



MINISTÉRIO DO AMBIENTE  
Instituto Nacional de Biodiversidade e  
Áreas de Conservação



# QUIÇAMA NATIONAL PARK

## ANGOLA

A LARGE AND MEDIUM SIZED  
MAMMALS SURVEY



**Cover photo:** A Leopard cub poses for a picture before joining its mother and sibling, near Mumbondo, in the south east area of Quiçama National Park. The photo on this page is of an Angolan (Southern) talapoin from the same area. David & Sara Elizalde -RWCP/INBAC 2017

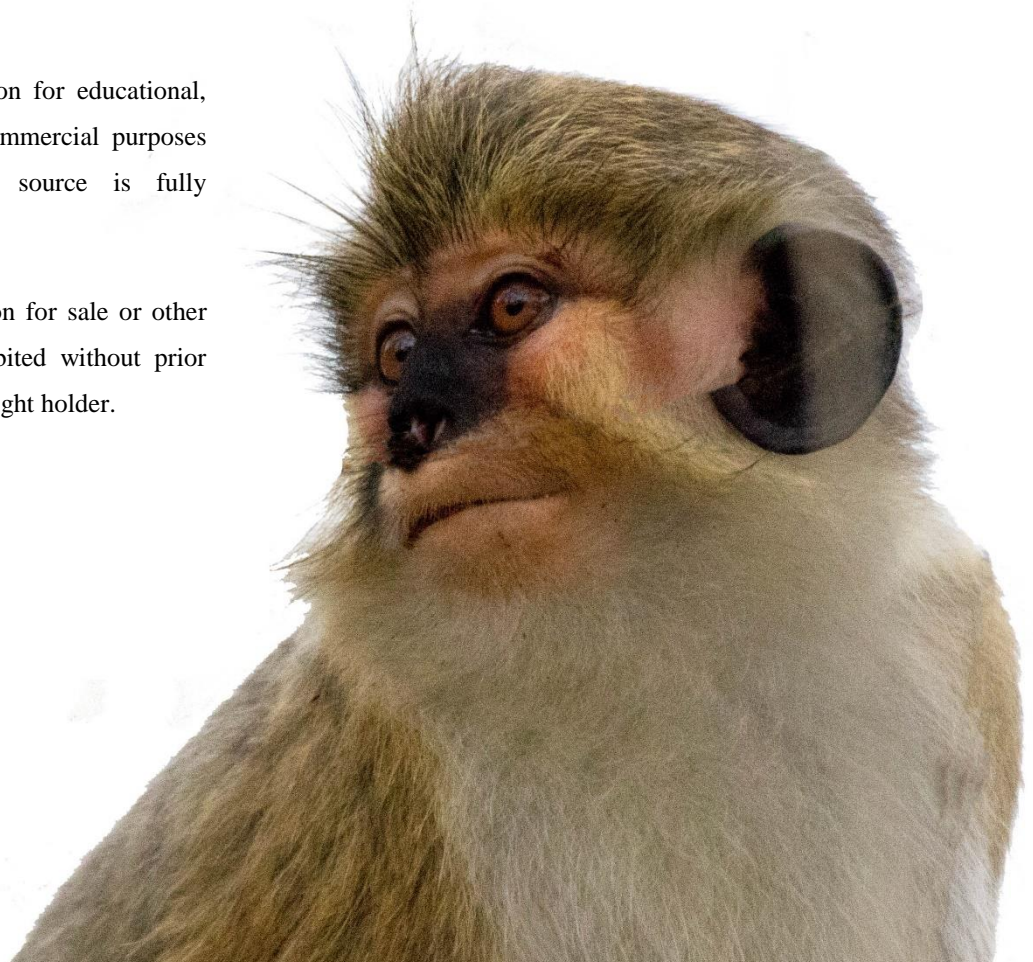
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# QUIÇAMA NATIONAL PARK

## ANGOLA

### A LARGE AND MEDIUM SIZED MAMMALS SURVEY

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# 1 EXECUTIVE SUMMARY

This report summarizes the results of a large and medium sized terrestrial mammals' survey conducted in Quiçama National Park during the dry season of 2017, revealing a mammal community composed of a total of 42 species, being 31 native, 2 reintroduced (previously existing in the park) and 9 introduced exotic species.

The survey was a joint effort of the Range Wide Conservation Program for Cheetah and African Wild Dogs (RWCP) and INBAC, as part of a contract to survey the large and medium mammals of the park and sponsored by the United Nations Development Program (UNDP) and the Global Environmental Fund (GEF). The RWCP operated under a signed cooperation agreement (MoU) pertaining to the conservation of cheetah and African wild dogs in Angola, where ground-based surveys of Angola's Protected Areas are included in order to assist with park management plans.

Wildlife populations in Quiçama NP were decimated during the civil war and, although slowly recovering now, are severely threatened by the intense bushmeat hunting perpetuated by local villagers and military forces, as well as by encroachment of settlements into the park.

A combination of complementary techniques (wildlife observations; camera trapping and interviews to officials and local communities) was used to provide a more complete picture of the mammalian community of the park and the challenges faced by these species. An additional effort was applied in the Special Conservation Area (SCA) to estimate the density of some of the native and introduced animals using distance sampling. All human settlements were noted, as well as their livelihood patterns, whenever information was willingly provided by communities. During the survey, all opportunistically observed signs of actions considered as illegal in a national park were noted. Areas potentially interesting for tourism activities were also noted.

Camera trapping was the main method applied to determine mammal's distribution and abundance along all the park extension. A total of 154 camera traps were deployed using a 15km grid and its quarter grids (7.5km), representing a survey effort of 4418 camera trap

nights distributed between 142 recovered and functioning camera traps (average 31 days/camera, ranging 4 to 69 days) that obtained a total of 101.824 images.

A total of 7.500 km was driven by car, motorcycle, quad bike or covered by foot to survey as much area as possible, inside and on some surrounding areas of the park, searching for tracks. In total, 688 direct observations (counting 1.440 individual animals), 374 dung piles, 288 tracks and 24 carcasses were recorded for wild mammals.

Population densities were calculated for the native and introduced mammals in the SCA. Within the indigenous mammals, the bushbuck (*Tragelaphus scriptus ornatus*) was the most abundant mammal with a density of 20,86/km<sup>2</sup>. Other native mammals' densities such as blue duiker (*Philantomba monticola*), common duiker (*Sylvicapra grimmia*) and the reintroduced common eland (*Taurotragus oryx*) were calculated but with less reliability due to the low number of observations. Most distressing are the estimated densities for exotic animals such as greater kudu (*Tragelaphus strepsiceros*) 5,28/km<sup>2</sup> and blue wildebeest (*Connochaetes taurinus*) 4,28/km<sup>2</sup>, which are both greater than desirable, especially taking into account that these mammals are exotic to the Quiçama system.

Outside the SCA, some species of the remnant mammal population are at high risk of becoming extinct in the near future. The results of the survey indicate that poaching for consumption or bushmeat sale became the fastest and easiest monetary solution, and even though there are no studies on mammal populations densities variation in the area, locals and poachers seem to agree on a general decline of mammal's density over the last years.

