

CONTENTS (cont'd)

VOLUME II Technical Reviews
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	Page
TABLE 5.1 : Checklist of wetland bird species recorded in wetlands of the Zambezi Basin	217
APPENDICES	235
Appendix 5.1 : Barotseland Bird Survey 1998	235
Appendix 5.2 : Barotseland Bird Survey	247
Appendix 5.3 : Zambezi Delta Survey	259
CHAPTER 6 : WETLAND HERPETOFAUNA	279
6.1 Introduction	279
6.2 Materials and methods	279
6.3 Zoogeography	285
6.4 Herpetofauna descriptions	289
6.5 Conclusions and recommendations	312
6.6 Introduction of reptiles into artificial impoundments in the middle Zambezi valley	314
6.7 References	314
TABLE 6.1: Checklist of reptiles and amphibians of wetlands in the Zambezi Basin and outside	319
FIGURES 6.1 - 6.29	333
APPENDICES	363
Appendix 6.1 : Barotseand amphibians	363
Appendix 6.2 : Barotseland herpetofauna	367
Appendix 6.3 : Zambezi Delta herpetofauna survey	377

CHAPTER 6 THE HERPETOFAUNA OF THE ZAMBEZI BASIN WETLANDS

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6.1 INTRODUCTION

Herpetofauna – that is tortoises, lizards, snakes, crocodiles, amphisbaenians and amphibians – are a comparatively well studied group within the Zambezi Basin. A review of our knowledge on the distribution of those species considered to be always or frequently associated with wetlands will help towards an understanding of biogeographic patterns across the basin. Such a review is presented here as part of the BFA/Zambezi Society project on the assessment of wetland biodiversity of the Zambezi Basin for IUCN.

There are relatively few fully aquatic reptiles and amphibians, the principal ones being the crocodiles, terrapins, clawed frogs or platannas, and a few snakes which feed on fish and frogs. Many more species inhabit reed beds, swamps, floodplains and river banks, while others utilize dry floodplains and retreat to termitaria and adjacent woodland to escape rising floodwaters. There are three categories of wetland reptiles or amphibians that can be recognised:

- a) Aquatic species like the terrapins, a few water snakes and the clawed frogs (*Xenopus*).
- b) Species that inhabit stream banks, dambos or floodplains.
- c) Widespread savanna species that move onto the floodplains as they dry out and retreat to emergent termitaria or the peripheral woodlands when the floodwaters return.

These criteria result in the recognition of 179 species in the wetlands of the Zambezi Basin proper. The only groups strictly excluded are rupicolous reptiles and amphibians and those amphibians that do not need open water for breeding purposes, i.e. *Probreviceps*, *Breviceps* and *Arthroleptis*.

Figure 6.1 (see page 333) shows the composite nature of the modern Zambezi Basin, a result of complex geological events during the Cainozoic era. The palaeo-Upper Zambezi formerly flowed south through the Kalahari to join the Limpopo River, and it was not until the late Pliocene or early Pleistocene that the Middle Zambezi captured the Upper Zambezi. The principal wetland areas are either along the Upper Zambezi and its former tributary, the Kafue–Chambeshi (including the Lake Bangweulu swamps), or on the Lower Zambezi and its major tributary, the Shire River. The Okavango Delta still has a tenuous link with the Upper Zambezi via the Magwegqana Spillway and the Linyanti/Chobe rivers, while the Pungwe Flats represent the old lower course of the Zambezi River.

6.2 MATERIALS AND METHODS

The taxonomy of the reptiles and amphibians has been revised, as far as possible, using the theoretical Evolutionary Species Concept (Mayden 1997), with the Phylogenetic Species Concept as the most important secondary concept. A phylogenetic species is defined as "the smallest population or group of populations within which there is a parental pattern of ancestry and descent and which is diagnosable by unique combinations of character states" (e.g. Cracraft 1997). In

practice this requires careful re-examination of currently recognised subspecies. Some of these prove to be segments of clines. For example, the snake taxon *Xenocalamus mechowii inornatus* Witte & Laurent was erected on the basis of its uniform black dorsum and high ventral scale count.

In a revision of the genus (Broadley 1971a), I pointed out that the colour pattern was very variable in this species, but retained *X. m. inornatus* as a southern subspecies on the basis of its higher ventral counts in both sexes, although intermediates were recorded from northwestern Zambia. As there seems to be gene flow throughout the extensive range of this species, I no longer recognise a subspecies *inornatus*. On the other hand, a proto-*Xenocalamus bicolor* colonised the southern Mozambique plain alluvium via the Limpopo Basin, and the eastern population was isolated by the subsequent erosion of the Kalahari sand cover from eastern Botswana. It was originally described as a “variety” *lineatus* Roux, based largely on colour pattern, but it also differs from *X. bicolor* in its very depressed narrow head and slender build. It is clearly a good evolutionary species.

Most of the available herpetological material from the Zambezi Basin has been examined by myself (reptiles) or John Poynton (amphibians). The collections involved are indicated by the following acronyms: AMNH – American Museum of Natural History New York; BMNH – British Museum (Natural History), London; FMNH – Field Museum of Natural History, Chicago; IRSNB – Institut Royal des Sciences Naturelles de Belgique, Brussels; MCZ – Museum of Comparative Zoology, Harvard; MNHN – Museum National d’Histoire Naturelle, Paris; MRAC – Musee Royal de l’Afrique Centrale, Tervuren; NMZB – Natural History Museum of Zimbabwe, Bulawayo; PEM – Port Elizabeth Museum; SMF – Senckenberg Museum, Frankfurt am Main; TM – Transvaal Museum, Pretoria; SMWN – National Museum of Namibia, Windhoek; USNM – United States National Museum of Natural History, Washington, DC; ZMB – Zoologisches Museum, Berlin.

Checklists of the herpetofauna have been compiled for 16 sites within the greater Zambezi Basin, and another four peripheral sites that demonstrate faunal links with the basin (Fig. 6.1 - page 333; Table 6.1 - page 319 and Table 6.2 - page 281). To evaluate the intensity of sampling that has been carried out at these sites, the major collections and relevant literature are summarised below.

Zambezi Headwaters

An important collection of amphibians made in the Mwinilunga District of Zambia by Rolanda Keith was deposited in the AMNH and has been examined (Poynton & Broadley 1985-91). The first comprehensive collection of reptiles from the area was made in 1991 and deposited in the NMZB (Broadley 1991). The list of herpetofauna is still incomplete: for example, no pythons have been recorded. It is possible that the Northern African Python (*Python sebae*) crosses the watershed from the Congo Basin as it has been recorded about 50 km from the Zambian border.

Barotse Floodplains

Roux (1907) listed a few Barotseland specimens deposited in the Neuchâtel Natural History Museum and described the endemic species *Typhlacontias gracilis*. The French missionary Ellenberger collected material for the MNHN, which was reported on by Angel (1920, 1921). The most important collections were made by Richard Japp west of the Zambezi during the period 1962-1966. These were initially sent to the FMNH and subsequently to NMZB. These were included in the Zambian reptile checklist (Broadley 1971b). Table 6.1 suggests that Barotseland has the richest aquatic/flood plain herpetofauna in the Zambezi Basin with 89 species so far recorded. Recent fieldwork by the BFA in the area added nine species to the list (one new to science), and there may be others still to be found.

Table 6.2. Summary of species richness for reptiles and amphibians of wetland areas of the Zambezi Basin and outside (areas as in Table 6.1).

Wetland areas: Zhw - Zambezi headwaters; Bar - Barotse floodplains; Cho - Chobe/E Caprivi; Oka - Okavango Delta; Ban - Bangweulu swamps; Kaf - Kafue Flats; Kar - Lake Kariba; Chv - Lake Chivero; Nya - Nyanga National Park; MRP - Misuku/Rungwe/Poroto mountains; Nyk - Nyika Plateau; Mal - Lake Malawi shoreline; Mul - Mulanje Mountain; Chi - Lake Chilwa; LSh - Lower Shire valley; Del - Zambezi Delta; Pun - Pungwe Flats; Upe - Upemba swamps & environs; Mwe - Lake Mweru & Mweru Wantipa; Map - Maputaland; ZB - present-day Zambezi Basin total.

GROUP	AREA																				
	Zhw	Bar	Cho	Oka	Ban	Kaf	Kar	Chv	Nya	MRP	Nyk	Mal	Mul	Chi	LSh	Del	Pun	Upe	Mwe	Map	ZB
CHELONII (turtles/tortoises)	2	3	4	3	2	4	3	4	1	0	0	6	0	2	6	4	4	3	3	6	10
SAURIA (lizards)	13	19	13	12	6	11	12	11	8	6	3	15	9	9	14	12	13	14	9	13	30
AMPHISBAENIA (worm-lizards)	1	4	4	2	1	1	3	1	0	0	0	0	0	0	2	0	2	1	1	0	9
SERPENTES (snakes)	22	30	24	22	21	18	22	20	21	10	3	27	22	15	24	22	25	17	22	26	55
CROCODYLIA (crocodiles)	0	1	1	1	1	1	1	10	0	0	0	1	0	1	1	1	1	1	2	1	1
AMPHIBIA (frogs & toads)	20	32	28	20	9	24	14	22	19	8	16	33	26	18	26	22	28	20	11	32	74
TOTAL	58	89	74	60	40	59	55	59	49	24	22	82	57	45	73	61	73	56	48	78	179

Chobe/Eastern Caprivi

The first specimens recorded from this area were obtained by V. FitzSimons on the Vernay-Lang Kalahari Expedition in 1930 (FitzSimons 1935). Additional material from the Caprivi accumulated in the TM, but major contributions were made by Richard Japp, who obtained long series of burrowing reptiles turned up by bulldozers working along the Caprivi/Zambia border west of Katima Mulilo. This material was sent to the Mutare Museum and subsequently transferred to the NMZB. Recently collected material is being channelled to the SMWN via the Directorate of Wildlife Conservation and Research.

Okavango Delta

Apart from a few specimens collected at Lake Ngami, the first herpetological collection from this region was made by V. FitzSimons in 1930 (FitzSimons 1935). A fair amount of material has accumulated in the NMZB, TM and USNM, and distributions have been mapped by Auerbach (1987).

Bangweulu Swamps

A small collection was made at Nsombo at the northern end of Lake Bangweulu by F. Haas in 1931 and deposited in the SMF. It was reported on by Mertens (1937), who described *Limnophis bangweolicus* from two specimens. Captain Charles Pitman collected in the southeastern swamps between the Lulimala and Lukulu Rivers during his faunal survey of Northern Rhodesia (Pitman 1934) and specimens were deposited in the BMNH. Pike (1964) recorded the Nose-horned Viper (*Bitis nasicornis*) and Jameson's Mamba (*Dendroaspis jamesoni*) from this area, but unfortunately the voucher specimens were destroyed in a fire. Only 40 species have been recorded from the Bangweulu swamps and floodplains, but as this region is a link between the Upemba and Kafue swamp/floodplain complexes, it is estimated that at least another 40 species should be present.

Kafue Flats

Material collected at Lochinvar by B.L. Mitchell in the 1950s is deposited in the NMZB. A provisional checklist of the herpetofauna of this national park was published by Simbotwe and Patterson (1983), voucher specimens being deposited in the Livingstone Museum. It is unfortunate that hardly anything has been collected from the Busango floodplain and Lukanga swamps north of the Kafue Flats, which may show links between the latter and the Bangweulu swamps.

Lake Kariba

Good samples of the herpetofauna were obtained when the lake was rapidly filling up in 1959, mainly by B.L. Mitchell on the Zambian side and Peter Taylor on the Zimbabwean side, the material being deposited in the NMZB. Reptile records for the Zimbabwean national parks bordering the lake were subsequently published (Broadley & Blake 1979). The Middle Zambezi is depauperate as regard to wetlands. The small floodplain habitat at Mana Pools is in decline due to the damming of the Zambezi at Kariba gorge, and the peripheral floodplains of the man-made lakes Kariba and Cabora Bassa are too young to have developed a herpetofauna typical of this habitat.

Lake Chivero

Being close to Harare, the herpetofauna of this Recreational Park has been quite well sampled since the dam was completed in 1952, most of the material being deposited in the NMZB. A checklist of the reptiles has been published (Broadley & Blake 1979) while the amphibians were covered by Poynton & Broadley (1985-1991).

Nyanga National Park

The first small collection from this area was reported on by FitzSimons (1958), the specimens being deposited in the TM. Subsequently material was collected by National Parks staff, R. Kroon and myself, the material being deposited in the NMZB (Broadley 1962). A checklist of the reptiles was subsequently published (Broadley & Blake 1979).

Misuku–Rungwe–Poroto Mountains

The earliest herpetological collections from the Misuku Mountains and Fort Hill [Chipata] were made by Alexander Whyte and presented to the BMNH by Sir H.H. Johnston (Boulenger 1897). In 1929 Mr & Mrs Rudyerd Boulton were attached to the Straus Central African Expedition and collected reptiles and amphibians on Rungwe Mountain, which were deposited in the AMNH; the snakes were reported on by Bogert (1940). These included the second specimen of *Lycodonomorphus whytii*. In 1930 Loveridge collected in the Ukinga, Rungwe and Poroto Mountains for the MCZ (Loveridge 1933) and in 1948 he spent a month camped at the edge of the Matipa Forest on the Misukus and made another important collection (Loveridge 1953a, 1953b). In 1970 an Umtali Museum expedition camped in the Mugesse Forest on the Misukus and made a comprehensive collection from the area (Broadley 1971c).

Nyika Plateau

The first collections from this area were made by Alexander Whyte and presented to the BMNH by Sir H.H. Johnston (Boulenger 1897), although many species listed for "Nyika Plateau" were probably taken at lower altitudes. In 1948-49 Loveridge made an important collection for the MCZ (Loveridge 1953a, 1953b). Further large collections made on both Malawian and Zambian sectors of the Nyika in 1962-64 were deposited in the NMZB (Stewart & Wilson 1966). An Umtali Museum expedition collected additional material on the plateau in 1970 (Broadley 1971c).

Lake Malawi Shoreline

Apart from a few specimens from Cape Maclear, the first significant collection from "Lake Nyassa" to arrive at the BMNH came from Alexander Whyte from the northwest coast between Nkhata Bay and Karonga (Boulenger 1897). In 1930 Loveridge spent 10 days collecting around Mwaya at the northern tip of the lake (Loveridge 1933) and in 1949 he spent a month collecting at Mtimbuka at the southern end (Loveridge 1953a, 1953b). In 1963-64 Margaret Stewart collected amphibians throughout Malawi, including the lake margins (Stewart 1967). In 1970 an Umtali Museum expedition collected herpetological material from Nkhata Bay northwards (Broadley 1971c).

Mulanje Mountain

The first herpetological collections from the "Shire Highlands" (Mts Zomba and Mulanje) were made by Alexander Whyte and sent to the BMNH by H.H. Johnston (Günther 1893, 1894). A few specimens were collected by the Vernay-Nyasaland expedition of 1946 and deposited in the AMNH, while larger collections made by Loveridge in 1948-49 went to the MCZ (Loveridge 1953a, 1953b). In 1962 and 1970 Umtali [Mutare] Museum expeditions to Malawi made important collections on Mulanje (Broadley 1963a, 1971c). Subsequently the local herpetofauna was well sampled by Andrew Stevens, who was based at the Chisambo Tea Estate close to the Mozambique border (Stevens 1974).

Lake Chilwa

Some Lake Chilwa specimens, especially *Pelusios castanoides*, were sent to the Albany Museum by B.L. Mitchell and have subsequently been transferred to the PEM. *P. sinuatus* probably does not

occur in the lake. The herpetofauna of the swamps and floodplain of Lake Chilwa is covered in the annotated checklists by Stevens (1974) and Dudley (1978).

Lower Shire Valley

The first specimens collected in this area were obtained by Dr Kirk while on the Livingstone expedition (Günther 1864). A collection made by the Berner-Carr Entomological Survey of the Shire valley in 1952 was deposited in the AMNH and reported on by Loveridge (1953c). The snakes of this area were covered by Sweeney (1961). Stevens (1974) subsequently published an annotated checklist covering the herpetofauna of southeastern Malawi.

Zambezi Delta

There are a few specimens in the BMNH collected by the Livingstone Expedition in 1858-63 at the "Zambezi mouth", but most of the material lacks precise locality data. During his Mozambique Expedition of 1843-47, Wilhelm Peters collected mainly along the coast and the Zambezi River upstream to Tete. Material from Quelimane, Boror and Chupanga, deposited in the ZMB, came from the margins of the delta. Unfortunately, many of Peters' specimens now lack precise locality data and are only catalogued as "Mossambique", while in other cases locality data appear to have been transposed (Peters 1854, 1882). A collection from the Zambezi Delta was made by the Zoological Society of London's Zambezi Expedition of 1927. Many specimens were sent back alive to the zoo, but some voucher specimens were deposited in the BMNH (Cott 1934, 1935). Despite a recent BFA expedition to the area, its herpetofauna remains poorly known.

Pungwe Flats

A few specimens from Beira are scattered in various museums, but the first important collections from the floodplain were made in November 1963 when two Umtali Museum expeditions collected many reptiles and amphibians from the open oil pipeline trench between Muda and Lamego and near Xiluvo (Broadley 1963b, 1964).

Upemba Swamps and Environs

These swamps are partially included in the northwestern sectors of the Upemba National Park, where an enormous collection of herpetological material was made by the "Mission G.F. de Witte" in 1946-49 and deposited in the IRSNB (Witte 1953, Laurent 1957, Schmidt & Inger 1959). This coverage provides a baseline sample of the wetland herpetofauna of the southeastern Congo Basin.

Lake Mweru and Mweru Wantipa

The alkaline swamps and floodplains of the Mweru Wantipa may have formerly been linked to the Bangweulu swamps via tributaries of the Chambeshi River. This area has a diversity of habitats because, while Lake Mweru has herbaceous swamps to the south of it, the Mweru Wantipa depression has halophytic swamps and floodplains. Important collections were made in the Mweru Wantipa by H.J. Bredo while Director of the International Red Locust Control Service at Mbala. These were deposited in the IRSNB with a few specimens going to the PEM. Bredo's snake collection was studied by Broadley & Pitman (1960). Subsequently more material was collected by D.F. Vesey-FitzGerald and donated to the BMNH, MCZ and NMZB. Material from the western shore of Lake Mweru deposited in the IRSNB and the MRAC was listed by Witte (1953).

Maputaland

This area of northern KwaZulu-Natal represents the southern limit of the Mozambique plain, limited by the Lebombo Range to the west and terminating at the St. Lucia Estuary. In this restricted area most of the East African savanna species reach the southern limit of their range. Annotated

checklists of the amphibia (Poynton 1980) and reptiles (Bruton & Haacke 1980) have been published, most of the voucher specimens have been deposited in the TM.

6.3 ZOOGEOGRAPHY

The investigation of the biodiversity of the wetlands of the Zambezi Basin has to take cognisance of the palaeogeography of the basin. The deposition of the Kalahari sands during the Tertiary and their subsequent erosion and redeposition on the east coast was responsible for the evolution and dispersal of amphisbaenians and various other burrowing reptiles. The palaeo-Upper Zambezi originally had a major tributary rising in northeastern Zambia, incorporating the present Chambeshi River and the Kafue River upstream of the Kafue Flats. This then joined the palaeo-Upper Zambezi via the Nanzhila and Sichifula rivers (Fig. 6.1). The palaeo-Zambezi was originally linked to the Limpopo Basin via the Motloutse River (Main 1987, Thomas & Shaw 1988, 1991), but the tectonic uplift of the Zimbabwe-Kalahari axis broke this connection and resulted in the formation of palaeo-Lake Makgadikgadi during the Pliocene. Lake Bangweulu was apparently formed when a tectonic uplift blocked the course of the Chambeshi; the lake itself was then captured by the Luapula River.

The basic approach to a zoogeographical study of the herpetofauna of the Zambezi Basin wetlands is that used by Poynton & Broadley (1991) in dealing with the amphibians of the Zambesiaca area. This requires the identification of discrete clusterings of species ranges using a quarter-degree grid (c.27 km on a side) for plotting distributions. Although the distributional data is now comprehensive enough to permit the general application of an evolutionary species concept (Mayden 1997), in some "difficult" groups, e.g. the *Hyperolius viridiflavus* complex, it is useful to retain the subspecies category pending the availability of more molecular data. Many 'subspecies' are either geographically well isolated or show very limited hybridisation where they are in contact, consequently these are now recognised as full species.

Twenty-three range clusters were identified. These are described below.

6.3.1 Eastern Escarpment Range Clusters

Five of the range clusters represent subdivisions of an Eastern Escarpment group, as follows:

Eastern Escarpment – South

Two species inhabit the well-watered temperate zone of South Africa, with relict populations on the eastern highlands and central watershed areas of Zimbabwe: the water snake *Lycodonomorphus rufulus* (Fig. 6.16) and the frog *Strongylopus fasciatus* (Fig. 6.24).

Eastern Escarpment – Zimbabwe

Two frogs, *Rana inyangae* and *Hyperolius swynnertoni broadleyi*, are endemic to the eastern highlands of Zimbabwe; the former has a sister species on Mulanje Mountain north of the Zambezi.

Eastern Escarpment – Trans-Zambezi

One water snake, *Lycodonomorphus mlanjensis*, occurs on the lower slopes of Mulanje Mountain and on the eastern highlands of Zimbabwe (Fig. 6.16), probably indicating a recent connection via riparian forest during a wetter climatic period.

Eastern Escarpment – Malawi

Five forms are near-endemic to the Malawi highlands. A snake, *Dipsadoboa flavida* (Fig. 6.17) and a frog, *Rana johnstoni*, are endemic to Mount Mulanje and the latter has a vicariant species on the

Nyanga highlands. A skink, *Eumecia johnstoni* (Fig. 6.8), and a sedge frog, *Hyperolius quinquevittatus mertensi*, are endemic to the Nyika Plateau. Another sedge frog, *Hyperolius marginatus albofasciatus*, has a wide range on the Shire Highlands of south Malawi, but also extends eastwards across the Niassa Platform in Mozambique.

Eastern Escarpment – North

Three species occur on the Malawi highlands, but are also found on the highlands of southwestern Tanzania. They are the water snake *Lycodonomorphus whytii* and the frogs *Strongylopus fuelleborni* (Fig. 6.24) and *Hyperolius pictus*.

Hyperolius spinigularis is at present known only from the foot of Mulanje Mountain and Amani in the eastern Usambaras, both areas with an exceptionally high rainfall. The species may eventually be found elsewhere in the Eastern Arc mountains, as the extensive Udzungwe range is poorly known.

6.3.2 Kalahari Sand Range Clusters

The next group of range clusters are associated with the Kalahari sands, which were deposited during the Tertiary period. They extended north to the Congo Basin, south to the Orange River and east to cover most of Zambia, Zimbabwe west of the Save River and the Northern Province of South Africa (Fig. 6.2 & Broadley 1978). As these sands were eroded away by the Zambezi, Save and Limpopo Rivers and their tributaries, the sand was redeposited as alluvium on the Mozambique Plain, forming an enormous bulge in the coastline between Beira and Maputo. While the palaeo-Upper Zambezi was linked to the Limpopo River, various amphisbaenians and their fossorial snake predators extended their ranges eastwards via the Limpopo riverine alluvium and became established in the coastal alluvium. The subsequent tectonic uplift of the Zimbabwe-Kalahari axis and the erosion of the Kalahari sand cover from eastern Botswana severed the connection between eastern and western populations, which have subsequently vicariated to become sister species.

Kalahari Fauna

There are three terrestrial species: the lizards *Mabuya punctulata*, *Gerrhosaurus auritus* (Fig. 6.9), and the snake *Naja anchietae*, which occur on the Barotse floodplain. The fossorial forms consist of a small skink *Typhlosaurus rohani* (Fig. 6.7), three amphibians, *Zygaspis quadrifrons* (Fig. 6.11), *Monopeltis mauricei* (Fig. 6.12) and *Dalophia pistillum* (Fig. 6.13), and two back-fanged snakes which are specialised predators on amphisbaenians, i.e. *Amblyodipsas ventrimaculatus* and *Xenocalamus bicolor* (Fig. 6.15). There are three vicariant species in the Mozambique Plain alluvium, extending back into the Limpopo basin, i.e. *Zygaspis vandami arenicola* Broadley, *Monopeltis sphenorhynchus* Peters (Fig. 6.12) and *Xenocalamus lineatus* Roux (Fig. 6.15). A large toad, *Bufo poweri*, is the only amphibian representative.

Barotse Endemics

Two fossorial skinks, *Typhlacontias gracilis* (Fig. 6.7) and *Typhlosaurus jappi* have vicariant species in the Kalahari, i.e. *T. rohani* (sympatric at Kalabo) and *T. lineatus* Boulenger respectively. The attenuated amphisbaenian *Dalophia ellenbergeri* is a near-endemic, with a single record from southeastern Angola (Fig. 6.13). *Rhamphiophis acutus jappi* is perhaps a specialized flood plain form: the typical form extends through miombo woodlands along the southern rim of the Congo Basin. The fossorial frog *Hemisus "barotseensis"* sp. nov. is a near-endemic, with a single record from the Kafue National Park.

Caprivi Near-endemics

The large amphisbaenian *Dalophia longicauda* has a restricted distribution centred on the Kalahari sands of the Caprivi Strip. It appears to be a sister species of *D. pistillum*, but the two forms are now sympatric in the Caprivi and the Hwange District of Zimbabwe (Fig. 6.13). *Ptychadena mapacha* is only known from the Katima Mulilo area.

Kafue Flats Endemics

Zygaspis kafuensis is only known from the margins of the Kafue Flats (Fig. 6.11) and *Hyperolius pyrrhodictyon* is a true endemic.

Palaeo-Upper Zambezi Fauna

An arboreal dwarf gecko, *Lygodactylus chobiensis*, is widespread in the Upper Zambezi area, but has extended its range into the middle Zambezi valley and its tributaries, reaching the eastern limit of its range at Tete (Fig. 6.6). A terrapin, *Pelusios bechuanicus* (Fig. 6.3), and two snakes, *Limnophis bangweolicus* (Fig. 6.19) and *Crotaphopeltis barotseensis* (Fig. 6.17) occur throughout the swamps, while the three amphibians, *Bufo lemairii* (Fig. 6.23), *B. kavangensis* and *Kassina kuvangensis* (Fig. 6.29) breed on the floodplains.

6.3.3 Savanna Range Clusters

The next group of range clusters involves wide-ranging savanna species.

Pan-African South of the Sahara

Six species occur throughout both tropical and temperate savannas from West Africa often to the southwestern Cape: the terrapin *Pelomedusa subrufa*, the monitor lizard *Varanus niloticus*, and the snakes *Bitis arietans*, *Crotaphopeltis hotamboeia*, *Dispholidus typus* and *Dasypeltis scabra*. Two other reptiles do not occur in temperate regions – the snake *Philothamnus semivariegatus* and the crocodile *Crocodylus niloticus*.

Northern Savanna

Twelve species range from the Sudanese savanna of West Africa south to the Zambezi Basin – the snakes *Naja nigricollis*, *Natriciteres olivacea* (Fig. 6.18) and *Dromophis lineatus* (Fig. 6.20), and the amphibians *Bufo maculatus*, *Hylarana galamensis* (Fig. 6.25), *Ptychadena oxyrhynchus*, *P. mascareniensis* (Fig. 6.26), *P. pumilio*, *P. schillukorum* (Fig. 6.26), *Phrynobatrachus acridoides*, *P. natalensis* and *Kassina senegalensis*.

Western Savanna

Eight species inhabit the lowland and plateau savannas of Angola and Namibia, with a subtraction margin eastwards. Many reach Malawi and the western Mozambique pedicle (to Tete), but rarely the Mozambique plain, often being replaced by a vicariant species. They are the lizards *Mabuya wahlbergii* and *Gerrhosaurus nigrolineatus* (Fig. 6.9), the snakes *Rhinotyphlops schlegelii* (reaches the south Mozambique plain and Maputaland), *Philothamnus angolensis* (Fig. 6.21) and *Thelotornis oatesii*, and the frogs *Phrynomantis affinis*, *Tomopterna cryptotis* and *Hyperolius benguellensis*.

Southern Savanna

The frogs *Xenopus laevis* and *Pyxicephalus adspersus* have their centre of distribution in temperate South Africa, but have extensive subtraction margins in plateau areas to the north.

Central Plateau Savanna

Twelve taxa have distributions centred on the plateau and highland areas of central Africa: the tortoise *Kinixys spekii*, the lizards *Mabuya megalura* (Fig. 6.7), *Lygosoma sundevallii*, *Panaspis “maculicollis”* sp. nov. and *Ichnotropis capensis*, the snakes *Psammophylax variabilis* and *Philothamnus heterolepidotus* (Fig. 6.22), and the frogs *Rana angolensis*, *Cacosternum boettgeri*, *Leptopelis bocagii* (Fig. 6.28), *Hyperolius alborufus* and *Hyperolius kivuensis*.

East African Savanna

One third of the taxa recorded from the Zambezi Basin wetlands belong to a relatively young fauna, which in many cases inhabits the coastal plain from southern Somalia to Maputaland, with a variable subtraction margin westwards. These consist of three terrapins – *Pelusios subniger* (Fig. 6.3), *P. castanoides* (Fig. 6.4) and *P. sinuatus* (Broadley 1981); the tortoise – *Kinixys belliana*; 14 lizards – *Acanthocercus atricollis*, *Agama mossambica*, *A. armata*, *Chamaeleo dilepis*, *Lygodactylus capensis*, *Hemidactylus mabouia*, *Mabuya boulengeri*, *M. varia*, *M. striata*, *Lygosoma afrum*, *Panaspis wahlbergii*, *Gerrhosaurus major*, *G. flavigularis*, and *Latastia johnstoni*, one amphisbaenian – *Chirindia swynnertoni*; 23 snakes – *Rhinotyphlops mucruso*, *Leptotyphlops scutifrons*, *Python natalensis*, *Causus rhombeatus*, *C. defilippii*, *Amblyodipsas polylepis*, *Aparallactus lunulatus*, *A. capensis*, *Elapsoidea boulengeri*, *Naja annulifera*, *N. mossambica*, *Lycophidion c. capense*, *Dipsadoboa aulica*, *D. flavida broadleyi* (Fig. 6.17), *Psammophylax tritaeniatus*, *Rhamphiophis a. acutus*; *R. rostratus*, *Psammophis mossambicus*, *Meizodon semiornata* (Fig. 6.19), *Prosymna stuhlmannii*, *Philothamnus hoplogaster*, *P. punctatus* and *Thelotornis mossambicana*; and 26 amphibians – *Xenopus muelleri*, *Bufo gutturalis*, *B. garmani*, *Phrynomantis bifasciatus*; *Hemisis marmoratum*, *Pyxicephalus edulis*, *Tomopterna marmorata*, *Hildebrandtia ornata*, *Ptychadena anchietae*, *P. porosissima*, *P. uzungwensis* (Fig. 6.27), *P. mossambica*, *Phrynobatrachus mababiensis*, *P. parvulus*, *Chiromantis xerampelina*, *Leptopelis mossambicus* (Fig. 6.28), *Kassina maculata* (Fig. 6.29), *Afrixalus brachycnemis*, *A. crotalus*, *A. fornasinii*, *Hyperolius tuberilinguis*, *H. argus*, *H. mitchelli*, *H. pusillus*, *H. nasutus* and *H. marmoratus taeniatus*.

Angolan Highlands Eastwards

The 26 taxa in this group have ranges centred on the Angolan highlands, with an eastwards subtraction margin which extends into southeastern Tanzania. There is a terrapin – *Pelusios nanus* (Fig. 6.3); five lizards – *Lygodactylus angolensis*, *Mabuya ivensii* (Fig. 6.12), *Eumecia anchietae* (Fig. 6.8), *Chamaesaura miopropus* (Fig. 6.10) and *Gerrhosaurus bulsi* (Fig. 6.9); two amphisbaenians – *Zygaspis nigra* (Fig. 6.11) and *Dalophia angolensis* (Fig. 6.13); seven snakes – *Causus bilineatus*, *Elapsoidea semiannulata* (Broadley 1998), *Lycophidion multimaculatum* (Broadley 1996), *Natriciteres bipostocularis* (Fig. 6.18), *Limnophis bicolor* (Fig. 6.19), *Rhamphiophis a. acutus* and *Philothamnus ornata* (Fig. 6.22); and 11 amphibians – *Xenopus petersii*, *Hemisis guineensis microps*, *Hylarana darlingi*, *H. lemairei*, *Ptychadena subpunctata* (Fig. 6.25), *P. grandisonae*, *P. upembae*, *P. guibei*, *Leptopelis parvocagii* (Fig. 6.28), *Hyperolius q. quinquetaeniatus* and *H. angolensis*.

Congo Basin

Seven species have ranges centred on the savannas of the southern Congo Basin. They are the lizard – *Tetradactylus ellenbergeri* (Fig. 6.10); three snakes – *Xenocalamus mechowii* (Fig. 6.15), *Grayia ornata* and *G. tholloni*; and three amphibians – *Ptychadena obscura*, *Afrixalus wittei* and *Hyperolius melanoleucus*. The Slender-snouted Crocodile, *Crocodylus cataphractus*, can be included here, but it also extends through the forested areas of the Congo Basin and West Africa.

East African Coastal Forest

Two frog-eating snakes are more or less restricted to forested or formerly forested areas of the Mozambique plain. The marsh-snake *Natriciteres sylvatica* (Fig. 6.18) is very common on tea estates and *Philothamnus natalensis* (Fig. 6.22) survives the destruction of forest and coastal bush. The Forest Cobra, *Naja melanoleuca*, has a wider range and occurs throughout equatorial forests from West Africa to Kenya and south to Maputaland; it is often semi-aquatic. The two amphibians, *Leptopelis flavomaculatus* and *Hyperolius puncticulatus*, are more restricted to a forest habitat and ascend to quite high altitudes on the eastern escarpments.

Lower Zambezi

Six taxa have distributions centred on the Lower Zambezi. These are the Flap-shelled Turtle *Cycloderma frenatum* (Fig. 6.5); two snakes – *Proatheris superciliaris* (Fig. 6.14) and *Lycodonomorphus obscuriventris* (Fig. 6.16); and three frogs – *Hemius guineensis broadleyi*, *Leptopelis broadleyi* and *Afrivalus delicatus*. An undescribed species of *Dromophis* (Branch, in prep.) from the north Mozambique coast may belong here, if it proves to be present in the Zambezi Delta.

Pungwe Flats Near - Endemic

Leptotyphlops pungwensis is only known from the Pungwe Flats (Broadley & Wallach 1997) and the distribution of *Lycophidion nanum* seems to be centred on this area (Broadley 1996).

Middle Zambezi

Monopeltis zambezensis is endemic to the Middle Zambezi Valley (Fig. 6.12). *Bufo beiranus* has a strange distribution, apparently centred on the mid-Zambezi Valley but extending west to the Barotse floodplains and east to the Pungwe Flats and southern Malawi. *Hyperolius m. marginatus* also has a distribution centred on the mid-Zambezi Valley, but extends up the Luangwa Valley into western Malawi and Mozambique.

Lake Malawi North Shoreline

A single reed frog, *Hyperolius nyassae*, is endemic to this region, being replaced southwards by *H. m. marginatus*.

6.4 HERPETOFAUNA DESCRIPTIONS

Below are given brief annotated accounts of the species found in the wetlands of the Zambezi Basin.

REPTILIA**TESTUDINES****PELOMEDUSIDAE*****Pelomedusa subrufa* (Bonnaterre 1789)**

Helmeted Terrapin

This species occurs throughout sub-Saharan Africa and southwestern Arabia [PAN]. In South Africa it occurs in permanent rivers and grows to a large size, but throughout the rest of its range, due to competition with *Pelusios* spp., it is restricted to swamps and ephemeral pans, stunted in size and buries itself in the mud to aestivate. It is omnivorous, but feeds mainly on insects, tadpoles and frogs.

Pelusios nanus Laurent 1956 Dwarf Hinged Terrapin
 This is the smallest species of hinged terrapin (the anterior portion of the plastron is hinged and can be raised to protect the laterally withdrawn head and the forelimbs). Its distribution extends from the Angolan Highlands round the southern rim of the Congo Basin to Lake Tanganyika and northern Zambia (Fig. 6.3) [ANG]. It is an inhabitant of small clear water streams.

Pelusios subniger (Bonnaterre 1879) Pan Hinged Terrapin
 This is an 'old' species which is represented by populations on Madagascar and a sister species on the Seychelles. It has a wide range in southeast Africa, extending north to Burundi and Tanzania, south to northern KwaZulu-Natal and west to the Okavango Delta (Fig. 6.3) [EAS]. Like *Pelomedusa*, this small species is an inhabitant of swamps and ephemeral pans.

