Universidade de Évora - Escola de Ciências e Tecnologia

Mestrado em Biologia da Conservação

Dissertação

The Mammals of Iona National Park and surrounding areas, Namibe Province, southwestern Angola: a preliminary checklist

Catarina Laia Franco Albino Freixial

Orientador(es) | Luís Miguel Pires Ceríaco
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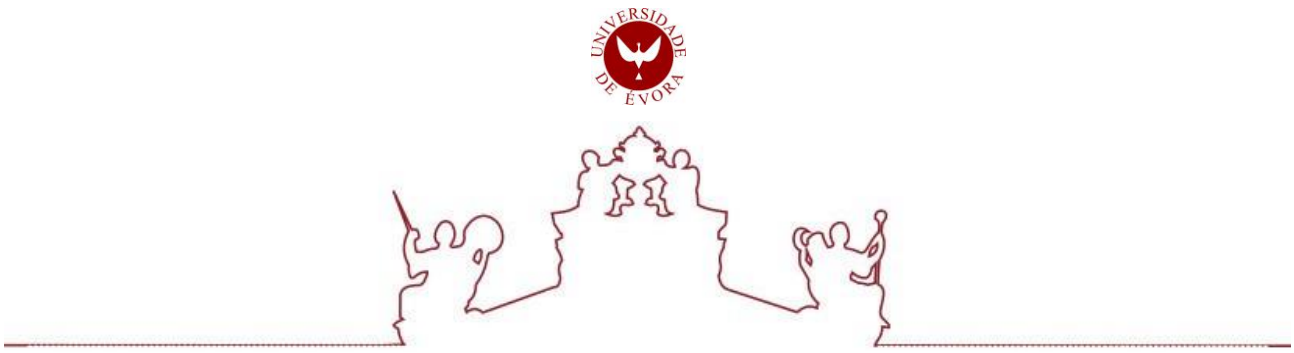

A Dissertação foi objeto de apreciação e discussão pública pelo seguinte júri nomeado pelo Diretor da Escola de Ciências e Tecnologia:

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Vogais	|	Adam Ferguson () (Arguente)
		Luís Miguel Pires Ceríaco () (Orientador)

Évora 2021

Adjustments to the dissertation due to Covid-19

My dissertation was based in field work in the Namib Desert, Angola. I went there from November 10th until December 3rd, 2019 to install camera traps equipment and perform distance sampling analyses through Iona National Park and its vicinities. The initial idea was to go back in March 2020 to collect the cameras and repeat the distance sampling analyses, to compare the data of the dry and wet seasons in the desert.

The main objective of my study was to understand the dynamics of the cheetah's prey inside the park and its vicinities. This objective came after a complaint of the owner of Omauha Farm, a lodge that is located in the vicinities of the park, about the presence of cheetahs inside the farm eating some species of ungulates present there. *Antidorcas marsupialis* and probably *Oryx gazella* were going to be the species studied here through the collected data of the distance sampling analysis.

But, due to the covid-19 pandemic, it was not possible to complete the second part of the field work. Therefore, this study had to have some changes, and with the data gathered from the first field work, the possible study was to make a checklist of the mammal's species present in the park and its vicinities.

Acknowledgements

I want to thank the Ministry of Culture, Tourism and Environment of the Republic of Angola and INBAC for providing the institutional support and permits for this work, and Range Wide Conservation Program for cheetah and African wild dogs for all the logistical and technical support.

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To my co-advisors Sara and David Elizalde another huge thank you for helping us fulfil this dream to work in Africa and being, once again, other incredible examples of what it is to be working in this area, for helping with the writing of this dissertation, for giving us your garden to sleep in and putting up with us!

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To Mr. Alvaro and Varito for letting us stay in the incredible Omauha Farm, one of the most amazing places I have ever been.

To my colleague and friend, Solange Nunes, for being my partner in this adventure and for always helping me when I needed. It was a bigger adventure having you there with me!

Last but not least I would like to thank my family, friends, cats and dogs, and André for is friendship and knowing always when I needed to catch some fresh air, but specially to my parents, that were there for me each and every step of the way, on the bad and good moments, and also for giving me the opportunity and all the support needed to go on this adventure.

The Mammals of Iona National Park and surrounding areas, Namibe Province, southwestern Angola: a preliminary checklist

Abstract

Angola has 14 protected areas throughout the country. Iona National Park is one, but due to the civil war few studies about the mammals were conducted here. This study aims to present a first preliminary checklist of the mammal fauna of this park and its surroundings. For this purpose, recent observation data (based on camera traps, opportunistic observations and records of reliable sources) and historical data (available in bibliography, museum collections and grey literature) were compiled and critically reviewed. A total of 14 orders, 37 families and 120 species were recorded for the study area. Of these, 26 species have recent records, while the remaining 94 only have historical records (where 38 are presented as potential species from the park). New data was obtained and species with no historical records inside Iona National Park were recorded, such as aardvark (*Orycteropus afer*), zorilla (*Ictonyx striatus*) and ground pangolin (*Smutsia temminckii*).

Key words

Angola; Conservation; Iona; Checklist; Mammals.

Os Mamíferos do Parque Nacional do Iona e áreas circundantes, Província do Namibe, sudoeste Angola: uma lista preliminar

Resumo

Angola tem 14 áreas protegidas ao logo do país. O Parque Nacional do Iona é uma delas, mas, devido à guerra civil, poucos estudos sobre mamíferos foram realizados aqui. Este estudo tem como objetivo apresentar a primeira lista de espécies de mamíferos deste parque e áreas circundantes. Para isso, foram compilados e criticamente revistos dados recentes (baseados em foto-armadilhagem, observações diretas e registos de fontes de confiança) e históricos (disponíveis em bibliografia, coleções de museus e literatura). Um total de 14 ordens, 37 famílias e 120 espécies foram registadas para esta área. Destas, 26 espécies têm registos recentes, enquanto as restantes 94 apenas têm registos históricos (onde 38 são apresentadas como potenciais espécies do parque). Novos dados foram obtidos e espécies sem dados históricos foram registados dentro do Parque Nacional do Iona, como o porco-formigueiro (*Orycteropus afer*), o zorilla (*Ictonyx striatus*) e o pangolim terrestre (*Smutsia temminckii*).

Palavras-chave

Angola; Conservação; Iona; Checklist; Mamíferos.

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Introduction

Angola is one of the largest countries in Africa, covering an area of approximately 1,246,700 km^2. The country's rich biodiversity is in part explained by the wide range of different habitats, changing from tropical forests in the northern parts of the country, to miombo-dominated savannas in the central parts and to desert in the southwestern regions (Marques *et al.* 2018; Huntley *et al.* 2019). Due to the 27 years of the civil war that engulfed the country until 2002, the study of Angola's remarkable biodiversity was almost completely neglected by local and foreign scientists, turning the country into one of the least explored in terms of its fauna and flora (Huntley *et al.* 2019).

A total of 16 orders, 48 families and 291 different species (plus 20 subspecies) of mammals are recorded for Angola (Beja *et al.* 2019). Of these, Rodentia is the order with most families (ten), followed by Chiroptera and Carnivora, both with eight families each (Beja *et al.* 2019; Kingdon *et al.* 2013a, 2013b; Kingdon & Hoffman 2013a). The orders Rodentia and Chiroptera combined harbour more than 50% of the diversity of mammal species in this country (Kingdon *et al.* 2013b, 2013c). The order Rodentia presents in Angola a remarkable diversity of endemic species, for example from the 48 species of the Muridae family, eight are endemic like the Angolan multimammate mouse (*Myomyscus angolensis*), Angolan marsh rat (*Dasymys nudipes*), Angolan vlei rat (*Otomys anchietae*) and others (Beja *et al.* 2019). There are a few more Angolan endemic species and subspecies in other orders, like Angolan dwarf galago (*Galagoides kumbirensis*) in the order Primates; Machado's butterfly bat (*Glauconycteris machadoi*) in the order Chiroptera; and giant sable antelope (*Hippotragus niger variani*), in the order Cetartiodactyla (Beja *et al.* 2019). This last one is an iconic species for Angola and has become one of the symbols of the country (Huntley *et al.* 2019).

Angola currently has 14 protected areas throughout the country, occupying an area of 169,249 km^2 (Mendelsohn & Mendelsohn 2018). There are nine National Parks (Iona, Cameia, Quiçama, Mupa, Bicuar, Cangandala, Mavinga, Luengue-Luiana and Maiombe); one Regional Nature Park (Chimalavera); two Integral Nature Reserves (Luando and Ilhéu dos Pássaros) and two Partial Reserves (Búfalo and Namibe) (Joubert 1971; Huntley *et al.* 2019). Some of these protected areas like Iona, Cameia, Quiçama and Bicuar were, before given that status, established as game reserves in

the 1930's, with the presence of mammals serving as the main incentive for their creation (Adams 2013; Beja *et al.* 2019; Huntley *et al.* 2019). National parks and game reserves were targets of many mammal research studies and some of those are still active today (Hill & Carter 1941; da Silva 1970; Huntley 1973; Crawford-Cabral 1989, 1998; Crawford-Cabral & Simões 1990). However, during the civil war (1975-2002), few studies were performed (Beja *et al.* 2019). In the post war period, the country progressed towards recovery with some studies but not as intense as before, due to the consequences of the war such as land mine fields, lack of researchers and infrastructure on a still to be implement new reality for government (Morais *et al.* 2018; Beja *et al.* 2019).

In 1998 the Base Law for Environment was approved, which was created to assure that the protection and preservation of certain areas was established (GoA 1998; Huntley *et al.* 2019). Meanwhile and despite that, most of these protected areas do not have the basic management capacity and effectiveness that it needs, which makes them difficult to study (Huntley *et al.* 2019). This might change soon, since Angola is aiming to change it, by improving, increasing and rearranging the management of the protected areas in the country. This change will also help the studies and conservation of the mammals and other groups of species (Beja *et al.* 2019).

This study aims to present a first preliminary checklist of the mammal fauna of Iona National Park and its surroundings. For this purpose, recent observation data and historical records available in bibliography, museum collections and grey literature were compiled and critically reviewed. Future research and the main conservation challenges faced by the mammals of Iona National Park fauna are discussed.

Iona National Park: brief description

Iona National Park (hereafter INP) was established in 1937 as Moçâmedes Game National Park and was the first protected area in Angola (Huntley *et al.* 2019). In 1957 the government changed the status to National Park, and it was given the name of Porto Alexandre National Park, and only later, in 1964, that Iona National Park received its official name (Huntley 2017; Mendelsohn & Mendelsohn 2018; Huntley *et al.* 2019; Ted Woods 2020). The park is located in the south west of Angola, inside the Namib Desert in Namibe Province (Huntley *et al.* 1971a, 1971b; Ceríaco *et al.* 2016) (Figure 1). The nearest cities are Tômbua (Porto Alexandre) and Moçâmedes (Namibe). The last one is situated 235 km (by car) and 170 km (by plane) to the north (Huntley 1971a). The park has three entrances on the north (Pediva, Salondjamba and Ponta Albina), and a base inside the park (Espinheira) (Figure 1.) (Huntley 1971a).

With an area of 15.150 km^2, INP is bordered by the Atlantic Ocean to west, the Curoca River to north and Cunene River to south (Huntley 1971a, 1971b; Kolberg & Kilian 2003; van der Westhuizen *et al.* 2017; GoA 2018; Huntley *et al.* 2019). Further south, in Namibia, just south of the Cunene River is one more protected area, the Skeleton Coast National Park, that ranges from the north of this country until another protected area, the Namib-Naukluft National Park, making this one of the biggest trans-frontier conservation area (TFCA) in the world (SADC 2015; Ted Woods 2020). To the east, INP is bounded by an escarpment that belongs to the escarpment of Serra da Leba and Chela, which divides the desert from the interior plateau (Mendelsohn & Mendelsohn 2018; Ceríaco *et al.* 2016). This escarpment is a very important geographic feature of the Namibe province as it separates the low areas of the Namib Desert with a coastal climate from the high areas of the Huíla Plateau with a tropical inland climate (Mendelsohn & Mendelsohn 2018; Ceríaco *et al.* 2016). The physiography and associated biomes present in the Namib Desert and above the Huíla Plateau are very different, harbouring very different species (Huntley *et al*. 2019).

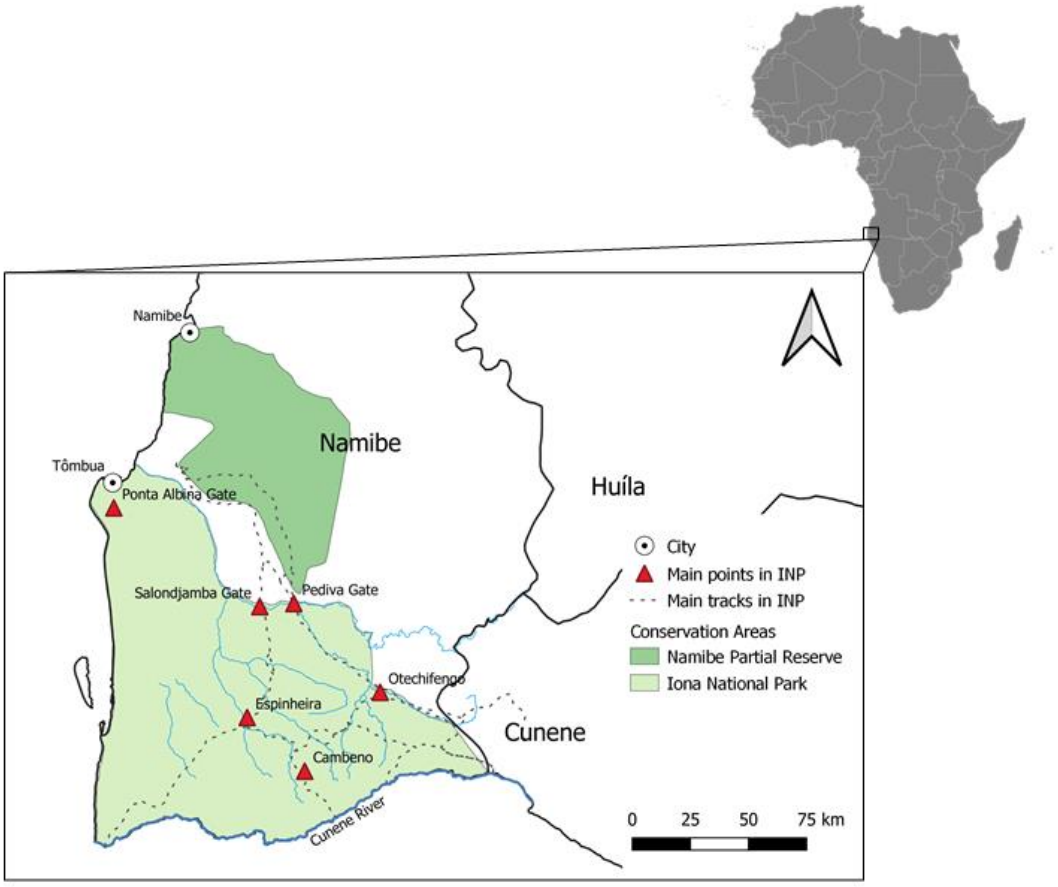

Figure 1. South west region of Angola including Iona National Park. Provincial boundaries and names are shown in black.

Despite its arid character INP hosts a considerable diversity of habitats such as desertic dunes, wide mopane (*Colophospermum mopani*) forest plains, high rocky mountains, grassy plains of the intermontane basins, deep riverbeds, cliffs, and savanna woodlands (Huntley 1971a, 1971b, 1972a, 2017). The vegetation in INP can be classified as woodlands, savannas and zones with *Colophospermum mopani*; zones near the littoral with *Acacia*, *Commiphora*, *Colophospermum*, *Ariistida*, *Schmidtia* and *Setaria*; discontinued coastal areas with *Aristida*, *Cissus*, *Salvadora* and *Welwitschia*; desert with changing dunes, *Odyssea* and *Sporobolus*; zone sub desertic; desert (Huntley 1972a). All these different characteristics inside INP can be grouped into five large areas: gravel plains (south west) (Figure 2A), desertic dunes (north west) (Figure 2B), vegetated valleys and hills (centre) (Figure 2C), high mountains (south centre) (Figure 2D), high mountains (east) (Figure 2D) (Kolberg & Kilian 2003).

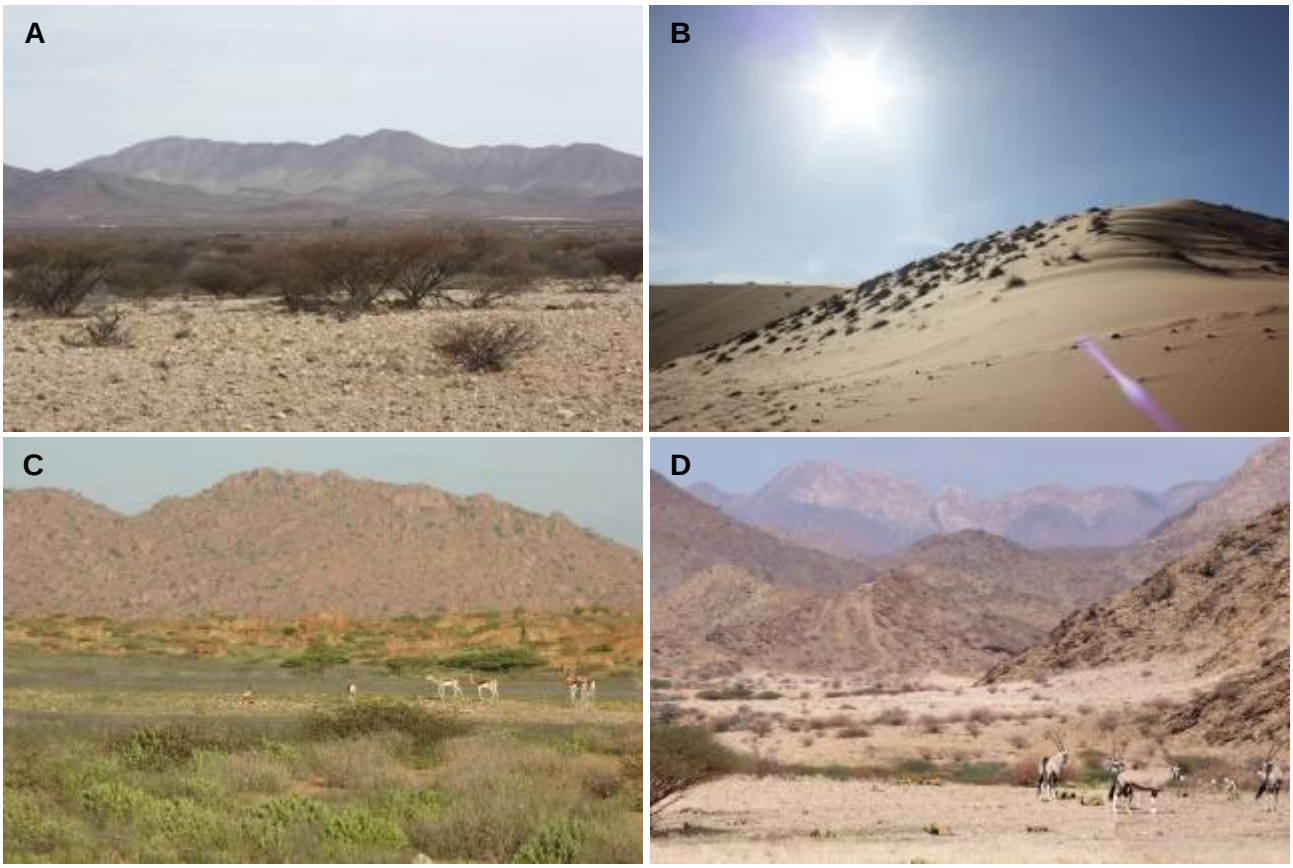

Figure 2. Examples of different habitats present in Iona National Park. A- Gravel Plains; B- Desertic Dunes; C- Vegetated Valleys with Rocky Granite outcrops; D- Vegetated Valleys with Rocky Mountains behind. Photo A and B by Catarina Freixial; C and D by Sara and David Elizalde.

Figure 3. Some of the more iconic flora species include the famous and endemic *Welwitschia mirabilis*. Photo by Catarina Freixial.

The Atlantic coast, in the southwest of Angola, is the driest region of this country, so the rain in INP is not certain every year (Mendelsohn & Mendelsohn 2018). In Angola, the rainy season normally starts in October and goes until April, but in the Namib desert this period is reduced, and it is only between January to March when there is more probability of rain in the area (Mendelsohn & Mendelsohn 2018). On the other hand, the Benguela current helps create a fog during the driest months (from May to September) that provides enough water to maintain the fauna and flora species during this period (Mendelsohn & Mendelsohn 2018; Huntley *et al.* 2019). However, some of the animals have adapted to the desert conditions, managing to lose or absorb water when they have to survive the difficulties of the desert weather (Huntley 1972a, 1972b).

The annual average temperature in INP is 18,1ºC, and for the precipitation is 18mms varying between 0 and 50mms in a year, which makes the Namib Desert the driest area of Angola (Huntley 1971a, 1974a; Mendelsohn & Mendelsohn 2018).

The Cunene river is the only permanent water source in the park and the Curoca river only flows during the wet season leaving small pools during the dry season (Huntley 1971a, 2017).

The park has very few scattered natural waterholes and some artificial ones created for cattle pastoralists. Given it's scarcity, water access rights for humans and wildlife has been a sensitive issue since at least the 1970's (Huntley 1971b).

INP is known for having some of the most iconic desert species of mammals, like aardwolf (*Proteles cristatus*), brown hyena (*Hyena brunnea*), meerkat (*Suricata suricatta*), dik-dik (*Madoqua kirkii*), klipspringer (*Oreotragus oreotragus*), springbok (*Antidorcas marsupialis*), gemsbok (*Oryx gazella*) and mountain zebra (*Equus zebra hartmannae*) (Huntley *et al.* 2019). According to Huntley (1971a) lions (*Panthera leo*), elephants (*Loxodonta africana*), black rhinoceros (*Diceros bicornis*), plain zebra (*Equus quagga*) and black-faced impala (*Aepyceros melampus petersi*) that are currently locally extinct from that area (Kingdon *et al.* 2013c; Kingdon & Hoffman 2013a; Ted Woods 2020), once habited INP. The most abundant species used to be the plain and mountain zebra (*E. quagga* and *E. z. hartmannae*), gemsbok (*O. gazella*) and springbok (*A. marsupialis*) (Huntley 1971a).

In 1971, the human and livestock population in INP was around 200 pastoralists with 2000 cattle and 1000 goats (Huntley 1971a). In 2015, the number of people living inside INP was already around 3000 (Mendelsohn & Mendelsohn 2018). According to

van der Westhuizen *et al.* (2017), the estimated number of livestock (cattle, goats, sheep and donkeys) was more than 8500 animals. The increase of pastoralists living inside the park and their livestock is threatening the wildlife (Huntley *et al.* 2019; MINAMB 2016b).

Besides, a recent checklist of the herpetofauna of the park (Ceríaco *et al.* 2016) and scattered data presented in different sources of information (see taxonomic accounts below), almost no recent data exists for the diversity and distribution of the park's fauna. This type of data is critical to foster future research but also to guide conservation and management plans.

Materials and Methods

The study area includes a northern section of Iona National Park as well as the Omauha Farm and its surroundings (Figure 4.) making a total area of 5625 km^2. Omauha Farm is a touristic complex located on the north of INP (-16.1986, 12.4008, 340m) with an area of around 50 km^2. The soil of the study area is characterized by having a big portion of desertic dunes with sandy quartz and rocky terrain (Diniz 1973). The study area includes two types of vegetation, grassy zones with mainly species from the *Aristida* genus and *Welwitschia mirabilis* and zones with *Colophospermum mopane* formation, with arid and dry plains (Diniz 1973; Estes 1989; Cardoso *et al.* 2019).

To document the mammal taxa inhabiting INP, we conducted field surveys covering most of the habitats present in the park, in November 2019 and later in June 2020. These were non-intensive surveys, mostly based on direct observation, where all the animals were observed in a transect (usually limited to the available roads). Data regarding species, number of individuals, georeferenced coordinates and locality was recorded and noted on the application SMART (SMART 2020). Indirect records (such as tracks and scats) were also recorded. No traps or methods specific for micro-mammals and bats were used. We also deployed a total of 40 camera traps using two camera-trap models: Panthera V6 and Cuddeback X-Change Color (four of these with infrared technology).

In order to be consistent with other studies (Funston *et al.* 2017; Elizalde *et al.* 2019; Groom *et al.* 2018; Overton *et al.* 2017), the study area was divided into a grid of 25 cells of 15x15 km (225 km^2), each cell representing a sampling unit (Figure 4). Given this protocol was originally designed to capture evidence of wide-ranging carnivore species (e.g., cheetah), it was necessary to adapt the grid size and divide each of the last cells into four smaller sampling units, making a total of 100 cells of 7,5x7,5 km (56,25 km^2). The adaptation of the grid size was a compromise between maximizing coverage to avoid large gaps between camera traps and ensuring documentation of small-ranged species. This survey design will help make the results comparable with future studies. The cameras were distributed across the study area, setting one camera per grid square, in places where it was more likely to capture a cheetah (for example, near potential play trees, riverbed, or near places with possible cheetah dung). Of the 40 cameras, 31 were deployed inside the limits of INP, five were installed inside the Omauha Farm and the remaining four in its vicinities (Figure 4.).

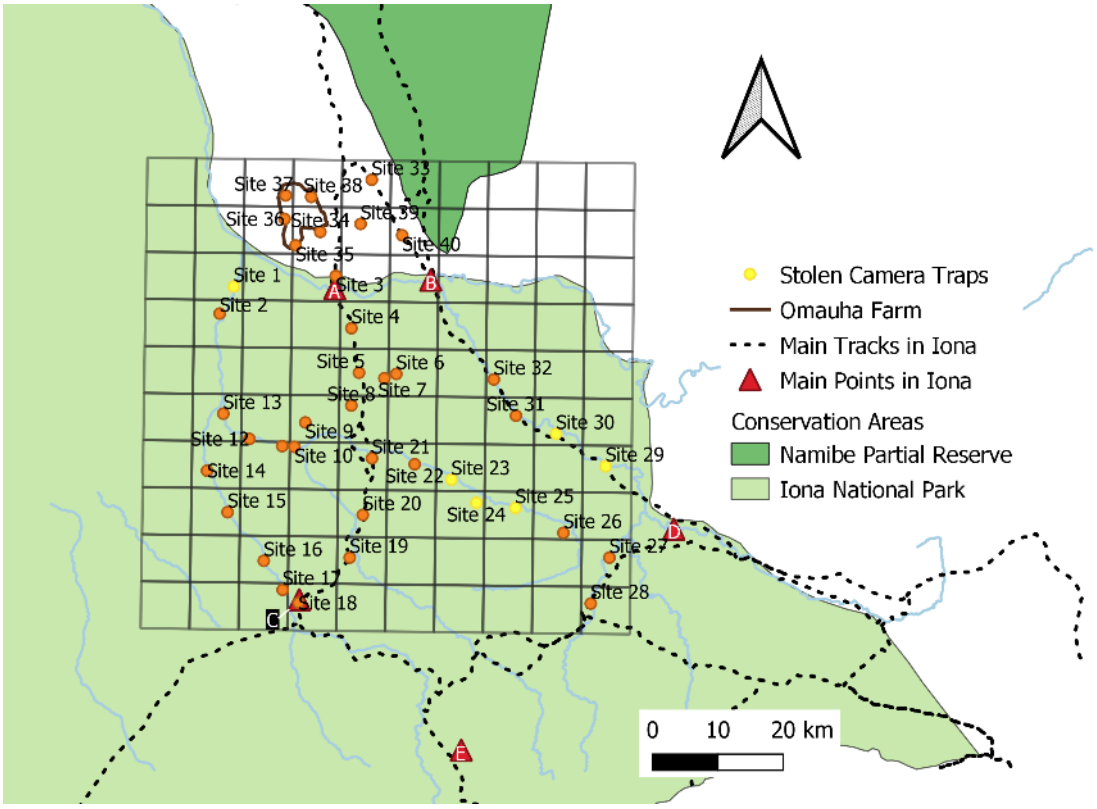

Figure 4. Map of the study area with the 7,5x7,5 km grid and the locations of the 40 camera trap sites. The yellow dots represent the stolen camera sites, and the orange dots the remaining camera sites (see Table 4. for coordinates). Main points in Iona National Park: A-Salondjamba Gate; B-Pediva Gate; C-Espinheira; D-Otchifengo; E-Cambeno.

