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The herpetofauna of Bicuar National Park and surroundings, southwestern Angola: a preliminary checklist

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***Abstract.*—Bicuar National Park (BNP) is a protected area in southwestern Angola where biodiversity has been poorly studied. BNP is located on the Angolan plateau on Kalahari sands, in a transition zone between the Angolan Miombo Woodland and the Zambezian Baikiaea Woodland ecoregions. Herpetological surveys were conducted in BNP and surrounding areas, through visual encounter surveys, trapping, and opportunistic collecting of specimens from 2015 to 2018. The regional herpetofauna is described here based on these surveys, literature records, and additional unpublished records. In total, 16 amphibian, 15 lizard, 18 snake, two testudine, and one crocodilian species were observed from the recent surveys, and in combination with historical records the species counts are 21, 36, 32, four, and one species for these herpetofauna groups, respectively. Important observations include the first record of *Xenocalamus bicolor bicolor* (Günther, 1868), the second records of *Sclerophrys poweri* (Hewitt, 1935) and of *Amblyodipsas ventrimaculata* (Roux, 1907), and the fourth record of *Monopeltis infuscata* (Broadley, 1997) for Angola. Additionally, the type locality of *Hyperolius benguellensis* (Bocage, 1893) is discussed. A part of the material could not be confidently identified to species level, reflecting the taxonomic uncertainty associated with the Angolan herpetofauna. Fossorial herpetofauna was well represented, reflecting adaptation to sandy soils, the dominant substrate in the area. The likely presence of endemic and poorly known species in BNP reinforces the importance of the park for the conservation of Angolan biodiversity. Further surveys are necessary for a more comprehensive understanding of the park's fauna and biogeographic affinities, and to improve conservation planning.**

Keywords. Amphibians, reptiles, fossorial, biodiversity surveys, protected areas, Kalahari sands, Huíla Province

***Resumo.*—O Parque Nacional do Bicuar (BNP) é uma área protegida no sudoeste de Angola cuja biodiversidade se encontra pouco estudada. Localiza-se no planalto de Angola em areias do Calaári, numa zona de transição entre as ecorregiões de Mata de Miombo Angolana e Mata de Baikiaea Zambeziana. Neste trabalho foram realizados levantamentos de herpetofauna no BNP e arredores, através de levantamentos de encontro visual, armadilhagem e recolha oportunística de espécimes entre 2015 e 2018. Aqui é apresentada uma descrição da herpetofauna da região baseada nestes levantamentos, em registos bibliográficos, e outros registos não publicados. Os dados recentes resultaram num total de 16 espécies de anfíbios, 15 espécies de lagartos, 18 espécies de cobras, duas espécies de quelónios, e uma espécie de crocodilo. A combinação destes dados com registos históricos resulta num total de 21, 36, 32, quatro, e uma espécies destes grupos herpetológicos, respectivamente. Entre os resultados mais importantes estão o primeiro registo de *Xenocalamus bicolor bicolor* Günther, 1868, o segundo registo de *Sclerophrys poweri* (Hewitt, 1935) e de *Amblyodipsas ventrimaculata* (Roux, 1907), e o quarto registo de *Monopeltis infuscata* Broadley, 1997 para Angola. A localidade-tipo de *Hyperolius benguellensis* (Bocage, 1893) é também discutida. Uma parte do material não pôde ser identificado com certeza ao nível da espécie, uma consequência da incerteza taxonómica associada à herpetologia angolana. A herpetofauna fossorial está bem representada, reflectindo uma adaptação a solos arenosos, o substrato dominante na área. A presença provável de espécies endémicas e pouco conhecidas no BNP reforça a importância do parque para a conservação da biodiversidade de Angola. Mais levantamentos contribuirão para um melhor conhecimento da fauna do parque e das suas afinidades biogeográficas e para um melhor planeamento de estratégias de conservação.**

Palavras-chave. Anfíbios, répteis, fossorial, levantamentos de biodiversidade, áreas protegidas, areias do Calaári, província da Huíla

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Introduction

Angola's biodiversity is poorly understood, especially when compared to other countries in southern Africa (Huntley et al. 2019b). A recent synthesis of the country's biodiversity (Huntley et al. 2019b) provides updated checklists for several taxonomic groups, including amphibians (Baptista et al. 2019) and reptiles (Branch et al. 2019c), as does the historical atlas by Marques et al. (2018), but all these lists highlight the understudied status of the herpetofauna in Angola. Southwestern Angola is one of the better-studied regions for vertebrates in the country (Crawford-Cabral and Mesquitela 1989), and this is reflected in herpetofauna, from which several type descriptions originated. Despite many historical herpetological surveys in the area (Bocage 1895; Schmidt 1933, 1936; Monard 1937a,b; Mertens 1938; Bogert 1940; Laurent 1964; Gans 1976; Poynton and Haacke 1993), contemporary studies continue to yield important discoveries of new species (Haacke 2008; Conradie et al. 2012, 2013; Stanley et al. 2016; Ceríaco et al. 2018b; Branch et al. 2019b), new species records for the country (Huntley 2009; Ceríaco et al. 2016; Branch et al., unpub. data), and rediscoveries of species not observed for several decades (Baptista et al. 2018; Branch et al. 2019a; Vaz Pinto et al. 2019).

The herpetofauna remains undersampled or unsurveyed in vast areas of southwestern Angola, including Bicuar National Park (BNP). Wulf Haacke conducted two significant herpetological surveys in this region in 1971 and 1974, collecting over 2,000 specimens (Branch et al. 2019c). Although BNP was not specifically sampled by Haacke, similar habitats near the park were included in the surveys. Poynton and Haacke (1993) described the amphibian collection resulting from these surveys, but information on the new and rare reptiles deposited in the Ditsong National Museum of Natural History (former Transvaal Museum) was never formally published (Branch et al. 2019c). The Angolan civil war prevented research in the country for 35 years (1974–2009) between Haacke's expeditions and the first post-war biodiversity surveys in southwestern Angola (Huntley 2009). The first herpetological surveys inside BNP were part of this effort, during a brief visit by Alan Channing. Only two adult *Hyperolius benguellensis* and several species of tadpoles were collected (Channing et al. 2013; A. Channing, pers. comm.), with the material deposited in Berlin Zoological Museum, and other observations remained unpublished. More recent surveys include two short visits to BNP in 2017 and 2018 by Butler et al. (2019).

To document the herpetofauna of BNP, we conducted surveys in and around the park from 2015 to 2018 as part of the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) project, which established an observatory in BNP. This is part of a network of five other Angolan observatories, and a total of 47 observatories throughout Southern Africa (Jürgens et al. 2018). Results of herpetological surveys in Tundavala observatory, southwestern Angola, were published recently (Baptista et al. 2018). This paper draws upon records and photographs of BNP herpetofauna partially available since 2017 through SASSCAL's on-line platform (SASSCAL ObservationNet 2018), and is their first formal publication. It presents the results of the 2015–2018 SASSCAL surveys, and it includes collated data from recent and historical collections and observations made by others in and around BNP to provide a more comprehensive account.

Materials and Methods

Study Area

Bicuar National Park (BNP) in Huíla Province, southwestern Angola, was declared as a Partial Game Reserve in 1957 to protect populations of big game before being upgraded to National Park status in 1964 (Teixeira 1968; Huntley et al. 2019a). The park was originally 790,000 ha in size (Huntley et al. 2019a), with boundaries described in *Diploma Legislativo* nº 3527 of 26 December 1964 (Teixeira 1968; Simões 1971). In 1972, a governmental decree in *Portaria* 384/72 deproclaimed areas of northern BNP for the expansion of the "Capelongo colonial settlement" ("Colonato de Capelongo") [L. Veríssimo, pers. comm.], defined the current boundaries of BNP, and decreased the park's area to 675,000 ha (Mendelsohn and Mendelsohn 2018; Huntley et al. 2019a).

BNP lies at ca. 1,200–1,400 m above sea level (asl), between the Cunene and Caculuvar rivers on wind-blown Kalahari sands (Mendelsohn and Mendelsohn 2018). This is the most extensive contiguous body of sand in the world (Leistner 1967) and extends from the southern African plateau to the Congo basin. The park

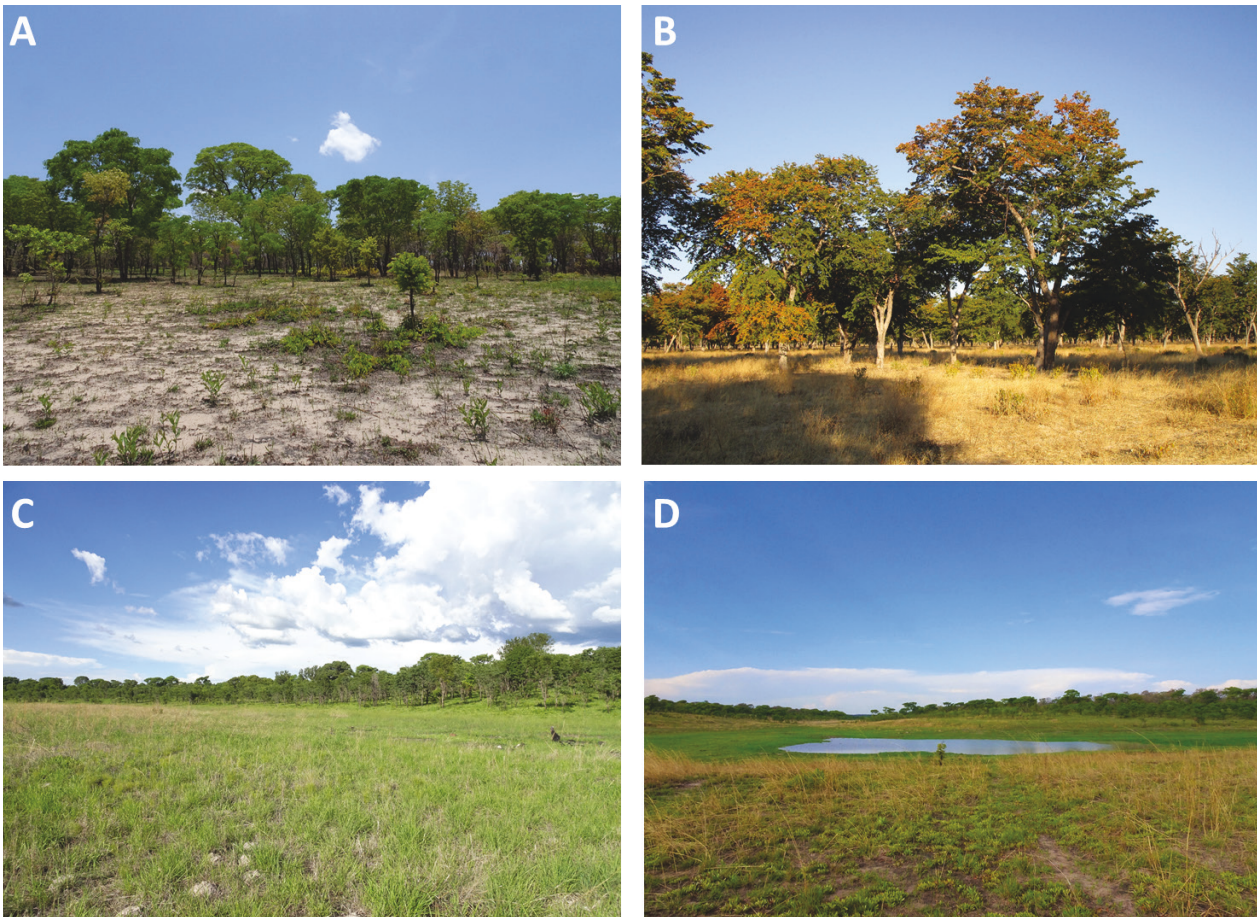

Fig. 1. Habitat types in the study area. (**A**) Angolan Miombo woodland on Kalahari sands, BNP; (**B**) *Burkea*/*Baikiaea* woodlands, Carmira Farm; (**C**) dry grassy wetland ("mulola") flanked by miombo woodlands ("tunda"), BNP; (**D**) temporary pan in a "mulola," BNP.

is part of the "Lower Cunene" mesological unit (Diniz 2006; Huntley 2019), and is located in a transition zone from moist to dry savannas. It comprises both the Angolan Miombo Woodland and Zambezian Baikiaea Woodland ecoregions, as defined by Burgess et al. (2004), which are equivalent to the *Brachystegia* and South-west Arid biomes, respectively, as characterized by Huntley (1974). The northern extent is dominated by miombo woodlands, consisting mostly of *Brachystegia spiciformis* and *Julbernardia paniculata,* while the south is covered predominantly by savannas dominated by *Burkea africana* (Teixeira 1968) [Fig. 1], and Angolan Mopane woodlands are present to the south of the park (Huntley 2019). In addition to woodlands, thickets, and scrublands of varied composition, open drainage lines hosting grasslands with geoxylic suffrutex shrublands are common throughout; see Teixeira (1968), Barbosa (1970), and Chisingui et al. (2018) for further details.

Elliptical in shape, the park is ca. 80 km in diameter from north to south and ca. 110 km from east to west (Fig. 2). The climate is seasonal, with precipitation falling mainly from October to April, and nocturnal frost occuring frequently in the dry season, especially in June and July. Meteorological data for BNP observatory are available from 2015 onwards (SASSCAL WeatherNet 2019). The average annual rainfall varies from ca. 900–950 mm in the northern border and 650–700 mm in the southern border, and average annual temperatures vary between ca. 19–20 °C in the north and 22–23 °C in the south, with values for north and south taken from Quipungo and Mulondo, respectively, in Mendelsohn and Mendelsohn (2018).

