was detected from the line, and each site given an encounter rate expressed as number of latrines encountered per km of transect (Figure 10).

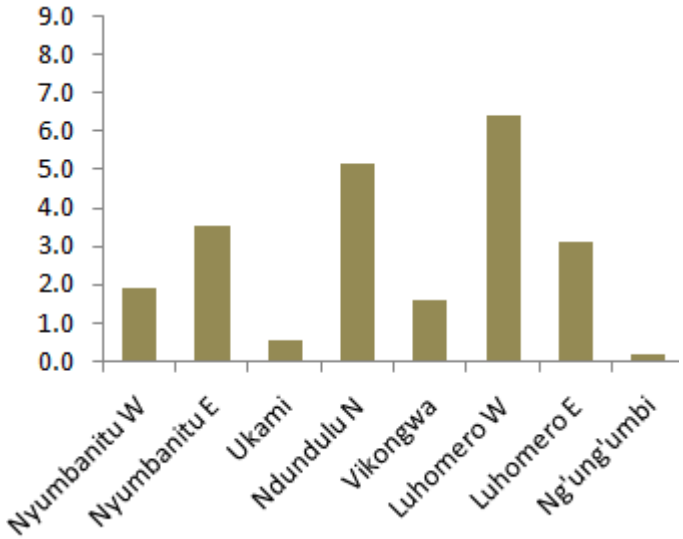

Figure 10. Encounter rates (encounters per km walked) of tree hyrax latrines at each site

Tree hyrax are at notably low density at Ng'ung'umbi, relative to other sites. On the transects, their latrines were recorded at a rate of 0.21 per km walked, compared with the mean across sites of 2.81, and the highest recorded encounter rate of 6.39 at Luhomero West. Only a single vocalisation was heard during the surveys, which was very unusual given the species' noisy nocturnal habits at many other sites around Udzungwa. Considering the remoteness of the area and low levels of human activity (see Section 4 below), it is unlikely that this low density is an artefact of hunting, in spite of the local Wahehe tribe's fondness for hyrax meat (Topp-Jørgensen *et al*, 2008; T. Jones, unpubl. data). Instead, determinant factors may be the high altitude and low seasonal temperatures of Ng'ung'umbi, and/or habitat type. Tree hyrax distribution is thought to be affected by availability of old trees with suitable holes for denning (Gaylard & Kerley, 2001), so perhaps the mosaic of bamboo and montane forest of Ng'ung'umbi is not abundant with denning sites. Confirming this would require focused ecological study of this fascinating and poorly understood animal.

Aardvark

Figure 11. An adult aardvark *Orycteropus afer* captured on camera-trap in Ng'ung'umbi, and a typical aardvark hole showing signs of recent activity.

The aardvark *Orycteropus afer* is an extremely elusive nocturnal creature, native to Africa and found in a variety of habitats (depending on availability of food and suitable burrowing substrate; Melton & Daniels, 1986), that is present in several Udzungwa forests but hardly ever seen (Jones, in prep.). The aardvark's unusual habit of burying its distinctive dung (Melton, 1976; Stuart & Stuart, 2000; Jones, personal observation) makes its presence even harder to detect. Aardvarks were captured on camera-traps during this study, providing sound verification of their presence. However, camera-trapping these animals requires large sampling effort, and a better potential indicator of aardvark abundance are the remarkably large entrances to their underground burrows. Caution is required because many other animals can make use of an aardvark burrow: one study in Zimbabwe found 17

other species making use of aardvark burrows (Smithers, 1971), and mentioned that the survival of some of these species may depend on the shelter which these burrows can provide. However a freshly dug burrow (depending on size), and footprints near the entrance, can be reliable indicators for an experienced observer. For this study, it was decided to record *active aardvark burrows* as a proxy for aardvark density, thus figure 12 compares encounter rates with burrow entrances as detected from the transect lines at each site.