All 40 cameras were installed from 13th November 2019 to 22nd November 2019. Six cameras were stolen or lost (Figure 4. Site 1, 23, 24, 25, 29 and 30) and one camera had date problems (Figure 4. Site 18). On February 23rd, the batteries of the nine cameras outside INP (including the ones inside the Omauha farm) were changed. It was not possible to change the remaining batteries of the cameras inside INP because the park was closed due to the Covid-19 pandemic. The cameras inside the Omauha farm and outside INP were collected from 9th to 10th of May, and the remaining cameras (the ones inside the park) were collected on June 3rd. During the camera traps setting period, opportunistic observations were conducted too.

All the available historical data regarding the existence and distribution of mammals within the limits of Iona National Park was also compiled. For these we conducted an extensive review of the available bibliography, museum specimens and grey literature (unpublished reports, thesis, etc.). Major reviews of Angolan fauna include those published by Hill & Carter (1941), Monard (1935), Ellerman *et al.* (1953), du Bocage (1889, 1890 and 1897), Crawford-Cabral (1986, 1989, 1996 and 1998),

Crawford-Cabral & Simões (1990) and Crawford-Cabral & Veríssimo (2005). Whenever possible, we recorded the catalogue numbers of all specimens housed in museums (mostly available from the works of Crawford-Cabral cited above). These include records from important collections as the American Museum of Natural History (AMNH), Instituto Superior de Ciências e de Educação da Huíla (ISCED), Museum of Comparative Zoology (MCZ), Museum of Ornithology and Mammalogy of Lubango (MOML), Natural History Museum of London (BM), Natural History Museum of Los Angeles County (LACM), Royal Museum for Central Africa (RMCA), and the Museu de História Natural e da Ciência da Universidade do Porto (MHNCUP). Museum acronyms follow Sabaj (2020).

All these historical records were analysed, taxonomically reviewed, georeferenced and gathered in a map (Figure 5.).

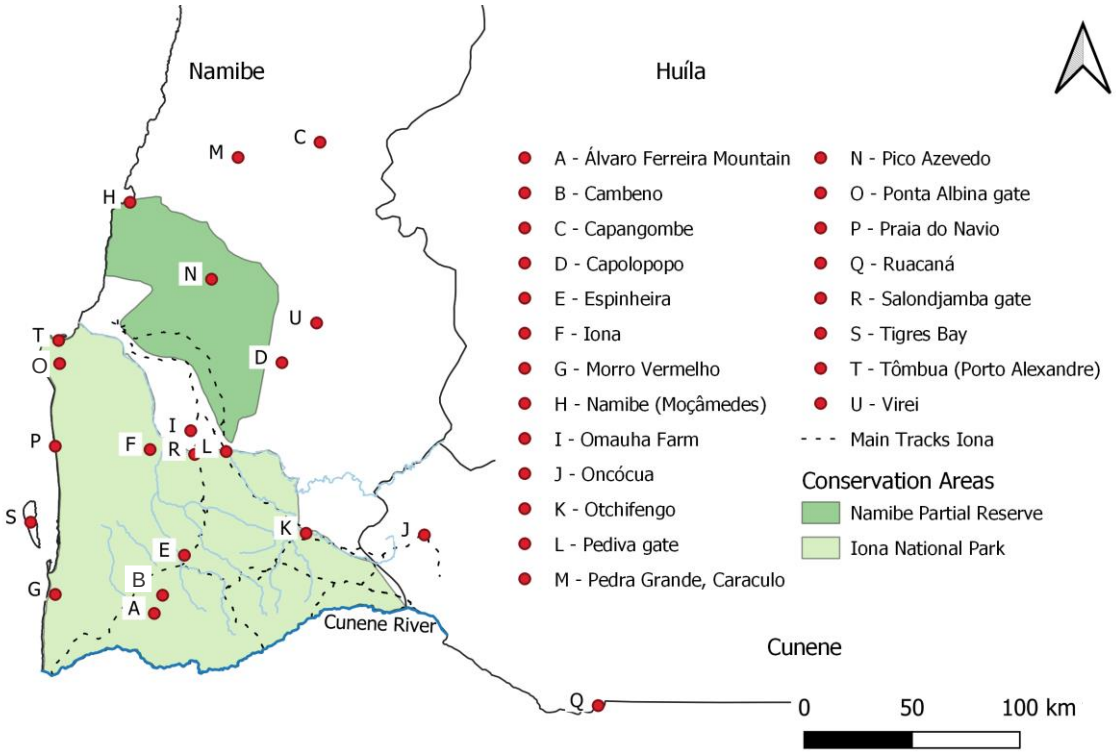

Figure 5. Map with the georeferenced localities. The red dots represent the main points present in the historical records (see Table 1. for coordinates). Provincial boundaries and names are shown in black.

The localities were georeferenced with the help of google maps and Marques et al. (2016). Georeferenced localities are summarized in Table 1. In addition to these sources, anecdotal information was gathered from local stakeholders and inhabitants.

Table 1. Georeferenced localities.

Localities	Longitude	Latitude
Álvaro Ferreira Mountain	12.2412452	-16.999979
Cambeno	12.2777056	-16.9201124
Capangombe	12.9665622	-14.9333062
Capolopopo	12.7998662	-15.8999994
Espinheira	12.3731052	-16.7447490
Iona	12.22291	-16.28106
Morro Vermelho	11.8079119	-16.9166457
Namibe (Moçâmedes)	12.1353540	-15.1967096
Omauha Farm	12.4008335	-16.1985937
Oncócua	13.4232974	-16.6556068
Otchifengo	12.9054514	-16.6483522
Pediva gate	12.5559993	-16.2900545
Pedra Grande, Caraculo	12.6079119	-14.9999788
Pico Azevedo	12.49197	-15.53400
Ponta Albina gate	11.82717	-15.90400
Praia do Navio	11.8079119	-16.2666456
Ruacaná	14.1841302	-17.4042
Salondjamba gate	12.4179188	-16.3024592
Tigres bay	11.7002872	-16.599838
Tômbua (Porto Alexandre)	11.8228337	-15.8028035
Virei	12.9515934	-15.7259426

Results

A total of 14 orders, 37 families and 120 species were recorded from INP and its closest vicinities (Table 2.). Of these, 26 (22%) were directly and indirectly observed during our surveys, while a majority 94 (78%) of the records originated from historical data.

Table 2. Mammals of Iona National Park and its vicinities.

Order	Number of Families	Number of Species
Order HYRACOIDEA	1	1
Order PROBOSCIDEA	1	1
Order MACROSCELIDEA	1	3
Order TUBULIDENTATA	1	1
Order PRIMATES	2	4
Order RODENTIA	7	30
Order LAGOMORPHA	1	3
Order ERINACEOMORPHA	1	1
Order SORICOMORPHA	1	5
Order CHIROPTERA	7	23
Order CARNIVORA	7	29
Order PHOLIDOTA	1	1
Order PERISSODACTYLA	2	3
Order CETARTIODACTYLA	4	15
14	37	120

In the following species accounts, we provide the data of both the recent and historical records. For each species account both common and scientific name, locality data, coordinates, date of collecting/observation, observer/collector, and source (for historical records only) is, whenever possible, provided. Latitude and longitude (WGS 84), and elevation (in meters) of collecting/observation sites are also provided for each record when available. Brief notes and comments on identification, taxonomy, natural history, ecology, and conservation are given whenever appropriate. Species accounts are ordered taxonomically by order and family, and alphabetically within families.

For the recent records, from the camera trap survey, opportunistic observations (during the camera trap displaying and retrieving) and records from the last ten years of reliable sources were compiled. As a result, from the camera trap survey (in 336 pictures with mammals), it was possible to identify 16 species of interest to this study (one species from the order Tubulidentata; one species from the order Primates; eight species from the order Carnivora; one species from the order Perissodactyla; and five species from the order Cetartiodactyla). There was also a few pictures of what it seems to be species of bats and others of hares in the camera trap images, however, due to the bad quality it was not possible to identify the exact species. From the opportunistic observations and the records of reliable sources, it was possible to identify 10 more different species of interest to this study.

For the historical records, grey literature and museums were consulted to gather the historical data. From this analysis, 56 more species were historically recorded at least once inside INP or in the close vicinities.

Following the species accounts, a list of species that probably exist inside INP is presented with species with historical records in the vicinities of the park, adding 38 more species to the list.

SPECIES ACCOUNTS

Order HYRACOIDEA

Family PROCAVIIDAE

Rock hyrax

Procavia capensis (Pallas, 1766)

Recent records: Nine individuals were spotted on the outskirts of Omauha Farm on top of rocks (-16.2205, 12.3977, 397,5m) by the authors on 22nd November 2019 (Figure 6.).

Historical records: The species has historical records from inside INP, Iona (Simões 1971), Cambeno and Espinheira (Crawford-Cabral & Veríssimo 2005); and in the vicinities of the park, Oncócua (Crawford-Cabral & Veríssimo 2005), Moçâmedes (du Bocage 1889, 1890, 1897; Hill & Carter 1941), 101 km east of Moçâmedes (AMNH/M-80605 and M-80606) (Hill & Carter 1941), Pico Azevedo (AMNH/M-80604) (Hill & Carter 1941) and other two from north of Namibia near the border with Angola (-17.4667, 13.3000, 1113m) (LACM/059632, 059633).

Comments: *Procavia capensis* has a wide range of occurrence, and is known from Senegal, southern Mauritania, through southern Algeria and Libya to Egypt and then southwards to southern Africa, but the species distribution is very discontinuous (Hoeck & Bloomer 2013). The species is distributed across southwestern Angola from the Benguela coast to the Cunene river, including the Namib desert and INP, and across Namibia (Hill & Carter 1941; Hoeck 2001; Crawford-Cabral & Veríssimo 2005; Werger & van Bruggen 2012). This species is normally associated with plain rocky habitats in the southwest arid coast and does not occur in altitudes above 1500 meters from sea level (Hill & Carter 1941; Crawford-Cabral & Veríssimo 2005; Beja *et al.* 2019). *P. capensis* is a small mammal, about 50cm in total length (Olds & Shoshani 1982). They live in groups and are diurnal (Olds & Shoshani 1982). Normally feeds on leaves, roots, berries and fruits (Hoeck 1975). According to Roche (1972), Olds & Shoshani (1982), Shoshani (2005) and Hoeck & Bloomer (2013) there are 17 recognized subspecies of *P. capensis*. Of these, only *P. c. welwitschii* occurs in southwest Angola, so this is the subspecies present inside INP where it appears to be very common, and it is normally spotted on rocks (Figure 6.). The conservation status of this species is Least Concern according to IUCN (Butynski *et al.* 2015).

Figure 6. A group of nine rock hyrax (*Procavia capensis welwitschii*) on the morning sun inside the Omauha Farm. Photo by Catarina Freixial.

Order PROBOSCIDEA

Family ELEPHANTIDAE

Savanna elephant

Loxodonta africana Blumenbach, 1797

Historical records: The species has historical records inside INP (da Silva 1970; Simões 1971; Huntley 1973), Iona (Fenyövi 1958; Juste & Carballo 1992), Cambeno (Crawford-Cabral & Veríssimo 2005) and Espinheira (Crawford-Cabral & Veríssimo 2005); and in the vicinities of the park, in Moçâmedes (da Silva 1970), 5 km west of Oncócua (Junior 1948) and Oncócua (Seia 1995).

Comments: Savanna elephants once inhabited the entire continent of Africa but, currently they are restricted to south of the Sahara, occupying only 20% of their historic range with a fragmented and patchy distribution (Poole *et al.* 2013). According to Blanc *et al.* 2007, there is still a large population with a wide range that passes through parts of Namibia, north of Botswana, Zimbabwe, Zambia and Angola. The same happened in Angola, the savanna elephant used to have a wide range through all the country, with the highest population's density in the south (Hill & Carter 1941; da Silva 1970; Crawford-Cabral & Veríssimo 2005; Poole *et al.* 2013; Beja *et al.* 2019). In 1972 there still existed a small group of savanna elephants inside INP (Huntley 1972a). But with the civil war in Angola and the illegal hunting for the ivory and meat, this species suffered a big loss of individuals in the country and currently this species is locally

extinct from INP (da Silva 1970; Taylor *et al.* 2018). The diet of a Savanna elephant is based on grass, roots and fruits (Werger & van Bruggen 2012). They also depend on water to survive, so in the dry areas, like the desert, they dig to find water (Werger & van Bruggen 2012). These big mammals are usually in groups, and the size of these groups may depend on the limited food, water or habitat resources of the area that they are in (da Silva 1970). In the area of INP the groups were normally small since it had few water points and too much human activity (da Silva 1970). According to the IUCN and the Red List of Angola the conservation status of this species is Vulnerable (Blanc 2008; MINAMB 2016a).

Order MACROSCELIDEA

Family MACROSCELIDIDAE

Bushveld sengi

Elephantulus intufi (A. Smith, 1836)

Historical records: This species is known from the arid region of the southwest of Angola (Crawford-Cabral 1991), namely in Tigres bay (MHNCUP/MAM 28), and Moçâmedes (MHNCUP/MAM 29). Several individuals were collected from Namibe Province (AMNH/M-80868, M-85662 and M-85663; ISCED/173, 391, 441, 490, 614, 632, 653, 654, 661, 700), with two of them from 101 km east of Moçâmedes (AMNH/M-85664 and AMNH/M-85661) (Hill & Carter 1941). Seven other individuals were collected from north Namibia near the border with Angola (-16.9999, 13.2000, 903m) (LACM/059690-059696).

Comments: This species occurs throughout Namibia, southwest of Angola, south of Botswana, and South Africa (Hill & Carter 1941; Perrin & Rathbun 2013a). It is present in the southwest of Angola, in parts of the Namib Desert and then northwards to Benguela (Beja *et al*. 2019). This is a small mammal that normally inhabits the semi-arid savannas with mopane woodlands and feeds mainly on ants (Kingdon *et al.* 2013c; Perrin & Rathbun 2013a; Beja *et al.* 2019). According to Hill & Carter (1941), this species has two subspecies *E. i. mossamedensis* and *E. i. alexandri*. Both occur in Angola, the first in the coastal plains and the second in the inlands (Huntley *et al.* 2019). According to the IUCN the conservation status of this species is Least Concern (Rathbun 2015).

Order TUBULIDENTATA

Family ORYCTEROPODIDAE

Aardvark

Orycteropus afer (Pallas, 1766)

Recent records: Individuals alone were caught on several different cameras (Site 2, 4, 10, 11, 21, 22, 32, 34 (Figure 7.), 36, 38 and 39 - see Table 4. for coordinates).

Comments: The distribution of *O. afer* is from south of Sahara and Senegal to Ethiopia and South Africa (Kingdon 1971; Skinner & Chimimba 2005). This is a very common species in Angola, being widespread throughout the country (Crawford-Cabral & Veríssimo 2005). Authors like Crawford-Cabral and Veríssimo (2005) used to believe that this animal was absent from the Namib desert, but the pictures captured by the cameras on this study prove the opposite. The aardvark is a common, nocturnal and medium to large sized mammal that is linked to the presence of termites since it is its main food (Taylor 2013a; Taylor *et al.* 2018). Although it is not common for a researcher to find a aardvark, holes made by them are usually found on the ground as reported by Crawford-Cabral & Veríssimo (2005), in other areas of Angola. According to Taylor (2013a), there are 18 subspecies of *O. afer*, but it is more likely that this number is too high and further studies in this matter are needed. This species is listed in the IUCN as Least Concern although in the Red List of Angola it has a Vulnerable conservation status (Taylor & Lehmann 2015; MINAMB 2016a).

Figure 7. An aardvark (*Orycteropus afer*) caught on camera trap on site 34.

Order PRIMATES

Family CERCOPITHECIDAE

Chacma baboon

Papio ursinus (Kerr, 1972)

Recent records: Several individuals spotted in the Omauha Farm (-16.1986, 12.3986, 345m) by the authors from 13th to 22nd November 2019; several individuals spotted on the outskirts of Omauha Farm (-16.2670, 12.4197, 358,5m; -16.2681,12.4192, 358,5m; -16.2690, 12.4189, 358,5m) by the authors on 15th November 2019; One specimen on the rocks near Omauha Farm (-16.3417, 12.4371, 309,5m) observed by the authors on 16th November 2019. Six individuals were spotted in the Omauha Farm (-16.2189, 12.3925, 340m) by Sara and David Elizalde on 5th June 2020. Groups of *P. ursinus* were caught on three different cameras (Site 4 (Figure 8.), 28 and 39 - see Table 4. for coordinates).

Historical records: This species has records inside INP (Huntley 1973), Iona (Machado 1969; Simões 1971); and in the vicinities of the park, from Benguela to Moçâmedes (du Bocage 1889), Moçâmedes (Seabra 1909), south of Angola (Ellerman *et al.* 1953) and Namibe (Anonymous 2009).

Comments: *P. ursinus* is endemic to Southern Africa, and it is widespread in the southwest of the continent, from Angola and Zambia southwards to Namibia, Zambia and South Africa (Cowlishaw 2013). The habitat of the chacma baboon is normally woodlands, sub-desert, savanna and rocky hills of arid regions (Hall 1966; Huntley 1973; Beja *et al.* 2019). This species lives in big groups and are opportunistic omnivores that feed mainly on bulbs, roots, seeds, fruits, invertebrates and small vertebrates (Machado 1969; Whiten *et al.* 1987). There are three subspecies *P. u. ursinus, P. u. griseipes* and *P. u. Ruacana*; *P. u.* griseipes occurs in the southeast of Angola and *P. u. Ruacana* occurs in the southwest of Angola, being this the subspecies present in INP (Taylor *et al.* 2018). This species is reported in the IUCN with a conservation status of Least concern (Sithaldeen 2019). On the other hand, the Red List of Angola classifies the *P. ursinus* as Endangered Species (MINAMB 2016a).

Figure 8. A chacma baboon (*Papio ursinus Ruacana*) caught on site 4.

Malbrouck monkey

Chlorocebus cynosuros (Scopoli, 1786)

Recent records: Several individuals were spotted 2 km southeast from the limits of INP (-16.9908, 13.2892, 633m) by the authors on 17th November 2019 (Figure 9.).

Historical records: This species has historical records inside INP, in Iona (Simões 1971) and near Pediva (-16.6667, 12.5833, 612m) (LACM/037699).

Comments: This species is endemic to Africa south of Equator, but their distribution is poorly known (Sarmiento 2013). However, it may occur across Africa, west of the Rift Valleys between the Congo Basin forests, Democratic Republic of Congo, in the north, and Zambezi river, Zambia, and lower Cunene river, Angola, in the south (Sarmiento 2013). This species is poorly known from Angola, especially the eastern half (from where no museum specimens have been collected) (Sarmiento 2013; Taylor *et al.* 2018). This is an arboreal species; therefore, the preferential habitat is woodlands and riparian forests near savannas, but always close to a water source (Sarmiento 2013; Beja *et al.* 2019). Malbrouck monkeys live in groups and are diurnal (Sarmiento 2013). They are omnivorous eating mainly fruits, seeds, flowers, birds' eggs, and occasionally invertebrates or small vertebrates (Sarmiento 2013). This species is classified as Least Concern by the IUCN (Wallis 2019).

Figure 9. An individual of malbrouck monkey (*Chlorocebus cynosuros*) spotted by the authors in the vicinities of Iona National Park. Photo by Catarina Freixial.

Order RODENTIA

Family SCIURIDAE

Congo rope squirrel

Funisciurus congicus (Kuhl, 1820)

Historical records: This species has been recorded in Moçâmedes (du Bocage 1890), and at 101 km east of Moçâmedes (Hill & Carter 1941). Four individuals were collected from Namibe province (AMNH/M-86471, M-86472 and M-86473; and MCZ/17776) and two from north Namibia near the border with Angola - one from Otjibundu/Cunene river (-17.2500, 11.7500, 0m) (MCZ/37079) and the other from -17.4667, 13.0333, 1280m (LACM/059713).

Comments: This species is the most widespread species of this family, ranging from the Congo basin to northwest of Namibia passing through western Angola (Thorington *et al.* 2013; Beja *et al.* 2019). *F. congicus* is arboreal and terrestrial, so its natural habitat has high forest trees and is usually near watercourses, like mopane woodlands and coastal palm groves (Thorington *et al*. 2013). This is a diurnal and common small mammal (Viljoen 1978; Thorington *et al*. 2013). It is omnivore and the diet includes seeds, fruits, stems and shoots from mopane trees (Viljoen 1978; Smithers 1983; Thorington *et al*. 2013). According to IUCN, the conservation status of this species is Least Concern (Cassola 2016a).

Damara ground squirrel

Xerus princeps (Thomas, 1929)

Historical records: This species has historical records in the vicinities of INP, from 101 km east of Moçâmedes (AMHN/M-86479) and Namibe province (AMHN/M-86480) (Hill & Carter 1941).

Comments: This species occurs continuously from southwest Namibia to southwest Angola, mainly in the Namib Desert (Waterman 2013; Beja *et al.* 2019). In Angola, this species is only known by the two specimens in the American Museum of New York (Hill & Carter 1941). This species is mainly terrestrial, so its habitat is normally the rocky and hilly ground of arid areas like open savannas (Waterman 2013). This large squirrel is diurnal and herbivorous, and its diet includes roots and grass stems (Herzig-Straschil & Herzig 1989; Waterman 2013). The conservation status of *X. princeps* is Least Concern according to IUCN (Cassola 2016b).

Family NESOMYIDAE

Grey African climbing mouse

Dendromus melanotis Smith, 1834

Historical records: This species is present in south of Angola (Crawford-Cabral 1998). One specimen was collected from Namibe province (ISCED/1604B).

Comments: *D. melanotis* is widespread throughout the African continent (Monadjem 2013a). In Angola, it occurs in south and southeast of the country extending to the centre (Crawford-Cabral 1998; Beja *et al.* 2019). This species is known to appear in a wide range of habitats, like savanna woodlands, tall and short grasslands, fringes of rivers, dry scrubs and dry woodlands (Lynch 1994; Rowe-Rowe & Meester 1982; Taylor 1998; Beja *et al.* 2019), being absent from rainforest (Monadjem 2013a). *D. melanotis* is a terrestrial, nocturnal and predominately granivorous mammal and its diet consists mostly in arthropods and vegetal matter (Monadjem 2013a). According to IUCN this species has a conservation status of Least Concern (Child & Monadjem 2016a).

Chestnut African climbing mouse

Dendromus mystacalis Heuglin, 1863

Historical records: This species has a record in Curoca (Crawford-Cabral 1998).

Comments: This species distribution goes from east of South Africa to Zimbabwe, Mozambique, Zambia and Botswana (Monadjem 2013b). In Angola, its distribution

goes from the northeast to the southwest (Crawford-Cabral 1988; Monadjem 2013b; Beja *et al.* 2019). This species is associated with savanna woodlands and grasslands, occupying a great range of habitats with tall grass (Rosevear 1969; Monadjem 2013b; Beja *et al.* 2019)**.** This small slender mouse is nocturnal and common (Monadjem 2013b). It is omnivorous, and its diet is mostly composed of vegetable matter and seeds but eats arthropods too (Monadjem 2013b). According to the IUCN this species has a Least Concern status of conservation (Child & Monadjem 2016b).

Pygmy rock mouse

Petromyscus collinus (Thomas & Hinton, 1925)

Historical records: This species has historical records from southern Angola (Coetzee 1972; Skinner & Smithers 1990), inside INP at 16º18'S 12º25'E and Espinheira (Crawford-Cabral 1998); and in its vicinities, Curoca river and Pico Azevedo (Crawford-Cabral 1998). Three individuals were collected from Namibe province (ISCED/4884, 4885 and 4902), and several other individuals from north Namibia near the Angola border (-17.7500, 12.6167, 771m) (LACM/060178-060188).

Comments: This species occurs in Namibia, Angola and South Africa (Coetzee 2013a). In Angola it is present in the desert areas of southwest, west of the escarpment and until Praia Madalena (Crawford-Cabral 1998; Coetzee 2013a; Beja *et al.* 2019). This species is restricted to the arid and semi-arid habitats, more specifically mountains and rocky areas where it can hide inside the crevices in the rocks (Withers 1979; Crawford-Cabral 1998; Coetzee 2013a). The adults of *S. collinus* can reach a length of 2,5 cm (Coetzee 2013a). This very small mouse is terrestrial and nocturnal (Coetzee 2013a). It is granivorous and omnivorous feeding mostly on seeds, some stems and insects (Coetzee 2013a). According to IUCN the conservation status of this species is Least Concern (Child 2016a).

Shortridge's pygmy rock mouse

Petromyscus shortridgei Thomas, 1926

Historical records: This species has historical records inside INP, in Espinheira (ISCED/4866-4868, 4878, 4884 and 4885) and Cambeno (ISCED/4902) (Crawford-Cabral 1998); and in its vicinities, Cunene Falls (Thomas 1926).

Comments: This species is present from Angola, Namibia and South Africa (Coetzee 2013b). In Angola, this species occurs in the southwest of the country, including the

Namib Desert and INP (Coetzee 2013b). The habitat of this species is hilly mountains in semi-arid areas, preferential granitic mountainous areas (Crawford-Cabral 1998; Coetzee 2013b). This very small mouse is nocturnal, solitary and its diet is composed mainly by seeds (Coetzee 2013b). This species as the conservation status of Least Concern by the IUCN (Schlitter 2016a).

Family MURIDAE

Cape short-tailed gerbil

Desmodillus auricularis (Smith, 1834)

Historical records: This species has historical records inside INP in Espinheira (ISCED/4889) and 20 km south of Espinheira (ISCED/4677) (Crawford-Cabral 1998); and in the vicinities, 20 km east of Moçâmedes (Crawford-Cabral 1998). One individual collected from north Namibia near the Angola border (-17.7500, 12.6167, 771m) (LACM/060172).

Comments: This species distribution includes Sierra Leon, Liberia, Guinea and Côte d'Ivoire (Nel 2013a). In Angola, it inhabits the southwest arid zone, including the Namib Desert (Davis 1974; Beja *et al.* 2019). The main habitat of this species is semi-arid regions, and it prefers hard ground (Werger & van Bruggen 2012; Beja *et al.* 2019). This gerbil is omnivorous, and its diet includes seeds and insects (Nel 2013a). According to IUCN this species as the conservation status of Least Concern (Cassola 2016c).

Bushveld gerbil

Gerbilliscus leucogaster (Peters, 1852)

Historical records: This species has historical records inside INP, at 26 km south of Espinheira (ISCED/4898, 4850 and 4851) and Espinheira (Crawford-Cabral 1998); and in its vicinities, Pico Azevedo (Crawford-Cabral 1998), Capolopopo (ISCED/662, 676, 677, 691, 694, 707 and 1075) (Crawford-Cabral 1998), Curoca River (du Bocage 1890; Wroughton 1906; Crawford-Cabral 1998), Cunene Falls (Thomas 1926), Moçâmedes (ISCED/4643, 4644, 4659 and 4660), 10 km south of Moçâmedes (Ribeiro 1974) and in Virei (-15.6500, 12.9667, 364m) (RMCA/59454RMCA34439-M-). Several individuals collected from Namibe province (ISCED/369, 370, 379, 384, 497, 559, 611, 612, 662, 691, 1135, 1143, 1144, 1148, 1155, 1158, 1160, 8122, 8123, 8130-8132, 8539, 8542, 8549 and 8551-8556), and several other individuals from north Namibia near the

Angola border (-17.7500, 12.6167, 771m) (LACM/060307, 060309-060345).

Comments: *G. leucogaster* is a widespread south and central african species, its distributions ranges from Angola, south of Republic Democratic of Congo, Zimbabwe, south of Tanzania, Malawi, Mozambique, Namibia, Botswana and north of South Africa (Smithers 1971; Dempster 2013). It is also widespread throughout Angola (Beja *et al.* 2019). According to Dempster (2013), this species can be found associated with open grasslands and wooded savannas on sandy ground. *G. leucogaster* is communal, nocturnal, terrestrial and omnivorous, feeding mostly in insects, seeds and herbage (Dempster 2013). According to IUCN, this species has the conservation status as Least Concern (Cassola 2016d).

Paeba hairy-footed gerbil

Gerbillurus paeba (A. Smith, 1836)

Historical records: This species has records inside INP, in 16º18'S 12º25'E and several individuals were collected from Espinheira (ISCED/4844, 4845, 4869, 4877, 4883, 4887, 4917-4919, 4923, 4927, 4929, 4931, 4940, 4947, 4956-4959, 4970 and 4971) and Cunene mouth (Crawford-Cabral 1998); and in its vicinities, as Moçâmedes (ISCED/4657), Curoca river (Crawford-Cabral 1998) and Pico Azevedo (AMNH/M-86046) (Hill & Carter 1941). One individual was collected from north Namibia near the Angola border (-17.7500, 12.6167, 771m) (LACM/060242).