Topographically BNP is generally flat, interrupted by relatively parallel drainage lines mostly flowing west to east (Fig. 2). The park is divided through the center by a larger depression, called Bicuar, which flows in the north-south direction and forms part of the Cunene River catchment (Teixeira 1968). Natural grasslands with geoxylic suffrutex shrublands occur in drainage lines that are seasonally filled with water (locally called "mulolas") [Fig. 1D] where cold air accumulates at night during the dry season. Many of the existing permanent water bodies in the park are artificial excavations made to attract game for observation purposes (Simões 1971). The park's elevated regions (locally called "tundas") are covered by woodlands, and are only 30–50 m higher in altitude than the valleys with grasslands. BNP's soils are mostly sandy (Missão de Pedologia de Angola 1959; Teixeira 1968), and arenosols as defined by Jones et al. (2013), with rare rocky outcrops. The landscape surrounding BNP

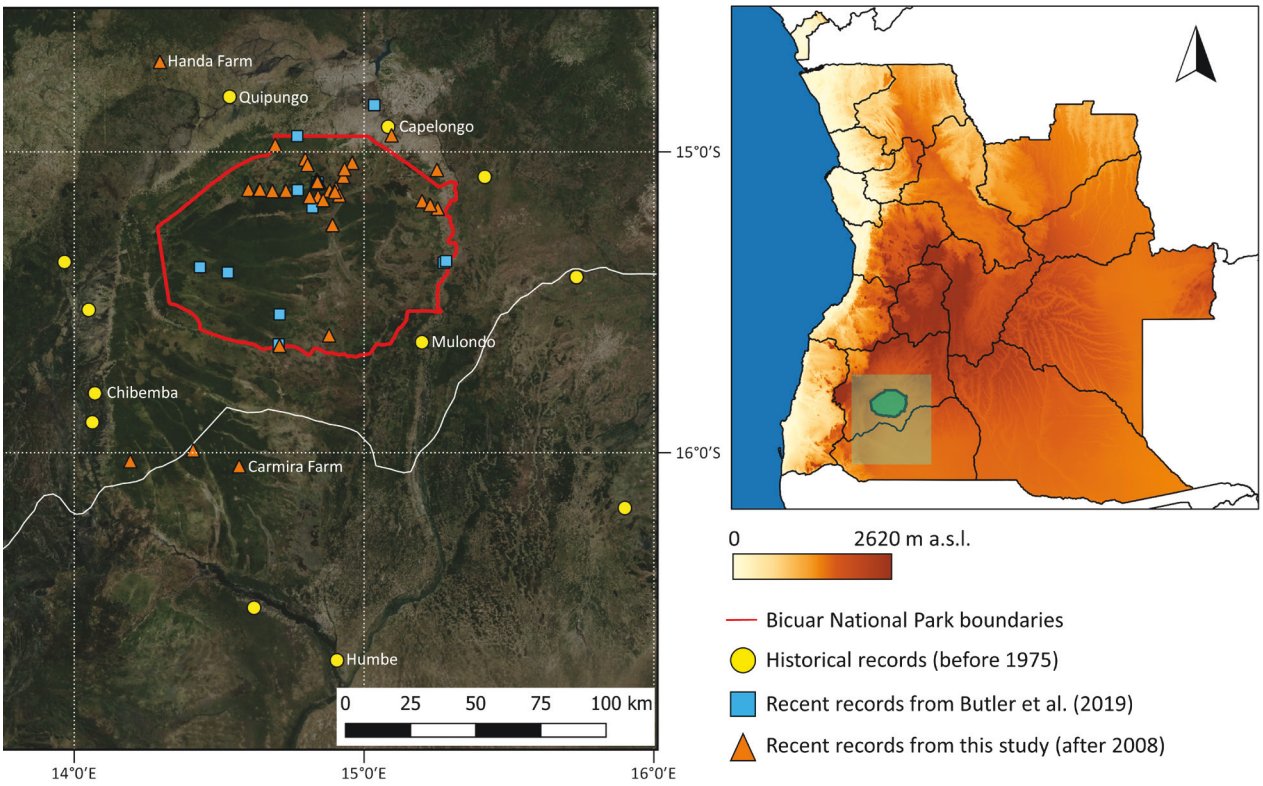

Fig. 2. Left: Bicuar National Park (BNP) and surveyed sites from historical and recent records. Right: Angola with provincial boundaries and location of BNP. Source of satellite image: Maxar (https://www.digitalglobe.com/).

is similar (Barbosa 1970; Mendelsohn and Mendelsohn 2018) such that records from localities surrounding the park are also reported in this work.

Survey Methods and Data Sources

For this study, surveys of herpetofauna were performed in BNP from October 2015 to April 2018. These included opportunistic collections during occasional visits to the park, and two series of focused surveys, from 2–10 December 2016 (during the rains) and 3–7 November 2017 (at the onset of the rains). For both surveys, diurnal and nocturnal Visual Encounter Surveys (VES) were performed, as well as dipnetting in water bodies by scooping the bottom, using nets of varied shape and mesh size. Trap arrays consisting of drift fences with pitfall and funnel traps were set during the 2016 survey at three sites within the following habitats: miombo woodlands not burnt for more than one year (site T1, see Appendix 1 for coordinates and duration), miombo woodlands not burnt for more than five years (T2, Appendix 1), and grassland along a drainage line (T3, Appendix 1). Each trap array consisted of one plastic drift fence (15 m long and 50 cm high) with two pitfall traps, one at each end of the drift fence, and six funnel traps placed on adjacent sides of the fence. Collecting sites in BNP and the surroundings included the Main Camp and permanent water bodies (waterhole near the Main Camp, Lagoa da Matemba, Lagoa do Djimbi, and Lagoa Nougalafa, among others). These sites are mapped in Fig. 2, and geographic coordinates are provided in Appendix 1. Surveyed habitat types included miombo and *Burkea/Baikiaea* woodlands, ponds, and excavations in drainage lines where water is permanently provided by water pumps. Large portions of the surveyed areas in the north were burnt two to four weeks prior to being surveyed.

Additional observations include records from Channing's 2009 visit (A. Channing, pers. comm.), as well as opportunistic records from other researchers working in the region (Manfred Finckh and Francisco Maiato, who provided photographs), and from two farms located near the park. Carmira Farm, located ca. 40 km northeast of Cahama and ca. 46 km south of BNP (site CF), has staff with a personal interest in collecting reptiles, as they have created a collection (Fig. 3) comprising snakes, amphisbaenians, and writhing skinks. Handa Farm, 30 km northwest of Quipungo and 48 km northwest of BNP (site HF), maintains a collection of photographic records of its fauna, including reptiles. All recent records in these sources were considered for this study, and all except Channing's 2009 data (A. Channing, pers. comm.) were verified by the authors. Butler et al. (2019) addressed BNP herpetofauna, and these results have also been incorporated into this work.

Collected specimens were photographed and euthanized by either submersion (in the case of frogs) or injection into the intracoelomic cavity (for reptiles) of a solution of tricaine methanesulfonate (MS222) [Conroy et al. 2009]. Tissue (liver or muscle) was preserved in 99.5% ethanol for genetic analysis. Specimens were fixed

Fig. 3. Carmira Farm private collection.

with formalin, then transferred to water (to remove the formalin), before finally being transferred to 70% ethanol for long-term storage. All photographs were taken by the first author (N. Baptista), except when noted. Specimens are held in the herpetological collection of Instituto Superior de Ciências da Educação da Huíla (ISCED-Huíla), Lubango, Angola. Additional specimens that were not collected for this study are deposited in Carmira Farm's private collection (Fig. 3).

Field guides (Branch 1998; Schiøtz 1999; Channing 2001; Marais 2004; du Preez and Carruthers 2009; Channing et al. 2012; Channing and Rödel 2019) were used for species identification, and additional taxon-specific literature was consulted when necessary. Nomenclature followed online databases: Amphibian Species of the World (Frost 2019) for amphibians, and The Reptile Database (Uetz et al. 2019) for reptiles, and was updated when appropriate. Only materials from the ISCED-Huíla collection and Carmira and Handa Farms were examined for this study. Taxonomic identification of historical records (published in the literature, and unpublished records from Haacke's surveys) and acoustic survey records may require verification.

Localities for historical data compiled for the BNP region (yellow dots in Fig. 2) were selected based on distances to the park (i.e., those within a 100 km radius of the park's boundaries) and physiographic similarity (Huntley 2019). The only exception to this is Humbe, which is located 110 km south of the park, but was also included in this account since it is an important historical collection site and is the type locality of several reptile species. Selected historical localities were: Cahama and surroundings, Capelongo (= Kapelongo, = Folgares), Catequero and surroundings, Chibemba and surroundings, Dongue and surroundings, Gambos (= Chibemba, see discussion in Branch et al. [2019a]), Humbe, Humbi (= Humbe), Humbia (= Humbe), Kandingu (= Kului River), Kangela (= Kului River), Kului River, Mulondo, Mupa, Osi (= Osse), Osse, Quipungo, and Viriambundo. Records from these localities were compiled from published literature such as Bocage (1895), Monard (1937a,b), Schmidt (1933), Bogert (1940), Laurent (1964), Gans (1976), Poynton and Haacke (1993), and from unpublished information in the Ditsong (=Transvaal) National Museum of Natural History's database (Haacke, TM).

Collected data were grouped into three classes (Fig. 2): i) historical records collected before 1975, which include records published in historical literature and unpublished records from TM; ii) recent records from Butler et al. (2019); and iii) recent records from this study, which refer to either data collected during field surveys from 2009 onwards performed within the scope of the SASSCAL project, A. Channing's personal records, opportunistic photographic records collected by other researchers in the region, and records from Carmira Farm and Handa Farm.

Results

The combined records (published and unpublished, recent and historical) of herpetofauna biodiversity from the BNP region comprises a total of 94 taxa. This includes 21 amphibian taxa (Table 1) and 73 reptilian taxa (36 lizards,

Table 1. Amphibians recorded from inside and the surroundings of Bicuar National Park, Angola, based on historical and recent records. Type of record: C = advertisement call; L = literature; O = observation; P = photograph; RR = new record for the region; V = voucher. Period of record: A = after 2008; B = before 1975. Taxonomy has been updated over the years, therefore original species citations may occur under different names.

	Species	Type of record	Records in the region of BNP Locality (Reference)	Inside BNP?	Period of record
	Arthroleptidae				
1.	*Leptopelis bocagii* (Günther, 1865)	RR, V	BNP (this study)	Y	A
	Bufonidae				
2.	*Mertensophryne* aff. *mocquardi* (Angel, 1924)	L	Mulondo (Monard 1937a)		B
3.	*Sclerophrys poweri* (Hewitt, 1935)	RR, V	BNP (this study)	Y	A
4.	*Sclerophrys pusilla* (Mertens, 1937*)*	L, V	Capelongo (Butler et al. 2019); BNP (this study)	Y	A
5.	*Sclerophrys regularis* (Reuss, 1833)	L	Humbe, Mulondo, Mupa, Osi (= Osse) (Monard 1937a)		B
	Hemisotidae				
6.	*Hemisus* cf. *guineensis* Cope, 1865	RR, V	BNP (this study)	Y	A
	Hyperoliidae				
7.	*Hyperolius angolensis* Steindachner, 1867 complex	L, V	Capelongo, Osi (= Osse) (Monard 1937a); BNP (Butler et al. 2019; this study)	Y	A, B
8.	*Hyperolius benguellensis* (Bocage, 1893) complex	V	BNP (Channing et al. 2013); BNP (Butler et al. 2019; this study)	Y	A
9.	*Kassina senegalensis* (Duméril and Bibron 1841)	L, V	Mulondo (Monard 1937a); BNP (this study)	Y	A, B
	Microhylidae				
10.	*Phrynomantis bifasciatus* (Smith, 1847)	C, L	Mulondo (Monard 1937a); BNP (this study)	Y	A, B
	Phrynobatrachidae				
11.	*Phrynobatrachus mababiensis* FitzSimons, 1932	C, L, V	BNP (Butler et al. 2019; this study)	Y	A
12.	*Phrynobatrachus natalensis* (Smith, 1849)	C, L	Kangela (Monard 1937a); BNP (this study)	Y	A, B
	Pipidae				
13.	*Xenopus petersii* Bocage, 1895	L, V	Kandingu, Osi (= Osse) (Monard 1937a); BNP (Butler et al. 2019; this study)	Y	A, B
	Ptychadenidae				
14.	*Hildebrandtia* cf. *ornata* (Peters, 1878)	L, P	Mulondo, Osi (= Osse) (Monard 1937a); Dongue (Poynton and Haacke 1993); between Chibemba and Cahama (this study)		A, B
15.	*Ptychadena ansorgii* (Boulenger, 1905)	L	Kandingu (Monard 1937a)		B
16.	*Ptychadena oxyrhynchus* (Smith, 1849)	L, V	Osi (= Osse) (Monard 1937a); BNP (Butler et al. 2019; this study)	Y	A, B
17.	*Ptychadena porosissima* (Steindachner, 1867)	C, RR	BNP (this study)	Y	A
	Pyxicephalidae				
18.	*Pyxicephalus adspersus* Tschudi, 1838	L, O	Humbe (Bocage 1895); Carmira Farm (this study)		A, B

Table 1 (continued). Amphibians recorded from inside and the surroundings of Bicuar National Park, Angola, based on historical and recent records. Type of record: C = advertisement call; L = literature; O = observation; P = photograph; RR = new record for the region; V = voucher. Period of record: A = after 2008; B = before 1975. Taxonomy has been updated over the years, therefore original species citations may occur under different names.

	Species	Type of record	Records in the region of BNP Locality (Reference)	Inside BNP?	Period of record
19.	*Tomopterna ahli* (Deckert, 1938)	L	BNP (Butler et al. 2019; Channing and Becker 2019)	Y	A
20.	*Tomopterna* cf. *cryptotis* (Boulenger, 1907)	C, L, V	Catequero (Boulenger 1907); Calequero (= Catequero), 2 km NW of (Poynton and Haacke 1993); BNP (this study)	Y	A, B
21.	*Tomopterna tuberculosa* (Boulenger, 1882)	L	BNP (Butler et al. 2019)	Y	A

32 snakes, four testudines, and one crocodilian, Table 2). Many of Haacke's data represent new records for the region (see Table 2), highlighting the relevance of his collections. The recent records resulting from this study recorded a total of 53 taxa; 16 amphibian taxa distributed across nine families and 13 genera (Table 1), and 36 reptilian taxa (15 lizards, 18 snakes, two testudines, and one crocodilian) distributed among 17 families and 35 genera (Table 2). This study revealed the first record of *Xenocalamus bicolor bicolor*, the second records of *Sclerophrys poweri* and of *Amblyodipsas ventrimaculata* (together with the record of Butler et al. [2019]), and the fourth record of *Monopeltis infuscata* in Angola. In total, 89 specimens were collected and deposited in the herpetological collection of ISCED-Huíla.