Pelusios bechuanicus FitzSimons 1932 Okavango Hinged Terrapin
 This large species is endemic to the clear waters of the palaeo-Upper Zambezi system (Fig. 6.3) [PUZ] but has a sister species, *P. upembae* Broadley 1981, just across the Zambezi-Congo watershed. The very large head has diagnostic yellow markings. The diet includes invertebrates and fish.

Pelusios castanoides Hewitt 1931 Yellow-bellied Hinged Terrapin
 This is another 'old' species with populations on Madagascar and a sister species on the Seychelles. It inhabits the lagoons of the Mozambique plain from southern Kenya south to Maputaland, extending inland to Lake Chilwa and the lagoons and swamps bordering Lake Malawi (Fig. 6.4) [EAS]. It feeds largely on aquatic snails.

Pelusios rhodesianus Hewitt 1927 Zambian Hinged Terrapin
 The distribution of this moderate-sized species seems to be centred on the southern rim of the Congo Basin, but extends north to Uganda and south to E Zimbabwe (Fig. 6.4) [PUZ]. There are also relict populations in Maputaland and on Durban Bluff, evidence for the former link between the palaeo-Upper Zambezi and the Limpopo. This species inhabits swamps and weed-choked lakes, being common in Lake Chivero near Harare.

Pelusios sinuatus (A. Smith 1838) Serrated Hinged Terrapin
 This is the largest species of the genus, attaining a shell length of 46.5 cm in Lake Tanganyika. It has a wide range in E Africa from Somalia south to KwaZulu-Natal and west to the rift valley [EAS]. It is common in the Middle and Lower Zambezi and their tributaries, but above the Victoria Falls it seems to be restricted to muddy backwaters, while *P. bechuanicus* occurs in the mainstream Zambezi. It is not known upstream from Kazungula. This species feeds mainly on snails and molluscs and is preyed upon by crocodiles.

TRIONYCHIDAE

Cycloderma frenatum Peters 1854 Zambezi Flap-shelled Turtle
 This large species (females can attain a shell length of 56 cm) occurs in rivers and lakes of East Africa from the Rufiji system in Tanzania south to the Save River in Mozambique. It is particularly abundant in the shallow waters of southern Lake Malawi (Fig. 6.5) [LZ] and fossil remains have been found in N Malawi. Its upstream distribution in the Zambezi River is blocked by the Cabora Bassa rapids. It feeds largely on bivalves and snails and could profitably be introduced into the man-made lakes of Kariba and Cabora Bassa. Both eggs and adults are eaten by man.

TESTUDINIDAE

Kinixys spekii Gray 1863

Speke's Hinged Tortoise

In this genus the rear portion of the carapace is hinged and can be closed down to protect the hind legs and tail. This species has a wide range on the central African plateau from S Kenya south to the northern provinces of South Africa (Broadley 1992) [CPS]. It has a depressed shell, which enables it to take shelter in rock crevices. It is usually active in the early morning, late afternoon or after rain. Its catholic diet consists largely of millipedes, snails and carrion.

Kinixys belliana Gray 1831

Bell's Hinged Tortoise

This species has a relatively domed shell with a black radial pattern on each carapacial shield. It occurs on the East African coastal plain from Somalia south to KwaZulu-Natal, and extends westwards through Uganda and Cameroon to Senegal. It also occurs in southern Malawi and SE Zimbabwe (Broadley 1992) [EAS]. Although occurring in moister habitats, the ecology is similar to that of the previous species.

SQUAMATA

AGAMIDAE

Acanthocercus atricollis (A. Smith 1849)

Southern Tree Agama

This large arboreal agama has a wide range throughout East African savannas from Ethiopia south to KwaZulu-Natal [EAS]. The usual habitat is the trunks of large trees, including palms. Its diet includes a wide range of insects and its habit of descending to the ground to feed on alate termites makes it vulnerable to predators.

Agama mossambica Peters 1854

Mozambique Agama

This moderate-sized agama is found from Tanzania south to central Mozambique, extending inland to Malawi and eastern Zimbabwe [EAS]. It is often found foraging on the ground, but is most often seen basking on the trunks of palms and other trees.

Agama armata (Peters 1854)

Tropical Spiny Agama

This small, terrestrial agama inhabits savannas from Tanzania south to KwaZulu-Natal and west to Zambia, the Caprivi and E Botswana [EAS]. It is cryptically coloured and is easily overlooked unless it moves. It may climb into low bushes or low down on tree trunks to bask, but it takes refuge in burrows. The diet consists largely of ants.

CHAMAELEONIDAE

Chamaeleo dilepis Leach 1819

Flap-necked Chameleon

This common chameleon has an enormous range throughout East Africa, south to N Namibia, Botswana and northern parts of South Africa [EAS]. Its main habitat is savanna woodland, where it feeds on grasshoppers and other insects, but also moves into reedbeds and papyrus. It is heavily preyed upon by raptorial birds and snakes, especially the boomslang and vine snake.

GEKKONIDAE

Lygodactylus angolensis Bocage 1896

Angolan Dwarf Gecko

This species has a patchy distribution in WC Africa and is the common species around Lake Kariba, where it often shares house walls with *L. chobiensis* [ANG].

Lygodactylus capensis (A. Smith 1849) Cape Dwarf Gecko
 This is the common species of dwarf gecko throughout most of SE Africa (Pasteur 1964) and its range is constantly being expanded by accidental transportation in the form of eggs stuck in crevices of packing crates, furniture or caravans [EAS]. It is basically arboreal, but may also be found in reedbeds.

Lygodactylus chobiensis FitzSimons 1932 Chobe Dwarf Gecko
 This is a relatively robust dwarf gecko, the males having forward directed black chevrons on the throat (sometimes solid black). They are common on trees and house walls in the Okavango Basin and along the Zambezi from Barotseland downstream to Tete (Fig. 6.6) [PUZ]. It is the southernmost species of the *L. picturatus* complex and appears to be a derivative of the widespread West African species *L. gutturalis* (Bocage), which ranges south through the eastern DRC to the Upemba National Park and Pweto at the northern end of Lake Mweru (Pasteur 1964).

Hemidactylus mabouia (Jonnés 1818) Tropical House-Gecko
 This moderate-sized arboreal gecko has a cosmopolitan distribution covering most of East Africa, Madagascar and the east coast of C and S America [EAS]. Because it has become a commensal of man it is rapidly expanding its range through accidental transportation of eggs. It emerges at night onto house walls to feed on insects.

SCINCIDAE

Typhlacontias gracilis Roux 1907 Barotse Burrowing Skink
 This small limbless skink lives beneath leaf litter in Kalahari sand regions of Barotseland northwards to Kabompo (Fig. 6.7) [BAR]. It largely replaces *T. rohani* on the Barotse floodplain.

Typhlacontias rohani Angel 1923 Kalahari Burrowing Skink
 This small skink is hard to distinguish from the previous species, and they are sympatric at Kalabo (Haacke 1997). It occurs in NE Namibia, N Botswana, NW Zimbabwe, SE Angola and adjacent Zambia west of the Zambezi (Fig. 6.7) [KAL]. This sand swimmer forages just below the surface of the sand at night, when it is relatively cool, feeding mainly on termites and beetle larvae.

LYGOSOMATINAE

Mabuya boulengeri Sternfeld 1911 Boulenger's Skink
 This slender long-tailed skink inhabits savannas from S Tanzania south to C Mozambique and E Zimbabwe (Fig. 6.7) [EAS]. It may bask on tree trunks, but is more frequently found on horizontal logs, in leaf litter (especially bamboo), in reeds along streams or climbing around in long grass (Broadley 1974). Oviparous.

Mabuya ivensii (Bocage 1879) Ivens' Skink
 This large elongate skink has a restricted range, extending from the Angolan highlands to the headwaters of the Zambezi (Fig. 6.12) [ANG]. It lives along streams and may take to the water to elude predators. The diet consists largely of beetles and grasshoppers (Branch & Haagner 1993).

Mabuya megalura Peters 1878 Grass Skink
 This slender long-tailed skink ranges from Ethiopia south to C Mozambique (Fig. 6.7) [CPS]. The only specimen from south of the Zambezi was found asleep at night clinging to long grass in the middle of a dambo. Viviparous.

- Mabuya punctulata*** (Bocage 1872) Speckled Skink
This small terrestrial skink has a distribution centred on the Kalahari, but extends west across Namibia to SW Angola, north to Barotseland and east through the Limpopo Basin to S Mozambique [KAL]. They may have burrows at the bases of bushes or take refuge under logs. In some parts of the range they are rupicolous (Broadley 1975). Viviparous.
- Mabuya varia*** (Peters 1867) Variable Skink
This moderate-sized terrestrial skink has a wide range from the Sudan south to the E Cape Province and west to Namibia [EAS]. It is common from sea level to mountain top and takes refuge under rocks and logs or in thick vegetation. Most populations are viviparous.
- Mabuya striata*** (Peters 1844) Striped Skink
This medium-sized arboreal skink ranges through East Africa from Ethiopia south to KwaZulu-Natal [EAS]. It is a commensal of man and rapidly moves onto bridges and buildings soon after construction. It feeds mainly on insects, but small lizards are sometimes devoured. Viviparous.
- Mabuya wahlbergii*** (Peters 1869) Wahlberg's Skink
This form replaces *M. striata* in savannas west of Tete, its range including Zambia, N Zimbabwe, N Botswana, most of Namibia and S Angola [WS]. It is particularly common on mopane trees.
- Eumecia anchietae*** Bocage 1870 Anchieta's Skink
This large, elongate, and very long-tailed skink has a range extending from the Angolan highlands around the southern rim of the Congo Basin to W Kenya (Fig. 6.8) [ANG]. There are only two or three digits on the vestigial forelimb and three on the hindlimb. This species uses serpentine locomotion to traverse its swamp or dambo habitat. Viviparous.
- Eumecia johnstoni*** (Boulenger 1897) Johnston's Skink
This skink is known only from the holotype, collected on the Nyika Plateau by Alexander Whyte (Fig. 6.8) [EEM]. It differs from the previous species in having only one toe on the forelimb and two on the hindlimb, and also lacks the distinctive striped body pattern of *E. anchietae*.
- Lygosoma afrum*** (Peters 1854) Mozambique Writhing Skink
This large skink has a range extending from the S Sudan and Ethiopia south to Inhambane in Mozambique [EAS]. The vestigial limbs are pentadactyle. It is found under detritus on sandy soils. Oviparous.
- Lygosoma sundevallii*** (A. Smith 1849) Sundevall's Writhing Skink
The distribution of this moderate-sized skink seems to be centred on the Kalahari, extending west to S Angola and N Namibia, east to W Mozambique and north to Kenya [CPS]. They shelter under rocks and logs on sandy soils feeding on small insects, especially termites. Oviparous.
- Panaspis wahlbergii*** (A. Smith 1849) Wahlberg's Snake-eyed Skink
This small species ranges through East Africa from Ethiopia south to KwaZulu-Natal [EAS]. Breeding males are bright orange below. This skink is common in leaf litter in moist savanna and feeds largely on termites. Oviparous.
- Panaspis "maculicollis"*** sp. nov. Spotted-neck Snake-eyed Skink
This very small skink replaces the previous species throughout W Mozambique, most of Zimbabwe, Botswana, the Caprivi and W Zambia [CPS]. Males have a black patch on the side of the neck
-

bearing several white spots, in the breeding season the orange ventral colouration is restricted to chin and throat. The species usually inhabits dry savanna and is found under rocks and logs.

Typhlosaurus jappi Broadley 1968

Barotse Blind Legless Skink

This robust legless sand swimmer is endemic to Barotseland west of the Zambezi [BAR]. It is yellow with two broad black dorsal stripes which fade out on the tail. The type series was exposed by graders during road construction.

CORDYLIDAE

Chamaesaura miopropus Boulenger 1894

Zambian Snake-Lizard

This serpentiform lizard has vestigial monodactyl fore- and hind-limbs and ranges from Angola east through S DRC, N Zambia and Malawi to S Tanzania (Fig. 6.10) [ANG]. It usually inhabits montane grassland, but three gravid females were caught in a few square metres of thick grass on the banks of a small tributary of the Kafue River near Chingola.

GERRHOSAURIDAE

Gerrhosaurus major Duméril 1851

Rough-scaled Plated-Lizard

This large robust lizard (up to 56 cm in total length) ranges from S Ethiopia south to KwaZulu-Natal and west to the Hwange District of Zimbabwe [EAS]. It is tawny above, with or without black streaks which become more pronounced posteriorly, and bright yellow below. This lizard takes refuge in burrows, derelict termitaria or rock crevices. Omnivorous, the diet includes soft fruits and flowers, insects, millipedes and smaller lizards. Oviparous.

Gerrhosaurus nigrolineatus Hallowell 1857

Black-lined Plated-Lizard

This large, but more slender, species ranges from Gabon south to N Namibia and eastwards to Uganda, Kenya, Tanzania, Malawi, W Mozambique, Zimbabwe and the northeastern provinces of South Africa (Fig. 6.9) [WS]. It is often sympatric with *G. flavigularis* in the eastern portion of its range. Reddish brown above with black-bordered yellow dorso-lateral stripes, the flanks are suffused with bright orange. These big lizards take refuge in rodent burrows or termitaria. The diet consists largely of grasshoppers, beetles and millipedes.

Gerrhosaurus auritus Boettger 1887

Kalahari Plated-Lizard

This large species inhabits the Kalahari, extending west into N Namibia, east to the Hwange National Park and north to Barotseland (Fig. 6.9) [KAL]. Juveniles show ragged dorso-lateral stripes like the previous species, but these fade out in the adults. The ecology is similar to that of the previous species.

Gerrhosaurus bulsi Laurent 1954

Spiny-tailed Plated-Lizard

This large robust species (up to 56 cm in total length) is distinguished by the very spinose scales on the tail. Juveniles have similar colouration to the previous species, but adults are uniform grey-brown. This species ranges from NE Angola to SE DRC (Fig. 6.9) [ANG]. These lizards are abundant in the N Mwinilunga District of Zambia, where they take refuge in burrows.

Gerrhosaurus flavigularis Wiegmann 1828

Yellow-throated Plated-Lizard

This lizard has an enormous range from the Sudan and Ethiopia to the SW Cape and west to E Namibia [EAS]. This relatively small slender species is readily distinguished by the smooth soles of the feet. It has a pair of black-bordered yellow dorso-lateral stripes like *G. nigrolineatus*, but the dorsum is olive brown and the flanks darker, sometimes with irregular yellowish vertical bars

(flanks sometimes orange in eastern specimens). It is common along streams and will take to the water to escape predators.

Tetradactylus ellenbergeri (Angel 1922) Ellenberger's Long-tailed Seps
This small serpentiform species ranges from the Angola highlands through S DRC and N Zambia to SW Tanzania (Fig 6.10) [COB]. It seems to frequent rank vegetation on floodplains and dambos.

LACERTIDAE

Latastia johnstoni Boulenger 1907 Malawi Long-tailed Lizard
This sand lizard ranges from C Tanzania through SE DRC, E Zambia and Malawi to the western Mozambique pedicle, it inhabits dry savanna and floodplains [EAS].

Ichnotropis capensis (A. Smith 1838) Cape Rough-scaled Sand Lizard
This medium-sized sand lizard ranges from southern Angola and NE Namibia to Zambia, S DRC, Botswana, Zimbabwe, northeastern parts of South Africa and S Mozambique [CPS]. It lives in burrows under bushes on sandy substrates. This is an 'annual' species – eggs are laid in November/December and hatch in January/March; few adults survive into their second year.

VARANIDAE

Varanus niloticus (Linnaeus 1766) Nile Monitor
This is the largest African lizard and it is ubiquitous throughout the savannas [PAN], being replaced in the rainforests by *V. ornatus* (Daudin). An aquatic species, its diet consists largely of crabs and mussels, but also includes insects, millipedes, and any vertebrate that it can catch, together with the eggs of crocodiles and terrapins, which are dug out of the nests.

AMPHISBAENIA

These blind burrowing reptiles construct burrow systems in sandy soils and feed on small invertebrates that fall into them.

AMPHISBAENIDAE

Zygaspis kafuensis Broadley & Broadley 1997 Kafue Round-snouted Worm-Lizard
This moderate-sized species is only known from the margins of the Kafue Flats (Fig. 6.11) [KAF].

Zygaspis nigra Broadley & Gans 1969 Black Round-snouted Worm-Lizard
This large and robust species occurs in E Angola, Zambia west of the Zambezi and the E Caprivi (Fig. 6.11) [ANG]. Most specimens have been exposed by bulldozers or graders working in Kalahari sand. This species is sympatric with several other amphisbaenians, including *Z. quadrifrons*.

Zygaspis quadrifrons (Peters 1873) Kalahari Round-snouted Worm-Lizard
This small species ranges from Namibia eastwards through Botswana, S DRC, Zambia and Zimbabwe to C Mozambique (Fig. 6.11) [KAL]. It feeds largely on termites and may be found in shallow burrows under rocks, logs or leaf litter.

Chirindia swynnertoni Boulenger 1907 Swynnerton's Round-snouted Worm-Lizard
This very small and slender species occurs in C Mozambique and SE Zimbabwe, also S Tanzania, mainly in miombo woodland, but also on floodplains in the Urema trough [EAS].

Monopeltis zambezensis Gans & Broadley 1974 Zambezi Wedge-snouted Worm-Lizard
This slender species is endemic to the Middle Zambezi Valley from Chete Gorge east to the Kanyemba area (Fig. 6.12) [MZ]. In the Dande Safari Area it is sympatric with *Zygaspis quadrifrons* and *Dalophia pistillum*.

Monopeltis mauricei Parker 1935 Western Slender Wedge-snouted Worm-Lizard
This very slender species is endemic to the Kalahari, extending north to the Kafue National Park and east into the Hwange District of Zimbabwe (Fig. 6.12) [KAL]. It has a vicariant species, *M. sphenorhynchus* Peters, in the Limpopo Basin. The diet includes termites (*Odontotermes*), ants and beetles.

Dalophia ellenbergeri (Angel 1920) Barotse Pestle-tailed Worm-Lizard
This genus is distinguished by its relatively long tail terminating in a callus pad, which seems to be used to block the end of its burrow to entry by carnivorous ants. This very slender species ranges from Barotseland (where it is sympatric with *D. pistillum*) into SE Angola (Fig. 6.13) [BAR]. When the Zambezi floodwaters inundate the Barotse floodplain, the amphisbaenians retreat to emergent termitaria or the fringing woodland (Owen, pers. comm.).

Dalophia angolensis Gans 1976 Angolan Pestle-tailed Worm-Lizard
This species is endemic to E Angola, with a single specimen recovered from the stomach of a snake (*Xenocalamus mechowii*) collected on the Zambezi River just inside Zambia (Fig. 6.13) [ANG].

Dalophia pistillum (Boettger 1895) Zambezi Pestle-tailed Worm-Lizard
This large species (maximum length 63 cm) has a wide, but patchy distribution extending from the extreme south of Angola and NE Namibia east through Botswana, Zambia and Zimbabwe to C and N Mozambique, with isolated records from northern regions of South Africa (Fig. 6.13) [KAL]. Although it inhabits Kalahari sand regions, it also tolerates harder substrates, as in the northern districts of Zimbabwe. The diet includes adult and larval beetles, termites (*Allodontermes* and *Hodotermes*), ant larvae and pupae (*Camponotus* sp.).

Dalophia longicauda (Werner 1915) Okavango Pestle-tailed Worm-Lizard
This elongate species has a very restricted distribution in the Caprivi Strip and the Hwange District of Zimbabwe, with isolated records from the Okavango River (type locality) and Okavango Delta (Fig. 6.13) [CAP]. It seems to be at least parapatric with the very similar *D. pistillum* throughout its range, and the two species can only be distinguished on counts of caudal annuli, i.e. tail length. The diet includes beetle larvae and ant larvae and cocoons (*Camponotus* sp.).

SERPENTES

TYPHLOPIDAE

Rhinotyphlops schlegelii (Bianconi 1850) Schlegel's Blind-Snake
This large, robust, species has a sharp horizontal cutting edge to the snout (in adults) and a visible eye. Above it is uniform black or mottled, immaculate below. Its range extends from S Angola and NE Namibia through Botswana and northeastern parts of South Africa to Swaziland and S Mozambique (to just north of the Save River) [WS].

Rhinotyphlops mucruso (Peters 1854) Zambezi Blind-Snake
This is the largest blind snake in the world, attaining a maximum length of 95 cm. It has a sharp horizontal cutting edge to the snout (in adults) and a visible eye. It occurs in lineolate and blotched

colour phases, immaculate below. Its range extends from coastal Kenya south to C Mozambique, west to SE DRC, Zambia, Zimbabwe and E Botswana [EAS]. The diet of blind snakes consists largely of ant brood and they feed infrequently, but build up large fat reserves. Large females lay up to 60 eggs.

LEPTOTYPHLOPIDAE

Leptotyphlops pungwensis Broadley & Wallach 1997 Pungwe Worm-Snake
This small pallid species is known only from the subadult holotype collected from the oil pipe-line trench crossing the Pungwe Flats between Muda and Lamego, where it was sympatric with both *L. longicaudus* and *L. scutifrons* [PUN].

Leptotyphlops scutifrons (Peters 1854) Peters' Black Worm-Snake
This all-black species has a wide range from Kenya south to South Africa and west to eastern Angola and Namibia [EAS]. It is the commonest species on the floodplains of Mozambique, but has not been recorded in western Zambia. The worm snakes feed on ant brood and small termites.

PYTHONIDAE

Python natalensis A. Smith 1840 Southern African Python
This is Africa's second largest snake, attaining a length of 5 m and exceeded only by the Northern African Python (*P. sebae*), which may exceed 6 m. This species ranges from C Kenya south to the Eastern Cape Province and west to DRC and Namibia [EAS], but in some areas has been locally exterminated by man. It is particularly common in waterside habitats, where it can ambush waterfowl and mammals coming to drink. Small Nile Monitors and crocodiles may be taken, while juveniles will take fish caught in nets or fish traps. This large snake is frequently eaten by man.

VIPERIDAE

Causus rhombeatus (Lichtenstein 1823) Rhombic Night-Adder
This large species (up to 93 cm) has a huge range in East Africa from the Sudan south to the southern coastal strip of South Africa [EAS]. It inhabits moist savanna and feeds mainly on toads. The long venom glands extend back into the neck, but the venom is very weak and bites on humans cause little more than local pain and swelling.

Causus bilineatus Boulenger 1905 Lined Night-Adder
This smaller species occurs in Angola, SE DRC and NE Zambia [ANG]. It inhabits moist miombo woodland.

Causus defilippii (Jan 1862) Snouted Night-Adder
This small species (maximum length 42 cm) occurs in East African savannas from Tanzania south to KwaZulu-Natal, extending west to Zimbabwe and E Zambia [EAS]. It has short venom glands and the bite causes local pain and swelling in man.

VIPERINAE

Proatheris superciliaris (Peters 1854) Eyebrow Viper
This recently erected monotypic genus seems to be basal to a clade terminating in the arboreal vipers of the genus *Atheris* (Broadley 1996b). The Eyebrow Viper is an inhabitant of floodplains from the northern end of Lake Malawi south to Beira (Fig. 6.14) [LZ]. This terrestrial snake shelters in rodent burrows, emerging at night to feed on frogs and small rodents. Gravid females may be found basking during the day.

Bitis arietans (Merrem 1820)

Puffadder

This heavily built viper has a pan-African distribution, being absent only from deserts, rainforests and high mountains [PAN]. A very common species in savannas, it relies on its cryptic colouration to escape observation as it lies in wait for rodents, consequently it is responsible for many snake bites on humans. The cytotoxic venom causes massive local tissue destruction, but very few bites are fatal.

ATRACTASPIDIDAE

Amblyodipsas polylepis (Bocage 1873)

Purple-glossed Snake

This large uniform black back-fanged snake (males up to 55 cm, females up to 112 cm) ranges from coastal Kenya south to KwaZulu-Natal and west to Angola [EAS]. It spends most of its time underground in burrows, feeding mainly on blind snakes and other fossorial reptiles. It moves around on the surface at night during wet weather.

Amblyodipsas ventrimaculatus (Roux 1907)

Kalahari Purple-glossed Snake

This small fossorial species has a purple-brown to black vertebral band, the flanks and subcaudals are bright yellow, the rest of the ventrum white. The distribution is limited to Kalahari sand regions of N Namibia, N Botswana, W Zambia and NW Zimbabwe [KAL]. The diet includes small amphisbaenians (*Zygaspis quadrifrons*) and limbless skinks (*Typhlacontias* spp.).

Xenocalamus bicolor Günther 1868

Bicoloured Quill-snouted Snake

This slender species is very variable in colouration. The 'typical' phase is black above and white below. In the Kalahari occurs a phase which is yellow above with a double row of purple-brown blotches, which may be confluent, white below. The only two specimens from Mozambique (Cheringoma Plateau) are uniform black above and below. The distribution covers Namibia, Botswana, northwestern parts of South Africa, N Zimbabwe and C Mozambique (Fig. 6.15) [KAL]. There is a sister species, *X. lineatus* Roux, in the Limpopo Basin. These burrowing snakes feed on amphisbaenians (*Zygaspis* and *Monopeltis*).

Xenocalamus mechowii Nieden 1913

Elongate Quill-snouted Snake

This large, but slender, species (maximum length 68 cm) is yellow to purple-brown above, with two rows of darker blotches, yellowish white below; a few melanistic specimens occur. It ranges from the Congo Basin south to N Namibia, W Zambia and NW Zimbabwe, being confined to Kalahari sand regions (Fig. 6.15) [COB]. The diet is restricted to amphisbaenians (*Zygaspis*, *Monopeltis* and *Dalophia*).

Aparallactus lunulatus (Peters 1854)

Reticulated Centipede-eater

This fossorial species is olive grey above with dark-edged scales, juveniles have a black collar followed by a series of black spots, but these gradually fade out in adults. It has an enormous range from Ghana west to Ethiopia and south to S Mozambique [EAS]. Snakes of this genus are specialist feeders on centipedes.

Aparallactus capensis A. Smith 1849

Cape Centipede-eater

This small species has a wide range from Kenya to South Africa and west to Angola and Namibia [EAS]. It is usually found under logs and stones in savanna, but also extends onto floodplains and into montane grassland.

ELAPIDAE

Elapsoidea semiannulata Bocage 1882

Angolan Garter-Snake

This fossorial species has a wide range from Senegal east to the Central African Republic and W DRC, then south to N Namibia and W Zambia [ANG]. It is sympatric with *E. boulengeri* on the Barotse floodplain and in the E Caprivi, but can be distinguished by its white ventrum.

Elapsoidea boulengeri Boettger 1895

Boulenger's Garter-Snake

This nocturnal species has a wide range in SE Africa, from E DRC, western and SE Tanzania south to Swaziland and the northern parts of South Africa, west to Zambia, Botswana and N Namibia (Broadley 1998) [EAS]. It occurs in savanna from sea level to 1500 m and is often associated with floodplains or mopane woodland. Juveniles are black with white or yellow crossbands, but these disappear in adults. The diet includes small snakes, lizards and amphibians.

Naja annulifera Peters 1854

Snouted Cobra

This large cobra (up to 245 cm) ranges from S Malawi to Swaziland and Kwazulu-Natal, west to Zimbabwe and E Botswana [EAS]. It usually lives in derelict termitaria and may be found basking nearby during the day. It does most of its hunting by night, feeding largely on toads, but also taking rodents, other snakes and eggs of domestic poultry, often becoming a persistent raider of chicken runs and killing any hen that interferes with it. This species secretes a potent neurotoxic venom and an untreated bite on man is likely to cause death through respiratory failure.

Naja anchietae Bocage 1879

Anchieta's Cobra

This species is closely related to the previous one, but it can be distinguished by usually having 17 scale rows at midbody, often reducing to 15 rows on the neck, whereas *N. annulifera* usually has 19 rows both at midbody and on the neck. This results in the scales on the neck of *N. anchietae* being distinctly larger. In large adults the snout becomes more pointed than in *N. annulifera*. This cobra inhabits moist savanna in Angola, NE Namibia, N Botswana, SW Zambia and NW Zimbabwe, with an apparently relict population in the Bangweulu swamps (Witte 1953, Pike 1964) [KAL]. In the eastern part of its range it seems to be restricted to a Kalahari sand substrate. Its ecology is similar to that of the previous species.

Naja melanoleuca Hallowell 1857

Forest Cobra

This large cobra inhabits forested or formerly forested areas of sub-Saharan Africa from Senegal east to Ethiopia, Kenya and S Somalia, south to Angola in the west and KwaZulu-Natal in the east [PAN]. It has a catholic diet, including small mammals, toads and frogs, lizards and snakes. It climbs and swims well and is expert at catching fish. It occurs along trout streams in the Nyanga National Park.

Naja nigricollis Reinhardt 1843

Black-necked Spitting Cobra

This big cobra (up to 270 cm) has a wide range in moist savannas from Senegal east to Ethiopia and S Somalia, south to Angola, Zambia, N Malawi and W and N Tanzania [NS]. Subadults are dark grey-brown above, adults usually become black, there is a single broad black band on the throat, the rest of the ventrum being mottled. The ecology is similar to that of the Snouted Cobra, but this species has fangs modified for 'spitting', the venom being projected as a diffuse spray aimed at the eyes of a person interfering with the snake. Unless washed out quickly, the cornea may be permanently damaged, resulting in blindness. The venom is cytotoxic and bites can cause extensive local necrosis.

Naja mossambica Peters 1854 Mozambique Spitting Cobra
 This is a relatively small cobra, reaching a maximum length of 154 cm. It has a wide range from SE Tanzania south to KwaZulu-Natal (with relict populations in S Somalia and on Pemba Island), west through S Malawi, S Zambia [Laurent (1956) indicates a relict population on the floodplain south of the Bangweulu swamps], Zimbabwe and Botswana to N Namibia and S Angola [EAS]. Its ecology resembles that of *N. nigricollis*, but being a smaller snake, the effects of its bite and 'spitting' are usually less serious.

COLUBRIDAE

Lycodonomorphus mlanjensis Loveridge 1953 Mulanje Water-Snake
 This robust snake inhabits montane grasslands in southern Malawi and eastern Zimbabwe (Fig. 6.16) [EEX]. It is a diurnal constrictor which preys upon frogs (including *Xenopus*) and small fish (including *Clarias*) in highland streams (Broadley 1967).

Lycodonomorphus rufulus (Lichtenstein 1823) Brown Water-Snake
 This nocturnal water snake has a wide range in well-watered regions of South Africa and Zimbabwe, with a relict population on Gorongosa Mountain in Mozambique (Fig. 6.16) [EES]. In the northern part of its range it is common in mountain streams, where it feeds on frogs, tadpoles and small fish. It is often sympatric with *L. mlanjensis* (Broadley 1967).

Lycodonomorphus whytii (Boulenger 1897) Whyte's Water-Snake
 This species is only known from three specimens from the extreme north of Malawi and SW Tanzania (Fig. 6.16) [EEN]. The habitat appears to be montane streams; a specimen from Rungwe mountain contained the remains of a frog.

Lycodonomorphus obscuriventris FitzSimons 1964 Floodplain Water-Snake
 This small species inhabits floodplains from S Malawi through Mozambique to N KwaZulu-Natal, extending west into southeastern Zimbabwe, the Kruger National Park and N Swaziland (Fig. 6.16) [LZ]. These snakes have been found in the late afternoon, hunting small frogs at the edges of muddy pans frequented by elephant (Broadley 1967).

Lycophidion multimaculatum Boettger 1888 Blotched Wolf-Snake
 This species ranges from S Gabon south through Angola to the Caprivi Strip, east through S DRC and N Zambia to the extreme west of Tanzania (Broadley 1996a) [ANG]. It is sympatric with *L. capense* in the E Caprivi.

Lycophidion capense capense (A. Smith 1831) Cape Wolf Snake
 This small snake has a wide range in savannas from the SW Cape north to Namibia, S Zambia, Malawi and S Tanzania [EAS]. It is a nocturnal constrictor that feeds mainly on sleeping skinks.

Lycophidion nanum (Broadley 1968) Dwarf Wolf Snake
 This very small species inhabits C Mozambique, just entering Zimbabwe at the southern end of the Chimanimani National Park [PUN]. This is a specialist predator on the small amphisbaenian *Chirindia swynnertoni*.

Grayia ornata (Bocage 1866) Ornate Water-Snake
 This aquatic species was described from the Angolan highlands and has a wide range in the Congo Basin [COB]. The only Zambian specimen was taken from a fish trap in the Kasombo stream, a

forested tributary of the Zambezi near its source. It had a frog in its stomach (Broadley 1983), but these snakes usually eat fish.

Grayia tholloni Mocquard 1897

Thollon's Water-Snake

This small species has a wide range from the Sudan south to W Tanzania west to Angola [COB]. The only two Zambian records are from the Mweru Wantipa (Broadley 1983) and the Kasombo stream (Broadley 1991), where it is sympatric with *G. ornata*. This is the southernmost locality for both species.

BOIGINAE

Crotaphopeltis hotamboeia (Laurenti 1768)

Herald Snake

This small back-fanged snake has an enormous range through the savannas of sub-Saharan Africa [PAN]. It is nocturnal and feeds largely on toads.

Crotaphopeltis barotseensis Broadley 1968

Barotse Water-Snake

This species has so far been recorded only from Kalabo (the type locality) on the Barotse floodplain and in the Okavango Delta (Fig. 6.17) [OKO]. It seems to replace the previous species in papyrus beds. The diet includes a variety of frogs (Broadley 1968).

Dipsadoboa aulica (Günther 1864)

Marbled Tree-Snake

This back-fanged arboreal snake ranges from S Malawi south to KwaZulu-Natal and westwards into SE Zimbabwe, the Kruger National Park and Swaziland (Fig. 6.17) [EAS]. It inhabits riparian woodland along large rivers, taking refuge in hollow trees or beneath leaf litter and it feeds mainly on geckos and arboreal frogs, especially *Hyperolius*. Several have been found in thatched roofs.

Dipsadoboa flavida flavida (Broadley & Stevens 1971)

Mulanje Cross-barred Tree-Snake

This snake is only known from a restricted area at the foot of Mount Mulanje in S Malawi (Fig. 6.17) [EEM]. Its favourite daytime retreat is inside old bamboo stems, from which it emerges at night to hunt frogs (*Hyperolius* spp., *Africalus* spp.) in nearby reedbeds.

Dipsadoboa flavida broadleyi Rasmussen 1989

Eastern Cross-barred Tree-Snake

This subspecies has a wide range from S Somalia south to Maputo in S Mozambique. There are only five records from Mozambique (Fig. 6.17) [EAS], where *D. aulica* is the commoner species.

NATRICINAE

Natriciteres bipostocularis Broadley 1962

Southwestern Forest Marsh-Snake

This small non-venomous snake inhabits forest-savanna mosaic from the Angolan highlands eastwards along the southern rim of the Congo Basin to NE Zambia (Fig. 6.18) [ANG]. It feeds on small frogs and tadpoles.

Natriciteres sylvatica Broadley 1966

Southeastern Forest Marsh-Snake

This species occurs on the margins of coastal forest patches from S Tanzania south to N KwaZulu-Natal (Fig. 6.18) [ECF]. Its diet includes fish-eating spiders.

Natriciteres olivacea (Peters 1854)

Olive Marsh-Snake

This small snake has a huge range from Guinea east to the Sudan and then south to S Mozambique and west to Angola (Fig. 6.18) [NS]. The diet includes frogs, tadpoles and small fish; they have also been seen eating alate termites. The marsh snakes have fragile tails, which snap off if seized.

Limmophis bicolor Günther 1865 Angolan Striped Swamp-Snake
 This robust aquatic snake occurs on the Angolan highlands, extending eastwards to the Zambezi headwaters (Fig. 6.19) [ANG].

Limmophis bangweolicus (Mertens 1936) Bangweulu Striped Swamp-Snake
 This snake ranges from the swamps of Mweru Wantipa and Lake Bangweulu along the southern rim of the Congo Basin into Angola, and south along the Upper Zambezi to the Okavango swamps (Fig. 6.19) [PUZ]. This species has a more pointed snout than the previous one, suggesting that it pokes around in crevices for its prey. A spiny eel was found in one stomach, but it takes a variety of small fishes.

PSAMMOPHIINAE

Psammophylax tritaeniatus (Günther 1868) Three-lined Grass-Snake
 This handsomely striped diurnal back-fanged snake has a distribution extending from S Tanzania south to the central plateau areas of South Africa (Free State) and west to Angola and Namibia [EAS]. It inhabits open grasslands and feeds on lizards, frogs and mice.

Psammophylax variabilis Günther 1893 Grey-bellied Grass-Snake
 This species inhabits montane grasslands from S Rwanda, Burundi, SE DRC and SW Tanzania south to S Malawi (Zambia and Mulanje plateau), but occurs on floodplains in W Zambia and the E Caprivi, entering Botswana at Kasane [CPS]. It is ovo-viviparous, at least the southern part of its range, and its diet includes small fish.