Comments: This species is recorded from southwestern Angola, Namibia, Botswana, western Zimbabwe, western Mozambique, and South Africa (Perrin & Dempster 2013a). In Angola it appears in the desertic plains and beaches of the Namibe province (Crawford-Cabral 1998). The main habitat of this species is desert, sub-desert, arid and semi-arid regions (Crawford-Cabral 1998; Werger & van Bruggen 2012; Perrin & Dempster 2013a; Beja *et al.* 2019). According to Perrin and Dempster (2013a), these habitats have a sandy soil or alluvium with absent grass and scrub. *G. paeba* does not inhabit the rocky areas neither the sandy dunes from the Namib Desert (Griffin 1990). This small gerbil is terrestrial and nocturnal (Perrin & Dempster 2013a). It is omnivorous and opportunistic, and its diet may include seeds, foliage or insects, depending on what is available (Perrin & Dempster 2013a). This species comprises five subspecies where one occurs in the southwest of Angola, *G. p. paeba* and another in the Skeleton Coast, Namibia, *G. p. infernus* (Perrin & Dempster 2013a). The conservation status of this species is Least Concern, according to IUCN (Cassola 2016e).

Setzer's hairy-footed gerbil

Gerbillurus setzeri (Schlitter, 1973)

Historical records: This species has records inside INP, in Espinheira (ISCED/4848 and 4861) (Crawford-Cabral 1998); and in its vicinities, 63 km south of Moçâmedes (Porto Alexandre road) (ISCED/745 and 746) (Crawford-Cabral 1966).

Comments: This species is spread through the Kuiseb river, Namibia, to southern Angola (Schlitter 1973). In Angola it is only present in the desertic areas of the Namibe province (Crawford-Cabral 1998). This species is associated with the desert, arid and semi-arid regions (Beja *et al*. 2019) and according to Dempster *et al.* (1998) it is restricted to hot and dry gravel plains with shallow and semi-compacted soil with almost no vegetation. *G. setzeri* is a small terrestrial and nocturnal gerbil (Perrin & Dempster 2013b). It is omnivorous, and it feeds mostly on arthropods, plant material and seeds (Perrin *et al.* 1992). According to IUCN the conservation status of this species is Least Concern (Cassola 2016f).

Namaqua veld rat

Aethomys namaquensis (A. Smith, 1834)

Historical records: This species has historical records inside INP, 16º18'S 12º25'E, Espinheira (ISCED/4864, 4870, 4879, 4882, 4886, 4942 and 4943), Cambeno (ISCED/4894-4897, 4901, 4903-4905, 4907 and 4911), Candave (34 km south of Espinheira) (ISCED/4912-4915) (Crawford-Cabral 1998), Cunene mouth (Crawford-Cabral 1998) and Porto Alexandre (Ribeiro 1974); and in its vicinities, Pico Azevedo (Ribeiro 1974), Cunene Falls (Thomas 1926), Oncócua (ISCED/6045) and Curoca river (Crawford-Cabral 1998). Several individuals were collected from Namibe province (ISCED/463, 663, 664, 666 and 8464), one in the Cunene falls (-17.25, 11.75, 0m) (MCZ/36961), another in Virei (-15.65, 12.9667, 364m) (RMCA/59459RMCA34444-M-) and several more from north Namibia near the border with Angola (-17.5, 13.0, 1324m; and -17.0, 13.2, 903m) (LACM/059864-059897).

Comments: This species is present in Angola, Botswana, Namibia, Zimbabwe, south of Zambia, South Africa and Mozambique (Kesner *et al.* 2013). In Angola, it occurs in the arid southwestern regions (Werger & van Bruggen 2012). Namaqua veld rat is common in the savannas and semi-arid regions with rocky habitats (Crawford-Cabral 1998; Kesner *et al.* 2013). *A. namaquensis* is terrestrial and semi-arboreal (Kesner *et al.* 2013). It is opportunistic, feeding mainly on grass and foliage, seeds and insects,

depending on what is available (Withers 1979; Kerley *et al.* 1990; Monadjem 1997). This species has four subspecies, where one, *A. n. alborarius*, appears in southwest Angola (Chimimba 2001; Kesner *et al.* 2013). According to IUCN, the conservation status of this species is Least Concern (Cassola *et al.* 2017).

Natal Multimammate Mouse

Mastomys natalensis (Smith, 1834)

Historical Records: This species has historical records in the Namibe province (ISCED/231, 241, 386, 519, 520, 551, 581, 608, 610, 618, 623, 628, 633, 781, 1086, 1091, 1097, 1135, 1137-1141, 1145, 1146, 1154, 1156, 1159, 4770, 4787-4789, 4791, 4795-4797, 4799, 4800, 8058, 8125, 8126, 8414, 8512, 8513, 8534-8536, 8540, 8541, 8543 and 8550), and 101 km east of Moçâmedes (AMNH/M-85765).

Comments: This species is widespread throughout sub-Saharan Africa (Leirs 2013a). In Angola it is present across the entire country (Leirs 2013a). *M. natalensis* can be found in savannas, grasslands with or without bushes, thickets or trees, and near human populations (Leirs 2013a). This small grey mouse is one of the most common species in the African savannas (Leirs 2013a). It is terrestrial and nocturnal, and an opportunistic omnivore, feeding mainly on cereal seeds, stems and leaves from grass, plants, insects and may even feed on carrion (Leirs et al. 1994; Leirs 2013a). According to the IUCN, this species has the conservation status of Least Concern (Granjon 2016).

House mouse

Mus musculus Linnaeus, 1758

Historical records: This species has historical records from Moçâmedes (ISCED/4658) (Crawford-Cabral 1998) and from Namibe province (ISCED/374 and 1055).

Comments: This species is not indigenous to Africa, and its distribution in this continent is not widespread (Happold 2013a; Beja *et al.* 2019). The habitat of this commensal species is linked to human activity, living in houses, food stores, urban buildings, gardens, sand flats, salty waste land, canal banks and plain groves (Osborn & Helmy 1980; Happold 2013a). According to Happold (2013a), *M. musculus* is nocturnal and diurnal, terrestrial and scansorial. This species is omnivorous, feeding on anything that is available (Happold 2013a). The IUCN attributes the conservation status of Least Concern to this species (Musser *et al.* 2016).

Angolan creek rat

Pelomys campanae (Huet, 1888)

Historical records: This species has historical records inside INP, in Tigres Bay (Seabra 1909); and in its vicinities, in Moçâmedes (Ribeiro 1974). Several individuals were collected from Namibe province (ISCED/380, 381, 561, 564, 565, 613, 620, 4793, 4798 and 8537).

Comments: This species distribution includes Democratic Republic of Congo and Angola (Hill & Carter 1941; Dieterlen 2013; Beja *et al.* 2019). In Angola, it is recorded mostly from the west coast, ranging from Cabinda to the Cunene river, and to the Angolan Escarpment, extending to the Angolan Plateau (Hill & Carter 1941; Crawford-Cabral 1998; Dieterlen 2013; Beja *et al.* 2019). This species can be found in grassland savannas within the creeks in the rocks and coastal plains (Dieterlen 2013). *P. campanae* is a medium-sized creek rat and its diet is composed of grass, stems, leaves and forage (Dieterlen 2013). According to IUCN the conservation status of this species is Least Concern (Cassola 2016g).

Brown rat

Rattus norvegicus (Berkenhout, 1769)

Historical records: This species has historical records inside INP, in Tigres Bay (Seabra 1909); and in its vicinities, the Angolan Coast (du Bocage 1890) and Porto Alexandre (Ribeiro 1974), being several individuals collected from this last locality (ISCED/4678-4684) (Crawford-Cabral 1998).

Comments: According to Happold (2013b), this species was introduced in Africa by boats and ships to the coastal cities, and its distribution is very patchy, having records in different cities with seaports (Hill & Carter 1941; Beja *et al.* 2019). In Angola it is distributed through the coast (Happold 2013b; Beja *et al.* 2019). The habitat of this species is normally near humans' constructions and settlements, rubbish tips, drains and sewers (Happold 2013b). This is a nocturnal, terrestrial, scansorial and commensal species (Werger & van Bruggen 2012; Happold 2013b). This large rat is bold and aggressive (Happold 2013b). *R. norvegicus* is omnivorous, and its diet includes almost everything that can be eaten (Werger & van Bruggen 2012; Happold 2013b). According to IUCN, this species has the conservation status of Least Concern (Ruedas 2016).

Black rat

Rattus rattus (Linnaeus, 1758)

Historical records: This species has a historical record in Moçâmedes (Ribeiro 1974), and a specimen was collected from this locality (ISCED/4668) (Crawford-Cabral 1998). Several individuals were collected from Namibe province (ISCED/375, 378, 806, 1059, 1060, 1062, 1063 and 1065).

Comments: This species is introduced in sub-Saharan region by European boats and ships and then to the rest of the country through river, rail and road transports (Hill & Carter 1941; Happold 2013c; Beja *et al.* 2019). In Angola it is very widespread throughout the country (Hill & Carter 1941; Crawford-Cabral 1998; Beja *et al.* 2019). This large rat can be found in rainforest zone (Rosevear 1969; Happold 2013c). Since it is commensal with humans, it can occur in habitats linked to people, like towns, villages, settlements, houses, shops and storehouses (Crawford-Cabral 1998; Werger & van Bruggen 2012; Happold 2013c) and it is implicated with the spread of plague (Werger & van Bruggen 2012). *R. rattus* is nocturnal and diurnal, terrestrial and scansorial (Happold 2013c). It is omnivorous, and its diet is composed by almost everything that is available (Werger & van Bruggen 2012; Happold 2013c). The conservation status of this species is Least Concern, according to IUCN (Krystufek *et al.* 2016).

Four-striped grass mouse

Rhabdomys pumilio (Sparrman, 1784)

Historical records: This species has historical records inside INP, Espinheira and Cunene mouth (Crawford-Cabral 1998); and in its vicinities, Pico Azevedo (Hill & Carter 1941). Several individuals were collected from Namibe province (ISCED/250, 793, 796, 797, 801, 805, 808, 1057, 1066, 2811, 4885 and 8509), namely in Espinheira (ISCED/4685-4688, 4690, 4691, 4842, 4852-4857, 4859, 4860, 4863, 4865, 4871, 4888, 4890-4892, 4920-4922, 4924, 4925, 4928, 4930, 4932-4939, 4941, 4948, 4969) (Crawford-Cabral 1998), and one from Pico Azevedo (AMNH/M-86036) (Hill & Carter 1941).

Comments: This species is widespread through South Africa and Namibia, and a few patches along central east Africa (Werger & van Bruggen 2012; Happold 2013d). In Angola, *R. pumilio* occurs only in the southern part of the Namibe Province (Frade 1963; Crawford-Cabral 1998). According to Happold (2013d) this species occurs in

bush and savannas habitat, dry river beds, forest and woodland ecotones, edges of agricultural lands and montane grasslands. This small common mouse is terrestrial and scansorial, diurnal and crepuscular (Happold 2013d). It is an opportunistic omnivore, and its diets is mostly composed of granivorous, leaves, seeds and insects (Happold 2013d). According to Frade (1963) and Crawford-Cabral (1998), in the southwest of Angola occurs the subspecies *R. p. bechuanae*. The conservation status of this species is Least Concern, according to IUCN (du Toit *et al.* 2019).

Family HYSTRICIDAE

Cape crested porcupine

Hystrix africaeaustralis Peters, 1852

Recent records: One cape crested porcupine spine was found near Espinheira (-16.7532, 12.3663, 437m) by Catarina Freixial on 15th November 2019.

Historical records: This species has historical records 8 km south of Espinheira (ISCED).

Comments: This species is recorded from South Africa northwards to Angola, southern Democratic Republic of Congo, Tanzania, southern Kenya and southern Uganda (Happold 2013e). In Angola it is widespread throughout the country (Hill & Carter 1941; Werger & van Bruggen 2012; Monadjem *et al.* 2015; Taylor *et al.* 2018; Beja *et al.* 2019). This is an eclectic species occurring in a large variety of habitats such as savanna, semi-deserts and forested areas, but does not occur in dense and moist forests, swamps and barren deserts (Happold 2013e; Beja *et al.* 2019). *H. africaeaustralis* is the large rodent in Africa and is well-known for having a portion of the body covered with spines (or quills), and it is the only species of the Hystricidae family in Angola (Werger & van Bruggen 2012; Happold 2013e; Monadjem *et al.* 2015; Beja *et al.* 2019). It is a nocturnal and terrestrial species that normally lives in monogamous pairs (Werger & van Bruggen 2012; Happold 2013e). This species is omnivorous, and its diet includes mainly roots, bark, bulbs, tubers, fruits and herbs (de Graaff 1981; de Villiers *et al.* 1994; Werger & van Bruggen 2012; Happold 2013e). According to IUCN, the conservation status of this species is Least Concern (Cassola 2016h).

Family PETROMURIDAE

Noki

Petromus typicus A. Smith, 1831

Historical records: This species has historical records in the southwest of Angola (Coetzee 1972) and 9 km north of Curoca River (Crawford-Cabral 1966). One individual was collected from northern Namibia near the Angola border (-17.7500, 12.6167, 771m) (LACM/060170).

Comments: This species occurs from northern South Africa, trough Namibia, to Angola (Coetzee 2013c). In Angola it is limited to the escarpment, mountains and inselbergs in the southwest of the country but to the east of Namib (Coetzee 2013c; Monadjem *et al.* 2015; Cassola 2016i; Taylor *et al.* 2018; Beja *et al.* 2019). The habitat of this species is the south west arid regions (Werger & van Bruggen 2012). It occurs in the rocks (granite, schist and sedimentary), and in places like mountains where the species can find shelter in the fissures of the rocks (Werger & van Bruggen 2012; Coetzee 2013c). This large squirrel-like rodent is diurnal, rupicolous and herbivorous, its main diet includes leaves, flowers, stems and fruits (Werger & van Bruggen 2012; Coetzee 2013c). The conservation status of this species is Least Concern, according to IUCN (Cassola 2016i).

Order LAGOMORPHA

Family LEPORIDAE

Cape hare

Lepus capensis Linnaeus, 1758

Recent records: Several individuals were spotted inside the Omauha Farm (-16.3760, 12.2179, 862,9m) by the authors from 13th to 22nd November 2019.

Historical records: This species is present inside INP (Juste & Carballo 1992), Iona (Simões 1971) and Espinheira (MOML, X 6 specimens) (Hilinganye 2015); and in its vicinities, Pico Azevedo and 100 km northeast of Moçâmedes (Hill and Carter 1941), Moçâmedes (Petter & Genest 1965; Jentink 1880), Tômbua (MOML, X 2 specimens) (Hilinganye 2015) and in the Namibe Partial Reserve (Juste & Carballo 1992). Two individuals were collected from Pico Azevedo (AMNH/M-80829 and M-80830) and another two from 101 km east of Moçâmedes (AMNH/M-80831 and M-80832) (Hill & Carter 1941). Several specimens were collected from Namibe province (ISCED/163, 408, 412, 427, 657, 715, 719, 1070, 4960, 4961 and 4968).

Comments: This species is distributed in two main regions in Africa, which the first includes South Africa, Namibia, Botswana, southern Zimbabwe, southern Angola and southern Zambia, and the second includes Kenya, Somalia, Ethiopia and parts of the Sahara Desert (Werger & van Bruggen 2012; Happold 2013f). In Angola, this species is present in the arid coastal region of the southwest, including INP (Werger & van Bruggen 2012; Beja *et al.* 2019). *L. capensis* can be found in open habitats like grasslands with short grass, savannas and semi-desertic areas (Genest-Villard 1969; Happold 2013f). This medium-sized hare is terrestrial, nocturnal and in Africa it is the most common species of the order Lagomorpha, being very common inside INP (Happold 2013f; Beja *et al.* 2019). It is herbivorous, and its diet is composed mostly of grass (Happold 2013f). According to Hill & Carter (1941) and Petter & Genest (1965), there is one subspecies *L. c. salae* that is probably restricted to the sub-desertic of the southwest desert in Angola and western Namibia. The conservation status of *L. capensis* is Least Concern according to IUCN (Johnston *et al.* 2019a).

Jameson's red rock-hare

Pronolagus randensis Jameson, 1907

Historical records: Two individuals were collected from Namibe province (ISCED/159 and 167).

Comments: This species occurs in two different populations, the first is distributed from northeast South Africa, eastern Botswana and Zimbabwe; the second is present in central and northwest Namibia and southwest Angola (Happold 2013g). In Angola it occurs in the extreme southwest and it is most likely connected to the Namibia population (Happold 2013g; Smith *et al.* 2018). The habitat of *P. randensis* is normally semi-arid grasslands with rocks, gorges, cliffs and rocky hills with boulders (the fissures in the rocks and the boulders are essential to this species) (Happold 2013g). This medium-sized hare is mainly nocturnal but can be active in the late afternoon for foraging (Happold 2013g). It is herbivorous, feeding mostly on grass at the base of rocks (Happold 2013g). According to IUCN, the conservation status of this species is Least Concern (Child *et al.* 2019).

Order ERINACEOMORPHA

Family ERINACEIDAE

Southern African hedgehog

Atelerix frontalis (A. Smith, 1831)

Historical records: This species has an historical record in Namibe (Anonymous 2009).

Comments: This species is distributed in two main regions in Africa, the first includes southwest Angola and central and northern Namibia; and the second includes western and central Zimbabwe, eastern Botswana and South Africa (Werger & van Bruggen 2012; Dippenaar & Baxter 2013a; Cassola 2016j; Taylor *et al.* 2018). In Angola, this species is restricted to the Namibe and Huíla Provinces (Cassola 2016j; Beja *et al.* 2019). *A. frontalis* can be found in different habitats from semi-arid and sub-temperate regions (Werger & van Bruggen 2012; Dippenaar & Baxter 2013a). This medium-sized hedgehog is nocturnal, terrestrial and very rare (Dippenaar & Baxter 2013a). It is omnivorous, and eats mainly invertebrates (grasshoppers, termites, beetles, earwigs, slugs and snails), small vertebrates (small mammals, eggs and chicks of terrestrial birds, frogs and lizards) and eventually some vegetable matter (Werger & van Bruggen 2012; Dippenaar & Baxter 2013a). According to Shortridge (1934) and Meester *et al.* (1986), this species has two subspecies, *A. f. angolae* and *A. f. frontalis*, being the first one present in southwest Angola and central and north Namibia. The conservation status of *A. frontalis* is Least Concern according to IUCN (Cassola 2016j).

Order SORICOMORPHA

Family SORICIDAE

Heather shrew

Crocidura erica Dollman, 1915

Historical records: One specimen was collected from Namibe province (ISCED/828).

Comments: This species is endemic to Angola and was recorded from western Angola (de Balsac & Meester 1971; Hutterer 1993, 2005; Gerrie & Kennerley 2016; Taylor *et al.* 2018). Few information is known about this large shrew (Jenkins & Churchfield 2013a; Beja *et al.* 2019). According to IUCN, this species has no sufficient data to have a conservation status (Data Deficient) (Gerrie & Kennerley 2016).

Bicoloured shrew

Crocidura fuscomurina (Heuglin, 1865)

Historical records: This species has a historical record in Moçâmedes (du Bocage 1889).

Comments: This species is widely distributed and recorded from many countries throughout the east of the African continent (Dippenaar & Baxter 2013b). In Angola it is present in the south of the country (Beja *et al.* 2019). This species can be found in woodland savannas and semi-arid regions (Dippenaar & Baxter 2013b). This very small shrew is nocturnal and terrestrial (Dippenaar & Baxter 2013b). It is insectivorous, feeding mostly on moths (Dippenaar & Baxter 2013b). According to de Balsac & Meester (1977) this species has seven subspecies, being one of them, *C. f. bicolor*, present in Angola. According to IUCN, this species has a conservation status of Least Concern (Hutterer & Howell 2016).

Blackish shrew

Crocidura nigricans Bocage, 1889

Historical Records: One specimen was collected from Namibe province (ISCED/ 8546).

Comments: This species is endemic to Angola (Taylor *et al.* 2018), and in Africa it is recorded from west Cameroon, Nigeria, Ghana and Côte d'Ivoire (Jenkins & Churchfield 2013b). In Angola it is present in the southwest of the country, in the mountains on the western side of the Angolan plateau (Beja *et al.* 2019). This large shrew is widespread along the rainforest habitats, and it was recoded in farmlands and grasslands too (Jenkins & Churchfield 2013b). According to IUCN, this species has a conservation status of Least Concern (Hutterer 2016).

Order CHIROPTERA

Family PTEROPODIDAE

Angolan epauletted fruit bat

Epomophorus angolensis Gray, 1870

Historical records: This species has historical records in Moçâmedes (Bergmans 1988; Matschie 1899). One specimen was collected from Namibe province (ISCED/8629), and three others from north Namibia near the Angola border (-17.48333, 13.0500, 1264m) (LACM/058979-058980) and (-17.4667, 13.0333, 1280m)

(LACM/058934).

Comments: This species is nearly endemic to Angola, being present only in the west and southern area of this country and northern Namibia (Bergmans 1988; Crawford-Cabral 1986; Taylor 2013b; Beja *et al.* 2019; Monadjem *et al.* 2020). *E. angolensis* is a small to medium-sized fruit bat that inhabits drier regions, when compared to other species from the same family (Taylor 2013b). This species is considered Near Threatened according to IUCN (Mildenstein 2016).

Wahlberg's epauletted fruit bat

Epomophorus wahlbergi (Sundevall, 1846)

Historical records: This species has been recorded in Moçâmedes (Seabra 1909; Bergmans 1988). Three individuals were collected from Namibe province (ISCED/1122, 1123, 1157).

Comments: This species is widespread mostly in the east-central and southern regions of the African continent (Werger & van Bruggen 2012; Happold 2013h; Monadjem *et al.* 2020). In Angola it is present in the western part of the country, and further southwards (Happold 2013h). This small to medium-sized fruit bat inhabits mainly woodland savannas with fruit trees, where it can feed on soft fruits, pollen and nectar (Happold 2013h; Monadjem *et al.* 2020). This species has two subspecies, *E. w. wahlbergi* and *E. w. haldemani*, being the latter the one present in Angola (Happold 2013h). The conservation status of this species is Least Concern according to IUCN (Shoeman 2016).

Family RHINOLOPHIDAE

Dent's horseshoe bat

Rhinolophus denti Thomas, 1904

Historical records: This species has historical records inside INP (Juste & Carballo 1992); and in its vicinities in the Namibe Partial Reserve (Juste & Carballo 1992) and Ruacaná falls (-17.38, 14.13, 937m) (Crawford-Cabral 1986). One individual collected from northern Namibia near the Angola border (-17.4667, 13.0333, 1280m) (LACM/058982).

Comments: This species is distributed in two main patches, one in the western and the other on the southern region of the continent (Cotterill 2013a; Monadjem *et al.* 2020). In Angola it is present in the south of the country (Cotterill 2013a; Monadjem *et*

al. 2020). This species has two subspecies recognized, *R. d. knorri* and *R. d. denti*, being the latter present in Angola (Cotterill 2013a). This bat is a very small microbat, even for the African rhinolophid species (Cotterill 2013a). *R. denti* normally inhabits semi-arid and desert vegetation areas, such as the Namib Desert (Cotterill 2013a). According to IUCN this species has a conservation status of Least Concern (Monadjem *et al.* 2017a).

Family HIPPOSIDERIDAE

Sundevall's leaf-nosed bat

Hipposideros caffer (Sundevall, 1846)

Historical records: This species has records in Moçâmedes (Seabra 1905) and in the Curoca River (Peters 1870). Three specimens were collected from Namibe province (ISCED/356, 760, 8118); one in Pedra Grande Caraculo (-15.13, 12.63, 618m) (ISCED/493) (Monadjem *et al.* 2020); and several other from north Namibia near the Angola border (-17.4667, 13.0333, 1280m) (LACM/058986-058991).

Comments: This species is widespread throughout the African continent, and in Angola it is present in the southwestern region (Bernard & Happold 2013a; Monadjem *et al.* 2020). This small microbat is insectivorous and, according to Bernard & Happold (2013a), feeds mostly on swarms and insects drawn to electric lights. *H. caffer* can be found mostly in woodland savannas and it is mainly gregarious (Bernard & Happold 2013a). This species has four recognized subspecies, *H. c. tephrus*, *H. c. angolensis*, *H. c. nanus* and *H. c. caffer*, being the second one present in Angola (Bernard & Happold 2013a). This species is considered Least Concern according to IUCN (Richards *et al.* 2020).

Family EMBALLONURIDAE

Mauritian tomb bat

Taphozous mauritianus E. Geoffroy, 1818

Historical records: This species has been recorded in Moçâmedes (Seabra 1909). One individual was collected from Namibe province (ISCED/44).

Comments: This species is well distributed in Africa and in Angola (Happold 2013l; Beja *et al.* 2019; Monadjem *et al.* 2020). This medium to large-sized bat is present in woodland savannas and rainforests (Happold 2013l). *T. mauritianus* feeds mostly on moths and it catches the prey mainly by fast-hawking in open spaces, but also by

chasing it against walls and by taking off and capturing the insects passing by them (Fenton *et al.* 1980; Werger & van Bruggen 2012; Happold 2013l; Monadjem *et al.* 2020). According to IUCN this species has a conservation status of Least Concern (Monadjem *et al.* 2017b).

Family NYCTERIDAE

Egyptian slit-faced bat

Nycteris thebaica E. Geoffroy, 1813

Historical records: This species has historical records in Moçâmedes (Seabra 1909), Capolopopo (-15.88, 12.88, 535m) (ISCED/679) (Monadjem *et al.* 2020) and in Curoca River (Hill & Carter 1941; Seabra 1900). One individual was collected from the Namibe province (ISCED/496), and another from north Namibia near the Angola border (-17.0000, 13.2167, 1009m) (LACM/058935).

Comments: This species is widespread throughout the whole African continent and Angola (Hill & Carter 1941; Monadjem *et al.* 2010; Bernard & Happold 2013b; Monadjem *et al.* 2020). It is normally found in open woodland savannas and in dense coastal and riverine forests (Werger & van Bruggen 2012; Bernard & Happold 2013b). This small microbat is communal and lives in small to large colonies (Bernard & Happold 2013b). It is insectivorous and feeds mostly on arthropods (Bernard & Happold 2013b; Monadjem *et al.* 2020). According to Bernard & Happold (2013b), *N. thebaica* catches the insects by slow-hawking, fly-catching, foliage- and ground-gleaning, and this occurs in, under and above tree canopies, over streams, near the ground and near lights and buildings (Seamark & Bogdanowicz 2002; Bernard & Happold 2013b; Monadjem *et al.* 2020). This species has six subspecies, *N. t. brockmani*, *N. t. thebaica*, *N. t. labiate*, *N. t. capensis*, *N. t. angolensis* and *N. t. damarensis* (Bernard & Happold 2013b). Only the last two can be found in Angola, *N. t. angolensis* in the southwest coastal of the country and *N. t. damarensis* in south central (Bernard & Happold 2013b). According to IUCN this species has a conservation status of Least Concern (Monadjem *et al*. 2017c).

Family MOLOSSIDAE

Little free-tailed bat

Tadarida pumila (Cretzschmar, 1830-1831)

Historical records: This species has historical records in Moçâmedes (Seabra 1909).

Comments: This species is widespread throughout Africa, and it is present in Senegal, Eritrea, Ethiopia, Somalia, Angola, Botswana and South Africa (Happold 2013j). In Angola, its distribution ranges from northwest to southwest of the country (Happold 2013j). According to Happold (2013j) this species inhabits mostly savannas, *Isoberlinia* woodland, mosaic of lowland rainforest, wetter and drier miombo woodlands and coastal mosaics. This very small microbat is the smallest of the free-tailed bats, but it is common (Happold 2013j). It is insectivorous, eating mainly soft-bodied insects, by fast-hawking on top of tree canopies, over waterpoints and sometimes between trees (Happold 2013j). This species' conservation status is considered Least Concern according to IUCN (Mickleburgh *et al.* 2019).

Family VESPERTILIONIDAE

Long-tailed serotine

Eptesicus hottentotus (A. Smith, 1833)

Historical records: This species has historical records in the vicinities of the park in Capolopopo (Crawford-Cabral 1966), with one specimen collected from this location (ISCED/727) (Monadjem *et al.* 2020).