Comments on the recent records from this study are provided in the species accounts below, which are arranged alphabetically by class, family, genus, and species, with notes on taxonomy and the relevance of the discoveries. For each species, the material used is described as the type of record, the field number of the collected specimen when applicable, and a code in brackets which represents the site where the specimen was recorded (see Appendix 1). Some records could not be assigned to a species with certainty because no voucher specimens were available for verification (e.g., *Hildebrandtia*, *Afrotyphlops)*, or due to taxonomical uncertainty in the group to which they belong (e.g., *Hyperolius*, *Hemisus*, *Panaspis*). In these cases, the nomenclature followed Sigovini et al. (2016). Collected tadpoles were not identified and are therefore not listed as materials below, and their future identification awaits the results of DNA sequencing. The only exceptions to this exclusion are the tadpoles assigned to *Kassina*.

Species Accounts

Amphibia

Arthroleptidae

Leptopelis bocagii (Günther, 1865)
Bocage's Burrowing Treefrog (Fig. 4A–B)

Material: NB520 (30); NB546 (28); NB547 (29); NB710 (27); NB765 (27); NB766 (27).

Comment: Reported in several localities in Angola (Ceríaco et al. 2018c; Marques et al. 2018), including recent records from Huíla Province (Baptista et al. 2018). It is considered a complex of cryptic species (Schiøtz 1999), and the Angolan material assigned to *Hylambates angolensis* Bocage, 1893, currently in the synonymy of *L. bocagii*, requires further study (Perret 1976). Dorsal coloration of individuals in BNP varied from completely

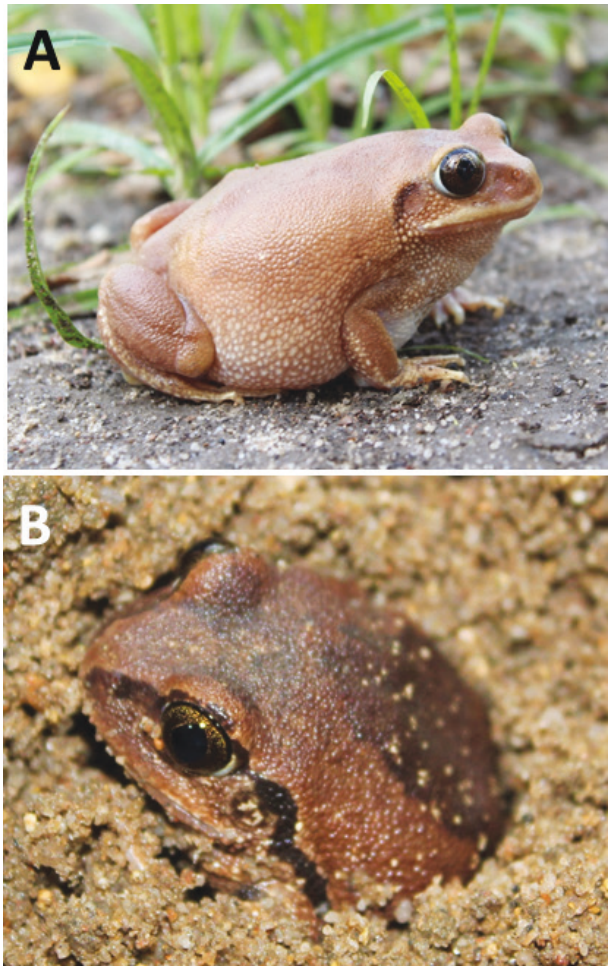

Fig. 4. *Leptopelis bocagii*, BNP. (**A**) female with plain back; (**B**) male with blotch in back.

plain to black with a horseshoe shaped blotch with white dots in the back (Fig. 4A–B).

Bufonidae

Sclerophrys poweri (Hewitt, 1935)
Western Olive Toad (Fig. 5)
Material: NB512 (36); NB756 (25); NB764 (26); NB767 (26); NB768 (26); NB769 (26).
Comment: Also occurring in northern Namibia and Botswana (Channing 2001), this is the second confirmed record of the species for Angola, after a previous record near Calai (Conradie et al. 2016). Some early records of *Bufo regularis sensu latu* may also refer to *S. poweri* (Ruas 1996). *Bufo regularis humbensis* Monard, 1937 was originally described from Mulondo, close to BNP. It is currently placed under the synonymy of *S. garmani* (Tandy and Keith 1972), which in Angola refers to *S. poweri*, and this synonymy should be reviewed. *Sclerophrys poweri* is very abundant in BNP and was found hundreds of meters away from water on moist nights. Breeding was observed in permanent pans, with males calling in choruses at night and eggs typically laid in gelatinous single strings.

Sclerophrys pusilla (Mertens, 1937)
Southern Flat-backed Toad (Fig. 6)
Material: NB056 (31); NB763 (26).
Comment: Taxonomy and identification of bufonids in Angola remains problematic (Baptista et al. 2019). *Sclerophrys pusilla* represents populations previously assigned to *S. maculata* in eastern and southern Africa, including Angola (Poynton et al. 2016). This species is known from several localities in the country (Poynton and Haacke 1993; Ruas 1996, 2002; Conradie et al. 2016; Ceríaco et al. 2018c; Marques et al. 2018). It was heard calling in BNP on 24 January 2009, but not collected (A. Channing, pers. comm.), and was recently recorded from Capelongo, near BNP (Butler et al. 2019). It was also found around the Main Camp facilities and in a permanent water body.

Hemisotidae

Hemisus cf. *guineensis* Cope, 1865
Guinea Snout-burrower (Fig. 7A–C)
Material: NB511 (15); NB550 (T2); NB551 (T2).
Comment: Tadpoles of this species were collected in BNP during the 2009 survey (A. Channing, pers. comm.). The taxonomy of *Hemisus guineensis* and *H. marmoratus* is not fully resolved. Angolan specimens of both species have been treated as a single taxon in the past (*Hemisus guineensis microps* Laurent, 1972) and records of the genus are scattered throughout the country (Ruas 1996; Marques et al. 2018). Recent records of *Hemisus* from Cangandala have been considered as *H. guineensis* (Ceríaco et al. 2018c; Vaz Pinto and Baptista, unpub. data). Coloration of adult frogs from BNP ranges from finely spotted forming lines, and mottled forming continuous blotches to almost plain with very small spots (see Fig. 7A–C). A similar pattern of variation in coloration was reported by W. Conradie (pers. comm.) in southeastern Angola, with all forms genetically confirmed as being *H.* cf. *guineensis*. Based on this, and the proximity to a previous record from the Cubango basin (Monard 1937a), BNP specimens likely belong to the same taxon.

Hyperoliidae

Hyperolius angolensis Steindachner, 1867 complex
Angola Reed Frog
Material: NB523 (41); NB524 (41); NB538 (27); NB539 (27); NB540 (27); NB541 (27).
Comment: This species was heard calling in BNP (site 31) on 24 January 2009, but no material was collected (A. Channing, pers. comm.). It was recently recorded in BNP by Butler et al. (2019), who provided photos of coloration variations. This is another unresolved complex of reed frogs in Africa (see Schiøtz 1999), with a number of names available for Angolan populations (Baptista et al. 2019, as *H. parallelus*). In Angola, this complex is recorded throughout the country (Monard 1937a; Laurent 1950, 1954, 1964; Poynton and Haacke 1993; Conradie et al. 2016; Baptista et al. 2018; Ceríaco et al. 2018c; Marques et al. 2018), with consistent regional color patterns. Poynton and Haacke (1993) referred to previous records in Huíla Province as *Hyperolius marmoratus huillensis*.

Hyperolius benguellensis (Bocage, 1893) complex
Benguela Long Reed Frog (Fig. 8A–B)
Material: NB510 (36); NB526 (41); NB542 (27); NB543 (27); NB544 (27).
ZMB 77273; ZMB 77274 (collected by Alan Channing, not analyzed).
Comment: *Hyperolius benguellensis* belongs to the challenging *Hyperolius nasutus* complex, with a problematic taxonomy throughout Africa (Schiøtz 1999; Amiet 2005; Marques et al. 2018). Channing et al. (2013) proposed a rearrangement for this group based on morphology, genetics, and advertisement calls, resulting in four species occurring in Angola: *H. nasutus*, *H. dartevellei*, *H. adspersus*, and *H. benguellensis*. Of these, three were originally described from Angola: *Hyperolius nasutus* Günther, 1865, type locality: Duque de Bragança (= Calandula); *Hyperolius adspersus* Peters, 1877, type locality: Chinchoxo, in Cabinda; and *Hyperolius benguellensis* (Bocage, 1893) type locality: "Cahata" that has been incorrectly assigned to Caota (e.g., Channing 2001; Marques et al. 2018; Frost 2019). In fact, Cahata is located 5 km east of Balombo Municipality and was a known collecting site for the famous naturalist José de Anchieta in the nineteenth century (Bocage 1895).

Fig. 5. *Sclerophrys poweri*, BNP

Fig. 7. *Hemisus* cf. *guineensis*, BNP. (**A**–**C**) Three variations in coloration.

Fig. 6. *Sclerophrys pusilla*, BNP

Although the region is still located in Benguela Province, it lies on the plateau at 1,230 m asl, more than 400 km east of the coastal town of Benguela and closer to the town of Huambo, while Caota is found on the outskirts of Benguela at 20 m asl. The name "*benguellensis*" is therefore misleading, and is probably the reason why Cahata was confused with Caota, but the latter is a beach site in the semi-arid Angolan southwest, and an unlikely habitat for a reed frog. We therefore re-establish the type locality of *H. benguellensis* to Cahata, near Balombo. The assignment of erroneous names to Angolan localities has been detected in other cases (Branch et al. 2017, 2018; Vaz Pinto et al. 2019), thus special attention must be given to this when consulting historical and recent literature. Channing et al. (2013) assigned one specimen from BNP to *H. benguellensis*, and we assign these specimens to this name, with the altitude similar to the true type locality providing further support. Butler et al. (2019) collected one specimen from BNP, recording it as *H.* cf. *nasutus*, and in this study we tentatively regard this record as the same as ours. Both species, *H. benguellensis* and *H. nasutus,* are sympatric in Cangandala National Park (Vaz Pinto, unpub. data). Specimens from this group have been also found in western Zambia (Bittencourt-Silva 2019) and assigned to *H. dartevellei* and *H. nasicus*. Similar to *H. angolensis* complex, a more complete understanding of this complex in Angola requires countrywide surveys and an integrated analysis of molecular, morphological, and advertisement call data.

Kassina senegalensis (Duméril and Bibron, 1841)
Bubbling Kassina

Material: NB525 (T1); NB536 (tadpoles) (7); NB545 (T3); NB552 (T2); NB761 (26).

Comment: Widespread throughout Africa and in Angola (Baptista et al. 2018; Marques et al. 2018). This species has been previously recorded in BNP as tadpoles (A. Channing, pers. comm.). Although subspecies have been proposed based on color patterns (Laurent 1957), more comprehensive studies are required to resolve this species' taxonomy.

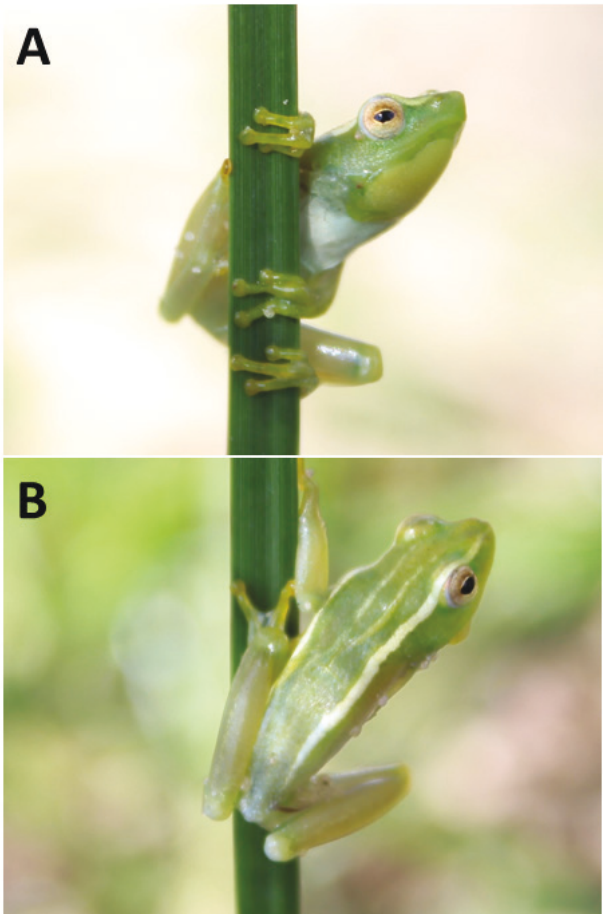

Fig. 8. *Hyperolius benguellensis* complex, BNP. (**A**) Ventral view; (**B**) dorsal view.

Microhylidae

Phrynomantis bifasciatus (Smith, 1847)
Banded Rubber Frog
Comment: This species was heard calling in BNP (site 31) on 24 January 2009, but no material was collected (A. Channing, pers. comm.). In Angola, it is known from Mulondo (Monard 1937a), which is located near the boundary of BNP, in addition to Quissange and Benguela (Bocage 1895), and Chingo (Ferreira 1904).

Phrynobatrachidae

Phrynobatrachus mababiensis FitzSimons, 1932
Mababe Puddle Frog
Comment: This species was heard calling in BNP (site 31) on 24 January 2009, and a single tadpole (A. Channing, pers. comm.) and adults (Butler et al. 2019) have been collected in BNP. In Angola, it is recorded from Lagoa Nuntechite (Poynton and Haacke 1993), Cubango, Cuito and Cuando rivers basins (Conradie et al. 2016), and Tundavala (Baptista et al. 2018). This species belongs to the *P. cryptotis* group (Marques et al. 2018) and is in need of further taxonomic studies all over Africa (Zimkus et al. 2010).

Phrynobatrachus natalensis (Smith, 1849)
Snoring Puddle Frog
Comment: This species was heard, but not recorded, calling in BNP (site 31) on 24 January 2009; no material was collected (A. Channing, pers. comm.). It is widespread in Angola (Ruas 1996, 2002; Marques et al. 2018) and includes several cryptic taxa (Zimkus et al. 2010) that are presently being investigated. Additional specimens collected from BNP will be crucial for species confirmation.