Rhamphiophis acutus acutus (Günther 1888) Eastern Striped Beaked-Snake
 This diurnal back-fanged snake ranges from Angola, through N Zambia to W Tanzania and Burundi [ANG]. It inhabits savanna woodland, especially miombo, and includes lizards and frogs in its diet.

Rhamphiophis acutus jappi Broadley 1971 Barotse Striped Beak-Snake
 This subspecies was described from Kalabo and has been recorded upstream at Zambezi (Balovale) [BAR]. It may be adapted for life on floodplains, as the Zambezi specimen had a large amphibaenian (*Dalophia ellenbergeri*) in its stomach.

Rhamphiophis rostratus Peters 1854 Rufous Beaked-Snake
 This large species has a wide range at low altitudes in East Africa, extending from the S Sudan south to Mozambique and the Mpumalanga Province of South Africa and west to N Botswana and the Caprivi [EAS]. It spends most of its time underground in rodent burrows and its diet includes a wide range of small vertebrates, including snakes.

Dromophis lineatus (Dumèril & Bibron 1854) Lined Olympic-Snake
 This snake ranges through West Africa from Guinea to the Sudan, south through C Africa to Zambia and the E Caprivi, just entering Botswana at Kasane, while the only Zimbabwean specimen (probably a waif) was collected on the south bank of the Zambezi at Nampini (Fig. 6.20) [NS]. This species inhabits swamps and dambos and its diet includes rodents and frogs.

Psammophis mossambicus Peters 1882 Olive Grass-Snake
 This large species ranges from the Sudan south to KwaZulu-Natal and west to Namibia [EAS]. It is usually uniform olive above and yellow below. Its preferred habitat is thick grass and reed beds and it preys upon rodents, lizards and frogs.

COLUBRINAE

Meizodon semiornatus semiornatus (Peters 1854) Semiornate Snake

This small species ranges from Kenya and Uganda south to KwaZulu-Natal, reaching its western limit on the Zimbabwe/Botswana border in the vicinity of the Kazuma depression (Fig. 6.19) [EAS]. It usually occurs along drainage lines and lives in hollow trees or under the loose bark on dead trees. It feeds on small frogs and lizards.

Prosymna stuhlmannii (Pfeffer 1893) East African Shovel-snout

This savanna species ranges from S Somalia south to KwaZulu-Natal, extending west to E Zambia, Zimbabwe and the Northern Province of South Africa [EAS]. The diet of these snakes consists of reptile eggs and they are often found inside hollow logs, where geckos lay their eggs.

Philothamnus angolensis Bocage 1882 Angolan Green-Snake

This large arboreal green-snake (up to c.120 cm) has a range extending from Angola and N Namibia through S DRC, Zambia and N Botswana to S Tanzania, Malawi, Zimbabwe and Mozambique to N KwaZulu-Natal (Fig. 6.21) [WS]. It is abundant in extensive beds of reeds and papyrus but also occurs in overhanging trees along river courses. It feeds mainly on frogs and toads, but also takes small lizards and nestling birds.

Philothamnus hoplogaster (Günther 1863) Southeastern Green-Snake

This small green-snake has a wide range in the East African savannas from Kenya south to the coast of the Eastern Cape Province in South Africa and west to Zambia and the E Caprivi [EAS]. Its preferred habitat is open grassy vleis and dambos. It feeds mainly on frogs, but also takes small fish and lizards.

Philothamnus ornatus Bocage 1872 Ornate Green-Snake

This handsome species has a yellow-bordered red-brown vertebral stripe. It has a patchy distribution from Angola east through Zambia to Lake Malawi at Nkhata Bay, south into N Botswana and Zimbabwe along the Harare-Nyanga watershed (Fig. 6.22) [ANG]. It is usually found along small streams or vleis in open grassland with patches of bullrushes and sedges. It feeds on small frogs.

Philothamnus heterolepidotus (Günther 1863) Slender Green-Snake

This very slender, small-headed, species ranges from S Sudan west to Ghana and south to Tanzania, N Zambia and Angola (Fig. 6.22) [CPS]. Its preferred habitat seems to be extensive beds of reeds and papyrus.

Philothamnus natalensis (A. Smith 1848) Natal Green-Snake

This species inhabits the south Mozambique plain from the Pungwe Flats south to Lake St Lucia in Maputaland, it extends inland to the eastern slopes of Mount Nyangani and the Save-Runde confluence in E Zimbabwe and the eastern border of the Kruger National Park (Fig. 6.22) [ECF]. It is usually associated with coastal forest.

Philothamnus semivariiegatus (A. Smith 1840) Variegated Bush-Snake

This long slender species occurs throughout the tropical savannas of sub-Saharan Africa [PAN]. It is strongly arboreal and feeds largely on geckos and other lizards, although frogs are also taken.

Philothamnus punctatus (Peters 1866) Spotted Bush-Snake

This species inhabits the East African lowlands from Somalia south to N Mozambique [EAS]. It has been collected at Nkhata Bay on the western shore of Lake Malawi.

Dispholidus typus (A. Smith 1829) Boomslang
 This large back-fanged tree-snake has an extensive distribution throughout the savannas of sub-Saharan Africa [PAN]. Its preys largely on chameleons, but also takes nestling birds and frogs. Its bite can be fatal to humans, the venom causing extensive internal haemorrhage.

Thelotornis oatesii (Günther 1881) Oates' Savanna Vine-Snake
 This slender arboreal back-fanged snake has a wide range from S Angola and northern Namibia, east to S DRC, Zambia, Malawi, N Botswana, Zimbabwe and W Mozambique [WS]. It often sits immobile in a bush beside a stream waiting for suitable prey to come within range. The vine snakes have the best eyesight of any African snake, and having spotted a suitable frog, lizard or small snake, they descend to the ground and slowly stalk their prey before seizing it after a short rush.

Thelotornis mossambicanus (Bocage 1895) East African Savanna Vine-Snake
 This snake has a wide range from S Somalia south to C Mozambique, extending west into Malawi and E Zimbabwe [EAS], where it hybridises with the previous species (Broadley 1979). This species inhabits coastal forests and savannas and is usually smaller and more slender than *T. oatesii*.

Dasyplectis scabra (Linnaeus 1758) Rhombic Egg-eater
 This species has a pan-African distribution in savannas [PAN]. It is particularly common and reaches a large size (approx. 1 m) in swamps, where the nests of bishop and weaver-birds provide an abundant supply of eggs.

CROCODYLIA

CROCODYLIDAE

Crocodylus niloticus Laurenti 1768 Nile Crocodile
 This species is ubiquitous in suitable water bodies throughout tropical sub-Saharan Africa [PAN]. Hutton (1984) carried out a field study on the crocodile population at Ngezi Dam. Blake (1974) and Blake & Loveridge (1975) reported on the role of crocodile rearing in Zimbabwe for commercial farming and conservation purposes.

AMPHIBIA

PIPIDAE

Xenopus laevis (Daudin 1802) Common Clawed-Frog
 This totally aquatic species of "platanna" occurs throughout well-watered parts of South Africa and north to Zimbabwe and S Malawi [SS], except where replaced by the following two species.

Xenopus petersii Bocage 1895 Angolan Clawed-Frog
 This frog has a wide range on plateau areas of SC Africa from Angola and N Namibia through S DRC, Zambia and N Botswana to SW Tanzania [ANG]. It seems to prefer clear water.

Xenopus muelleri (Peters 1844) Tropical Clawed-Frog
 This species has an enormous range at low altitudes from the Sudan south to KwaZulu-Natal and west to Ghana. It is common along the Middle and Lower Zambezi and also occurs in the Okavango Delta, the Caprivi and on the Barotse floodplain [EAS]. This frog is found in muddy backwaters which dry out, when the *Xenopus* take refuge at the bottom of cracks in the dried mud where there is still some moisture.

BUFONIDAE

Bufo gutturalis Power 1927

Guttural Toad

This common large toad has a wide range in moist savannas from Kenya and Uganda south to the northern parts of South Africa [EAS].

Bufo garmani Meek 1867

Olive Toad

This large toad has a patchy distribution in dry savannas from Somalia south to the northern parts of South Africa [EAS].

Bufo poweri Hewitt 1935

Kalahari Toad

This very large toad occurs in the Kalahari, extending into NW Zimbabwe and north to the Barotse floodplains [KAL].

Bufo maculatus Hallowell 1854

Flat-back Toad

This moderate-sized toad occurs throughout tropical savannas of sub-Saharan Africa [NS].

Bufo lemairii Boulenger 1901

Yellow Swamp Toad

This toad is unusual in having a pointed snout like a frog, the males are brilliant yellow during the breeding season. The species has a limited range from the Okavango Swamps (Haacke 1982) along the floodplains of the Upper Zambezi to Lake Bangweulu, the Chambeshi River (Mertens 1937), and S DRC (Fig. 6.23) [OKO]. Pitman (1934) noted, "In mid-May found in hundreds of thousands in an extensive swamp on the edge of the flats east of the Bangweulu swamps, between the Rivers Lulimala and Lukulu, near the village of Marbo. Has a very pleasing mellow cry, which is quite musical when uttered simultaneously by several dozens".

Bufo kavangensis Poynton & Broadley 1988

Kavango Dwarf Toad

This very small toad ranges from NE Namibia through N Botswana to NW Zimbabwe [OKO]. Males call while clinging to grass stems in shallow pans.

Bufo beiranus Loveridge 1932

Beira Dwarf Toad

This tiny toad has a patchy distribution from the Pungwe Flats via the Middle Zambezi and SW Zambia to the Barotse floodplain [MZ].

MICROHYLIDAE

Phrynomantis bifasciatus (A. Smith 1847)

Red-banded Rubber-Frog

This fossorial species has a wide range in savannas from Kenya south to KwaZulu-Natal and west to N Namibia [EAS]. It lives underground and feeds mainly on termites, emerging during the rains to breed in temporary pans, the high-pitched trilling call of the male being very distinctive.

Phrynomantis affinis Boulenger 1901

Red-spotted Rubber-Frog

This nominal species is only known from a few specimens from N Namibia, W Zambia and S DRC [WS]. Its status is uncertain.

HEMISIIDAE

Hemiscus marmoratus (Peters 1854)

Marmorate Shovel-snouted Frog

This small fossorial species has a wide range in East Africa from Somalia south to N KwaZulu-Natal and west to the E Caprivi [EAS]. It spends most of its time underground, feeding on termites.

Hemissus "barotseensis" sp. nov. Barotse Shovel-snouted Frog
Specimens of a small *Hemissus* recently collected on the Barotse floodplains differ in advertisement call, morphology and colour pattern, and represent an undescribed species [BAR].

Hemissus guineensis microps Laurent 1972 Congo Shovel-snouted Frog
This large form ranges from the lower DRC through Angola and W Zambia to the Okavango Swamps [ANG].

Hemissus guineensis broadleyi Laurent 1972 Broadley's Shovel-snouted Frog
This large form ranges from the Hwange District of Zimbabwe east to the Pungwe Flats [LZ] and may be sympatric with *H. marmoratus*.

RANIDAE

Pyxicephalus adspersus Tschudi 1838 Highveld Bullfrog
This very large frog ranges across plateau areas of South Africa, Botswana, C Namibia, Zimbabwe and C Mozambique [SS]. It breeds in temporary pans, gorges itself on a wide range of invertebrates and small vertebrates (frogs, snakes, rodents), then spends the dry months underground in a cocoon derived from the epidermis.

Pyxicephalus edulis Peters 1854 Tropical Bullfrog
This smaller species occurs throughout savanna lowlands of East Africa as far south as Maputaland and west to Nigeria [EAS]. Its breeding behaviour is quite different from that of *P. adspersus* (Channing *et al.* 1994).

Tomopterna cryptotis (Boulenger 1907) Kalahari Sand-Frog
This is a very common frog in Namibia, the Kalahari and dry savannas of Zimbabwe and W Mozambique [WS], breeding in ephemeral pans.

Tomopterna marmorata (Peters 1854) Marmorate Sand-Frog
This russet-coloured species has a more eastern distribution [EAS] and is usually associated with sand rivers, burying itself in the damp sand of the river bed during the dry season.

Rana angolensis Bocage 1866 Common River-Frog
This frog has a wide distribution throughout the central plateau areas of Africa from Ethiopia south to South Africa [CPS]. It lives along well vegetated banks of streams and rivers, jumping into the water when disturbed.

Rana johnstoni Günther 1893 Mulanje River-Frog
This aquatic species is endemic to cold mountain streams on Mulanje Mountain in S Malawi [EEM].

Rana inyangae Poynton 1966 Nyanga River-Frog
This diurnal species is known only from the Nyanga and Chimanimani National Parks on the eastern escarpment of Zimbabwe [EEZ]. It lives in turbulent water in cold mountain streams and frequently sits on rock ledges behind small waterfalls.

Strongylopus fasciatus (A. Smith 1849) Striped Long-toed Frog
This species has a disjunct distribution extending from the southern coast and plateau regions of South Africa to the Eastern Highlands of Zimbabwe, with relict populations scattered across the

Zimbabwean plateau (Fig. 6.24) [EES]. These frogs live in grassy dambos and only resort to water to breed. Their long toes are not webbed.

Strongylopus fuelleborni (Nieden 1910) Poroto Long-toed Frog
This is a vicariant species of *S. fasciata* with relict populations on the highlands of Malawi and SW Tanzania [EEN]. Its habitat is montane meadows (Loveridge 1953d).

Hylarana darlingi (Boulenger 1902) Golden-backed Frog
This attractive frog inhabits plateau areas from Angola through Zambia and Zimbabwe to S Malawi and W Mozambique [ANG]. It occurs in both savanna and coastal forest.

Hylarana lemairei (Witte 1921) White-lipped Frog
This forest species has the tips of the toes expanded into discs. It inhabits the S DRC, NE Angola and N Zambia, where it is common at the Zambezi headwaters [ANG].

Hylarana galamensis (Dumèril & Bibron 1841) Galam Swamp Frog
This strongly aquatic frog ranges from Senegal east to S Somalia, south to the Save River in Mozambique, and west to Malawi and N Zambia, including the Bangweulu Swamps (Fig. 6.25) [NS].

Hildebrandtia ornata (Peters 1878) Ornate Burrowing Frog
This beautiful frog ranges from Kenya south to Mozambique and west to S Angola and N Namibia [EAS]. It inhabits open savanna and breeds in ephemeral pans.

Ptychadena subpunctata (Bocage 1866) Spot-bellied Ridged-Frog
This large species has a wide range centred on the swamps and river backwaters of the Upper Zambezi and the Okavango Delta, extending into Angola and S DRC (Fig. 6.25) [ANG].

Ptychadena oxyrhynchus (A. Smith 1849) Sharp-snouted Ridged-Frog
This frog ranges through moist savanna woodlands from Senegal to the Eastern Cape Province of South Africa [NS]. It breeds in shallow pools along streams or on rock outcrops.

Ptychadena anchietae (Bocage 1867) Plain Ridged-Frog
This species has a wide range through dry savannas from Ethiopia south to KwaZulu-Natal and west to Angola [EAS]. Its usual habitat is the bare margins of 'sand rivers' where it takes to the water when disturbed. It takes refuge under debris deposited by floodwaters.

Ptychadena obscura (Schmidt & Inger 1959) Obscure Ridged Frog
Similar to the previous species, but restricted to the SE DRC and N Zambia [COB].

Ptychadena mascareniensis (Dumèril & Bibron 1841) Mascarene Ridged-Frog
This savanna species has a patchy distribution from Sierra Leone east to Egypt and south to Kwazulu-Natal (Fig. 6.26) [NS], it also occurs on Madagascar, Mascarene and Seychelles Islands. This frog is restricted to swamps and marshes.

Ptychadena porosissima (Steindachner 1867) Striped Ridged-Frog
This small species inhabits uplands from Ethiopia and Uganda south to the Eastern Cape Province of South Africa and west to Angola [EAS]. It lives in open grasslands and dambos.

Ptychadena grandisonae Laurent 1954 Grandison's Ridged-Frog
This species ranges from NE Angola through Zambia to E DRC and Rwanda [ANG].

Ptychadena upembae (Schmidt & Inger 1959) Upemba Ridged-Frog
This species has been recorded from Angola, S DRC, Zambia and Malawi [ANG].

Ptychadena uzungwensis (Loveridge 1932) Udzungwe Ridged Frog
This frog inhabits upland grasslands from Rwanda south to the Soutpansberg, extending west to E Angola (Fig. 6.27) [EAS].

Ptychadena pumilio (Boulenger 1920) Dwarf Ridged-Frog
This small species has a patchy distribution in moist savanna from Senegal east to DRC and south to Maputaland [NS]. It is unusual in being very active in the day time.

Ptychadena guibei Laurent 1954 Guibe's Ridged-Frog
This small species has a patchy distribution from Angola east to C Mozambique and north to S DRC [ANG]. It inhabits moist grassland and savanna, especially in dambos.

Ptychadena mossambica (Peters 1854) Mozambique Ridged-Frog
This short-legged species occurs from Kenya and Uganda south to Maputaland, west to Zambia the E Caprivi and Botswana [EAS]. It is common along sand rivers (with *P. anchietae*) and on some floodplains.

Ptychadena schillukorum (Werner 1907) Nile Ridged-Frog
This short-legged species ranges from the White Nile south to the Pungwe Flats in C Mozambique and west to Ghana (Fig. 6.26) [NS]. It inhabits floodplains and Loveridge (1953b) found specimens "sunken in damp sand under debris deposited on sand bars by the shrinking Zambezi River (near Tete)". Males call while floating in the water.

Ptychadena mapacha Channing 1993 Mapacha Ridged-Frog
This short-legged species is presently known only from the E Caprivi near Katima Mulilo (Channing 1993) [CAP].

Phrynobatrachus acridoides (Cope 1867) Zanzibar Puddle-Frog
This small frog inhabits lowland savannas from West Africa to Somalia and south to Maputaland, extending westwards into Malawi and E Zimbabwe [NS]. It is abundant on the Pungwe Flats and other floodplains.

Phrynobatrachus natalensis (A. Smith 1849) Natal Puddle-Frog
This species occurs throughout savanna areas south of the Sahara [NS], except where replaced by *P. acridoides*. It is usually associated with permanent shallow water.

Phrynobatrachus mababiensis FitzSimons 1932 Mababe Dwarf Puddle-Frog
This very small species has a wide range in E and S Africa [EAS] and is usually sympatric with one of the previous two species.

Phrynobatrachus parvulus (Boulenger 1905) Angola Dwarf Puddle-Frog
This little frog occurs in highland areas from Angola and DRC east to Tanzania, Malawi and E Zimbabwe [ANG]. It inhabits moist savanna and margins of montane forest, being common at the margins of weed-choked pools.

Cacosternum boettgeri (Boulenger 1882) Boettger's Dainty Frog
This pretty little frog ranges from Ethiopia to South Africa, but avoids the tropical lowlands and mountain ranges [CPS].

RHACOPHORIDAE

Chiromantis xerampelina Peters 1854 Southern Foam-nest Frog
This large tree frog occurs throughout the East African lowlands from coastal Kenya south to Maputaland and west to E Botswana and the E Caprivi [EAS]. It is particularly common in mopane woodland. The foam nest is whipped up from mucus produced with the eggs by the female, assisted by one or more males.

HYPEROLIIDAE

Leptopelis flavomaculatus (Günther 1864) Yellow-spotted Forest Tree-Frog
This large tree frog ranges from coastal Kenya south to C Mozambique, inland to Malawi and the eastern escarpment in Zimbabwe [EAS]. It is usually found in lowland forests near streams and it has a distinctive cat-like drawn-out "meecow" call, with males usually calling from leaves or branches three or four metres above ground level.

Leptopelis broadleyi Poynton 1985 Triad Tree-Frog
This small species inhabits N and C Mozambique, just entering S Malawi and E Zimbabwe. Males call from trees and bushes at a height of one to two metres and have a distinctive triad "meow-meow-meow" call.

Leptopelis mossambicus Poynton 1985 Mozambique Tree-Frog
This moderate sized tree frog ranges from S Malawi south through Mozambique, SE Zimbabwe, NE South Africa and Swaziland to Maputaland (Fig. 6.28) [EAS]. Males call from reedbeds or low shrubs, the call being an abrupt "cluck".

Leptopelis parbocagii Poynton & Broadley 1987 Upemba Burrowing-Frog
This species inhabits upland regions from Angola east through S DRC and N Zambia to Malawi and N Mozambique (Fig. 6.28) [ANG]. Males call from the ground or low vegetation.

Leptopelis bocagii (Günther 1864) Bocage's Burrowing-Frog
This 'burrowing tree frog' inhabits upland savannas from Ethiopia south to Zimbabwe (Fig. 6.28) [CPS]. It spends the dry season underground, and when the rains break the males initially begin calling from underground and then from ground level. The call is a brief "cluck".

Kassina maculata (Duméril 1853) Red-legged Pan Frog
This large frog inhabits the East African lowlands from Kenya south to KwaZulu-Natal (Fig. 6.29) [EAS]. It breeds in shallow pans and lagoons, the males calling while floating in the water. During the dry season, these frogs may often be found aestivating in banana axils.

Kassina kuvangensis (Monard 1937) Kuvangu Running-Frog
This moderate-sized frog has a restricted range from S Angola to NW Zambia (Fig. 6.29) [OKO]. They call from shallowly-flooded grasslands. The large tadpoles are spectacularly mottled in black and yellow.

Kassina senegalensis (Duméril & Bibron 1841) Senegal Running-Frog
This small species occurs throughout tropical savannas south of the Sahara [NS]. It breeds in shallow ephemeral pans and pools, the males calling from under the shelter of grass tufts. These frogs aestivate under rocks and logs and within termitaria.

Afrivalus brachycnemis (Boulenger 1896) Malawi Spiny Reed-Frog
This small savanna reed frog ranges from coastal Kenya to S Malawi [EAS]. The males call from grass or reeds standing in shallow water.

Afrivalus delicatus Pickersgill 1984 Kwazulu Spiny Reed-Frog
This tiny reed frog inhabits a narrow coastal strip from the Zambezi Delta south to Durban [LZ]. Its habitats includes coastal bush and grassland marshes and swamp forests (Pickersgill 1984).

Afrivalus crotalus Pickersgill 1984 Rattling Spiny Reed-Frog
This species ranges from SE Tanzania through S Malawi, N and C Mozambique into E Zimbabwe [EAS]. Abundant on floodplains and pans in savanna.

Afrivalus wittei (Laurent 1941) Witte's Spiny Reed-Frog
This species ranges from N Angola, S DRC and W and N Zambia to SW Tanzania [COB]. It inhabits moist savannas.

Afrivalus fornasinii (Bianconi 1849) Fornasini's Spiny Reed-Frog
This larger species ranges from Kenya south to KwaZulu-Natal, extending into Malawi and E Zimbabwe [EAS]. Common in reedbeds.

Hyperolius tuberilinguis A. Smith 1849 Tinker Reed-Frog
This reed frog inhabits the eastern lowlands from Kenya to KwaZulu-Natal, extending into Malawi and E Zimbabwe [EAS]. Common in reedbeds surrounding swamps and bordering rivers.

Hyperolius pictus Ahl 1931 Variable Montane Reed-Frog
This reed frog is restricted to the highlands of SW Tanzania and N Malawi [EEN]. It is common around small pools and streams on the Nyika Plateau and during the day can be found sitting on heaths and sedges about a metre above water level (Stewart & Wilson 1966).

Hyperolius quinquevittatus quinquevittatus Bocage 1866 Five-lined Reed-Frog
This species ranges from the Angola highlands through SE DRC, N Zambia and Malawi to S Tanzania [ANG]. It occurs in swampy grassland.

Hyperolius quinquevittatus mertensi Poynton 1964 Mertens' Reed-Frog
This small subspecies replaces the typical form on the Nyika Plateau [EEM], living on short grasses and sedges and breeding in small pools between tussocks (Stewart & Wilson 1966).

Hyperolius kivuensis Ahl 1931 Kivu Reed-Frog
This species inhabits moist savanna woodlands from Uganda south to S Zambia [CPS].

Hyperolius argus Peters 1854

Argus Reed-Frog

This attractive species inhabits the eastern lowlands from S Somalia south to Durban, entering S Malawi and E Zimbabwe [EAS]. The preferred habitat is large bodies of still water such as lagoons and backwaters of big rivers. Males prefer calling from horizontal surfaces such as lily pads and emergent rocks.

Hyperolius puncticulatus (Pfeffer 1893)

Golden Sedge-Frog

This species inhabits forested areas from coastal Kenya and Tanzania, through the southern highlands to S Malawi [EAS]. In Mugesse Forest on the Misuku Hills they were found sitting on leaves 1-2 m above the ground. Loveridge (1953d) gives the habitat as "montane meadows", but reports that a series was taken in wild bananas in the Matipa Forest on the Misuku Mountains, while two males were caught at the foot of Mulanje Mountain while calling from grass and sedges in a swamp (Loveridge 1953b).

Hyperolius mitchelli Loveridge 1953

Mitchell's Sedge-Frog

This attractive species ranges from the Usambara Mountains in NE Tanzania south through Malawi to C Mozambique [EAS]. The types were collected in a banana grove near the shore of Lake Malawi just north of Mtimbuka (Loveridge 1953b). At Maforga, the southernmost locality, they were calling from shrubs beside a small marshy stream in an area of forest/savanna mosaic (Poynton & Broadley 1987).

Hyperolius spinigularis Stevens 1971

Spiny-throated Sedge-Frog

This small sedge frog was described from the Chisambo Tea Estate at the foot of Mulanje Mountain. It is otherwise only known from the East Usambara Mountains in NE Tanzania [MEA]. The species prefers rather overgrown dambo areas in protected areas.

Hyperolius pusillus (Cope 1862)

Water-lily Frog

This small species ranges from S Somalia to the Transkei [EAS]. It inhabits open pans in savanna and males call from lily pads.

Hyperolius nasutus Günther 1864

Günther's Sharp-snouted Reed-Frog

This small species occurs throughout sub-Saharan tropical savannas [EAS]. Males call from reeds, sedges and grass stems well above water level.

Hyperolius benguellensis (Bocage 1893)

Benguela Sharp-snouted Reed-Frog

This closely related species has a patchy distribution from Angola and N Namibia east to Malawi and Zimbabwe [WS].

Hyperolius viridiflavus complex

This group of reed frogs has long been considered a taxonomic nightmare (Poynton & Broadley 1987), but their relationships are now being investigated using DNA sequencing (Wieczorec, Drewes & Channing, in prep.). The following taxonomic arrangement is still provisional, as tissue samples have not yet been collected for many of these taxa.

Hyperolius marmoratus taeniatus Peters 1854

Striped Reed-Frog

This frog inhabits the Mozambique plain south to Lake St. Lucia, extending into S Malawi and NE and S Zimbabwe [EAS]. Abundant in reedbeds surrounding swamps or along rivers.

Hyperolius alborufus Laurent 1964 Cazombo Reed-Frog
This form is restricted to the Upper Zambezi headwaters in NW Zambia and adjacent Angola [ZHW].

Hyperolius angolensis Steindachner 1867 Angolan Reed-Frog
This species ranges from E Angola and N Namibia into W Zambia and N Botswana [ANG]. Channing & Griffin (1993) treated *H. angolensis* as a full species because its advertisement call differs from that of *H. marmoratus*.

Hyperolius swynnertoni broadleyi Poynton 1963 Broadley's Reed-Frog
This handsomely striped reed frog inhabits the Eastern Highlands and central plateau regions of Zimbabwe, with a relict population on Gorongosa Mountain in Mozambique [ZIM].

Hyperolius marginatus marginatus Peters 1854 Margined Reed-Frog
This form has a curious range from N Malawi and E Zambia through the W Mozambique pedicle and along the Middle Zambezi Valley and escarpment to the Botswana border in the Hwange National Park [MZ].

Hyperolius marginatus albofasciatus Hoffman 1944 White-striped Reed-Frog
This subspecies is restricted to the uplands of S Malawi and N Mozambique [EEM].

Hyperolius pyrrhodictyon Laurent 1965 Kafue Flats Reed-Frog
This reed-frog is restricted to the Kafue Flats and environs [KAF] and is distinguished by a bold red ventral network (Laurent 1965).

Hyperolius melanoleucus Laurent 1941 Black and White Reed-Frog
This form extends from the highlands of extreme SE DRC south through the upper Kafue tributaries to the Lusaka area [COB].

Hyperolius nyassae Ahl 1931 Nyasa Reed-Frog
This form is restricted to the reed beds and swamps along the northern shores of Lake Malawi [MAL].

6.5 CONSERVATION

6.5.1 Wetlands of special interest

Barotse Floodplain

The central Barotse floodplain covers an area of up to 7500 km². Although largely covered with grass, there are isolated clumps of trees (especially on termitaria) which provide suitable habitat for arboreal reptiles, particularly those snakes that prey upon birds eggs and fledglings. The Barotse floodplain has been a relatively stable area since the early Tertiary (c. 50 million years BP) and consequently may have the richest herpetofauna, as it includes elements of the Kalahari fauna and two vicariant endemic species, all the elements of the palaeo-Upper Zambezi wetland fauna, and elements from the Angola highlands and Congo Basin, in addition to widespread savanna species entering from the east. The many fossorial and terrestrial reptiles inhabiting the Barotse floodplains make a mass migration to the woodlands when the Zambezi is in flood (R.G. Japp, pers. comm.) or else retreat to the emergent termitaria (C.R. Owen, pers. comm.).

Chobe - Linyanti System

During the Quaternary this section of the mid-Zambezi trough contained a palaeo-Lake Caprivi, linked by the Chobe River to Lake Liambezi and the Kwando/Linyanti swamps (Shaw & Thomas 1988). This swamp area has been a major barrier to some fossorial reptiles, especially amphisbaenians. This floodplain system is linked to the southern Barotse floodplain, so it has a similar herpetofauna. The area is vulnerable to dessication, being largely dependent on high Zambezi floods backing up into it.

Lower Shire River

The floodplains and marshes in this area are densely populated and heavily cultivated on the Malawi side of the river and only the permanently flooded core of the Elephant Marsh is likely to remain intact. With the development of irrigation schemes, the expansion of sugar plantations and rice paddies are major threats to wetland habitats. The herpetofauna is similar to that of the Zambezi Delta and the Pungwe Flats.

Zambezi Delta

The present Zambezi Delta is very young, dating back only to the Pleistocene. The previous course turned south through the Urema trough and Pungwe Flats to reach the sea near Beira. Despite the delta being the 'core area' of the Lower Zambezi ecosystem, its herpetofauna remains poorly known. It has a wide range of habitats and should support a diverse herpetofauna, including many of the species presently known from the Lower Shire River and the Pungwe Flats.

Lake Bangweulu & Chambeshi River

The herpetofauna of this huge area of open lake, rivers, swamps and floodplains remains poorly known, but undoubtedly rivals that of the Barotse floodplain in richness. It apparently has most of the palaeo-Upper Zambezi herpetofauna in addition to many elements from the Angola highlands and the Congo Basin. It is presently linked to Lake Mweru by the Luapula River, but the presence of *Limnophis bangweolicus* in the Mweru Wantipa indicates that this marshy area was formerly linked to Lake Bangweulu, perhaps via the Chambeshi River. The Lake Bangweulu complex is clearly a key to our understanding of the zoogeography of the Zambezi Basin wetlands and extensive fieldwork is required to improve our knowledge of the herpetofauna. The lake could prove to be a southern stronghold of the Slender-snouted Crocodile (*Crocodylus cataphractus*), which is under threat throughout most of its range.

6.5.2 Species of conservation interest***Eumecia johnstoni***

Nyika Serpentine Skink

This elongate skink is only known from the type specimen, collected over 100 years ago on the Nyika Plateau. It may now be extinct due to grass fires, but may still survive in permanently wet swampy areas, where it would be difficult to find.

Proatheris superciliaris

Eyebrow Viper

This near-endemic monotypic genus appears to be restricted to a floodplain habitat and appears to be close to the primitive stock that gave rise to the arboreal bush vipers of the genus *Atheris*. It could come under pressure through increasing cultivation of flood plains for rice, which is apparent near Beira.

Crotaphopeltis barotseensis

Barotse Water Snake

This small back-fanged snake seems to more or less restricted to papyrus swamps of the Palaeo-Upper Zambezi system. Its position is secure unless any way of removing papyrus on a large scale is developed.

Hemisus barotseensis

Barotse Snout-burrowing Frog

This small frog is a Barotse floodplain near-endemic, but does not seem to threatened in any way.

Ptychadena mapacha

Mapacha Ridged-Frog

This species is at present known only from the East Caprivi wetlands, so its status is uncertain.

Hyperolius marmoratus pyrrodictyon

Kafue Reed-Frog

This frog is endemic to the Kafue Flats and is likely to prove to be a good species. It could be at risk during the tadpole stage due to agricultural pollution from fertilisers and insecticides.

6.5.3 Sites of conservation interest

Most sites consist of large and complex areas of open water, swamps and floodplains, making it impossible to accurately map distributions of reptiles and amphibians or to determine sites particularly worthy of conservation. In such cases the selection of such sites will have to be based on habitat, i.e. vegetation types. An exception is in northern Mwinilunga District, where wetland areas are on a much smaller scale. Here a case could perhaps be made for a conservation area extending from the forested Zambezi source close to the DRC border, westwards across the Nyambala Plain and the watershed between the Upper Zambezi tributaries and the Luakela River (an affluent of the Lunga River, which in turn is a tributary of the Kabompo River) to the forested Kasombu (Isombo) stream where it flows into Angola.

6.6 INTRODUCTION OF REPTILES INTO DAMS IN THE MIDDLE ZAMBEZI

Few reptiles can be considered important natural resources. The Nile Crocodile is already being farmed for the production of skins, meat and curios. All the chelonians are used for food, but the most important is the Zambezi Flap-shelled Turtle (*Cycloderma frenatum*) which provides quite a lot of meat (females attain a carapace length of 56 cm). Females lay around 15-25 hard shelled eggs about 35 mm in diameter, which are eaten by the Yao along the southern shores of Lake Malawi (Loveridge 1953a). These turtles feed largely on aquatic snails and bivalves. The latter are now superabundant in Lake Kariba, where the 'fossilised' trunks of submerged trees provide a good substrate for them (Kenmuir 1978). The situation is presumably similar in Lake Cabora Bassa. It is recommended that these artificial impoundments could be enriched by the introduction of *Cycloderma* from southern Lake Malawi (or the Lower Zambezi). The eggs could be collected and flown to a Zimbabwean crocodile farm for incubation, the hatchlings being released in the estuaries in the Matusadona National Park.

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Table 6.1. Checklist of the reptiles and amphibians of wetlands in the Zambezi Basin and outside.

Habitat aquatic status: aq - fully aquatic; sa - semi-aquatic; fp - typically inhabiting floodplains; (blank) - migrant onto dry floodplains.

Cluster Range clusters: ANG - Angola Highlands eastwards; BAR - Barotse near-endemic; CAP - Caprivi near-endemic; COB - Congo Basin; CPS - Central Plateau savanna; EAS - East African savanna; ECF - East African coastal forest; EE - Eastern Escarpment [suffix letters: M Malawi; N North; S South; X trans-Zambezi; Z Zimbabwe]; KAF - Kafue Flats endemic; KAL - Kalahari; LZ - Lower Zambezi; MAL - Lake Malawi north shoreline; MZ - mid-Zambezi valley; NS - northern savanna; PAN - pan-African south of Sahara; PUN - Pungwe Flats; PUZ - palaeo-Upper Zambezi; SS - southern savanna; WS - western savanna.

Wetland areas: Zhw - Zambezi headwaters; Bar - Barotse floodplains; Cho - Chobe/E Caprivi; Oka - Okavango Delta; Ban - Bangweulu swamps;

Kaf - Kafue Flats; Kar - Lake Kariba; Chv - Lake Chivero; Nya - Nyanga National Park; MRP - Misuku/Rungwe/Poroto mountains; Nyk = Nyika Plateau; Mal - Lake Malawi shoreline; Mul - Mulanje Mountain; Chi - Lake Chilwa; LSh - Lower Shire valley; Del - Zambezi Delta; Pun - Pungwe Flats; Upe - Upemba swamps & environs; Mwe - Lake Mweru & Mweru Wantipa; Map - Maputaland.

