

Herpetological survey of the Niassa Game Reserve, northern Mozambique – Part I: Reptiles

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Abstract. Significant contributions to the poorly known reptile fauna of northern Mozambique were made during a biodiversity survey of the Niassa Game Reserve (NGR), situated in northern Mozambique, bordering Tanzania. Of approximately 100 reptile species currently known from northern Mozambique, 57 species were recorded from the NGR. Important discoveries included: a new species of girdled lizard (*Cordylus* sp.) in rock cracks on the summit outcrops of Serra Mecula; the first national records of *Melanoseps* sp. and *Lygodactylus angularis* (both isolated populations are atypical and further studies are required to assess their taxonomic status); the first records for northern Mozambique for *Chirindia swynnertoni*, *Lygodactylus chobiensis*, *Pachydactylus punctatus*, *Elasmodactylus tetensis*, and *Latastia johnstoni*; the most northerly records of *Pachydactylus punctatus*, *Agama kirkii*, and *Gerrhosaurus vallidus*; an unusual population of *Bitis arietans* whose taxonomic status require further analysis; and a population of *Cycloderma frenatum* in the Lugenda River that fills a large gap in the species' known distribution.

Key words. Reptilia: Squamata, Chelonia, Crocodylia, Mozambique; distribution; life history; taxonomy.

Introduction

The herpetofauna of northern Mozambique remains one of the most poorly known in Africa. This is a consequence of the inaccessibility of the region in general and the protracted civil war in particular. The southern part of the country, i.e. south of the Zambezi River, has traditionally been incorporated into the southern African region and its fauna has been dealt with in numerous reviews of the subcontinent (e.g. BRANCH 1998, CHANNING 2002). However, the region north of the Zambezi, including the provinces of Zambezia, Nampula, Niassa and Cabo Delgado, remains scientifically poorly known and many regions lack even preliminary surveys. In a zoogeographic analysis of the amphibians of the 'Zambesiaca' area (Botswana, Zambia, Malawi, Mozambique, Zimbabwe, and eastern Caprivi Strip), POYNTON & BROADLEY (1991) noted that large tracts of northern Mozambique were poorly known or uncollected, and only 23 localities for any amphibian were known for the area 14° to

18° S and 36° to 42° E, with most restricted to the coastal region. Reptile collections from the region are similarly meagre.

As part of a formal biodiversity survey of the Niassa Game Reserve (NGR) organised by the Sociedade para e Gestão e Desenvolvimento da Reserva do Niassa (SGDRN), a survey of the herpetofauna was undertaken in the period from 19 October to 7 November 2003. The reptile discoveries made during this survey are documented below. The results of the amphibian survey will be presented in Part II (BRANCH et al. in prep.).

Study Site

The NGR is situated in northern Mozambique, Niassa Province, adjacent to the Rovuma River, the border with Tanzania (Fig. 1a). The core area of the NGR lies between the Rovuma and Lugenda rivers from around 36°25'E eastwards to their confluence. At present it covers 23,040 km², with a surrounding buffer zone of hunting blocks

(19,239 km²), giving a total under the jurisdiction of SGDRN (Sociedade para e Gestão e Desenvolvimento da Reserva do Niassa) of 42,279 km² (Fig. 1b). Multiple use is allowed within the reserve, which includes a District Centre (Mecula) with an estimated human population of 12,000. The NGR is one of the largest protected Miombo forest ecosystems in the world, and is the largest conservation area in Mozambique. The landscape is mostly gently undulating plateau at 300-600 m altitude, rising to a high plateau and hills in the West at around 1,370 m and gradually falling to 150 m at the confluence of the Rovuma and Lugenda rivers at the northeastern boundary. Much of the plateau is covered in dry to mesic Miombo woodland on relatively sandy, nutrient-poor soils. The eastern and central parts are dominated by scattered granite inselbergs rising out of the plain to 600-800 m a.s.l. (Fig. 2). The microclimate of these inselbergs is harsh for plant growth, although a variety of discrete forest patches are associated with fire-protected gullies that funnel water draining from the granite exposures.

The NGR has a tropical climate, with a warm and rainy summer and a cool, dry winter. Temperatures range from 15-30 °C during summer and from 10-20 °C in winter. Annual rainfall is usually less than 1000 mm, with rarely more than 2-3 mm per month of rain during winter, and from 200-230 mm per month in December-January.

The vegetation of the region is complex. WHITE (1983) initially referred the area to "Drier Zambezian Miombo woodland (*Brachystegia/Julbernardia*)" with intrusions of East African coastal elements along the Rovuma and Lugenda rivers. The NGR was subsequently included within the Miombo Ecoregion, which comprises Caesalpinoid woodlands (FROST et al. 2002, TIMBERLAKE & CHIDUMATO 2002). This ecoregion (essentially tropical dry woodland) covers more than 3 million km² and extends northwards to Angola and southern Democratic Republic of Congo (DRC), and as far south as the tropical bush lands of South Africa. Much of the

Miombo Ecoregion, including the NGR, lies on the Central African Plateau, a flat area of undulating woodlands and grasslands that track the upland drainage of the plateau.

TIMBERLAKE et al. (2003) recognised four broad vegetation groups within the NGR. Miombo woodland with a well-developed grass layer that is dominated by *Brachystegia* and *Julbernardia* and covers 95% of the NGR. It is well developed along the Mecula-Mbatamila watershed, where it is interspersed with hydromorphic grasslands (dambos). On steeper slopes, especially in areas of secondary growth, bamboo thickets (*Oxytenanthera abyssinica*) are common. Riverine woodland and forest are confined to alluvial soils associated with the major rivers, particularly the Lugenda River, where they form a narrow band 20-500 m wide. Granitic inselbergs (Fig. 2) dominate the landscape and show a stratification of vegetation depending upon exposure. The mostly bare rock slopes are exposed to desert-like conditions, with vegetation dominated by the Resurrection Bush (*Myrothamnus flabelliforme*), the sedge *Coleochloa* sp., and succulents such as *Aloe*, *Euphorbia* and *Kalanchoe*. Gullies and the foot slopes contain more nutrient-rich and moister soils, and support thick woodland that becomes forest in association with the large inselberg complexes. Serra Mecula is the highest point in the NGR and is an incised range that rises to 1,442 m a.s.l. It contains two vegetation types not found elsewhere in the area. The mountain plateau, at around 800-1,000 m a.s.l., comprises *Brachystegia* woodland, which is now mostly destroyed in the southern and eastern parts and replaced with fire-maintained sub-climax grassland with bracken and scattered shrubs and small trees. Denser forest or woodland is found along the deeply incised streams that drain centrally along the bisected range. Small patches of evergreen moist forest (1-5 ha in size) occur at higher altitude (1,000-1,300 m), or are associated with gullies below the larger peaks. These contain species commonly associated with the eastern African escarpment from Ethiopia

to South Africa. A scrub vegetation of low, scattered trees and a range of herbs and succulents is associated with the highest peaks, and is similar to that found in moist situations in eastern Zimbabwe and the Malawi massifs. TIMBERLAKE et al (2003) concluded that Serra Mecula was an outlier of upland or montane vegetation associated with the Afromontane archipelago, and is of great conservation significance.

Materials and methods

Specimens were mainly located opportunistically, during visual and acoustical surveys of all habitats by up to four people. Surveys were undertaken during the day and during the evening. As access within the NGR is very difficult during the rainy season, the survey was undertaken at the end of the long dry season (July-November), before the first rains had fallen.

Our survey was supplemented with additional records collected during fieldwork in the region during the fish and carnivore surveys, and included: a small numbers of amphibians and terrapins during the freshwater fish survey (R. BILLS, 14-26 August 2003); frogs and reptiles collected opportunistically during a small carnivore survey (K. and C. BEGG, 2003-2004); frogs and reptiles collected opportunistically around the Lusingi Hunting lodge (D. LITTLETON and J. WILSON, Lewire Hunting Concession, Block C, 2004); a small series of snakes collected at Mbatamila (NGR) by C. MACKIE (1999) and deposited in the National Museum, Bulawayo, Zimbabwe (NMZB) (D. BROADLEY pers. comm.). Collecting localities are detailed in Appendix 1.