Two main elephant (*Loxodonta africana*) groups exist in the park, one deriving from 30 animals reintroduced in the SCA coming from a rehabilitation centre in South Africa (originally from Gonarhezou National Park in Zimbabwe) and the second is a native group that survived the intensive poaching during the civil war and now hides in the dense forests from the southern part of the park to the wilderness area south east of its border.

Hippopotamus (*Hippopotamus amphibius*) populations in Quiçama National Park are small and highly threatened. In the northern area of the park the hippos are confined to the Cuanza

river and its adjacent lagoons. In the southern part of the park, hippos exist in the Longa river lagoons system. In this area, hippos are openly poached with wire snares, to protect crops and for meat. This indicates that the remnant populations of hippos in the Longa and Cuanza systems are threatened and may end up extinct in the near future if no action is implemented.

Leopard (*Panthera pardus*) is the only large carnivore remaining in the park. There is a relatively healthy population in the south-east area of the park. Lions (*Panthera leo*) and African wild dogs (*Lycaon pictus*) are absent from the system for at least a decade. Cheetah (*Acinonyx jubatus*) is most likely absent from the system since no sign of its presence was found but further research is recommended, most specifically in the south of the park where it occurred historically (Crawford-Cabral et al, 1990). Reliable reports of hyena (*Crocuta crocuta*) indicate it could have been present until a couple of years ago, but no recent records were found.

The survey provided the first verifiable record of the presence of side-striped jackal (*Canis adustus*) for Quiçama National Park.

According to the results of this survey, the forest buffalo (*Syncerus caffer nanus*) remnant populations in the park will most likely become extinct in the near future if no action is taken urgently to prevent that from happening. The team was able to capture images and evidence of small sized and dispersed populations of this mammal species in the south east of the park.

Collateral data from small mammals was also taken into account. A small and not well-known mongoose species, Ansorge's Cusimanse (*Crossarchus ansorgei*), is known in Angola only from a single specimen collected in 1908, north of the Cuanza river. The results in this survey represent the first published records of the species for Angola in the last 109 years.

Throughout the entire park, human population was mostly concentrated on the park's borders, in Muxima, Mumbondo, Longa and Cabo Ledo. The 2014 census revealed a total of 25.086 persons presently living in Quiçama municipality. Human settlements are increasing deep inside the park, living in more or less small communities. Encroachment and all its



consequences (hunting, deforestation, habitat fragmentation, cattle) is one of the biggest threats Quiçama NP faces.

Recent invasions by commercial agriculture and cattle farms in the southwest and northeast of the park, have contributed to a decline in mammals' density in those areas, in some cases even extinction.

Bushmeat, for personal and commercial purposes, is undoubtedly the other biggest threat Quiçama NP is facing presently. There is a culture of hunting meat, passed down across generations, and found to be prevalent, widespread and, in some areas, not regarded as illegal by the population. The harvested products and meat are used to nurture large markets in Luanda but creating little job opportunities for locals. Bushmeat hunting was recorded: 1) in the bush with people seen hunting or evidence of that, such as shell casings; and 2) in processing camps with meat drying racks. Bushbuck, blue duiker, bushpig and southern reedbuck are amongst the most targeted animals.

According to our subjective assessments, Quiçama holds a high tourism potential. Its proximity to the capital Luanda and beautiful and diverse habitats are ideal criteria for a successful ecotourism experience, provided fauna density numbers are improved. Both four-wheel-drive routes with remote camp sites and stationary accommodation, such as the lodges in Cabo Ledo or the new developments in the Cuanza river banks, represent high tourism potential. The hospitality of the southeast population is an additional form of tourism potential.

## RECOMMENDATIONS

- Identify and secure important habitat zones within the park as well as corridors for wildlife to access key drinking and foraging areas with no human developments, important both for biodiversity conservation and tourism development.
- Consider a co-management model with the private sector to help provide funds and other support to manage and protect the park.

- Incentivize visitors to respect the regulated speed limits and place effective speed humps along the road from the main gate to Cáua.
- Identify and clearly sign tourism routes that can be used by individual tourists and some more exclusive ones to be used by properly authorized tourism operators, including the one currently managing Cáua.
- Remove alien species from Quiçama National Park in so far as possible. These animals can be used to re-populate other Angolan National Parks that previously supported these species or could be sold to private wildlife farms in Angola to generate revenue for other conservation activities in the park.
- Monitor the alien species that are spreading out of the SCA, specially kudu.
- Assess the hypothesis of re-introducing large carnivores such as leopard or hyena in the SCA, to balance the whole system.
- Implement environmental awareness programs with the communities in the south, prior to any changes on what is now the hunting system.
- Implement patrol effort and presence of the park administration in the south. This will be essential for the conservation of indigenous elephant, and the endangered forest buffalo and southern reedbuck populations.
- Apply serious and updated penalties on poaching of species such as hippo, forest buffalo, elephant and reedbuck and slowly expanded the list, until all poaching is illegal.
- Implement environmental awareness programs to positively contribute to the conservation of the remnant population of elephants in the south and pursue further research, making use of DNA analysis, to determine the species composition of this population.
- Ensure safety to the hippo population by directly involving the population on its protection.
- Safeguard protection of the forest buffalo by implementing an environmental education program to friendly inform the local population, administrations and traditional authorities, on the parks borders and current legislation. Make use of the proactive and positive attitude of the south eastern population, as well as their invaluable knowledge

on the area, in favour of the forest buffalo conservation and eventual relocation of animals to repopulate the northern areas where they would have better protection and visibility for tourists. Given the fragility of the forest buffalo populations, further assessment from buffalo and wildlife relocation specialists must be sought. We strongly recommend the implementation of a conservation programme in the south for this species prior to any relocation.

- Consider the remnant population of southern reedbuck as threatened and secure its protection.
- Release, once protection and management are ensured, eland populations outside the fenced area and repopulate the park with populations of roan antelope from other protected areas in Angola, provided the species has increased sufficiently in numbers on those.
- Improve the conservation status of blue duiker, common duiker and bushbuck by intensively and continuously patrolling the areas or routes clearly defined as being used by poachers.
- Make use of the existing relative abundance of species such as serval and civet in tourism marketing.
- Establish a tourism trail outside the SCA passing through other areas with tourism potential such as the ones highlighted in this report.
- Use Angolan talapoin in marketing for tourism and implement control measures to the vervet monkey population in Cáua.
- Repeat the survey with similar design in five years' time.
- Invite a regionally experienced NGO to provide advice on fire management.
- Implement a park re-gazetting or zonation to prevent further damage by encroachment.
- Implement speed humps on the tar road from Cabo Ledo to Muxima and apply a fee to heavy loaded long vehicles only.