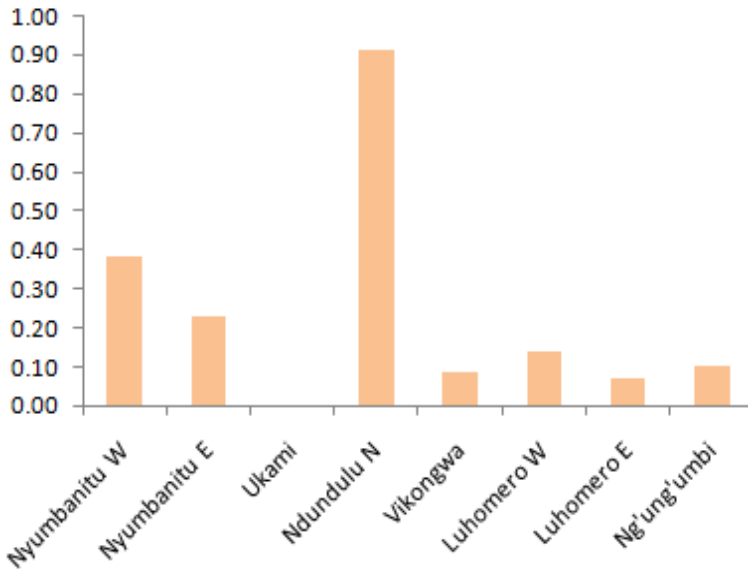

Figure 12. Encounter rates of active aardvark holes at Ng'ung'umbi and seven other sites in northern Udzungwa. Sample sizes for aardvark holes vary from zero up to 10 (Ndundulu north).

Aardvarks are not abundant at Ng'ung'umbi, but appear to be at a density similar to the rest of the Ndundulu-Luhomero massif, with the exception of Ndundulu N where a high density of active burrows was recorded.

Forest antelopes

As discussed above (section 2.2.2), due to the difficulties of correctly identifying East African forest antelope dung piles to species in the field, we have combined dung of the entire antelope community recorded at each site, which varied from 3 to 5 of the following species: red duiker, Abbott's duiker, blue duiker, suni and bushbuck. However, we know from the camera-trapping survey and direct observations that all 5 of these species are present at Ng'ung'umbi.

These data allowed calculation of estimates of absolute dung density at all sites, as a proxy for density of the animals themselves. Densities were generated using DISTANCE 6.0, and varied from 4,330 piles/km^2 at Luhomero W up to 26,029 piles/km^2 at Ukami (figure 13). The half-normal model most commonly gave the best fit to the data (86.4% of sites), after truncating the data to between 200-350 cm. This is because the great majority of records were less than 3.5 m from the centre of the line, reflecting the detectability of antelope dung piles on the forest/woodland floor. Thus the average effective strip-width for recording antelope dungs was 4-7 m. Coefficients of Variance at 95% confidence limits averaged around 0.2 across all sites (range = 0.13-0.26, median = 0.21, mean = 0.22), which is consistent with other published analyses of large mammal dung transect data using DISTANCE (Plumptre, 2000). Generally, 80-95% of this variance derived from encounter rate, while only 5-20% of variance came from detection probability, indicating appropriate methodology for recording these kinds of data, and good fit of the data to the model.

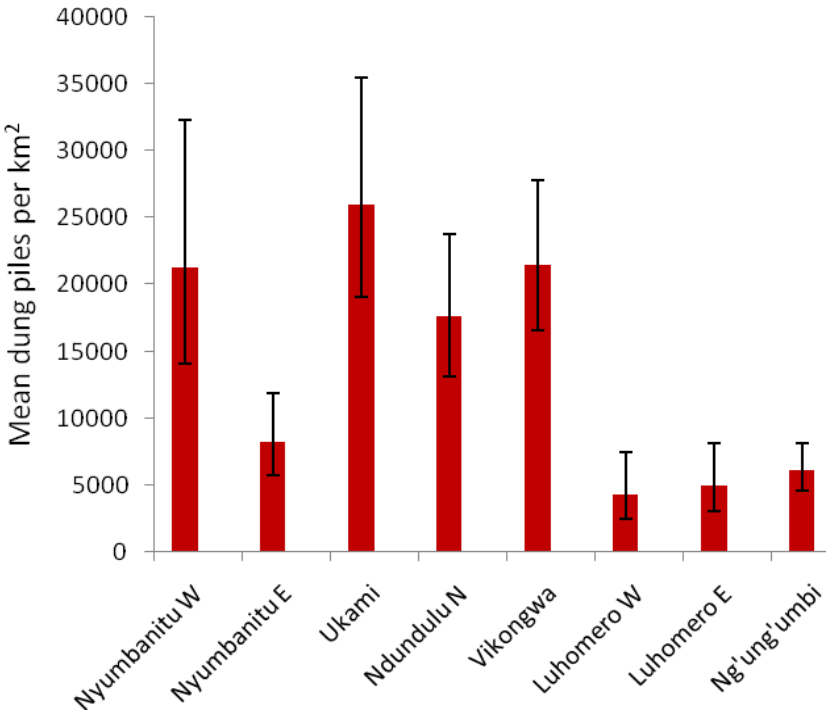

Figure 13. Estimated dung density of the forest antelope guild (red duiker, Abbott's duiker, blue duiker, suni and bushbuck combined) at each of the 8 sites sampled.