To supplement opportunistic collecting, habitats were also sampled using arrays of funnel and pitfall traps placed along drift fences. The construction and installation of drift fences and funnel traps are detailed in BRANCH & RÖDEL (2003). Trap lines were set in different microhabitat types, including: 1. Mbatamila camp (location 3, Appendix 1),

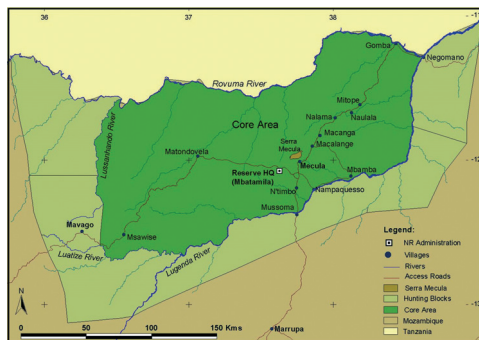


Fig. 1. (A) Location of Niassa Game Reserve in northern Mozambique; (B) Niassa Game Reserve, showing core area, surrounding hunting blocks, human settlements, drainage lines and Serra Mecula (courtesy of SGRDN).

19-26 October 2003, two drift fences, each 30 m long and with 3 pitfall traps and 7 and 8 funnel traps respectively, were installed along a dry streambed, between small pools of water in sandy substrate maintained by elephant activity, and 2. Serra Mecula (location 24, Appendix 1), 26 October- 2 Novem-

ber 2003, one drift fence, 30 m long set along edge of small swamp in evergreen forest, with 3 pitfall traps and 8 funnel traps (Fig. 3).

Voucher specimens were collected, anaesthetized and killed in a chlorobutanol solution (amphibians) or by injection with 'Euthanse' (reptiles). Thereafter they were fixed in 10% formalin, before being transferred to 50% isopropanol for long-term storage. Vouchers were deposited in the collections of the Port Elizabeth Museum (PEM), South Africa, and a representative collection of specimens was lodged in the National Museum of Mozambique, Maputo. Tissue samples (amphibians: toe tips; reptiles: liver or tail tips) of most species were preserved in 95% ethanol. Catalogue numbers and localities (in brackets) for vouchers are given in Appendix 2. Abbreviations used are: BL = body length; TL = tail length.

Species accounts

A number of reptiles collected were widespread species that did not include new insight into the species' taxonomy, biology or distribution. They include: *Agama armata* PETERS, 1854; *Acanthocercus atricollis* (A. SMITH, 1849); *Chamaeleo dilepis* LEACH, 1819; *Trachylepis striata* (PETERS, 1844); *Varanus niloticus* (LINNAEUS, 1766); *Rhinotyphlops mucrosa* (PETERS, 1854); *Python natalensis* A. SMITH, 1840; *Lycophidion capense* (A. SMITH, 1831); *Rhamphiphis rostratus* PETERS, 1854; *Psammophis mossambicus* PETERS, 1882; *Philothamnus semivariatus* A. SMITH, 1847; *Telescopus semiannulatus* A. SMITH, 1849; *Meizodon semiornatus* (PETERS, 1834); *Thelotornis capensis oatesii* (GÜNTHER, 1881); *Dispholidus typus* (A. SMITH, 1829); *Naja mossambica* PETERS, 1854; *Dendroaspis polylepis* GÜNTHER, 1864; *Causus rhombeatus* (LICHTENSTEIN, 1823); and *Pelusios sinuatus* (A. SMITH, 1838). Localities and vouchers details for these species are included in Appendix 2. Remarks on the significance of the other species are given below.

Selected species list

Elasmodactylus tetensis (LOVERIDGE, 1953) – A usually solitary, rupicolous species that prefers deep, wide cracks on isolated boulders, or large exfoliating flakes on exposed bedrock or inselbergs. Isolated populations are known from southern Tanzania (Liwale and Lumesule River, BROADLEY & HOWELL 1991), but it has not been recorded north of the Zambezi River Valley in Mozambique (BROADLEY 1966, BLAKE 1965). Current generic assignment follows BAUER & LAMB (in press).

Pachydactylus punctatus PETERS, 1854 – A small, terrestrial gecko found under flat rocks on bedrock and sand on inselbergs and Serra Mecula. Single clutches of paired hard-shelled eggs were found in sand pockets below rocks on bedrock. BROADLEY (2003) noted that the population in Upemba Park, Katanga, is isolated and may represent a taxonomic novelty. The *Mecula* specimens represent a considerable range extension within Mozambique, with the previous northern limit being from the type locality at Tete (BROADLEY 1966). The species is not known from adjacent southern Tanzania (BROADLEY & HOWELL 1991, BROADLEY 2003).

Chondrodactylus turneri (GRAY, 1864) – A large adult was collected active in the early evening on flat ground on the Lugenda floodplain. Current generic assignment follows BAUER & LAMB (in press).

Hemidactylus platycephalus PETERS, 1854 – It is common around human habitation in Mbatamila, Lechengwe, and Mecula, and also found on trees in floodplain habitats, on inselbergs and bedrock outcrops in Miombo woodland, as well as on Serra Mecula. It is vocal, the call consisting of a series of 10-19 clicks, usually given around sunset. The partly-digested remains of one gecko were found in a *Lamprophis capensis*. A series of six eggs measured from 11.2-11.8 x 10.1-11.2 mm (mean 11.6 x 10.7 mm).

Hemidactylus mabouia (MOREAU DE JONNES, 1818) – Wide-spread and usually found in rock cracks. One was found in a tree hole and others on buildings with *H. platycephalus*. Two eggs measured from 9.2-9.3 x 8.0-8.1 mm.

Lygodactylus capensis (A. SMITH, 1849) – The commonest and most widespread dwarf day gecko in NGR. A number of specimens were captured in funnel traps in the dry bed of the stream at Mbatamila indicating that the species, at least occasionally, forages terrestrially. Two specimens from the Serra Mecula uplands were darker than those from the lowland, with dusky infusions to the sides of belly and throat. A series of six eggs measured from 11.2-11.8 x 10.1-11.2 mm (mean 11.6 x 10.7 mm).

Lygodactylus grottei STERNFELD, 1911 – Common on the reed walls of the hunting concession camp at Lusingi in riverine forest along the Lugenda River and on buildings at Napata Camp, approximately 70 km upstream of Lusingi. Treated as a subspecies of *L. capensis* by BROADLEY & HOWELL (1991) and SPAWLS et al. (2002). Although not found in strict syntopy with *L. capensis*, *L. grottei* shows no signs of intergradations in the diagnostic subcaudal condition. Both species also occur together at Moma, coastal Nampula Province (W.R. BRANCH unpub. obs.), where again the two putative subspecies occur in close geographic proximity without intergradation. The two taxa are consequently treated as separate species.

Lygodactylus angularis GÜNTHER, 1893 – Restricted to moist evergreen forest on the summit of Serra Mecula. All specimens, except hatchlings, were collected on thin (10-20 cm diameter) tree trunks, where they sheltered in knotholes. Up to four individuals were collected from the same tree. A massive communal egg-laying site with over 500 eggs was discovered behind an exfoliating, northeast-facing flake (approximately 30 cm wide and 50 cm deep) on a large boulder about 4 m

from the edge of a patch of montane evergreen forest. Many eggs were old and had hatched, and the site appeared to represent many years of accumulated eggs. Other egg sites of 8-13 eggs were discovered under flat boulders on bedrock at the forest edge, and in small holes in an upright small dead tree. A series of 19 eggs measured 5.9 x 7.3 mm (mean 5.5 x 6.9 mm). A recent hatchling measured 13 mm BL + 11 mm TL. This arboreal species has a curiously disjunct distribution, and is known from scattered localities in Malawi and northern Zambia (BROADLEY & HOWELL 1991, HAAGNER et al. 2000). Specimens from DRC and adjacent north-west Zambia, previously treated as a northern subspecies (*L. a. heeneni*) were raised to specific status by HAAGNER et al. (2000). BROADLEY (2000b) recorded a northeastern extension of the species in low altitude Miombo woodland in the Kiolmbero valley, Ulanga District, Tanzania (08°03'S, 36°02'E). The records of SPAWLS et al. (2002) from southern Kenya are a considerable northern disjunction and require confirmation. The species has not been previously recorded from Mozambique.