# Quiçama National Park



- Agriculture project
- Cattle farm
- Kraal
- Palm tree plantation
- Quarry
- Hunting Camp
- Scouts Outpost
- Military
- Viewpoint
- Tourist Lodge
- Tourist project
- River Cross
- Gas station
- Special Conservation Area
- Tourist Development Area
- Militarized Area

- Municipal Capital
- Comuna Capital
- Village
- Tar road
- Main gravel road
- Track
- Trail
- Permanent river
- Ephemeral river

## 2 INTRODUCTION

Quiçama National Park (QNP) was established as a Game Reserve in 1938 (portaria nº 2:620, de 16/04/1938) for the protection of elephant and forest buffalo herds (Huntley, 2017). Later, in 1957, it was elevated to the status of National Park (Boletim Oficial, diploma legislativo nº 2:837, de 11/12/1957), maintaining the natural borders in almost all its perimeter: in the north, the Cuanza river and floodplain, from its mouth to Muxima; in the east, a belt of thicket between the Cuanza and Longa rivers, passing through Demba-Chio, Mumbondo and Capolo, following the Longa river in the south; and in the west, the Atlantic Ocean coast line between the mouths of Cuanza and Longa rivers.

Records of wildlife populations in QNP report to the early 1950's with the work of Fernando Frade on mammals from the natural reserves in Angola. This work was posteriorly complemented by Crawford-Cabral's fieldwork at Quiçama in 1968/69, resulting in the production of a checklist of mammals (see Table 1), both confirmed and expected to be present at QNP (Crawford-Cabral, 1989).

In the 1970's, Teixeira and Huntley described the presence of 'healthy' populations of elephant (*Loxodonta africana*), forest buffalo (*Syncerus caffer nanus*), eland (*Taurotragus oryx livingstonii*), roan (*Hypotragus equinos cottoni*), southern reedbuck (*Redunca arundinum*), bushbuck (*Tragelaphus scriptus ornatus*), blue duiker (*Cephalophus monticola*) and common duiker (*Sylvicapra grimmia splendidula*) (Teixeira et al., 1967; Huntley, 2017). The populations of antelopes showed very high reproductive rates.

The presence of defassa waterbuck (*Kobus defassa*), known by locals as Quissema, was not confirmed by Huntley (1971) and Crawford-Cabral (1989) had doubts about its presence, but the species was historically registered for QNP (Bocage, 1890), from where the park's name is derived. Other species present at the park were hippopotamus (*Hippopotamus amphibious capensis*), warthog (*Phacochoerus aethiopicus shortridgei*), bushpig (*Potamochoerus porcus nysae*), thick-tailed galago (*Galago crassicaudatus*), blue monkey (*Cercopithecus mitis mitis*), vervet monkey (*Cercopithecus pygerythrus*), Angolan talapoin (*Cercopithecus talapoin*) and manatee (*Trichechus senegalensis*) (Teixeira et al., 1967; Huntley, 1973).

TABLE 1 - CHECKLIST OF MAMMALS PRESENT AT QUIÇAMA NATIONAL PARK ADAPTED FROM CRAWFORD-CABRAL (1989). KEY: (OC) – OCCURRENCE CONFIRMED; (PB) – PROBABLE OCCURRENCE; (NOT OC) – OCCURRENCE NOT CONFIRMED; (INT) – NON NATIVE INTRODUCED ANIMALS

<b>Order Carnivora</b>	<b>Order Chiroptera</b>
<i>Herpestes ichneumon (oc)</i>	<i>Tadarida pumila (oc)</i>
<i>Genetta maculata (oc)</i>	<i>Mops condylura (oc)</i>
<i>Civettictis civetta (oc)</i>	<i>Triaenops persicus (oc)</i>
<i>Crocota crocuta (oc)</i>	<i>Rousettus aegyptiacus (pb)</i>
<i>Felis lybica (oc)</i>	<i>Epomophorus wahlbergi (pb)</i>
<i>Panthera pardus (oc)</i>	<i>Epomophorus angolensis (pb)</i>
<i>Panthera leo (oc)</i>	<i>Micropteropus pusillus (pb)</i>
<i>Acinonyx jubatus (oc)</i>	<i>Taphozous mauritanus (pb)</i>
<i>Lycaon pictus (oc)</i>	<i>Nycteris thebaica (pb)</i>
<i>Genetta felina (pb)</i>	<i>Nycteris macrotis (pb)</i>
<i>Canis adustus (pb)</i>	<i>Hipposideros ruber (pb)</i>
<b>Order Primates</b>	<i>Hipposideros commersoni (pb)</i>
<i>Otolemur crassicaudatus (oc)</i>	<i>Pipistrellus nanus (pb)</i>
<i>Cercopithecus mitis (oc)</i>	<b>Order Rodentia</b>
<i>Chlorocebus aethiops (oc)</i>	<i>Funisciurus pyrrhopus (oc)</i>
<i>Cercopithecus talapoin (oc)</i>	<i>Funisciurus congicus (oc)</i>
<b>Order Artiodactyla</b>	<i>Heliosciurus gambianus loandicus (oc)</i>
<i>Potamochoerus larvatus (oc)</i>	<i>Hystrix africaeaustralis (oc)</i>
<i>Phacochoerus africanus (oc)</i>	<i>Thryonomys swinderianus (oc)</i>
<i>Hippopotamus amphibius (oc)</i>	<i>Cricetomys gambianus (oc)</i>
<i>Syncerus caffer nanus (oc)</i>	<i>Tatera leucogaster (oc)</i>
<i>Tragelaphus scriptus (oc)</i>	<i>Thallomys paedulus quissamae (oc)</i>
<i>Taurotragus orix (oc)</i>	<i>Pelomys campanae (oc)</i>
<i>Cephalophus monticola anchietae (oc)</i>	<i>Aethomys bocagei (oc)</i>
<i>Sylvicapra grimmia splendidula (oc)</i>	<i>Praomys carillus (oc)</i>
<i>Redunca arundinum (oc)</i>	<i>Praomys natalensis (oc)</i>
<i>Hippotragus equinus (oc)</i>	<i>Mus minutoides (oc)</i>
<i>Kobus ellipsiprimnus (not oc)</i>	<i>Rattus rattus (oc)</i>
<i>Ceratotherium simum (int)</i>	<i>Saccostomus campestris (pb)</i>
<b>Order Proboscidae</b>	<i>Oenomys hypoxanthus (pb)</i>
<i>Loxodonta africana (oc)</i>	<i>Praomys morio (pb)</i>
<b>Order Lagomorpha</b>	<b>Order Sirenia</b>
<i>Lepus victoriae (oc)</i>	<i>Trichechus senegalensis (oc)</i>
<b>Order Tubulidentata</b>	
<i>Orycteropus afer (oc)</i>	

In 1968, as part of Operation Rhino, a project lead by Ian Player, a breeding group of white rhinos was introduced to QNP. There seems to be no consensus in the literature regarding the

number of introduced animals and their development in Quiçama. Huntley (1973) refers that a group of 10 animals were introduced and that there were no signs of reproduction. Later, the same author mentions the birth of a first calf in 1973 (Huntley, 2017). A report from late 1980's (Crawford-Cabral, 1989) mentions that a breeding couple and a calf were introduced in 1969 and even though there was no record for the last rhino reported, the author considered the species most likely to be extinct in the park by then.