At Ng'ung'umbi, overall density of forest antelopes compares well to its closest two sites on Luhomero mountain. These three sites share a similar altitudinal range above 1600 m asl,

and are dominated by the montane forest habitat type, and these two factors probably best explain the relatively low overall density of antelopes compared to the other, lower altitude, submontane forest sites. Nevertheless, the presence of Abbott's duiker, which is Endangered (Moyer *et al*, 2006), in decline, and limited to only a handful of remaining forests – all of them in Tanzania – is a significant finding, and adds to the value of Ng'ung'umbi and the whole of the Ndundulu-Luhomero massif.

Elephants

As with the forest antelopes, the perpendicular distance of each elephant dung pile from the transect was measured, and the resultant datasets from all sites were conducive to DISTANCE analysis. No elephant sign was recorded at Ndundulu N, while densities at the other sites, as generated using DISTANCE 6.0, varied from about 200 piles/km^2 at Nyumbanitu W up to 11,402 piles/km^2 at Ng'ung'umbi (figure 14). The half-normal model gave the best fit to the data most often (60% of sites), usually after truncating the data from 250-600 cm. While some outlying piles were detected up to 10 m from the line (note that elephant dung boli may be larger than a football, while antelope dung piles are never larger than a tennis ball), the majority of records were from less than 5 m from the centre of the line, giving an average effective strip-width for recording elephant dung of 5-10 m, depending on the thickness of the ground level vegetation. Excluding Ndundulu N and Nyumbanitu W because it had a very small sample size, Coefficients of Variance at 95% confidence limits averaged around 0.25 across all sites (range = 0.16-0.56, median = 0.24, mean = 0.28), which is consistent with other published analyses of elephant dung transect data using DISTANCE (Plumptre, 2000). Generally, 80-95% of this variance derived from encounter rate, while only 5-20% of variance came from detection probability, indicating appropriate methodology for recording these kinds of data, and good fit of the data to the model.

The highest dung densities were found at Luhomero E and Ng'ung'umbi, tracts of montane forest with bamboo (1600-2200 m asl) within the well protected UMNP, which are the two most remote sites of all those sampled.

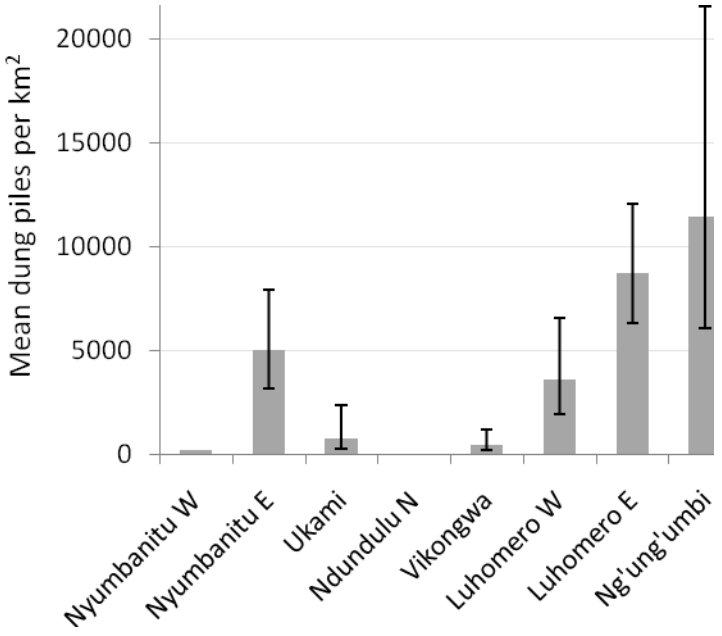

Figure 14. Estimated dung density of elephants at each of the 8 sites sampled.