Lygodactylus cf. *chobiensis* FITZSIMONS, 1932 – The species was rare in the NGR, and localised to small populations in thick Miombo woodland, where it climbed 2-3 m high on small saplings. In all voucher specimens the mental lacked a pair of posterior clefts, and was bordered by three sub-equal granules; the rostral narrowly entered the nostril on both sides in both Mbatamila females, but was separated from the nostril on both sides in the Lugenda male and on one side in the Lugenda female; the nasals were separated usually by a single granule (two in one); the tail was verticillate, with 6-7 rows of small granules on the dorsal surface and three enlarged median subcaudals per vertical. In coloration, a bright yellow stripe runs from the chest to the cloaca along the centre of the belly; the head had faint yellow highlights, particularly on the snout; a dark band runs from the snout, through the eye to the



Fig. 2. Inselbergs and Lugenda River, southern Niassa Game Reserve.



Fig. 3. Evergreen forest on Serra Mecula, area of the drift fences.

forelimb insertion; the neck was light grey-yellow with a band of 3 blotches on each side of the midline; lower labials bright yellow in one specimen, yellowish in other, which had more dusky throat markings; throat coloration

varied, usually with a prominent pale, dark-edged pale V-shape (apex directed forwards) that may appear as paired dark V-shapes, or as a pale V on a dusky throat (the throat of the single male was heavily infused with blue-grey obscuring the V-shape); body grey with scattered light-centred, dark blotches on upper flanks and tail (up to 9-10 blotches on original tail); lower surface of tail grey; yellowish tinge below limbs; the colour darkens with stress, making the pale-centred dorsolateral spots on body and tail more prominent.

The taxonomic assignment of the specimens is problematic. In body coloration, lack of mental clefts, verticillate tail and enlarged median subcaudals, the specimens resemble both *L. chobiensis* and *L. gutturalis*. The throat markings most resemble *L. gutturalis* (see illustration in RÖLL 2003), but the rostral condition (entering nostril in *chobiensis*, excluded in *gutturalis*) is intermediate. BROADLEY (2000a) notes that *L. chobiensis* is the southernmost species of the *L. picturatus* complex and appears to be a derivative of the widespread *L. gutturalis*. The former is largely restricted to the upper and middle Zambezi valley, but BROADLEY (1971) also recorded it at Lusaka. The most northerly record for the species is from Chingola (HAAGNER et al. 2000), and it is currently known in Mozambique only from the Tete region (BROADLEY 2000a), approximately 850 km southwest of the NGR. The Central African species *L. gutturalis* reaches northern Tanzania (SPAWLS et al. 2002) and Pwetu at the northern end of Lake Mweru, Zambia (BROADLEY 2000a), over 1,200 km west of the NGR. We conservatively assign the NGR population to *L. chobiensis*, but note that a review of the species complex is indicated.

Agama mossambica PETERS, 1854 – Within the NGR the species was restricted to trees or hut walls. In a large male (BL: 108 mm, tail truncated; PEM R16149) the preanal pores are in two rows. A large female (BL: 102 mm, TL: 176 mm; PEM R5545) exceeds the previous record female size (BL: 100 mm, TL

150 mm from Xiluvo, BROADLEY 1966), but even so is exceeded by another female from Namalope, Nampula Province, Mozambique (BL: 105 mm, TL: 177 mm; PEM R15601). The male throat coloration is a heavy blue reticulate pattern, which may form vague longitudinal bands. A large blue basal blotch occurs in adult males, but not juveniles or females. The belly was uniform cream, but may be suffused with blue-grey.

Agama kirkii BOULENGER, 1885 – Adult males from NGR had dirty orange throats with longitudinal pale bands which run parallel on the front of the throat, but converge to the midline proximally. The central band was broader and became enlarged and blotched at the base of the throat; the outer bands were 1-2 scales wide and were in some cases broken up into a series of pale spots on the sides; up to 25+ fine white bands on tail. Maximum size: male, BL: 104 mm (PEM R5548). *Agama kirkii* can be distinguished from *A. mossambica* by the reticulate pattern on the chest of juveniles. BROADLEY (1966) noted the large size of specimens from Malawi and north Mozambique. In Zimbabwe, BROADLEY (1962) noted that the species was common on rock outcrops at low altitude, but was less plentiful at higher altitudes. This conformed to the situation in NGR, where *A. kirkii* was abundant on low inselbergs and bedrock outcrops, but although observed on the upper slopes of Serra Mecula it was absent from the summit plateau.

McLACHLAN (1981) emphasised the usefulness of throat coloration for the identification of southern African agamas. BROADLEY (1966) described adult male *A. kirkii* breeding coloration but did not give details of throat colouration, except to note that northern specimens usually had a black blotch at the base of the throat. LOVERIDGE (1950) diagnosed a southern subspecies, *A. k. fitsimensi*, on the basis of its poorly developed nuchal and vertebral crests, weaker keels and mucrones on the dorsal scales, and the absence of a dark basal spot on the throat. BROADLEY (1962) noted that scutellation fea-



Fig. 4. Limbless burrowing skink (*Melanoseps* cf. *loveridgei*) from Serra Mecula.

tures were clinal and the black throat spot remained the only diagnostic feature for the subspecies. However, he later also found this feature to vary clinally (BROADLEY 1966). It is absent in NGR specimens, the most northerly recorded population, supports BROADLEY'S (1966) decision to synonymise the poorly defined southern subspecies. The NGR records represent a considerable northern extension of the species range, from Mitucue Mountain, the previous northern record (D. BROADLEY pers. comm.). The species so far is not recorded from southern Tanzania (BROADLEY & HOWELL 1991), although suitable habitat occurs in the region.

Trachylepis bouleengeri STERNFELD, 1911 – The voucher specimen was active in the early morning among dead branches of a fallen tree next to an elephant wallow on the edge of the forest; another specimen was observed foraging in rank vegetation in a drainage line, whilst another was asleep in thick reeds 30 cm above water. The Niassa record fills in the considerable gap between the Tanzanian populations and the northernmost Mozambique record (Nampula-Marrupula: BLAKE 1965, BROADLEY 1974).

Trachylepis maculilabris (GRAY, 1845) – A large female was collected on a tree in the Lipumbulo floodplain. BROADLEY (1974) noted no records for Mozambique north of the Zambezi valley. Later, BROADLEY (2000c) indicated that the range of *M. maculilabris* extended into northern Mozambique, al-

though there were no documented specimens. The NGR record is the first published record for the Province. However, the species has also been collected from the coastal localities of Moebase (Zambezia Province) and Moma, Nampula Province (W.R. BRANCH unpubl. data). There is significant genetic divergence between *M. maculilabris* from Amani, Tanzania, and from coastal Mozambique (sequences used in CARRANZA et al 2001, based on material collected by W.R. BRANCH from Moebase, Zambezia Province), indicating a possible cryptic species in the region (MAUSFELD-LAFDHIYA et al. 2004). Additional material recently collected in south-east Africa (W.R. BRANCH unpubl. data) may help resolve this problem.

Trachylepis margaritifera (PETERS, 1854) – The specimens conform to the coloration of *T. margaritifera* (BROADLEY & BAUER 1998), and with one exception also have only 5 supraciliaries (6 in *M. pulcherrima*, BROADLEY & BAUER 1998). The records fill in the considerable gap between populations in southern Tanzania and the previous northern records for Mozambique (e.g. Mitacué Mountain and Nampula; BROADLEY & BAUER 1998).