Pipidae

Xenopus petersii Bocage, 1895
Peters' Clawed Frog
Material: NB757 (27); NB758 (27); NB759 (27).
Comment: This species is widespread in Angola (Monard 1937a as *X. laevis*; Ruas 1996, 2002; Baptista et al. 2018; Ceríaco et al. 2018c; Marques et al. 2018). It has been previously recorded in BNP from both tadpoles (A. Channing, pers. comm.) and adults (Butler et al. 2019). Furman et al. (2015) consider that in Angola, *X. petersii* is widespread and *X. poweri* is restricted to southeastern Angola, but few samples from Angola were used in their analysis and this genus is worthy of a more comprehensive assessment in the country. Hamerkop (*Scopus umbretta*) and Lilac-breasted Roller (*Coracias caudatus*) were seen preying upon this species in BNP.

Ptychadenidae

Hildebrandtia cf. *ornata* (Peters, 1878)
Ornate Frog (Fig. 9)
Material: Photographic record (F. Maiato, on wetland between Chibemba and Cahama, approximate coordinates same as site 42).
Comment: Two species of *Hildebrandtia* exist in Angola: *H. ornata* and *H. ornatissima* (Marques et al. 2018; Baptista et al. 2019). *Hildebrantia ornata* is limited to the southwest, and *H. ornatissima* extends northwards to the central plateau (Ruas 1996; Marques et al. 2018). Boulenger (1919) provides morphological distinction between *H. ornatissima* (Bocage, 1897), endemic to Angola, and *H. ornata* (Peters, 1878) (= *R. ruddi*), originally described from Kenya but with a wide distribution in Africa. Perret (1976) considered *H. ornata* and *H. ornatissima* as two valid species based on morphology, but Poynton and Haacke (1993) contest that, and consider them subspecies." Specimens collected from Dongue, 28 km west of BNP and other localities in southwestern Angola had mixed features from both taxa and were assigned to *H. ornata ornata* (Poynton and Haacke 1993). A single frog was photographed, approximately 55 km southwest of BNP's boundaries, and it is provisionally assigned to *H. ornata* based on the identification of material collected in close proximity (Poynton and Haacke 1993). *Hildebrandtia*

Fig. 9. *Hildebrandtia* cf. *ornata*, between Chibemba and Cahama (*Photo by F. Maiato*).

specimens have also been recently collected from several localities in Huíla and Malanje provinces (Baptista and Vaz Pinto, unpub. data), and the genus requires a revision in the country.

Ptychadena oxyrhynchus (Smith, 1849)
Sharp-nosed Ridged Frog (Fig. 10A–B)
Material: NB750 (25).
Comment: Species identification for *Ptychadena* in Angola is not resolved (Baptista et al. 2019). A single specimen was found near Lagoa da Matemba, but no advertisement call was heard. It was assigned to *P. oxyrhynchus* based on morphology and coloration (Fig. 10A–B). This species has recently been recorded from BNP (Butler et al. 2019) and is known from several localities in Angola (Marques et al. 2018).

Ptychadena porosissima (Steindachner, 1867)
Grassland Ridged Frog
Comment: This species was heard calling in BNP (site 31) on 24 January 2009, but no material was collected and no call was recorded (A. Channing, pers. comm.). Widespread in sub-Saharan Africa, and recorded in Angola from the west and the northeast (Ruas 1996; Marques et al. 2018). Additional specimens will be important for confirmation of species identification in BNP.

Pyxicephalidae

Pyxicephalus adspersus Tschudi, 1838
African Bullfrog
Material: Interviews.
Comment: Staff from Carmira Farm mentioned that this frog—which is unmistakable by its distinctive size, morphology, and behavior—appears during the first heavy rains. *Pyxicephalus adspersus* is recorded from southern Angola in Humbe (Bocage 1895), Mupanda (Monard 1937a), and Pereira d'Eça (= Ondjiva) and 23 km NW Pereira d'Eça (Poynton and Haacke 1993, as *P. a. edulis*). Several synonymies exist within *P. adspersus* (Frost 2019). Consensus regarding whether *P. edulis* occurs in the Zambezi Region (previously the Caprivi Strip), has not been reached (Herrmann and Branch 2013), and the Angolan material requires further analysis. Locally called "mafuma," it is captured for consumption and bushmeat trade. It may also have cultural relevance in Angola, as in some parts of Cunene Province this frog's mating behavior is said to inspire a traditional fight called "engolo" among the Nkhumbi people (J. Moniz, pers. comm.).

Tomopterna cf. *cryptotis* (Boulenger, 1907)
Cryptic Sand Frog (Fig. 11A–C)
Material: NB751 (25); NB752 (25); NB753 (25); NB754 (25); NB755 (25); NB762 (26).
Comment: The species was found breeding in early December, with males calling in loud choruses on banks of water bodies in BNP. Collected specimens had considerable coloration variation (see Fig. 11A–C). *Tomopterna cryptotis* was originally described from Catequero (ca. 95 km south of BNP), and has been recorded between Calequero (= Catequero) and Cahama (ca. 75 km southwest of BNP) [Poynton and Haacke 1993] among other localities in Angola (Ruas 1996; Marques et al. 2018). This species is morphologically indistinguishable from *T. tandyi* (Channing and Bogart 1996), which was originally described from the Eastern Cape in South Africa and is known from Namibia, Botswana, and South Africa (Channing 2001, du Preez and Carruthers 2009). Although *T. tandyi* is considered as being present in southwestern Angola (Channing 2001; Channing and Rödel 2019), there are no literature records from the country, and its occurrence is presumably based on the morphology of similar frogs in Namibia (A. Channing, pers. comm.). However, *Tomopterna* species are highly cryptic, and difficult to distinguish based on morphology. Due to the fact that the BNP records are near-topotypical, these specimens are assigned to *T. cryptotis,* but the advertisemen calls heard in BNP resembled those of *T. tandyi* provided by du Preez and Carruthers (2019). Further integrative revision of these species in Angola is needed to confirm this assignment. Two other species from the same genus have recently been recorded from BNP (Butler et al. 2019): *T. tuberculosa* and *T. damarensis*, which was recently re-assigned to *Tompterna ahli* (Channing and Becker 2019), which means that at least three species may occur sympatrically. Given the highly cryptic morphology of species within this genus (Channing and Rödel 2019), and the continuing descriptions of new species (Wilson and Channing 2019), all of these new records require revision.

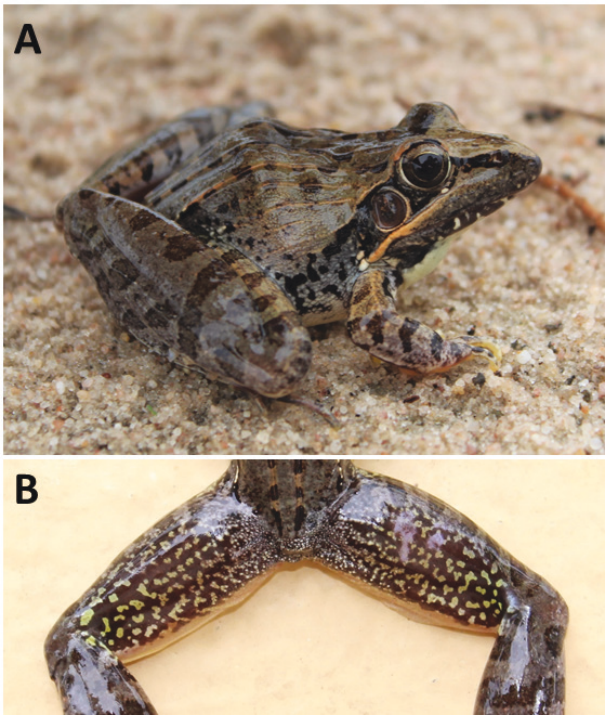

Fig. 10. *Ptychadena oxyrhynchus*, BNP. (**A**) Individual; (**B**) detail of thighs.

Reptilia
Squamata
Sauria
Agamidae

Acanthocercus sp.
Tree Agama (Fig. 12)
Material: NB709 (31).
Comment: This species was previously assigned to *Acanthocercus atricollis* (Smith, 1849) until Wagner et al. (2018) revived the name *A. cyanocephalus* for western populations, which included Angola. Reported in several publications from Angola (Bocage 1879, 1895; Ferreira 1902; Boulenger 1905; Monard 1931, 1937b; Schmidt 1933; Laurent 1950, 1964; Manaças 1963; Conradie et al. 2016; Ceríaco et al. 2018c; Marques et al. 2018), but material from Huíla Province belongs to a different species, which is in the process of being described (Marques et al. 2018; Butler et al. 2019). Recently recorded in BNP (Butler et al. 2019), abundant at the park's headquarters, and found on large and tall *Burkea africana* trees.

Agama aculeata (Merrem, 1820)
Ground Agama
Material: NB770 (32).
Comment: Ground Agamas occur widely in southern Africa (Bates et al. 2014) and are reported throughout Angola (Marques et al. 2018). The taxonomy of Angolan populations remains unresolved, and a recent phylogeny of *Agama* (Leaché et al. 2014) did not include Angolan

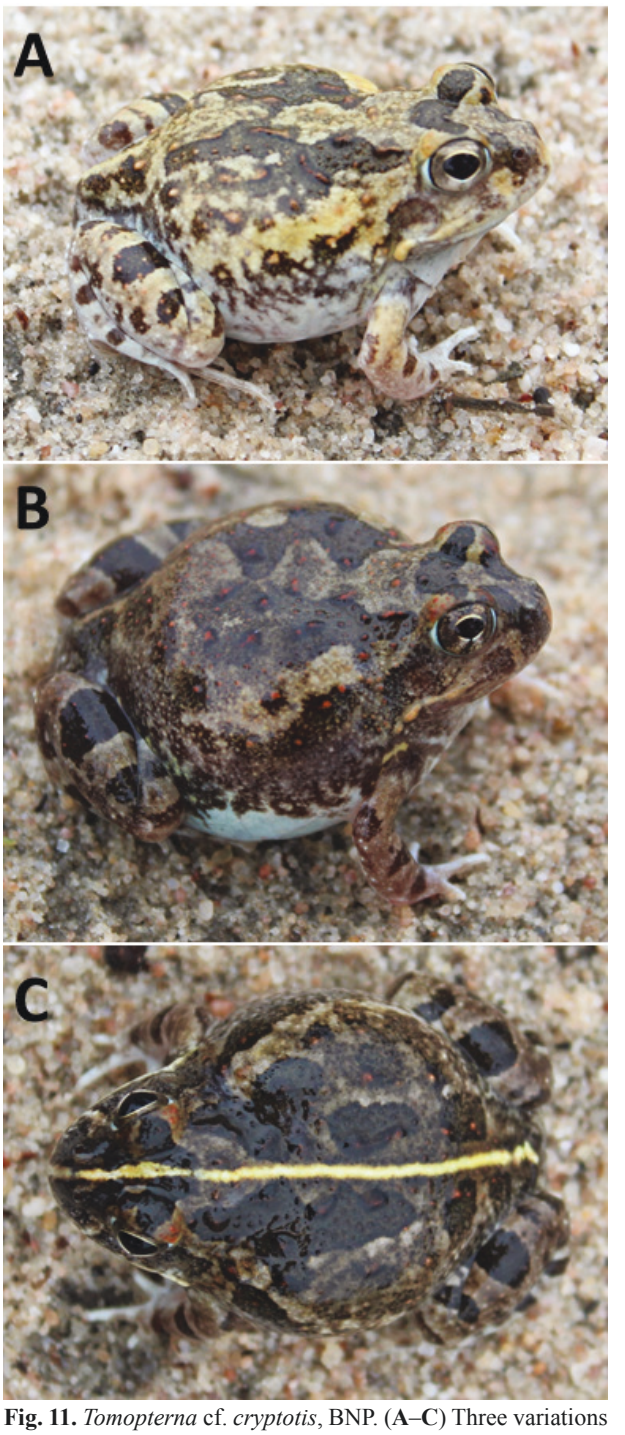

Fig. 11. *Tomopterna* cf. *cryptotis*, BNP. (**A**–**C**) Three variations in coloration.

samples. Recently recorded in BNP (Butler et al. 2019), in this study it was found on the ground in degraded shrubland in the outskirts of BNP.

Amphisbaenidae

Monopeltis cf. *anchietae* (Bocage, 1873)
Anchieta's Spade-snouted Worm Lizard (Fig. 13)
Material: One photographic record of a freshly killed individual (L. Gata, CF).

Table 2. Reptiles recorded from inside and the surroundings of Bicuar National Park, Angola, based on historical and recent records. Type of record: CR = new record for the country; H = unpublished record from Ditsong (= Transvaal) Museum's collection; L = literature; O = observation; P = photograph; RR = new record for the region; V = voucher; E = endemic. Period of record: A = after 2008; B = before 1975. Taxonomy has been updated over the years, therefore original species nomenclature may occur under different names.