Species	Habitat	Cluster	Area																						
			Head	Bar	Cho	Oka	Ban	Kaf	Kar	Chv	Nya	MRP	Nyk	Mal	Mul	Chi	LSh	Del	Pun	Upe	Mwe	Map			
REPTILIA																									
TESTUDINES																									
Pelomedusidae																									
<i>Pelomedusa subrufa</i>	sa	PAN		X	X	X																X	X	X	X
<i>Pelusios nanus</i>	aq	ANG	X				X																		
<i>Pelusius subniger</i>	sa	EAS							X	X												X			X
<i>Pelusios bechuanicus</i>	aq	PUZ		X	X	X		X																	
<i>Pelusios castanooides</i>	aq	EAS											X								X	X	X		X

Species	Habitat	Cluster	Area																				
			Head	Bar	Cho	Oka	Ban	Kaf	Kar	Chv	Nya	MRP	Nyk	Mal	Mul	Chi	LSH	Del	Pun	Upe	Mwe	Map	
<i>Gerrhosaurus flavigularis</i>		EAS								X	X		X				X	X					X
<i>Tetradactylus ellenbergeri</i>	fp	COB	X	X								X								X			
Lacertidae																							
<i>Latastia johnstoni</i>		EAS															X						X
Varanidae																							
<i>Varanus niloticus</i>	sa	PAN	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AMPHISBAENIA																							
Amphisbaenidae																							
<i>Zygaspis kafuensis</i>		KAF						X															
<i>Zygaspis nigra</i>		ANG		X																			
<i>Zygaspis quadrifrons</i>		KAL	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Chirindia swynnertoni</i>		EAS																		X			
<i>Monopeltis zambezensis</i>		MZ													X								
<i>Monopeltis mauricei</i>		KAL			X			P															
<i>Dalophia ellenbergeri</i>	fp	ANG		X																			
<i>Dalophia angolensis</i>		ANG	P																				
<i>Dalophia longicauda</i>		CAP			X																		
<i>Dalophia pistillum</i>		KAL		X	X	X	X		X								X						X

Species	Habitat	Cluster	Area																			
			Head	Bar	Cho	Oka	Ban	Kaf	Kar	Chv	Nya	MRP	Nyk	Mal	Mul	Chi	LSH	Del	Pun	Upe	Mwe	Map
Aparallactus lunulatus		EAS							X	P							X		X		X	
Aparallactus capensis		EAS		X					X	X									X	X	X	
Elapidae																						
Elapsoidea semiannulata		ANG		X																		
Elapsoidea boulengeri		EAS		X	X				X	P							X					X
Naja annulifera		EAS							X	X							X		X			X
Naja anchietae		KAL		X	X				X													
Naja melanoleuca	sa	PAN	X					X									X				X	
Naja nigricollis		NS	X	X				X												X		X
Naja mossambica		EAS			X				X	X							X					X
Colubridae																						
Lycodonomorphus mlanjensis	sa	EEX																				
Lycodonomorphus rufulus	sa	EES								P												X
Lycodonomorphus whytii	sa	MRP												X								
Lycodonomorphus obscuriventris	fp	LZ															X					X
Lycophidion multimaculatum		ANG	X	X																X		X
Lycophidion capense capense		EAS			X				X								X					X
Lycophidion nanum		PUN																				X
Crotaphopeltis hotamboeia		PAN	X	X				X	X								X					X

Species	Habitat	Cluster	Area																				
			Head	Bar	Cho	Oka	Ban	Kaf	Kar	Chv	Nya	MRP	Nyk	Mal	Mul	Chi	LSh	Del	Pun	Upe	Mwe	Map	
<i>Crotaphopeltis barotseensis</i>	sa	OKO		X	P	X																	
<i>Dipsadoboa aulica</i>		EAS															X						X
<i>Dipsadoboa flavida flavida</i>		EEM											X										
<i>Dipsadoboa flavida broadleyi</i>		EAS															X						
<i>Natriciteres bipostocularis</i>	sa	ANG	X																				
<i>Natriciteres sylvatica</i>	sa	ECF										X		X			X						X
<i>Natriciteres olivacea</i>	sa	NS		X	X	X	X	X					X				X				X	X	
<i>Linnophis bicolor</i>	aq	ANG	X																				
<i>Linnophis bangweolicus</i>	aq	OKO		X	X	X	X																X
<i>Grayia ornata</i>	aq	COB	X																				X
<i>Grayia tholloni</i>	aq	COB	X																				
<i>Psammophylax variabilis</i>		CPS		X	X								X				X						
<i>Rhamphiophis acutus acutus</i>		ANG	X					X															
<i>Rhamphiophis acutus jappi</i>	fp	BAR		X																			
<i>Rhamphiophis rostratus</i>		EAS				X																	
<i>Dromophis lineatus</i>	fp	NS		X				X															X
<i>Psammophis mossambicus</i>		EAS	X	X	X	X	X	X	X	X			X				X				X	X	X
<i>Meizodon s. semiornata</i>	fp	EAS						X									X				X	X	P

Species	Habitat	Cluster	Area																				
			Head	Bar	Cho	Oka	Ban	Kaf	Kar	Chv	Nya	MRP	Nyk	Mal	Mul	Chi	LSH	Del	Pun	Upe	Mwe	Map	
<i>Leptopelis mossambicus</i>		EAS															X	X				X	
<i>Leptopelis parbocagii</i>		ANG															X		X				
<i>Leptopelis bocagii</i>		CPS	X	X				X		X													
<i>Kassina maculata</i>	sa	EAS					X										X	X					X
<i>Kassina kuvangensis</i>	sa	OKO	X	X																			
<i>Kassina senegalensis</i>		NS	X	X	X			X	X								X	X	X			X	X
<i>Afraxalus brachynemesis</i>		EAS											X										
<i>Afraxalus delicatus</i>		LZ																X					X
<i>Afraxalus crotalus</i>		EAS															X						
<i>Afraxalus wittei</i>		COB	X	X				X												X			
<i>Afraxalus forasini</i>		EAS											X				X	X					X
<i>Hyperolius tuberilinguis</i>		EAS								X			X				X	X					X
<i>Hyperolius pictus</i>		EEN											X										
<i>Hyperolius q. quinquevittatus</i>		ANG	X										X										
<i>Hyperolius q. mertensi</i>		EEM															X						
<i>Hyperolius kivuensis</i>		CPS																					
<i>Hyperolius argus</i>		EAS																					X
<i>Hyperolius punctulatus</i>		ECF											X										
<i>Hyperolius mitchelli</i>		EAS																					
<i>Hyperolius spinigularis</i>		MEA																					
<i>Hyperolius pusillus</i>		EAS															X	X					X

Fig. 6.2. Africa showing the present distribution of Kalahari sand and derived east coast alluvium [fine stipple], palaeo-lakes [coarse stipple, names in upper case] and recent lakes and swamps [coarse stipple, names in lower case].

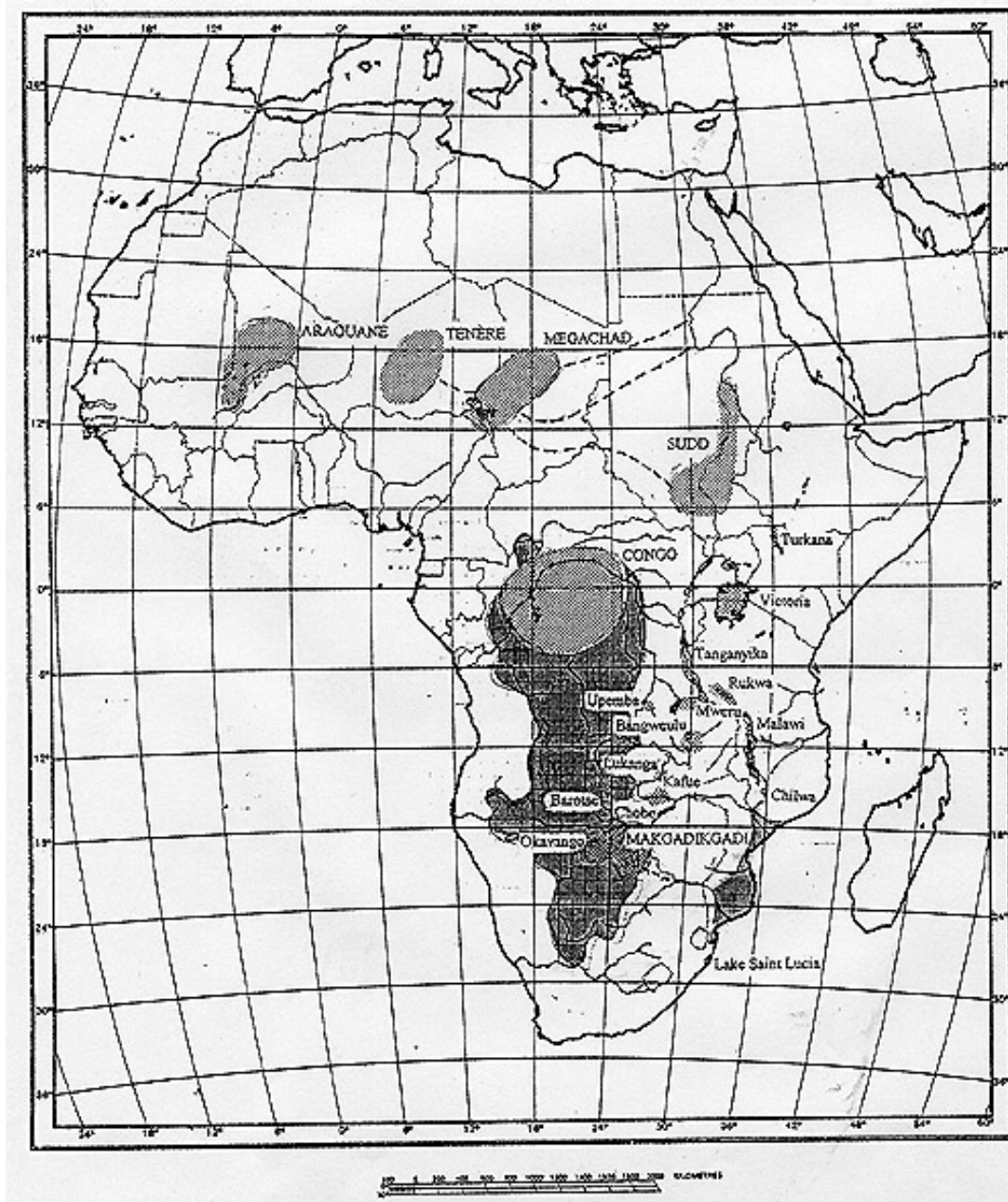


Fig. 6.3. Distribution Map: *Pelusios nanus*, *P. subniger*, *P. bechuanicus*.

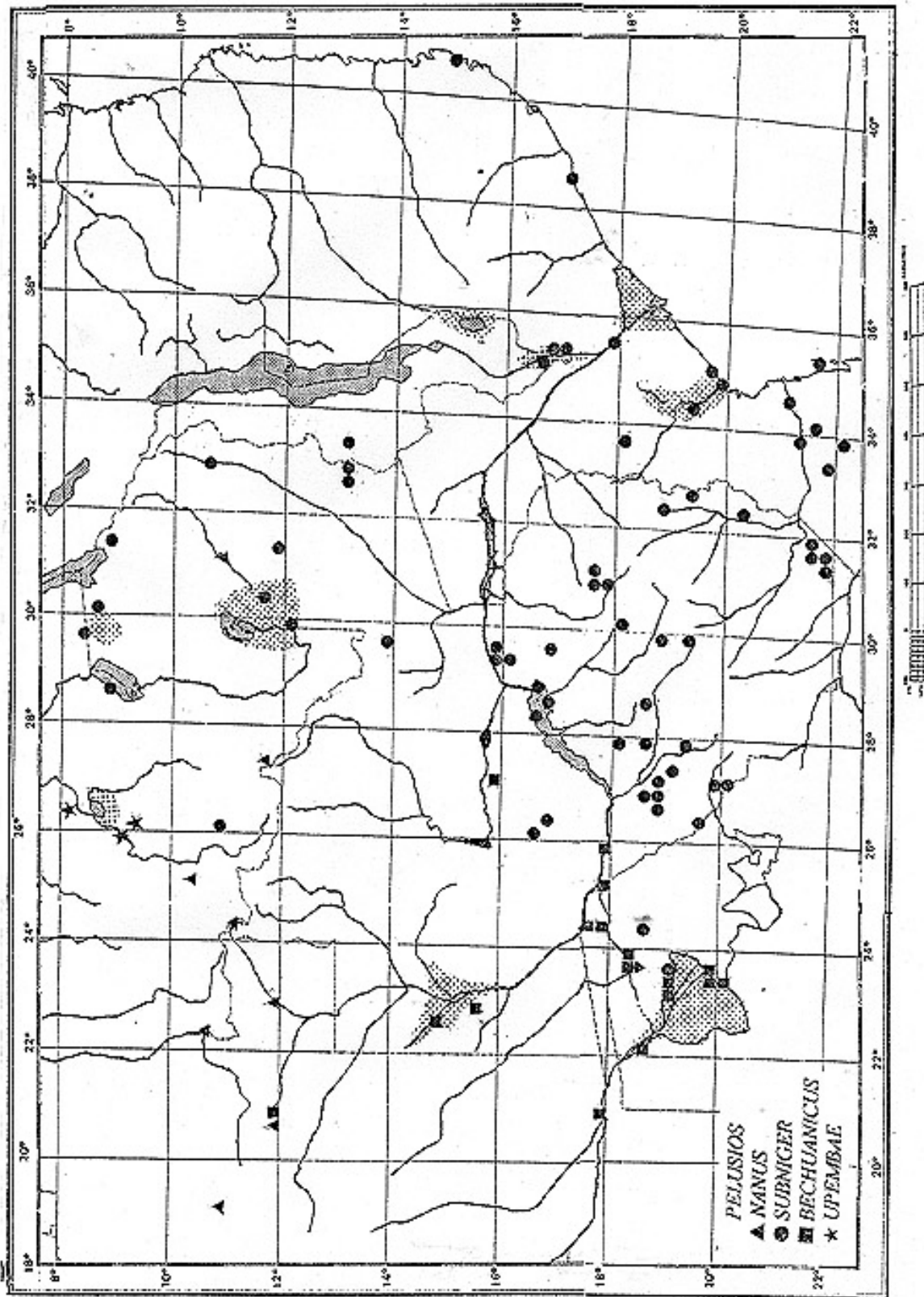


Fig. 6.4. Distribution Map: *Pelusios castanoides*, *P. rhodesianus*

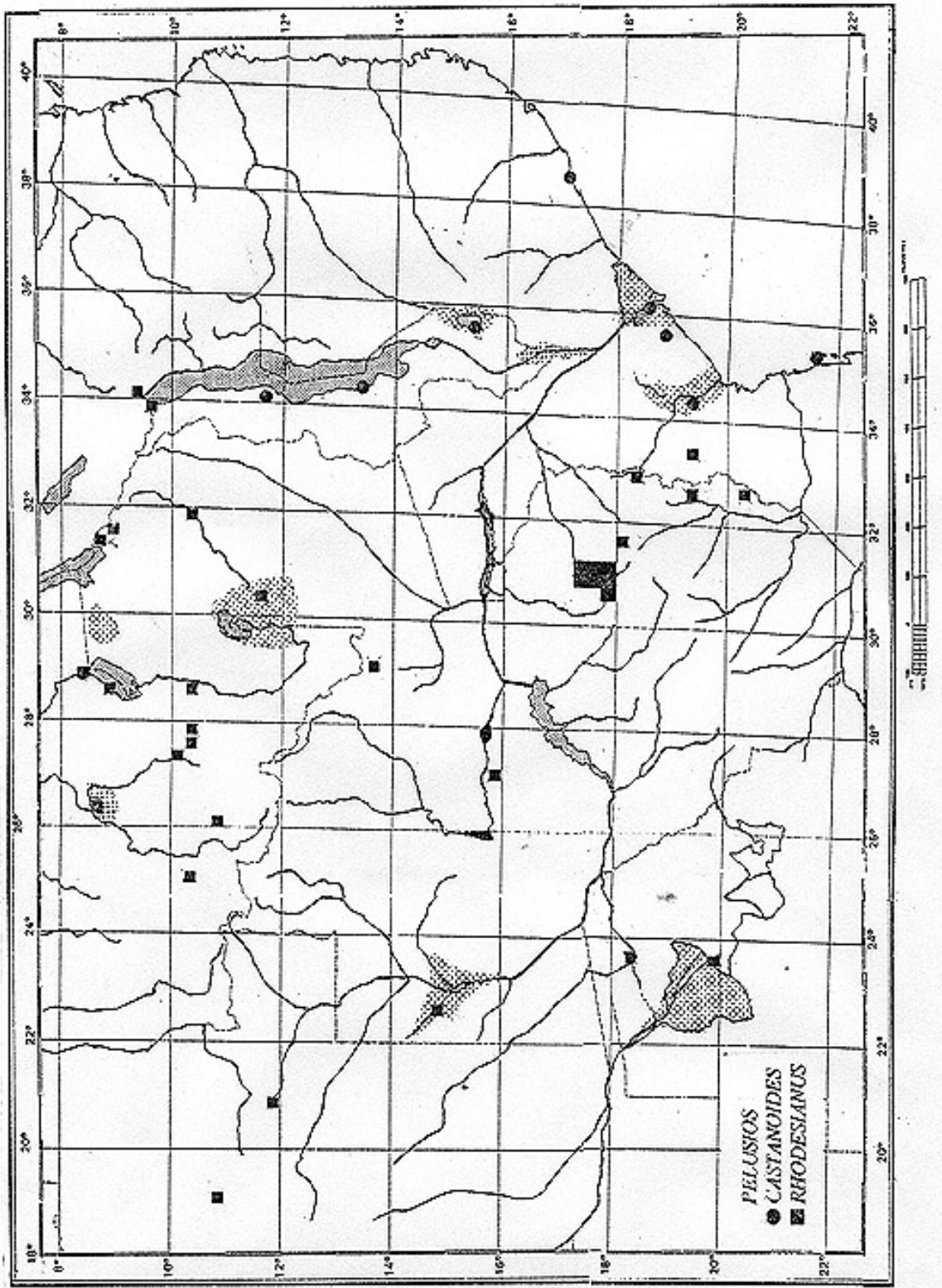


Fig. 6.5. Distribution Map: *Cycloderma frenatum*

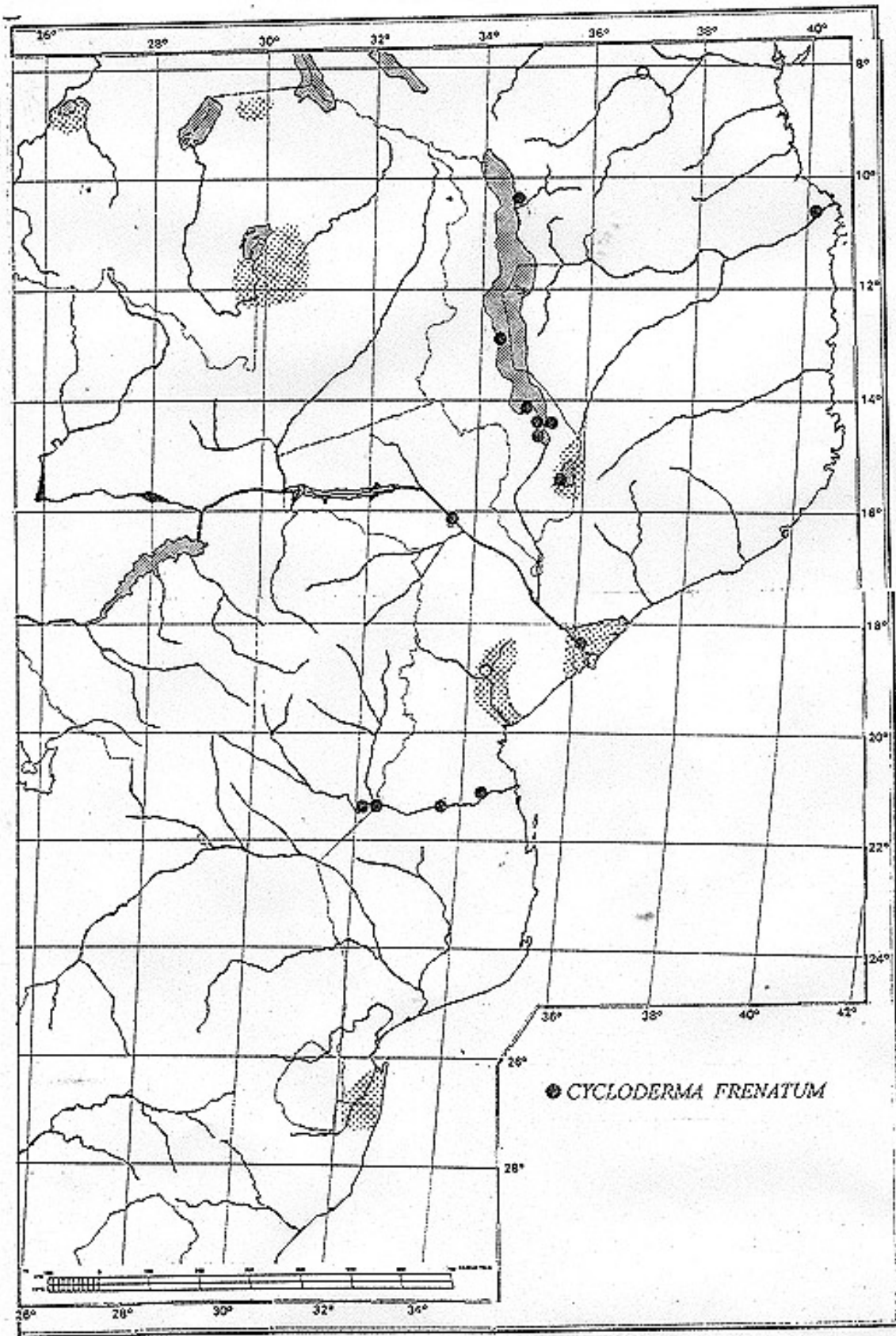


Fig. 6.6. Distribution Map: *Lygodactylus chobiensis*, *L. gutturalis*

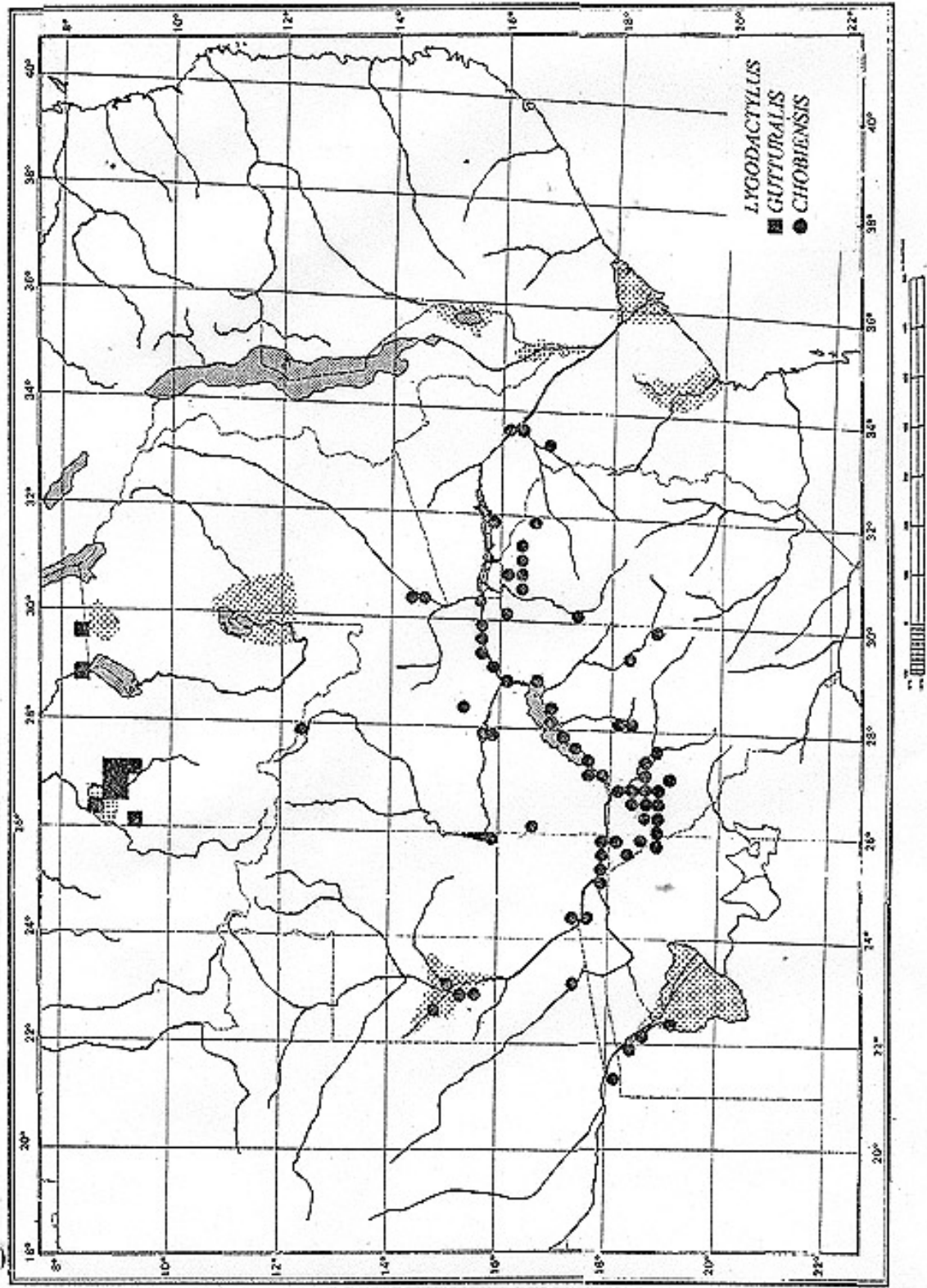


Fig. 6.7. Distribution Map: *Typhlacontias gracilis*, *T. rohani*, *Mabuya boulengeri*, *M. megalura*

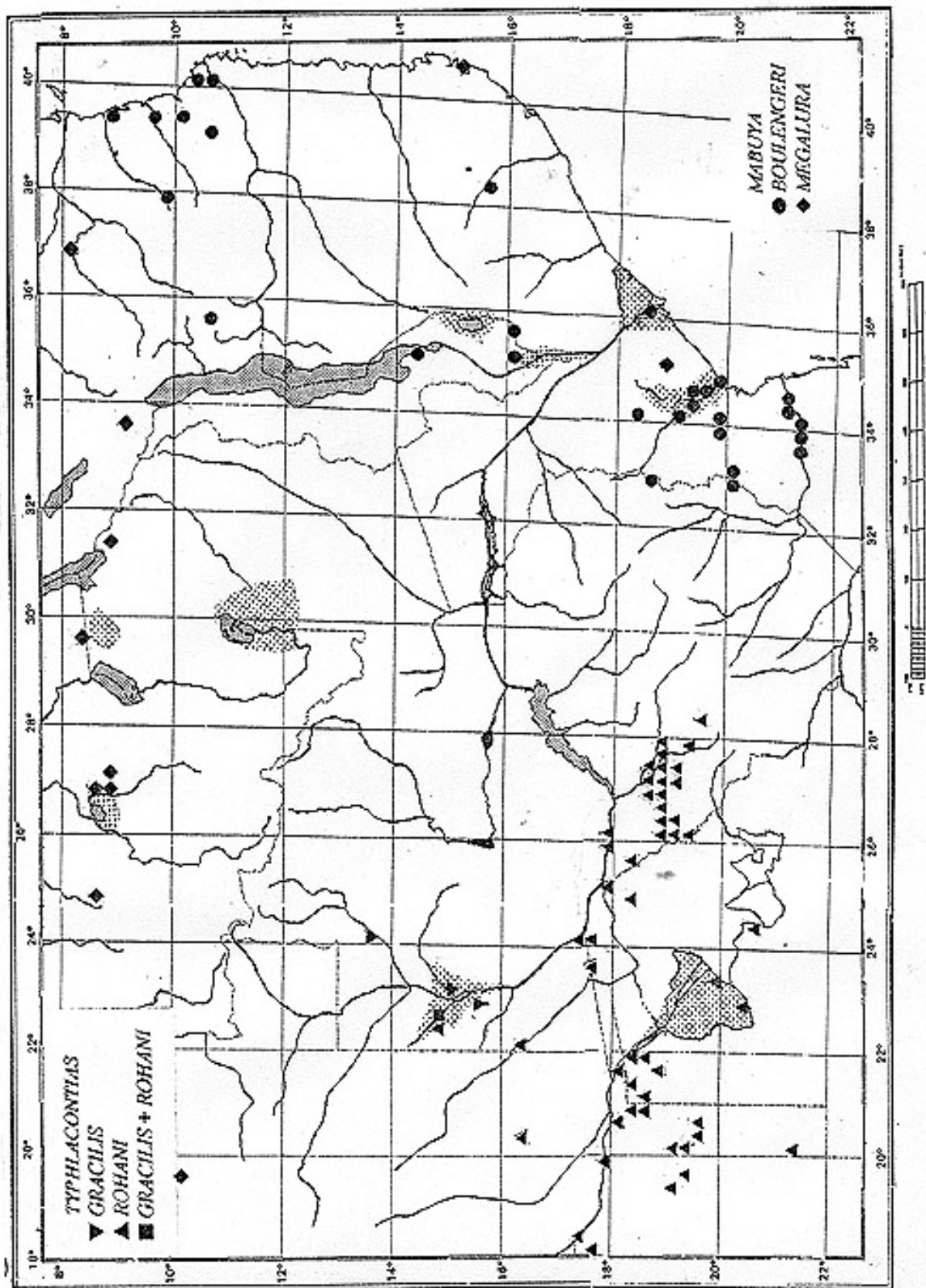


Fig. 6.8. Distribution Map: *Eumecia anchietae*, *E. johnstoni*

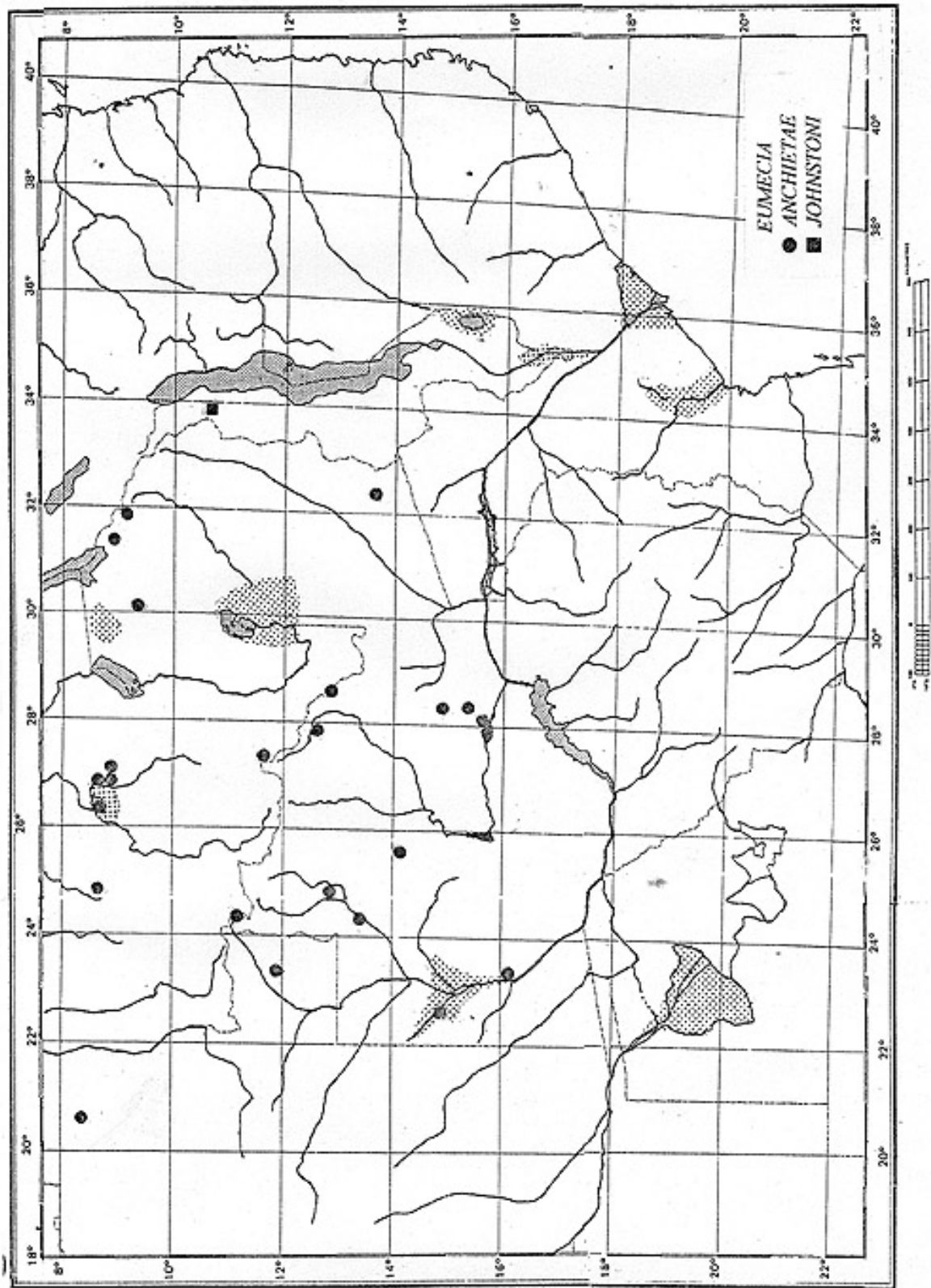


Fig. 6.9. Distribution Map: *Gerrhosaurus nigrolineatus*, *G. auritus*, *G. bulsi*

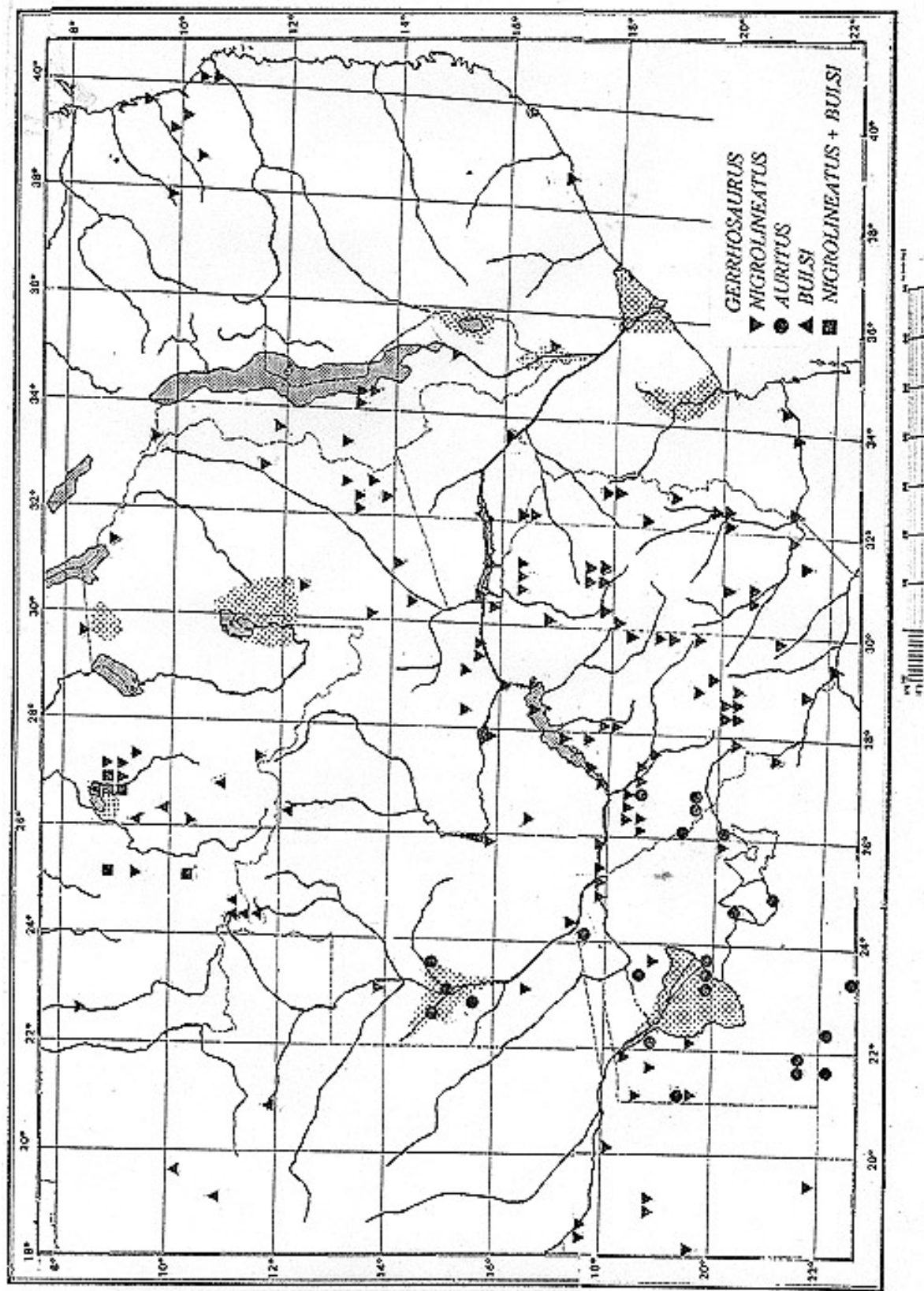


Fig. 6.10. Distribution Map: *Tetradactylus ellenbergeri*, *Chamaesaura miopropus*, *C. macrolepis*