Trachylepis varia (PETERS, 1867) – Nearly all specimens had tricarinate dorsal scales, including three specimens (two adults and a juvenile) from Serra Mecula. The sole exception was a large male from Serra Mecula with quinquecarinate scales. All specimens have mucronate, keeled subdigital lamellae. Most specimens had immaculate throat and ventral coloration, although two males had speckled throats. Midbody scale row counts ranged from 30–34 (Serra Mecula specimens 30–32). Of five mature females (SVL 53–63 mm) in the series, four were reproductively active. Clutch size varied from 3–6, egg size from 6.5–11.0 mm diameter, and embryos were in early to advanced stages of development. The series confirms viviparity in the Niassa population (oviparity is recorded from populations in northern South Africa, JACOBSEN 1989), and indicates that reproduc-

tion is asynchronous. In a review of *Trachylepis* in southeastern Africa, BROADLEY (2000c) reassessed the status of *T. varia* and elevated the montane subspecies *brauni* (including *hildae*), known from isolated populations on the Nyika Plateau, Malawi, and Ukinga Mountains, Tanzania, to a full species. Specimens from throughout the NGR, including Serra Mecula, conform to *T. varia*, particularly in having the subocular enter the lip. This feature seems more useful in separating the two species, than the key features used by BROADLEY (2000c), i.e. nature of ear lobules, nostril condition, and lamellae under fourth toe.

Melanoseps sp. (Fig. 4) – Two adult females with midbody scale rows: 20; nostril pierced between rostral and first upper labial as in *M. ater* complex (BRYGOO & ROUX-ESTEVE 1981); scales between mental and cloaca 142–144; glossy black above, ventrum white with each scale black-centred forming diffuse longitudinal stripes; BL/tail ratio 3.7 (largest specimen, in which the tail appears original). Both were collected together in a rotting log on a slope close to a swamp in closed-canopy evergreen forest on Serra Mecula. Reproduction in the genus is poorly known. SPAWLS et al. (2002) state that all species lay eggs. However, the NGR specimens were gravid females; PEM R16167 (BL: 142 mm, TL: 38 mm) with eight eggs (5 right oviduct, 3 left oviduct), PEM R16168 (BL: 125 mm, TL: 30 mm) with three eggs (2 right, 1 left). All the eggs had obvious developing embryos on the upper surfaces, and the species is probably viviparous. LOVERIDGE (1953) noted that gravid females of *M. ater misukuensis*, taken from mid-September to mid-October in northern Malawi, contained eggs and tiny embryos. Birth in Niassa *Melanoseps* probably occurs in December–January, after the start of the summer rains.

These fossorial skinks have a patchy distribution, although they may be locally abundant. These appear to be the first records of the genus from Mozambique. The type locality of *M. ater* was given as Zambezi

River, but BROADLEY (in BRYGOO & ROUX-ESTEVE 1981) notes that it was probably collected from the Shire Highlands, Malawi, during Kirk's Zambezi River Expedition. In the last revision of the genus, BRYGOO & ROUX-ESTEVE (1981) recognised four species, two with poorly defined subspecies. They described *M. loveridgei* from southern Tanzania, diagnosing it from *M. ater* by the low number of midbody scale rows (18, but 22 in one specimen) and small size (BL <140 mm). Ventral coloration “clair avec des lignes de points sombres.” fell within the range exhibited by typical *M. ater*. The poorly defined subspecies of *M. ater* have higher midbody-scale-row counts (24 in *M. matengoensis*) or a pink-yellowish ventrum with stripes (*M. a. misukuensis*). Species allocation of the Niassa specimens is problematic. Cephalic scutellation in *M. ater* and *M. loveridgei* is similar, and in the Niassa specimens uninformative. The largest NGR specimen slightly exceeds the maximum recorded for *M. loveridgei* (BL: 136 mm), but as it is a sexually mature female this slight increase in length may be expected. Midbody scale rows (20) fall between that of *M. loveridgei* (18) and *M. ater* (22-24). Midventral body scale counts (142-144) fall out of the range of *M. rondoensis* (114-128) and *M. ater* (146-174), but within those of *M. loveridgei* (135-150). On the basis of distribution and morphology the specimens may be tentatively referred to *M. loveridgei*. BROADLEY (2000d) treated *M. uzungwensis* as a full species, diagnosing it in part by its larger size than parapatric *M. loveridgei* in Tanzania, and is currently undertaking a revision of the genus (D. BROADLEY pers. comm.).

Panaspis wahlbergii (A. SMITH, 1849) – Partly-digested remains found in *Lamprophis capensis*. All adult males lack the diagnostic white neck spots of *P. maculicollis* (JACOBSEN & BROADLEY 2000), which is currently known in Mozambique only from the central Tete and Manica Provinces. SCHMITZ et al. (2005) have referred *P. wahlbergii* to the revived genus *Afroablepharus*. However, before

such a reassignment the status and content of *Afroablepharus* requires a fuller assessment of genetic divergence within southern and eastern African savannah species, including *P. cabindae* from Angola.

Lygosoma afrum (PETERS, 1854) – These large specimens (BL: 105-109 mm) were both collected in the foothills of Serra Mecula. One was excavated from a hole at the base of a tree into which a *Gerrhosaurus* (probably *G. nigrolineatus*) had escaped.

Latastia johnstoni BOULENGER, 1907 (Fig. 5) – This is the first confirmed record of the genus in Mozambique, and the specimens show colour pattern and habitat differences from typical *L. johnstoni*, from upland grasslands in northern Malawi (LOVERIDGE 1953) and from Lake Chilwa in the south (STEVENS 1974). The only previous records of the species in Mozambique (STERNFELD 1911) are both problematic; Cabayra is not traced, and Chifumbazi is on the border and specimens may have been obtained from Zambia.

Specimens from NGR showed a nostril between 3 nasals (2 small post nasals, one enlarged supranasal), narrowly excluded from first supralabial; supranasals in broad contact behind rostral; frontonasal enlarged, in contact on sides with upper postnasal and first loreal; prefrontals paired, in broad contact in midline, and on sides with paired loreals and two small preoculars; frontal trapezoid, broader anteriorly; frontoparietals in broad contact; interparietal large, elongate with occipital pit; single, large occipital scale; parietals large and like other head shields smooth, in contact laterally with two temporal shields; anterior temporal 3x length of posterior temporal; 7 supraciliaries, separated from enlarged pair of supraoculars by a row of 9-10 small granules; lower eyelid scaly; subocular very large, narrow below and bordering lip; supralabials 5+3 on both sides; infralabials 7; four pairs of enlarged chin shields, largest the fourth, and first three in contact in midline; tympanum visible; earhole large, oval, without lobes, but with



Fig. 5. *Latastia johnstoni* from the sandy bank of Rio Incaloue.

narrow crescent-shaped upper tympanic shield; dorsal scales small, in 44 rows, weakly keeled on back, faint or absent on flanks; ventrals in 6 + 2 longitudinal rows, smooth, wider than long, smaller along midline; well-developed collar of 7 scales, largest in middle; subdigital lamellae with paired keels, 24-25 in series under fourth toe; femoral pores in hatchlings and females, 14-15 under each thigh. The body pattern is basically striped with barred flanks; a wide (12 scales wide), plain brown dorsal band that is darker on edges, is bordered laterally in turn by a pale tan stripe (2 scales), a darker band (3), another pale stripe (2) and blotched dark band (4), and finally a paler band (3) before the enlarged flank scales; flanks with 14 irregular blotched bars, with two fainter bars on the neck; two faint pale blue (in preservative; yellow-green in life) spots occur on the flanks either side of the front limb insertion; belly uniform white; tail pale orange-brown, lighter below. Hatchling colour is bolder, lacking the barred flanks, and with a bright orange tail.