Comments: This species is present in Somalia, Kenya, Zambia, Angola, Zimbabwe, Malawi, Mozambique, Namibia and South Africa (Cotterill & Happold 2013a; Monadjem *et al.* 2020). In Angola, it can be found in the southwestern region of the country (Monadjem *et al.* 2010; Cotterill & Happold 2013a; Monadjem *et al.* 2020). Normally inhabits woodland savannas and, when in deserts, near rivers (Cotterill & Happold 2013a). This small microbat lives and roosts in small groups and is insectivorous (Cotterill & Happold 2013a; Monadjem *et al.* 2020). According to Cotterill & Happold (2013a), it might have four subspecies, *E. h. portavernus*, *E. h. bensoni*, *E. h. pallidior* and *E. h. hottentotus*, but more studies need to be done to be sure of this information. According to IUCN, this species has the conservation status of Least Concern (Monadjem *et al.* 2017d)

Schlieffen's twilight bat

Nycticeinops schlieffeni (Peters, 1859)

Historical records: This species has historical records from the vicinities of the park, in Ruacaná falls (Crawford-Cabral 1986). One individual was collected from north Namibia near the Angola border (-17.48333, 13.81667, 1068m) (LACM/48721).

Comments: This species occurs disjunctly in two parts of Africa, one on the west part of the continent and below the Sahara Desert and other on the east side from Sudan to South Africa, going westwards to Angola and Namibia (Happold 2013k). In Angola it is present in the southeastern part of the country (Happold 2013k). *N. schlieffeni* can be found in semi-desertic grassland and shrubland, coastal habitats and in wetter and drier miombo woodlands (Happold 2013k). According to Beja *et al.* (2019), this species is associated with aquatic riparian habitats. This very small microbat is insectivorous and opportunistic, eating a wide range of different small insects (but mainly aerial) by slow-hawking (Happold 2013k; Monadjem *et al.* 2020). This species has the conservation status of Least Concern according to IUCN (Monadjem *et al.* 2017e).

Yellow-bellied house bat

Scotophilus dinganii (A. Smith, 1833)

Historical records: This species has historical records in Moçâmedes (Seabra 1909).

Comments: This species is widespread throughout the continent (Happold 2013l). In Angola it is present in the north, west and southwest region of the country (Happold 2013l). It can be found in a wide range of different habitats, bellow the Sahara Desert, being mostly present in woodland savannas but can also appear in rainforest habitats, being linked mainly to habitats with trees (Happold 2013l; Beja *et al.* 2019; Monadjem *et al.* 2020). This small microbat is insectivorous, feeding mainly on beetles, by moderately fast hawking above the tree's canopies and houses (Happold 2013l; Monadjem *et al.* 2020). This species has a conservation status of Least Concern according to IUCN (Monadjem & Griffin 2017a).

Angolan wing-gland bat

Cistugo seabrae Thomas, 1912

Historical records: This species has historical records in Moçâmedes (Thomas 1912; Seamark & Kearney 2006), with a specimen collected from this location (BM/1906.1.3.3) (Crawford-Cabral 1986).

Comments: This species' distribution is restricted to the Namib Desert, being recorded from Angola to north of South Africa (Kearney 2013a; Beja *et al.* 2019; Monadjem *et al.* 2020). In Angola it is present from Moçâmedes southwards to the border with Namibia and was described from specimens obtained in Moçâmedes (Kearney 2013a; Beja *et al.* 2019; Monadjem *et al.* 2020). This species is found mainly in arid areas,

such as desert and semi-desert, near water sources (Shortridge 1942; Herselman & Norton 1985; Monadjem *et al.* 2020). Angolan wing-gland bat is a very small microbat, and it is insectivorous (Kearney 2013a; Monadjem *et al.* 2020). This species is considered Least Concern according to IUCN (Monadjem *et al*. 2017f).

Order CARNIVORA

Family CANIDAE

Black-backed jackal

Canis mesomelas Schreber, 1775

Recent records: One individual was spotted running in INP (-16.5091, 12.2716, 300m) by the authors on 15th November 2019. Several individuals of *C. mesomelas* were caught on three different cameras (Site 6, 12 and 13 (Figure 10.) - see Table 4. for coordinates).

Historical records: This species has historical records inside INP (Juste & Carballo 1992)**,** Iona (Simões 1970), Espinheira (ISCED/4840, 4843 and 4946) (Crawford-Cabral 1989); and in its vicinities, Pico Azevedo (Hill & Carter 1941), 63 km south of Moçâmedes in the road of Porto Alexandre (Crawford-Cabral 1968), Capolopopo (ISCED/684, 696 and 697) (Crawford-Cabral 1989) and Namibe Reserve (Juste & Carballo 1992). Four individuals collected in Namibe province (ISCED/176, 686, 687 and 4946) and one in Pico Azevedo (AMNH/M-80652).

Comments: This species' distribution is divided in two disjunct populations across the continent, one in the northeastern and eastern regions, and the other in the southern region (da Silva 1970; Loveridge & Nel 2013). In Angola, this species occurs in the south and southwest of the country, including INP (da Silva 1970; Huntley 1972a; Werger & van Bruggen 2012; Loveridge & Nel 2013). *C. mesomelas* is present in very different habitats, ranging from arid coastal desert, mopane woodlands and savanna woodlands to areas where the rain falls intensely (up to 2000 mm) (Rowe-Rowe 1982; Crawford-Cabral 1990). This species is an opportunistic and generalist feeder, as it inhabits different habitats, it feeds on what it can find (Werger & van Bruggen 2012; Loveridge & Nel 2013). *C. mesomelas* is a fox-like small canid, generally common, monogamous, and it is mainly diurnal although it has nocturnal activity (da Silva 1970; Loveridge & Nel 2013). According to Loveridge & Nel (2013), two subspecies are recognized, *C. m. schmidti* and *C. m. mesomelas*, being the latter present in Angola. The IUCN classifies the *C. mesomelas* as Least Concern (Hoffmann 2014a). On the

other hand, this species is reported in the Red List of Angola with the conservation status of Vulnerable Species (MINAMB 2016a).

Figure 10. A black-backed jackal (*Canis mesomelas mesomelas*) caught on site 13.

African wild dog

Lycaon pictus (Temminck, 1820)

Historical records: This species has historical records inside INP (Simões 1971); and in its outskirts, between Pediva and Capolopopo (ISCED/723-726) (Crawford-Cabral & Simões 1990).

Comments: This species used to have a wide distribution in sub-Saharan Africa, but currently this distribution is reduced to patches (Werger & van Bruggen 2012; McNutt & Woodroffe 2013). From the late nineties and beginning of the new century (Fanshawe *et al.* 1997; Woodroffe *et al.* 2004) to now (Woodroffe & Sillero-Zubiri 2020) this species is either known or presumed, to be extinct or near-extinct in some African countries. In Angola it was once widespread throughout the country too (Huntley 1974; Crawford-Cabral & Simões 1990), but currently, its distribution is limited to the south, mostly to the southeast of the country, near the border with Namibia, being locally extinct from INP (INBAC 2016; Beja *et al.* 2019; Overton *et al.* 2020; Monterroso *et al.* 2020). This species can be found in different habitats, like short-grass plains, semi-desert areas, bushy savannas, woodlands and upland forest (McNutt & Woodroffe 2013). African wild dogs are carnivorous and are cursorial predators that hunt in packs (da Silva 1970; Werger & van Bruggen 2012; McNutt & Woodroffe 2013). This large canid is

characterized by the round ears that it has and by the strong and unpleasant scent (da Silva 1970; McNutt & Woodroffe 2013). *L. pictus* is reported in IUCN and in the Red List of Angola with a conservation status of Endangered species (MINAMB 2016a; Woodroffe & Sillero-Zubiri 2020).

Cape fox

Vulpes chama (A. Smith, 1833)

Recent records: Two individuals spotted in INP (-16.4348, 12.4835, 436m) by the authors on 14th November 2019. Two individuals were spotted inside the park (-16.4250, 12.5060, 401m) by Sara and David Elizalde on 2nd June 2020. Several individuals of *V. chama* were caught on two different cameras (Site 6 and 17 (Figure 11.) - see Table 4. for coordinates).

Historical records: This species is present in south Angola (Shortridge 1934) and has records in the road to INP (Crawford-Cabral 1968), and inside the park, Iona (Simões 1971), Espinheira (ISCED/4839) (Crawford-Cabral 1989), Moçâmedes Desert, Morro Preto Plains (da Silva 1970); and its vicinities, Pico Azevedo (da Silva 1970), Capolopopo and Curoca River (Crawford-Cabral 1968). Three individuals collected from Namibe province (ISCED/172, 445 and 452).

Comments: This species is present mainly in the southern region of the country (da Silva 1970; Werger & van Bruggen 2012; Nel *et al.* 2013). Southwest of Angola is the northernmost location of Africa that this species occurs, being present in INP (Huntley 1973; Nel *et al.* 2013; Beja *et al.* 2019). This species can be found in the desert and sub-desert areas, mainly in open scrub country and grasslands, and in Angola it is associated with pans, rock outcroppings, inselbergs and kopjes of the Namib Desert (Stuart 1975; Crawford-Cabral 1989; Nel *et al.* 2013). *V. chama* is the smallest canid present in southern Africa and it is a common animal, though it is more active at dusk and night (da Silva 1970; Stuart 1975; Nel *et al.* 2013). It is omnivorous feeding mostly on rodents, beetles and grasshoppers, albeit hares, reptiles, birds, other invertebrates and some wild fruits can be found in its diet too (da Silva 1970; Werger & van Bruggen 2012; Nel *et al.* 2013). The IUCN classifies the conservation status of *V. chama* as Least Concern (Hoffmann 2014b). On the other hand, this species is reported in the Red List of Angola as Endangered Species (MINAMB 2016a).

Figure 11. A cape fox (*Vulpes chama*) caught on site 17.

Bat-eared fox

Otocyon megalotis (Desmarest, 1822)

Historical records: This species has historical records inside INP (Crawford-Cabral 1989), Iona (Simões 1971); and in its vicinities, Pico Azevedo (Hill & Carter 1941; da Silva 1970) and Moçâmedes (Ferreira 1989). Two individuals were collected from Namibe province (AMNH/M-80622 and ISCED/8115) and another two from Pico Azevedo (ISCED/692 and 693) (Crawford-Cabral 1989).

Comments: This species has two disjunct populations, one in the eastern and the other in the southern areas of the continent (Hill & Carter 1941; Nel & Maas 2013). In Angola it occurs in the south and southwest of the country, including INP (Huntley 1973; Nel & Maas 2013; Beja *et al.* 2019). This species inhabits mainly open grasslands with short-grass areas and bare patches, arid and semi-arid savannas and shrublands (Werger & van Bruggen 2012; Nel & Maas 2013). This small bat-eared fox is mainly nocturnal, bigamous and common inside the conservation areas (da Silva 1970; Nel & Maas 2013). It is insectivorous, feeding mostly on harvester termites, beetles and ants, although fruits, small mammals, birds, eggs and reptiles can be a part of its diet too (da Silva 1970; Nel 1978; Skinner & Chimimba 2005; Nel & Maas 2013). *O. megalotis* has

shown some adaptations corresponding to the insectivorous diet as the number and shape of the teeth and the size of the ears, which are big to locate the insects and larvae, and might even help with the thermoregulation (Smithers 1971; Maas 1993; Kieser 1995; Werger & van Bruggen 2012; Nel & Maas 2013). According to Nel & Maas (2013), this species has two subspecies, *O. m. megalotis* and *O. m. virgatus*, being the first the one that is present in Angola, and in INP. The IUCN classifies the *O. megalotis* with the conservation status of Least Concern (Hoffmann 2014c). On the other hand, this species is reported in the Red List of Angola as a Vulnerable species (MINAMB 2016a).

Family MUSTELIDAE

Zorilla

Ictonyx striatus (Perry, 1810)

Recent records: One individual was caught on camera (site 8 (Figure 12.).

Historical records: This species has a historical record in the vicinities of the park, Capolopopo (Crawford-Cabral 1989). Three individuals were collected from Namibe province (ISCED/684, 783 and 784).

Comments: This species is widespread throughout the continent bellow the Sahara desert (Stuart & Stuart 2013a). In Angola it is present in all the country except for the northeast (Stuart & Stuart 2013a). *I. striatus* is present in a wide range of different habitats such as open grassland, savanna woodland, rocky areas, forest, desert and semi-arid environments (Stuart & Stuart 2013a; Taylor *et al.* 2018; Beja *et al*. 2019). This slow skunk-like small carnivore is very easily recognized in Africa, it is found normally alone or in pairs (Werger & van Bruggen 2012; Stuart & Stuart 2013a). This species is nocturnal, and it is characterized by ejecting a strong smell through its anal glands (Werger & van Bruggen 2012). It is generalist, feeding mainly on insects but may eat small murids, reptiles and invertebrates and more occasionally eggs and fruits (Werger & van Bruggen 2012; Stuart & Stuart 2013a; Beja *et al.* 2019). According to IUCN, *I. striatus* has a conservation status of Least Concern (Stuart *et al.* 2015).

Figure 12. A zorilla (*Ictonyx striatus*) caught on site 8.

African clawless otter

Aonyx capensis (Schinz, 1821)

Historical records: This species has historical records in Moçâmedes (Hill & Carter 1941).

Comments: According to Nel & Sommers (2002), this is the otter species with the broadest distribution in Africa, and it is present in the tropical and sub-tropical regions with freshwater of the sub-Saharan Africa. In Angola it occurs in the rivers of the east centre and south of the country (Somers & Nel 2013). This medium-sized otter is mainly aquatic, and it is always present in habitats with freshwater (or marine habitats as long as it is near fresh water), but can also be found in impoundments, estuaries, mangroves and even in desert conditions near rivers (van Niekerk *et al.* 1998; Somers & Nel 2004, 2013; Nel & Somers 2007). The African clawless otter is adapted to live in the water, being characterized by having a dense fur to isolate the body when it is inside the water, a webbed back foot to help with the propulsion and the tail acts as a rudder (Somers & Nel 2013). This species has three recognized subspecies, *A. c. capensis*, *A. c. hindei* and *A. c. meneleki*, being the first one present in Angola (Coetzee 1977; Somers & Nel 2013). According to IUCN, this species has a conservation status of Near Threatened (Jacques *et al.* 2015).

Ratel

Mellivora capensis (Schreber, 1776)

Recent records: One carcass of *M. capensis* was found in the Omauha Farm (12.3864, -16.2157, 327m) by the authors on 21st November 2019 (Figure 13.).

Historical records: This species has a historical record in Moçâmedes (du Bocage 1890).

Comments: This species is widespread throughout Africa, except for some areas in the north (Begg *et al.* 2013; Taylor *et al.* 2018). In Angola it is present in the entirety of the country, and according to Begg *et al.* (2013) it was not present in the Namib Desert, although Beja *et al.* (2019) point to recent unpublished data that mention its presence there. The ratel can occur in a wide range of habitats, from desert to moist rainforests (Begg *et al.* 2013; Taylor *et al.* 2018). It has claws that help them dig and climb (Begg *et al.* 2013). It is mainly nocturnal, and it appears in pairs or alone (Begg *et al.* 2013). *M. capensis* is an opportunistic, generalized carnivore, eating from small insect larvae to baby ungulates (Begg *et al.* 2013). According to Baryshnikov (1988, 2000), this species has ten subspecies and divides them in two groups (based on the mantle colour), '*capensis*' group, with all the African subspecies and two from the Arabia and Asia, and '*indica*' group, with the rest of the Asian subspecies. The IUCN classifies this species with the conservation status of Least Concern (Do Linh San *et al.* 2016). Although, in the Red List of Angola it is reported as Vulnerable (MINAMB 2016a).

Figure 13. A carcass of ratel (*Mellivora capensis*) found inside the Omauha Farm. Photo by Sara and David Elizalde.

Family OTARIIDAE

Cape fur seal

Arctocephalus pusillus (Schreber,1775)

Recent records: Several individuals of this species were seen in the coastal dunes area of INP, namely in Praia do Navio (-16.277583, 11.822361, 8m) on 8th December 2013 (Figure 14.) and Tigres bay in August 2018 by Luís Ceríaco.

Historical records: This species has historical records in southern Angola (Skinner & Smithers 1990), Tigres bay (Vilela 1923); and in the vicinities of INP, Moçâmedes (da Franca 1967).

Comments: This species is endemic to southern African waters, being present on the coastline from southern Angola to southeast of South Africa (David & Oosthuizen 2013; Hofmeyr 2015). In Angola it occurs from the coast of Tigres bay going southwards to the border with Namibia, including INP (David & Oosthuizen 2013; van der Westhuizen *et al.* 2017). According to David & Oosthuizen (2013), this species occurs in three marine zones, in the cold and productive waters on the coast of Benguela (southern Africa's west coast), in the mixed waters from Agulhas (warm water) and Atlantic (cold water) (South Africa's south coast), and the warm waters from Agulhas (South Africa's southeast coast). This fur seal might be the most abundant and is the largest of the eight species of fur seals worldwide (David & Oosthuizen 2013). Cape fur seal are opportunistic feeders, eating mainly fish and cephalopods and very occasionally crustaceans are part of the diet too (David & Oosthuizen 2013). This species has two subspecies, *A. p. pusillus* and *A. p. doriferus*, being the first one present in Angola (David & Oosthuizen 2013). According to IUCN, this species has the conservation status of Least Concern (Hofmeyr 2015).

Figure 14. A juvenile cape fur seal (*Arctocephalus pusillus pusillus*) in the Praia do Navio, coastal area of INP. Photo by Luís Ceríaco.

Family FELIDAE

Lion

Panthera leo (Linnaeus, 1758)

Recent records: On 1st August 2013, a male desert lion crossed the Cunene River to INP, going up until Tigres bay, returning to Namibia on 16th August 2013 (Flip Stander 2019).

Historical records: This species has historical records inside INP, Iona (Fenyövi 1958); and in its vicinities, Moçâmedes district (da Silva 1944-46; Themido 1946; Borges 1950), along railway from 78 km to 118 km east of Moçâmedes, Cunene River Mouth, about 100 km from Moçâmedes (da Silva 1944-46), Oncócua and 70 km from Moçâmedes (Fenyövi 1958).

Comments: This species used to be widespread throughout Africa, excluding the inner Sahara Desert and the equatorial forest (West & Packer 2013), but recent studies indicates that it is locally extinct from many regions of Africa and has a patchy distribution throughout the continent, being present only in some protected areas and their outskirts (Werger & van Bruggen 2012; West & Packer 2013). In Angola, lions used to be present in the forests in the northeast, the miombo woodlands in the centre and the mopane woodlands in the southwest of the country (Crawford-Cabral & Simões 1990), being present in INP (da Silva 1970; Huntley 1971a, 1972a, 1973). Currently this species is locally extinct from INP (Mendelsohn & Mendelsohn 2018), and although

there is a recent record in the park, this species is currently not established in the park, and it is considered a non-residential event. Lions are normally one of the first felines species to disappear from an area when there is limited prey and/or conflict with humans happen (for example war) (Taylor *et al.* 2018), and according to Ray *et al.* (2005) this species has been reduced from 83% of its range inside the African continent. *P. leo* can be found in woodlands, montane areas, hills, semi-desert regions and used to be found in the desert (West & Packer 2013). This species is the largest of Africa's carnivores (West & Packer 2013). It is carnivorous but opportunistic, feeding normally on medium to large-sized ungulates, but occasionally on rodents, hares, birds and reptiles (Werger & van Bruggen 2012; West & Packer 2013). According to Hemmer (1974) and Nowell & Jackson (1996), this species has eight subspecies, *P. l. azandica*, *P. l. bleyenberghi*, *P. l. krugeri*, *P. l. leo*, *P. l. melanochaita*, *P. l. nubicus*, *P. l. senegalensis*, *P. l. persica*, being the subspecies *P. l. bleyenberghi* the one present in Angola and that used to occur in INP. The IUCN classifies *P. leo* with the conservation status of Vulnerable species (Bauer *et al.* 2016). On the other hand, this species is reported in the Red List of Angola as Endangered species (MINAMB 2016a).

Leopard

Panthera pardus (Linnaeus, 1758)

Recent records: Tracks of a leopard were found inside INP (-16.4316, 12.4900, 431m) on 2nd June 2020 by Sara and David Elizalde. One individual was caught on camera (Site 36 (Figure 15.) - see Table 4. for coordinates).

Historical records: This species has historical records in INP (de Queiroz 1965); and in its vicinities, in south of Capolopopo (Fenykövi 1958) and in Curoca River (Capello & Ivens 1886).

Comments: This species is widespread mainly throughout sub-Saharan Africa, although it is estimated that this species has suffered a loss of 36,7% of its distribution in Africa (da Silva 1970; Ray *et al.* 2005; Werger & van Bruggen 2012; Hunter *et al.* 2013). In Angola, leopards used to occur throughout the entire country, including INP (da Silva 1970; Huntley 1971a, 1973; Hunter *et al.* 2013; Maclennan 2015). *P. pardus* is present in a wide range of habitats, from rainforest, woodlands, grassland savannas, forests, mountain, coastal scrub, shrubland, semi-desert and deserts (Hunter *et al.* 2013). Leopards are large cats characterized by their spotted fur (that offers camouflage), and for its robust muscular forequarters (that provides them with the skill

to climb, making them partly arboreal) (da Silva 1970; Kingdon 1977; Werger & van Bruggen 2012; Hunter *et al.* 2013). This species is carnivorous feeding on a panoply of animals, from arthropods to primates and also small, medium and large ungulates (Kingdon 1977; Werger & van Bruggen 2012; Hunter *et al.* 2013). It hunts alone, opportunistically and mainly during the night, early morning and late afternoon (Werger & van Bruggen 2012; Hunter *et al.* 2013). A total of 15 subspecies were described by Allen (1939) comparing the pelage and cranial differences; however, this division was contradicted by molecular studies, and eight subspecies are now suggested (Hunter *et al.* 2013). *P. pardus* is reported by the IUCN and the Red List of Angola with a conservation status of Vulnerable species (MINAMB 2016a; Stein *et al.* 2020).

Figure 15. A leopard (*Panthera pardus*) caught on site 36.

Caracal

Caracal caracal (Schreber, 1776)

Recent records: Individuals were caught on two cameras (Site 31 and 34 (Figure 16.) - see Table 4. for coordinates).

Historical records: This species has historical record inside INP, Iona (Simões 1971); and in its vicinities, north of Capolopopo and 15 km east of Pico Azevedo (Crawford-Cabral 1968). Several individuals were collected from Namibe province (ISCED/226, 671, 683, 774, 776).

Comments: This species is widely distributed throughout Africa, being absent in the forest of the equatorial belt and the central region of the Sahara Desert (Hill & Carter

1941; Stuart & Stuart 2013b). In Angola it occurs in the central and southern region of the country (Crawford-Cabral 1989; Stuart & Stuart 2013b). This robustly built cat is present in different habitats, such as semi and sub-desert, open savanna, scrubland, moist woodland, thicket montane forest, rugged mountains, hills, desert plains, dry river courses, rocky inselbergs, drier woodland and savanna with cover (da Silva 1970; Crawford-Cabral 1989; Stuart & Stuart 2013b). This reddish uniformly coloured species is mainly nocturnal and common in some areas where it occurs (da Silva 1970; Werger & van Bruggen 2012; Stuart & Stuart 2013b). It is characterized for having a well-developed ear, which helps when it needs to hunt, and for having a dark tuft on top of the ears, which act as a communication tool (Stuart & Stuart 2013b). The caracal is mainly carnivorous, and feeds mostly on small and medium-sized mammals, usually murids and antelopes but also feeds on birds, reptiles, invertebrates, fishes and plant matter (da Silva 1970; Werger & van Bruggen 2012; Stuart & Stuart 2013b). According to Smithers (1975), *C. caracal* has seven subspecies described, but Stuart & Stuart (2013b) questions this description and proposes that it might be better to consider it as geographical variations. The IUCN classifies *C. caracal* with the conservation status of Least Concern (Avgan *et al.* 2016). On the other hand, this species is reported in the Red List of Angola as a Vulnerable species (MINAMB 2016a).

Figure 16. A caracal (*Caracal* caracal) caught on site 34.

Cheetah

Acinonyx jubatus (Schreber, 1775)

Recent records: Individuals alone were caught on three different cameras (Site 2 (Figure 17.), 14 and 15 - see Table 4. for coordinates).

Historical records: This species has historical records in INP (de Queiróz 1965).

Comments: This species used to have a wider range of distribution on the African continent (Myers 1975; Nowell & Jackson 1996; Sunquist & Sunquist 2002), but currently it is estimated that it has disappeared from 76% of its former distribution in Africa, being present in a patchy distribution, from Senegal to Somalia southwards to South Africa, and appear to have some small isolated populations in the north (Morocco, Algeria and Egypt) (Caro 2013; Durant *et al.* 2016). In Angola, this species occurs in the southeast and southwest of the country, including INP (INBAC 2016; Monterroso *et al.* 2020). The usual habitat for this feline is open plains, open grasslands, savanna woodlands (miombo and *Acacia*), semi-desert and in high mountains (Caro 2013). According to Caro (2013), this medium-sized spotted feline is the fastest animal on earth (in a small distance), and it is characterized for having tall and slim legs meant to help with these short and explosive sprints that can go up to at least 105 km/hour (Sharp 1977). Cheetahs are carnivores and its diet is based mainly in small to medium-sized ungulates [blesboks (*Damaliscus pygargus)*, impalas *(Aepyceros melampus*), Thomson's gazelle (*Eudorcas thomsonii*), Grant's gazelle (*Nanger granti*) and springbok (*Antidorcas marsupialis*)], even though occasionally they feed on small birds (guineafowl) and mammals (hares, porcupines, rats) (Caro 2013). This species comprises five subspecies, *A. j. hecki* (west African cheetah), *A. j. jubatus* (southern African cheetah), *A. j. raineyi* (east African cheetah), *A. j. soemmeringi* (central African cheetah) and *A. j. venaticus* (Asiatic cheetah), being the southern African cheetah (*A. j. jubatus*) the one found in Angola, including INP (Caro 2013). The IUCN classifies *A. jubatus* with the conservation status of Vulnerable (Durant *et al.* 2015). On the other hand, this species is reported in the Red List of Angola as an Endangered species (MINAMB 2016a).

Figure 17. A southern African cheetah (*Acinonyx jubatus jubatus*) caught on site 2.

Wildcat

Felis silvestris Schreber, 1777

Recent records: One individual was caught on one camera (Site 7 (Figure 18.) - see Table 4. for coordinates).

Historical records: This species has historical records inside INP, Iona (Simões 1971) and 16 km south of Espinheira (ISCED/4964) (Crawford-Cabral 1989); and in its vicinities, as Capolopopo (Crawford-Cabral 1968). Two specimens were collected from Namibe province (ISCED/116 and 457) and one more from 16 km south of Espinheira (ISCED/4964).

Comments: This species is widespread throughout Africa, being present in roughly all the countries of this continent (Stuart *et al.* 2013). It is broadly distributed throughout Angola, including the southwest and INP (Huntley 1972a,1973; Crawford-Cabral 1989; Stuart *et al.* 2013). It is found in a wide range of habitats, from sea level to high mountains (e.g., more than 3800 m in Kenya and Ethiopia), such as the Sahara Desert fringe, hills, rocky outcrops, around cultivated areas and near human settlements (Stuart *et al.* 2013). Shelter to rest during the day is an important feature in the typical habitat of wildcats (Stuart *et al.* 2013). *F. silvestris* is a very common species with solitary and nocturnal habits (Stuart *et al.* 2013). Wildcats are predominantly carnivorous, feeding mainly on murids, but other small vertebrates (hares, rabbits, squirrels, springhares, birds, amphibians, reptiles and also young of gazelles, goats

and lambs) and occasionally small invertebrates (grasshoppers, spiders, scorpions) are also eaten which may show the opportunistic side of this feline (Stuart *et al.* 2013). According to Stuart *et al*. (2013), this species has a wide range of subspecies, based on the colour of the fur (darker on the southern and eastern areas; lighter on the southwestern area of Africa), but it is rather difficult to divide the subspecies when its distribution overlaps, mainly due to the hybridization with the domestic cat. The IUCN classifies *F. silvestris* with the conservation status of Least Concern (Yamaguchi *et al.* 2015). On the other hand, this species is reported in the Red List of Angola as a Vulnerable species (MINAMB 2016a).

Figure 18. A wildcat (*Felis* silvestris) caught on site 7.