	Taxa	Endemic?	Type of record	Records in the region of BNP Locality (and Reference)	Inside BNP?	Period of record
	Sauria					
	Agamidae					
1.	*Acanthocercus* sp.	E	L, V	Mupa (Monard 1937b); BNP (Butler et al. 2019; this study)	Y	A, B
2.	*Agama aculeata* (Merrem, 1820)		H, L, V	Cahama and Chibemba, 21 km NW of (Haacke, TM); BNP (Butler et al. 2019; this study)	Y	A, B
3.	*Agama planiceps shacki* Mertens, 1938	E	H, RR	Chibemba, 5 km S; Dongue, 10 km NW of (Haacke, TM)		A, B
	Amphisbaenidae					
4.	*Monopeltis* cf. *anchietae* (Bocage, 1873)		L, V	Humbe (Bocage 1873); Mupa (Monard 1937b); Carmira Farm (this study)		A, B
5.	*Monopeltis infuscata* Broadley, 1997		L, V	Humbe (Bocage 1873; Broadley 1997); Carmira Farm (this study)		A, B
6.	*Monopeltis perplexus* Gans, 1976	E	L	Humbe (Gans 1976)		B
7.	*Zygaspis quadrifrons* (Peters, 1862)		L, V	BNP (Butler et al. 2019); Carmira Farm (this study)	Y	A, B
	Chamaeleonidae					
8.	*Chamaeleo dilepis quilensis* (Bocage 1886)		H, L, V	Cahama, 23 km SE (Haacke, TM); Kului (Monard 1937b); BNP (Butler et al. 2019; this study)	Y	A, B
	Cordylidae					
9.	*Cordylus machadoi* Laurent, 1964		H, RR	Chibemba, 5 km S; Humbia, 12 km E (Haacke, TM)		B
	Gekkonidae					
10.	*Chondrodactylus fitzsimonsi* (Loveridge, 1947)		H, RR	Viriambundo (Haacke, TM)		B
11.	*Chondrodactylus laevigatus* (Fischer, 1888)		L, O	Mulondo (Schmidt 1933); Humbe (Monard 1937b); BNP (Butler et al. 2019); Carmira Farm (this study)	Y	A, B
12.	*Hemidactylus benguellensis* Bocage, 1893	E	L	Capelongo (Butler et al. 2019)		A
13.	*Lygodactylus angolensis* Bocage, 1896		RR, V	BNP (this study)	Y	A
14.	*Lygodactylus bradfieldi* Hewitt, 1932		H, L	Humbe-Cahama, 36 km from; Humbe, 5 km N of; Humbia (Haacke, TM); BNP (Butler et al. 2019)	Y	A, B
15.	*Pachydactylus punctatus* Peters, 1854 complex		L, V	Kului (Monard 1937b; Bauer et al. 2006); BNP (this study)	Y	A, B

Table 2 (continued). Reptiles recorded from inside and the surroundings of Bicuar National Park, Angola, based on historical and recent records. Type of record: CR = new record for the country; H = unpublished record from Ditsong (= Transvaal) Museum's collection; L = literature; O = observation; P = photograph; RR = new record for the region; V = voucher; E = endemic. Period of record: A = after 2008; B = before 1975. Taxonomy has been updated over the years, therefore original species nomenclature may occur under different names.

	Taxa	Endemic?	Type of record	Records in the region of BNP Locality (and Reference)	Inside BNP?	Period of record
16.	*Rhoptropus barnardi* Hewitt, 1962		H, RR	Chibemba, 11 km S; Chibemba, 5 km S; Humbia, 12 km E (Haacke, TM)		B
	Gerrhosauridae					
17.	*Gerrhosaurus bulsi-multilineatus* complex	E*	H, L, V	Capelongo, Mulondo (Monard 1937b); Cahama, 10 km NW; Cahama, 21 km NW – Chibemba, Cahama, 30 km SE of (Haacke, TM); BNP (Butler et al. 2019; this study)	Y	A, B
18.	*Matobosaurus maltzahni* (De Grys, 1938)		H, RR	Dongue, 10 km NW of (Haacke, TM)		B
	Lacertidae					
19.	*Heliobolus lugubris* (Smith, 1838)		H, L	Mulondo (Monard 1937b); Cahama, 3 km NW of (Haacke, TM)		B
20.	*Ichnotropis bivittata* Bocage, 1866		L	Kului (Monard 1937b)	Y	B
21.	*Ichnotropis capensis* (Smith, 1838)		L, V	BNP (Butler et al. 2019; this study)	Y	A
22.	*Meroles squamulosus* (Peters, 1854)		L	Capelongo (Monard 1937b)		B
23.	*Nucras broadleyi* Branch, Conradie, Vaz Pinto, Tolley 2019	E	L	Capelongo (Monard 1937b)		B
	Scincidae					
24.	*Acontias occidentalis* FitzSimons, 1941		L	Mupa (Monard 1937b; FitzSimons 1941)		B
25.	*Mochlus sundevalli* (Smith, 1849)		RR, V	Carmira Farm (this study)		A
26.	*Panaspis wahlbergi-maculicollis* complex		L, V	BNP (Butler et al. 2019; this study)	Y	A
27.	*Sepsina angolensis* Bocage, 1866		H, L	Chibemba (Laurent 1964); Viriambundo (Haacke, TM)		B
28.	*Trachylepis albopunctata* (Bocage, 1867)		L	BNP (Butler et al. 2019)	Y	A
29.	*Trachylepis binotata* (Bocage, 1867)		H, L	Mupa (Monard 1937b); Chibemba, 11 km S; Humbe (Haacke, TM); BNP (Butler et al. 2019)	Y	A, B
30.	*Trachylepis chimbana* (Boulenger, 1887)		H	Humbe (Schmidt 1933); Humbia, 12 km E of (Haacke, TM)		B
31.	*Trachylepis spilogaster* (Peters, 1882)		H, L, V	Humbe to Cahama, 36 km NW of (Haacke, TM); BNP (Butler et al. 2019; this study)	Y	A, B
32.	*Trachylepis sulcata ansorgii* (Boulenger, 1907)		H, RR	Chibemba, 11 km S (Haacke, TM)		B

Table 2 (continued). Reptiles recorded from inside and the surroundings of Bicuar National Park, Angola, based on historical and recent records. Type of record: CR = new record for the country; H = unpublished record from Ditsong (= Transvaal) Museum's collection; L = literature; O = observation; P = photograph; RR = new record for the region; V = voucher; E = endemic. Period of record: A = after 2008; B = before 1975. Taxonomy has been updated over the years, therefore original species nomenclature may occur under different names.

	Taxa	Endemic?	Type of record	Records in the region of BNP Locality (and Reference)	Inside BNP?	Period of record
33.	*Trachylepis sulcata sulcata* (Peters, 1867)		L	Capelongo (Butler et al. 2019)		A
34.	*Trachylepis varia* (Peters, 1867) clade B (Weinell and Bauer 2018)		H, L	Capelongo (Monard 1937b); Cahama, 21 km NW – Chibemba, Humbia, 12 km E of (Haacke, TM)		B
35.	*Trachylepis wahlbergi* (Peters, 1869)		H, L	Humbi, Capelongo, Kului, Mulondo, Mupa (Monard 1937b); Humbe, 5 km N of (Haacke, TM)		B
	Varanidae					
36.	*Varanus albigularis angolensis* Schmidt, 1933		L, P	Mulondo, Mupa (Monard 1937b); BNP (this study)	Y	A, B
	Serpentes					
	Colubridae					
37.	*Crotaphopeltis hotamboeia* (Laurenti, 1768)		L, V	Gambos, Humbe (Bocage 1895); Capelongo (Monard 1937b); Nougalafa Lake (this study)		A, B
38.	*Dasypeltis scabra* (Linnaeus, 1758)		L	Gambos (Bocage 1895)		B
39.	*Dispholidus typus viridis* (Smith, 1838)		L, P, V	Humbe (Bocage 1895); Mupa (Monard 1937b); Capelongo (Bogert 1940); Carmira Farm (this study)		A, B
40.	*Philothamnus angolensis* Bocage, 1882		H, L	Capelongo (Bogert 1940); Humbe (Haacke, TM)		B
41.	*Philothamnus semivariegatus* (Smith, 1840) *sensu lato*		L, P, V	Humbe (Bocage 1895); Mupa (Monard 1937b);; Carmira Farm, Handa Farm (this study)		A, B
42.	*Telescopus semiannulatus polystictus* Mertens, 1954		L	Humbe, Gambos (Bocage 1895)		B
43.	*Thelotornis capensis oatesi* (Günther, 1881)		RR, V	BNP (this study)	Y	A
	Elapidae					
44.	*Dendroaspis polylepis* Günther, 1864		L, P	Mulondo (Schmidt 1933); BNP, Handa Farm (this study)	Y	A, B
45.	*Elapsoidea semiannulata semiannulata* Bocage, 1882		L	Gambos (Bocage 1895; Broadley 1998)		B
46.	*Naja anchietae* Bocage, 1879		L, V	Humbe (Bocage 1895); Capelongo (Bogert 1940); Mupa (Monard 1937b); BNP, Handa Farm (this study)	Y	A, B

Table 2 (continued). Reptiles recorded from inside and the surroundings of Bicuar National Park, Angola, based on historical and recent records. Type of record: CR = new record for the country; H = unpublished record from Ditsong (= Transvaal) Museum's collection; L = literature; O = observation; P = photograph; RR = new record for the region; V = voucher; E = endemic. Period of record: A = after 2008; B = before 1975. Taxonomy has been updated over the years, therefore original species nomenclature may occur under different names.

	Taxa	Endemic?	Type of record	Records in the region of BNP Locality (and Reference)	Inside BNP?	Period of record
47.	*Naja nigricollis* Reinhardt, 1843		L, P	Humbe (Bocage 1895); Capelongo (Bogert 1940); Osi (= Osse) (Monard 1937b); Handa Farm (this study)		A, B
	Lamprophiidae					
48.	*Amblyodipsas polylepis* (Bocage, 1873)		L	Humbe (Bocage 1895)		B
49.	*Amblyodipsas ventrimaculata* (Roux, 1907)		L, V	BNP (Butler et al. 2019; this study)	Y	A
50.	*Aparallactus capensis* Smith, 1849		L	Gambos (Bocage 1895)		B
51.	*Boaedon angolensis* Bocage, 1895	E	H, L, RR, V	Cahama, 3 km NW of (Haacke, TM); BNP (Butler et al. 2019); Carmira Farm (this study)	Y	A, B
52.	*Hemirhagerrhis viperina* (Bocage, 1873)		H, L	Humbe (Bocage 1895); Chibemba, 5 km S (Haacke, TM)		B
53.	*Prosymna angolensis* Boulenger, 1915		L, V	Capelongo (Bogert 1940); BNP (this study)	Y	B
54.	*Prosymna visseri* Fitzsimons, 1959		H, RR	Chibemba, 5 km S (Haacke, TM)		B
55.	*Psammophis angolensis* (Bocage, 1872)		L	Humbe (Bocage 1895; Schmidt 1933)		B
56.	*Psammophis mossambicus* Peters, 1882		L, V	Capelongo (Bogert 1940); Mupa (Monard 1937b); BNP, Handa Farm (this study)	Y	B
57.	*Psammophis subtaeniatus* Peters, 1882		L, P, V	Humbe, Mulondo, Mupa (Monard 1937b); BNP (Butler et al. 2019); Carmira Farm (this study)	Y	A, B
58.	*Psammophylax tritaeniatus* (Günther, 1868)		H, L	Gambos, Humbe (Monard 1937b); Capelongo (Bogert 1940); Humbe–Cahama, 36 km NW of (Hacke, TM)		B
59.	*Psammophylax ocellatus* (Bocage, 1873)	E	L	Gambos, Humbe (Bocage 1895; Branch et al. 2019a)		A, B
60.	*Pseudaspis cana* (Linnaeus, 1758)		L, V	BNP (Butler et al. 2019); Carmira Farm (this study)	Y	A
61.	*Xenocalamus bicolor bicolor* Günther, 1868		CR, V	Carmira Farm (this study)		A
	Leptotyphlopidae					
62.	*Leptotyphlops scutifrons* (Peters, 1854)		H, L	Capelongo (Monard 1937b); Quipungo (Haacke, TM)		B
63.	*Namibiana* aff. *rostrata* (Bocage, 1886)	E	L, V	Humbe (Bocage 1895); BNP (Butler et al. 2019); Handa Farm (this study)	Y	A, B

Table 2 (continued). Reptiles recorded from inside and the surroundings of Bicuar National Park, Angola, based on historical and recent records. Type of record: CR = new record for the country; H = unpublished record from Ditsong (= Transvaal) Museum's collection; L = literature; O = observation; P = photograph; RR = new record for the region; V = voucher; E = endemic. Period of record: A = after 2008; B = before 1975. Taxonomy has been updated over the years, therefore original species nomenclature may occur under different names.

	Taxa	Endemic?	Type of record	Records in the region of BNP Locality (and Reference)	Inside BNP?	Period of record
	Pythonidae					
64.	*Python anchietae* Bocage, 1887		H, RR	Viriambundo (Haacke, TM)		B
65.	*Python natalensis* Smith, 1840		L, V	Capelongo (Bogert 1940); BNP (this study)	Y	A, B
	Typhlopidae					
66.	*Afrotyphlops* cf. *schlegelii* (Bianconi, 1849)		L, P	Humbe (Bocage 1893); BNP (this study)	Y	A, B
	Viperidae					
67.	*Bitis arietans* Merrem, 1820		L, V	Capelongo (Bogert 1940); BNP (this study)	Y	A, B
68.	*Causus rhombeatus* (Lichtenstein, 1823)		P, RR	Handa Farm (this study)		A
	Testudines					
	Pelomedusidae					
69.	*Pelomedusa subrufa* (Bonnaterre, 1789)		L, V	Humbe (Bocage 1895); BNP (Butler et al. 2019; this study)	Y	A, B
70.	*Pelusios* cf. *nanus* Laurent, 1956		L	Osi (= Osse) (Monard 1937b); Broadley (1981)		B
	Testudinidae					
71.	*Kinixys* cf. *belliana* Gray, 1831		L, V	Osi (= Osse) (Monard 1937b); BNP (Butler et al. 2019; this study)	Y	A, B
72.	*Stigmochelys pardalis* (Bell, 1828)		L	Mupa (Monard 1937b)		B
	Crocodilia					
	Crocodylidae					
73.	*Crocodylus niloticus* Laurenti, 1768		L, O	Capelongo (Monard 1937b); BNP (this study)		A, B

Comment: *Monopeltis anchietae* is recorded from southwestern Angola (Marques et al. 2018), and Branch et al. (2019b) discuss its taxonomical history. The coloration pattern of the specimen (Fig. 13) conforms to the most common pattern associated with *M. anchietae* (Broadley et al. 1976), but the photograph resolution does not allow for the detailed scale counts necessary to provide a positive identification. The species was recorded in Humbe (Bocage 1873), approximately 110 km south of BNP, and the Carmira Farm specimen is provisionally assigned to *M. anchietae*, pending the collection of additional material for confirmation.

Monopeltis infuscata Broadley, 1997
Infuscate Spade-snouted Worm Lizard (Fig. 14)
Material: One unlabelled and bleached specimen in Carmira Farm's private collection.

Comment: Scalation features of the specimen (dorsal head shield with blind lateral sutures (Fig. 14), four postgenials in the first row, more than seven postgenials in the second row, two precloacal pores, 204 body annuli, and 10 caudal annuli) match the description of *M. infuscata* (Broadley 1997). In Angola, the species was recorded in Humbe in Cunene Province, Tombole River in Cuando-Cubango Province, and a locality named "Sturuba" (Broadley 1997) which could not be determined. This is the third confirmed locality for the species in the country and the first for Huíla Province, and additional voucher specimens and genetic material should be collected. Found among sandy soils in *Baikea/Burkea* woodlands, *Monopeltis anchietae* and *M. infuscata* are known to be sympatric in Humbe (Broadley 1997), approximately 110 km south of BNP, supporting their co-occurrence in Carmira Farm.