Cordylus sp. – A new rupicolous species that was restricted to isolated rock outcrops on the summit of Serra Mecula. Related to *C. rhodesianus* and *C. nyikae* (BROADLEY & BRANCH 2002). Further details are given in BRANCH et al. (in press).

Platysaurus maculatus BROADLEY, 1965 – Despite the numerous inselbergs and rock outcrops throughout the NGR, this species is surprisingly rare and has been observed only on the lower slopes of larger inselbergs along the Lugenda River. It was absent from Serra Mecula. The Niassa observations fill in the gap between the northern records in Mozambique (Mitucué Mountain, Ribaué Mountain, Nampula, BROADLEY 1978) and the isolated population in southern Tanzania (BROADLEY 1995). Another isolated population in the Zambezi Valley is currently treated as a southern subspecies, *P. m. lineicauda* (BROADLEY 1978), but should probably be treated as a separate species (D. BROADLEY, pers. comm.).



Fig. 6. Hatchling of *Varanus albigularis* with unusual coloration (compare text) from the south bank of the Lugenda River, west of the Lusingi camp.

Gerrhosaurus vallidus A. SMITH, 1849 – The Niassa specimens represent a northern range extension for the species, previously recorded from 50 km northeast of Tete, and a sight record from Mitucué Mountain (D. BROADLEY pers comm.). The species is not known from adjacent southern Tanzania (BROADLEY & HOWELL 1991), but may occur there in similar habitats. The specimens have the normal coloration and scutellation of *G. v. vallidus* (FITZSIMONS 1943, BROADLEY 1966).

Gerrhosaurus sp. – An adult, gracile tan-coloured plated lizard with an obvious pale side stripe was spotted in the foothills of Serra Mecula but escaped into a hole at the base of a tree. It was probably *G. nigrolineatus*, which is known from savannah habitat in eastern Tanzania (SPAWLS et al. 2002). There are few Mozambique records; BROADLEY (1966) notes western records from Chinainza (Tete Province) and Tete (LOVERIDGE

1953). Both *G. nigrolineatus* and *G. flavigularis* were found in sympatry at Moebase, Zambezia Province, and Moma, Nampula Province (W.R. BRANCH unpubl. data).

Varanus albigularis (DAUDIN, 1802) (Fig. 6) – A boldly marked hatchling collected in a hollow tree 3 m above the ground. The hatchling coloration differs considerably from that of southern African specimens in having a bluish tinge to the snout, labials and throat, paired thin dark tail bands, and the dorsal pale trunk bands replaced by dark-edged, orange-centred ocelli. SPAWLS et al. (2002) also noted the bright coloration of specimens from southern Tanzania, which would be referable to *V. a. ionidesi* LAURENT, 1964. However, BROADLEY & HOWELL (1991) noted the great variation in coloration and scalation of *V. albigularis*, and recognised no subspecies.

Chirindia swynnertoni BOULENGER, 1907 – No amphisbaenians have previously been recorded from northern Mozambique. A juvenile (BL: 67.6 mm, TL: 7.7 mm; damaged, 3.6 mm of body and tail separated) was unearthed 10 cm deep in sandy soil in the Lugenda River floodplain in *Faidherbia albida* woodland, 7 July 2004. The specimen conforms to *Chirindia orientalis* (STERNFELD, 1911) in having a rounded snout; parietals not in contact with post-supralabials; the absence of a discrete ocular; having two supralabials; two postgenials in the first row; and 12 + 12 segments in a midbody annulus (GANS & RHODES 1967). Body and tail annuli are 250 + 27, respectively, and there are four preanal pores. *Chirindia orientalis* is known only from the type series from Mikindani, Southern Province, Tanzania (GANS & RHODES 1967), with an additional specimen from Tunduru (about 100 km to the north; GANS & KRAKLAU 1989). It has previously been separated from *C. swynnertoni*, currently known from the eastern highlands of Zimbabwe and adjacent Mozambique (BROADLEY & GANS 1978), by the presence of a postmental and shorter tail (GANS & RHODES 1967, BROADLEY & GANS 1978). However, the latter is of dubious use as D. BROADLEY (pers. comm.) noted little difference in average tail length between *C. orientalis* (BL/tail length 8.3, GANS & KRAKLAU 1989) and near topotypic *C. swynnertoni* from the eastern border of Zimbabwe (BL/tail length is 7.4-9.1). The two species also have similar numbers of caudal annuli (*C. orientalis*: 22-23, *C. swynnertoni*: 19-26), so there is little support for relative tail length as a diagnostic feature between the two putative taxa. Although the Niassa specimen has only four preanal pores, whilst *C. orientalis* has 6 pores (D. BROADLEY pers. comm.) and *C. swynnertoni* usually also has 6 pores (but 7 and 2 in single specimens; BROADLEY & GANS 1978), the NGR specimen is not sexually mature and the pores are probably not fully developed. It is evident that *C. orientalis* and *C. swynnertoni* are presently poorly diagnosed. There is a hiatus of over 600 km between the two putative species, and no congeners have

such a wide and apparently disjunct distribution. Further material, supplemented with genetic analysis, is needed to resolve the situation, and until such material is available it seems appropriate to follow BROADLEY & HOWELL (1991) who synonymised the two taxa.

Aparallactus capensis A. SMITH, 1849 – An adult was collected under an old log in burnt Miombo woodland on the upper slopes of Serra Mecula. The stomach contained a recently eaten centipede. PEM R16339 is a hatchling (BL: 91 mm, TL: 9 mm) collected 8 June 2004.

Lamprophis capensis (DUMÉRIL & BIBRON, 1854) – Body light brown with varying degrees of light tan vermiculation on the forebody. The head has two broad paler stripes, one covering the upper labials and another running from the snout, through the upper eye, and extending to a variable distance onto the side of the body. This coloration appears boldest in juveniles, and in the single large adult body colouration is darker and the head stripes are hardly distinguishable. Males: ventrals 199-207, subcaudals 63-72 (N = 5); females: ventrals 209-220, subcaudals 46-52 (N = 5). Two specimens had guts contents swallowed head first; *Hemidactylus platycephalus* and *Panaspis wahlbergii*, respectively.

Lamprophis capensis has recently been revived for southern populations previously assigned to *L. fuliginosus* (HUGHES 1997, BROADLEY et al. 2003). The transitional region is believed to occur in northern Zambia and Tanzania, where the two putative taxa were separated by ventral counts and head coloration (HUGHES 1997). Scale counts for the ten specimens from Niassa generally conform to those given for material from Kilimanjaro, Tanzania (HUGHES 1997), except that the Tanzanian counts show no sexual dimorphism between ventral and subcaudal counts for both putative taxa. Although the Niassa material is limited, a strong sexual dimorphism in both ventrals and subcaudals is indicated.

In contradiction to the Tanzanian data (HUGHES 1997), counts for Zambian snakes (BROADLEY et al 2003) show wide overlap between the species for both ventrals (*fuliginosus* 187-237, *capensis* 187-232) and sub-caudals (*fuliginosus* 43-73, *capensis* 39-66). Nonetheless, the taxa in Zambia can generally be distinguished by body coloration and head stripes (BROADLEY et al. 2003). Caution, however, is required as body coloration in *L. capensis* is well known to darken with age (BRANCH 1998, BROADLEY et al. 2003), and head stripes may be variable and also fade with age. The colouration of the Niassa material conforms to east coast populations in southern Africa. CUNHA (1935) recorded both *Boodon lineatus* (= *Lamprophis capensis* ?) and *Boodon fuliginosus* (*L. fuliginosus* ?) from Massangulo, distinguishing the species on the basis of uniform dark coloration in the latter. His scale counts, however, were uninformative (*lineatus* - ventrals 192-237, sub-caudals 47-70; *fuliginosus* - 205-237, 47-67, respectively).