Family VIVERRIDAE

Common genet

Genetta genetta (Linnaeus, 1758)

Historical records: This species has historical records in INP, Espinheira (ISCED/ 4962), 18 km south of Espinheira (ISCED/4963) and 10-15 km north of Espinheira (ISCED/4966 and 4967) (Crawford-Cabral 1989); and in its vicinities, 101 km north of Moçâmedes (AMNH/M-80740) (Hill & Carter 1941), 8 km southwest Ruacaná (ISCED/8098) and Capolopopo (Crawford-Cabral 1969). Several individuals were collected from Namibe province (ISCED/196, 413, 418, 454, 660, 823, 4962, 4963, 4966, 4967, 8610).

Comments: This species is widespread throughout Africa, being present in three

areas, one in northern Africa, another in the centre from west to east, and the third in the southwest of the continent (Delibes & Gaubert 2013). In Angola it is present in the south of the country (Delibes & Gaubert 2013). Common genet is mainly found in habitats where there are available prey and woody or rocky shelters, such as forest with bushy areas, mountainous areas, rocky ravines, wooded savannas and can also be on bushlands, farmlands and grasslands (Smithers 1971; Kingdon 1977; Delibes & Gaubert 2013). This is one of the most common small and nocturnal carnivores in Africa (Delibes & Gaubert 2013). *G. genetta* is a generalist, feeding mainly on small mammals, but can also feed on birds, eggs, reptiles, amphibians, fish, insects, arthropods, fruits, mushrooms and garbage (Delibes & Gaubert 2013). According to IUCN, this species has the conservation status of Least Concern (Gaubert *et al.* 2015).

Central African large-spotted genet

Genetta maculata (Gray, 1830)

Historical records: Six specimens of this species were collected on the Namibe Province (ISCED/182, 235573, 8052, 8051 and 8057).

Comments: This species is widespread through central Africa, southwards to Namibia and north of South Africa (Angelici & Gaubert 2013). In Angola it is present in all of the country (Angelici & Gaubert 2013). Its habitat ranges from rainforests, swamp zones, riverine vegetation, open and closed woodlands, moist forests, savanna-forest mosaics, thickets and even grassy savanna, to dry savanna and arid regions (Smithers 1971; Kingdon 1977; Rautenbach & Nel 1978; Yalden *et al.* 1996; Angelici & Gaubert 2013). This is a relatively common, solitary species and it has terrestrial and arboreal habits (Angelici & Gaubert 2013). The central African large-spotted genet is mainly carnivorous feeding on terrestrial and aquatic small invertebrates (bivalves, insects, scorpions, centipedes, and others) and small vertebrates (fish, amphibians, lizards, snakes, birds, and others) (Angelici & Gaubert 2013). According to IUCN, this species has the conservation status of Least Concern (Angelici *et al.* 2016).

Family HYAENIDAE

Brown hyena

Hyaena brunnea Thunberg, 1820

Recent records: Tracks of two brown hyenas were observed in INP (-16.4958, 12.2611, 295m; -16.7184, 12.8100, 624m) by the authors on 15th and 17th November

2019, respectively. An individual was spotted by Sara Elizalde and David Elizalde 36 km southwest of Espinheira (-17.0014, 12.0952, 543m) on 19th August 2018 (Figure 19.). A carcass was found on the road between Namibe and Tômbua before the exit to the road to INP, by the General Director (Aristófanes Pontes), Head of Biodiversity Management Department (Sango de Sá), INP administrator and International Consultants on 13th October 2018 (Sango de Sá, pers. comm.).

Historical records: This species has historical records in the arid southwest of Angola (Huntley 1974a), including INP (Huntley, 1974a), and the Cunene River (Anonymous 2009).

Comments: This species is endemic to southern Africa, being widespread throughout that region from Angola to South Africa (Werger & van Bruggen 2012; Mills 2013). In Angola it is present only on the southwest of the country, including INP (Huntley 1971a, 1973; Crawford-Cabral & Simões 1990; Maclennan 2015). The brown hyena's main habitat is the desert areas along the coast, semi-desert, open scrub and open woodland savanna, all areas where the rainfall ranges from 100 mm to 650 mm (Mills 1998). This medium-sized hyena can live independent of water, but needs shelter (either a tree, a bush or a hole on the ground) during the hotter hours of the day (Mills 2013). It is mainly active during the night but may also have some diurnal and crepuscular activity and can be found alone or in pairs (Werger & van Bruggen 2012; Mills 2013). This species is characterized by having strong teeth and jaws and well-developed muscles of the neck and head, which gives them the ability to open up larger leg bones and eat the extremely nutritive marrow inside (da Silva 1970; Mills 2013). *H. brunnea* are mainly scavengers, feeding mostly on vertebrates, but also on fruits, insects, birds' eggs, reptiles, fishes and sometimes kills small animals opportunistically (da Silva 1970; Ewer 1973; Mills 2013). In the Namib Desert it feeds mainly on baby cape fur seals (*Arctocephalus pusillus*) but also eats other species that appear dead on the shore (Goss 1986; da Silva 1970; Mills 2013). The IUCN classifies *H. brunnea* with a conservation status of Near Threatened (Wiesel 2015). On the other hand, according to the Red List of Angola this species is Extinct (MINAMB 2016a), but as it is referred in this study, individuals and tracks were recently recorded inside INP.

Figure 19. A brown hyena (*Hyaena brunnea*) running inside Iona National Park. Photo by Sara & David Elizalde.

Spotted hyena

Crocuta crocuta (Erxleben, 1777)

Recent records: Punctual records of spotted hyenas probably solitary in the extreme east of the park, near Otchifengo.

Historical records: This species has historical records in Moçâmedes (da Silva 1970).

Comments: This species is well distributed throughout the continent, south of the Sahara Desert (da Silva 1970; Werger & van Bruggen 2012; Hofer & East 2013). In Angola it is widespread in all of the country (da Silva 1970; Werger & van Bruggen 2012; Hofer & East 2013). *C. crocuta* can be found in very different habitats ranging from semi-desert, savanna and open woodland, dense dry woodland to montane habitats (Hofer & East 2013). This is the largest extant hyaena, it is terrestrial, mainly nocturnal and normally is found alone or in pairs (da Silva 1970; Hofer & East 2013). Spotted hyaenas are mainly described as scavengers but also hunt, eating small invertebrates (lizards and rodents), eggs, crabs and also large and medium-sized ungulates (da Silva 1970; Kruuk 1972; Hofer & East 2013). This species has a dentition adapted to crunch instead of to cut and tear the tissues of the prey (da Silva 1970; Hofer & East 2013). The IUCN classifies *C. crocuta* with the conservation status of Least Concern (Bohm & Höner 2015). On the other hand, it is present in the Red List of Angola as an Endangered species (MINAMB 2016a).

Aardwolf

Proteles cristatus (Sparrman, 1783)

Recent records: One individual was spotted running from a den, inside INP (-16.4253, 12.5064, 402m) by the authors on 14th November 2019, and another individual was spotted looking at the researchers from inside the den, in the outskirts of the Omauha Farm (-16.1448, 12.4114, 364m) by Sara and David Elizalde on 19th November 2019. Individuals alone were caught on several different cameras (Site 3, 4 (Figure 20.), 6, 7, 8, 17, 18, 21, 22, 31, 39 and 40 - see Table 4. for coordinates).

Historical records: This species has historical records inside INP, in Iona (Simões 1971), between Espinheira and Curoca river (Crawford-Cabral 1968), 10 km south of Espinheira (ISCED/4954) and 7 km north of Espinheira (ISCED/4965) (Crawford-Cabral 1989) and Morro Preto (da Silva 1944-46); and in its vicinities, Pico Azevedo (da Silva 1944-46), Capolopopo (Crawford-Cabral 1968) and Cunene River (Anonymous 2009). Several individuals were collected from Namibe province (ISCED/165, 209, 212 and 659), being one from 10 km south of Espinheira (ISCED/4954) and other from 7 km north of Espinheira (ISCED/4965) (Crawford-Cabral 1989).

Comments: This species occurs in two disjunct areas separated for 1500 km, one on the eastern and northeastern, and the other in southern Africa (da Silva 1970; Anderson 2013). In Angola it is present in southwestern area of the country, including INP (Huntley 1972a, 1973, 1974b; Anderson 2013). Aardwolf can be found in open and grassy plains, karroid habitats, grasslands and scrub, open savanna woodlands and inland gravel plains (Skinner & Chimimba 2005; Anderson 2013). This medium-sized carnivore is not common and mainly nocturnal, so it is not easy to find (Werger & van Bruggen 2012; Anderson 2013). *P. cristatus* is insectivorous, feeding mainly on termites, liking them from the surface of the ground with its large tongue (da Silva 1970; Kruuk & Sands 1972; Werger & van Bruggen 2012; Anderson 2013). This species has two subspecies *P. c. cristatus* and *P. c. septentrionalis*, being the first one present in the southern Africa (Anderson 2013). The IUCN classifies *P. cristatus* with the conservation status of Least Concern (Green 2015). On the other hand, aardwolf is reported in the Red List of Angola as an Endangered species (MINAMB 2016a).

Figure 20. An aardwolf (*Proteles cristatus cristatus*) caught on site 4.

Family HERPESTIDAE

Kaokoveld slender mongoose

Galerella flavescens Bocage, 1889

Historical Records: One specimen was collected from Namibe province (ISCED/1108).

Comments: This species is present only in Angola and Namibia (Taylor 2013c). In Angola it is distributed in the southwest of the country (Taylor 2013c). *G. flavescens* is present in arid hills and kopjes far from water (Shortridge 1934; Taylor 2013c). The Angolan slender mongoose feeds mainly on insects, small rodents, birds, lizards, crabs and other animals from water (Shortridge 1934; Rathbun & Rathbun 2006; Rathbun & Cowley 2008; Warren *et al.* 2009; Taylor 2013c). According to Crawford-Cabral (1996), the subspecies of *G. flavescens* can be separated into two groups based on the colour of the fur and geography, therefore, the species with a yellow fur and present in southwestern Angola belong to the subspecies *G. f. flavescens*, and on the other hand, the individuals with dark fur and that occur in the northwestern and northcentral Namibia belong to the subspecies *G. f. nigrata*. According to IUCN, this species has the conservation status of Least Concern (Rapson & Rathbun 2015).

Meerkat

Suricata suricatta (Schreber, 1776)

Recent records: Several individuals were spotted few km west of Espinheira (-16.8250, 12.2240, 473m) by David and Sara Elizalde on 16th August 2016 (Figure 21.).

Historical records: This species has historical records inside INP (Huntley 1974b), between Morro Vermelho and Iona (ISCED/753), at 18 km south of Espinheira (ISCED/4949-4953 and 4972) and 4 km north of Espinheira (ISCED/4881), Espinheira (ISCED/4846 and 4847), north of Serra Álvaro Ferreira and Morro do Coelho (Crawford-Cabral 1966, 1971, 1989).

Comments: This species is endemic to southern Africa and in Angola it occurs in the southwestern part of INP, and then from south of the Cunene and Zambezi Rivers to South Africa (Crawford-Cabral 1971, 1989; Werger & van Bruggen 2012; Macdonald 2013; Jordan & San 2015; Taylor *et al.* 2018). Its normal habitat is arid and semi-arid lands, that usually have short grasses and sparse woody growth, also found on plains and compact dunes (Huntley 1972a; Macdonald 2013). This meerkat is genetically near the *S. marjoriae* but have enough different characteristics to be described as a new species (Crawford-Cabral 1971). The meerkats are a gregarious and diurnal species (Zumpt 1968; Macdonald 2013). It is carnivorous, feeding mainly on invertebrates, insects, spiders, scorpions, reptiles, small mammals and birds (Zumpt 1968; Macdonald 2013). The species has three subspecies, *S. s. suricatta* present in southern Namibia, Botswana and South Africa; *S. s. marjoriae*, present in the Namib Desert and central and northwestern Namibia; and *S. s. iona*, present in southwestern Angola (and in Iona National Park), being an endemic of INP. This endemic subspecies has been described by Crawford-Cabral (1971), based on specimens collected in INP. The conservation status of the meerkats is Least Concern by the IUCN (Jordan & San 2015). On the other hand, the Red List of Angola consider it an Endangered species (MINAMB 2016a).

Figure 21. A group of iona meerkats (*Suricata suricatta iona*) inside Iona National Park. Photo by Sara and David Elizalde.

Banded mongoose

Mungos mungo (Gmelin, 1788)

Historical records: This species has historical records 24 km above Cunene falls (Hayman 1963), in the Cunene falls and in Ruacaná (Crawford-Cabral 1989). One specimen was collected from Ruacaná, Namibe province (ISCED/8111) (Crawford-Cabral 1989).

Comments: This species is distributed throughout the continent, below the Sahara Desert to south of Africa (Cant & Gilchrist 2013). In Angola it occurs in the majority of the country (Hill & Carter 1941; Cant & Gilchrist 2013; Gilchrist and Do Linh San 2016). It is present in a wide range of habitats, but it is mainly found in savannas and woodlands, normally near water points and termite hills (Werger & van Bruggen 2012; Cant & Gilchrist 2013). *M. mungo* is a medium-sized terrestrial mammal and has a great sense of smell, vision and hearing (Cant & Gilchrist 2013). It feeds mainly on insects, snails, myriapods, small reptiles, birds (young and eggs) and wild fruits (Smithers 1971; Rood 1975; Smithers & Wilson 1979; Rautenbach 1982; Hiscocks & Perrin 1990; Werger & van Bruggen 2012; Cant & Gilchrist 2013). According to Kingdon (1997), this species has four distinctive regional populations: *M. m. mungo*, in western Africa; *M. m. zebra*, in the Horn of Africa; *M. m. colonus*, in eastern Africa; and *M. m. taenionotus*, in southern Africa, but no subspecies are detailed. According to IUCN, this species has the conservation status of Least Concern (Gilchrist & Do Linh San 2016).

Dwarf mongoose

Helogale parvula (Sundevall, 1847)

Historical records: This species has historical records from southwest Angola (Hayman 1963), Capolopopo (ISCED/670) (Crawford-Cabral 1989) and Cunene Falls (Thomas 1926). Four individuals were collected from Namibe province (ISCED/ 177, 187, 372 and 373), and one from north Namibia near the Angola border (-17.4667, 13.3000, 1113m) (LACM/059638).

Comments: This species is distributed from south Somalia and Ethiopia to northeast South Africa and westwards to northern Namibia, southwest and central Angola and southeastern Democratic Republic of Congo (Creel 2013). *H. parvula* is normally present in partially woody habitats of intermediate thickness, and normally with termite hills, like open woodlands or savannas with rock outcropping or crevices (Creel 2013). This is the smallest of the mongooses, diurnal and the most abundant in its normal habitat of the small carnivores, normally found in packs of eight to ten, and sometimes more (Werger & van Bruggen 2012; Creel 2013). This species is mainly insectivorous (eating mostly coleoptera, orthoptera and isoptera) but also feeds occasionally on small vertebrates such as murids, snakes and lizards (Werger & van Bruggen 2012; Creel 2013). According to Coetzee (1977), this species is grouped in three sections, *parvula* (first section), that has four subspecies that belong to southern Africa; *undulata* (second section), that has six subspecies that belong to east and north-east Africa; and *varia* (third section), that has three subspecies that belong to central Africa. Of these, the subspecies that occur in Angola, near INP, is *H. p. mimetra* that is present in the first section (Creel 2013). According to IUCN, this species has the conservation status of Least Concern (Sharpe & Do Linh San 2015).

Order PHOLIDOTA

Family MANIDAE

Ground pangolin

Smutsia temminckii (Smuts, 1832)

Recent Records: A carcass of a ground pangolin was found in INP, in Pediva (-16.2900545, 12.5559993, 232m) on 2nd December 2013 by Luís Ceríaco. An individual was found in Capangombe (-14.9333062,12.9665622, 419m) on 4th August 2018, by Luís Ceríaco (Figure 22.).

Historical records: This species has historical records in Moçâmedes (du Bocage

1890).

Comments: This species is widespread throughout the eastern and southern region of the continent (Swart 2013). In Angola it is present in the centre and southeast regions, and it is the most common species of pangolin in this country (Swart 2013; Beja *et al.* 2019). This pangolin can be found mainly in savanna woodland with some dense scrub but can also inhabit floodplain grasslands and rocky slopes (Coulson 1989). This medium-sized pangolin has most of the body covered by scales which provide them protection from predators (Swart 2013). It is mostly nocturnal, and it is highly selective myrmecophagous, eating mostly ants and termites that can be found in aggregations on the ground (Swart 2013). The conservation status of this species by the IUCN and the Red List of Angola is Vulnerable (MINAMB 2016a; Pietersen *et al.* 2019).

Figure 22. A ground pangolin (*Smutsia temminckii*) in Capangombe. Photo by Luís Ceríaco.

Order PERISSODACTYLA

Family EQUIDAE

Plains zebra

Equus quagga Boddaert, 1785

Historical records: This species has historical records from inside INP, in Iona (Crawford-Cabral & Veríssimo 2005), in Espinheira (da Silva 1958), south of Pediva (Fenyövi 1958) between Iona and Oncócua (Fenyövi 1958); and in the vicinities of the park, 30 km from Oncócua to Iona (Fenyövi 1958), in Moçâmedes (da Silva 1970),

101 km east of Moçâmedes (Hill & Carter 1941), between Morro Preto and Pico Azevedo, Bero river (near the Pico Azevedo) (Teixeira 1945), Oncócua (Granado & Serrano 1992) and Cunene River (Capello & Ivens 1886; Monard 1935; da Silva 1970). Two individuals were collected from south Angola, near Pediva (-16.6667, 12.5833, 612m) (LACM/037702-037703), and another two from Moçâmedes (-15.16667, 12.16667, 6m) (AMNH/M-80593 and M-80484).

Comments: This species is present in Africa from south of Sudan and south of Ethiopia to north of Namibia and north of South Africa, being native to 16 different countries in this continent (Klingel 2013a; King & Moehlman 2016; Taylor *et al.* 2018). The population of this equid has suffered a huge decline in Angola since the 1960/70s, due mainly to poaching during the civil war that was more intense for this species compared to other ungulates (da Silva 1970; Huntley 1973; Huntley & Matos 1992; Crawford-Cabral & Veríssimo 2005; Klingel 2013a; King & Moehlman 2016; Beja *et al.* 2019). According to Huntley *et al.* (1971a), this species was one of the most common species in INP, with an estimated population of 200 individuals but currently it is presumably extinct from the park (Crawford-Cabral & Veríssimo 2005). This species is gregarious, having large herds, and can be found in open plains, grasslands, grassland-bushland mosaics and in the Miombo Woodland belt (da Silva 1970; Klingel 2013a). *E. quagga* depends on water, standing only one day without drinking it and it is mostly a grazer, feeding mainly on grass (90% of the diet), but can occasionally eat other herbs by mistake (Huntley 1972a; Klingel 2013a). This species has six subspecies *E. q. crawshaii*, *E. q. borensis*, *E. q. boehmi*, *E. q. chapmani*, *E. q. burchellii* and *E. q. quagga*, being *E. q. chapmani* the only present in Angola (Klingel 2013a). The conservation status of the plains zebra is Near Threatened by the IUCN (King & Moehlman 2016). On the other hand, the Red List of Angola considers this species as Vulnerable (MINAMB 2016a).

Mountain zebra

Equus zebra Linnaeus, 1758

Recent records: The authors spotted a few individuals in the outskirts of Omauha Farm: three individuals (-16.5201, 12.3653, 332m); two individuals (-16.5032, 12.2659, 298m); two individuals (-16.5024, 12.2652, 298m); two individuals (-16.2000, 12.3737, 311m) from 13th to 15th November 2019. Zebra dung was found inside the Omauha Farm (-16.1951, 12.3758, 314m) by the authors on 22nd February 2020. Tracks were

found inside the park (-16.7364, 12.3421, 421m) by Sara and David Elizalde on 2nd June 2020. Individuals were caught on four different cameras (Site 11 (Figure 23.), 12, 36 and 37 - see Table 4. for coordinates).

Historical records: This species has historical records inside INP (de Queiroz 1965; da Silva 1970; Crawford-Cabral & Veríssimo 2005), Iona (Morais 1957; Simões 1971), Cambeno (Morais 1957), Espinheira (Crawford-Cabral & Veríssimo 2005), south of Moçâmedes (Monard 1930) and coast of Moçâmedes (da Silva 1970); and in the vicinities of the park, Namibe province (Crawford-Cabral & Veríssimo 2005), Pico Azevedo (57 km southeast of Moçâmedes) (Hill & Carter 1941), about 70 km northeast of Moçâmedes, 50 km east of Porto Alexandre (Thomas 1900), Curoca River (Thomas 1900; Statham 1926), Morro Preto plains, all littoral between Curoca and Cunene rivers (da Silva 1944-46), Moçâmedes (Monard 1935), Oncócua (Serrano & Andrade 1973), 120 km southeast of Moçâmedes (Statham 1926) and 130 km north of Moçâmedes (Shortridge 1934). Two specimens collected from Namibe province (AMNH/M-80534 and M-80592).

Comments: In Africa, this species is distributed in two patches, one in South Africa and another in Namibia and Angola, separated by an area with plains therefore with no mountain habitats (Werger & van Bruggen 2012; Penzhorn 2013). In Angola it used to occur throughout the country until south of Benguela, but currently it occurs only in the southwest of the country, in the mountains that stretch from the Namib Desert through the central plateau in Namibia (Shortridge 1934; da Silva 1970; Crawford-Cabral & Veríssimo 2005; Penzhorn 2013). This distribution includes INP, and according to Huntley *et al*. (1971a), it used to be one of the most common species inside the park with a population of around 200 individuals, but with the civil war the number of individuals decreased (Huntley & Matos 1992; Crawford-Cabral & Veríssimo 2005; Penzhorn 2013; Taylor *et al.* 2018). Even though the status of the mountain zebra is currently unknown, this equid is still present in the park and recent aerial studies have shown an increase of this species in the park (Kolberg & Kilian 2003; Crawford-Cabral 2005; van der Westhuizen *et al.* 2017). This species can be found in mountainous habitats and escarpment areas with around 2000m of height and in INP it occurs in open sandy plains (Huntley 1972c; Penzhorn 2013). This equid eats mainly grass but feeds on woody plants if it does not find grass, and it is dependent on water, digging for it if there is no water source in the vicinities (Huntley 1972c; Penzhorn 2013). This can be a limitation in the distribution of *E. zebra* (Penzhorn 2013). This species has two

subspecies, *E. z. zebra* and *E. z.* hartmannae, being the latter native from Angola and present in INP (Penzhorn 2013; Beja *et al.* 2019). It is possible that this species is hybridizing with donkeys in the desert, but further genetic studies need to be done (Penzhorn 2013; Beja *et al.* 2019). The conservation status of the mountain zebras is Vulnerable by the IUCN (Gosling *et al.* 2019). On the other hand, the Red List of Angola considers this species as Endangered (MINAMB 2016a).

Figure 23. A mountain zebra (*Equus zebra hartmannae*) caught on site 11.

Family RHINOCEROTIDAE

Black rhinoceros

Diceros bicornis (Linnaeus, 1758)

Historical records: This species has historical records in southern Angola (du Bocage 1890), which includes INP, Espinheira (Crawford-Cabral & Veríssimo 2005), Iona (Statham 1924; da Silva 1944-46; Fenyövi 1958; Granado & Serrano 1959; Simões 1971; Broom *et al.* 1974), Pediva (Statham 1924; da Silva 1944-46, 58; Fenyövi 1958), Cambeno (Statham 1924; da Silva 1944-46, 1958), from Iona to Oncócua (Fenyövi 1958) and Otchifengo (Serrano & Andrade 1973); and in its vicinities, Namibe province, Pico Azevedo (Crawford-Cabral & Veríssimo 2005), Moçâmedes (Jentink 1887), Curoca Valley and River (Baptista *et al.* 1930; Hill & Carter 1941; Fenyövi 1958; Capello & Ivens 1881), Cunene (Statham 1924), north Curoca and Oncócua (Granado & Serrano 1959).

Comments: This species used to occur in most of southern and eastern Africa,

distributed in Angola, Namibia, Zambia, Democratic Republic of Congo, Somalia, Ethiopia, Sudan, Chad, Central African Republic, Cameroon and Nigeria, albeit now the bulk of this species (96% of the continent population) is concentrated in South Africa, Namibia, Zimbabwe and Kenya (da Silva 1970; Emslie & Adcock 2013). In Angola it occurred in two disjunct patches, one in the northern and the other in the southern region of the country, but it no longer exists here due to the civil war and poaching, and in INP the last sighted black rhinoceros was seen by Alvaro Batista in 1981 (da Silva 1970; Huntley 1971a, 1972a, 1973, 1974b; Crawford-Cabral & Veríssimo 2005; Werger & van Bruggen 2012; Emslie & Adcock 2013; Mendelson & Mendelson 2018; Taylor *et al.* 2018). The habitat of the black rhino is anywhere where herb and woody browse exists in abundance, such as deserts, desert plains, semi-desert, wooded savannas, woodlands, forests, sub-alpine heathlands and succulent valley bushvelds (Huntley 1972a; Emslie & Adcock 2013). It is thought that this species had the habit of rubbing on stones to scratch its body, smoothing it; these stones can still be found in the southwest of Angola, including INP (Figure 24.), serving as additional proof that this species historically occurred in this area (Mendelsohn and Mendelsohn 2018). This rhinoceros has refined hearing and smell, as opposed to the poor sense of vision (da Silva 1970; Emslie & Adcock 2013). It is dependent on water, but can go several months without directly drinking it, only from the plants that it eats (Emslie & Adcock 2013). The black rhinoceros is the second smallest of the rhino species, is normally found alone or in pairs and is characterized by having a hooked upper lip that helps it to pull the branches of trees and bushes, into its mouth, as well as the presence of two horns composed by a thick cluster of hairs and skin (da Silva 1970; Emslie & Adcock 2013). *D. bicornis* is a browser, feeding mostly on trees, bushes, herbs and succulents, and very seldomly is grass eaten (Werger & van Bruggen 2012; Emslie & Adcock 2013). Four subspecies of *D*. *bicornis* have been recognized, *D. b. longipes* (western black rhino), *D. b. michaeli* (eastern black rhino), *D. b. minor* (southern-central black rhino) and *D. b. bicornis* (south-western black rhino) (Emslie & Adcock 2013). The southern-central black rhino subspecies occurs from South Africa to southern Tanzania, and it used to be present in the north of Angola; the southwestern black rhino, that is distributed from Namibia to South Africa, used to occur in southern Angola, being this the subspecies that was present in INP; currently, both subspecies are locally extinct from the Angolan territory (Emslie & Adcock 2013). The conservation status of this species is Critically Endangered by the IUCN (Emslie 2020).

On the other hand, the Red List of Angola considers this species as Extinct (MINAMB 2016a).

Figure 24. Possible scratching stone smoothed by southwestern black rhino (*Diceros bicornis bicornis*) inside Iona National Park. Photo by Catarina Freixial.

Order CETARTIODACTYLA

Family HIPPOPOTAMIDAE

Common hippopotamus

Hippopotamus amphibius Linnaeus, 1758

Historical records: This species has historical records from 15 km downstream Ruacaná Falls (Maia 1929), in Ruacaná (Trense 1959) and in Oncócua (Granado & Serrano 1959).

Comments: This species is distributed through the majority of the lakes, lagoons and rivers in sub-Saharan Africa (Klingel 2013b). In Angola it used to be present in almost all of the rivers, lagoons and lakes of the country, except the ones in the forests of Cabinda, North Cuanza and South Cuanza provinces, rivers in the desert of Namibe province (although it has records in the Cunene river), in the Humpata plateau and the highlands of Huíla province, and the majority of the plains between Cunene and Okavango rivers (Hill & Carter 1941; da Silva 1970; Crawford-Cabral & Veríssimo 2005; Klingel 2013b). The populations of hippos in Angola have been decreasing through the years, being rare in the seventies, and only observed in Quiçama National Park by the nineties (da Silva 1970; Huntley 1973; Juste & Carballo 1992; Crawford-Cabral &

Veríssimo 2005). Currently few general studies have showed that small populations still occur in the Cuanza, Queve and Luando rivers, and in the Quiçama National Park and Luando Strict Reserve, but, on the other hand it appears to have disappeared from Iona, Mupa and Bicuar National Parks (Kolberg & Kilian 2003; NGOWP 2017; Overton *et al.* 2017; van der Westhuizen *et al.* 2017; Groom *et al.* 2018; Taylor *et al.* 2018; NGOWP 2020). *H. amphibius* is restricted to areas with grassland or grassland-bushland mosaics and near a water supply (river, lake, swap or wallow) as it relies on water to regulate its body temperature (thermoregulation) and to protect the skin (Werger & van Bruggen 2012; Klingel 2013b). This species is a grazer, feeding on a variety of grasses, and can also, in extreme situations, feed on woody plant browse and fruits; it feeds during the night, resting during the day (Ansell 1965; Werger & van Bruggen 2012; Klingel 2013b). The common hippo is an unique species being well adapted to amphibious life, with its barrel body, short legs and naked skin (Werger & van Bruggen 2012; Klingel 2013b). *H. amphibious* is gregarious and can be found in small to medium sized groups (Klingel 2013b). This species has five subspecies, *H. a. amphibius*, *H. a. tschadensis*, *H. a. kiboko*, *H. a. constrictus* and *H. a. capensis*, being the *H. a. constrictus* the one present in Angola (Klingel 2013b). The conservation status of this species is Vulnerable by the IUCN (Lewison & Pluháček 2017).