Ng'ung'umbi had the highest elephant dung density of all sites sampled, followed by Luhomero E. Both of these sites are remote, lie within the well protected UMNP, are of similar altitude (1600-2200 m asl), and contain tracts of montane forest with bamboo – which appears to be a favourite food of Udzungwa elephants (K. Nowak & T. Jones, unpubl. data). At the edge of the open wet valleys in Ng'ung'umbi are impressively large, well established elephant (and buffalo) wallows (figure 2). This area is clearly of great importance for the Udzungwa elephant population.

3.2.2 Opportunistic mammal records

Several records of mammals were made opportunistically during the expeditions, along survey walks and when moving between transects. Most notably, the presence of the following mammals not recorded on transects or by camera traps was noted:

1. Lion *Panthera leo*: dung observed, Ng'ung'umbi swamps
2. Otter (probably African clawless otter *Aonyx capensis*): dung observed, Ng'ung'umbi swamps
3. Crested porcupine *Hystrix cristata*: quill found, Ng'ung'umbi forest
4. (Probable) bush rat *Aethomys sp*.: abundant in the highland swamps of Ng'ung'umbi; a dead individual was found and photographed (Figure 15)

Figure 15. Probable bush rat *Aethomys sp.* (identification tentative pending collection; thanks to W.T. Stanley, Field Museum of Chicago, for assistance). Abundant in the swamps of Ng'ung'umbi, at 2000m asl.

On one occasion, a group of 13 buffalo including two infants was seen in the Ng'ung'umbi swamp. Two groups of elephants were counted: a cow-calf group of 7 individuals close to a bamboo patch at 2000m asl, and a group of 4 bulls disturbed in the Ibito valley at 1600m asl.

All of these mammals are included in the final site list (Appendix 1).

3.2.3 Camera trapping survey

17 cameras running for a total of 639 trap-days (mean of 37.6 trap-days per camera) took 710 photos of animals, equaling 499 captures (after same-species photos within the same 24-hour period are removed). 22 mammals and 3 bird species were recorded (Table 2).

Table 2. Summary of camera-trapping results for all species photographed (in alphabetical order of common name), with pooled capture rate from all 17 cameras, total number of photos, and the number of camera stations at which each species was photographed.

Species	Capture rate[1]	Number of photos	Number of stations
aardvark	0.020	14	9
Abbott's duiker	0.036	29	1
orange ground-thrush	0.002	1	1
blue duiker	0.041	47	5
buffalo	0.011	8	8
bushbuck	0.014	9	5
bushpig	0.016	16	5
bushy-tailed mongoose	0.013	9	2
Elephant	0.025	36	10
giant pouched rat	0.108	94	9
honey badger	0.020	14	3
leopard	0.005	3	2
marsh mongoose	0.003	2	1
palm civet	0.002	1	4
olive pigeon	0.025	19	14
red duiker	0.155	178	4
grey-faced sengi	0.013	8	6
servaline genet	0.042	27	1
slender mongoose	0.002	1	3
spotted hyena	0.006	4	2
squirrel	0.003	2	15
suni	0.196	170	3
Sykes' monkey	0.005	3	4
Udzungwa forest-partridge	0.019	13	4
unknown rat	0.002	1	1

[1] Capture-rate = number of captures divided by number of trap-days (see Methods section 2.2.3 for more details)

The species-accumulation curve for this camera-trapping survey indicates that the total sampling effort of 639 trap-days was adequate to record the great majority of detectable mammal species present (figure 16). 19 out of the 22 mammal species recorded were captured after 204 trap-days; between 500 and 639 trap-days, three additional, more elusive species were added to the list.