Natriciteres sylvatica BROADLEY, 1966 – Most specimens had cream bellies, although one had bright yellow labials, throat and belly. A number of specimens were collected during the day (10h00 and 17h30) crawling in leaf litter in closed-canopy evergreen forest. Other snakes were trapped overnight in pitfall traps, indicating both diurnal and nocturnal activity. Three snakes had recently eaten, two specimens containing *Arthroleptis xenodactyloides* (one and two, respectively), and another a *Phrynobatrachus natalensis*. Of 14 specimens collected two (14.3%) had truncated tails. BROADLEY (1987) noted the high frequency of truncated tails in *Natriciteres* and associated it with their diurnal activity and increased predation risk, particularly from predatory birds. One specimen was killed and partially devoured by a land crab in a pit-fall trap. Previously this snake was treated as an eastern subspecies of *N. variegata*, but recently has been elevated to specific status (BROADLEY et al. 2003).

Psammophis orientalis BROADLEY, 1977 – A large male had a partly-digested adult *Trachylepis varia* in its stomach. Previously considered an eastern subspecies of *P. subtaeniatus* but raised to specific status by BROADLEY (2002).

Hemirhaggheris nototaenia (GÜNTHER, 1864) – One adult had eaten a *Lygodactylus* sp.

Philothamnus hoplogaster (GÜNTHER, 1863) – Two *Mecula* specimens were sheltering behind bark on dead trees, one a metre above ground at an elephant wallow on the edge of a patch of evergreen forest; another two at Napata were sleeping under dead bark on a tree on the bank of the Lugenda River; and another was active on the road at 10h00 in *Brachystegia* on Serra *Mecula* several hundred meters from water.

Philothamnus punctatus PETERS, 1866 – The species has been recorded rarely in Mozambique. BROADLEY (2000a) noted a southern limit of Lumbo in northern Mozambique, although the species has also been collected as far south as Moebase, Zambezia Province (W.R. BRANCH unpubl. data).

Crotaphopeltis hotamboeia (LAURENTI, 1768) – One specimen had eaten a small *Bufo* sp.

Bitis arietans arietans (MERREM, 1820) – The taxonomic status of puff adders in northern Mozambique requires further analysis. In addition to the normal colour pattern, some specimens display a bold, complicated pattern that is similar on the hind body to that of the *B. gabonica*. Similar unusual markings were noted on specimens from the coastal Moebase region, Zambezia Province, Mozambique (W.R. BRANCH unpubl. data). Moebase specimens were also like Gaboon Vipers in their behaviour, being very tractable and showing very little inclination to bite, even when provoked. Insufficient material is currently available to assess the taxonomic significance of these differences.

Causus defilippii (JAN, 1862) – One specimen had eaten a small ranid frog.

Cycloderma frenatum PETERS, 1854 – A large Lugenda specimen (approx. 40 cm carapace length) was captured on a fisherman's long-line left overnight and baited with fish remains. The body of the terrapin was kept by the captor for eating, and only the head was salvaged. The Lugenda specimens fill in a large gap in the species distribution, which has not previously been recorded from northern Mozambique (BROADLEY 2000a), although it is known from Moebase (BRANCH unpubl. obs.) and from the lower Ruenya River at Kitaya in southern Tanzania (LOVEDRIDGE 1942).

Kinixys belliana GRAY, 1831 – No live specimens or bones were found of this usually common tortoise. The only evidence indicating its presence in the NGR was the remains of a supracaudal scute and limb bone fragments in a Honey Badger scat (K. and C. BEGG, pers. comm.). The heavy incidence of fire in the NGR may have negatively impacted tortoise populations.

Crocodylus niloticus LAURENTI, 1768 – The eye shine of a few juvenile specimens was observed in the Lugenda River and in dambos on the Mbatamila-Matondovela road. Relatively few crocodiles remain in the NGR. CRAIG & GIBSON (2002) reported only ten sightings along the Lugenda River and none on the Ruvuma River during the 2002 animal census. They estimated only 202 crocodiles in the area, and only 79 in the NGR, and speculated that this low density was due to human impact. The low density of crocodiles in the NGR is reflected in the relatively low number of crocodile attacks on the numerous fishermen (< 2-3 per year).

Discussion

The reptile fauna of Mozambique was last reviewed by PETERS (1882), when faunal studies in the region were in their infancy. Large

tracts of the country were then unexplored, and this remains the situation for much of northern Mozambique. However, the reptile fauna of southern Mozambique (i.e. south of the Zambezi River) was reviewed in BRANCH (1998) and the snakes in BROADLEY (1990b). Together these cover a significant proportion of the total Mozambique reptile fauna. Since 1988 there have been a number of reviews of reptile groups extending into the region (e.g., BROADLEY 1990a, b, 1992, 1994, 1996, 1997; BROADLEY & BROADLEY 1997; and BROADLEY & WALLACH 1996, 1997). BROADLEY & HOWELL (1991) reviewed the reptile fauna of Tanzania and, with a number of subsequent additions (BROADLEY 1995a, b), these give an indication of species that may extend southwards into northern Mozambique. Additional western species from adjacent Malawi may also occur (e.g. BRANCH & RYAN 2000), and integration of the above publications indicates that approximately 100 reptile species may occur in northern Mozambique. Despite this reptile diversity, endemism within Mozambique is surprisingly low with only 12 taxa endemic to the country, most being associated with isolated populations on the various offshore islands (BROADLEY 1990a, 1992).

A total of 169 species (70 lizards, 9 amphisbaenians, 75 snakes, 14 chelonians and a single crocodile) have been recorded for southern Mozambique, south of the Zambezi River (BRANCH 1998). Our survey assessed only a small fraction of the NGR during a period of general faunal inactivity due to dry conditions. Nonetheless, we recorded remarkable herpetofaunal diversity, including 57 reptiles (30 lizards, including one amphisbaenid, 23 snakes, three chelonians and a crocodile). This makes the NGR the richest herpetological site recorded in northern Mozambique. Numerous important findings were made, including the discovery of a new species of girdled lizard and at least five other taxa of equivocal taxonomic status that require further comparative material and fuller analysis to determine whether they are also taxonomic novelties.

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- 3: stream and trapline at Mbatamila camp (12°11'01"S, 37°33'03"E; 470 m asl; 1237BA); 4: bedrock expanses north of Mbatamila camp (12°10'26"S, 37°32'51"E; 1237BA); 5: 25 km west of camp on road to Matondovela (12°07'50"S, 37°21'34"E; 1237AB); 6: 6.7 km along road to Matondovela (12° 08'45"S, 37° 28'02" E; 1237AB); 7: 11.1 km west along the road to Matondovela; (12°08'S, 37°28"E; 1237AB); 8: dry dambo with small pool of water, 11.6 km along Mbatamila-Matondovela road (12°08'45"S, 37°28'01"E; 1237AB); 9: 15.5 km along the Mbatamila-Matondovela road (12°07'55"S, 37°26'08"E; 487 m asl.; 1237AB); 10: 24.7 km along Mbatamila-Matondovela road (12°07'50"S, 37°21'37"E; 1237AB); drainage line with granite bedrock and few pools in Miombo woodland; 11: 28.6 km along Mbatamila-Matondovela road (12°07'13"S, 37°19'39"E; 1237AB), drainage line in deep river channel with stagnant, leaf-covered pool with tree-lined banks; 12: large expanse of bedrock in miombo woodland at 32.3 km along Mbatamila-Matondovela road (12°07'24"S, 37°17'43"E; 1237AB); 13: southern base of Namba inselberg (12°06'50"S, 37°15'01"E; 1237AB); leaf litter in drainage donga; 14: Lechengwe village, south of Mecula Village (12°10'52"S, 37°39'50"E; 1237BA); shambas in cleared miombo woodland with emergent bedrock and rock outcrops; 15: bridge crossing Rio Incaloue, 14 km north of Lugenda River (12°19'19"S, 37°39'26"E; 1237BC) on road to Mussoma; dry sandy riverbed, with scattered rocks and debris piles; 16: pool in small drainage line, 2 km N Lugenda River (12°25'14"S, 37°40'12"E; 1237BC) on road to Lugenda bridge; miombo woodland; 17: Lugenda River, Mussoma road bridge (12°06'23"S, 37°40'16"E, 1237BC); 18: Mecula Village (12°05'26"S, 37°38'21"E; 1237BA); 19: south region of Mecula Village on road to Mussoma (12°10'39"S, 37°40'27"E; 1237BA); 20: 400 north of Mbatamila-Matondovela road along the sand tract to Nyati (12°05'20"S, 37°33'39"E; 1237BA); open miombo woodland on sandy soil; 21: upper reaches of the Rio Licombe (12°05'20"S, 37°33'39"E; 1237BA); series of pools along drainage line with scattered trees; 22: 9 km along Rio Licombe valley (12°04'27"S, 37°33'55"E; 1237BA); laterite outcrop in dry miombo; 23: western foothills of Serra Mecula (12°02'38"S, 37°36'51"E; 1237BA); rocky outcrops along drainage line in transitional Miombo; 24: small swamp in evergreen forest, 1 km east of Serra Mecula camp (12°02'55"S, 37°38'30"E; 1237BA); 25: small stream through evergreen ri-