The carnivore populations were once abundant due to the large numbers of prey, but their numbers were reduced in the 1960's by an anti-predator campaign that made use of strychnine-baited carcasses (Huntley, 2017). By the 1970's, a reduced number of predator populations could still be found which included lion (*Panthera leo*), leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), spotted hyena (*Crocuta crocuta*), African wild dog (*Lycaon pictus*) and serval (*Felis serval*). (Teixeira et al., 1967; Huntley, 1973; Huntley, 2017).

Quiçama National Park, as other protected wildlife areas in Angola, was once the home to abundant herds of a diverse faunal composition. Larger mammals' populations suffered a reduction in numbers throughout the years and by the 1970's excessive poaching had already severely diminished the number of animals present in the park. By then, of the remaining animals, only elephant, eland, bushbuck, roan, southern reedbuck and forest buffalo were still abundant (Huntley, 1974). The civil war that followed the independence of Angola, resulted in the collapse of wildlife within the country and QNP was no exception. By late 1999, only a few southern reedbucks, bushbuck and bushpig could be found at irregular intervals in the park. There were reports of the presence of some forest buffalo in the dense thickets along parts of the Cuanza river but those were not proven in any of the field investigations (Liebenberg, 2001).

In early 2000, a rehabilitation project - Operation Noah's Ark - started under the patronage of Kissama Foundation, an Angolan not for profit organization. The project aimed to relocate a variety of game species previously occurring or abundant in the area. The animals were airlifted out of various parts of southern Africa to the Cabo Ledo military base, located within

Quiçama National Park. A fenced area of 10.500ha was secured in the northern sector of the park, neighbouring the Cuanza river, with the sole purpose of providing a sanctuary, poacher free, where the re-introduced animals could breed and increase numbers for further distribution of game to other areas in the park (Liebenberg et al., 2001). The initial relocation of game was followed by two similar operations, one in 2001 and the last in 2015.

The different species relocated to the Special Conservation Area and their numbers are summarized in Table 2. Unfortunately, many of these species were exotic to the park and do not belong there.

TABLE 2 - SUMMARY OF RELOCATED SPECIES IN 2001 AND 2002 TO THE SPECIAL CONSERVATION AREA\*

Common Name	Scientific Name	Year 2000	Year 2001	Notes
Elephant	<i>Loxodonta africana</i>	16	16	2 births; 2 died; native
Livingstone's Eland	<i>Taurotragus oryx livingstonii</i>	8		native
Greater kudu	<i>Tragelaphus strepsiceros</i>	10		exotic
Blue Wildebeest	<i>Connochaetes taurinus</i>		12	exotic
Burchell's/Common Zebra	<i>Equus quagga burchellii</i>		14	2 died; drowned in river; exotic
Giraffe	<i>Giraffa camelopardalis</i>		4	exotic
Ostrich	<i>Struthio camelus</i>		12	exotic

\*Adapted from Liebenberg (2001) and Goetz (2009)

In 2008, the park manager Rolland Goetz presented an estimation of number of animals at that time, as summarized in Table 3 (Goetz, 2009).

TABLE 3 – ESTIMATED NUMBER OF ANIMALS IN THE SPECIAL CONSERVATION AREA - 2008

Common Name	Scientific Name	Number of animals in 2008
Elephant	<i>Loxodonta africana</i>	55
Livingstone's Eland	<i>Taurotragus oryx livingstonii</i>	140
Kudu	<i>Tragelaphus strepsiceros</i>	50
Blue Wildebeest	<i>Connochaetes taurinus</i>	45
Burchell's/Plains Zebra	<i>Equus quagga burchellii</i>	45
Giraffe	<i>Giraffa camelopardalis</i>	11
Ostrich	<i>Struthio camelus</i>	15



Between 2010 and 2015, there were four records of elephant deaths in the park (Carmignani, 2015).

In late 2014, a third reintroduction of game species to the Special Conservation Area occurred and their numbers are summarized in Table 4. The list provided by the park administration does not include blesbok, but this species and number of introduced animals is referenced in Huntley, 2017, p. 369.

TABLE 4 – SUMMARY OF INTRODUCED GAME SPECIES IN THE SPECIAL CONSERVATION AREA IN DECEMBER 2014\*

Common Name	Scientific Name	Quantity	Notes
Impala	<i>Aepyceros melampus</i>	32	33 came, 1 died; exotic
Kudu	<i>Tragelaphus strepsiceros</i>	14	15 came, 1 died; exotic
Hartebeest	<i>Alcelaphus buselaphus</i>	29	exotic
Gemsbok	<i>Oryx gazella</i>	8	exotic
Eland	<i>Taurotragus oryx</i>	16	2 escaped at Cabo Ledo air strip; native
Burchell's/Plains Zebra	<i>Equus quagga burchellii</i>	16	exotic
'Burro do mato' Waterbuck	<i>Kobus ellipsiprymnus</i>	16	Native according to historical records
Nyala	<i>Tragelaphus angasii</i>	12	exotic
Blue Wildebeest	<i>Connochaetes taurinus</i>	16	exotic
Blesbok	<i>Damaliscus pyrgargus</i>	36	(Huntley, 2017); exotic

\*Data provided by Quiçama N.P. Administration.

In 2014, a mammals' survey was conducted in Quiçama NP by a Brazilian MSc student, being the first since the independence of the country in 1975. The survey, based solely on interviews of the resident population within the park borders, produced a checklist of 44 mammals recorded for the park as shown on Table 5 (Braga et al., 2017). Considering the data gathering technique, the list was very comprehensive although included species not historically mentioned for the park or out of their known range, such as black-rhino (*Diceros bicornis*) and cape fox (*Vulpes chama*) (Crawford-Cabral, 1989; Kingdon, 2016). Additionally, species such as African wild dog (*Lycaon pictus*), lion (*Panthera leo*) and roan antelope (*Hippotragus equinus*) were most likely extinct from the Quiçama system in 2014.