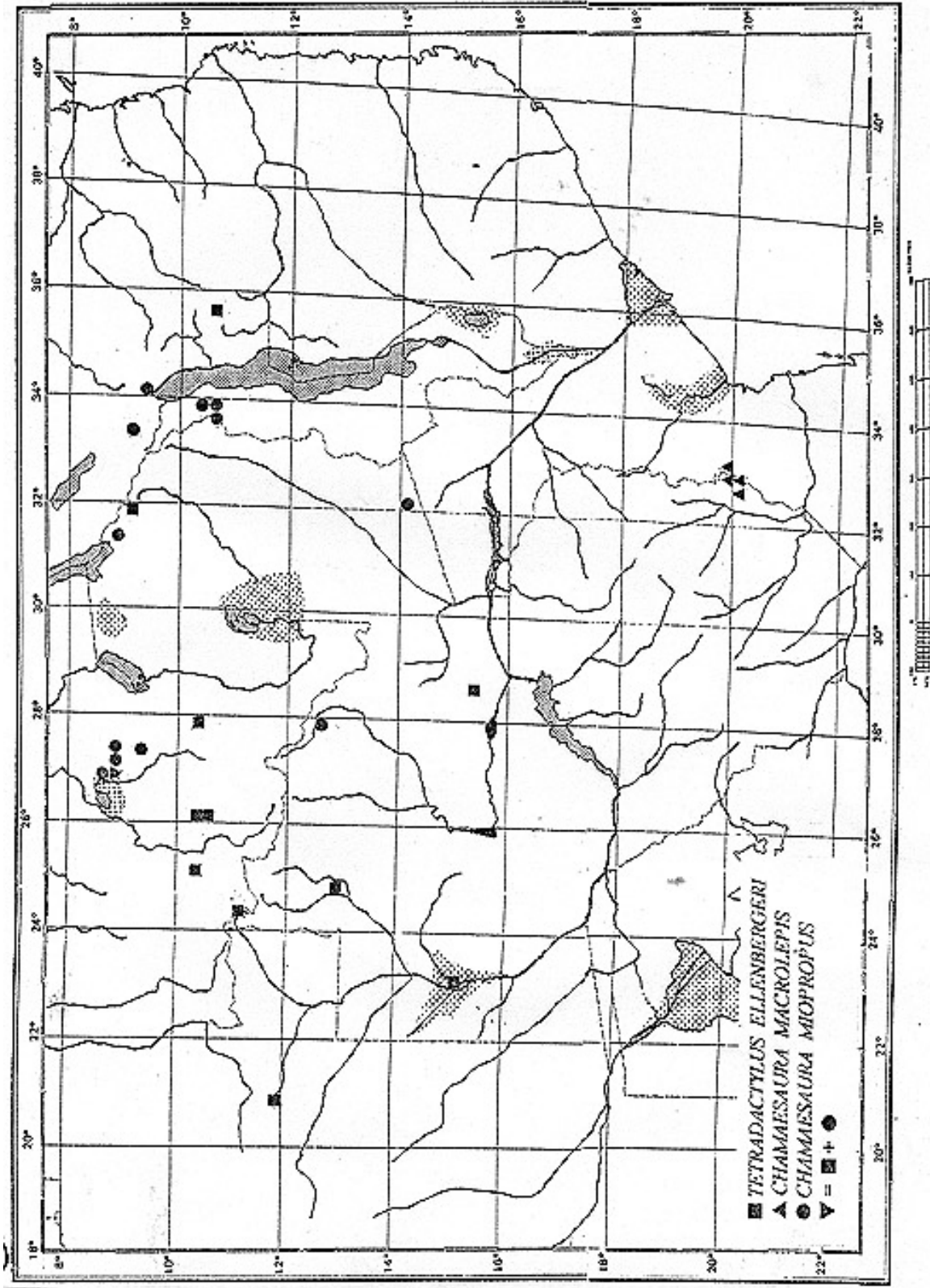


Fig. 6.11. Distribution Map: *Zygaspis kafuensis*, *Z. nigra*, *Z. quadrifrons*, *Chirindia swynnertoni*

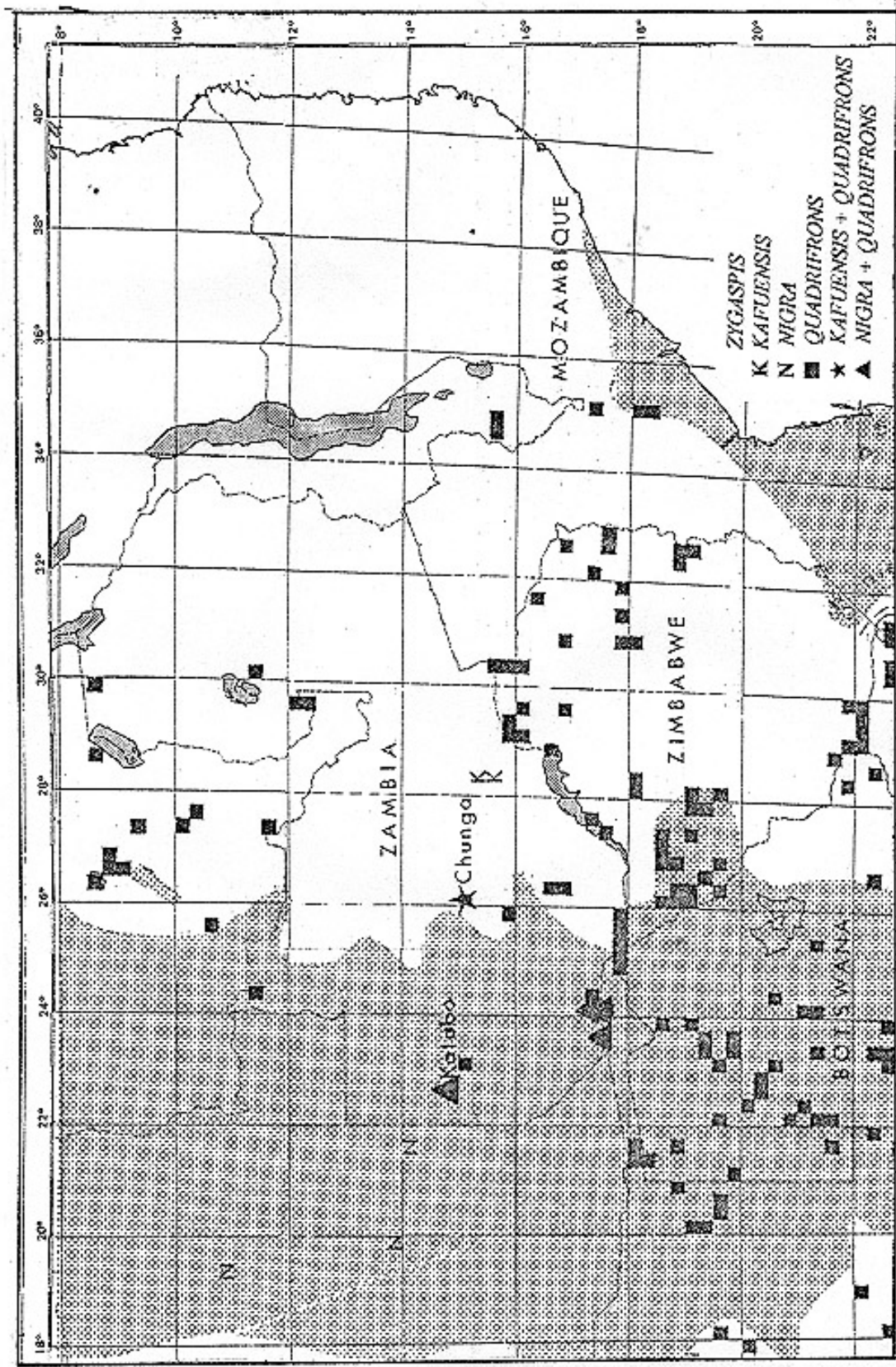


Fig. 6.12. Distribution Map: *Monopeltis zambezensis*, *M. sphenorhynchus*, *M. mauricei*, *Mabuya ivensii*

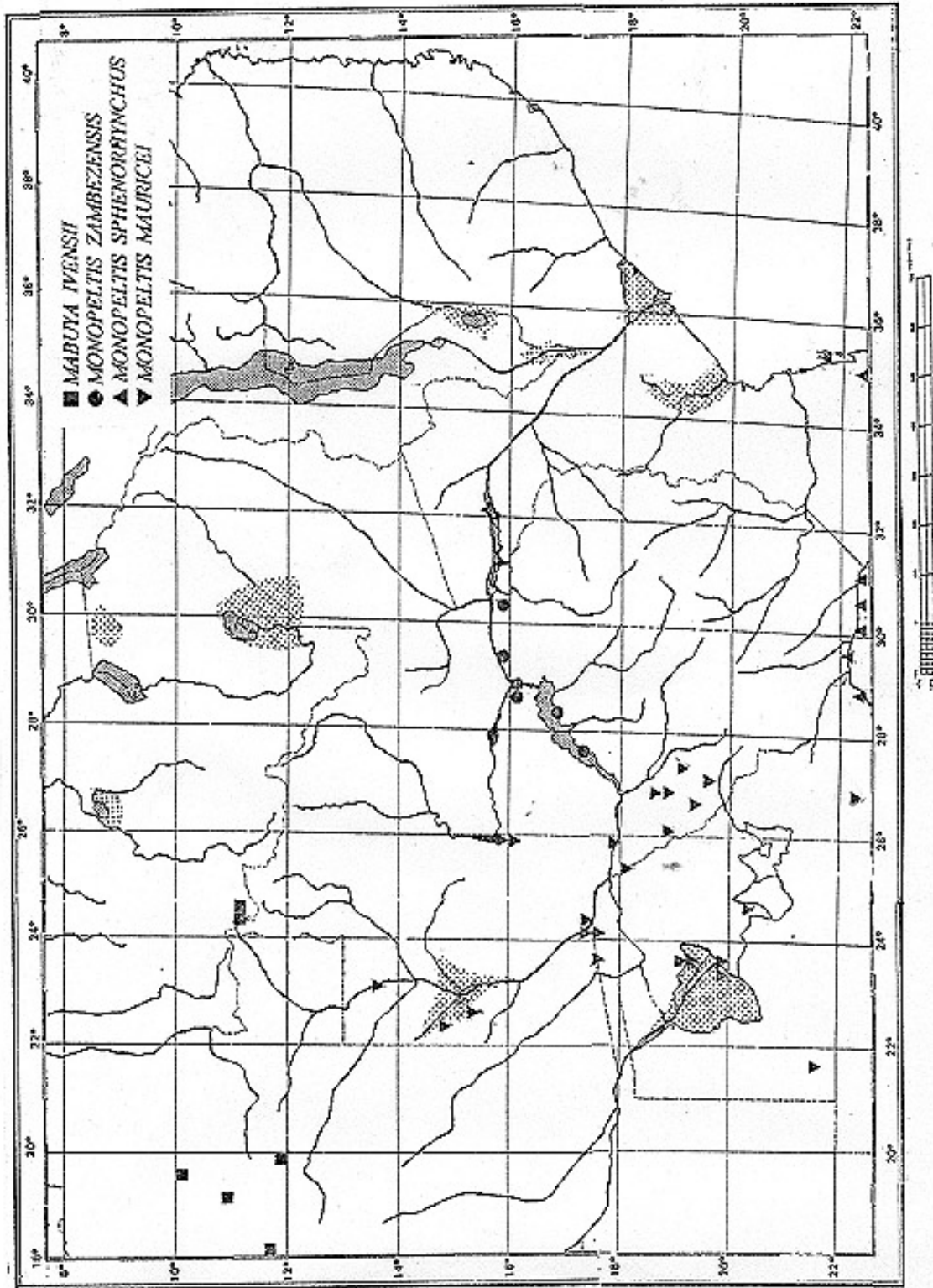


Fig. 6.13. Distribution Map: *Dalophia pistillum*, *D. longicauda*, *D. angolensis*, *D. ellenbergi*

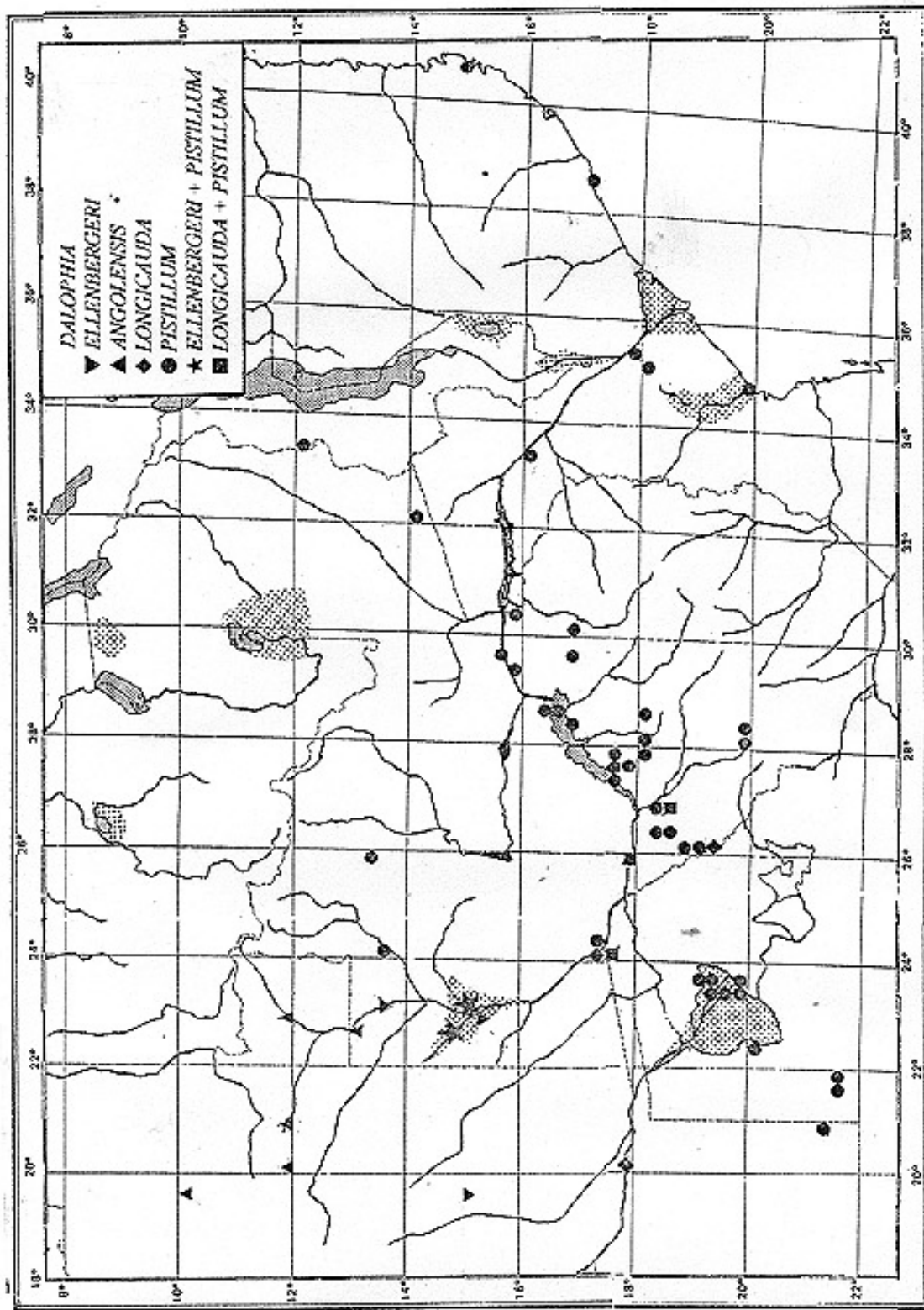


Fig. 6.14. Distribution Map: *Proatheris superciliaris*

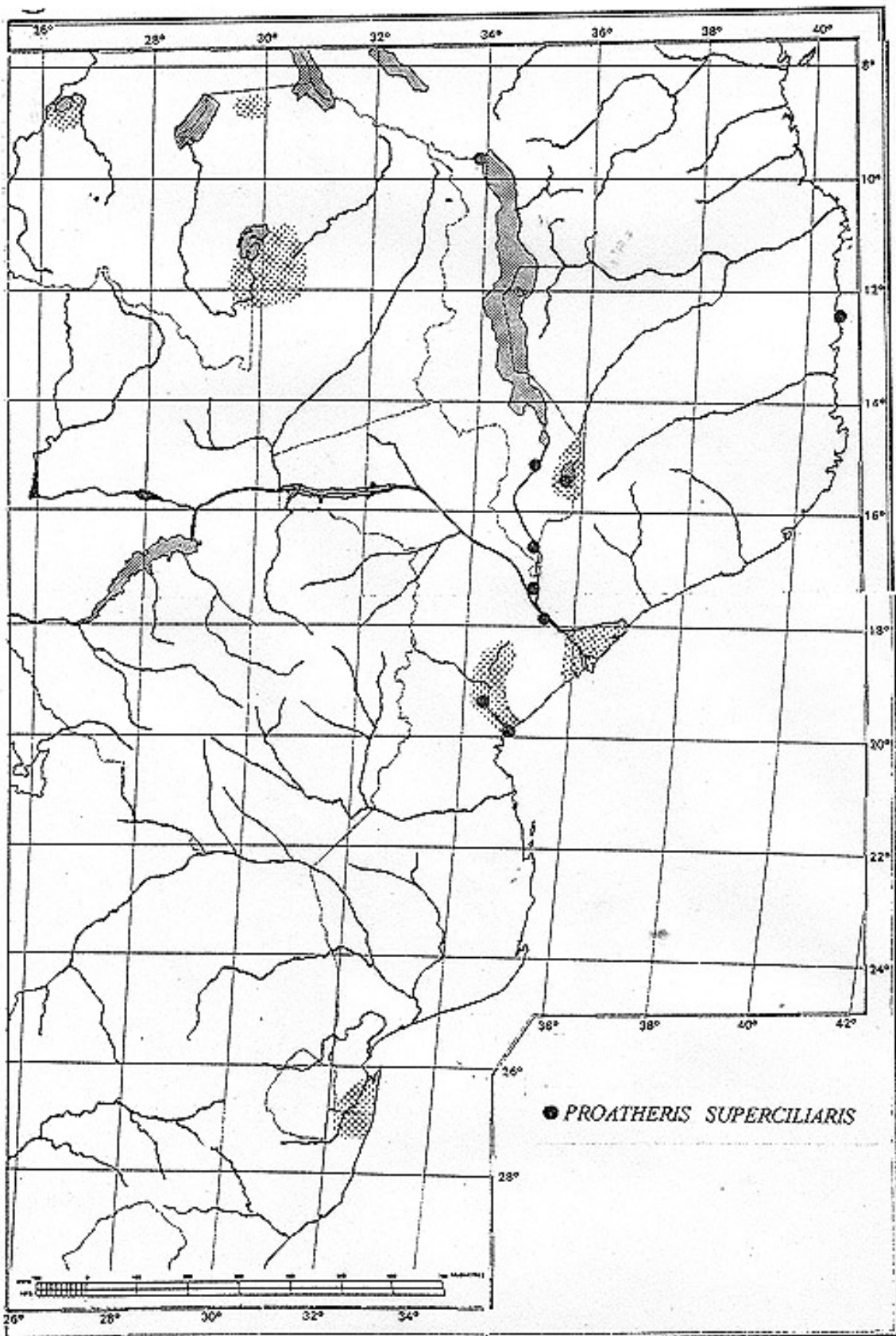


Fig. 6.15. Distribution Map: *Xenocalamus bicolor*, *X. lineatus*, *X. mechowii*

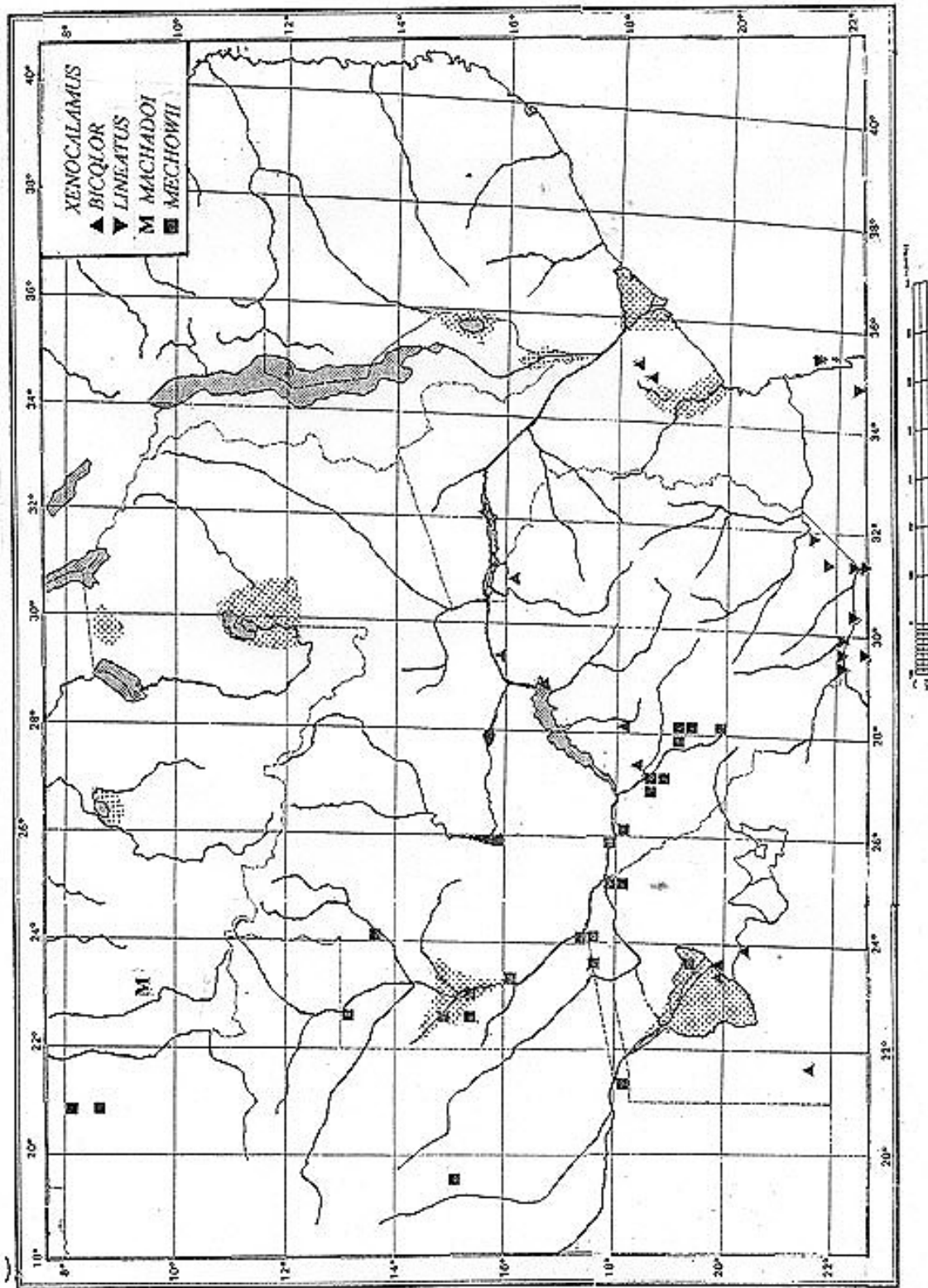


Fig. 6.16. Distribution Map: *Lycodonomorphus bicolor*, *L. rufulus*, *L. whytii*, *L. mlanjensis*, *L. obscuriventris*

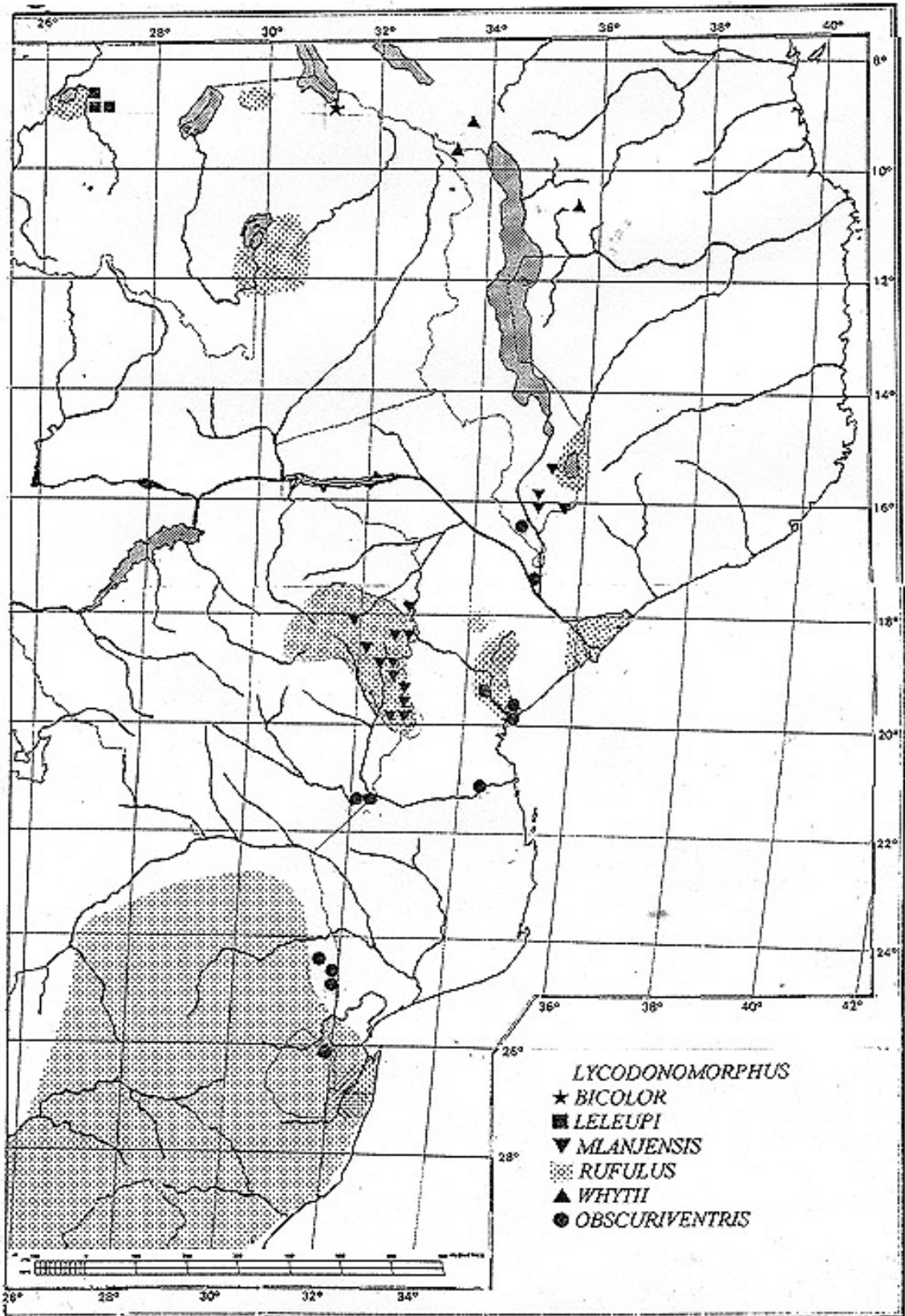


Fig. 6.17. Distribution Map: *Crotaphopeltis barotseensis*, *C. degeni*, *Dipsadoboa shrevei*, *D. aulica*, *D. flavida flavida*, *D. flavida broadleyi*

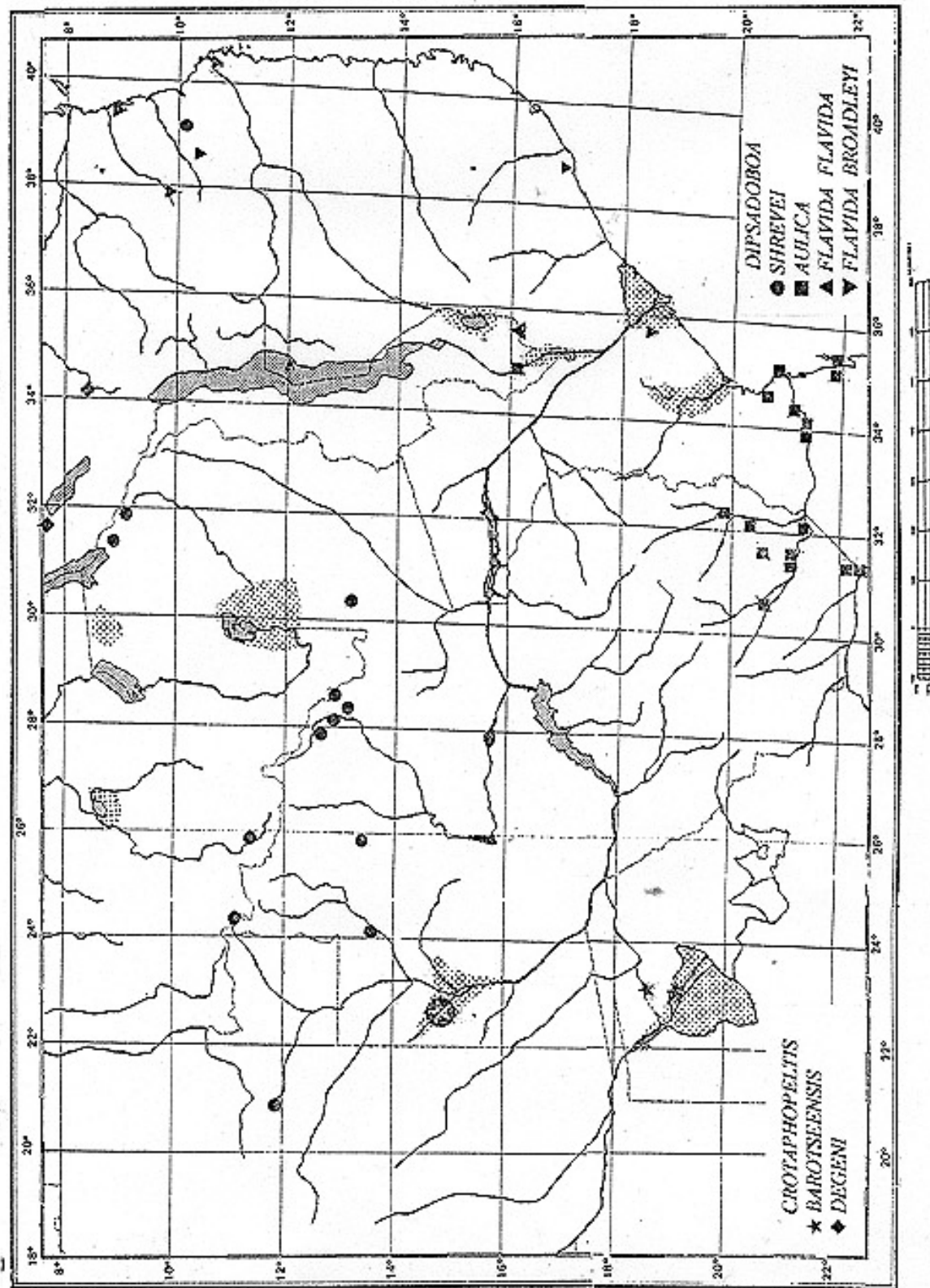


Fig. 6.18. Distribution Map: *Natriciteres bipostocularis*, *N. sylvatica*, *N. olivacea*

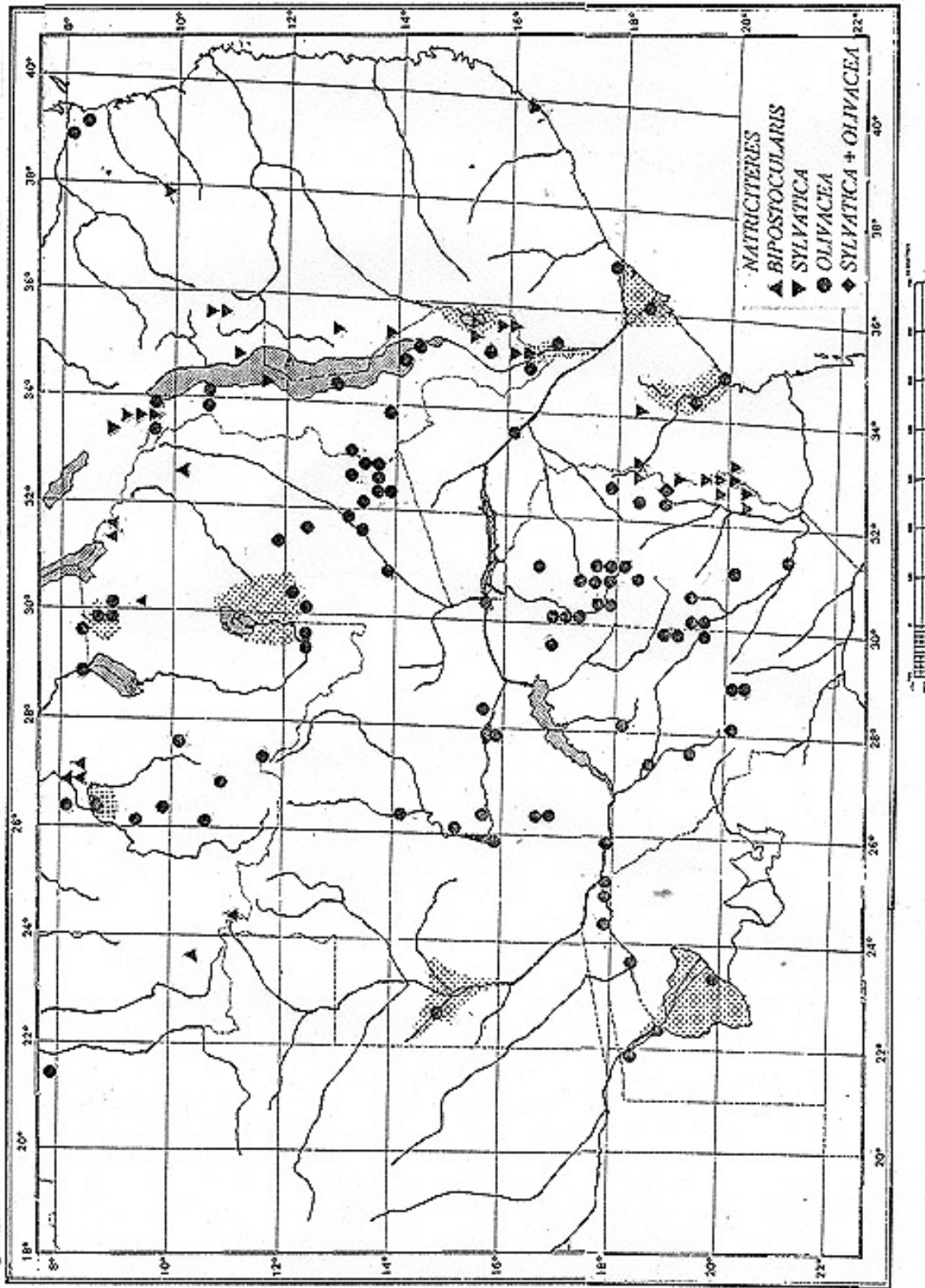


Fig. 6.19. Distribution Map: *Limnophis bicolor*, *L. bangweolicus*, *Meizodon semiornata*
semiornata

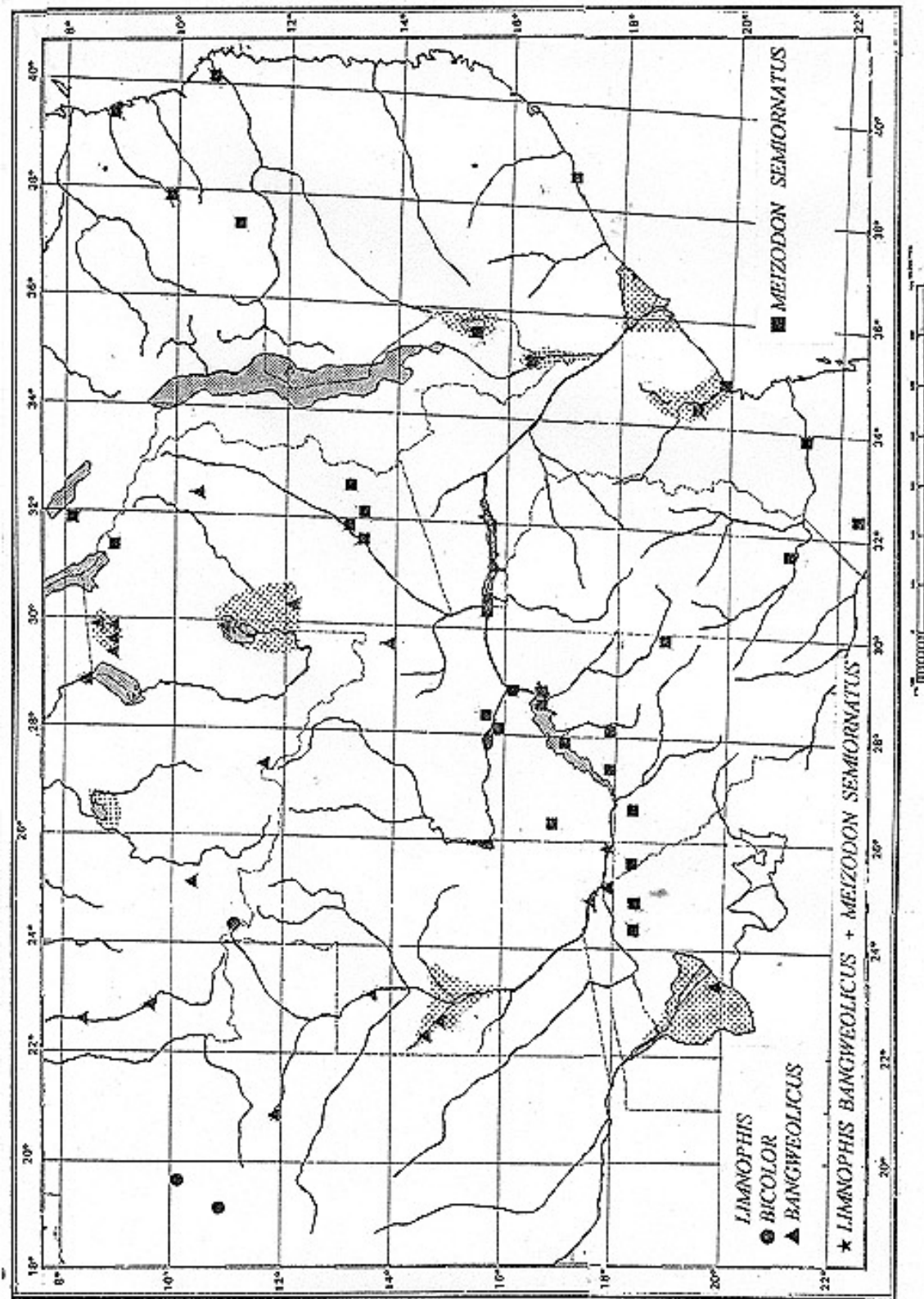


Fig. 6.20. Distribution Map: *Dromophis lineatus*, *Dromophis* sp. nov.