Appendix 1

Collecting localities

Niassa Game Reserve: 1: Mbatamila (Maputo) camp, Niassa Game Reserve, Niassa Province, Mozambique (12°11'01"S, 37°33'03"E; 470 m asl.; 1237BA); 2: Inselberg to west of Mbatamila camp (12°10'31-59"S, 37°32'39-44"E; 615 m asl);

verine forest, 1.5 km south of Serra Mecula camp; (12°03'04"S, 37°38'15"E; 1237BA); 26: Mbatamila airstrip (12°10'12"S, 37°32'33"E; 1237BA); 27: 13.3 km north from Matondovela Road on road to Nyati, 2.9 km past turning to Serra Mecula, in valley of Rio Licombe (12°01'50"S, 37°33'07"E; 1237BA); 28: track to Nyati road, valley of Rio Licombe, Niassa Game Reserve (11°56'17"S, 37°31'19"E; 1137DC); 29: road south of Mecula at junction of Matondovela Rd (12°05'20"S, 37°33'39"E; 1237BA); 30: Serra Mecula Camp (12°02'55"S, 37°38'30"E; 1237BA); 31: summit rock cracks of Serra Mecula, in burnt grassland (12°03'11"S, 37°38'49"E; 1237BA); 32: summit rock cracks, Serra Mecula (12°02'39"S, 37°38'38"E; 1237BA); 33: summit rock cracks, Serra Mecula (12°02'44"S, 37°38'23"E; 1237BA); 34: summit rock cracks, Serra Mecula (12°02'25"S, 37°38'32"E; 1237BA); 35: Serra Mecula (12°02'43"S, 37°38'35"E; 1237BA); 36: summit rock cracks, Serra Mecula (12°03'30"S, 37°38'22"E; 1090 m asl.; 1237BA); 37: Serra Mecula summit (12°04'39"S, 37°37'49"E, 1413 m asl; 1237BA), barren, lichen-covered rock cap; 38: Serra Mecula summit region (12°04'36"S, 37°37'57"E; 1237BA), edge of evergreen forest; 39: Serra Mecula summit region (12°04'32"S, 37°38'06"E, 1260 m asl; 1237BA), small patch of riverine forest with a small stream; 40: Serra Mecula Mountain summit region (12°04'24"S, 37°38'12"E; 1237BA), elephant wallow at small spring in grassland; 41: Serra Mecula, drainage line from summit to north west (12°03'41"S, 37°38'12"E; 1237BA), edge of evergreen forest; 42: western slopes of Serra Mecula (12°02'21"S, 37°37'59"E, 751m asl; 1237BA), burnt dry miombo woodland; 43: western slopes of Serra Mecula (12°02'46"S, 37°37'21"E, 643 m asl; 1237BA), burnt dry miombo woodland; 44: track down from Serra Mecula camp (12°02'38"S, 37°38'07"E, 880 m asl; 1237BA), dry miombo woodland; 45: Lugenda River, Niassa Game Reserve (12°10'29"S, 38°14'02"E; 1238AA); 46: Lugenda River, Lipumbulo Mt., 20 km downstream of Mbamba Village, Niassa Game Reserve (12°11'29.5"S, 38°10'29"E; 1238AA); 47: Katembe airstrip (12°18'03"S, 36°41'49"E, 400 m asl; 1236BC); 48: Nyati scout camp, Rouvuma River (11°41'37"S, 37°23'34"E, 370 m asl; 1137CB); 49: south bank Lugenda River, west of Lusingi camp (12°22'59"S, 37°44'44"E, 295 m asl; 1237BC); 50: Ngolonge (Coronge) inselberg, south west of Lusinge camp, Block C; 51: Lusingi camp, Luwire Concession, Block C, Niassa Game

Reserve (12°15'53"S, 38°00'38"E, 308m asl; 1238AC); 52: very muddy waterhole and elephant wallow in clayey soil of Lugenda River valley east of Lusingi Camp (12°17'23"S, 30°00'19"E; 260 m asl.; 1238AC); 53: Napata camp, Luwire Concession, Block C, Niassa Reserve (12°27'06"S, 37°29'23"E; 1237AD); 54: near Napata camp, Luwire Concession, Block C, Niassa reserve (12°27'06"S, 37°29'23"E; 1237AD); 55: road between Msawize and Matondovela (12°30'29"S, 36°34'09"E, 700m; 1236DA).

Small Carnivore Survey (KEITH AND COLLEEN BEGG): BC1: Lugenda River (12°11'36"S, 28°10'59"E); BC2: Nkuti village fields (12°12'52"S, 37°54'53"E); BC3: Lugenda floodplain (12°10'27"S, 38°05'49"E); BC4: Lugenda floodplain (12°11'21"S, 38°03'51"E); BC5: Lipumbulo floodplain (12°11'36"S, 38°10'58"E); BC6: Lipumbulo floodplain (12°11'29"S, 38°10'41"E); BC7: Lipumbulo floodplain (12°11'33"S, 38°10'56"E); BC8: Miombo woodland (12°01'38"S, 37°52'53"E); BC9: Mbamba road, miombo woodland (12°02'23"S, 37°53'26"E); BC10: Nkuti village inselberg (12°06'31"S, 37°50'31"E); BC11: track through riverine forest at base of Serra Mecula (12°02'30"S, 37°37'07"E); BC12: Lugenda floodplain (12°10'54"S, 38°04'33"E); BC13: Lugenda floodplain (12°11'31"S, 38°11'04"E); BC14: Serra Mecula (12°06'48"S, 37°39'37"E); BC15: Lugenda River (12°13'46"S, 38°00'01"E); BC16: Lugenda floodplain (12°11'32"S, 38°12'11"E); BC17: Lugenda floodplain (12°09'14"S, 38°08'26"E); BC18: Lugenda River (12°11'33"S, 38°04'05"E); BC19: riverine forest at base of Serra Mecula (12°02'58"S, 37°34'09"E); BC20: base of Serra Mecula (12°05'20"S, 37°33'39"E); BC21: bamboo thicket on edge dry riverbed (12°09'07"S, 38°02'38"E); BC22: grass on sandy bank, Lugenda River (12°11'34"S, 38°12'34"E).

Freshwater Fish Survey (ROGER BILLS): N1: Mbatamila-Matondovela Road, 1st river crossing (12°08'17"S, 37°32'03"E); N11: Mbatamila – Mussoma Road, dambo tributary of Incalau stream (12°18'47"S, 37°39'26"E); N13: Mbatamila – Mussoma Road, Lugenda River at rocks 500m below Mussoma bridge (12°26'21"S, 37°40'28"E); N14: Mbatamila-Matondovela road, Ziani stream/swamp (12°25'09"S, 37°40'14"E); N16: Mbatamila – Mussoma road, Incalau River, main road crossing (12°19'16"S, 37°39'26"E); N17: Mbatamila – Mussoma road, pools in Gomesh stream near Mecula (12°11'29"S, 37°38'12"E); N18: Mbatamila-Matondovela road,

Nagaga stream near Matondovela (12°05'47"S, 37°10'37"E); N23: Chamba Scout Camp, swampy pools on Milele River (11°36'36"S, 36°55'32"E); N27: Lugenda River downstream from Mbamba (12°10'56"S, 38°04'43"E); N31: Mbatamila – Mussoma Road, Lucombe stream pools, Nyati road (12°05'15"S, 37°33'38"E); N35: Mutundu Scout Camp, Lugenda River upstream from confluence with Ruvuma River (11°25'30"S, 38°28'47"E); N41: Mbatamila – Nyati Road, Lucombe stream pool (12°05'58"S, 37°33'43"E).