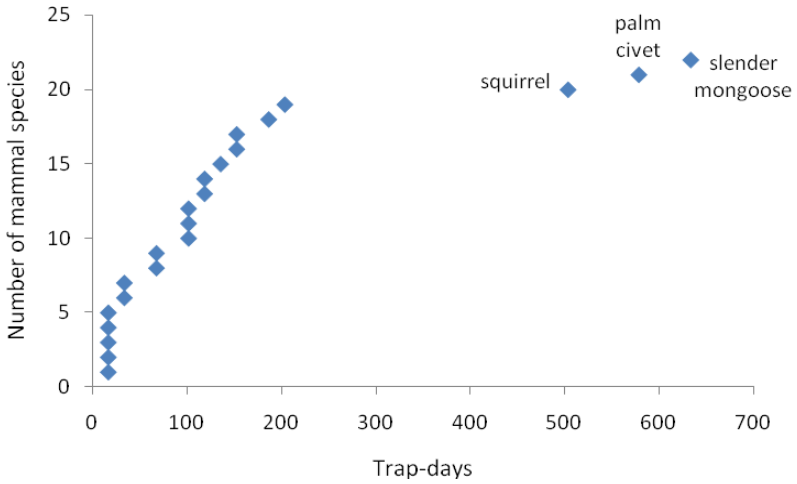

Figure 16. Species accumulation curve over the Ng'ung'umbi camera-trap sampling period.

Figure 17 below compares the frequency with which each species was recorded against the number of camera-trap stations at which it was recorded. Thus the red bars represent the capture rate of each species across all 17 camera-traps pooled, representing a crude proxy of density across the study site. Green bars represent the number of camera traps at which each species was captured, giving a crude indication of occupancy across the study site. These results suggest, for example, that suni and red duiker are found throughout the study site and in high density, while Abbott's duiker, honey badger and bushbuck are fairly widely distributed but at relatively low density.

One special result of this survey is the first confirmation of the presence of the recently described grey-faced sengi *Rhyncocyon udzungwensis* (Rovero *et al*, 2008). These new records extend the known range of this rare and extraordinary Udzungwa-endemic animal.

Despite the absence of kipunji, the camera-trap survey was successful in revealing the exceptional diversity of the medium to large mammal community of Ng'ung'umbi and the Ndundulu-Luhomero massif. Other noteworthy species found at Ng'ung'umbi include the Endangered Abbott's duiker together with four other antelope; Lowe's servaline genet; three sympatric species of mongoose; elephant and buffalo; and a diverse large carnivore community comprising honey badger, otter, spotted hyena, leopard and lion.