Family SUIDAE

Common warthog

Phacochoerus africanus (Gmelin, 1788)

Historical records: This species has historical records in INP, from INP to the sub plateau of Oncócua (Crawford-Cabral & Veríssimo 2005); and in the vicinities of the park, Moçâmedes (da Silva 1944-46), along the Cunene River (Monard 1935), Oncócua (Seia 1999) and Ruacaná (Dias 1960).

Comments: This species is widespread throughout sub-Saharan Africa but is absent from the east centre of the continent (Cumming 2013). In Angola it is widespread throughout the country (Hill & Carter 1941; Cumming 2013; Beja *et al.* 2019). According to Werger & van Bruggen (2012) and Cumming (2013) this species is well adapted to dry savannas and steppes and can be found in moist and dry savanna grassland, open and arid bushlands and woodlands. This bare-skinned large mammal lives in small family groups, is diurnal and during the night has the habit of sleeping in a hole, that sometimes belonged to an aardvark (*Orycteropus afer*) (Werger & van Bruggen 2012;

Cumming 2013). It is mainly graminivorous, feeding mostly on green grass, but can also eat grass seeds and roots, depending on the season (Cumming 1975; Werger & van Bruggen 2012; Cumming 2013). This species has four subspecies *P. a. africanus*, *P. a. aeliani*, *P. a. massaicus* and *P. a. sundevallii*, being the last one the subspecies present in Angola (Cumming 2013). The conservation status of this species is Least Concern by the IUCN (de Jong *et al.* 2016).

Family GIRAFFIDAE

Giraffe

Giraffa camelopardalis (Linnaeus, 1758)

Historical records: This species has historical records inside INP, 240 km southwest Humbe (Lydekker 1904); and in the vicinities, in the Cunene river (Crawford-Cabral & Veríssimo 2005) and Oncócua (Granado & Serrano 1959).

Comments: This species used to be widespread throughout the entire continent, however, currently there are no representatives of this species in northern Africa, and in western Africa region there is only one population remaining in southwest Niger, inside a conservation area (Ciofolo & Le Pendu 2013). In Angola, *G. camelopardalis* was present in the south area of the country, in two distinct populations, one on the southwest that included the semi-desertic areas of the Namib Desert that disappeared in the 1940's, and the other on the southeast of the country that is presumed to be extinct (da Silva 1970; Crawford-Cabral & Veríssimo 2005; Werger & van Bruggen 2012; Ciofolo & Le Pendu 2013; Mendelsohn & Mendelsohn 2018). This species is normally found in habitat where *Acacia*, *Commiphora* and *Combretum* are available, such as desert scrub, semi-desertic areas, plains, savannas, savanna forests, woodlands and shrublands (Hill & Carter 1941; da Silva 1970; Fennessy 2004; Werger & van Bruggen 2012; Ciofolo & Le Pendu 2013). The giraffe is the tallest of the animals (can reach up to 5.5m in height) and it is characterized by having a long neck and limbs, that led to adaptations on a physiological and morphological level (da Silva 1970; Ciofolo & Le Pendu 2013). This species is a selective browser, and its diet consists of leaves and buds on trees and shrubs, mainly of the *Acacia* species, although other species in genera such as *Balanites*, *Commiphora*, *Boscia*, *Combretum*, *Ziziphus* and *Grewia* are also eaten (da Silva 1970; Ciofolo & Le Pendu 2013). Giraffes do not depend on water, being able to go months without drinking it, which might be due to its diet on succulent plants (da Silva 1970; Werger & van Bruggen 2012). It is gregarious,

found in small herds, but can also be solitary (Werger & van Bruggen 2012; Ciofolo & Le Pendu 2013). This species comprises eight subspecies, being the subspecies *G. c. angolensis*, as the name indicates, the one that was present in Angola (da Silva 1970; Werger & van Bruggen 2012; Ciofolo & Le Pendu 2013). The conservation status of this species is Least Concern by the IUCN (Marais 2018). On the other hand, the Red List of Angola considers this species as Endangered (MINAMB 2016a).

Family BOVIDAE

Greater kudu

Tragelaphus strepsiceros (Pallas, 1766)

Recent records: A group of at least three *T. strepsiceros* was caught on one camera (Site 7 (Figure 25.) - see Table 4. for coordinates).

Historical records: This species has historical records inside INP (Juste & Carballo 1992), between Salondjamba and Espinheira (Huntley 1972a), between Biquessemo and Iona (Júnior 1948), between Brutue and Pediva (Ferreira 1989) and between Oncócua and 30 km of Iona (Fenyövi 1958); and in the vicinities of the park, from Gungo river to Cunene river, from coastal areas to Chela escarpment (Namibe Province) (Crawford-Cabral & Veríssimo 2005), Curoca River (du Bocage 1890; Borges 1950; Capello & Ivens 1886), 101 km east of Moçâmedes (Hill & Carter 1941); Cunene River (Statham 1926; Borges 1950; da Silva 1970), Oncócua (Granado & Serrano 1959), 15 km downstream from Ruacaná Falls (Maia 1929) and Ruacaná (Dias 1960; Trense 1959; Tyszka 1966).

Comments: This species is widespread throughout the eastern and southwestern region of Africa (Owen-Smith 2013). In Angola it is present in the south of the country, including INP (Huntley 1973; Crawford-Cabral & Veríssimo 2005; Owen-Smith 2013). This species can be found in a wide range of habitats, usually were the vegetation is high enough to bring some protection, such as grasslands, savannas, arid shrubland and semi-desertic regions along riparian corridors, and dry thornbush (with low rainfall–200mm) to woodlands (with strong rainfall–1000mm) (da Silva 1970; Estes 1989; Werger & van Bruggen 2012; Owen-Smith 2013). This large and majestic antelope is normally a browser, feeding on a wide range of different plants and usually drinks water through them (in the leaves and fruits) (da Silva, 1970; Werger & van Bruggen 2012; Owen-Smith 2013). According to Owen-Smith (2013) greater kudus are characterized by having stripes on the upper body, humped shoulder region, long neck and the males

have big horns in spiral form. The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2020a).

Figure 25. Three individuals of greater kudu (*Tragelaphus strepsiceros*) caught on site 7.

Common eland

Tragelaphus oryx (Pallas, 1766)

Historical records: This species has historical records inside INP in Pediva (Crawford-Cabral & Veríssimo 2005); and in the vicinities of INP, Namibe Province, Otchifengo and Salondjamba (Crawford-Cabral & Veríssimo 2005), between Pediva and Brutue (Ferreira 1989), Cunene River (Borges 1950; da Silva 1944-46, 1970; Statham 1922; Vasconcelos 1924), Moçâmedes-Virei road (da Silva 1970) and Oncócua (Fenyövi 1958; Granado & Serrano 1959; Seia 1999).

Comments: This species is widespread through southern Africa, from southeast Sudan and southwest Ethiopia to South Africa (Thouless 2013). According to Thouless (2013), in Angola, common eland used to be widespread throughout the country and present in the Namibe province and in INP, but currently it is believed to be nearly extinct due to uncontrolled poaching, however there is not much information about this species in Angola, and it does not appear on the recent aerial studies in INP (da Silva 1970; Huntley 1973; Estes 1989; Kolberg & Kilian 2003; Crawford-Cabral & Veríssimo 2005; van der Westhuizen *et al.* 2017; Thouless 2013). Common eland can be found in different habitats, from semi-desert scrub to open woodland and alpine moorlands (Thouless 2013). According to Thouless (2013), it prefers bush habitat for the dry

season and grasslands for the wet season, reflecting on its diet. This cow-like bovine species has nocturnal activity and it is characterized for having straight spiral horns and a dewlap (Thouless 2013). This species is a browser, feeding on grass and other herbs and it is not dependent on water, lowering its body temperature by night and staying in the shade by day, reduces its water needs (Werger & van Bruggen 2012; Thouless 2013). This species has three subspecies, *T. o. oryx*, *T. o. livingstonii* and *T. o. pattersonianus*, being the first one present in Angola. The conservation status of this species by the IUCN is Least Concern (IUCN SSC ASG 2016a).

Common duiker

Sylvicapra grimmia (Linnaeus, 1758)

Historical records: Two individuals were collected from Moçâmedes (AMNH/M-80575 and M-80576).

Comments: This species is widespread throughout sub-Sahara Africa (Wilson 2013). In Angola it is the antelope most widespread throughout the country, and although in recent studies this species does not occur in INP, it has records in the vicinities of the park (da Silva 1970; Estes 1989; Crawford-Cabral & Veríssimo 2005; Werger & van Bruggen 2012; Wilson 2013). This species is more common in savanna woodlands, open country and mountainous areas (da Silva 1970; Wilson 2013). The common duiker is a medium-sized and common animal that is normally found in pairs, if not alone (da Silva 1970; Wilson 2013). It is a browser and frugivore, feeding on a wide range of different plants, but rarely eats grass (Wilson 2013). *S. grimmia* has 19 subspecies, being *S. g. steinhardti* and *S. g. splendidula* the ones present in Angola (Wilson 2013). According to the IUCN, this species has the conservation status of Least Concern (IUCN SSC ASG 2016b). Although, according to the Red List of Angola, the conservation status of this species is Endangered (MINAMB 2016a).

Steenbok

Raphicerus campestris (Thunberg, 1811)

Recent records: Several individuals were spotted in INP and near Omauha Farm, always one individual at a time (-16.4348, 12.4835, 436m; -16.4301, 12.4970, 415m; -16.5227, 12.3080, 312m; -16.5216, 12.3025, 312m; -16.5537, 12.2328, 317m; -16.5517, 12.4947, 404m) by the authors from 14th to 16th November 2019. Two individuals alone and a group of two were spotted inside the park (-16.4400, 12.4771,

436m; -16.7153, 12.3355, 407m; -16.5528, 12.4986, 406m) by Sara and David Elizalde on 2nd and 3rd June 2020. One individual was spotted on the outskirts of the Omauha Farm (-16.2005, 12.5065, 351m) on 5th June 2020 by Sara and David Elizalde. Individuals were caught on several different cameras (Site 8, 9, 10, 11, 12, 14, 15, 16, 22, 28, 31 and 32 (Figure 26.) - see Table 4. for coordinates).

Historical records: This species has historical records inside INP (Crawford-Cabral & Veríssimo 2005), Pediva (Juste & Carballo 1992) and Iona (Simões 1971); and in its vicinities, between Pediva and Virei, Pico Azevedo, Capolopopo (Juste & Carballo 1992) between Brutue and Pediva (Ferreira 1989), Namibe province (Crawford-Cabral & Veríssimo 2005), 101 km east of Moçâmedes and Moçâmedes (AMNH/M-80539 and M-80540) (Hill & Carter 1941), north of Curoca (Granado & Serrano 1959) and Ruacaná (Shortridge 1934). Two individuals collected from Namibe province (AMNH/M-80538 and M-80541).

Comments: This species has a disjunct distribution of two populations, one in the eastern region (from Kenya to Tanzania), and the other in the southern region of the continent (from Angola, Zambia, Zimbabwe and Mozambique to South Africa) (Werger & van Bruggen 2012; du Toit 2013). In Angola it is present in the south of the country, including INP (da Silva 1970; Huntley 1971a, 1972a, 1973; Simões & Crawford-Cabral 1988; Estes 1989; Crawford-Cabral & Veríssimo 2005; du Toit 2013). The normal habitat of *R. campestris* has to have available food during all the year, it is normally near water sources, and this happens from semi-desert to alpine moorland zones up to 3500m (Simões & Crawford-Cabral 1988; du Toit 2013). This small antelope is common in its range, it is normally found alone, and it is active mostly in the night, but also in the morning and late afternoon, in order to rest in the shadows during the hotter hours of the day and this way it is saving the water in its body (du Toit 2013). Steenboks are mixed feeders, but mainly browsers, eating mostly green browse but also geophytes, berries, flowers and pods (Simões & Crawford-Cabral 1988; Werger & van Bruggen 2012; du Toit 2013). This species comprises two subspecies, *R. c. campestris* and *R. c. neumanni*, being the first one present in southern Africa (Angola and Zambia) (du Toit 2013). The conservation status of this species by the IUCN is Least Concern (IUCN SSC ASG 2016c).

Figure 26. A steenbok (*Raphicerus campestris campestris*) caught on site 32.

Kirk's dik-dik

Madoqua kirkii (Günther, 1880)

Recent records: A total of three individuals were spotted in INP, two on 17th November 2019 (-16.7751, 12.7834, 685m), and the third one on 19th November 2019 (-16.5555, 12.8028, 476m), by the authors. Two groups of two and two individuals alone were spotted inside the park, the first group of two (-16.5526, 12.4936, 404m) on 3rd June 2020, and the other group along with the two separate individuals (-16.6154, 12.6561, 502m; -16.6614, 12.7609, 590m; -16.5159, 12.7361, 419m, respectively) on 4th June 2020 by Sara and David Elizalde. Individuals were caught on three different cameras (Site 9, 26 (Figure 27.) and 40 - see Table 4. for coordinates).

Historical records: This species has historical records inside INP (Crawford-Cabral & Veríssimo 2005), Iona Peak (Broom *et al.* 1974), Pediva (Trense 1959; Ferreira 1989); and in its vicinities, Moçâmedes (da Silva 1944-46), 101 km east of Moçâmedes (AMNH/M-80587) (Hill & Carter 1941), from Lobito to Cunene river (Crawford-Cabral & Veríssimo 2005), north of Curoca (Granado & Serrano 1959), Capolopopo (Trense 1959) and Ruacaná (Shortridge 1934). One individual was collected from north Namibia near the Angola border (-16.6667, 12.5833, 612m) (LACM/037700). Three specimens collected from Namibe province (AMNH/M-80588 and M-80589).

Comments: This species has two separated areas of occurrence, one in the east and the other in the southwest of Africa (Werger & van Bruggen 2012; Brotherton 2013). In

Angola it occurs in the southwest portion of the country, from Lobito to the border with Namibia (Crawford-Cabral & Veríssimo 2005; Skinner & Chimimba 2005). This species can be found in arid areas or open woodlands with dense thorn scrub or with almost no grass stony ground, rocky hills, outcrops in savannas, steppes of *Colophospermum mopane* and dry woodlands of *C. mopane* and *Spyrostachys africana* from the foot of Chela Escarpment (Tinley 1969; Hendrichs 1975; Crawford-Cabral & Veríssimo 2005; Skinner & Chimimba 2005; Werger & van Bruggen 2012). The dik-diks are widespread and abundant in its usual habitats (Brotherton 2013). This small antelope is adapted to live in arid and hot climate, being able to live only with the water provided by its diet, and it is characterized for having the ability to reduce the water loss by having a concentrated urine and dry stools (Huntley 1972a, 1972b; Maloiy 1973; Hoppe 1977; Maloiy *et al.* 1988; Estes 1989; Crawford-Cabral & Veríssimo 2005; Brotherton 2013). This group of animals is considered a browser, feeding mostly on leaves, flowers, shoots and fruits from shrubs, bushes and trees, and occasionally, when sprouting, it may eat grass (Brotherton 2013). According to Brotherton (2013), there are four genetically different groups of *Madoqua kirkii*, that are treated as species, *M. (k.) kirkii* (which have three subspecies), *M. (k.)* cavendishi (which have two subspecies), *M. (k.) thomasi* and *M. (k.) damarensis*, being first three present in the east of the African continent, and the latter in the southwest, therefore, the one present in the southwest of Angola, including INP (Huntley 1971a, 1973, 1974b; Crawford-Cabral & Veríssimo 2005). The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2016d).

Figure 27. A damara dik-dik (*Madoqua kirkii damarensis*) caught on site 26.

Springbok

Antidorcas marsupialis (Zimmermann, 1780)

Recent records: Several specimens of *A. marsupialis* were spotted in herds from one to 15 individuals every day during the survey time, from 13th to 22nd November 2019 by the authors. These individuals were seen inside and between Omauha Farm and Iona National Park (-16.2424, 12.4248, 285m; -16.3197, 12.4225, 217m; -16.3377, 12.4245, 276m; -16.2439, 12.4246, 291; -16.3423, 12.4376, 250m; -16.5304, 12.3521, 330m; -16.5235, 12.3326, 325m; -16.5239, 12.3249, 322m; -16.5236, 12.3224, 319m; -16.5229, 12.3177, 315m; -16.5214, 12.3158, 313m; -16.6191, 12.2606, 343m: -16.6498, 12.2802, 360m; -16.4876, 12.4576, 387m; -16.4758, 12.4588, 393m; -16.3390, 12.4352, 251m; -16.2242, 12.4253, 316m; -16.5525, 12.4974, 405m; -16.5627, 12.5554, 428m; -16.5659, 12.5702, 436m; -16.5893, 12.6073, 471m; -16.4054, 12.6283, 331m; -16.2413, 12.3416, 270m; -16.3085, 12.2869, 249m; -16.3031, 12.2728, 230m; -16.3019, 12.2732, 231m; -16.2947, 12.2739, 227m; -16.3237, 12.2564, 240m; -16.3330, 12.2579, 245m; -16.3444, 12.2485, 249m; -16.3465, 12.2395, 251m; -16.3267, 12.2626, 237m; -16.3244, 12.2649, 242m; -16.3230, 12.2693, 241m; -16.2029, 12.4239, 341m; -16.2170, 12.3897, 333m; -

16.2435, 12.3607, 287m; -16.1973, 12.3713, 304m; -16.1931, 12.3979, 330m; -16.1696, 12.3990, 379m; -16.1726, 12.3683, 315m; -16.1848, 12.3605, 282m; -16.2170, 12.3897, 333m; -16.1994, 12.3734, 307m; -16.2007, 12.3791, 321m). From 1st to 5th of June 2020, several groups in herds from one to 14 individuals of *A. marsupialis* were spotted near Omauha Farm (-16.1645, 12.4395, 422m; -16.2492, 12.4254, 276m; -16.2179, 12.3985, 360m; -16.2305, 12.3658, 295m; -16.2430, 12.3628, 285m; -16.1777, 12.3558, 293m; -16.1861, 12.3614, 284m; -16.1973, 12.3714, 304m; -16.1992, 12.3733, 307m; -16.2007, 12.3780, 314m; -16.1397, 12.4374, 395m) by Sara and David Elizalde. A single individual was spotted north of the Omauha Farm (-15.9824, 12.5060, 407m) on 1st of June 2020, by Sara and David Elizalde. Several more herds from one to six individuals were spotted inside INP (-16.3695, 12.4438, 290m; -16.5224, 12.3293, 322m; -16.5509, 12.2315, 316m; -16.7264, 12.3373, 414m; -16.7364, 12.3421, 421m; -16.7431, 12.3462, 427m; -16.7345, 12.3481, 419m; -16.7335, 12.3482, 418m; -16.7248, 12.3402, 411m; -16.7546, 12.3650, 438m; -16.7368, 12.4010, 466m; -16.7319, 12.4105, 479m; -16.7253, 12.4189, 490m; -16.7252, 12.4190, 490m; -16.7247, 12.4198, 491m; -16.6545, 12.4451, 455m; -16.6173, 12.4624, 421m; -16.3488, 12.5754, 337m) as well as on with 21 and another with 33 individuals (-16.7383, 12.3965, 459m; -16.7384, 12.3471, 419m, respectively) by Sara and David Elizalde from 1st to 5th June 2020. Individuals in herds or alone were caught on several different cameras (Site 2, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 34, 36 (Figure 28.), 37, 38, 39 and 40 - see Table 4. for coordinates). Several carcasses were observed inside the Omauha Farm by the authors between 13th and 22nd november 2019.

Historical records: This species has historical records south of the Namibe province and inside INP (de Queiróz 1965; Crawford-Cabral & Veríssimo 2005), Iona (Simões 1971), between Pediva and Iona (Crawford-Cabral & Veríssimo 2005), Espinheira (Junior 1948; da Silva 1958), Pediva (Trense 1959; Juste & Carballo 1992) and Moçâmedes Desert (Monard 1930); and in its vicinities, from Moçâmedes to the Curoca River (Sokolowsky 1903), 30 km from Oncócua to Iona (Fenyövi 1958), Oncócua (Granado & Serrano 1959), Namibe Partial Reserve (Crawford-Cabral & Veríssimo 2005), coastal region between Benguela and Moçâmedes (Blaine 1922), Moçâmedes (Monard 1935; da Silva 1958; da Silva 1970; Ferreira 1989), 70 km southeast of Moçâmedes (Hill & Carter 194), between Brutue and Pediva (Ferreira 1989), Pico Azevedo (Hill & Carter 1941; Teixeira 1945; Juste & Carballo 1992), between Morro

Preto and Pico Azevedo (Teixeira 1945), Virei (da Silva 1944-46; Juste & Carballo 1992), southwest Capolopopo (Fenyövi 1958; Trense 1959; Juste & Carballo 1992) and Porto Alexandre (Fenyövi 1958; Trense 1959). Several individuals were collected from Namibe province (AMNH/M-80514, M-80515, M-80516, M-80517, M-80518, M-80519, M-80520, M-80521, M-80522, M-80523, M-80524, M-80525, M-80526, M-80527, M-80528, M-80529, M-80530, M-80531, M-80532, M-80533, M-80535, M-80536 and M-80537), other individual was collected from south Angola, near Pediva (-16.6667, 12.5833, 612m) (LACM/037701), and another from north Namibia near the Angola border (-17.7500, 12.6167, 771m) (LACM/060624).

Comments: This species is present in southern Africa, from Angola, Namibia, Botswana and South Africa (Skinner 2013). In South Africa, this species has been reintroduced, since the population there has suffered a decrease due to the skin trade, and currently this gazelle occurs again in its former range, plus some areas out of that range (Skinner 2013). In Angola, this species is present in the coast from the Namib Desert to Benguela, including INP albeit recent studies (Kolberg & Kilian 2003; van der Westhuizen *et al.* 2017) showed that the population in this park has decreased from 2003 to 2017 (Hill & Carter 1941; Huntley 1971a, 1971b, 1972a, 1972b, 1973, 1974b; Estes 1989; Skinner 2013). *A. marsupialis* can be found in arid regions, desert, semi-desert, open grasslands, short grass fringes of pans, fossil river beds and valley terraces (Crawford-Cabral & Veríssimo 2005; Werger & van Bruggen 2012; Skinner 2013). This medium-sized antelope is characterized by having fur that helps them save water, by off-loading excessive heat rapidly without perspiring and by reflecting the sun (Skinner 2013). Springboks are browsers, feeding mainly on succulent browse with more leaves than stem, although it also eats grass; it does not depend on water, obtaining it mainly through the plants, and when it is available (da Silva 1970; Werger & van Bruggen 2012; Skinner 2013). This species is gregarious, grouping in herds from a few individuals to huge herds with hundreds of thousands (Skinner 2013). The conservation status of *A marsupialis* is Least Concern according to IUCN (IUCN SSC ASG 2016e).

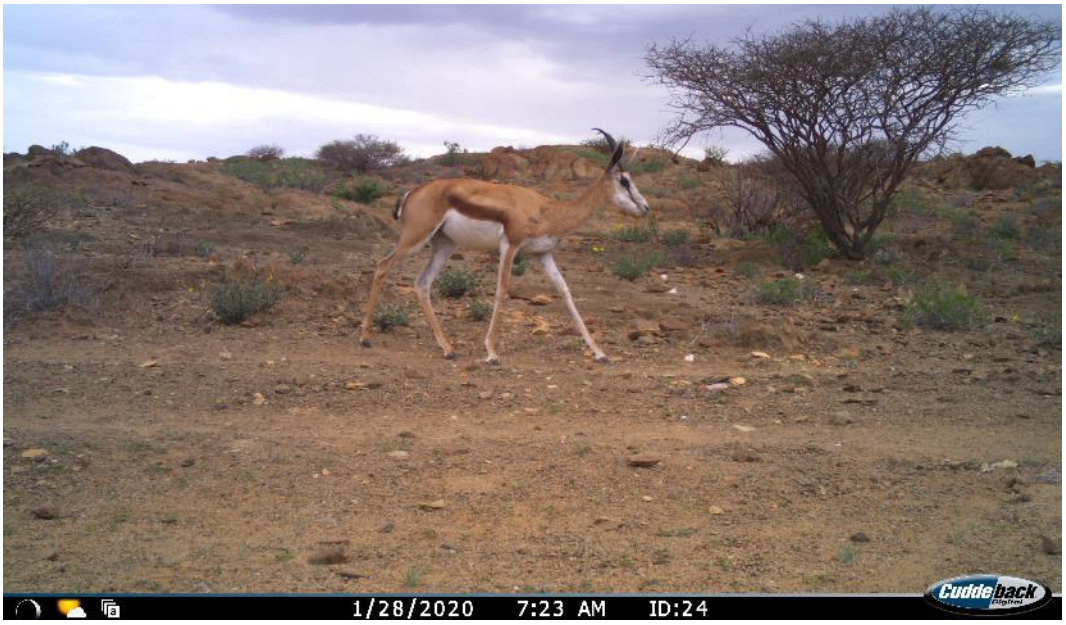

Figure 28. A springbok (*Antidorcas marsupialis*) caught on site 36.

Klipspringer

Oreotragus oreotragus (Zimmermann, 1783)

Recent records: One individual was spotted in Namibe Partial Reserve (-15.68, 12.34, 228m) on February 22nd, 2020 by Sara and David Elizalde (Figure 29.). One more individual was spotted near Moçâmedes city (-15.2160, 12.1410, 45m) on June 1st, 2020 by Sara and David Elizalde.

Historical records: This species has historical records inside the park, Iona (Simões 1971; Broom *et al.* 1974), Pediva (Juste & Carballo 1992); and in the vicinities of the park, such as Namibe Province (from the dunes to the Chela escarpment) (Crawford-Cabral & Veríssimo 2005), 101 km east of Moçâmedes (AMNH/M-80553) (Hill & Carter 1941), north bank of Cunene River (da Silva 1944-46), Cunene falls (Thomas 1926), north of Curoca River (Granado & Serrano 1959) and Ruacaná (Shortridge 1934).

Comments: This species is widespread throughout the continent, occurring from Sudan, Eritrea, Somalia and Ethiopia to South Africa, along the coast in Namibia and Angola (da Silva 1970; Roberts 2013). In Angola, it is present only in the southwest of the country, including INP (Hill & Carter 1941; Huntley 1972a, 1973; Estes 1989; Crawford-Cabral & Veríssimo 2005; Roberts 2013). Its normal habitat has to be rocky and mountainous, so it is usually found in rocky slopes, outcrops or cliffs, or in flat, often sandy, scrubland at the base of the slopes, and in Angola it can be found mainly in the Chela Escarpment and arid coastal areas (da Silva 1970; Huntley 1972a; Estes

1989; Crawford-Cabral & Veríssimo 2005; Werger & van Bruggen 2012; Roberts 2013). This small and stocky antelope is characterized by having the digital bones changed, compared to other antelopes, in order to offer this animal, the necessary traction to dislocate rapidly on rocky and slippery habitats, and a big coat of fur that amortises the falls when it happens (da Silva 1970; Roberts 2013). This species is a browser, feeding on young leaves, flowers, seeds and fruits, which provides them energy and protein content (Roberts 2013). This species comprises 11 subspecies: *O. o. oreotragus*, *O. o. transvaalensis*, *O. o. tyleri*, *O. o. stevensoni*, *O. o. aceratos*, *O. o. centralis*, *O. o. schillingsii*, *O. o. aureus*, *O. o. saltatrixoides*, *O. o. somalicus* and *O. o. porteousi*, being the subspecies *O. o. tyleri* the one present in INP (Ansell 1972). The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2016f).