Appendix 2

Reptile voucher specimens

Localities are given in brackets (see Appendix 1)

Squamata: Gekkonidae: *Elasmodactylus tetensis*: four specimens - PEM R5540, R5547 (2), R5551-52 (4); sight record (12). *Pachydactylus punctatus*: two specimens - PEM R5541 (2), R16204 (43); sight records (4, 12; both egg sites). *Chondrodactylus turneri*: one specimen - PEM R5952 (BC4). *Hemidactylus platycephalus*: nine specimens - PEM R5535-36, R5553 (4), R5555 (1), R5559 (9), R16175 (31), R16183 (33); sight records: (14, 36, 47, 51, 53, BC6). *H. mabouia*: nine specimens - PEM R5537-38, R5546 (2), R16156 (1), R16169 (31), R16170 (24), R16181 (33), R16182 (32), R16199 (36); sight record (38). *Lygodactylus capensis*: 10 specimens - PEM R5544, R16128-29 (3), R16137 (21), R16140-41 (3), R16155, R5959 (1), R16174 (31), R16187 (30); sight records (4, 35). *L. grotei*: four specimens - PEM R1616214-17 (51). *L. cf. angularis*: six specimens - PEM R16189, 16192-95 (all 38); sight record (41). *L. cf. chobiensis*: four specimens - PEM R5556, R5558 (1), R5961-62 (BC8); sight record (16). **Agamidae:** *Agama armata*: six specimens - PEM R16118 (14), R16136 (29), R16138 (28), R5948 (BC3), R5949 (BC9); sight records (54, BC2). *A. mossambica*: four specimens - PEM R5530, R5545 (1), R16134 (14), R16149 (20); sight records (17, 51, 53). *A. kirkii*: four specimens - PEM R5548 (2), R5550 (4), R16114 (15), R16135 (14); sight records (12, 43). *Acanthocercus atricollis*: one specimen - PEM R16124 (19); sight records (7, 22, 26, 49). **Chamaeleonidae:** *Chamaeleo dilepis*: five specimens - PEM R16117 (14), R16119-21 (19), R16178 (31). **Scincidae:** *Trachylepis boulengeri*: one specimen - R16179 (24); sight records (3, 9). *T. maculilabris*: one specimen: R5954 (BC5); sight records (18, 25). *T. margaritifera*: seven specimens - PEM

R5539 (2), R16126-27 (14), R16152-53 (14), R16239 (35), R5956 (BC10); sight records (4, 12, 15, 50, 51, 53, 54). *T. striata*: four specimens - PEM R16122-23 (19), R16125 (14), R16139 (27); sight records (26, 48, 52). *T. varia*: 14 specimens - PEM R5542 (1), R5554 (1), R5560 (10), R16111 (15), R16143-48 (21), R16176 (31), R16197, R16205 (43); one juvenile in EtOH (37); sight records (6, 12, 14, 20, 22, 26, 35, 47, 50, 51, 53, 54). *Melanoseps* sp. (cf. *M. loveridgei*): two specimens - PEM R16167-68 (24). *Panaspis wahlbergii*: seven specimens - PEM R5531-32 (1), R5543 (1), R5549 (1), R5561-62 (13), R16130 (3); sight records (15, 22, 26, 27, 47, 48). *Lygosoma afrum*: two specimens - PEM R16133 (23), R16206 (23). **Lacertidae:** *Latastia johnstoni*: three specimens - PEM R16112-13 (15), R16218 (54). **CORDYLIDAE:** *Cordylus* sp.: nine specimens - PEM R16163-66 (31), R16180 (32), R16184 (34), R16198 (36), R16202-03 (43). *Platysaurus maculatus*: sight record (photograph) - (50). **Gerrhosauridae:** *Gerrhosaurus vallidus*: two specimens: PEM R16177 (31); R16196 (4); sight records (4, 12, 15, 50, 54). *G.* sp. (*G. nigrolineatus* ?): sight record (23). **VARANIDAE:** *Varanus albigularis*: one specimen: PEM R16213 (49). *Varanus niloticus*: sight records (11, 48). **Amphisbaenidae:** *Chirindia swynnertoni*: one specimen: PEM R16340 (BC13). **Serpentes: Typhlopidae:** *Rhinotyphlops mucrosa*: one specimen: PEM R16207 (23). **Pythonidae:** *Python natalensis*: Photograph of large adult (BC14); sight record (51). **Atractaspididae:** *Aparallactus capensis*: two specimen: PEM R16200 (42), R16339 (BC12). **Natricidae:** *Natriciteres sylvatica*: seven specimens - PEM R16158-59, R16160-62, R16173, R16188 (all 24). **Colubridae: Lamprophinae:** *Lamprophis capensis*: 11 specimens - PEM R5544, NMZB 16658 (1), R16109 (14), R16157 (14), R16186 (30), R16191 (14), R16201 (42), R16219 (14), R16329-31 (51). *Lycophidion capense*: one specimen: PEM R16110 (14). **Psammophiinae:** *Rhamphiophis rostratus*: one specimen - PEM R16220 (14). *Psammophis orientalis*: three specimens - PEM R16132 (22), R16142 (26), R16151 (14). *P. mossambicus*: one specimen - NMZB 16656 (1). *Hemirhaggheris nototaenia*: three specimens - NMZB 16659 (1), PEM R16334-35 (51). **Boiginae:** *Philothamnus hoplogaster*: six specimens - PEM R16171 (24), R16185 (24), R16224 (44), R16222-23 (53); R16350 (BC16). *P. semivariatus*: two specimens - PEM R16131 (19), R16211 (14); sight records (1, 51). *P. punctatus*: one specimen - PEM R16336 (51).

Telescopus semiannulatus: sight record (51). *Meizodon semiornatus*: two specimens – PEM R16115 (14), R16212 (14). *Crotaphopeltis hotamboeia*: five specimens – PEM R16116 (14), R16150 (14), R16154 (26), R16172 (30), PEM R16337 (51). **Dispholidinae**: *Thelotornis capensis oatesii*: one specimen - PEM R16240 (55); sight records (1, 28); *Dispholidus typus*: one specimen - NMZB 16657 (1). **Elapidae**: *Naja mossambica*: one specimen - PEM R16210 (46); sight records (1, 28, 51). *Dendroaspis polylepis*: one specimen - PEM R5557 (5); sight record (28). **Viperidae**: *Bitis arietans arietans*: two specimens - PEM R5959, head only (1), PEM R16338 (BC11); sight records (1, 28, 14, 51). *Causus rhombeatus*: one specimen - NMZB 16660 (1). *C. defilippii*: five specimens - PEM R16190 (30), R16208 (23), R16221 (18), R16332-33 (51); sight records (1, 28). **Chelonia**: **Pleurodira**: **Pelomedusidae**: *Pelusios sinuatus*: three specimens - PEM R16366 (17), R16209, (45), R16368 (47); sight records (48, 51, 53). **Cryptodira**: **Trionychidae**: *Cycloderma frenatum*: two specimens - PEM R5953 (BC1), PEM R16369 (BC18); sight records (17, 51, 53). **Testudinidae**: *Kinixys belliana*: sight record (BC17). **Crocodylia**: **Crocodylidae**: *Crocodylus niloticus*: sight records (9, 51, 53).

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