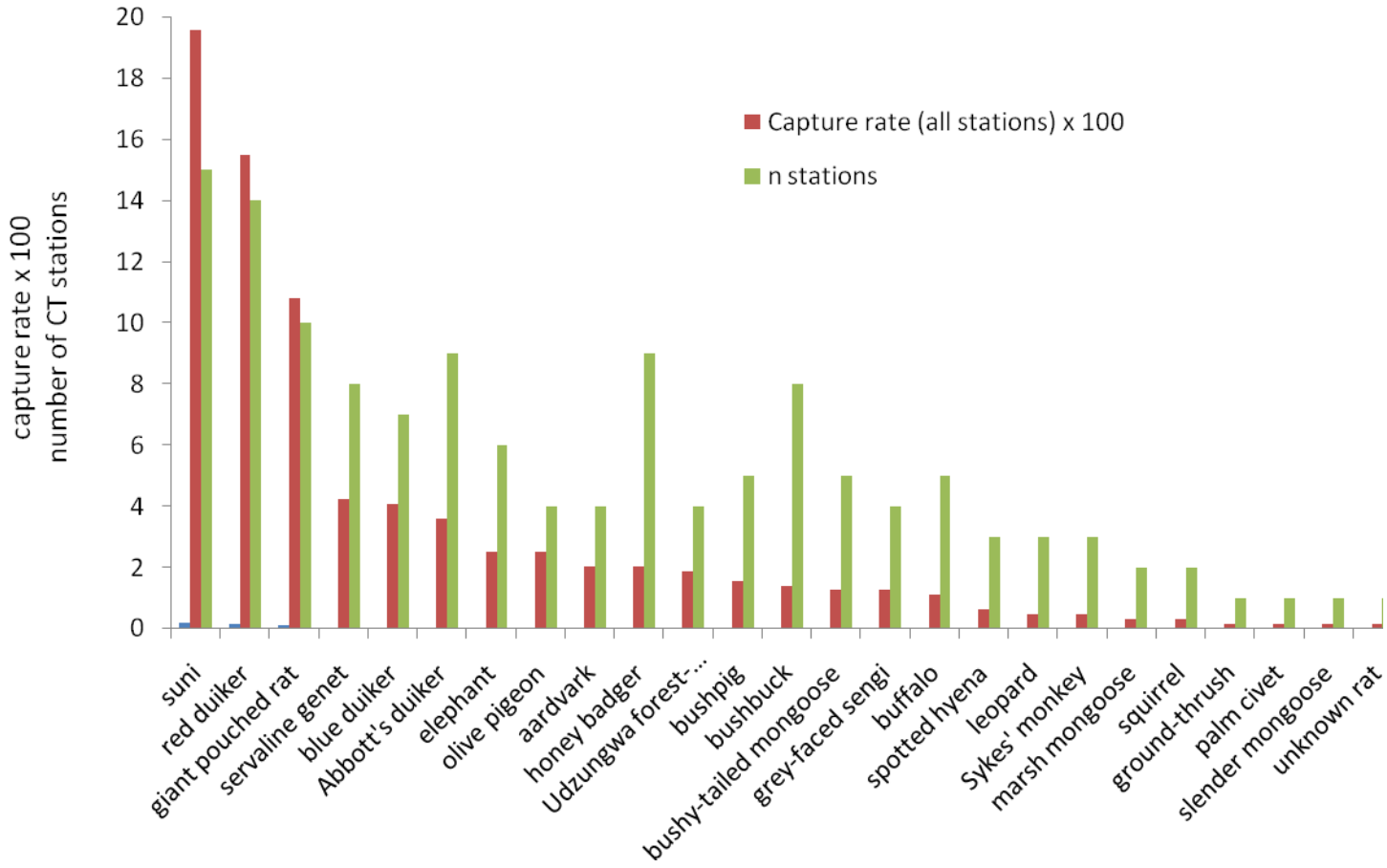

Figure 17. Animals caught on camera-traps at Ng'ung'umbi, November 2010 to January 2011. Y-axis gives a measure of (a) capture-rate times 100, and (b) the actual number of camera-traps from which each species was recorded. Thus red bars represent the relative capture rate of each species across all 17 camera-traps pooled; green bars show the number of camera traps at which each species was captured.

3.3 Birds and Reptiles

61 bird species were recorded in total at Ng'ung'umbi over the three expeditions. These include the endemic Udzungwa forest-partridge *Xenoperdix udzungwensis* (Dinesen *et al*, 1994), which were observed on one occasion and also captured on camera-trap a total of 13 times, at 4 different camera-trap stations (capture rate = 0.019; Appendix 2). Two other bird species were captured on the camera-traps: olive pigeon *Columba arquatrix* and orange ground-thrush *Zoothera gurneyi* (table 2, figure 17).

The provisional bird list for Ng'ung'umbi, based on all these records and checked against previous data from this and other sites of the area (Marshall *et al*, 2001; Jones & Rovero, 2003; Jones, unpubl. data) is given below, together with the recorded altitudinal range for each species (Table 3).

One reptile was identified to species level (thanks to M. Menegon, Trento Museum of Natural Sciences for expert verification) from the Ng'ung'umbi swamps: the grey-bellied grass snake *Psammophylax variabilis.*

Table 3. Provisional bird list for Ng'ung'umbi plateau

Species		**Altitude (m asl)**
Hamerkop	*Scopus umbretta*	2000
Little sparrowhawk	*Accipiter minullus*	1500
African harrier-hawk	*Polyboroides typus*	2000
Mountain buzzard	*Buteo oreophilus*	2100
Common buzzard	*Buteo buteo*	1600
Bateleur	*Terathopius ecaudatus*	2000
Long-crested eagle	*Lophaetus occipitalis*	1800
Verreaux's eagle	*Aquila verreauxii*	2100
African crowned eagle	*Stephanoaetus coronatus*	1800-2000
Martial eagle	*Polemaetus bellicosus*	2000
Scaly francolin	*Francolinus squamatus*	2050
Udzungwa forest-partridge	*Xenoperdix udzungwensis*	1800
Wood sandpiper	*Tringa glareola*	2100
Olive pigeon	*Columba arquatrix*	2100
Lemon dove	*Aplopelia larvata*	1700-1800
Livingstone's turaco	*Tauraco livingstonii*	1700-2100
Barred long-tailed cuckoo	*Cercococcyx montanus*	1700
African wood owl	*Strix woodfordii*	2000