Figure 29. A klipspringer (*Oreotragus oreotragus tyleri*) spotted in the vicinities of Iona National Park.

Impala

Aepyceros melampus (Lichtenstein, 1812)

Historical records: This species has historical records in the Namibe province, from the bottoms of the Chela Escarpment to the south of the Benguela province (Crawford-Cabral & Veríssimo 2005), Oncócua (Granado & Serrano 1959) and in Ruacaná (Shortdrige 1934; da Silva 1944-46; Trense 1959; Dias 1960).

Comments: This species has two disjunct populations one in the southwest region, occurring in Angola and Namibia and the other in the eastern region of the continent, from Kenya to South Africa (Werger & van Bruggen 2012; Fritz & Bourgarel 2013). In

Angola it occurs in the southwest, including INP (Huntley 1971a, 1972a; Estes 1989; Crawford-Cabral & Veríssimo 2005; Fritz & Bourgarel 2013). The impala is an ecotone species normally present in habitats near water sources, due to its dependence on water, and canopy cover in order to rest in the shade as it is not well adapted to dry and hot environments (Fritz & Bourgarel 2013). The northern population is usually found in light woodlands, savannas and open *Acacia* savannas; and the southwestern population in mopane (*Colophospermum mopane*) woodlands, semi-arid regions, wooded savanna and open grassy vleis, normally these areas are particularly close to lakes (Crawford-Cabral & Veríssimo 2005; Fritz & Bourgarel 2013). This medium-sized antelope is a mixed feeder, due to the ingestion of grass, woody plants and occasionally fruits (Fritz & Bourgarel 2013). Impalas have a clear sexual dimorphism and are gregarious, with small to large herds (Fritz & Bourgarel 2013). This species comprises two subspecies *A. m. melampus* (common impala – eastern population) and *A. m. petersi* (black-faced impala – southwestern population), being the black-faced impala the one that might be present in INP once it occurs in southwestern Angola and northwestern Namibia (Fritz & Bourgarel 2013). The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2016g).

Common wildebeest

Connochaetes taurinus (Burchell, 1824)

Historical records: This species has historical records inside INP, Pediva (Machado 1979); and east of Cunene River (Blaine 1922), Cunene Basin and Valley and Ruacaná Falls (Machado 1979) and Cunene Banks (da Silva 1970).

Comments: This species is present in Namibia, Botswana Mozambique, Kenya and southwards to South Africa (Estes 2013). In Angola it occurs in the southern region of the country and its distribution has been decreasing due to uncontrolled hunting and competition for resources with livestock (Estes 1989; Crawford-Cabral & Veríssimo 2005; Estes 2013). Common wildebeests are normally found in short grasslands, open bushlands, woodlands, floodplains and *Acacia* savannas (Estes 1989; Werger & van Bruggen 2012; Estes 2013). This large-sized antelope is characterized by having a pair of cow-like horns, a heavy set body and physiological adaptations such as the skill to decrease the water loss adapted to its large migratory habits (Estes 2013). *C. taurinus* is dependent on water and it is a grazer, feeding on a vast variety of grasses (Werger & van Bruggen 2012; Estes 2013). This species comprises five subspecies, *C. t.*

taurinus, *C. t. cooksoni*, *C. t. johnstoni*, *C. t. albojubatus* and *C. t. mearnsi*, being the first subspecies (*C. t.* taurinus) the one present in south Angola (Estes 2013). The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2016h).

Roan antelope

Hippotragus equinus (É. Geoffroy Saint-Hilaire, 1803)

Historical records: This species has historical records in the Moçâmedes district (Jentink 1887; da Silva 1944-46) and in Ruacaná (Shortridge 1934).

Comments: This species used to be widespread throughout sub-Saharan Africa, but currently its distribution has declined greatly in some parts of Africa, being present only in conservation areas or around them (Hill & Carter 1941; Chardonnet & Crosmary 2013). This species used to be one of the most common antelopes in west and central Africa and one of the rarest antelopes in east and southern Africa (da Silva 1970; Estes 1989; Crawford-Cabral & Veríssimo 2005; Chardonnet & Crosmary 2013). In Angola it is present in the centre, south and southeast of the country (Chardonnet & Crosmary 2013). It can be found in plains, savannas, light woodlands and mopane grasslands (Chardonnet & Crosmary 2013). This large-sized antelope is normally found in small to medium herds, except the bulls that are usually found alone (Chardonnet & Crosmary 2013). It is considered to be a selective grazer, feeding occasionally on browse (Chardonnet & Crosmary 2013). This species comprises three groups with a total of six subspecies, the western population group with *H. e. koba*; the central population group with *H. e. charicus* and *H. e. bakeri*; and the eastern and southern population group with *H. e. langheldi*, *H. e. cottoni*, and *H. e. equinus* (Chardonnet & Crosmary 2013), being the subspecies *H. e. cottoni*, the one that may occur in INP. The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2017).

Gemsbok

Oryx gazella (Linnaeus, 1758)

Recent records: Several individuals were spotted in the Omauha Farm and its outskirts (-16.2009,12.3812; 318m; -16.2010, 12.3718, 308m; -16.2006, 12.3802, 308m; -16.1983, 12.3889, 323m) by the authors from 13th to 22nd November, 2019; several other individuals were spotted inside INP (-16.5227, 12.3305, 323m; -16.5208, 12.2994, 310m; -16.5169, 12.2922, 309m; -16.5150, 12.2890, 305m; -16.5115,

12.2819, 302m; -16.9464, 12.2611, 212m; -13.4878, 12.2586, 292m) by the authors from 13th to 22nd November, 2019. On the 2nd and 3rd of June, several individuals were spotted alone or in groups from two to seven, inside the park (-16.7264, 12.3373, 414m; -16.7462, 12.3509, 424m; -16.7313, 12.3474, 417m; -16.7546, 12.3650, 438m; -16.7378, 12.3981, 462m) by Sara and David Elizalde. Individuals alone or in herds were caught on several different cameras (Site 10, 11 (Figure 30.), 12, 13, 14, 15, 16, 17, 18, 19, 34, 36, 37 and 38 - see Table 4. for coordinates).

Historical records: This species has historical records inside INP (de Queiróz 1965; Crawford-Cabral & Veríssimo 2005), from INP to sub-plateau of Oncócua (Crawford-Cabral & Veríssimo 2005), south of Moçâmedes (Capello & Ivens 1881; Juste & Carballo 1992), Moçâmedes Desert (Capello & Ivens 1886), from Tigres bay to Chiambala (da Silva 1944-46, 1970; Seia 1995), Tigres bay (da Silva 1970; Juste & Carballo 1992), 10 to 15 km south of Moçâmedes (near the coast) (da Silva 1944-46) and south of Espinheira plateau (Baptista *et al.* 1930); and in its vicinities, Namibe Partial Reserve (Crawford-Cabral & Veríssimo 2005), margins of Curoca (Capello & Ivens 1886), plains between the Curoca and Bero rivers and between Moçâmedes and Damba dos Flamingos (da Silva 1944-46), Pico do Azevedo (da Silva 1958), Curoca River (Baptista *et al.* 1930; da Silva 1958), Cunene river mouth, littoral between Moçâmedes and Damba dos Flamingos (da Silva 1970), Cunene river mouth, plains between the Curoca and Bero rivers, between Moçâmedes and Damba dos Flamingos (Seia 1995), between Morro Preto and Pico do Azevedo (Teixeira 1945) and Antilopes Island (Cunene river mouth) (Baptista *et al.* 1930; Simmons *et al.* 1993).

Comments: This species is present only in the southwest of the continent, from Angola southwards to Namibia, Botswana, Zimbabwe and South Africa (Werger & van Bruggen 2012; Knight 2013). Gemsbok was present in Angola from Benguela southwards to INP, in the seventies (da Silva 1970; Huntley 1971a, 1971b, 1972a, 1972b, 1973, 1974b); in the eighties the populations north of the Namibe province were decreasing due to uncontrolled hunting and had the conservation status of threatened (Estes 1989); latter, in the nineties the species was presumed to be locally extinct (Estes 1999), being present only in INP due to the conservation of the park (Kolberg & Kilian 2003; Crawford-Cabral & Veríssimo 2005; van der Westhuizen *et al.* 2017). This species can be found in open arid and semi-arid grasslands, open savannas, light woodlands, mopane (*Colophospermum mopane*) and *Baikiaea* woodlands and may even be found in dune fields and arid mountainous areas (Knight 2013). This species

is well adapted to life in extreme desert conditions (hot and arid), being characterized by having a fur colour that helps reflect the heat from the sun; for having adapted the water loss to the minimum; and for being able to thermoregulate the brain temperature (Huntley 1972a; Werger & van Bruggen 2012; Knight 2013). *O. gazella* are considered to be generalist grazers, although in the dry season they feed on browse as well and its diet is composed by grasses, forbs, thick-leaved plants, wild melons, ground fruits, roots, tubers and onions (Werger & van Bruggen 2012; Knight 2013). The gemsbok use water-rich fruits such as the tsama melon (*Citrullus lanatus*), nara (*Acanathosicyos horridus*) and the tuber of other plants as the gemsbok cucumber (*A. naudinianus*) as a water source in the dry months (da Silva 1970; Knight 2013). To complement its poor diet, this species has the habit of mineral licking in the pans and dry riverbeds (Werger & van Bruggen 2012; Knight 2013). The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2020b).

Figure 30. A gemsbok (*Oryx gazella*) caught on site 11.

Species that probably exist inside Iona National Park

- Order Macroscelidea

In the family Macroscelididae, two other species, the western rock sengi (*Elephantulus rupestris* (A. Smith, 1831)) and the round-eared sengi (*Macroscelides proboscideus* (Shaw, 1800)), probably exist in INP too since they were described south of the border of the park in Namibia (Perrin 2013a; Perrin & Rathbun 2013b; Taylor *et al.* 2018). *E. rupestris* is an insectivorous small sengi, eating mostly ants and termites (Perrin 2013a). This terrestrial species is crepuscular and is adapted to life among rocks in arid and semi-arid regions (Perrin 2013a). *M. proboscideus* is an omnivorous small round-bodied sengi, eating mostly insects and herbage (Perrin & Rathbun 2013b). This species is nocturnal and crepuscular and is found in desert and semi-arid areas, in the Namibian part of the Namib Desert it is found in kopjes (Perrin & Rathbun 2013b). According to IUCN the conservation status of both species is considered Least Concern (Rathbun & Smit-Robinson 2015a, 2015b).

- Order Primates

Although there are no recent or historical records inside INP, it is possible that two species of the family Galagidae are present inside the park, due to the fact that the known distribution of these species includes southern Angola (Taylor *et al.* 2018). These are the large-eared greater galago (*Otolemur crassicaudatus* (É. Geoffroy, 1812)) and the southern lesser galago (*Galago moholi* A. Smith, 1836). Both species are small mammals, nocturnal and omnivorous, where the diet includes fruit, seeds, roots, eggs, invertebrates and small vertebrates (Werger & van Bruggen 2012; Bearder & Svoboda 2013; Pullen & Bearder 2013). Both species are normally present in woodlands, savanna and arid habitats, with the difference that the *O. crassicaudatus* uses the mid to high strata and the *G. moholi* uses all strata (Bearder & Svoboda 2013; Pullen & Bearder 2013; Beja *et al.* 2019). The large-eared greater galago has three subspecies, *O. c. crassicaudatus*, *O. c. monteiri* and *O. c. argentatus*, and the southern lesser galago have two, *G. m. moholi* and *G. m. bradfieldi* (Bearder & Svoboda 2013; Pullen & Bearder 2013). The subspecies that probably exist in INP are *O. c. monteiri* and *G. m. bradfieldi*, for each species, respectively (Bearder & Svoboda 2013; Pullen & Bearder 2013). Both species are classified with a conservation status as Least Concern by the IUCN (Bearder *et al.* 2019; Masters & Bearder 2019).

- Order Rodentia

This is another order that probably has more species inside INP, with eleven species divided in following families: Gliridae, Nesomyidae, Muridae and Pedetidae. In the family Gliridae, there are two species that probably occur in the park, the Kellen's African dormouse (*Graphiurus kelleni* (Reuvens, 1890)) and the rupicolous African dormouse (*Graphiurus rupicola* (Thomas & Hilton, 1925)), as the distribution of both species includes the southern region of Angola (Holden 2013a, 2013b; Beja *et al.* 2019). *G. kelleni* is nocturnal, arboreal and probably omnivorous; it inhabits woodland savannas and riverine and rocky areas (including caves) (Holden 2013a). *G. rupicola* is a medium-sized dormouse, that inhabits the fissures between the rocks, from 400m to 1586m of height (Holden 2013b). According to IUCN, the conservation status of these species is Least Concern (Cassola 2016k; Schlitter 2016b).

In the family Nesomyidae, there are three species that probably occur inside INP, the cape pouched mouse (*Saccostomus campestris* Peters, 1846), the long-eared mouse (*Malacothrix typica* (A. Smith, 1834)) and the tiny fat mouse (*Steatomys parvus* Rhoads, 1896), due to the widespread distribution of these species in Angola (Monadjem 2013c; Perrin 2013b; Beja *et al.* 2019), except the *M. typica*, which is restricted to the arid environments of the extreme southwest of the country (de Graaff 1981; Crawford-Cabral 1998; Happold 2013m; Beja *et al.* 2019). *S. campestris* is a very common mouse that is terrestrial, nocturnal and granivorous, feeding on different seeds; it can be found in woodlands, grasslands and close to marshes (Perrin 2013b). *M. typica* is a nocturnal, terrestrial and herbivorous, feeding mainly on green vegetation and seeds (Smithers 1971); it can be found in arid areas of short grass savannas and scrublands (Werger & van Bruggen 2012; Happold 2013m); and it is characterized for being a very small uncommon mouse with large ears and short tail (Happold 2013m). *S. parvus* is a nocturnal and terrestrial very small plump mouse (Monadjem 2013c). According to the IUCN, the three species of this family here represented have the conservation status of Least Concern (Cassola 2016l; Cassola & Child 2016; Schlitter & Monadjem 2017).

In the family Muridae, besides the 11 species already present in the species accounts, there are five more that might occur inside INP, red veld rat (*Aethomys chrysophilus* (de Winton, 1897)), southern African multimammate mouse (*Mastomys coucha* (Smith, 1834)), Angolan meadow mouse (*Myomyscus angolensis* (Bocage, 1890)), black-tailed Acacia rat (*Thallomys nigricauda*) and Littledale's whistling rat

(*Parotomys littledalei* Thomas, 1918), as historically the distribution of these species included the surrounding areas of the park (Jackson 2013; Linzey *et al.* 2013; Leirs 2013b, 2013c; Nel 2013b). In addition to the distribution, one specimen of the species *A. chrysophilus* was collected in the north of Namibia near the border with Angola (LACM/059863); six specimens of *M. coucha* were collected from the Namibe province (ISCED/62, 73, 252, 254, 255 and 371); and also, from the Namibe province, five specimens of *M. angolensis* were collected (ISCED/428, 799, 800, 812 and 1058). The red veld rat is nocturnal and terrestrial, although it climbs on trees and excavates burrows when needed; it can be found in savanna woodlands and it is omnivorous (feeding mainly in insects, seeds and plants) (Linzey *et al.* 2013). The southern African multimammate mouse is common, nocturnal and terrestrial; it is normally present in grasslands and woodland savannas but can also be near the human settlements (Leirs 2013b). The Angolan meadow mouse can be found in grasslands, and elevated areas (up to 1000m) (Leirs 2013c). The black-tailed Acacia rat is nocturnal, arboreal and herbivorous, eating mainly leaves and buds from the Acacia trees (Nel 2013b). The Littledale's whistling rat is diurnal, terrestrial and herbivorous, its diet includes a panoply of different type of plants, and it can be found in desertic habitats such as sand dunes and gravel plains of the Namib Desert and in the coastal plains of Namibia (Coetzee 1969; Coetzee & Jackson 1999; Jackson 2013). These five species have the conservation status of Least Concern, according to IUCN (Cassola 2016m, 2016n; Child 2016b; Child & Taylor 2016; Coetzee 2016).

In the Pedetidae family, the species that is possible that occurs inside the park is the southern African springhare (*Pedetes capensis* (Forster, 1778)), due to the wide distribution range throughout the country (Butynski 2013; Beja *et al.* 2019), and it is present in the northern region of Namibia, near the Angola border (-17.4667, 13.0333, 1280m) (LACM/059669). *P. capensis* can be found in the arid and semi-arid regions with little vegetation on the sandy and compact ground (Butynski 2013). This spring hare is common, and it is the only species of this family occurring in Angola (Butynski 2013; Beja *et al.* 2019). It is nocturnal (active in the dusk or at night), terrestrial and herbivorous, its diet is composed mainly of grasses (Butynski 2013). According to the IUCN, this species has the conservation status of Least Concern (Child 2016c).

- Order Lagomorpha

For the family Leporidae, the species that might occur inside the park, is the African savanna hare (*Lepus victoriae* Thomas, 1893), due to the well distributed range throughout the country (Happold 2013n). The habitat of the African savanna hare is grasslands and semi-arid grasslands with bushes and scrubs (Happold 2013n). This medium-sized mammal is terrestrial, nocturnal and herbivorous, eating mostly grass (Stewart 1971). According to the IUCN, this species has the conservation status of Least Concern (Johnston *et al.* 2019b).

- Order Soricomorpha

Two more species that may occur inside INP, belong to the family Soricidae, the reddish-grey shrew (*Crocidura cyanea* (Duvernoy, 1838)) and African giant shrew (*Crocidura olivieri* (Lesson, 1827)). *C. cyanea* might occur in the area due to the restricted distribution to the southern regions of the country, which correspond to the continuous population from Namibia (Baxter & Dippenaar 2013; Baxter *et al.* 2016; Beja *et al.* 2019), *C. olivieri* is well distributed throughout the country (Churchfield & Hutterer 2013). The reddish-grey shrew is tolerant to a lot of different habitats, ranging from montane forest, grasslands, savanna, dense shrubs and rocky outcrops (Baxter & Dippenaar 2013), and the African giant shrew is easily found in well-vegetated moist habitats, but can also be found in grazed grasslands (Churchfield & Hutterer 2013). The first species is a small-medium (female) / medium-sized (male) shrew, nocturnal, terrestrial and insectivorous, feeding mostly on insects (Baxter & Dippenaar 2013), while the second is a large shrew, terrestrial and feeds mainly in invertebrates (Churchfield & Hutterer 2013). According to IUCN, both species have the conservation status of Least Concern (Baxter *et al.* 2016; Cassola 2016o).

- Order Chiroptera

There are 12 more species distributed across the families: Pteropodidae, Rhinolophidae, Hipposideridae, Molossidae and Vespertilionidae, that might occur inside the park. From the Pteropodidae family, the other species that could occur in the area is the African straw-coloured fruit bat (*Eidolon helvum* (Kerr, 1792)), once it might not have records from the park or its vicinities, it is present in the northern region of Namibia and it is known for making long migrations, being possibly present in the southern region of Angola too (Thomas & Henry 2013; Beja *et al.* 2019). This fruit bat

is linked to the habitats with fruit trees, feeding mostly on fruits and leaves of these trees (Thomas & Henry 2013). It starts to be active at dusk and usually it is found in groups (Thomas & Henry 2013). According to the IUCN, this species has the conservation status of Near Threatened (Cooper-Bohannon *et al.* 2020).

From the family Rhinolophidae, two other species might be present in the park, the Geoffroy's horseshoe bat (*Rhinolophus clivosus* Cretzschmar, 1828) and the Rüppell's horseshoe bat (*Rhinolophus fumigatus* Rüppell, 1842), due to the distribution in the southern region of Angola (Bernard & Happold 2013c), and *R. fumigatus*, besides being present in the centre and near the southwest regions of the country, it has a record in the Namibe province too (ISCED/8119) (Cotterill & Happold 2013b). Geoffroy's horseshoe bat can be found in a large variety of habitats, that change from woodland savannas, montane forests, open grasslands, to desert and semi-desertic habitats (Bernard & Happold 2013c), while the Rüppell's horseshoe bat is found mainly in savannas (Cotterill & Happold 2013b). Both species forages by fly-catching and slow-hawking and the diet is mainly composed by small to medium-sized insects, such as beetles and moths (Bernard & Happold 2013c; Cotterill & Happold 2013b). According to the IUCN the two species have the conservation status of Least Concern (Monadjem *et al.* 2017g, 2017h).

In the family Hipposideridae there is one more species that might occur in the park, which is the striped leaf-nosed bat (*Hipposideros vittatus* (Peters, 1852)), due to its presence in the southern regions of Angola (Happold 2013o). This large sized bat can be found mainly in woodland savannas and coastal forests (Happold 2013o; Monadjem *et al.* 2020). The striped leaf-nosed bat forages by fly-catching and it feeds mainly on beetles (Vaughan 1977; Happold 2013o). According to the IUCN this species has the conservation status of Near Threatened (Mickleburgh *et al.* 2020).

The family Molossidae has three more species that can be present in the park, which are the Roberts's flat-headed bat (*Sauromys petrophilus* (Roberts, 1917)), the Egyptian free-tailed bat (*Tadarida aegyptiaca* (E. Geoffroy, 1818)) and the pale free-tailed bat (*Tadarida chapini* (J. A. Allen, 1917)), being the first and second species present in the southwestern region of Angola (Crawford-Cabral 1989; Cotterill 2013b; Bernard & Happold 2013d), and the third in a small area in the southeast vicinities of the park, near Oncócua (ISCED/6046) (Happold & Cotterill 2013; Monadjem *et al.* 2020). According to Cotterill (2013b), *S. petrophilus* can be found in wetter and drier woodland savannas, shrublands *Acacia*-wooded grasslands and deserts. This very

small microbat is insectivorous, feeding mostly on small, soft bodied, insects, but can eat beetles and moths too (Freeman 1981; Monadjem *et al.* 2020). *T. aegyptiaca* can be found in open woodlands, bushland savannas, arid scrublands, open grasslands and also in arid areas (Bernard & Happold 2013d). This medium-small sized bat is insectivorous and forages by fast-waking, and it can feed in high altitude or near water, feeding in aquatic insects (Shortridge 1934; Smithers 1971; Bernard & Happold 2013d; Monadjem *et al.* 2020). *T. chapini* can be found in woodland savannas, miombo and mopane woodland and in rainforests (Happold & Cotterill 2013). This very small microbat forages by fast-hawking in open spaces, and feeds mainly on insects (Happold & Cotterill 2013). This species has three subspecies being *T. c. lancasteri* present in the northeast region of Angola and *T. c. shortridgei* present in the southwest region of the country (Happold & Cotterill 2013). According to the IUCN, the three species have the conservation status of Least Concern (Monadjem *et al.* 2017l, 2017j, 2017k).

In the family Vespertilionidae, there are five other species that may occur in the park, the Anchieta's pipistrelle (*Pipistrellus anchietae* (Seabra, 1900)), the cape pipistrelle (*Pipistrellus capensis* (A. Smith, 1829)), the banana pipistrelle (*Pipistrellus nanus* (Peters, 1852)), the zulu pipistrelle (*Pipistrellus zuluensis* (Roberts, 1924)) and the white-bellied house bat (*Scotophilus leucogaster* (Cretzschmar, 1830)). These species potentially exist inside the park due to the fact that their distribution includes the INP or its vicinities, Anchieta's pipistrelle is present in the southwest of Angola (Kearney 2013b), the cape pipistrelle is widespread throughout the country (Kearney 2013c), as well as the banana pipistrelle including the Namibe province (ISCED/64 and 4990) (Happold 2013p), the zulu pipistrelle has been recorded in Angola (Happold *et al.* 2013), and the white-bellied house bat is present in the north of Namibia near the Angola border (-17.4667, 13.0333, 1280m) (LACM/059084-059086) (Cakenberghe & Happold 2013). *P. anchietae* is very small microbat can be found in riverine, coastal and scrub forests and bushvelds, normally near water sources (Kearney 2013b). *P. capensis* is also a very small microbat can be found in a large variety of habitats, except some desertic and coastal regions (Kearney 2013c). Forages by slow-hawking normally between, around and over the canopies (Kearney 2013c). *P. nanus* can be found in a wide range of forest and savanna habitats (Happold 2013p). This microbat starts foraging at dusk, and forages by slow-hawking, in between the trees and its canopies, feeding mostly on small beetles and moths (Happold 2013p). This species

has seven subspecies, being *P. n. fouriei* the one present in south Angola (Happold 2013p). *P. zuluensis* can be found in semi-desert grasslands and shrublands, woodland savannas and dry shrublands and bushlands (Happold *et al.* 2013). This very small microbat forages by slow-hawking, near trees. *S. leucogaster* can be found in riverine woodlands, mopane and miombo woodlands, shrub savannas and open grasslands (Cakenberghe & Happold 2013). This species forages by moderately fast-hawking from two to 20m high, feeding mostly in insects (Cakenberghe & Happold 2013). According to the IUCN, the two species have the conservation status of Least Concern (Monadjem *et al.* 2017l, 2017m, 2017n, 2017o; Monadjem & Griffin 2017b).

- Order Carnivora

There are six more species that are potentially present inside the park, one from the family Canidae, one from the family Felidae, one from the family Viverridae and three from the family Herpestidae. In the Canidae family, the side-striped jackal (*Canis adustus* Sundevall, 1847) is the species that probably occurs on the extreme east of INP, as it is widespread throughout Angola, but mainly in the eastern region of the country (Loveridge & Macdonald 2013; Beja *et al.* 2019). According to Loveridge and Macdonald (2013), it has three subspecies, being *C. a. adustus* from southern Africa, and therefore, the species that occurs in Angola. This species is normally present in habitats with water, like savannas, woodlands and woodlands mosaics (Coe & Skinner 1993; Skinner & Chimimba 2005; Werger & van Bruggen 2012). This medium-sized canid is omnivorous, having a very wide diet, including mainly, small mammals, birds, reptiles, insects, carrion and vegetable matter (Werger & van Bruggen 2012; Loveridge & Macdonald 2013). This species has a conservation status of Least Concern according to IUCN, however, according to the Angolan Red List of Threatened Species, *C. adustus* has a conservation status of Vulnerable (Hoffmann 2014d; MINAMB 2016a).

In the family Felidae, the serval (*Leptailurus serval* (Schreber, 1776)) is the species that might be present in the park, due to the wide distribution in Angola, and its presence in Namibe province (ISCED/1098) (Hunter & Bowland 2013). *L. serval* is more common in savannas, grasslands and dry areas, but it is strongly linked to water sources (Hunter & Bowland 2013). Servals are characterized by having exceptional hearing, due to the developed ear bullae (Hunter & Bowland 2013). It is carnivorous, feeding mainly on murids, birds and snakes (Hunter & Bowland 2013). According to the

IUCN, this species has the conservation status of Least Concern (Thiel 2019).

From the family Viverridae, tow more species might exist inside the park. These species are the miombo genet (*Genetta angolensis* Bocage, 1882) and the African civet (*Civettictis civetta* (Schreber, 1776)), once the first species is present in the vicinities of the INP (Crawford-Cabral 2013), and the second species has a wide distribution, being present in almost all of Angola, from the north to southwest through the Angolan plateau and the Escarpment zone (da Silva 1970; Crawford-Cabral 1989, 2013; Ray 2013). Miombo genets are medium-sized species that can be found mainly in open miombo woodland interspersed with savannas (Crawford-Cabral 2013). This species is also called the Angolan genet, and it is terrestrial and nocturnal (Crawford-Cabral 2013). *G. angolensis* appears to have suffered an adaptation on the dentition level, for grasping, and it feeds mainly on arthropods but can occasionally feed on insects, fruit and grass (Ansell 1969; Crawford-Cabral 2013). According to IUCN, this species has the conservation status of Least Concern (Gaubert *et al.* 2016). African civets are mainly nocturnal and occur in secondary forest, woodlands, bushlands and aquatic habitats, and can also be found near villages, and in deforested and degraded areas (da Silva 1970; Ray 2013). This dog like carnivore is terrestrial although it is characterized by being adapted to swim (Ray 2013). It is one of the most common carnivores, being numerically dominant (Ray 2013). It is omnivorous and opportunistic, feeding mainly on fruit, arthropods (millipedes, beetles and orthopterans), mammals (rodents and hares) and occasionally other vertebrates (birds and reptiles) (Bothma 1965; Rosevear 1974; Guy 1977; Randall 1977; Smithers & Wilson 1979; Pendje 1994; Ray 1996; Angelici 2000; Ray 2013). The IUCN classifies *C. civetta* with the conservation status of Least Concern (Do Lihn San *et al.* 2019). On the other hand. this species is reported in the Red List of Angola as a Vulnerable species (MINAMB 2016a).