Fig. 12. *Acanthocercus* sp., BNP (male).

Zygaspis quadrifrons (Peters, 1862)
Kalahari Round-snouted Worm Lizard (Fig. 15)
Material: One unlabelled and bleached specimen in Carmira Farm's private collection.
Comment: This specimen conforms morphologically to *Z. quadrifrons* (Broadley and Broadley 1997). For many years, the species was known from Angola only from Monard's (1931) description of *Amphisbaena ambuellensis* from 'Chimporo' (= Tchimpolo), which was subsequently synonymized with *A. quadrifrons* by Loveridge (1941) and later transferred to *Zygaspis* by Alexander and Gans (1966). No additional Angolan material was collected until recent surveys in southeastern Angola (Conradie et al. 2016) and BNP (Butler et al. 2019). Broadley and Broadley (1997) recognized five groups within *Z. quadrifrons*. Additional voucher specimens and genetic material are necessary to confirm species identification, and to evaluate the validity of Monard's taxon "*ambuellensis*" for Angolan material (Branch et al. 2019c). Found in the same habitat as *M. infuscata*.

Chamaeleonidae

Chamaeleo dilepis quilensis (Bocage, 1886)
Quilo Flap-necked Chameleon (Fig. 16)
Material: NB760 (33); NB 1084 (C1).
Comment: This subspecies is common and widespread throughout Angola (Marques et al. 2018). It was recently recorded in BNP (Butler et al. 2019) and observed throughout the park, and it has been historically recorded near BNP (Monard 1937b; Haacke, TM).

Gekkonidae

Chondrodactylus aff. *laevigatus* (Fischer, 1888)
Button-scaled Gecko
Comment: A large individual of the genus *Chondrodactylus* was observed on buildings at Carmira Farm (N. Baptista, pers. obs.), but it was not photographed or collected, and is provisionally assigned to *C. laevigatus* based on recent records of this species from BNP (Butler et al. 2019). Records from near the park in Mulondo (Schmidt 1933, as *Pachydactylus stellatus*), and Humbe (Monard 1937b, as *P. bibroni*) are also assigned to this taxon, which is known to occur in southwestern Angola (Marques et al. 2018).

Lygodactylus angolensis Bocage, 1896
Angola Dwarf Day Gecko (Fig. 17)
Material: NB517 (31).
Comment: Specimens of this taxon were first described as *L. capensis* by Bocage (1895), who subsequently assigned them to a new species, *L. angolensis*, described

Fig. 13. *Monopeltis* cf. *anchietae*, Carmira Farm (*Photo by L. Gata*).

Fig. 14. *Monopeltis infuscata*, Carmira Farm.

Fig. 15. *Zygaspis quadrifrons*, Carmira Farm.

Fig. 16. *Chamaeleo dilepis quilensis*, BNP.

from Hanha, Benguela Province (Bocage 1897). Schmidt (1933) described a new species of dwarf day gecko, *L. laurae*, which was later synonymized with *L. angolensis* (Marques et al. 2018; Branch et al. 2019c). Widely distributed through Africa, localities in Angola were compiled by Marques et al. (2018) and include Chimboa da Hanha (= Capira); Cacondo (= Caconda), 2 km W of; Cubal; Cutenda, 3 km S of; Negola, 6 km S of; and Quimbango (Haacke, TM). The single BNP specimen conforms to the original description of *L. angolensis* in scalation and coloration, and is similar to specimens collected in the urban environments of Lubango (Baptista, unpub. data). Specimens collected at the same localities (BNP and Lubango) on other occasions have been assigned to *L. bradfieldi* (Butler et al. 2019), and these observations deserve further morphological and genetic comparisons.

Pachydactylus punctatus Peters, 1854 complex
Speckled Thick-toed Gecko (Fig. 18)
Material: NB513 (14); NB514 (T1); NB515 (T1); NB530 (T3); NB773 (34); NB774 (34); NB775 (34).
Comment: This species was recorded in southwestern Angola (Monard 1937b; Laurent 1964; Marques et al. 2018), including Kului, near BNP (in Monard 1937b as *P. serval*, assigned to *P. punctatus* by Bauer et al. 2006). BNP specimens are morphologically different (larger, sturdier, paler, and with a different blotching pattern) from other specimens found in Tundavala and Lubango, Huíla Province (Baptista et al. 2018; Butler et al. 2019), that are also assigned to the *P. punctatus* complex. These lizards also inhabit different habitats and microhabitats (found on the ground in rocky areas in Tundavala; under the bark of fallen logs in recently burnt areas during the day and in leaf litter near a dirt road during the night in BNP) and very likely belong to different species. Tundavala is along the high altitude edge of the Angolan plateau (above 2,000 m asl) and, given the very specious nature of this genus (Heinicke et al. 2017) and the existence of cryptic diversity reported in Angola (Branch et al. 2017), the taxonomic status of this complex requires further investigation.

Gerrhosauridae

Gerrhosaurus bulsi-multilineatus complex
Plated Lizard (Fig. 19)
Material: NB531 (31); NB776 (2); NB777 (3).
Comment: Five species of *Gerrhosaurus* are known to exist in Angola: *G. auritus*, *G. bulsi*, *G. multilineatus*, *G. nigrolineatus*, and G. *skoogi* (Branch et al. 2019c). *Gerrhosaurus nigrolineatus* is recorded in areas adjacent to BNP, in Capelongo and Mulondo (Monard 1937b), and from the surroundings of Cahama (Haacke, TM).

Fig. 17. *Lygodactylus angolensis*, BNP.

Fig. 18. *Pachydactylus punctatus* complex, BNP.

Fig. 19. *Gerrhosaurus bulsi-multilineatus* complex (juvenile), BNP.

Bates et al. (2013) discussed the problematic status of Angolan populations referred to as *G. nigrolineatus*, and species boundaries within the *G. bulsi-multilineatus* complex remain unresolved. Assignment of recently collected specimens is pending until genetic assessment of the Angolan material is published (M. Bates, pers. comm.). Specimens collected recently in BNP by Butler et al. (2019) were assigned to *G.* cf. *multilineatus*. One juvenile was collected in the Main Camp (Fig. 19), and adults were collected from burrows in degraded shrubland near the park boundary, and they are similar to the specimen illustrated in Butler et al. (2019).

Lacertidae

Ichnotropis capensis (Smith, 1838)
Cape Rough-scaled Lizard (Fig. 20A–B)
Material: NB771 (34); NB772 (34); NB779 (12); photographic record (M. Finckh, site 43).
Comment: *Ichnotropis capensis* and *I. bivittata* are known to occur sympatrically in Angola (Laurent 1964; Marques et al. 2018), and five taxa within this genus are listed for Angola (Marques et al. 2018; Branch et al. 2019c). The systematics of the genus *Ichnotropis* is poorly established (Laurent 1964), and while there is no recent systematic revision of the group (Edwards et al. 2013), a thorough historical revision was recently published (Berg 2017). According to this, two subspecies of *I. capensis* occur in Angola, *I. c. capensis* (Smith, 1838) and *I. c. overlaeti* Witte and Laurent, 1942, with the latter being restricted to northern Angola (Marques et al. 2018). Rough-scaled lizards have recently been collected in BNP and were referred to *Ichnotropis bivittata pallida* Laurent, 1964 (Butler et al. 2019), but we have regarded them as *I. capensis,* given that *I. b. pallida* is morphologically distinct, and occurs in higher altitudes, such as Humpata (Laurent 1964). Specimens from BNP have a bright orange/red lateral line that is more evident in males than in females, and living males have a bright yellow chin and chest (Fig. 20A–B) that becomes bleached when preserved. Detailed and comprehensive studies of species within this genus in Angola are needed.

Fig. 20. *Ichnotropis capensis*, BNP. (**A**) Female; (**B**) male.

Scincidae

Mochlus sundevalli (Smith, 1849)
Sundevall's Writhing Skink (Fig. 21)
Material: One unlabelled bleached specimen in Carmira Farm's private collection.
Comment: Widespread throughout eastern and southern Africa, in Angola this species is recorded from the coastal plains south of Cuanza River, lower Cuando River basin (records compiled in Marques et al. [2018]), and northeastern Angola in Dundo (Laurent 1964).

Panaspis wahlbergi-maculicollis complex
Snake-eyed Skink (Fig. 22A–B)
Material: NB516 (T3); NB548 (T1); NB549 (T2).
Comment: Small leaf-litter inhabiting skinks have numerous cryptic lineages in southern and eastern Africa (Medina et al. 2016). Historically, Bocage (1895) reported on material from Caconda and Cahata collected by Anchieta, and recently *P. maculicollis* was recorded from southeastern Angola (Conradie et al. 2016). A population of "*P. wahlbergi*" in northern Namibia was shown to form part of the *P. maculicollis* complex (Medina et al. 2016) and was subsequently described as a new species, *Panaspis namibiana* (Ceríaco et al. 2018a). Snake-eyed skinks recently collected in BNP were assigned to *P.* aff. *namibiana* (Butler et al. 2019). BNP specimens from this study have fused anterior parietals, conforming to the *P. wahlbergi* complex, but prefrontals are well separated (see Fig. 22B), distinguishing them from *P. namibiana* (Ceríaco et al. 2018a). The taxonomic status of the BNP

Fig. 21. *Mochlus sundevalli*, Carmira Farm.

population and its affinities to the *P. maculicollis* or *P. wahlbergi* radiations requires further study, as do other Angolan populations from Humpata, Quilengues, and the Cuanza Sul escarpment (Vaz Pinto and Baptista, unpub. data).

Trachylepis spilogaster (Peters, 1882)
Kalahari Tree Skink
Material: NB519 (31); NB527 (10); NB528 (9); NB529 (13); NB532 (6); NB533 (9); NB778 (31).
Comment: Recently recorded in BNP (Butler et al. 2019), it was the most frequently observed reptile species during the BNP surveys, and together with *Pachydactylus puntactus*, was one of only two species to be found in the park's woodlands after recent fires.

Varanidae

Varanus albigularis angolensis Schmidt, 1933
Angolan Savanna Monitor (Fig. 23)
Material: One photographic record (M. Finckh, site 40).
Comment: Several records of *Varanus albigularis* from Angola have been assigned to two different subspecies (Marques et al. 2018). Schmidt (1933) described *V. a. angolensis* from 'Gaúca, Bihe' (= Zaúca River, Malanje) (Crawford-Cabral and Mesquitela 1989), and the BNP record is assigned to this taxon. This species still needs a wide-ranging phylogenetic assessment. The individual was observed in the ecotone between grassland and woodlands.

Serpentes
Colubridae

Crotaphopeltis hotamboeia (Laurenti, 1768)
White-lipped Herald Snake
Material: NB522 (41); four unlabelled specimens in Carmira Farm's private collection; one photographic record from Handa Farm (J. Traguedo, HF).
Comment: A widespread and common species in Angola (Marques et al. 2018), found active at night, on the edge of Lagoa Nougalafa (= Nugarrafa, = Nongalafa).

Fig. 22. *Panaspis wahlbergi-maculicollis* complex, BNP. Head (**A**) lateral view and (**B**) dorsal view.

Dispholidus typus viridis (Smith, 1838)
Green Boomslang (Fig. 24)
Material: Two unlabelled bleached juvenile specimens in Carmira Farm's private collection; one photographic record (L. Gata, CF).
Comment: Branch (2018) provides an overview of the two subspecies of boomslang existing in Angola, *D. t. punctatus* and *D. t. viridis*. These were shown to deserve full species status (Eimermacher 2012), but this taxonomic adjustment requires further consensus. Neither scalation nor juvenile coloration allow assignment of the Carmira Farm specimens to either taxon, but the green coloration of a photographed adult (Fig. 24) is consistent with *D. t. viridis* **(**Eimermacher 2012), as are other material from Humbe. Resolution of species boundaries in *Dispholidus* and the assignment of Angolan populations requires further genetic studies.

Philothamnus semivariegatus (Smith, 1840) *sensu lato*
Spotted Bush Snake (Fig. 25)
Material: Two unlabelled bleached specimens in Carmira Farm's private collection; one photographic record from Handa Farm (J. Traguedo, HF).
Comment: The complex taxonomic history of this species is discussed by Branch (2018). We cautiously assign specimens from Carmira Farm to *P. semivariegatus* based on scalation (three supra-labials entering orbit, temporal arrangement 2+2, and keeled ventrals), however, coloration of specimens from both farms did not have any markings (atypical of *P. semivariegatus*).

Fig. 23. *Varanus albigularis angolensis*, BNP (*Photo by M. Finkch*).

Fig. 24. *Dispholidus typus viridis*, Carmira Farm (*Photo by L. Gata*).

Historical records from Angola were compiled (Marques et al. 2018), and additional records include coastal lowlands in Benguela Province (Vaz Pinto, unpub. data). This species is paraphyletic having at least four different lineages (Engelbrecht et al. 2019), and the Carmira Farm specimens might group with clade 4. Records of *P. angolensis* from Capelongo (Bogert 1940) and Humbe (Haacke, TM) deserve careful comparison with this material.

Thelotornis capensis oatesi (Günther, 1881)
Oates' Vine Snake (Fig. 26)
Material: NB1065 (5).
Comment: Widely distributed in Angola, with records from Hanha (Bogert 1940), Chitado (Hellmich 1957), Alto Chicapa (Laurent 1964), and Longa (Conradie et al. 2016). The specimen collected in BNP conforms in coloration and scalation to this subspecies (see Fig. 26).

Elapidae

Dendroaspis polylepis Gunther, 1864
Black Mamba
Material: Shed skin found in BNP. Photographic records (L. Gata, CF; J. Traguedo, HF).
Comment: This species is recorded from several localities in Angola (Marques et al. 2018). Locally known as "kuiva" (J. Traguedo, pers. comm.).