TABLE 5 – CHECKLIST OF MAMMALS PRESENT IN QUIÇAMA N.P. ACCORDING TO BRAGA ET AL, 2017, FROM A HUMAN POPULATION SURVEY WORK CONDUCTED IN 2014-2015

Common Name	Scientific Name
Porcupine	<i>Hystrix africae australis</i>
Vervet Monkey	<i>Cercopithecus cynosurus</i>
Blue Monkey	<i>Cercopithecus mitis mitis</i>
Southern Talapoin	<i>Miopithecus talapoin</i>
Thick-tailed Galago	<i>Otolemur crassicaudatus</i>
African wild dog**	<i>Lycaon pictus</i>
Cape fox*	<i>Vulpes chama</i>
African wild cat	<i>Felis silvestris</i>
Serval	<i>Leptailurus serval</i>
Lion**	<i>Panthera leo</i>
Leopard	<i>Panthera pardus pardus</i>
Marsh Moongoose	<i>Atilax paludinosus</i>
Spotted Hyena	<i>Crocuta crocuta</i>
Honey badger	<i>Mellivora capensis</i>
African striped weasel	<i>Poecilogale albinucha</i>
Spotted-necked otter	<i>Hydrictis maculicollis</i>
African civet	<i>Civettictis civetta</i>
Genet	<i>Genetta genetta</i>
Roan**	<i>Hippotragus equinus</i>
Blue duiker	<i>Philantomba monticola</i>
Reedbuck	<i>Redunca arundinum</i>
Common duiker	<i>Sylvicapra grimmia</i>
Forest buffalo	<i>Syncerus caffer nanus</i>
Bushbuck	<i>Tragelaphus scriptus</i>
Kudu	<i>Tragelaphus strepsiceros</i>
Eland	<i>Taurotragus oryx</i>
Giraffe	<i>Giraffa camelopardalis</i>
Blue wildebeest	<i>Connochaetes taurinus</i>
Hippopotamus	<i>Hippopotamus amphibius</i>
Bushpig	<i>Potamochoerus larvatus</i>
Warthog	<i>Phacochoerus aethiopicus</i>
Zebra	<i>Equus quagga burchelli</i>
Black Rhino*	<i>Diceros bicornis</i>
Elephant	<i>Loxodonta africana</i>
Manatee	<i>Trichechus senegalensis</i>
Aardvark	<i>Orycteropus afer</i>

\*Species out of range and not historically present.

\*\* Species most likely to be absent from Quiçama N.P. in 2014.

A report from early 2015 (Ron, 2015), mentioned the presence of small groups of forest buffalo occurring in the southeast area of the park but it was contradicted by a research project

performed in late 2015, that mentioned the species was absent from the Quiçama system (Carmignani, 2015). None of the reports provided physical evidence of the facts.

To our knowledge, the present work is the first to employ a joint survey methodology combining complementary strengths of different techniques to assess and provide evidence of the terrestrial large and medium sized mammal population in Quiçama National Park.

### 3 STUDY AREA

Quiçama National Park is situated 70km south of Luanda, the capital of Angola, and occupies an area of 9960 km<sup>2</sup>.

The climate in the park is strongly influenced by the south Atlantic high-pressure cell and the cold offshore Benguela current, flowing in the northerly direction. This weather pattern results in a gradient precipitation, with rainfall increasing from south-west to north-east and a mean annual precipitation between 300 and 400mm. The mean annual temperature is about 24 degrees Celsius, markedly dropping in the dry season (May to October). The park also experiences high atmospheric humidity related to its proximity to the Atlantic Ocean, with a mean annual humidity of about 80%, benefiting both the herbaceous layer and woody vegetation. (Teixeira, 1967; Huntley, 1971)

In terms of its geology, formations from the Quaternary, Middle and Upper Tertiary are largely dominant, mainly constituted by non-consolidated deposits of sand, clay and marl, being the sandy the most representative. Other sedimentary formations occur in the oriental part of the park, related to the Cretaceous and Eocene periods (Diniz, 2006).

Pedological aspects include three main soil clutches that can be found in the park: “musseque” soils, essentially with coarse texture and bright colors; “catete” soils, integrated in the clay substrates, with heavy texture and very dark or black coloured; and the transition soils, occurring in strips topographically existing between the other two main groups, with medium and bark textures. Other soil units are also existent even though not as well represented: chalky and clay soils, in the Muxima area; the alluvial soils, with accentuated hydromorphism, in the Cuanza and Longa floodplains; and the alluvial-colluvial soils represented along the natural drainage lines that cross the park (Diniz, 2006).

A vegetation map was created in 1967 by the Instituto de Investigação Agronómica de Angola – Divisão de Botânica Agrícola e Fitogeografia (Teixeira et al., 1967) where the main vegetation communities described are directly related to its climatic and edaphic characteristics: dry forest formations (*Hymenostegia*, *Pteleopsis*, *Combretum* or *Ptaeroxylon*

*oliquum*, *Croton*, *Berchemia*, depending on the area); *Strychnos* thicket ('Mato de Mutolo'); Forested savanna (*Adansonia*, *Sterculia*, *Acacia*); *Setaria welwitschii* savanna; Grassy prairies with shrubs (*Hyphaene gossweileri*); and Meadows (*C. papyrus*, *Echinochloa*).