From the family Herpestidae, the three species that probably occur inside the park are the marsh mongoose (*Atilax paludinosus* (G. Cuvier, 1829)), the slender mongoose (*Herpestes sanguineus* (Rüppell, 1835)) and the white-tailed mongoose (*Ichneumia albicauda* (G. Cuvier, 1829)), due to the presence of, *A. paludinosus* (ISCED/8053) and *I. albicauda* (ISCED/1111 and 8630) in the Namibe province, and *H. sanguineus* is present in all the country (Baker & Ray 2013; Hoffmann & Taylor 2013; Taylor 2013d; Beja *et al.* 2019). *A. paludinosus* can be found in riparian habitats, like rivers, swamps, marshes and dams (Werger & van Bruggen 2012; Baker & Ray

2013; Beja *et al.* 2019). This species is nocturnal, partly aquatic and it is a rather common species in suitable habitat (Werger & van Bruggen 2012; Baker & Ray 2013). The diet is based on aquatic prey, mostly crabs, but also rodents, birds, frogs, reptiles and fruits (Werger & van Bruggen 2012; Baker & Ray 2013). According to IUCN its conservation status is Least Concern (Do Linh San *et al.* 2015). What is thought to have been an individual of *H. sanguineus* was spotted near Omauha Farm (-16.4970,12.4549, 381m) by the authors on 16th November 2019, but due to the fast running of the animal, no considerations will be made about this sighting. Slender mongooses can be found in a lot of different habitats, from arid sub-desertic areas to forest fringes and savannas (Werger & van Bruggen 2012; Hoffmann & Taylor 2013), and according to Smithers (1971), the habitat is required to have some kind of cover. This species is absent from the Namib Desert (Hoffmann & Taylor 2013) however, the present study shows a record in the desert. *H. sanguineus* is diurnal, mostly terrestrial and common through all Angola (Hoffmann & Taylor 2013). It is a generalist carnivore, eating small vertebrates (reptiles such as lizards and snakes; birds; and rodents such as squirls and murids), small invertebrates (mainly insects such as grasshoppers, termites, beetles and ants) and occasionally fruits (berries and figs) (Ansell 1965; Smithers 1971; Rood & Waser 1978; Smithers & Wilson 1979; Skinner & Chimimba 2005; Werger & van Bruggen 2012; Hoffmann & Taylor 2013). This species has a complicated subspecies history (Hoffmann & Taylor 2013), so none will be designated here. According to IUCN, this species has the conservation status of Least Concern (Do Linh San & Maddock 2016). *I. albicauda* can be found mainly in grasslands, savannas and woodland areas (Taylor 2013d). It is mainly insectivorous and insects such as beetles, grasshoppers and crickets constitute a large proportion of its diet (Taylor 2013d). It has six subspecies, being *I. a. loandae*, the one present in Angola (Taylor 2013d). According to the IUCN, this species has the conservation status of Least Concern (Do Lihn San 2015).

- Order Cetartiodactyla

One more species from the family Bovidae might exist in the park. This species is the bushbuck (*Tragelaphus scriptus* (Pallas, 1766)), due to its presence in the proximities of the park, having historical records from Chela escarpment to the inland border of the Namibe Province (Crawford-Cabral & Veríssimo 2005), and two specimens of this species were collected from Namibe province (AMNH/M-80483),

being one from 101k km east of Moçâmedes (AMNH/M-80484). *T. scriptus* is the most widespread antelope throughout the African continent (da Silva 1970; Estes 1989; East 1999; Werger & van Bruggen 2012). In Angola it is present in almost all of the country (Crawford-Cabral 2005; Plumptre & Wronski 2013; Beja *et al.* 2019). Mr. Alvaro Baptista found a male bushbuck near Omauha lodge, allegedly strayed from the less arid mountain ranges further east. These medium-sized antelopes can be found in very different habitats, from coastal regions to mountains, woodlands, scrub and forest edges (Werger & van Bruggen 2012; Plumptre & Wronski 2013). To camouflage in such wide range of habitats, this species has different coat colour and patterning (Plumptre & Wronski 2013). Individuals of this species are found normally alone or in pairs and it is not common to observe them because of the fur pattern and its nocturnal activity, being on the shade during the day (da Silva 1970; Plumptre & Wronski 2013). This species is a browser, feeding mostly on herbs and young green leaves of grass (Werger & van Bruggen 2012; Plumptre & Wronski 2013). According to Plumptre & Wronski (2013), the subspecies of this species can be classified in two groups, scriptus group that includes four subspecies, *T. s. scriptus*, *T. s. phaleratus*, *T. s. bor* and *T. s. decula*, and sylvaticus group that includes seven more subspecies, *T. s. sylvaticus*, *T. s. roualeynei*, *T. s. ornatus*, *T. s. dama*, *T. s. delamerei*, *T. s. fasciatus* and *T. s. meneliki*, of these, *T. s. ornatus* is the one present in Angola. The conservation status of this species is Least Concern by the IUCN (IUCN SSC ASG 2016i).

Discussion

A total of 14 orders, 37 families and 120 species of mammals occur inside the park and in its vicinities. The orders Rodentia, Chiroptera and Carnivora are the orders with the most families (with 7 families each) represented inside the park and its vicinities. The family with the highest number of species is the family Muridae from the order Rodentia, with 16 species, followed by the family Bovidae from the order Cetartiodactyla with 12 species, and then by the family Vespertilionidae from the order Chiroptera with a total of nine species. Some species are reported in this checklist as potentially occurring inside INP, based on past studies or where the range of the species was near the borders of the park.

The order Cetartiodactyla is the order with the most number of records reported from the camera trapping efforts. This is probably due to the fact that the larger species, for example, the gemsbok (*Gazella oryx*), can be detected in a range up to 30 meters, while the smaller species, as the majority in the Rodentia order, have to be in a two meter range to be detected by the camera sensor (Wearn & Glover-Kapfer 2017; Molloy & Cowan 2018). In addition, this particular survey, as explained in the materials and methods, the cameras set to catch large mammals. Thus, it is unsurprising that there were no records of species in the order Rodentia recorded using the camera traps and only four pictures of what appears to be a single species of bat in the order Chiroptera. The images of the bats were of insufficient quality to determine the exact species, further supporting the need for targeted small mammal trapping in the area to accurately document species diversity.

According to the IUCN, three species and one subspecies that are currently present in Iona National Park have the conservation status of Vulnerable (leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), ground pangolin (*Smutsia temminckii*) and mountain zebra (*Equus zebra hartmannae*)); five of Near Threatened (African straw-coloured fruit bat (*Eidolon helvum*), Angolan epauletted fruit bat (*Epomophorus angolensis*), striped leaf-nosed bat (*Hipposideros vittatus*), African clawless (*Aonyx capensis*) and brown hyena (*Hyaena brunnea*)); with the majority of the remaining species listed as Least Concern. In comparison, 24 of the 114 species here listed, are also present in the Red List of Angola, although currently only 19 are still present in the park. These species and their conservation status include: Vulnerable for ten species (aardvark (*Orycteropus afer*), side-striped jackal (*Canis adustus*), black-backed jackal

(*Canis mesomelas*), bat-eared fox (*Otocyon megalotis*), ratel (*Mellivora capensis*), leopard (*P. pardus*), caracal (*Caracal caracal*), wildcat (*Felis silvestris*), african civet (*Civettictis civetta*) and ground pangolin (*S. temminckii*)); Endangered for seven species and one subspecies (chacma baboon (*Papio ursinus*), cape fox (*Vulpes chama*), cheetah (*A. jubatus*), spotted hyena (*Crocuta crocuta*), aardwolf (*Proteles cristatus*), meerkat (*Suricata suricatta*), mountain zebra (*E. z. hartmannae*) and common duiker (*Sylvicapra grimmia*)). According to The Red List of Angola, the brown hyena (*H. brunnea*) is considered extinct from Angola, however, new data gathered as part of this thesis indicate that this species is still present in the southwest region of the country, including INP.

According to Kingdon *et al.* (2013a, 2013b, 2013c, 2013d) and Kingdon & Hoffman (2013a, 2013b), from the 120 species listed in this checklist, 38 species and 9 subspecies are endemic to southern Africa (for example: *Elephantulus* intufi, *Gerbillurus paeba*, *Canis mesomelas mesomelas*, *Arctocephalus pusillus*, *Equus zebra hartmannae*, *Oryx gazella*, and others); of these, seven species and two subspecies are endemic to Namibia and Angola (for example: *Xerus princeps*, *Epomophorus angolensis*, *Madoqua kirkii damarensis*, *Galerella flavescens*, and others); of these, tow species are endemic to Angola (*Crocidura erica* and *Myomyscus angolensis*) and one subspecies is endemic to the INP (*Suricata suricatta iona*); on the other hand three species here listed have been introduced in the African continent by boats and ships from European countries (*Mus musculus*, *Rattus norvegicus* and *R. rattus*). The presence of endemic species and subspecies, to southern Africa, Angola and INP, in the park means that these areas are the only region where these species exist, which makes it even more important to preserve and monitor the species present in INP.

Some species that once inhabited Iona National Park, are currently locally extinct, such as the African lion (*Panthera leo*), black rhinoceros (*Diceros bicornis*), wildebeest (*Connochaetes taurinus*), giraffe (*Giraffa camelopardalis*), black-faced impala (*Aepyceros melampus*) and African elephant (*Loxodonta africana*) (Mendelsohn & Mendelsohn 2018). The reintroduction of some of these species like the black rhinoceros (*D. bicornis*) and giraffes (*G. camelopardalis*), would be important, due to the conservation status of this species, being Extinct and Endangered (respectively, according to The Red List of Angola (MINAMB 2016a)), and also due to large species of mammals attract tourism, which the park might benefit from (Okello *et al*. 2028). Although the reintroduction of all the species that once inhabited the park but are

currently locally extinct is not always important. For example, the reintroduction of the african wild dog (*Lycaon pictus*), that is present in the Red List of Angola with the conservation status of Endangered species, would not be important, once its presence in Angola is mostly limited to the east, centre and south centre regions of the country, therefore its previous presence in the park might be due to the movement of populations from the east region to the park (INBAC 2016).

According to IUCN (1992), since 1975 most of Angola's mammal populations have suffered some or even total loss (local extinction). Such decreases indicate an urgent need to implement more conservation projects in the near future. Some conservation projects have been successfully established in national parks in other parts of Angola. The Giant Sable Antelope Conservation Project (Vaz Pinto 2019) was able to recover the sub-species from near extinction, and outside of national parks, the Kitabanga Project in Quissama and Cambeu Project in Lobito, have found similar success with reintroductions of sea turtles (Cambeu 2020; Kitabanga 2021). Similar projects should be developed for other mammal species in INP that have been decreasing or are facing other conservation threats such as the mountain zebra (Kolberg & Kilian 2003; van der Westhuizen *et al.* 2017). Expansion of similar programs throughout the country and for other species would help to enhance ecotourism opportunities and protect the unique and diverse flora and fauna found in Angola.

One of the probable cause for the loss of biodiversity is the civil war that persisted in the country for almost 30 years. In most of the cases, wildlife products such as meat, ivory and fur, were commercialized in exchange for arms and ammunition to the support the war (Dudley *et al.* 2002; Montesh 2013). A lot of poaching used to happen in the park, where the main interest were the zebras for trade of the skin (Huntley 2017). Elephants and rhinoceroses were poached for their tusks, to trade the ivory and horns for goods (Chase & Griffin 2011; Montesh 2013; Bersacola *et al.* 2014). The poaching of elephants, rhinoceros, lions and plain zebras, lead to their extinction inside INP. Recent studies show that illegal hunting might still be happening in INP, with species such as springbok (*Antidorcas marsupialis*) being targeted (van der Westhuizen 2017).

Another reason for the loss of mammal biodiversity in the Iona National park is the increasing human population (van der Westhuizen 2017), as similar patterns have been reported in other parks in Angola (Petracca *et al.* 2019). There is a lot of human presence throughout the park, which leads to direct interaction with and disturbance to

the park's ecosystems and wildlife. With human settlement comes livestock, leading to alteration of habitats and the potential for direct competition for resources with ungulates or other species, making it challenging for wildlife to adapt and coexist (van der Westhuizen 2017). In 1972, Huntley identified this problem, saying that forcing the tribes to leave the protected area is not an option, but there are a few things that can be managed, like prohibition of trade inside the park (Huntley 1972a). In the last years, from 2003 to 2017, the number of people living in the park increased from an estimated population of 629, up to 3000 individuals, and the estimated number of livestock is more than 8500 animals (Kolberg & Kilian 2003; van der Westhuizen *et al.* 2017; Mendelsohn & Mendelsohn 2018). Although the number of livestock decreased substantially from 2003 to 2017, the human presence expanded from the northern and eastern regions of the park to the southcentral regions (Kolberg & Kilian 2003; van der Westhuizen *et al.* 2017).

To help mitigate these problems it is important to take conservation measures such as zoning, which helps define certain areas to different intensities of use, separating the areas with more human presence, from those with more wildlife which need more protection, and from tourism, recreation, and others (Pouya & Pouya 2018). The park is also in need of increased infrastructure and managerial capacities to better control and supervise human activities and wildlife populations inhabiting this area. Such measures have been identified in the park's management plan (MINAMB 2016b). The implementation of this plan is imperative towards helping the park evolve into a monitored and safer park for the people and the animals, and also to help with the local economy, for example with the implementation of ecotourism.

The present checklist is an important first step for future work targeting the mammals of INP, serving as a reference base and a management tool for the park. Further studies of the mammals of INP are necessary in order to increase the knowledge of the fauna still present, especially for small mammals, which require specific methodologies to effectively survey (Wilson *et al.* 1996). Such efforts may even reveal the presence of new species to both the country and INP. This checklist and the checklist of the herpetofauna of INP (Ceríaco *et al.* 2016) are the only two base studies of this protected area. Expanding such survey efforts to additional fauna groups, like birds or selected invertebrates, would be very interesting and important to the area, due to the fact that these groups are poorly studied in the area, in order to better understand the ecosystems of the park.

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Appendix

Table 3. Summarized list with all the species present in this study. This list has the information about the type of record ['Recent'; 'Historical'; and 'Potential' (species that might exist in the INP)]; IUCN and Red List of Angola conservation status ('IUCN/RL'); 'Endemicity'; and additional information on whether the species is locally extinct from the INP ('Locally extinct').

Order/ Family /Species	Records			IUCN/ RL	Endemicity	Locally extinct
	Recent	Historical	Potential			
Order Hyracoidea						
Family Procaviidae						
Procavia capensis (Pallas, 1766)	x[2]	x		LC		
Order Proboscidea						
Family Elephantidae						
Loxodonta africana Blumenbach, 1797		x		VU/VU		x
Order Macroscelidea						
Family Macroscelididae						
Elephantulus intufi (A. Smith, 1836)		x		LC	Southern Africa	
Elephantulus rupestris (A. Smith, 1831)			x	LC	Namibia/ South Africa	
Macroscelides proboscideus (Shaw, 1800)			x	LC	Southern Africa	
Order Tubulidentata						
Family Orycteropodidae						
Orycteropus afer (Pallas, 1766)	x[1]			LC/VU		
Order Primates						
Family Cercopithecoidea						
Papio ursinus (Kerr, 1972)	x[1;2]	x		LC/EN	Southern Africa*	
Chlorocebus cynosurus (Scopoli, 1786)	x[2]	x		LC		
Family Galagidae						
Otolemur crassicaudatus É. Geoffroy, 1812			x	LC		
Galago moholi A. Smith, 1836			x	LC	Southern Africa	
Order Rodentia						
Family Sciuridae						
Funisciurus congicus (Kuhl, 1820)		x		LC		
Xerus princeps (Thomas, 1929)		x		LC	Angola/ Namibia	

Family Gliridae						
Graphiurus kelleni (Reuvens, 1890)			x	LC		
Graphiurus rupicola (Thomas & Hinton, 1925)			x	LC	Southern Africa	
Family Nesomyidae						
Saccostomus campestris Peters, 1846			x	LC	Southern Africa	
Dendromus melanotis Smith, 1834		x		LC		
Dendromus mystacalis Heuglin, 1863		x		LC		
Malacothrix typica (A. Smith, 1834)			x	LC	Southern Africa	
Steatomys parvus Rhoads, 1896			x	LC		
Petromyscus collinus (Thomas & Hinton, 1925)		x		LC	Southern Africa	
Petromyscus shortridgei Thomas, 1926		x		LC	Angola/ Namibia	
Family Muridae						
Desmodillus auricularis (Smith, 1834)		x		LC	Southern Africa	
Gerbilliscus leucogaster (Peters, 1852)		x		LC	Southern Africa	
Gerbillurus paeba (A. Smith, 1836)		x		LC	Southern Africa	
Gerbillurus setzeri (Schlitter, 1973)		x		LC	Angola/ Namibia	
*Aethomys chrysophilus (*de Winton, 1897)			x	LC		
Aethomys namaquensis (A. Smith, 1834)		x		LC		
Mastomys coucha (Smith, 1834)			x	LC	Southern Africa	
Mastomys natalensis (Smith, 1834)		x		LC		
Mus musculus Linnaeus, 1758		x		LC		
Myomyscus angolensis (Bocage, 1890)			x	LC	Angola	
Pelomys campanae (Huet, 1888)		x		LC		
Rattus norvegicus (Berkenhout, 1769)		x		LC		
Rattus rattus (Linnaeus, 1758)		x		LC		
Rhabdomys pumilio (Sparrman, 1784)		x		LC		
Thallomys nigricauda (Thomas, 1882)			x	LC	Southern Africa	
Parotomys littledalei Thomas, 1918			x	LC	Namibia/ South Africa	
Family Pedetidae						
Pedetes capensis (Forster, 1778)			x	LC	Southern Africa	
Family Hystricidae						
Hystrix africaeaustralis Peters, 1852	x[3]	x		LC		

Family Petromuridae						
Petromus typicus A. Smith, 1831		x		LC	Southern Africa	
Order Lagomorpha						
Family Leporidae						
Lepus capensis Linnaeus, 1758	x[2]	x		LC		
Lepus victoriae (Thomas, 1893)			x	LC		
Pronolagus randensis Jameson, 1907		x		LC	Southern Africa	
Order Erinaceomorpha						
Family Erinaceidae						
Atelerix frontalis (A. Smith, 1831)		x		LC	Southern Africa	
Order Soricomorpha						
Family Soricidae						
Crocidura cyanea (Duvemoy, 1838)			x	LC	Southern Africa	
Crocidura erica Dollman, 1915		x		DD	Angola	
Crocidura fuscomurina (Heuglin, 1865)		x		LC		
Crocidura nigricans Bocage, 1889		x		LC		
Crocidura olivieri (Lesson, 1827)			x	LC		
Order Chiroptera						
Family Pteropodidae						
Eidolon helvum (Kerr, 1792)			x	NT		
Epomophorus angolensis Gray, 1870		x		NT	Angola/ Namibia	
Epomophorus wahlbergi (Sundevall, 1846)		x		LC		
Family Rhinolophidae						
Rhinolophus clivosus Cretzschmar, 1828			x	LC		
Rhinolophus denti Thomas, 1904		x		LC		
Rhinolophus fumigatus Rüppell, 1842			x	LC		
Family Hipposideridae						
Hipposideros caffer (Sundevall, 1846)		x		LC		
Hipposideros vittatus (Peters, 1852)			x	NT		
Family Emballonuridae						
Taphozous mauritianus E. Geoffroy, 1818		x		LC		
Family Nycteridae						
Nycteris thebaica E. Geoffroy, 1813		x		LC		

Family Molossidae						
Sauromys petrophilus (Roberts, 1917)			x	LC	Southern Africa	
Tadarida aegyptiaca (E. Geoffroy, 1818)			x	LC		
Tadarida chapini (J. A. Allen, 1917)			x	LC		
Tadarida pumila (Cretzschmar, 1830-1831)		x		LC		
Family Vespertilionidae						
Eptesicus hottentotus (A. Smith, 1833)		x		LC		
Nycticeinops schlieffeni (Peters, 1859)		x		LC		
Pipistrellus anchietae (Seabra, 1900)			x	LC	Southern Africa	
Pipistrellus nanus (Peters, 1852)			x	LC		
Pipistrellus zuluensis (Roberts, 1924)			x	LC		
Scotophilus dinganii (A. Smith, 1833)		x		LC		
Scotophilus leucogaster (Cretzschmar, 1830)			x	LC		
Cistugo seabrae Thomas, 1912		x		LC	Southern Africa	
Order Carnivora						
Family Canidae						
Canis adustus Sundevall, 1847			x	LC/VU		
Canis mesomelas Schreber, 1775	x[1;2]	x		LC/VU	Southern Africa*	
Lycaon pictus (Temminck, 1820)		x		EN/EN		x
Vulpes chama (A. Smith, 1833)	x[1;2]	x		LC/EN	Southern Africa	
Otocyon megalotis (Desmarest, 1822)		x		LC/VU	Southern Africa*	
Family Mustelidae						
Ictonyx striatus (Perry, 1810)	x[1]	x		LC		
Aonyx capensis (Schinz, 1821)		x		NT		
Mellivora capensis (Schreber, 1776)	x[4]	x		LC/VU		
Family Otariidae						
Arctocephalus pusillus (Schreber, 1776)	x[2]	x		LC	Southern Africa	
Family Felidae						
Panthera leo (Linnaeus, 1758)	x[2]	x		VU/EN		x
Panthera pardus (Linnaeus, 1758)	x[1;4]	x		VU/VU		
Caracal caracal (Schreber, 1776)	x[1]	x		LC/VU		
Leptailurus serval (Schreber, 1776)			x	LC		
Acinonyx jubatus (Schreber, 1775)	x[1]	x		VU/EN		
Felis silvestris Schreber, 1777	x[1]	x		LC/VU		

Family Viverridae						
Genetta angolensis Bocage, 1882			x	LC	Southern Africa	
Genetta genetta (Linnaeus, 1758)		x		LC		
Genetta maculata (Gray, 1830)		x		LC		
Civettictis civetta (Schreber, 1776)			x	LC/VU		
Family Hyaenidae						
Hyaena brunnea Thunberg, 1820	x[2;3;4]	x		NT/EX	Southern Africa	
Crocuta crocuta (Erxleben, 1777)	x[2]	x		LC/EN		
Proteles cristatus (Sparrman, 1783)	x[1;2]	x		LC/EN	Southern Africa*	
Family Herpestidae						
Atilax paludinosus (Cuvier, 1829)			x	LC		
Galerella flavescens Bocage, 1889		x		LC	SW Angola/ NW Namibia	
Herpestes sanguineus (Rüppell, 1835)			x	LC		
Ichneumia albicauda (G. Cuvier, 1829)			x	LC		
Suricata suricatta (Schreber, 1776)	x[2]	x		LC/EN	Southern Africa	
Mungos mungo (Gmelin, 1788)		x		LC		
Helogale parvula (Sundevall, 1847)		x		LC		
Order Pholidota						
Family Manidae						
Smutsia temminckii (Smuts, 1832)	x[2;4]	x		VU/VU		
Order Perissodactyla						
Family Equidae						
Equus quagga Boddaert, 1785		x		NT/VU		x
Equus zebra Linnaeus, 1758	x[1;2;3]	x		VU/EN	Southern Africa	
Family Rhinocerotidae						
Diceros bicornis (Linnaeus, 1758)		x		CR/EX	Southern Africa	x
Order Cetartiodactyla						
Family Hippotamidae						
Hippopotamus amphibius Linnaeus, 1758		x		VU		
Family Suidae						
Phacochoerus africanus (Gmelin, 1788)		x		LC		
Family Giraffidae						
Giraffa camelopardalis (Linnaeus, 1758)		x		LC/EN	Southern Africa*	x

Family Bovidae						
Tragelaphus strepsiceros (Pallas, 1766)	x[1]	x		LC		
Tragelaphus scriptus (Pallas, 1766)			x	LC		
Tragelaphus oryx (Pallas, 1766)		x		LC		
Sylvicapra grimmia (Linnaeus, 1758)		x		LC/EN		
Raphicerus campestris (Thunberg, 1811)	x[1;2]	x		LC	Southern Africa*	
Madoqua kirkii (Günther, 1880)	x[1;2]	x		LC	Angola/ Namibia*	
Antidorcas marsupialis (Zimmermann, 1780)	x[1;2;4]	x		LC	Southern Africa	
Oreotragus oreotragus (Zimmermann, 1783)	x[2]	x		LC		
Aepyceros melampus (Lichtenstein, 1812)		x		LC	Southern Africa*	x
Connochaetes taurinus (Burchell, 1824)		x		LC	Southern Africa*	x
Hippotragus equinus (É. Geoffroy Saint-Hilaire, 1803)		x		LC		
Oryx gazella (Linnaeus, 1758)	x[1;2]	x		LC	Southern Africa	

'Recent': (x1) camera trap images; (x2) direct observations; (x3) tracks or scats; (x4) carcasses.
'IUCN/RL' - DD (Data deficient), LC (Least Concern), NT (Near Threatened), VU (Vulnerable), EN (Endangered), CR (Critically Endangered), EW (Extinct in the Wild), EX (Extinct). All IUCN statuses were obtained from the IUCN website, https://www.iucnredlist.org/, <accessed on 24 Mar 2021>
'Endemicity' – ('*') at least one subspecies is endemic from the written area; 'Southern Africa' the species is present in at least three of the following countries: Angola; Botswana; Democratic Republic of Congo; Lesotho; Malawi; Mozambique; Namibia; South Africa; Swaziland; Tanzania; Zambia; Zimbabwe. All the endemicity information is according to Kingdon et al. (2013a, 2013b, 2013c, 2013d) and Kingdon & Hoffman (2013a, 2013b).

Table 4. Information regarding the coordinates of the sites and the cameras.

Site	Camera number	Camera type	GPS Coordinates		
			Long	Lat	m
Site 1	150	Cuddeback	12,2727	-16,2995	237
Site 2	134	Cuddeback	12,2526	-16,3385	246
Site 3	63524	Panthera	12,4195	-16,2843	236
Site 4	133	Cuddeback	12,4420	-16,3596	284
Site 5	139	Cuddeback	12,4528	-16,4235	314
Site 6	136	Cuddeback	12,5064	-16,4253	402
Site 7	142	Cuddeback	12,4893	-16,4315	431
Site 8	138	Cuddeback	12,4418	-16,4707	409
Site 9	145	Cuddeback	12,3756	-16,4952	363
Site 10	60	Cuddeback	12,3600	-16,5302	332
Site 11	147	Cuddeback	12,3424	-16,5292	329
Site 12	123	Cuddeback	12,2952	-16,5188	307
Site 13	148	Cuddeback	12,2577	-16,4825	290
Site 14	130	Cuddeback	12,2344	-16,5646	320
Site 15	42	Cuddeback	12,2639	-16,6243	348
Site 16	128	Cuddeback	12,3160	-16,6942	388
Site 17	63977	Panthera	12,3430	-16,736	418
Site 18	146	Cuddeback	12,3659	-16,7547	438
Site 19	63554	Panthera	12,4395	-16,6896	492
Site 20	63988	Panthera	12,4583	-16,6282	433
Site 21	63594	Panthera	12,4714	-16,5467	383
Site 22	129	Cuddeback	12,5328	-16,5553	411
Site 23	25	Cuddeback	12,5857	-16,5774	452
Site 24	15	Cuddeback	12,6215	-16,6108	482
Site 25	22	Cuddeback	12,6776	-16,6181	518
Site 26	63563	Panthera	12,7467	-16,654	592
Site 27	63512	Panthera	12,8128	-16,6897	614
Site 28	143	Cuddeback	12,7861	-16,7557	665
Site 29	56	Cuddeback	12,8074	-16,5581	472
Site 30	9	Cuddeback	12,7360	-16,5115	417
Site 31	63588	Panthera	12,6785	-16,4854	290
Site 32	23	Cuddeback (Infra-Red)	12,6466	-16,4333	346
Site 33	10	Cuddeback (Infra-Red)	12,4712	-16,1459	419
Site 34	5	Cuddeback	12,3972	-16,2209	355
Site 35	26	Cuddeback (Infra-Red)	12,3617	-16,2403	294
Site 36	24	Cuddeback (Infra-Red)	12,3459	-16,2023	276
Site 37	19	Cuddeback	12,3475	-16,1685	281

Site 38	1	Cuddeback	12,3841	-16,1706	323
Site 39	144	Cuddeback	12,4551	-16,2095	416
Site 40	6	Cuddeback	12,5149	-16,2258	325