Naja anchietae Bocage, 1879
Anchieta's Cobra (Fig. 27A–B)
Material: NB793 (21); NB250 (banded morph) [HF].
Comment: Branch (2018) discusses the description, history, and taxonomy of *N. anchietae* in Angola. This is a common species occurring in southern Angola, with known records compiled by Broadley (1995). Recent records are from Malanje Province (Ceríaco et al. 2014, Vaz Pinto, unpub. data), on the edge of the plateau in Tundavala (Baptista et al. 2018), Cassinga (Vaz Pinto, unpub. data), and Bimbe (Baptista and Vaz Pinto, unpub. data).

Naja nigricollis Reinhardt, 1843
Black-necked Spitting Cobra (Fig. 28)
Material: Photographic record (J. Traguedo, HF).
Comment: The taxonomy of African cobras (*Naja*) has undergone significant changes in recent years (Branch 2018). The name *Naja nigricollis* has a complex history of synonymies and varieties, and only when two varieties, *N. n. nigricincta* and *N. n. woodi,* were elevated to full species, was the name *N. nigricollis* stabilized to represent a species (Wuster et al. 2007). It is widespread

Fig. 25. *Philothamnus semivariegatus sensu latu*, Carmira Farm.

Fig. 26. *Thelotornis capensis oatesi*, BNP (*Photo by T. António*).

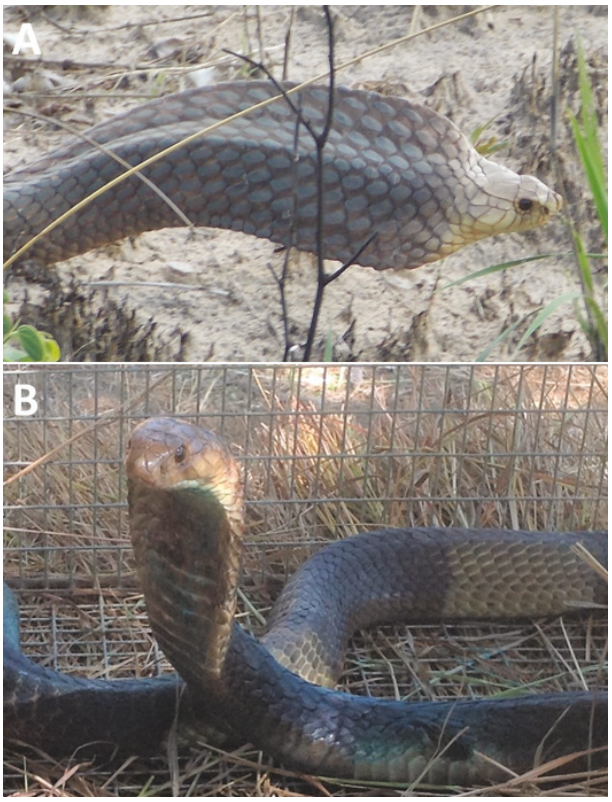

Fig. 27. *Naja anchietae*. (**A**) BNP (*Photo by F. Maiato*); (**B**) Handa Farm (*Photo by J. Traguedo*).

in Angola, but avoids dense forest. Locally known as "turula n'jila" (J. Traguedo, pers. comm.).

Lamprophiidae

Amblyodipsas ventrimaculata (Roux, 1907)
Kalahari Purple-glossed Snake
Material: NB595 (20); one individual seen in grasslands near lake from Main Camp (site T3), not collected.
Comment: The specimen's scalation (15 midbody scale rows, 21 subcaudals, 203 ventrals, five upperlabials, 2nd and 3rd entering the eye) and coloration (similar to specimen illustrated in Butler et al. [2019]) conform to *A. ventrimaculata* (Branch 1998; Marais 2004). Together with Butler et al. (2019), BNP is the second record of this species for Angola, the first being from the Cuito River source (Portillo et al. 2018; Branch et al. 2019c), and represents a northwestern extension of the known range (Botswana, Zimbabwe, Namibia, and Zambia).

Boaedon angolensis (Bocage, 1895)
Angolan House Snake (Fig. 29A–B)
Material: One unlabelled bleached specimen in the private collection of Carmira Farm.
Comment: This species was recently recorded from BNP (Butler et al. 2019). The scalation of the Carmira Farm specimen (23 midbody scale rows, 116 ventrals, more than 55 subcaudals, see Fig. 29A–B for head scalation), accords with the revision of Angolan house snakes currently in progress (Hallermann et al., unpub. data).

Fig. 28. *Naja nigricollis*, Handa Farm (*Photo by J. Traguedo*).

Prosymna angolensis Boulenger, 1915
Angolan Shovel-snout Snake (Fig. 30)
Material: NB521 (T1).
Comment: Originally described from Huíla, Angola (discussion on type locality in Branch [2018]), this species was recorded historically from southwestern and central Angola (Marques et al. 2018), and more recently, from the southeast of Angola (Conradie et al. 2017) and Tundavala (Baptista, unpub. data). Its upper and lower labials, ventral scales (145), and low subcaudal counts (16) conform to the species characterization (Bocage 1895, as *P. frontalis*). It has gray coloration with a dark blotch behind the head, a series of paired dark spots along the back, and immaculate white/creamish belly and flanks. It was found in sandy soils in miombo woodlands.

Psammophis mossambicus Peters, 1882
Olive Grass Snake (Fig. 31)
Material: NB 518 (head only) (T1); photographic record (J. Traguedo, HF).
Comment: This species belongs to the *P. sibilans* complex (Kelly et al. 2008, Trape et al. 2019). The collected snake had a uniformly pale-yellow belly, and dorsal coloration was plain gray with a thin darker vertebral dash. Head scalation and ventral (159) and subcaudal (80) scale counts recorded from the specimen conform to *P. mossambicus* (Broadley 2002, Trape et al. 2019). It is locally known as "muiha on njolo" (J. Traguedo, pers. comm.).

Psammophis subtaeniatus Peters, 1882
Stripe-bellied Sand Snake (Fig. 32)
Material: Four unlabelled specimens from Carmira Farm private collection; one photographic record (L. Gata, CF).
Comment: This species is restricted to the semi-arid scrubland and mopane woodland, above and below the escarpment in southwestern Angola (Branch 2018). Additional recent records include specimens from Equimina and Serra da Neve (Vaz Pinto and Baptista, unpub. data).

Fig. 29. *Boaedon angolensis*, Carmira Farm. Head (**A**) lateral view and (**B**) dorsal view.

Pseudaspis cana (Linnaeus, 1758)
Mole Snake
Material: One unlabelled specimen from Carmira Farm private collection; one photographic record (L. Gata, CF).
Comment: This snake is known from several localities in Angola (Branch 2018; Marques et al. 2018) and was recently found in BNP (Butler et al. 2019).

Xenocalamus bicolor bicolor Günther, 1868
Slender Quill-snouted Snake (Fig. 33A–B)
Material: Two unlabelled specimens in the private collection of Carmira Farm.
Comment: *Xenocalamus bicolor* is only recorded in Angola from a northern subspecies described in the northeast of the country, *X. b. machadoi* (see Broadley 1971; Branch 2018; Marques et al. 2018). It occurs in the Zambezi Region and adjacent western Zambia, and it is usually associated with Kalahari sands (Branch et al. 2019). Its presence was considered to be likely for southeastern Angola (Branch et al. 2019), and this record is the first for the country. The presence of supraoculars separating the frontals from contacting the orbit (Fig. 33B), conforms to *X. b. bicolor*, as does the number of ventrals (204, 233) [Broadley 1971]. *Xenocalamus b. bicolor* is known to have great intraspecific variation in coloration, and this feature is rarely diagnostic (Broadley 1971). The patterns of both Carmira Farm specimens resemble the "*maculatus*" phase described by Broadley (1971), but more heavily marked (Fig. 33A).

Fig. 30. *Prosymna angolensis*, BNP.

Leptotyphlopidae

Namibiana aff. *rostrata* (Bocage, 1886)
Angolan Beaked Thread Snake (Fig. 34)
Material: NB599 (HF).
Comment: Thread snakes are a difficult group to study due to their very small size and conservative morphology (Broadley and Broadley 1999; Branch 2018). *Namibiana rostrata* is endemic to Angola, and originally described from Humbe, ca. 110 km south of BNP. It has recently been recorded from BNP (Butler et al. 2019), and we provisionally assign the specimen from Handa Farm to the same species. Haacke (TM) collected two thread snakes, one from Paiva Couceiro (= Quipungo, TM45190), around 30 km southeast of Handa Farm, and another from Hoque (TM 46699), ca. 77 km northwest of BNP,

Fig. 31. *Psammophis mossambicus*, Handa Farm (*Photo by J. Traguedo*).

Fig. 32. *Psammophis subtaeniatus*, Carmira Farm.

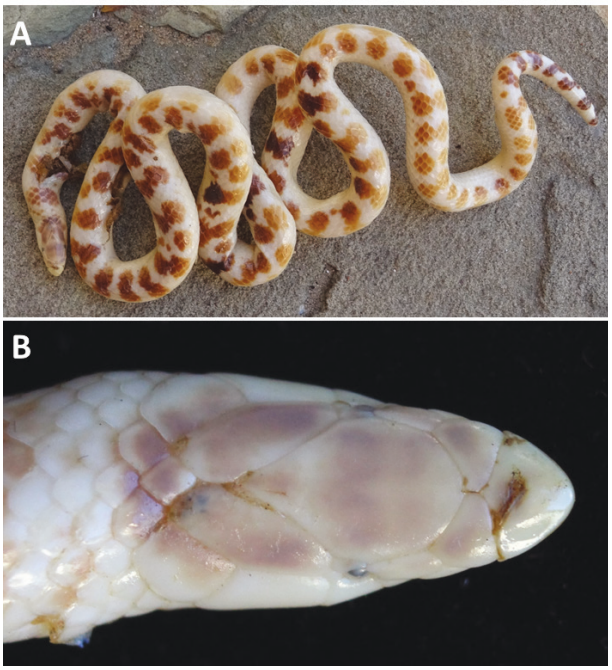

Fig. 33. *Xenocalamus bicolor bicolor*, Carmira Farm. (**A**) Full specimen; (**B**) dorsal view of head.

Fig. 34. *Namibiana* aff. *rostrata*, Handa Farm.

both identified as *Leptotyohlops scutifrons scutifrons*. All these records should be carefully compared to confirm species identification.

Pythonidae

Python anchietae Bocage, 1877
Namib Dwarf Python
Comment: *Python anchietae* is endemic to the Namib Desert and adjacent areas in Angola and Namibia. It was collected in Viriambundo (Haacke, TM), ca. 30 km west of BNP. Although this is a historical record, it is discussed in the species accounts here due to its relevance. This is the fourth known record of this near-endemic species in the country, after the type locality Catumbela (Bocage 1887), Hanha (Bogert 1940), and between Lobito and Hanha (Laurent 1964), and the first record above the Angolan escarpment. In Namibia, it occurs inland up to near Windhoek, indicating that the species may extend further inland in Angola and occur in BNP.

Fig. 35. *Afrotyphlops* cf. *schlegelii*, BNP (*Photo by M. Finkch*).

Python natalensis Smith, 1840
Southern African Python
Material: NB794 (1); one individual observed in BNP's hide for game viewing (27); one photographic record from Carmira Farm (L. Gata, CF); several photographic records from Handa Farm (J. Traguedo, HF).
Comment: Two species of African python exist in Angola, the northern *P. sebae*, and the southern *P. natalensis* (Branch 2018). Material from BNP belongs to *P. natalensis*.

Typhlopidae

Afrotyphlops cf. *schlegelii* (Bianconi, 1849)
Schlegel's Blind Snake (Fig. 35)
Material: Photographic record (M. Finckh, 39).
Comment: One specimen was photographed after heavy rainfall at night (nearly 100 mm of precipitation). Dorsal coloration was dark yellowish with scattered dark blotches (Fig. 35) and snout-vent length measured around 70 cm (M. Finckh, pers. comm.). *Afrotyphlops schlegelii* is a sister species of *A. mucruso*, and both have been recorded from Angola. Marques et al. (2018) limit *A. mucruso* to northeastern Angola, and *A. schlegelii* to the southwest, and Haacke (TM) also has records for Huíla Province (as *Rhinotyphlops schlegelii petersii*). A taxonomic discussion is presented in Broadley and Wallach (2009), and further discussions of both species in Angola are presented by Conradie et al. (2016) and Branch (2018). Confident identification requires additional material, and the genus deserves further taxonomic revisions.

Viperidae

Bitis arietans Merrem, 1820
Puff Adder
Material: NB713 (19); one photographic record and one specimen from Carmira Farm private collection.
Comment: Common and widespread in Angola, recorded from several localities (Bocage 1895; Ferreira 1897; Schmidt 1933; Bogert 1940; Hellmich 1957; Laurent 1950, 1954, 1964; Thys van der Audenaerde 1967; Manaças 1981; Conradie et al. 2016), with few

Fig. 36. *Causus rhombeatus*, Handa Farm (*Photo by J. Traguedo*).

records from the southwest (Branch 2018; Marques et al. 2018). In Angola, it is widely known as "surucucu."

Causus rhombeatus (Lichtenstein, 1923)
Rhombic Night Adder (Fig. 36)
Material: Photographic record from Handa Farm (J. Traguedo, HF).
Comment: The taxonomy of night adders in Angola has long been confusing (Branch 2018). *Causus bilineatus* was described from a variety of *C. rhombeatus* by Boulenger (1905), but synonymies and species validity remained problematic until a recent revision by Rasmussen (2005), who reassessed *C. bilineatus* and related species, mapped the geographic distribution of Angolan night adders, and provided a key to the genus. Scale counts could not be made on the specimen from Handa Farm, although the photographed snake had a very conspicuous V-shaped marking on the head, 25 well-separated dark conspicuous rhombic vertebral markings occasionally with a white contour against a paler background, and lacked dorsolateral stripes (Fig. 36). It was therefore assigned to *C. rhombeatus*, which is widespread in Angola (Rasmussen 2005; Marques et al. 2018).

Testudines
Pelomedusidae

Pelomedusa subrufa (Bonnaterre, 1789)
Marsh Terrapin
Material: NB780 (35); photographic record (M. Finckh, site 43).
Comment: This species is widespread in southern, eastern, and western Africa (Branch 2012; Turtle Taxonomy Working Group 2017). It has been recorded from several localities in Angola (Marques et al. 2018), and recently from BNP (Butler et al. 2019). Petzold et al. (2014) recorded unexpected species diversity in a molecular phylogeny of *Pelomedusa* and referred northern Namibian material to *P. subrufa*.