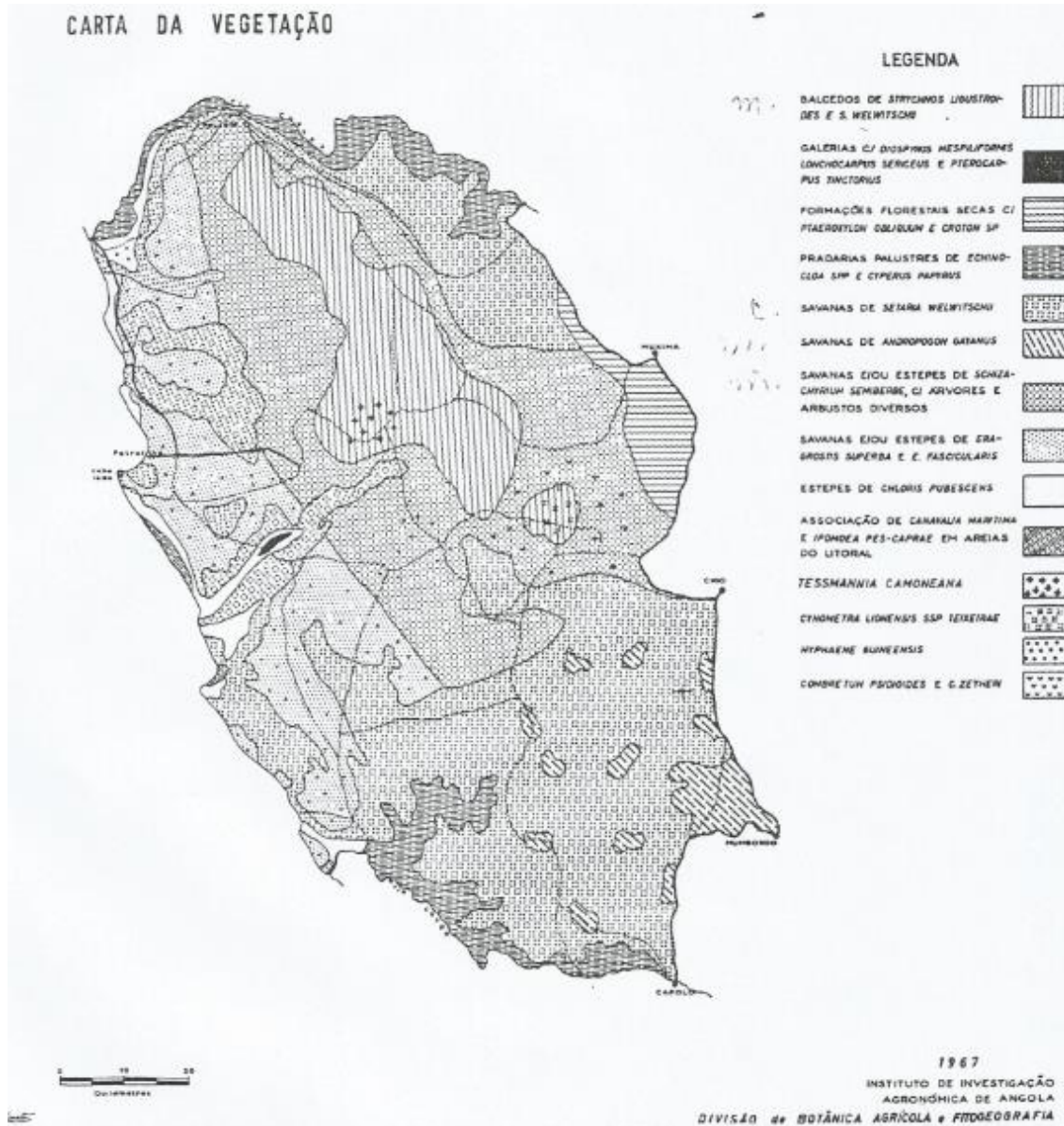


FIGURE 1 - QUIÇAMA NATIONAL PARK VEGETATION MAP EXTRACTED FROM TEIXEIRA (1967)

In 1972 a 1:100.000 vegetation map was produced by Huntley where 28 vegetation units were defined and grouped into 6 vegetation structural units as shown on the adapted map from Figure 2. These vegetation groups and its units are: 1) edaphic communities, that

included lakes and rivers, strand - *Canavalia/Ipomoea*, mangrove - *Rhizophora*, swamp forest – *Raphia*, floodplain -*Cyperus/Echinochloa* swamp, floodplain - *Vetiveria/Echinochloa* grassland, and pans - *Guibourtia/Pteleopsis*; 2) open grasslands with *Chloris/Setaria*, *Setaria*, *Eragrostis/Digitaria*, *Andropogon*, *Heteropogon/Andropogon*; 3) tree and clump savanna including *Chloris/Euphorbia*, *Eragrostis/Hyphaene*, *Schizacharium/Hyphaene*, *Schizacharium/Combretum*, *Schizacharium/Diospyros*, *Andropogon/Combretum*; 4) savanna wooldland with *Eragrostis/Adansonia*, *Eragrostis/Sterculia* and *Eragrostis/Acacia*; 5) Thicket with two undifferentiated species units, *Strychnos*, and *Adansonia/Acacia/Commiphora*; and 6) Forest including *Adansonia/Commiphora*, *Ptaeroxylon/Croton* and *Pterocarpus/Lonchocarpus*.

Interesting to mention is the presence of *Tessmannia camoneana* Torre, a species described from this area in 1966 and potentially endemic to the province (Teixeira et al., 1967).

In Quiçama National Park, the Longa, Cuanza and Teque (N’Gunza) are permanent rivers. Ephemeral rivers are: Omba, Nginga and Cula that drain to the Longa river; Sangano. Perdizes and Mienguenge that drain to the Atlantic Ocean and Nascimento that drains to the Cuanza river mouth (Teixeira et al., 1967; Diniz, 2006).

The human occupation in and around the park was estimated to be 7010 persons in 1970’s, most of it restricted to the vicinities of Muxima, Chio, Mumbondo, Capolo and Cabo Ledo, along the park’s borders. Around 1597 persons lived in small villages inside the park – Galinda, Cassebo, Quindembele, Mucolo, Cacumba and Gunza Demba. Most of its populations worked in the oil company Petrofina, while others dedicated to subsistence agriculture of maize, manioc, sweet potatoes, sorghum, palm oil and beans or industrial agriculture of cotton in the clay soils (Teixeira et al., 1967; Huntley, 2017). As far as occupation goes, still by the 1970’s, over 100.000 hectares of the park area were illegally occupied by a cattle company named *Pecuária da Barra do Cuanza* with over 20.000 head of cattle grazing in the west of the park (Huntley, 2017).

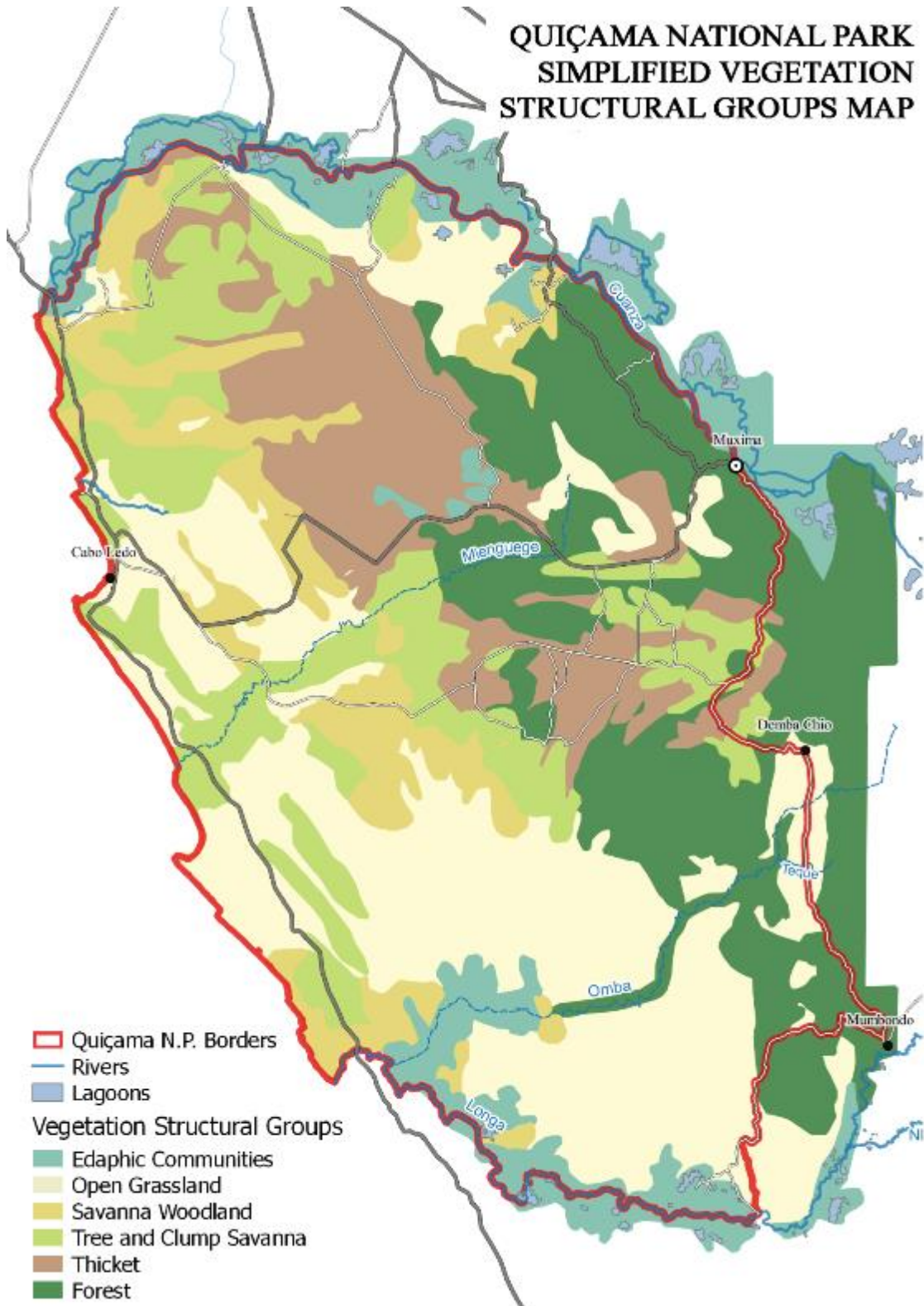


FIGURE 2 - MAIN VEGETATION STRUCTURAL GROUPS IN QUIÇAMA NATIONAL PARK, ADAPTED FROM HUNTLEY (1972)