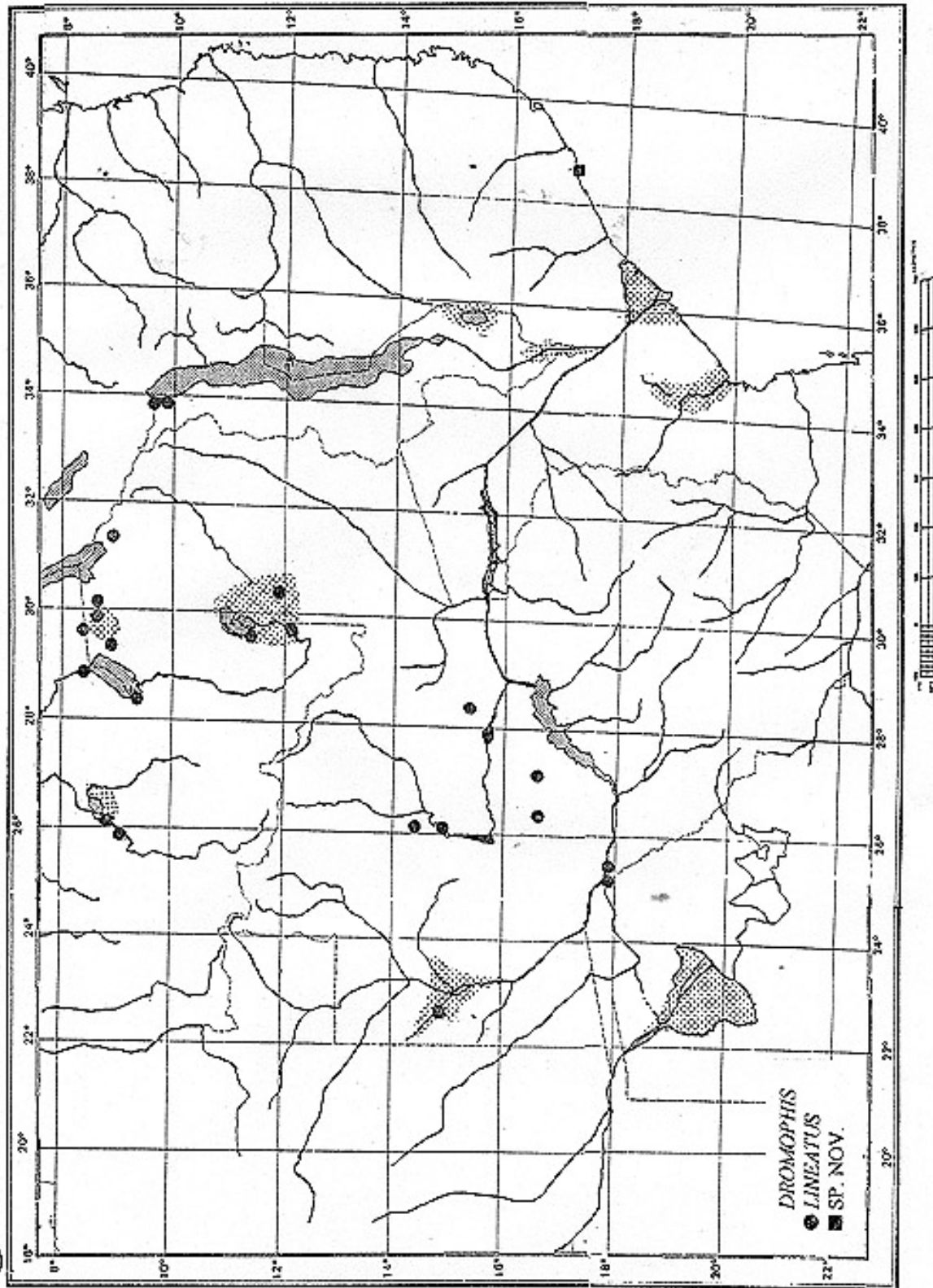


Fig. 6.21. Distribution Map: *Philothamnus angolensis*, *P. punctatus*

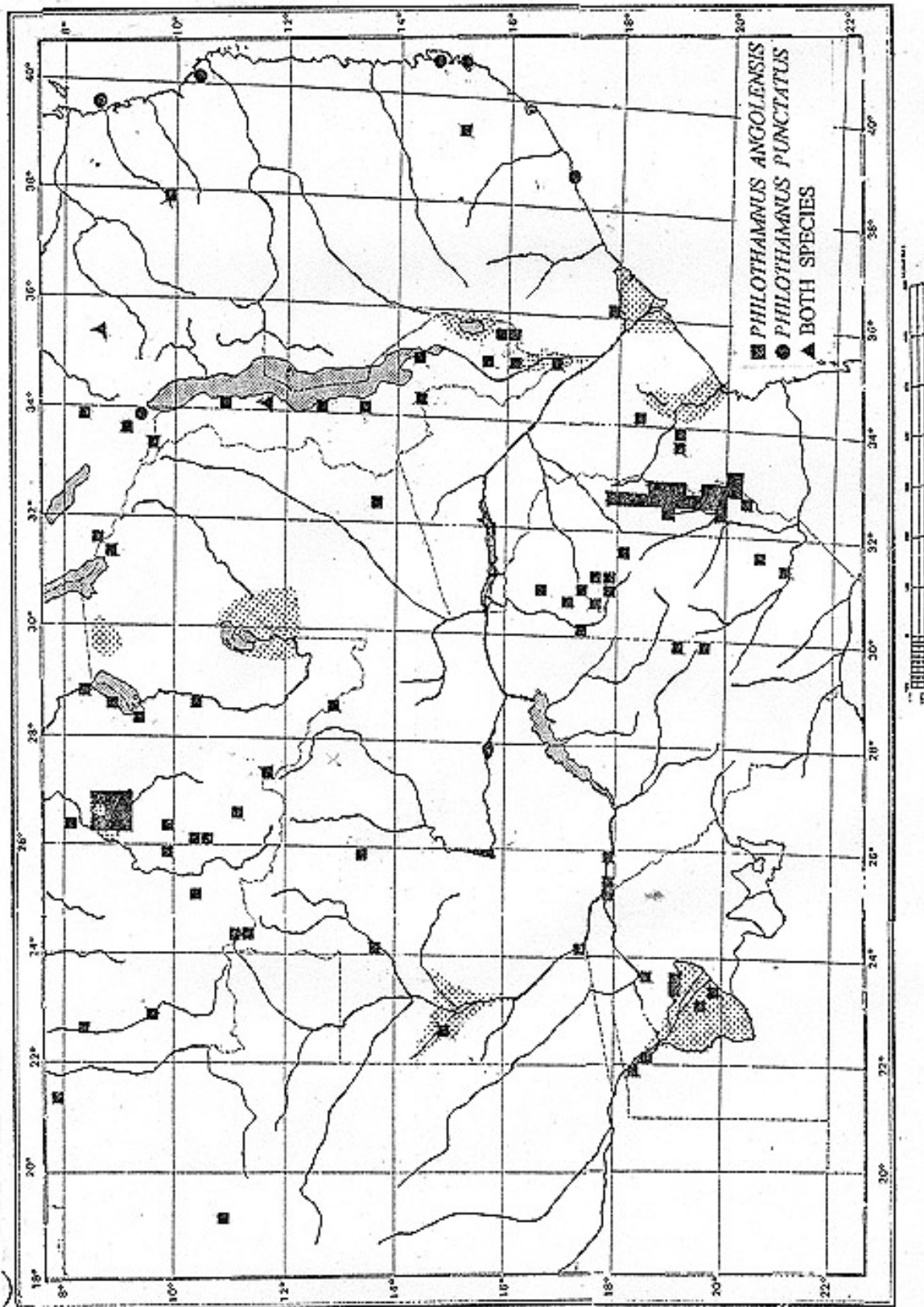


Fig. 6.22. Distribution Map: *Philothamnus natalensis*, *P. ornatus*, *P. heterolepidotus*

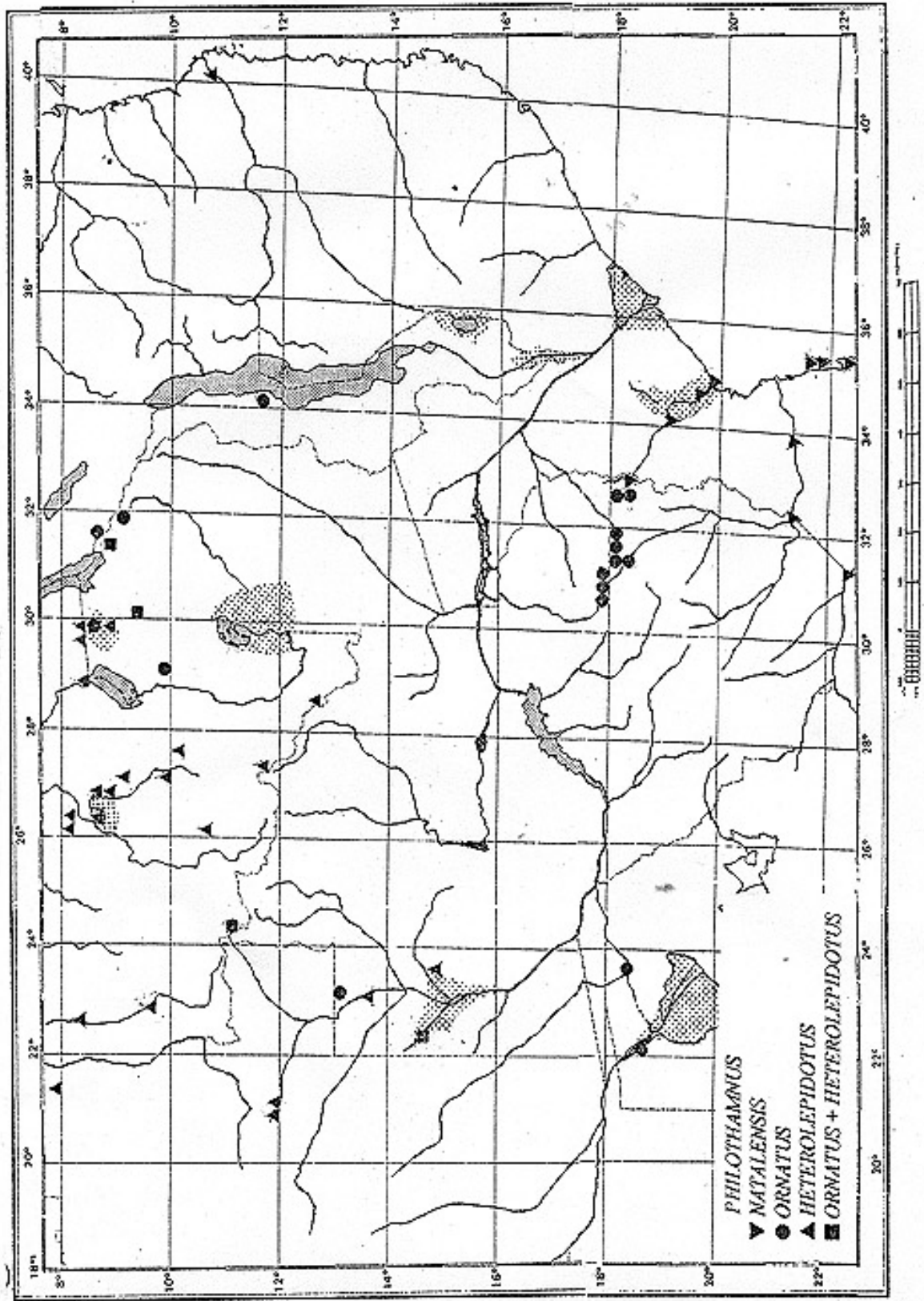


Fig. 6.23. Distribution Map: *Bufo lemairii*

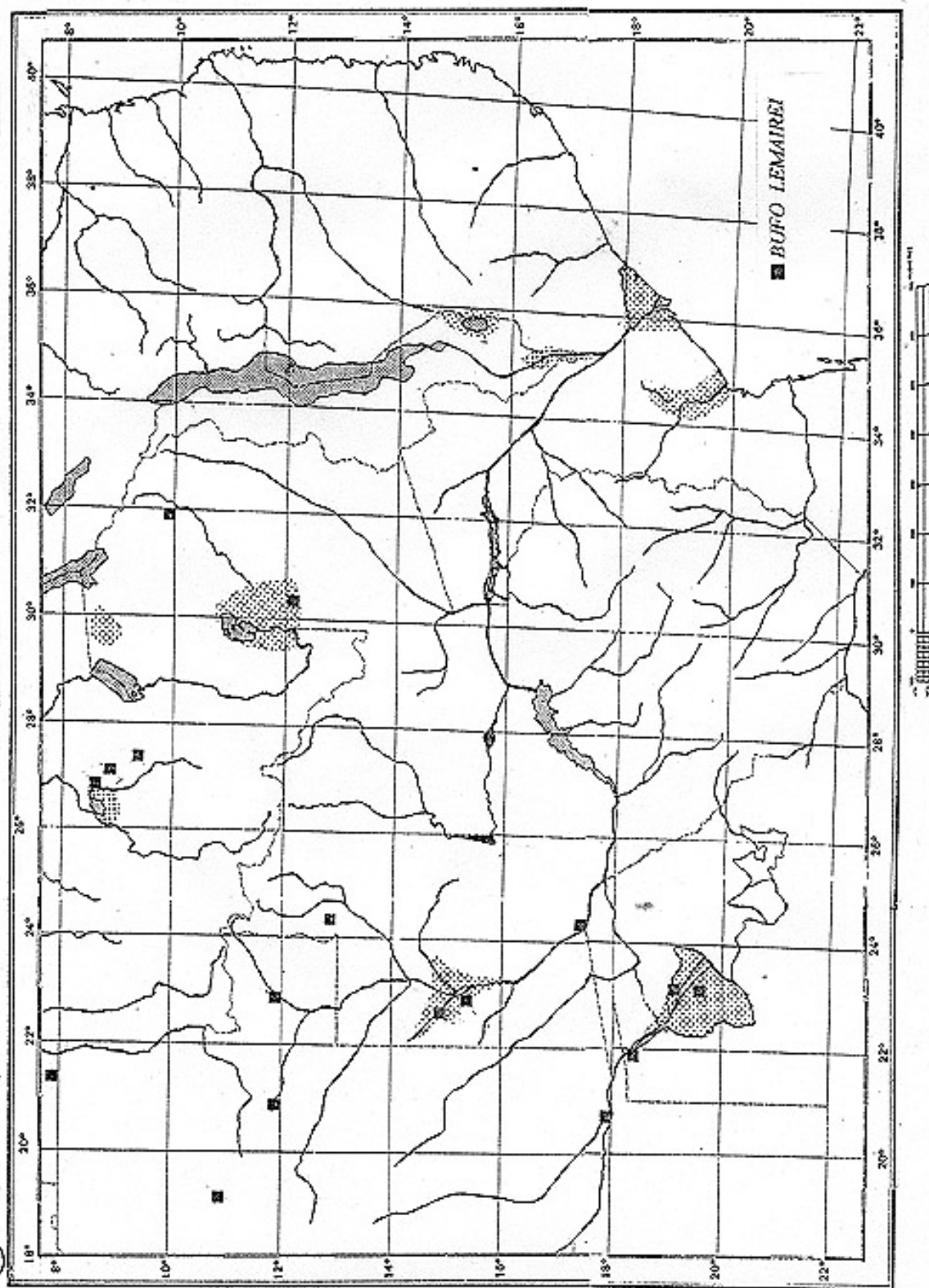


Fig. 6.24. Distribution Map: *Strongylopus fasciatus*, *S. fuelleborni*

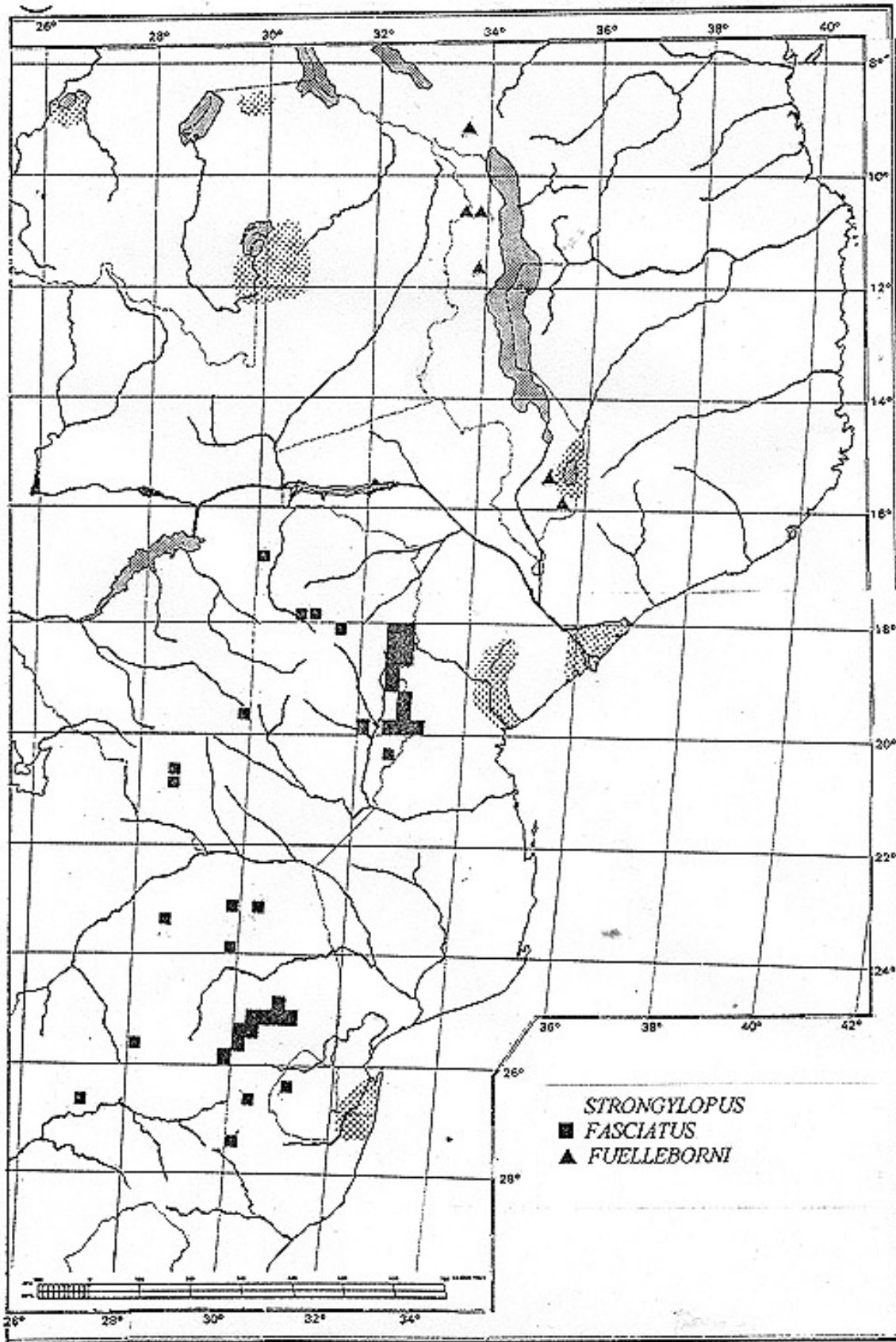


Fig. 6.25. Distribution Map: *Hylarana galmensis*, *Ptychadena subpunctata*

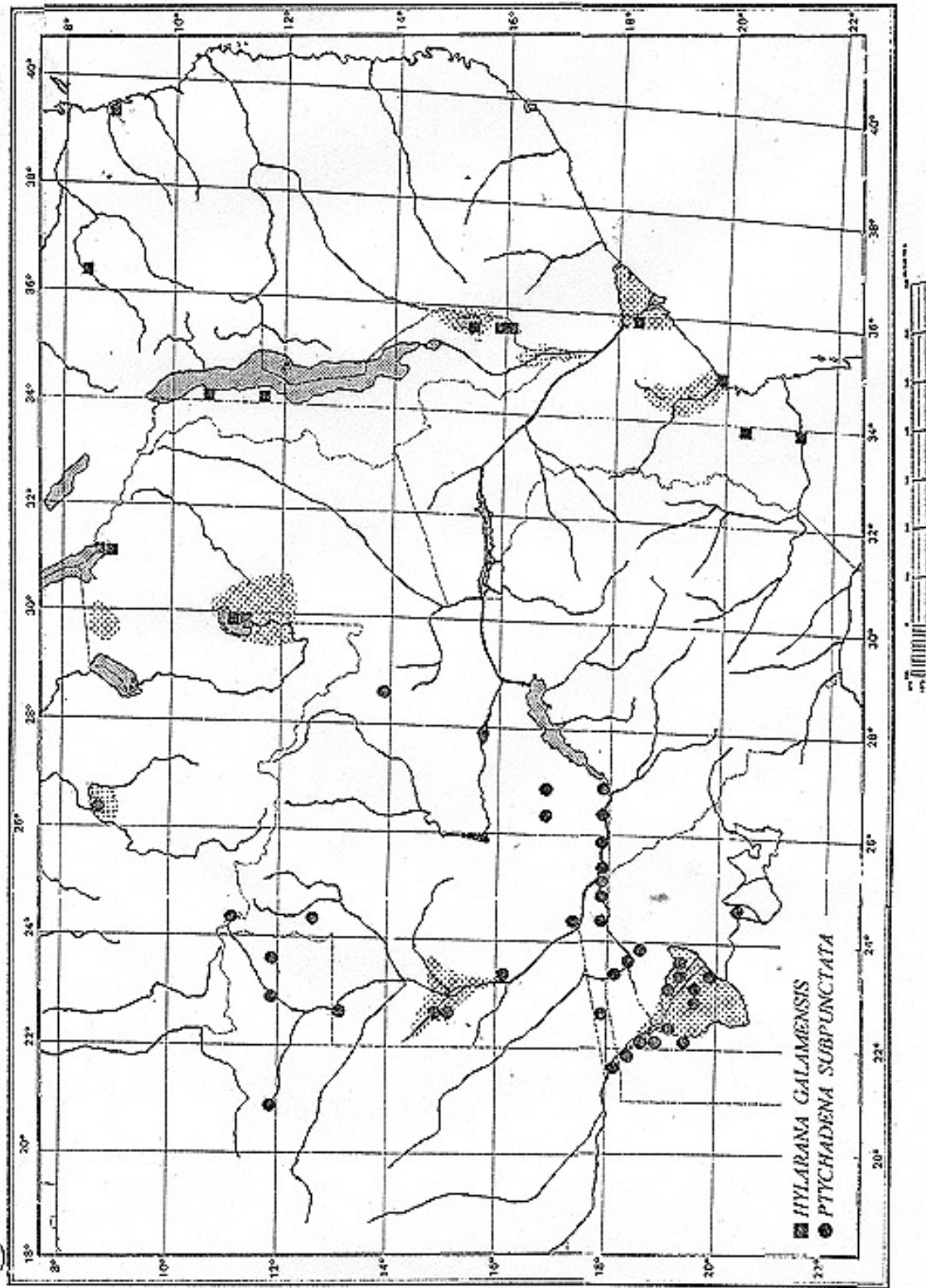


Fig. 6.26. Distribution Map: *Ptychadena mascareniensis*, *P. schillukorum*

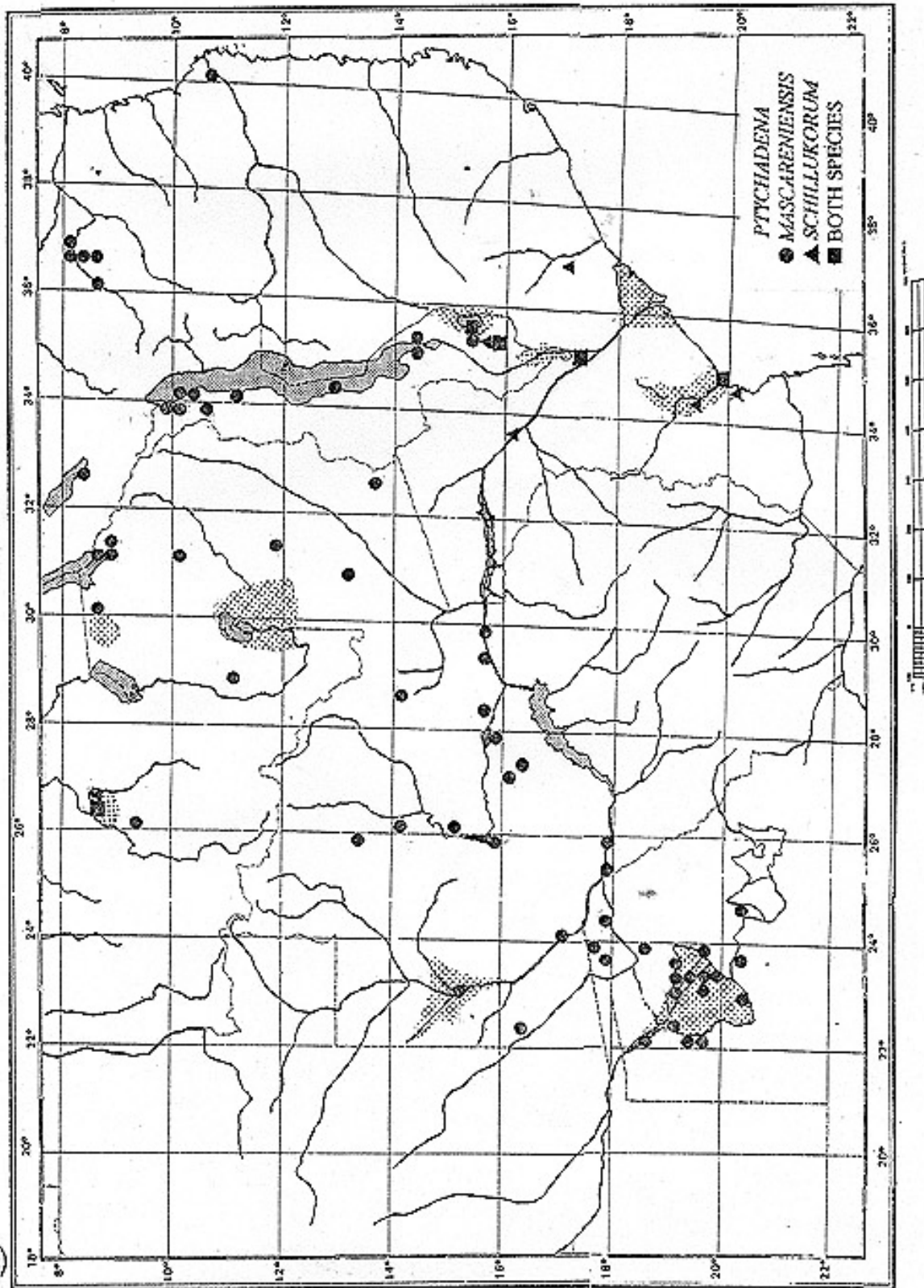


Fig. 6.27. Distribution Map: *Ptychadena uzungwensis*

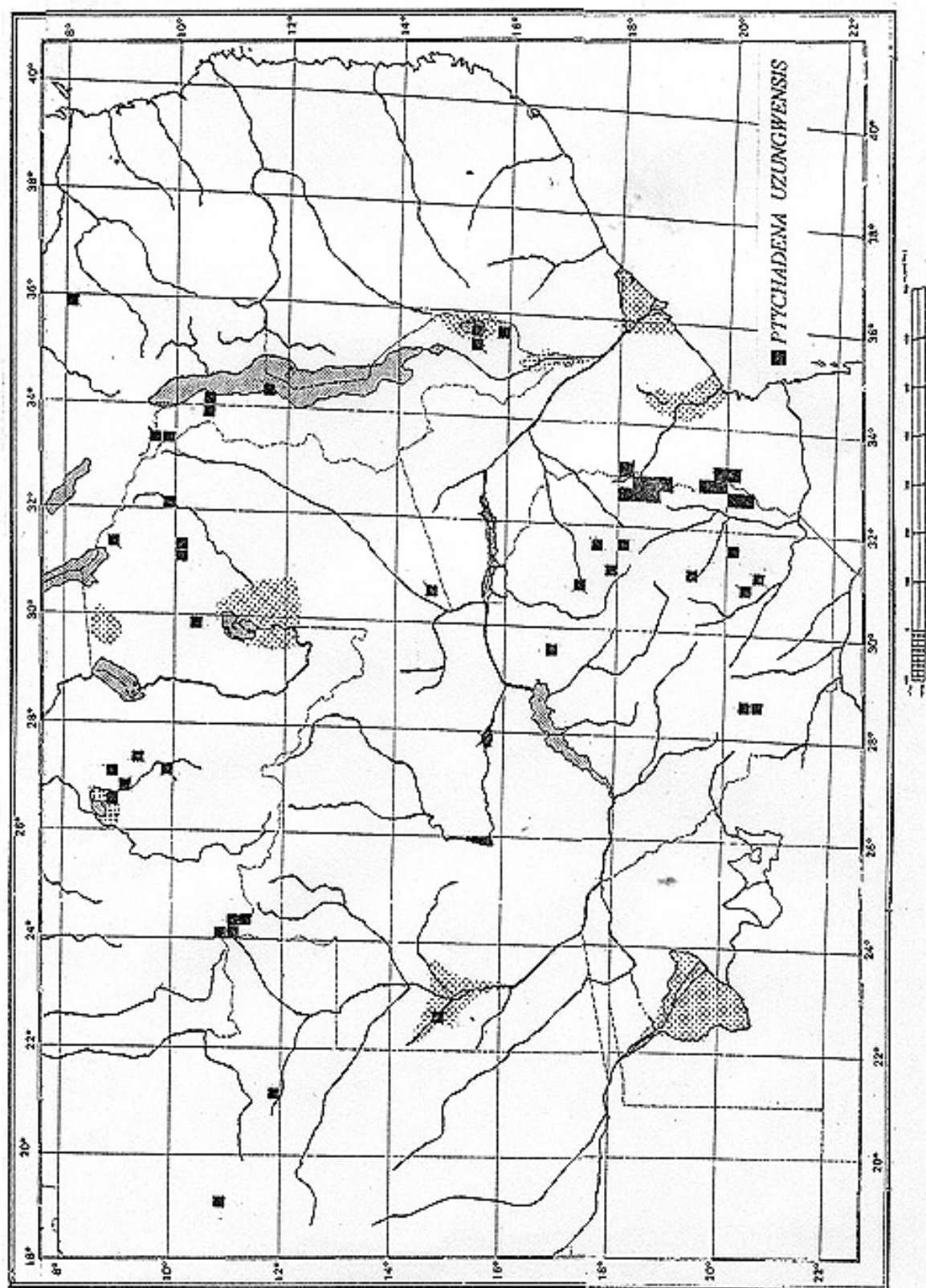


Fig. 6.28. Distribution Map: *Leptopelis mossambicus*, *L. parvocagii*, *L. bocagii*

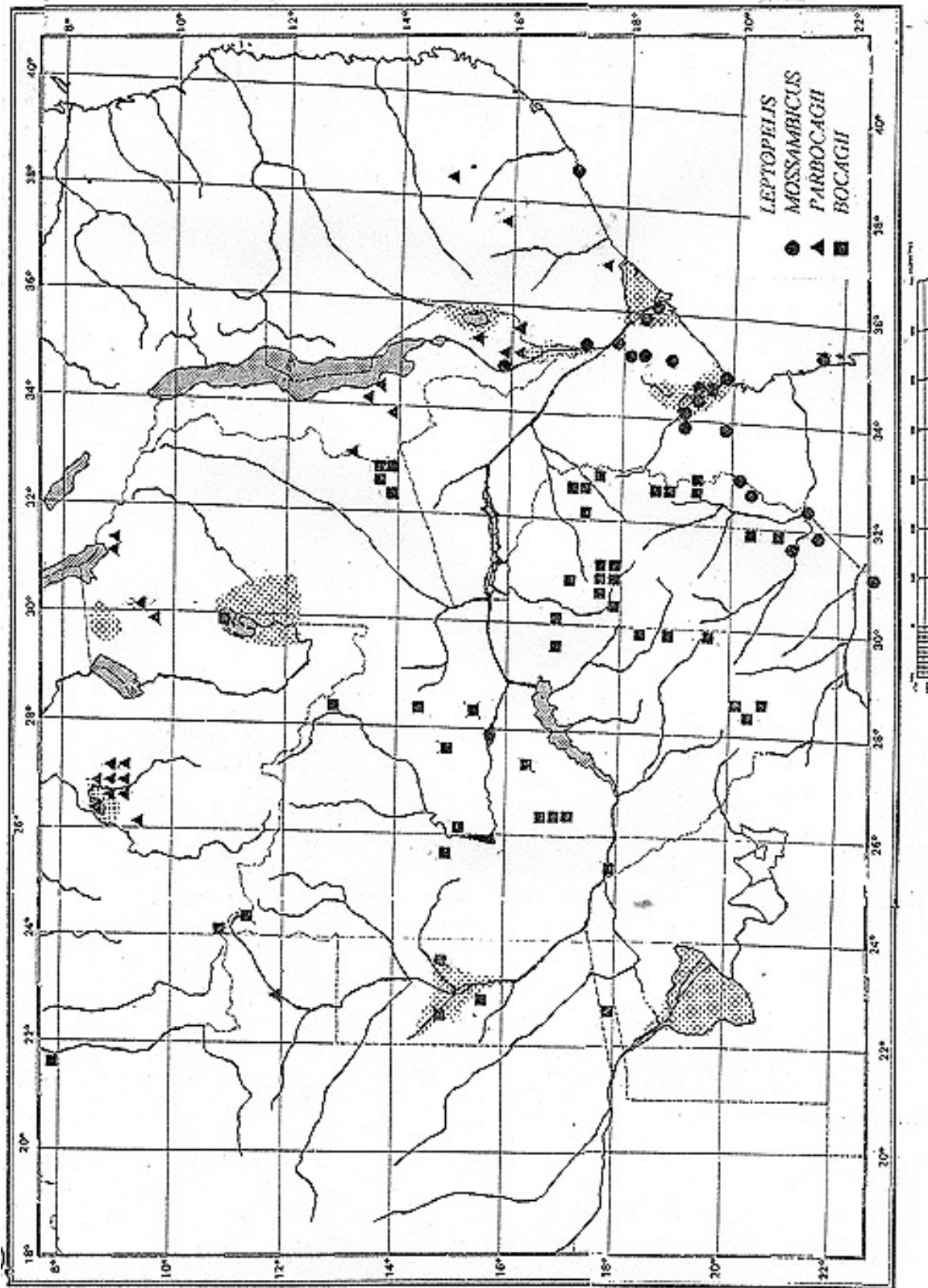
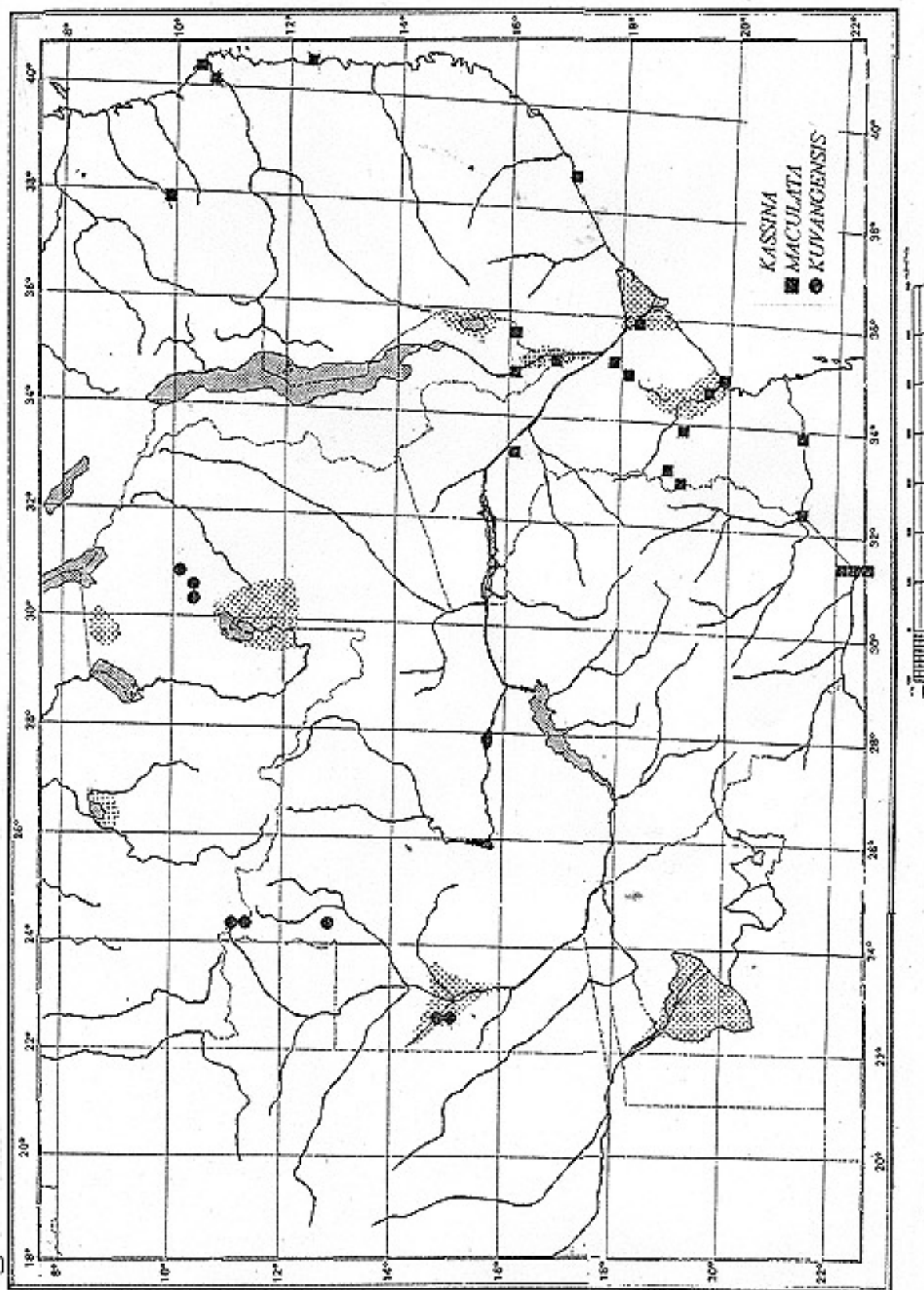


Fig. 6.29. Distribution Map: *Kassina maculata*, *K. kuvangensis*



CHAPTER 6 : APPENDIX 1

SURVEY OF THE WETLAND AMPHIBIANS OF THE BAROTSE FLOODPLAINS

Alan Channing

1. INTRODUCTION

As part of the Zambezi Basin Wetlands Biodiversity project, being implemented by the Biodiversity Foundation for Africa and the Zambezi Society on behalf of IUCN-ROSA, a survey of the amphibians of the Barotse floodplain area was carried out from 26 October to 4 November 1998. This was at the onset of the rainy season, the period when amphibians are most active. Although it rained at every site during this period, there was insufficient precipitation to bring out all the species. This report should thus be regarded as one of a series that should be carried out at different times of the year.