Fiery-necked nightjar	*Caprimulgus pectoralis*	2100
Scarce swift	*Schoutedenapus myoptilus*	1800
Speckled mousebird	*Colius striatus*	2100
Bar-tailed trogon	*Apaloderma vittatum*	1600-2100
Green wood-hoopoe	*Phoeniculus purpureus*	1800
Crowned hornbill	*Tockus alboterminatus*	2000
Trumpeter hornbill	*Bycanistes bucinator*	1550
Silvery-cheeked hornbill	*Bycanistes brevis*	1800-2100
African broadbill	*Smithornis capensis*	1800
Mosque swallow	*Hirundo senegalensis*	1700-2100
Black saw-wing	*Psalidoprocne holomelas*	1500-1800
White-headed saw-wing	*Psalidoprocne albiceps*	2050
Green-throated greenbul	*Andropadus nigriceps chlorigula*	2000
Orange ground-thrush	*Zoothera gurneyi*	2050
Spot-throat	*Modulatrix stictigula*	1700-2000
White-starred robin	*Pogonocichla stellata*	1700-1800
Swynnerton's robin	*Swynnertonia swynnertoni*	1700
Sharpe's akalat	*Sheppardia sharpie*	1800-2000
Olive-flanked robin-chat	*Cossypha anomala*	2000
African stonechat	*Saxicola torquata*	2000
Evergreen forest warbler	*Bradypterus lopezi*	1700-2100
Rattling cisticola	*Cisticola chiniana*	2000-2100
Yellow-bellied hyliota	*Hyliota flavigaster*	1900
African tailorbird	*Orthotomus metopias*	1800
Chapin's apalis	*Apalis chapini*	1800-1900
Bar-throated apalis	*Apalis thoracica*	1800-2000
Ashy flycatcher	*Muscicapa caerulescens*	2000
White-tailed crested-flycatcher	*Elminia albonotata*	1900
Forest batis	*Batis mixta*	1600-1900
African hill-babbler	*Pseudoalcippe abyssinica*	1700
Malachite sunbird	*Nectarinia famosa*	2100
Moreau's sunbird	*Cinnyris loveridgei x mediocris*	2000-2100
Variable sunbird	*Cinnyris venustus*	1900-2100
Collared sunbird	*Hedydipna collaris*	2100
Fulleborn's black boubou	*Laniarius fuelleborni*	1900
Square-tailed drongo	*Dicrurus ludwigii*	1700
White-naped raven	*Corvus albicollis*	1600-2100
Kenrick's starling	*Poeoptera kenricki*	1900
Waller's starling	*Onychognathus walleri*	2000-2100
Red-winged starling	*Onychognathus morio*	2000-2200
Forest weaver	*Ploceus bicolor*	1700
Fawn-breasted waxbill	*Estrilda paludicola*	2000
Yellow-browed seedeater	*Serinus striolatus whytii*	2000

3.4 Threats

A rapid assessment of threats to the habitats and endangered plant and animal communities of Ng'ung'umbi, and the surrounding area, was made during each of the site visits. Comparing data from the mammal surveys with results from other comparable sites, as done in this report, also helps to evaluate of the status and health of the area's endangered mammal populations, and the faunal community as a whole.

While trekking to camp from the UMNP Mbatwa Ranger Post at the start of our first survey in July 2010, in the Ibito Valley area about 3km north of the Ng'ung'umbi forest, we spotted two male poachers carrying large elephant tusks (TANAPA rangers were informed and pursued them on foot from the Msosa Ranger Post). On two occasions at camp in August 2010, at about 2000m asl, we heard gunshots about 1 km away. Pit-traps dug to catch elephants among the bamboo patches were also found, but these were all old (dug >10 years ago). Other illegal activities such as cutting of trees and poles, or setting of snares, were not observed.

Despite the confirmed absence of kipunji, the study area was found to harbour an exceptional diversity of medium to large mammals, consistent with other areas of the Ndundulu-Luhomero massif. Compared with many other forests of the Udzungwa Mountains (Jones, in prep.), several of these species are found in high density including elephants and the Endangered Abbott's duiker. This latter species is endemic to Tanzania but has been extirpated in recent decades from several forests, leaving its few sites within the Udzungwa Mountains as its only remaining stronghold (Rovero *et al*., in press). Ng'ung'umbi is also an important site for Udzungwa-endemic species including the Udzungwa red colobus and the grey-faced sengi.