Testudinidae

Kinixys cf. *belliana* Gray, 1831
Bell's Hingeback Tortoise
Material: NB711 (18); NB712 (17); NB509 (16) (tissue only); photographic record (M. Finckh, site 43).
Comment: In a molecular phylogeny of *Kinixys*, only *K. belliana* was shown to occur in Angola (Kindler et al. 2012). However, only northern Angolan material was included and it is very likely that *K. spekii* may enter southern Angola (see Marques et al. 2018), thus the identification as *K. belliana* is tentative. This group is widely distributed in Angola (Marques et al. 2018) and has recently been collected in BNP (Butler et al. 2019). This species has been observed at several sites throughout the park and is locally harvested for consumption and for the pet trade.

Crocodilia
Crocodilydae

Crocodylus niloticus Laurenti, 1768
Nile Crocodile
Material: Interviews.
Comment: Staff from BNP referred to the existence of this species in the Cunene River, the eastern boundary of the park. Historical records mention its occurrence in the area (Monard 1937b; Simões 1971).

Discussion

This account presents one new record for the country (*Xenocalamus bicolor bicolor*), as well as records of reptile species that are potentially new to science (*Pachydactylus*, *Namibiana*). Butler et al. (2019) reported eight amphibian taxa and 21 reptile taxa (two testudines, 14 lizards, and five snakes) from BNP and adjacent Capelongo, while this study doubles the number of amphibian species (16), and almost quadruples the number of snake species (18) encountered. These increases in known species diversity are more significant when compared to the total species counts (94, including historical records) for the region. Despite the considerable udpate in knowledge that this study presents, further surveys are likely to describe additional diversity. Closely related taxa recorded in this study and by Butler et al. (2019), namely *Lygodactylus angolensis* and *L. bradfieldi*, require further research and comprehensive comparisons to confirm whether they refer to sympatric congeneric species or different designations of the same taxa.

Ambiguous taxonomy reflects the unresolved status of Angolan herpetology, as the bulk of species accounts

presented here refer to problematic taxonomy and a lack of supporting studies. This is true even for the BNP region, which is situated within the southwest, the more thoroughly studied part of the country. This knowledge gap reinforces the importance of promoting surveys which include voucher specimens and DNA sample collections published with survey results, as highlighted previously (Russo et al. 2019). The inclusion of DNA barcoding for identification purposes is increasingly common (Bittencourt-Silva 2019) and provides a more comprehensive understanding of the results. Although not included in the scope of this publication, biopsies and specimens collected are being used for ongoing studies (Baptista et al., unpub. data; Lobon-Rovira et al., unpub. data).

The herpetofauna of the BNP region is similar to that of other regions further east where Kalahari sands are also the dominant substrate. It shares 12 amphibian and 30 reptilian species with southeastern Angola (Conradie et al. 2016); seven amphibian and 20 reptilian species with western Zambia, Ngoye Falls, and surrounding areas (Pietersen et al. 2017); and nine amphibian and five reptilian species with recently surveyed areas of west Zambia (Bittencourt-Silva 2019).

In a study of herpetofauna in the southern Kalahari domain, Haacke (1984) noted the relevance of a latitudinal rainfall gradient as a driver of diversity in the Kalahari. This gradient affects vegetation canopy structure on a wide scale in Botswana (Scholes et al. 2004), and it is also reflected in the avifauna species assemblages of BNP, which comprise biome-restricted species from both the northern Angolan Miombo Woodland and the southern Zambezian Baikiaea Woodland ecoregions (Dean 2000; BirdLife International 2018). The effect of this gradient on the herpetofauna of BNP is not yet known, and would be an interesting research topic for understanding the relevance of BNP for conserving herpetofauna. Records of species that were previously only reported from the coastal plain of Angola, such as *Python anchietae*, have shown that they occur above the escarpment. This shows how studying the park's herpetofauna may also contribute to understanding the west-to-east altitudinal and rainfall gradients, and the distribution limits of plateau and lowland species.

Monopeltis perplexus, an endemic Angolan amphisbaenian, was originally described from a vague type locality: "Hanha or Capelongo" (see discussion in Branch et al. 2018). If Capelongo (9 km northeast of BNP) is confirmed as the type locality, *M. perplexus* is likely to occur in BNP and would be sympatric with *M. anchietae* and *M. infuscata*. Sympatric distributions of amphisbaenians highlight the importance of Kalahari sands for fossorial species. Although fossorial species are well represented in the BNP region, the absence of fossorial groups such as *Acontias*, *Typhlacontias*, and *Sepsina*, which have been recorded from adjacent areas on Kalahari sands (Monard 1937b; Branch and McCartney 1992; Haacke 1997; Conradie et al. 2016; Pietersen et al. 2017; Marques et al. 2018; Bittencourt-Silva 2019) is likely a result of undersampling.

Rupicolous species such as *Cordylus machadoi*, *Matobosaurus maltzahni*, *Hemirhagerrhis viperina*, and *Agama p. schaki* were not found in the park despite historical records, likely as a reflection of the rarity of rocky outcrops. Substrate specificity and isolation have important influences on the geographic distribution of reptiles, especially lizards, and are considered better determinants of presence than vegetation type (Bauer and Lamb 2005; Roll et al. 2017). Endemic sand-adapted reptiles were reported in the Kalahari (Haacke 1984). The BNP region has a small contact zone with the larger Kalahari sands block to the east (Missão de Pedologia de Angola 1959; Huntley 2019). Moreover, the park is delimited in the east by the large Cunene River, which may be a barrier to species dispersal, much like the Zambezi River (Pietersen et al. 2017). The combination of factors driving speciation in the BNP region, especially for fossorial species, is thus still unclear, and may be clarified by assessing the genetic divergence between BNP specimens and those from the easternmost regions of the Kalahari sands (e.g., southeastern Angola).

Commercial and small-scale farms occupy large portions of northwest BNP (Mendelsohn and Mendelsohn 2018). Additional disturbances include poaching and conversion of woodlands into thickets and shrubland following intense and frequent fires (Mendelsohn and Mendelsohn 2018; Mendelsohn 2019). Several mammalian species are either extinct or on the verge of extinction in the park (Overton et al. 2017; Mendelsohn and Mendelsohn 2018), but the consequences of these disturbances for herpetofauna are largely unknown. Some species are reportedly collected opportunistically for the pet and bushmeat trades (e.g., *Kinixys*), a phenomenon that has also occurred in Cangandala National Park (Ceríaco et al. 2018c).

The establishment of protected areas generally favors the conservation of mammals, birds, and amphibians, while reptiles are usually neglected (Roll et al. 2017). Likewise, the distributions of large mammals in Angola has defined the designation of conservation areas (Huntley et al. 2019a). BNP is an Important Bird and Biodiversity Area, relevant for the conservation of avifauna (Dean 2000; BirdLife International 2018) that also supports considerable reptile diversity. Some of the species likely to occur in the park are endemic to Angola (*Monopeltis perplexus*, *Nucras broadleyi*, *Psammophylax ocellatus*, *Namibiana rostrata*), to Angola and Namibia (*Python anchietae*), or are poorly studied (*Mertensophryne mocquardi*). A better understanding of the park's herpetofauna should reinforce its important role in the conservation of Angolan biodiversity.

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Bill Branch (1946–2018) was born in London and worked as Curator of Herpetology at the Port Elizabeth Museum for over 30 years (1979–2011), and upon his retirement he was appointed as Curator Emeritus of Herpetology. His herpetological studies have focused mainly on the systematics, phylogenetic relationships, and conservation of African reptiles. He has published over 300 scientific papers, and numerous popular articles and books. The latter include: *South African Red Data Book of Reptiles and Amphibians* (1988), *Dangerous Snakes of Africa* (1995, with Steve Spawls), *Field Guide to the Reptiles of Southern Africa* (1998), *Tortoises, Terrapins and Turtles of Africa* (2008), and A*tlas and Red Data Book of the Reptiles of South Africa, Lesotho and Swaziland* (multi-authored, 2014), as well as smaller photographic guides. In 2004 Bill was the 4th recipient of the "Exceptional Contribution to Herpetology" award of the Herpetological Association of Africa. Bill has undertaken field work in over 16 African countries, and described nearly 50 species, including geckos, lacertids, chameleons, cordylids, tortoises, adders, and frogs. He supervised all tasks related to herpetology in the SASSCAL project, the creation of a herpetofauna archive in ISCED-Huíla, and many other ongoing initiatives in Angolan herpetology.

Appendix 1. List of collecting sites in Bicuar National Park, Angola, and surroundings, with coordinates (decimal degrees). Asterisks (*) indicate sites located outside of the park. Sampling method: AS = active searching or opportunistic observation; DOR = dead on road; T = trapping.

Site	Name	Latitude (°S)	Longitude (°E)	Date or date range	Sampling method	Habitat type
1	BNP, road between Tunda Gate and Main Camp	-15.610300	14.879561	6 Nov 2017	DOR	Grassland along Luconda drainage line
2	BNP, near Tchiwacussi	-15.189030	15.254460	6 Nov 2017	AS	Secondary growth scrubland in old crop fields, near Tambi drainage line
3	BNP	-15.177040	15.228570	6 Nov 2017	AS	Degraded scrubland near Tambi drainage line
5	BNP	-15.148550	14.841380	16 Mar 2018	AS	Miombo woodland with considerable bush encroachment
6	BNP	-15.130452	14.683723	6 Dec 2016	AS	Recently burnt open miombo woodland
7	BNP	-15.129961	14.730298	6 Dec 2016	AS	Temporary pond along Bicuar drainage line
9	BNP	-15.126656	14.637726	6 Dec 2016	AS	Recently burnt open miombo woodland
10	BNP	-15.126032	14.601210	6 Dec 2016	AS	Open miombo woodland
12	BNP, road along Bicuar drainage line	-15.104853	14.840320	7 Nov 2017	AS	Grassland
13	BNP	-15.100510	14.845050	6 Dec 2016	AS	Open miombo woodland
14	BNP, close to Main Camp, road to Hombo gate	-15.096715	14.839058	2 Dec 2016	AS	Leaf litter accumulated along the road, in open miombo woodland
15	BNP, drainage line upstream Main Camp water hole	-15.092432	14.836883	2 Dec 2016	AS	Grassland
16	BNP, road between Capelongo Gate and Lagoa da Matemba	-15.082880	14.928760	2 Dec 2016	AS	Dense miombo woodland
17	BNP, road between Capelongo Gate and Main Camp	-15.057374	14.932907	7 Dec 2017	AS	Dense miombo woodland
18	BNP, road between Capelongo Gate and Main Camp	-15.036282	14.959543	7 Dec 2017	AS	Mosaic of dense miombo woodland and shrubland
19	BNP	-15.160722	14.859036	7 Dec 2017	AS	Miombo woodland
20	BNP	-15.129161	14.881776	2 Jul 2017	AS	Open miombo woodland
21*	Outskirts of BNP	-14.945094	15.095214	6 Nov 2017	DOR	Degraded open shrubland
25	Lagoa da Matemba	-15.122320	14.902980	4 Nov 2017	AS	Permanent water body with aquatic vegetation
26	Lagoa do Djimbi	-15.145520	14.914670	5 Nov 2017	AS	Permanent water body
27	Main Camp water whole	-15.102406	14.836857	8 Dec 2016	AS	Permanent water body
28	Main Camp water whole	-15.098320	14.837030	7 Dec 2016	AS	Permanent water body
29	Main Camp water whole	-15.098060	14.836990	7 Dec 2016	AS	Permanent water body
30	Drainage line upstream Main Camp water whole	-15.093490	14.837450	4 Dec 2016	AS	Grassland
31	BNP Main Camp	-15.100725	14.839557	2009–2017	AS	Human facilities, sandy soils, tall Burkea africana trees, surrounded miombo woodland
32*	Outskirts of BNP	-15.060080	15.251800	6 Nov 2017	AS	Degraded open shrubland
33	BNP	-15.150060	14.812300	5 Nov 2017	AS	Miombo woodland with considerable bush encroachment
34	BNP, near Bicuar drainage line	-15.243460	14.891460	5 Nov 2017	AS	Recently burnt open miombo woodland
35	BNP, road between Hombo Gate and Main Camp	-15.024986	14.796841	4 Nov 2017	AS	Open miombo woodland with regenerating understorey

Appendix 1. List of collecting sites in Bicuar National Park, Angola, and surroundings, with coordinates (decimal degrees). Asterisks (*) indicate sites located outside of the park. Sampling method: AS = active searching or opportunistic observation; DOR = dead on road; T = trapping.

Site	Name	Latitude (°S)	Longitude (°E)	Date or date range	Sampling method	Habitat type
36	BNP, close to Main Camp, road to Hombo gate	-15.095409	14.838751	2 Nov 2016	AS	Miombo woodland
39	BNP, Tunda Gate	-15.645000	14.708333	6 Dec 2015	AS	Dry woodland on deep sands
40	BNP	-15.133300	14.900000	11 Dec 2015	AS	Ecotone between grassland and woodland
41*	Lagoa Nougalafa, outskirts of BNP	-14.977117	14.693638	6 Dec 2016	AS	Permanent water body
42*	Between Chibemba and Cahama	-16.03	14.20	15 Feb 2010	AS	Small wetland, approximate coordinates
43	BNP	-15.042928	14.805010	5 Dec 2016	AS	Border of one a grassland valley, in the ecotone between suffrutex grasslands and woodland, crossing sandy dirt road
CF*	Carmira Farm	-16.044722	14.569167	2015–2018	AS	Baikiaea/Burkea woodland, deep Kalahari sands
C1*	Road to Carmira Farm	-15.992383	14.410287	5 Apr 2018	AS	Baikiaea/Burkea woodland, deep Kalahari sands
HF*	Handa Farm	-14.699722	14.295833	2015–2018	AS	Degraded miombo woodland with overgrazing and deforestation
T1	Woodland trapline 1	-15.094405	14.838312	2–7 Dec 2016	T	Miombo woodland not burnt for more than 1 year
T2	Woodland trapline 2	-15.100358	14.838958	7–10 Dec 2016	T	Miombo woodland not burnt for more than 5 years
T3	Grassland trapline	-15.102190	14.837057	2–10 Dec 2016	T	Grassland near permanent body of water