Four sites were visited: the Bulozzi Floodplain near Mongu, part of the Luena Flats some 50 km north of Mongu, Ndau School about 60 km south of Mongu, and the Luanginga River northwest of Kalabo. Each site was only visited very briefly.

2. SURVEY TECHNIQUES AT NDAU SCHOOL

The surveys of amphibians (by A. Channing and J. Measey) and reptiles (by G. Rasmussen and S. Broadley) were carried out separately, but the techniques employed in both surveys are given here. Only the results of the amphibian survey are presented in this appendix; Appendix 6.2 incorporates reptile findings.

2.1 Amphibians

The intention here was to structure a survey in such a way that it could be repeated easily. As the area is heavily disturbed it was considered more productive to conduct a standard 24 hour survey based on sounds, adults and tadpoles.

- (a) *Sounds*: This involves listening after dark and also after rain, to determine:
 - i) where species are calling, and
 - ii) which species are present based on calls.Sites where species are calling are visited to check for the presence of other non-calling species.
- (b) *Adults*: Damp places and other likely habitats are carefully examined after dark using good torches, looking for feeding adults.
- (c) *Tadpoles*: Pools, lake edges, and vegetated stream edges are netted during the day and night looking for the presence of tadpoles. If caught, samples are preserved for later identification.

2.2 Reptiles

The survey comprised the following four techniques:

- (a) *Pitfall traps*: The start of the survey was at the mango grove north of Ndau School (15°25.14S / 22°58.00 E). From the mango trees three pitfall sites each with three buckets (32 cm diam. x 32 cm depth) were constructed. Pitfalls were left out for a full 24 hour period commencing 1900 hrs. (a) Site 1: bearing 150° x 300 m from mango grove, set adjacent to papyrus 1 m above water level (two amphibians collected). (b) Site 2: bearing 130° x 180 m, set adjacent to moist grass habitat 2 m above water level (nil return). (c) Site 3: bearing 0° x 50 m, set in short dry grassland habitat 4 m above water level (one lizard).

Pitfalls were set running parallel with the water body. The drift fence was made of corrugated plastic, 9 m long, 30 cm high and set 3-5 cm into the substrate. Buckets were set so that the lip of the bucket

was 100 mm below ground. Buckets were set at 6 hour intervals, with the first and last bucket 1.5 m from the end of the drift fence.

- (b) *Transects*: The collecting transect was walked from the camp at 15°25.14S / 22°58.00E, bearing 150° until the woodland ecotone was reached, a distance of 1000 m (three lizards seen).

A further transect was done for 1000 m on a bearing of 150° from the mango trees north of Ndau School using three people walking 3 m apart. Along this transect active reptile holes on grass plain were counted (27 active holes sighted). The objective of this exercise was to evaluate reptile activity.

- (c) *Leaf litter search*: At the forest ecotone, five trees were selected and 5 m² of leaf litter was removed going right up to the base of the tree. The top 7 cm of substrate was raked over (two lizards seen). More leaf litter was checked 15 m away (nil return).
- (d) *Visual search*: Scanning of school buildings was carried out at 1100 hrs (three lizards seen) and 1700 hrs (two lizards seen).

3. SPECIES LISTS

3.1 Bulozhi Floodplain near Mongu

26 October to 4 November 1998;
centred on 15°15'36.7" S / 23°07'46.0 E

Grassy floodplain used extensively for cassava cultivation and cattle grazing. Consists of a number of shallow depressions that fill seasonally, as well as permanent flowing water.

Family Bufonidae

Bufo gutturalis Power, 1927

Guttural Toad

Locally abundant, found on grassy floodplain and near water.

Bufo maculatus Hallowell, 1854.

Flat-backed Toad

Very common along the edges of waterways.

Family Hemisotidae

Hemismus marmoratus (Peters), 1854

Marbled Snout-burrower

Found in damp soil near water in localised patches of thick vegetation.

Family Hyperoliidae

Hyperolius m. angolensis Steindachner, 1867

Angolan Reed Frog

Found above ground level in tall papyrus adjacent to water

Leptopelis bocagii (Gunther), 1864

Bocage's Tree Frog

Widespread in grassy flood plain in rangelands.

Family Microhylidae

Breviceps poweri Parker, 1934

Power's Rain Frog

Found on grassy floodplain. Abundant but difficult to find.

Family Pipidae

Xenopus petersi Bocage, 1895

Peter's Platanna

Common in water bodies with muddy substrates.

Family Ranidae

Phrynobatrachus natalensis (Smith), 1849

Natal Puddle Frog

Abundant near water.

Ptychadena mascareniensis (Dumeril & Bibron), 1841
Locally abundant in flooded grassland. Mascarene Ridged Frog

Ptychadena subpunctata (Bocage), 1866
Locally very common around waterbodies with thick vegetation. Spotted Ridged Frog

Ptychadena taenioscelis Laurent, 1954
Present in localized patches in thick vegetation near water. Small Ridged Frog

Pyxicephalus adspersus Tschudi, 1838
Uncommon. Found on grassy flood plain. African Bullfrog

Tomopterna tandyi Channing & Bogart, 1996
Occur in patches on the grassy floodplain. (Previously called *T. cryptotis*) Tandy's Sand Frog

3.2 Luena Flats, 50 km north of Mongu 26 October to 4 November 1998;
centred near Sikongo, 14°49'26.7"S / 23°11'28.1"E

Grassy floodplain with patches of palms and woodland.

Family Hemisotidae

Hemisus g. microps Cope, 1865
Common on raised "islands" where palms are present. Guinea Snout-burrower.

Family Hyperoliidae

Leptopelis bocagii (Gunther), 1864.
Very common in low numbers on the grassy flood plain. Bocage's Tree Frog.

Family Pipidae

Xenopus petersi Bocage, 1895
Common in cattle drinking ponds and other water bodies. Found with small catfish. Peter's Platanna

3.3 Luanginga River, northwest of Kalabo 26 October to 4 November 1998;
centred on 14°58.4'S / 22°41.1'E

Grassy floodplain fringed with woodland. Used for cattle grazing and some cassava fields.

Family Bufonidae

Bufo gutturalis Power, 1927
Locally abundant, found on grassy floodplain and near water. Guttural Toad

Family Microhylidae

Phrynomantis bifasciatus (Smith), 1847
Scarce, recorded from the vegetation along the Lueta River. Banded Rubber Frog

Family Ranidae

Ptychadena subpunctata (Bocage), 1866
Locally very common around waterbodies with thick vegetation. Spotted Ridged Frog

3.4 Ndau School 26 October to 4 November 1998;
centred on 15°25'05.3"S / 22°58.02.6"E

Very disturbed vegetation used for grazing cattle and cassava fields. Deep lake and much flowing water. The woodland west of the area was too dry to survey.

Family Bufonidae*Buto gutturalis* Power, 1927

Guttural Toad

Locally abundant, found on grassy floodplain and near water.

Bufo maculatus Hallowell, 1854.

Flat-backed Toad

Very common along the edges of waterways.

Family Hyperoliidae*Leptopelis bocagii* (Gunther), 1864

Bocage's Tree Frog

Very common in low numbers on the plain.

Family Pipidae*Xenopus petersi* Bocage, 1895

Peter's Platanna

Abundant in the lake.

Family Ranidae*Phrynobatrachus natalensis* (Smith), 1849

Natal Puddle Frog

Common in thick vegetation along the lake edge.

Tomopterna tandyi Channing & Bogart, 1996

Tandy's Sand Frog

Present near the lake edge.

4. DISCUSSION**4.1 Amphibian success on the Floodplain**

At the present time no mechanized agriculture is used, no insecticides are used, and very little drainage manipulation has taken place. This makes the flood plain as a whole an interesting frog habitat that should yield many ore new (unrecorded) species.

We recorded the African bullfrog for the first time. This is surprising given the huge size of the adults and their day-time breeding activity. However, our local sources informed us that they are not eaten by the local Lozi speakers.

4.2 The Floodplain as a unit

We travelled extensively across the floodplain. There is no reason to suggest that there are different frog habitats present on a macro-scale. The sites we surveyed (Mongu, Kalabo, Ndau and Sikongo) can all be regarded as the same habitat in terms of frogs.

I suggest that future surveys work in easily accessible areas, probably the floodplain adjacent to Mongu, in order to maximize the return per unit effort.

4.3 Changes of usage patterns on the Floodplain

I recommend that increased usage of the flood plain for grazing or large-scale agriculture, be discouraged. The teachers at Ndau School are aware of the increasing human pressure on their environment, from more people around the area, to fishermen coming from as far as Lusaka in order to catch fish in their lake. Frogs are presently able to survive due only to the relatively low-level use of the flood plain.

4.4 Special frog species

We recorded 16 species, of which two have not previously been found in the area. Given better rains, I believe that there are probably 10 or more additional species to be added to the checklist. It is not possible to single out any frog species of special biological or conservation concern.

CHAPTER 6 : APPENDIX 2 THE HERPETOFAUNA OF BAROTSELAND, ZAMBIA

Donald G. Broadley

1. INTRODUCTION

The herpetofauna of Barotseland is poorly known but obviously very rich. A few reptiles collected by the Swiss missionary Boiteaux were reported on by Roux (1907). The earliest comprehensive collection from Lealui District was made by the French missionary Ellenberger and deposited in the Natural History Museum in Paris, where they were reported on by Angel (1920, 1921, 1922) who described four new species of reptiles. During the period 1962-64, R.G. Japp, a representative of WENELA based at Kalabo, made large collections which were deposited in the Field Museum of Natural History, Chicago, and the Natural History Museum of Zimbabwe. From this material I described three new species and one subspecies of reptile.

Unfortunately the BFA herpetofaunal survey carried out at the end of October 1998 was hampered by lack of sufficient rain to bring the reptiles and amphibians out in force, but the mammal and bird team, which went in a week later, did get some rain and added more species to the list. My wife and I visited the area for ten days in March 1999, at the end of the rains, concentrating on the western edge of the floodplain around Ndaui School and added more snakes and amphisbaenians. Altogether these surveys recorded one new species of frog and four new amphibians for Barotseland. Three lizards new for Barotseland were also northwestern range extensions, while one lizard and one snake were recorded east of the Zambezi for the first time.

2. ANNOTATED CHECKLIST

REPTILIA

CHELONIA (tortoises/turtles)

Pelomedusidae

Pelomedusa subrufa (Bonnaterre)

Helmeted Terrapin

This widespread species inhabits ephemeral pans. It has been recorded from Kalabo (Broadley 1971).

Pelusios bechuanicus FitzSimons

Okavango Hinged Terrapin

New material: Mongu (shell), Ndaui School (hatchling); previously recorded from Kalabo. This is the common terrapin in the clear waters of the Okavango and the Upper Zambezi. It also occurs on the Kafue Flats and an ancestral form crossed the watershed into the Congo Basin and gave rise to a sister species *P. upembae* in the Upemba National Park (Broadley 1971).

Pelusios rhodesianus Hewitt

Zambian Hinged Terrapin

New material: several broken shells from Ndaui School; previously recorded from Kalabo (Broadley 1971). This terrapin prefers weed-choked backwaters and its distribution seems to be centred on the Bangweulu Swamps.

SAURIA (lizards)

Agamidae

Acanthocercus atricollis A. Smith

Southern Tree Agama

New material: Ndanda, also seen at Ndaui School. This widespread large tree agama has previously been recorded from Lealui (Angel 1920).

Agama armata Peters

Tropical Spiny Agama

New material: Ndanda. This eastern tropical species has previously been recorded from Lealui (Angel 1920).

Chamaeleonidae*Chamaeleo dilepis* Leach

Common Flap-neck Chameleon

New material: Nda School. This widespread species has previously been recorded from Lealui (Angel 1920) and Kalabo.

Gekkonidae*Lygodactylus capensis* (A. Smith)

Cape Dwarf Gecko

New material: Mongu. This widespread species was previously recorded from Lealui (Angel 1920).

Lygodactylus chobiensis FitzSimons

Chobe Dwarf Gecko

New material: Lealui, Nda School. This species, previously recorded from Kalabo, is endemic to the Zambezi Basin, extending downstream to Tete.

Hemidactylus mabouia (Jonnés)

Tropical House Gecko

New material: Mongu. New for Barotseland, but the wide distribution of this species is due to the accidental transportation of the eggs by man.

Scincidae*Sepsina angolensis* Bocage

Angola Burrowing Skink

The only Zambian specimens of this western species are from Kalabo (Broadley 1971).

Typhlacontias gracilis Roux

Barotse Burrowing Skink

New material: Mongu, Nda School; previously recorded from Lealui (Angel 1920). This small limbless skink is endemic to western Zambia.

Typhlacontias rohani Angel

Kalahari Burrowing Skink

This species is closely related to *T. gracilis* and the two species are sympatric at Kalabo (Haacke 1997).

T. rohani has a wide range from northeastern Namibia across to the Hwange District of Zimbabwe.

Mabuya maculilabris (Peters)

Speckle-lipped Skink

This tropical forest species reaches its southern limit in Zambia at Kalabo (Broadley 1971).

Mabuya capensis (Gray)

Cape Skink

This widespread southern African skink extends into the Kalahari and there appears to be a relict population on the Liuwa Plain (Broadley 1971).

Mabuya punctulata Bocage

Speckled Skink

New material: Ndanda, Nda School. This is the first record of this small arenicolous species east of the Zambezi, it was previously recorded from Kalabo. It ranges from southwest Angola through the Kalahari to southern Mozambique.

Mabuya varia (Peters)

Variable Skink

New material: Nda School, Ndanda. This widespread savanna species was previously recorded from Kalabo.

Mabuya wahlbergii (Peters)

Wahlberg's Skink

New material: Mongu, Nda School, Sikongo. This western arboreal species is a common commensal of man, living on buildings.

Eumecia anchietae Bocage

Bocage's Dambo Skink

This large skink, with vestigial limbs and a long tail, inhabits swampy areas from Angola to western Kenya. It has been recorded from Lealui (Angel 1920) and Kalabo.

Lygosoma sundevallii (A. Smith) Sundevall's Writhing Skink
New material: Ndau School. This widespread central African fossorial skink has been recorded from Lealui (Angel 1920) and Kalabo.

Panaspis "maculicollis" Jacobsen & Broadley, in prep. Spotted-neck Snake-eyed Skink
New material: Ndanda. New for Barotseland, these specimens also represent a northwestern range extension for this small species.

Typhlosaurus jappi Broadley Barotse Legless Skink
This species is endemic to Barotseland and was described from Kalabo.

Lacertidae

Ichnotropis capensis (A. Smith) Cape Rough-scaled Lizard
New material: 4 & 20 km SE of Kalabo, Ndau School, Ndanda. This is the commonest sand lizard in the Kalahari sand regions, previously recorded from Lealui (Angel 1920) and Kalabo. An "annual" species.

Ichnotropis squamulosa Peters Common Rough-scaled Lizard
New material: Ndanda. New for Barotseland and a northwestern range extension for this widespread "annual" species, which has its life cycle staggered in relation to that of *T. capensis*.

Gerrhosauridae

Gerrhosaurus auritus Boettger Kalahari Plated Lizard
New material: Ndau School, Ndanda. This Kalahari endemic was previously recorded from Lealui (Angel 1920) and Kalabo. It seems to be very common in Barotseland, but is replaced in northwestern Zambia by *G. bulsi* Laurent.

Tetradactylus ellenbergeri (Angel) Ellenburger's Plated Snake-lizard
The type specimen is from Barotseland (Angel 1922), but all other records are from further north (Angola to SE Tanzania).

Varanidae

Varanus niloticus (Linnaeus) Nile Monitor/Water Leguaan
This widespread species has been recorded from Kalabo and was seen at Ndau School.

AMPHISBAENIA (worm lizards)

Amphisbaenidae

Zygaspis nigra Broadley & Gans Black Round-snouted Amphisbaenian
New material: Ndau School. This large species was described from Kalabo. It extends south to the eastern Caprivi and west into Angola, but has not been found east of the Zambezi.

Zygaspis quadrifrons Peters Kalahari Round-snouted Amphisbaenian
New material: Ndau School. This widespread small species has previously been recorded from Lealui (Angel 1920) and Kalabo.

Dalophia ellenbergeri Angel Barotse Pestle-tailed Amphisbaenian
New material: Ndau School. This slender species was described from Lealui; there is a long series from Kalabo and a single record from SE Angola.

Dalophia pistillum (Boettger) Zambezi Pestle-tailed Amphisbaenian
This large species has been recorded from Lealui (Angel 1920) and Kalabo. It has a wide range in the Zambezi basin, extending south through the Kalahari into northern regions of South Africa.

SERPENTES (snakes)

Pythonidae*Python natalensis* A. Smith

Southern African Python

New material: Ndau School. This is the first record from Barotseland, but there is a specimen from Kabompo to the north.

Typhlopidae*Typhlops schmidtii* Laurent

Schmidt's Blind Snake

This species occurs in the southeast of the DRC and NW Zambia. It has been recorded from Kalabo.

Rhinotyphlops mucruso (Peters)

Zambezi Blind Snake

This widespread East African species has been recorded from Lealui (Roux-Estève 1974).

Viperidae*Causus rhombeatus* (Lichtenstein)

Rhombic Night Adder

This widespread savanna species has been recorded from Kalabo.

Causus bilineatus Boulenger

Lined Night Adder

This small species has been recorded from Kalabo, which seems to be close to the southern limit of its range.

Bitis arietans (Merrem)

Puff Adder

This widespread savanna species has been recorded from Kalabo.

Atractaspididae*Atractaspis congica* Peters

Congo Stiletto Snake

This western fossorial species reaches the southern limit of its range at Katima Mulilo in the eastern Caprivi. It has been recorded from Kalabo.

Amblyodipsas polylepis (Bocage)

Common Purple-glossed Snake

New material: Ndau School, Lealui. This widespread fossorial species had previously been recorded from Lealui (Angel 1921) and Kalabo.

Amblyodipsas ventrimaculatus (Roux)

Kalahari Purple-glossed Snake

This Kalahari endemic was described from Barotseland and has been recorded from Lealui (Angel 1921) and Kalabo (Broadley 1971).

Xenocalamus mechowii Peters

Angolan Quill-snouted Snake

New material: Ndau School. This large fossorial species is a specialist predator on amphisbaenians. It is restricted to Kalahari sand regions and has previously been recorded from Senanga (Pitman 1934) and Kalabo District (Broadley 1971).

Hypoptophis wilsoni Boulenger

Wilson's Burrowing Snake

This very rare species is known only from the southeastern DRC and western Zambia. One specimen has been recorded from Kalabo (Broadley 1971).

Aparallactus capensis A. Smith

Cape Centipede-eater

This widespread species has been recorded from Kalabo.

Elapidae*Elapsoidea semiannulata* Bocage

Angolan Garter Snake

New material: Mongu (first record east of the Zambezi). This Angolan species has previously been recorded from Kalabo (Broadley 1971) and Liumba Hill Mission.

Elapsoidea boulengeri Boettger

Zambezi Garter Snake

This species is widespread in the Zambezi Basin but in Barotseland it has only been recorded from Lealui (Angel 1921).

Naja anchietae Bocage

Anchieta's Cobra

This species replaces the Snouted Cobra (*Naja annulifera*) in the Kalahari sand regions. It has been recorded from Lealui (Angel 1921, as var. *barotseensis*) and Kalabo.

Naja nigricollis Reinhardt

Black-necked Spitting Cobra

This large species, widespread in west and central Africa, reaches the southern limit of its range at Katima Mulilo. It has been recorded from Lealui (Angel 1921), Sikongo and Kalabo.

Colubridae*Lamprophis ? fuliginosus* (Boie)

Sooty House Snake

Barotseland and eastern Caprivi specimens seem to represent this west and central African species, but fresh material is needed to confirm this range extension. Specimens have been recorded from Lealui (Angel 1921) and Kalabo. To the south and east, the Brown House Snake (*L. capensis* Duméril & Bibron) occurs.

Mehelya capensis (A. Smith)

Cape File Snake

This widespread large savanna species has been recorded from Kalabo.

Mehelya nyassae (Günther)

Black File Snake

This small species has been recorded from Kalabo.

Lycophidion multimaculatum Boettger

Blotched Wolf Snake

This western species has been recorded from Kalabo District and Mongu (Broadley 1971) and extends south to the Caprivi.

Natriciteres olivacea (Peters)

Olive Marsh Snake

This widespread aquatic species has been recorded from Lealui (Angel 1921) and Kalabo.

Limnophis bangweolicus (Mertens)

Bangweulu Striped Swamp Snake

This water snake is endemic to the greater Okavango system and has been recorded from Kalabo (Broadley 1971).

Psammophylax variabilis Günther

Grey-bellied Grass Snake

In the eastern part of its range this species inhabits montane grassland, but there is a western population on the Barotse floodplain extending south to Kasane. It has been recorded from Kalabo (Broadley 1971).

Rhamphiophis acutus jappi Broadley

Barotse Striped Beaked Snake

New material: Ndau School. This subspecies was described from Kalabo and extends up the Zambezi River to Zambezi (Balovale). It is replaced by the typical form in Mwinilunga District.

Dromophis lineatus (Duméril & Bibron)

Lined Olympic Snake

This swamp-dwelling species reaches its southern limit in the Kazungula area. It has been recorded from Kalabo.

Psammophis jallae Peracca

Jalla's Sand Snake

This widespread species has been recorded from Lealui (Angel 1921) and Kalabo (Broadley 1971).

Psammophis mossambicus Peters

Olive Grass Snake

New material: Ndau School. Previously recorded from Lealui (Angel 1921) and Kalabo.

Psammophis angolensis (Bocage) Dwarf Sand Snake
This dwarfed species has been recorded from Lealui (Angel 1921) and Kalabo District.

Prosymna angolensis Boulenger Angola Shovel-snout
This western species has been recorded from Kalabo (Broadley 1971). Its diet consists of reptile eggs.

Philothamnus angolensis Bocage Angola Green Snake
New material: Ndau School. This species inhabits reedbeds and trees along streams. It has previously been recorded from Lealui (Angel 1921) and Kalabo.

Philothamnus hoplogaster Bocage Southeastern Green Snake
This species inhabits open dambos. It has been recorded from Kalabo.

Philothamnus ornatus Bocage Ornate Green Snake
This striped green snake has been recorded from Lealui (Angel 1921) and Kalabo.

Philothamnus heterolepidotus (Günther) Slender Green Snake
New material: Ndanda. This very attenuated species reaches the southern limit of its range in Barotseland. It has been recorded from the Liuwa Plain.

Philothamnus semivariiegatus (A. Smith) Variegated Bush Snake
This widespread species is less dependant on water than most members of the genus. It has been recorded from Kalabo.

Crotaphopeltis hotamboeia (Laurenti) Herald Snake
This widespread species has been recorded from Kalabo District.

Crotaphopeltis barotseensis Broadley Barotse Water Snake
This species is endemic to the greater Okavango system, where it is associated with papyrus swamps. Kalabo is the type locality.

Telescopus semiannulatus (A. Smith) African Tiger Snake
This widespread savanna species has been recorded from Lealui (Angel 1921) and Kalabo.

Dispholidus typus (A. Smith) Boomslang
This widespread savanna species has been recorded from Lealui (Angel 1921) and Kalabo.

Thelotornis oatesii (Günther) Oates' Vine Snake
New material: Matabele Plain. This western savanna tree snake has been recorded from Lealui (Angel 1921) and Kalabo.

Dasypeltis scabra (Linnaeus) Common Egg-eater
This widespread species has been recorded from Lealui (Angel 1921) and Kalabo.

CROCODYLIA

Crocodylidae

Crocodylus niloticus Laurenti Nile Crocodile
Sight records: Ndau School. In an ecological survey, Cott (1961) analysed the stomach contents of 179 crocodiles collected between Lukulu and Senanga in 1957. Adults were feeding mainly on fish (especially *Claris* sp.) and terrapins. Only one contained human remains.

AMPHIBIA

Pipidae

Xenopus petersii Bocage Peters' Clawed Frog/Platanna
New material: Kalabo, Mongu, Sikongo, Ndau School. Previously recorded from Lealui (Angel 1921) and Kalabo District.

Xenopus muelleri (Peters) Tropical Clawed Frog/Platanna
Previously recorded from Kalabo (Broadley 1971).

Bufonidae

Bufo gutturalis Power Guttural Toad
New material: Ndau School, Ndanda. Previously recorded from Kalabo District.

Bufo poweri Hewitt Power's Toad
New material: Ndanda, Ndau School. New record for Barotseland.

Bufo maculatus Hallowell Flatback Toad
New material: Mongu, Ndau School. Previously recorded from Kalabo.

Bufo lemairii Boulenger Lemaire's Toad
New material: Ndau School. This swamp-dwelling species has previously been recorded from Kalabo (Broadley 1971), Lukona Mission and Sesheke.

Bufo beiranus Loveridge Beira Dwarf Toad
This small species has been recorded from Kalabo and Sandaula Plain.

Microhylidae

Phrynomantis bifasciatus (A. Smith) Red-banded Rubber Frog
Heard at Kalabo.

Phrynomantis affinis (Boulenger) Spotted Rubber-Frog
A specimen in poor condition from Kalabo was assigned to this species with some doubt (Poynton & Broadley 1985).

Breviceps poweri Parker Power's Rain Frog
New material: Mongu. Previously recorded from Kalabo.

Breviceps adpersus Peters Bushveld Rain Frog
Recorded from Kalabo (Broadley 1971).

Hemisotidae

Hemismus barotseensis Channing & Broadley (in press) Barotse Snout-burrowing Frog
New material: Mongu, Sikongo, Ndanda, Ndau School. Alan Channing recorded the diagnostic call of the holotype male at Mongu. Previously recorded from Lealui (as *Hemismus marmoratum* (Angel 1921) or *H. guineensis microps* (Laurent 1972)).

Ranidae

Pyxicephalus adpersus Tschudi Common Bullfrog
New material: Mongu. Recorded from Lealui by Angel (1921).

Pyxicephalus edulis Peters Tropical Bullfrog
Recorded from Kalabo (Parry 1982).

- Tomopterna ? cryptotis* (Boulenger) Kalahari Sand Frog
New material: Mongu, Ndau School, Ndanda. Previously recorded from Kalabo and Sandaula Plain. A recording made by R. Sternstedt at Ndau School should establish the identity of this population.
- Hylarana darlingi* (Boulenger) Golden-backed Frog
Recorded from Kalabo (Broadley 1971). This species occurs in both open savanna woodland and evergreen forest.
- Ptychadena subpunctata* (Bocage) Spot-bellied Grass Frog
New material: Mongu, Kalabo, Ndanda. Previously recorded from Kalabo.
- Ptychadena mascareniensis* (Duméril & Bibron) Mascarene Grass Frog
New material: Mongu. New record for Barotseland.
- Ptychadena porosissima* (Steindachner) Striped Grass Frog
Recorded from Nyambala and Sandaula Plains (Broadley 1971).
- Ptychadena grandisonae* Laurent Grandison's Grass Frog
Recorded from Kalabo (Broadley 1971).
- Ptychadena upembae* (Schmidt & Inger) Upemba Grass Frog
Recorded from Sandaula Plain.
- Ptychadena perplicata* Laurent Plicate Grass Frog
New material: Ndanda. New record for Barotseland, previously recorded from Angola and N Zambia.
- Ptychadena uzungwensis* (Loveridge) Udzungwe Grass Frog
New material: Ndanda. Previously recorded from Kalabo.
- Ptychadena pumilio* (Boulenger) Dwarf Grass Frog
New material: Mongu. Previously recorded from Kalabo and Liuwa Plain.
- Ptychadena guibei* Laurent Guibé's Grass Frog
Recorded from Sandaula Plain.
- Phrynobatrachus natalensis* (A. Smith) Natal Puddle Frog
New material: Mongu, Ndau School, Ndanda, Litoya Dambo. Previously recorded from Kalabo and Sandaula Plain.
- Phrynobatrachus mababiensis* FitzSimons Mababe Dwarf Puddle Frog
New material: Ndanda. Previously recorded from Kalabo and Sandaula Plain.
- Hyperoliidae**
- Leptopelis bocagii* (Günther) Bocage's Burrowing Frog
New material: Mongu, Sikongo, Ndau School, Ndanda. Previously recorded from Kalabo.
- Kassina kuvangensis* (Monard) Cubango Running Frog
Recorded from Kalabo and Kalengo (Broadley 1971).
- Kassina senegalensis* (Duméril & Bibron) Senegal Running Frog
Recorded from Kalabo, Nyambela and Sandaula Plains.
- Afrixalus wittei* (Laurent) Witte's Leaf-folding Frog
Recorded from Kalabo (Broadley 1971).
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Hyperolius nasutus Günther

Günther's Sharp-snouted Reed Frog

New material: Ndanda, Ndau School. Previously recorded from Kalabo and Sandaula Plain.

Hyperolius benguellensis (Bocage)

Bocage's Long Reed Frog

New material: Ndanda. New record for Barotseland.

Hyperolius angolensis Steindachner

Angolan Reed Frog

New material: Kalabo, Lealui (with juvenile pattern, but this is the type locality of *aposematicus* Laurent, which may be a valid taxon). Previously recorded from Kalabo and Sandaula Plain (Broadley 1971).

3. DISCUSSION

At present the herpetofauna of the Barotse floodplain and environs is known to include 70 species of reptiles (Testudines 3; Sauria 23; Amphisbaenia 4; Serpentes 39; Crocodylia 1) and 34 species of amphibian. This makes it the most species-rich wetland in the Zambezi Basin. However, there seem to be several species missing. No tortoises have been recorded, but both the Leopard Tortoise (*Geochelone pardalis*) and Speke's Hinged Tortoise (*Kinixys spekii*) are likely to occur, with a possibility of Bell's Hinged tortoise (*Kinixys belliana*) coming from Angola. No species of Thick-toed Gecko (*Pachydactylus*) has been recorded in Barotseland and the Savanna Monitor (*Varanus albigularis*) should occur. There should be a worm snake, either *Leptotyphlops kafubi*, which occurs in the region of the Zambezi headwaters, or *L. scutifrons*, which occurs to the south in the eastern Caprivi. Pitman (1934) reported that Mr J. Soane Cambell had found one specimen of a small horned adder during his over 20 years of residence in Barotseland, so *Bitis caudalis* may occur. Two piscivorous water snakes of the genus *Grayia* occur in the Upper Zambezi tributaries and could extend downstream to Barotseland. Several more back-fanged snake species are likely be added to the Barotseland checklist, including Bark Snake (*Hemirhagerrhis nototaenia*), the Three-lined Grass Snake (*Psammophylax tritaeniatus*), the Rufous Beaked Snake (*Rhamphiophis rostratus*), the Stripe-bellied Sand Snake (*Psammophis subtaeniatus*) and Gerard's Black and Yellow Burrowing Snake (*Chilorhinophis gerardi*). The Semiornate Snake (*Meizodon semiornata*) favours drainage lines and is likely to occur on the Barotse floodplain, so the total number of snake species in Barotseland could be close to 50. It is also likely that more species of amphibians will be added to the list.

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CHAPTER 6 : APPENDIX 3 SURVEY OF THE REPTILES AND AMPHIBIANS OF THE ZAMBEZI DELTA

W.R. Branch

1. HISTORICAL STUDIES

The terrestrial vertebrates of Mozambique remain very poorly-known. Scientifically, Mozambique (including the Zambezi Delta area) remains unstudied and there exist few recent reviews for any vertebrate Class. Reptiles were first reviewed by Peters (1882), following his original explorations in the early part of the 19th century. With the exception of an unpublished review (Broadley 1966), no recent synopsis of the herpetofauna of Mozambique has appeared, although numerous generic reviews have improved our knowledge for the area (see sections 3.2 and 4.2). During recent (1997) surveys for a proposed mining development in the coastal region around Moebase (Zambézia Province), important herpetological collections have been made, including the discovery of new species, important range extensions and additions to the Mozambique herpetofauna (Branch, in prep.).