Overall, we conclude that the remoteness of this area of Luhomero-Ndundulu, within the Udzungwa Mountains National Park, has in recent decades largely preserved the special habitats, plants and animals of the area from the kinds of disturbance and overexploitation which is occurring in other parts of the Udzungwa Mountains (e.g. Rovero *et al*, 2010). However, illegal hunting is occurring, including of elephants for ivory (and possibly meat also). Considering the current local and national upward trends in both elephant poaching for ivory, and poaching in general (UMNP Protection Department, unpubl. data; forthcoming National Elephant Management Plan; EIA, 2010; various media sources), this is a cause for concern. We have found that Ng'ung'umbi, with its abundance of bamboo, is an important refuge area for the Udzungwa elephant population. It is therefore imperative that the UMNP rangers extend their foot patrols into this remote area as much as possible, and that the UMNP be continuously supported in these efforts.

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Appendix 1. Checklist of mammals recorded at Ng'ung'umbi

Scientific name	Common name	Recorded	Red list status
Primates			
Cercopithecidae			
Cercopithecus mitis cf moloneyi	Sykes' monkey	O	LC
Colobidae			
Procolobus gordonorum	Udzungwa red colobus	O	VU
Colobus angolensis palliatus	Angolan colobus	O	LC
Macroscelidea			
Macroscelididae			
Rhynchocyon udzungwensis	Grey-faced elephant-shrew	C,O	VU
Rodentia			
Nesomyidae			
Cricetomys gambianus	Giant pouched rat	C,D,O	LC
Sciuridae			
Paraxerus lucifer	Tanganyika mountain squirrel	C,O	DD
Hystricidae			
Hystrix cristata	Crested porcupine	D(quill)	LC
Carnivora			
Mustelidae			
Aonyx capensis	African clawless otter	D	LC
Mellivora capensis	Honey badger	C,D	LC
Viverridae			
Genetta servalina lowei	Lowe's servaline genet	C,D	LC
Nandiniidae			
Nandinia binotata	African palm civet	C	LC
Herpestidae			
Herpestes sanguine	Slender mongoose	C	LC
Atilax paludinosus	Marsh mongoose	C,D	EN
Bdeogale crassicauda	Bushy-tailed mongoose	C	LC
Hyaenidae			
Crocuta crocuta	Spotted hyena	C,D	LC
Felidae			
Panthera pardus	Leopard	C,D	LC
Panthera leo	Lion	D	VU
Tubulidentata			
Orycteropodidae			
Orycteropus afer	Aardvark	C,D(hole)	LC

Hyracoidea			
Procaviidae			
Dendrohyrax arboreus	Eastern tree hyrax	D,O	LC
Proboscidea			
Elephantidae			
Loxodonta africana	African elephant	C,D,O	VU
Artiodactyla			
Suidae			
Potamochoerus larvatus	Bush pig	C,D	LC
Bovidae			
Philantomba monticola	Blue duiker	C,D	LC
Cephalophus harveyi	Harvey's duiker	C,D,O	LC
Cephalophus spadix	Abbott's duiker	C,D	EN
Neotragus moschatus	Suni	C,D	LC
Syncerus caffer	African buffalo	C,D	LC
Tragelaphus scriptus	Bushbuck	C,D,O	LC

C = camera-trapped
D = dung or other sign
O = observation (seen or heard)

Appendix 2. Gallery of mammals captured on camera-trap at Ng'ung'umbi

1. Sykes' monkey *Cercopithecus mitis moloneyi*

2. Grey-faced sengi *Rhyncocyon udzungwensis*

3. Squirrel *Paraxerus sp.*

4. Giant pouched rat *Cricetomys gambianus*

5. Honey badger *Mellivora capensis*

6. Slender mongoose *Herpestes sanguinea*

7. Marsh mongoose *Atilax paludinosus*

8. Bushy-tailed mongoose *Bdeogale crassicauda*

9. Spotted hyena *Crocuta crocuta*

10. Servaline genet *Genetta servalina*

11. African palm civet *Nandinia binotata*

12. Leopard *Panthera pardus*

13. Aardvark *Orycteropus afer*

14. African elephant *Loxodonta africana*

15. Bushpig *Potamochoerus larvatus*

16. African buffalo *Syncerus caffer*

17. Bushbuck *Tragelaphus scriptus*

18. Blue duiker *Cephalophus monticola*

19. Harvey's duiker *Cephalophus harveyi*

20. Abbott's duiker *Cephalophus spadix*

21. Suni *Neotragus moschatus*

…and one special bird: Udzungwa forest-partridge *Xenoperdix udzungwensis*