## 4 METHODS

For the mammal's survey in Quiçama National Park, a combination of different complementary methodologies was employed. The main techniques used in the present work were: 1) Wildlife observations; 2) Camera trapping; 3) Interviews to officials and local communities and 4) Spoor surveys. For the Special Conservation Area, two additional methodologies were used to estimate the population size of targeted species: a) Distance sampling; and b) Dung piles counts, also employed in the Central and Southern areas of the park. The combination of complementary techniques provides a more complete picture of the mammals' community of the park and the challenges faced by these. The used techniques are thoroughly detailed below to facilitate their replication in future surveys.

Throughout the survey, remote imagery was used as well as spatial information on water sources, human distributions and access routes, to guide our survey efforts. Interviews with local administrators, traditional authorities and inhabitants also proved to be an invaluable source of information.

Two representatives from INBAC, Sango de Sá and Gercelina Alexandre, assisted with camera trap placement, entry and download of field data into SMART and interviews to authorities and locals. Two head of scouts' team from Quiçama were seconded to the project, Ernesto Lubuquilo and Benguela. These scouts were trained in the camera trap placement, population survey techniques and dung piles count. They were part of the survey team throughout the work occurring in the northern part of the park. For the southern part of the park, the team counted on the support of Mr Alcides 'Malecas', a local primary teacher with great knowledge on the area and its fauna. Mr Alcides was trained in the camera trap placement and line transect methodology, and it was of invaluable help to the information gathering for the survey.

### 4.1 CAMERA TRAPPING

Camera Trapping is a non-invasive technique frequently applied to monitor wildlife populations, effective to gain information on highly cryptic species and that can be used in



difficult terrains, where other techniques would not be applicable. It makes use of fixed cameras, triggered by passive infra-red sensors activated by movement and body heat, to trap images of animal movements and collect information on species distribution and habitat use, as well as population structure and behaviour. The technique incurs minimal environmental disturbance, being robust to hard conditions and ground or climate variations. Additionally, camera trapping is equally efficient at collecting data by day and night (Silveira et al., 2003; Rowcliffe, 2008).



**FIGURE 3 – DR. ROSEMARY GROOM SUPERVISED THE SURVEY, HERE TRAINING SANGO DE SÁ, FROM INBAC, IN PLACING A PANTHERA V6 CAMERA TRAP. ERNESTO LUBUQUILLO, CHIEF SCOUT ON THE LEFT.**

For the Quiçama mammals' survey, the study area was divided into 47 grid cells of 15 x 15 km (225 km<sup>2</sup>), each cell representing a sampling unit. The grid size is the same used by the NGO 'Panthera' in Mavinga and Luengue-Luiana NPs and by RWCP in Bicuar National Parks (also in partnership with Panthera) (Funston et al., 2017; Overton et al., 2017). The fact that we respected the same grid cell, will allow a comparison of results in the future, even if methodologies differ between surveys.

For the present survey, it was decided that a further division of each sampling unit into four smaller units would benefit the data analysis, since almost 40% of the grid cells were not accessible by road. In the end, the study area was divided in 188 cells of 7,5 x 7,5 km (56.25 km<sup>2</sup>) each, aiming to place one camera trap per sampling unit or at least four camera traps per 225 km<sup>2</sup> sampling unit (see Figure 4). In areas where the occurrence of key species, such as

forest buffalo, elephant or large carnivores was suspected, either due to information from locals or observation of tracks, more cameras were deployed to improve probability of detection, a fact that was taken into account when analysing the data.

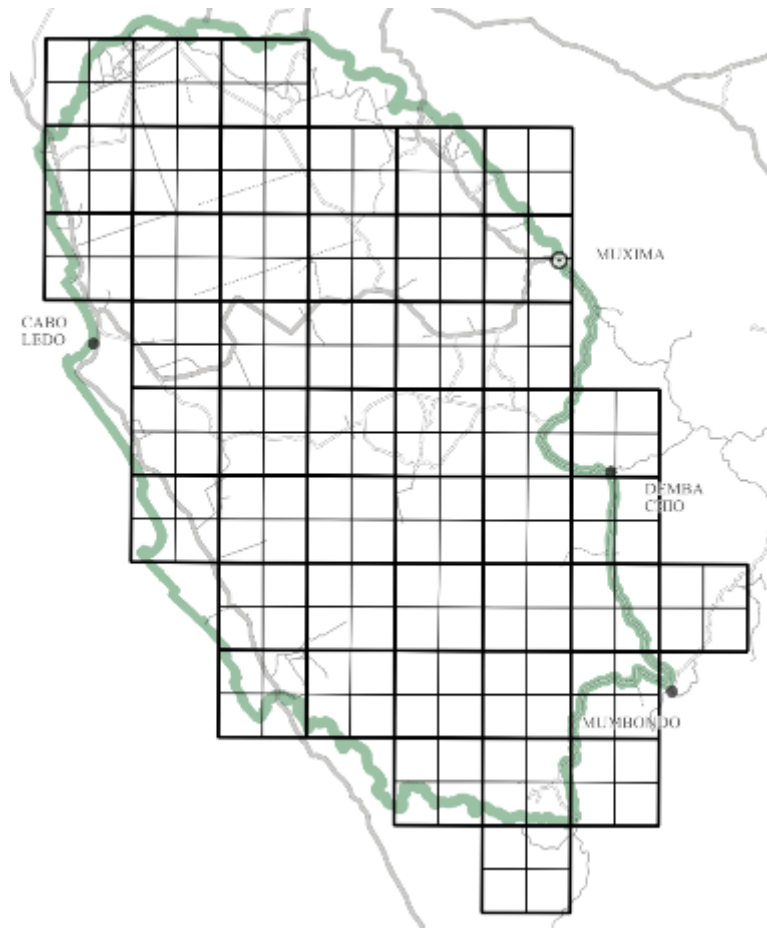


FIGURE 4 - 15KM SIDE (225KM<sup>2</sup>) GRID (DARK LINE) AND 7.5KM SIDE (56.25KM<sup>2</sup>) GRID (LIGHT LINE) USED IN THE SURVEY

It is important to mention that previous to the camera deployment in the central and southern part of the park, the team explained the work to local and traditional authorities, as well as to the local communities living in the park. This action proved to be very successful in assuring the safety of the cameras and not a single camera was destroyed or stolen in the south.