2. MATERIALS AND METHODS

2.1 Field survey

A field survey, organized by the Biodiversity Foundation of Africa, was undertaken from 24 July to 10 August 1999 to the Zambezi Delta and its surroundings. The herpetological team comprised William Branch and Bernardo Muantinte, with opportunistic assistance supplied by other members of the survey. During this visit all accessible habitats present in the delta area were inspected, and the presence of reptiles and amphibians confirmed by the collection of voucher specimens and/or the presence of characteristic tracks and signs. Due to problems of access and time constraints certain habitats were not adequately surveyed, e.g. mangrove and permanent wetland. Localities in the palm savanna-wetland ecotone were well-surveyed, but displayed varying degrees of human impact. However, these were not considered serious limitations of the survey. The unsurveyed habitats, although among the most pristine in the region, contain a small range of microhabitats and also have relatively depauperate herpetofaunas. In contrast, Malingapansi and Marromeu and the surrounding old sugar cane fields still retained high herpetofaunal diversity. Paid local assistants were also used to collect specimens.

2.2 Collections

Representative collections of reptiles and amphibians were collected opportunistically and systematically from the study area and its surroundings. Some specimens were purchased from local villagers, who were questioned as to where they were collected, but these specimens usually lacked detailed habitat data. Specimens were euthanased, fixed in buffered formalin and stored in spirit. Identification of specimens was based on comparison with specimens held in the Port Elizabeth Museum, and by reference to keys in the relevant scientific literature. Voucher specimens were preserved, labelled, photographed and deposited in the Port Elizabeth Museum herpetological collection. A representative collection has been forwarded for deposition in the National Museum, Maputo.

2.3 Conservation categories

No Red Data Books have been prepared for Mozambique. It has therefore been necessary to make a conservative assessment of potentially threatened species in Mozambique by considering their conservation status in Red Data Books from adjacent countries (South Africa) and in international lists, e.g. CITES legislation or the IUCN Red List of threatened animals (Ballie & Groombridge 1996; henceforth termed Red List).

The following categories are included in the South African Red Data Book (SA RDB) for Reptiles and Amphibians (Branch 1988):

Endangered (End) — Species in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are species whose numbers have been reduced to a critical level or whose habitat has been so drastically diminished and/or degraded that they may be deemed to be in immediate danger of extinction.

Vulnerable (Vul) — Species believed likely to move into the Endangered category in the near future if the causal factors continue operating. Included are species of which all or most of the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbances, species with populations which have been seriously depleted and whose ultimate security is not assured, and species with populations which are still sizable but which are under threat from serious adverse factors throughout their range.

Rare — Species with small populations which are not at present endangered or vulnerable but which are at risk. These species are localized within a restricted geographical area or habitats, or are thinly scattered over a somewhat more extensive range.

Indeterminate (Indet.) — Species that are suspected of belonging in the categories Endangered, Vulnerable or Rare, but for which insufficient information is currently available.

The following additional categories have also been applied:

Restricted — Taxa endemic and localized within limited geographical areas. They could easily be threatened and their status should be monitored. The host country is their sole guardian, and their loss would result in the extinction of the taxa.

Peripheral — Taxa with a restricted distribution, but whose main distribution falls outside the political boundaries of the area. The local population could easily be threatened and their status should be monitored. The host country is not their sole guardian and their loss would not result in the extinction of the taxa, but would reflect deterioration of the local environment.

Specific attention was paid to species known to be endemic or mainly restricted to Central Mozambique.

3. AMPHIBIANS

3.1 Introduction

Amphibians are an important and often neglected component of terrestrial vertebrate faunas. They are well represented in sub-Saharan Africa, from which approximately 600 species have been recorded. Currently amphibians are of increasing scientific concern as global reports of declining amphibian populations continue to increase (Phillips 1994, and references therein). Although there is no consensus on a single cause for this phenomenon, there is general agreement that the declines in many areas, even in pristine protected parks, are significant and do not represent simple cyclic events. Frogs have been aptly called bioindicator species, whose abundance and diversity is a poignant reflection of the general health and well-being of aquatic ecosystems.

Amphibians are important components of wetland systems, particularly ephemeral systems from which fish are either excluded or of minor importance. In these habitats, they are dominant predators of invertebrates, many of which may impact significantly on humans (e.g. as vectors of disease, such as mosquitos and bilharzia snails) or their livestock and/or crops.

3.2 Amphibians in a regional context

The diverse amphibian fauna of Mozambique was recently reviewed by Poynton and Broadley (1985-1991), who recognized 53 species occurring in the country. Despite this relatively high diversity, they noted no endemic Mozambique amphibians. Although this review forms a useful baseline, it should be noted that their map of collecting effort in Mozambique (Poynton & Broadley 1991: 246) reveals dramatically how poorly known much of Northern Mozambique remains. North of the Zambezi River they noted that “large tracts are poorly or uncollected”. The Central Mozambique region, excluding the Zambezi Delta, is only slightly better surveyed. For the Zambezi Delta region, Poynton and Broadley (1985-1991) record only 12 species – *Xenopus muelleri*, *Hemisus marmoratum*, *Amnirana galamensis*, *Phrynobatrachus acridoides*, *Leptopelis mossambicus*, *Kassina senegalensis*, *Afrixalus delicatus*, *A. fornasini*, *Hyperolius tuberilingus*, *H. argus*, *H.*

pusillus and *H. marmoratus taeniatus*. All are based on collections by Cott (Parker 1930) from the Fambani River near Marromeu (1835Bc).

3.3 Sampling

Amphibian specimens were collected opportunistically by turning logs, water weed, etc, and by searches of water margins at night. Tadpoles were also collected and identified by reference to existing keys, or sent for identification. A number of specimens obtained during fish surveys were also included.

3.4 Limitations and cautions

It should be stressed that the survey occurred out of the main amphibian breeding season. As a consequence few frogs were breeding during the visits. Surveys of such limited scope cannot be considered adequate to confidently assess the total amphibian diversity present. Breeding for most amphibian species in the region is at its most intense following the onset of summer rain (December-January). Of 19 amphibian species recorded from the area during the visit, only four species were calling in July-August, and no amplexus and/or spawning was noted. A considerable number of species had thus finished breeding and returned to dormancy at the time of the survey. Their presence in the area could not therefore be confirmed.

Recent taxonomic studies in southern Africa (Boycott 1988, Channing *et al.* 1994) have identified cryptic, sibling amphibian species only after careful analysis of their breeding calls. Amphibians are often morphologically conservative, with cryptic species being indistinguishable on external morphology. In such circumstances, identification of species relies on analysis of advertisement calls. Some identifications are therefore provisional.

These factors limit the extent to which the amphibian fauna can be adequately referenced, and the confidence with which the conservation status of the amphibians and their sensitivity to developmental impacts be assessed. Despite these caveats, however, the amphibian survey was still considered successful and it represents one of the most important scientific collections obtained from the region.

3.5 Amphibians present in the Zambezi Delta area

Over 150 specimens were collected, and numerous other observations made. The presence of a total of 19 amphibian species were confirmed in the Delta area (Table 1 - see end of this Appendix). Breeding in the area was confirmed by vocalization for a number of species, including *Hyperolius argus*, *Phrynobatrachus acridoides* and *Bufo maculatus*. The presence of tadpoles and metamorphosing juveniles of *Xenopus muelleri*, *Phrynobatrachus mababiensis*, *P. acridoides*, *Kassina maculata*, *Hyperolius marmoratus*, *Africalus fornasini* and *Arthroleptis stenodactylus* indicate that these species also breed in the area.

A number of other amphibian species recorded from the Zambezi Delta area (Fambani River; Parker 1930) but which were not collected during the survey, include *Hemisus marmoratus*, *Africalus delicatus*, *Hyperolius tuberilingus* and *H. pusillus*.

Other species that are likely to occur in the region (Poynton & Broadley 1985-1991) include:

Highly probable – *Phrynomantis bifasciatus*, *Ptychadena anchietae*, *Ptychadena mascareniensis*, *Ptychadena schillokorum* and *Amnirana galamensis*;

Possible – *Arthroleptis xenodactyloides*, *Leptopelis flavomaculatus*, *Hildebrandtia ornata* and *Ptychadena guibei*.

3.6 New discoveries and range extensions

No obviously new amphibian species were discovered in the Zambezi Delta region. This is not unexpected in view of the lack of amphibian endemics in Mozambique, and the uniform coastal habitat. However, two small hyperoliid specimens could not be easily assigned to known species. One specimen, collected in a banana plantation in Malingapansi, may represent *Hyperolius parkeri* from coastal Tanzania and Kenya, which has been recorded once from Central Mozambique (Dondo, Poynton & Broadley 1987). Another small hyperoliid collected at the base camp on the western edge of the wetlands of the Marromeu Buffalo Reserve

is referred to *Hyperolius*, but is not obviously referable to known species. It has a horizontal pupil and creamy, reticulate colouration.

Specimens of the running frog (*Kassina senegalensis*) appear more gracile and more conspicuously marked than specimens from the southern parts of the species' extensive range. They appear referable to the *argyreivittis* form (Poynton & Broadley 1987, Schiøtz 1999), and may merit further taxonomic investigation.

It is possible that taxonomic novelties still exist among the Zambezi Delta amphibians. Resolution of the taxonomic status of these forms will require further surveys during the main frog breeding season so that detailed recordings of vocalizations can be obtained.

Species confirmed in the region, but which were previously unrecorded from the Zambezi Delta (based on distribution maps in Poynton & Broadley 1991) included *Pyxicephalus edulis*, *Ptychadena mossambica*, *Phrynobatrachus mababiensis*, *Kassina maculata*, *Hyperolius nasutus*, *Chiromantis xerampelina*, *Bufo gutturalis* and *B. maculatus*.

3.7 Comments on the amphibian fauna

The confirmed amphibian fauna of the Zambezi Delta includes 19 species, with a further five species probably occurring and four others possible. This is lower than that of coastal Maputaland (41 species, Passmore & Carruthers 1995), although comparable to the tropical component (34 species, Poynton 1990) of the latter.

Due to the poor comparative data for amphibian distributions in Central and Northern Mozambique, many of the specimens collected represent important range extensions, or gap fillers, relative to the distributions in Poynton & Broadley (1991). These include:

Arthroleptis stenodactylus – With the exception of material collected at Moebase (Branch, unpub. obs.), these specimens are the only records from the coastal plain north of Beira.

Pyxicephalus edulis – There are few records of this large, fossorial species in Central and Northern Mozambique. With the exception of recent material from Moebase (Branch, unpub. obs.), these are the only records east of Caia.

Ptychadena pumilio – There are few Mozambique records of this wide-ranging species. This is the only record for the lower Zambezi River. Although only once recorded from northern Mozambique, this species was common at Moebase (Branch, unpub. obs.).

Phrynobatrachus mababiensis – These are the first records from the coastal plain north of Beira.

Chiromantis xerampelina – There are few Mozambique records of this wide-ranging species from the lower Zambezi and northern Mozambique. These are the first records from the coastal plain north of Beira.

Kassina maculata – South of 13°S, these are the only records from the coastal plain north of Beira. Also known from Caia and Dondo.

Kassina senegalensis – Although previously collected at Fambani, there are only three records for northern Mozambique E of 36°E. The species has recently been collected at Moebase (Branch, unpub. obs.).

Bufo maculatus – The first records for the coastal plain north of Beira for this wide-ranging species.

3.8 Amphibian species of special concern

No Mozambique amphibian species are listed in the international Red List (Baillie & Groombridge 1996) and no Southern African threatened amphibians (Branch 1988) occur in the region. However, caution should be taken in assuming that the conservation status of all the amphibians in the region is safe. Mozambique has not prepared a national inventory of endangered species, and this report cannot presume to predetermine its

national priorities, or the extent of national threats to the herpetofauna. The absence of threatened amphibian species is more a reflection of conservation effort than scientific knowledge. Ballie and Groombridge (1996) note that globally the numbers of known threatened amphibians "... are certainly under-estimates as relatively few have been evaluated.", and that "... the percentage of amphibians that are estimated to be threatened (25%) is similar to that of mammals, reptiles and fishes." The status of 'isolated' populations of *Hyperolius parkeri* and *H. mitchelli* recorded from the Zambezi Delta region (Poynton & Broadley 1987) require fuller investigation.

3.9 Biology notes

All amphibians are intolerant of marine ecosystems and are absent from the shore, estuarine and brackish mangrove environments. Arboreal species may, however, traverse and forage in mangrove foliage. Amphibians are found in all other habitats within the region. One species, the shovel-footed squeaker (*Arthroleptis stenodactylus*), undergoes direct development and is therefore not dependent upon standing or flowing water. It lays its large eggs underground in damp soil, where they undergo direct development, the tadpole stage being spent within the egg, fully developed froglets emerging. It was only found in forested habitats on the edge of the wetlands. The Mozambique rain frog (*Breviceps mossambicus*) is another burrowing species that undergoes direct development. It probably also occurs in the Delta region, but in sandy, well-drained soils around the edge of the wetlands. It will occur only in transit through low-lying areas that become seasonally inundated. All other frogs in the region require water bodies for their free-living tadpoles to complete development.

The East African puddle frog (*Phrynobatrachus acridoides*) was collected in seepage areas at most sites (5 of the 11 in the study region). These included woodland, palm savannah and disturbed habitats. Other common wetland species, that adapted well to disturbed habitats, included *Afrixalus fornasini* and *Hyperolius marmoratus taeniatus*. Fossorial amphibians (*Pyxicephalus edulis* and *Kassina senegalensis*) were only collected in the vicinity of human settlements. However, the apparent restriction of these species to these habitats is an artifact of collecting effort. These cryptic, burrowing species were uncovered during land clearing activities during both subsistence farming and sugarcane field preparation. These species may have been present in other habitats but overlooked.

3.10 Existing impacts on amphibians

Exploitation

No evidence of exploitation of frogs in the region was noted. Although dried fish were commonly offered in the market stalls of Marromeu and other villages, no large amphibians were offered. This is somewhat surprising, for although the large majority of amphibians in the region are either distasteful (e.g. *Bufo* and *Phrynomantis* spp), the African bullfrog (*Pyxicephalus edulis*) is edible (hence its scientific name) and was known to be eaten by local people (Peters 1882).

Habitat destruction

The loss of forest habitats for cultivation will affect only a few of the forest adapted amphibians. Rice plantations within the wetlands were restricted to a relatively small area and did not significantly affect breeding sites for the amphibians present. Similarly, although the preparation of sugar cane fields causes considerable habitat destruction, it is high-intensity agriculture in a well-circumscribed area. Moreover, due to the relatively long standing crop period, many fossorial reptiles and amphibians have been shown to be relatively tolerant of sugarcane production (Johnson & Raw 1989).

The maintenance of a system of drainage channels in the sugar plantations also provides corridors for movement by aquatic species and also breeding habitats for many small amphibians. The presence of permanent water bodies may also stimulate populations of species that have extended larval development (e.g. *Ammirana galamensis*) or require permanent water (e.g. the tropical platanna *Xenopus muelleri*).

There was no evidence of visible pollution within the vicinity of the permanent or temporary local villages. However, the use of herbicides and insecticides during sugar cane production can be expected to increase and should be monitored.

4. REPTILES

4.1 Introduction

Reptiles form a significant, but neglected component of terrestrial vertebrate faunas in Africa. With the exception of land tortoises all terrestrial reptiles are carnivorous, although some larger lizards do supplement their diet with vegetable matter in certain seasons. In ecosystems reptiles therefore play an important role in nutrient cycling and in population control of their prey items. Most snakes are specialist feeders, taking specific and limited food classes, and this is often reflected in their common names, i.e. egg-eaters, slug-eaters, centipede eaters, etc. They are usually habitat generalists, occupying a wide range of specific habitats and vegetation types, provided their primary prey is present. In contrast, most lizards take a wide-range of insect prey, and niche separation between sympatric species usually occurs via habitat selection and/or diel activity (e.g. most geckos are nocturnal). Congeneric species especially occupy different habitats that are determined more by the habitat physical and substrate characteristics rather than the presence of specific plants and/or soil.

4.2 Reptiles in a regional context

The reptile fauna of Mozambique was last reviewed by Peters (1882). At that time studies in the area were in their infancy, and large tracts of the country were unexplored. 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 in the region, (eg. Broadley 1990a, 1992, 1994, 1995, 1996, 1997, Broadley & Broadley 1997, Broadley & Wallach 1997), particularly the fossorial forms inhabiting the alluvial coastal sands. These were prompted by studies on the fauna inhabiting the Bazaruto Archipelago. Broadley & Howell (1991) have also recently reviewed the reptile fauna of Tanzania, and this gives an indication of the species likely to extend along the coastal plain into northern and central Mozambique.

Integration of the above publications indicates that approximately 153 reptile species occur in southern and central Mozambique. Endemicity in Mozambique reptiles is surprisingly low with only approximately 12 taxa endemic to the country, most being associated with disjunct populations on the various off-shore islands.

4.3 Sampling

Most reptiles were collected opportunistically during surveys on foot in the various habitats present in the study area. Sticky glue traps were used in an attempt to collect inaccessible arboreal species. Fossorial species were uncovered by raking within leaf litter, and in sandy soil beneath rotting logs, collapsed huts, etc. Many specimens were collected by local villagers. Most specimens were preserved and accessioned into the Port Elizabeth herpetological collection. Identification was confirmed by comparison with voucher specimens and from published keys.

Local villagers were also shown a series of colour pictures (Branch 1998) and asked whether they were familiar with the species. Evidence of local utilization of reptile species was obtained by direct questioning of villagers and also by observations on village middens for reptile remains.

4.4 Limitations and cautions

Due to late rains the seasonally inundated wetlands were still drying out. This may have delayed the onset of snake activity during the survey. The large number and variety of snakes collected around Marromeu during the last three days of the survey indicates that snake activity had just started. The reptile fauna of the Zambezi Delta region appears to be relatively well-known. The lack of rupicolous habitats and the large areas of seasonally-inundated grassland limit habitat diversity, which in turn probably reduces reptile diversity. Few taxonomic novelties can be expected.

4.5 Reptiles present in the Zambezi Delta

A diverse reptile fauna was discovered in the Zambezi Delta region, listed in Table 1. It comprises 33 species, including 11 lizards, 19 snakes, 2 chelonians and a crocodile.

Other species that are likely to occur in the region (Branch 1998, Broadley 1990b) are listed in Table 2 (see end of this Appendix). It includes at least four chelonians, 18 snakes, one amphisbaenid and six lizards. Together with the confirmed species, this gives a projected reptile fauna of over 50 species.

4.6 New discoveries and range extensions

No new reptile taxa were discovered during the survey. In addition, most reptiles were previously known from the region and only three represent significant records or range extensions.

Blue-tailed tree lizard (*Holaspis guentheri laevis*) – On two occasions these small, attractive, arboreal lizards were observed in riverine forest near Site 2. Despite the use of sticky traps they eluded capture. They are few Mozambique records for the species (Amatongas (Cott 1934), Cavalo, near Gorongosa Mountain, Dondo, Inhamitanga Forests (Broadley, pers. comm.), and Moebase, northern Mozambique (Branch, unpub. obs). The Camp 1 records represents a slight eastern range extension in the delta region.

Black file snake (*Mehelya nyassae*) – There are very few records of this small, semi-fossorial species, from Mozambique (Inhambane, Maputo, Lumbo - Broadley 1966, 1990b). The Marromeu record represents a range extension of approximately 400 km east from the nearest records in Eastern Zimbabwe.

Cross-barred tree snake (*Dipsadoboa flavida broadleyi*) – This very rare and secretive arboreal species was previously known from only two Mozambique records (Beira and Maputo), that represented a considerable disjunction from the East African population (southern Somalia to Tanzania). The species has also recently been collected at Moebase (Branch, unpub. obs). The Camp 1 record is the fifth for Mozambique, and a slight northern extension from Beira that closes the coastal gap between the southern and northern populations (Rasmussen 1989).

4.7 Reptiles of special concern

The lack of a National Red Data List for Mozambique means that an assessment of the conservation status of the reptile fauna must be made by comparison with international lists and/or those from adjacent countries.

Only five Mozambique reptile species are listed as threatened in the 1996 Red List; all are sea turtles. None enter significantly into the Zambezi Delta system.

An additional Mozambique chelonian listed in the Near Threatened category of the 1996 Red List is the Zambezi soft-shelled terrapin (*Cycloderma frenatum*). This large trionychid has a patchy distribution in the Zambezi drainage area. No specimens were obtained. Discussion with local fishermen was contradictory. Some knew the species, but considered it rare and not found in the main river. The majority of fishermen questioned did not know the species.

An additional five reptiles are listed on CITES legislation (all in Appendix II). All have been listed in general categories (Pythonidae, Testudinidae, Varanidae and *Chamaeleo*) because elsewhere in Africa they have been subject to over-exploitation, either for the skin trade (pythons and monitors) or pet trade (chameleons and tortoises).

4.8 Biology notes

Many reptiles were rare (or inactive during the survey period) and encountered three or less times (19 species). It was thus not possible to assess their habitat requirements on the specimens collected. The habitat associations of the majority of species were thus determined from general knowledge of their biology and behaviour.

The apparent lack of habitat specificity among reptiles is characteristic of snakes, which may simplistically be considered food-limited, i.e. they specialize on specific food types and will hunt them in a variety of habitats. Lizards and chelonians are usually more habitat specific, but select physical characteristics of their environment rather than specific plant species. Thus miombo and riverine forests may support similar reptile species that simply require thick vegetation, hollow tree stumps, or leaf litter. Reptiles linked to well-wooded

habitats include: the Mozambique agama (*Agama mossambica*), Eastern tree lizard (*Holaspis guentheri laevis*), tiger snake (*Telescopus semiannulatus*), boomslang (*Dispholidus typus*), cross-barred tree snake (*Dipsadoboa flavida broadleyi*), and the green mamba (*Dendroaspis angusticeps*). Boulenger's skink (*Mabuya boulengeri*) was twice encountered in ecotonal situations, on fallen logs alongside clearings.

Some generalist species (6) were encountered in three or more habitats, and included the house gecko (*Hemidactylus platycephalus*), flapnecked chameleon (*Chamaeleo dilepis*), spotted bush snake (*Philothamnus semivariatus*), white-lipped cat snake (*Crotaphopeltis hotamboeia*) and puffadder (*Bitis arietans*).

Aquatic species, utilizing the wetlands include the hinged terrapin (*Pelusios castanoides*), Nile monitor (*Varanus niloticus*), Nile crocodile (*Crocodylus niloticus*), and various frog-eating snakes, e.g. white-lipped cat snake (*Crotaphopeltis hotamboeia*), southern green snake (*Philothamnus hoplogaster*) and olive marsh snake (*Natriciteres olivacea*).

Reptile habitat specialists, particularly fossorial species, may continue to survive in cultivated lands (Johnson & Raw 1989), and locally included the Zambezi blind snake (*Rhinotyphlops mucruso*) and southern burrowing asp (*Atractaspis bibronii*).

4.9 Existing impacts on terrestrial reptiles

Exploitation

On two occasions salted Southern African python (*Python natalensis*) skins (each approximately 2.5 m TL) were noted in villages (Marromeu and Malingapansi). Neither were offered for sale. Both were killed by local farmers who complained that the pythons had killed chickens around their homes. That both farmers had bothered to keep the skins indicates that they had a commercial value. No further evidence was found indicating that this exploitation was directed, and not simply incidental. Elsewhere in Africa, trade in python and monitor skins reaches very large scales.

The hunting concession at Safari Delta Lodge (Coutada 11) stated that it occasionally had clients who shot crocodiles in the Delta. An extended river trip from Marromeu to Malingapansi (5-6 August) revealed only 16 crocodiles basking on the river banks, all downstream from Luabo. They ranged in size from 2.5 m to juveniles, and all were visible, basking on sand and mud banks during the day. They allowed relatively close approach indicating that current hunting pressures cannot be high.

Habitat Destruction

The large-scale clearance of forest and well-wooded savanna can be expected to impact significantly on many reptiles. For arboreal, forest specialists this will obviously result in habitat loss and fragmentation. In some cases, however, more generalist species foraging in open veld may be expected to increase in numbers. This is particularly likely for terrestrial species. Commensal species such as the striped skink (*Mabuya striata*) and Cape dwarf day gecko (*Lygodactylus capensis*) can be expected to increase in numbers around villages. Large numbers of snakes, including large venomous species, were still present in the cleared sugarcane fields around Marromeu, indicating that many are tolerant of some disturbance.

4.10 Reptiles of medical significance

Venomous Snakes

Mozambique has a rich snake fauna including 16 venomous species (Spawls & Branch 1995). Snakes with medically significant venom were common in the Zambezi Delta. Eight venomous species were present (Southern burrowing asp, *Atractaspis bibronii*; green mamba, *Dendroaspis angusticeps*; forest cobra, *Naja melanoleuca*; spitting cobra, *N. mossambica*; snouted cobra, *N. annulifera*; puff adder, *Bitis arietans*; boomslang, *Dispholidus typus*; Mozambique twig snake, *Thelotornis mossambicanus*), of which seven have bites that have caused human fatalities (Spawls & Branch 1995). Of the 56 snakes seen or collected, 15 were venomous with the puff adder (6 specimens, 10.7%) and spitting cobra (5 specimens, 8.9%) being among the commonest species encountered. Another three venomous species (Swamp adder, *Proatheris superciliaris*; black mamba, *Dendroaspis polylepis*; and Boulenger's garter snake, *Elapsoidea boulengeri*) may also occur in the region.

Discussion with fishermen indicated that snakebite was not uncommon in the region and that some fatalities occurred each year. No estimate of the incidence of snakebite and subsequent mortality was possible, however. The species responsible for the majority of bites were given as the puffadder, Mozambique spitting cobra and southern burrowing asp.

Crocodiles

Large Nile crocodiles (>2 m) are still found in the Zambezi Delta, and two large specimens capable of attacking people were observed downstream from Malingapansi. Interviews with local fishermen and farmers indicated that all were aware of crocodile attacks in the region and thus took due care near water. They accepted the presence of crocodiles, however, and made no attempt to kill large specimens unless they were known to be a danger to people or livestock. The main concern for many fishermen was damage to set gill nets.

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Appendix 6.3, Table 1 Herpetofauna of the Zambezi Delta, Central Mozambique.

Taxon	Common name	Sites										Total		
		1	2	3	4	5	6	7	8	9	10		11	
CLASS REPTILIA														
LACERTILIA (lizards)														
FAMILY: GEKKONIDAE														
<i>Hemidactylus mabouia</i>	Tropical house gecko	O												1
<i>Hemidactylus platycephalus</i>	Flat-headed house gecko		Y					O	Y					3
<i>Lygodactylus capensis capensis</i>	Cape dwarf gecko	O						O	Y	Y				4
FAMILY: VARANIDAE														
<i>Varanus niloticus</i>	Nile monitor	Y							Y					2
FAMILY: CHAMAELEONIDAE														
<i>Chamaeleo dilepis dilepis</i>	Flap-necked chameleon								Y					1
FAMILY: AGAMIDAE														
<i>Agama mossambica</i>	Mozambique agama		Y											1
FAMILY: LACERTIDAE														
<i>Holaspis guntheri laevis</i>	Eastern tree lizard		O											1
FAMILY: SCINCIDAE														
<i>Mabuya varia</i>	Variable skink		Y											1
<i>Mabuya boulengeri</i>	Boulenger's skink								Y	Y				2
<i>Mabuya striata</i>	Striped skink	O	Y					O						3
FAMILY: GERRHOSAURIDAE														
<i>Gerrhosaurus flavigularis</i>	Yellow-throated plated lizard		Y										Y	2
SERPENTES (snakes)														

Y = Voucher specimen(s); O = Observed

Taxon	Common name	Sites										Total			
		1	2	3	4	5	6	7	8	9	10		11		
FAMILY: TYPHLOPIDAE															
<i>Rhinotyphlops mucruso</i>	Zambezi blind snake									Y	Y				2
FAMILY: BOIDAE															
<i>Python natalensis</i>	Southern African python				O										1
FAMILY: COLUBRIDAE															
<i>Lamprophis capensis</i>	Brown house snake		Y						Y	Y					3
<i>Mehelya nyassae</i>	Black file snake									Y	Y				1
FAMILY: ATRACTASPIDIDAE															
<i>Atractaspis bibronii</i>	Southern burrowing asp									Y					1
FAMILY: COLUBRIDAE															
<i>Natriciteres olivaceae</i>	Olive marsh snake								Y						1
<i>Prosynna stuhlmanni</i>	Stuhlmann's shovel-snouted snake								Y						1
SUBFAMILY: COLUBRINAE															
<i>Dipsadoboa flavida broadleyi</i>	Cross-barrred tree snake		Y												1
<i>Crotaphopeltis hotamboeia</i>	White-lipped cat snake	Y	Y						Y	Y					4
<i>Philothamnus hoplogaster</i>	Southern green snake		Y						Y	Y					3
<i>Philothamnus s. semivariiegatus</i>	Variiegated bush snake	Y	Y						Y	O					4
<i>Dispholidus typus</i>	Boomslang								Y						1
<i>Thelotornis mossambicanus</i>	Mozambique twig snake								Y						1
SUBFAMILY: PSAMMOPHIINAE															
<i>Psammophis mossambicus</i>	Olive grass snake								Y	Y					2
FAMILY: ELAPIDAE															
<i>Naja annulifera</i>	Snouted cobra										Y				1

Taxon	Common name	Sites										Total
		1	2	3	4	5	6	7	8	9	10	
<i>Naja mossambica</i>	Mozambique spitting cobra								Y	Y	Y	2
<i>Naja melanoleuca</i>	Forest cobra								Y			1
<i>Dendroaspis angusticeps</i>	Green mamba							Y				1
FAMILY: VIPERIDAE												
<i>Bitis arietans arietans</i>	Puff adder	Y	Y				O	Y	Y			5
CHELONIA (tortoises/terrapins)												
FAMILY: TESTUDINIDAE												
<i>Kinixys belliana belliana</i>	Bell's hingeback tortoise							Y				1
FAMILY: PELOMEDUSIDAE												
<i>Pelusios castanoides castanoides</i>	Yellow-bellied hinged terrapin							Y				1
CROCODYLIA (crocodiles)												
FAMILY: CROCODYLIDAE												
<i>Crocodylus niloticus</i>	Nile crocodile							Y				1
CLASS AMPHIBIA												
ANURA (frogs/toads)												
FAMILY: ARTHROLEPTIDAE									Y			
<i>Arthroleptis stenodactylus</i>	Shovel-footed squeaker											1
FAMILY: BUFONIDAE												
<i>Bufo gutturalis</i>	Guttural toad		Y					Y				2
<i>Bufo maculatus</i>	Flat-backed toad		Y						Y			2
FAMILY: HYPEROLIIDAE												
<i>Afrixalus fornasinii</i>	Greater leaf-folding frog	Y	Y					Y	Y			4
<i>Hyperolius argus</i>	Argus reed frog		Y				Y		Y			3

Taxon	Common name	Sites											Total		
		1	2	3	4	5	6	7	8	9	10	11			
<i>Hyperolius marmoratus taeniatus</i>	Painted reed frog								Y	Y				4	
<i>Hyperolius cf parkeri</i>	Parker's reed frog								Y					1	
<i>Hyperolius sp.</i>		Y												1	
<i>Hyperolius nasutus</i>	Long reed frog	O												1	
<i>Kassina maculata</i>	Red-legged kassina					Y			Y					2	
<i>Kassina senegalensis</i>	Bubbling kassina									Y				1	
<i>Leptopelis mossambicus</i>	Mozambique tree frog								Y	Y	Y			3	
FAMILY: PIPIDAE															
<i>Xenopus muelleri</i>	Tropical platanna									Y				1	
FAMILY: RANIDAE															
<i>Phrynobatrachus acridoides</i>	East African puddle frog		Y				Y	Y		Y				5	
<i>Phrynobatrachus mababiensis</i>	Dwarf puddle frog		Y											2	
<i>Ptychadena mossambica</i>	Mozambique grass frog		Y							Y				2	
<i>Ptychadena pumilio</i>	Dwarf grass frog		Y											1	
<i>Ptychophthalmus edulis</i>	African bullfrog								Y	Y	Y			3	
FAMILY: RHACOPHORIDAE															
<i>Chiromantis xerampelina</i>	Grey tree frog		Y											1	
Total species		52	8	24	2	3	1	3	1	3	1	3	28	23	4

Appendix 6.3 Table 1 (continued) List of localities:

1	26-28 July 1999	18°17'28"S / 35°56'21"E	Marromeu, Zambezi River
2	28 July-3 Aug 1999	18°33'13"S / 35°40'37"E	Camp 1, patch of riverine forest on edge of Zambezi wetlands
3	28-31 July 1999	18°33'45"S / 35°40'59"E	Wet grassland, edge of wetlands near Camp 1 (Woody's trap line)
4	28-31 July 1999	18°33'22"S / 35°39'37"E	Dry forest on edge of wetlands, pit-trap array for Woody
5	29-31 July 1999	18°33'15"S / 35°39'48"E	Clear river in semi-cleared <i>Brachystegia</i> woodland, near Camp 1
6	31 July 1999	10 km E of Site 7	Palm & wooded 'island' on floodplain
7	36376	18°25'03"S / 36°06'02"E	On Zambezi River, 2 km downstream from Luabo
8	5 Aug 1999	18°48'57"S / 36°14'46"E	Fishing village in mangroves near mouth of Zambezi
9	5-8 Aug 1999	18°40'36"S / 36°06'17"E	Malingapansi village, 65 km S Marromeu; mixed grassland, palm savanna & riverine forest
10	3-10 Aug 1999	18°23'04"S / 35°52'55"E	Old sugar canes fields, 4 km W Marromeu
11	9 Aug 1999		Nhane Village, 9.5 km upstream from Marromeu

Appendix 6.3, Table 2 : Reptiles that have or may yet be discovered in the Zambezi Delta region, but which were not confirmed during the field survey.

Species	Scientific Name	Locality
Terrapins (4 species)		
Marsh terrapin	<i>Pelomedusa subrufa</i>	Quelimane
Pan hinged terrapin	<i>Pelusios subniger</i>	
Serrated hinged terrapin	<i>Pelusios sinuatus</i>	
Zambezi soft-shelled terrapin	<i>Cycloderma frenatum</i>	
Snakes (19 species)		
Pungwe thread snake	<i>Leptotyphlops pungweensis</i>	Pungwe Flats
Eye-brow viper	<i>Proatheris superciliaris</i>	Beira
Snouted night adder	<i>Causus defilippii</i>	
Black mamba	<i>Dendroaspis polylepis</i>	Mossuril
Boulenger's garter snake	<i>Elapsoidea boulengeri</i>	
Cape centipede eater	<i>Aparallactus capensis</i>	Angoche
Floodplain water snake	<i>Lycodonomorphus obscuriventris</i>	Charre
Dwarf wolf snake	<i>Lycophidion nanum</i>	Chitengo, Gorongosa Nat. Park
Snouted wolf snake	<i>Lycophidion acutirostris</i>	Lumbo
Cape file snake	<i>Mehelya capensis</i>	
Semiornate snake	<i>Meizodon semiornatus</i>	
Angola green snake	<i>Philothamnus angolensis</i>	Moebase, Shire Valley
Natal green snake	<i>Philothamnus natalensis</i>	Beira
Dwarf sand snake	<i>Psammophis angolensis</i>	
Eastern stripe-bellied sand snake	<i>Psammophis orientalis</i>	
Marbled tree snake	<i>Dipsadoboa aulica</i>	Chinde
Eastern tiger snake	<i>Telecopus semmiannulatus</i>	
Common eggeater	<i>Dasypeltis scabra</i>	
Eastern eggeater	<i>Dasypeltis medici</i>	Ribaue
Olive marsh snake	<i>Natriciteres olivacea</i>	Angoche
Amphisbaenids (2 species)		
Swynnerton's worm lizard	<i>Chirindia swynnertoni</i>	Pungwe Flats
Pestle-tailed worm lizard	<i>Dalophia pistillum</i>	Beira
Lizards (7 species)		
Wahlberg's Snake-eyed skink	<i>Panaspis wahlbergi</i>	
Mozambique writhing skink	<i>Lygosoma afrum</i>	
Eastern Coastal skink	<i>Mabuya depressa</i>	Beira
Grass-top skink	<i>Mabuya megalura</i>	Chiniziua Dist.
Common rough-scaled lizard	<i>Ichnotropis squamulosa</i>	Charre
Tropical girdled lizard	<i>Cordylus tropidosternum</i>	
Rough-scaled plated lizard	<i>Gerrhosaurus major</i>	Pungwe Flats