Camelot software version 1.3.5 was used to classify the camera trap images (<https://gitlab.com/camelot-project/camelot>). Camelot is open-source camera trapping software for wildlife researchers and conservationists.

## 4.2 WILDLIFE OBSERVATIONS

While travelling within the park's area, the survey team recorded information using a smartphone running the program SMART (Spatial Monitoring and Reporting Tool), according to a predefined protocol for wildlife observation surveys. The information gathered included all direct observations of animals, their distance and behaviour, as well as other noteworthy observations, including but not limited to: spoor of large carnivores or elephants, human features (such as waterholes), human activities, livestock, and villages. The recorded observations provide additional information on animals and features gathered in other more systematic survey techniques. Locations of all observations and the survey path were also recorded in the smartphone.

## 4.3 SPOOR SURVEYS

Following the methodology described by Funston et al. (2010), the team conducted spoor survey to track for large carnivores in Quiçama NP, with minor modifications to adapt the techniques to the conditions in the field.

In the northern area, the team drove more than 50km and no tracks of large carnivores were found, which is coincident with the lack of images on camera traps.

On the central and southern areas, the selection of transects was mainly related to access availability and substrate quality. In a pilot study, the team drove all possible routes, looked for intersections and marked routes with more than 50% of vegetation cover. The road access to these areas is extremely limited but the routes with more than 50% of vegetation cover were excluded. Sections of the viable routes were identified, where the clay and sandy substrates would allow interpretation of animal tracks.

The sections - named transects – were driven once to avoid double counting the same track incidence and in the early morning, so only track from the previous 24h were used for analysis. A quadbike, driven at 5-10km/h was used as an observation platform. The tracker, a local experienced poacher, was seated on the front and scanned for tracks directly ahead of the vehicle. Where tracks were found, the vehicle stopped, and the species was identified,

discounting any that could not be reliably identified. During all survey period, the same team of researchers and tracker was used, we are thus confident that our spoor indices were not confounded by observer bias.

All tracks of carnivores and the prevalent game species were recorded. Road substrate quality was recorded every 500 m. All direct observations of mammals were also recorded, and the distance to the animal. Animal behaviour was recorded, such as whether it was running away or relaxed. All data was entered into a smartphone using the software SMART and Cybertracker.

The track index is calculated as the number of sets of tracks per 100 km of survey. A set of tracks are those from a given individual, and only fresh tracks less than 24 hours were included. For large carnivores, this track index was converted to estimated animal density of number of animals per 100 km<sup>2</sup> using the equation

$$Density = 0,3003 \times track\ index$$

This is a slight modification (Overton, unpublished) of the calibration equation given in Winterbach et al. (2016) for large carnivores on sandy soils. Small carnivores are not reliably detected, especially on sandy soils.

The ‘catete’ soils prevailing from Demba-Chio to Mumbondo, are reduced to mud in the rainy season making the heavy-duty trucks (Unimog/Kamaz) the only vehicles that can possibly cross this area. The consequences of this on the state of the road is a 2-line’s way that extends for kilometres between the two localities and which proved to be a challenge when applying the spoor survey technique.



FIGURE 5 - SANDY (LEFT) AND "CATETE" CLAY (RIGHT) SOIL ROADS DEEPLY CARVED BY TRUCK CIRCULATION IN SOUTH EAST QUIÇAMA

#### 4.4 HUMAN POPULATION SURVEYS

Interviews conducted to local population and traditional authorities proved to be extremely useful to provide information on current and historical species distributions, accessibility, locations of water sources, human population dynamics, wildlife conflicts, and information on pressures such as poaching or encroachment. Interviews were conducted as structured conversations to provide information on species distributions, including both current and historical distributions. The team also asked about poaching and other pressures.

The course of the interview depended on the person being interviewed and their likely knowledge about the area, but mainly all conversations included the following list of topics:

- Water availability and water sources throughout the year
- Mammals' distributions and movements. It was asked whether the species was present, and if so where. If the species was not present we asked the last time it had been present and the nearest location that they knew of to the location of the interview.
- Road conditions and access to particular areas of interest.
- Pressures on the park, including poaching, human settlement and livestock.

Interviewers were asked to identify animals when looking into a set of mammals' images. Some of the images represented animals not occurring in the park, not even historically. This allowed the team to verify the level of knowledge of the interviewer and assure the quality of data provided.



FIGURE 6 - INTERVIEW TO THE OLDEST MEN IN CACOMBE.

The team also asked specific questions about human wildlife conflict and most respondents were comfortable with providing information on the subject.

In every chosen village or settlement, at least the traditional authority (Soba) or the person representing him was interviewed, plus at least 2 to 3 other local residents with good knowledge of the area and its fauna. These last interviewers were chosen in a first introductory conversation undertaken at our arrival to the village. In general, local populations were extremely cooperative and interested in the survey.

While interviews are immensely useful sources of information, they are subject to many vagaries and the results must be interpreted with caution. Persons vary greatly in their knowledge, and not all persons are willing to admit to having no knowledge on a certain

subject. Identification of animals can also be problematic, especially for rarer species. Respondents are also not always entirely honest or forthcoming, for a range of reasons.

#### 4.5 DISTANCE SAMPLING

Even though not directly requested for the Quiçama NP terrestrial mammals survey work, the team did an extra effort to estimate the population density of some of the ungulates in the Special Conservation Area (SCA), essential information for management purposes.

To estimate the size or density of these biological populations, the team applied Distance Sampling (DS), a methodology in which the distance from a line to a detection is recorded and from which the density and/or abundance of animals is estimated. The data analysis is done with software *Distance* (Thomas et al., 2006; Thomas et al., 2010).

The survey region (SCA) was sampled by driving all possible routes within the area and trying to, as much as possible, have all habitats proportionally represented. To maximize observations, one observer was seated on the top of the vehicle as shown on Figure 7.



FIGURE 7 - DISTANCE SAMPLING FROM CAR ROOF AT THE SPECIAL CONSERVATION AREA.

In DS, an observer drives along a line, recording any animals detected within a distance  $w$  of the line (blue spots on Figure 8). It is assumed that all animals on the line are detected, but detection probability decreases with increasing distance from the line. Hence, not all animals in the strip of half-width ( $w$ ) need to be detected. In addition, the distance and angle from the transect line of each detected animal is recorded, in order to calculate the perpendicular distance of the animal to the transect. These sightings and their distances allow the estimation of the proportion of animals in the strip that are detected, therefore allowing one to estimate the animal density and abundance. If animals occur in well-defined clusters (e.g. herds), then detections refer to clusters rather than to individual animals, so the distance is measured to the central point of the cluster and the number of animals is counted (Thomas et al., 2006).

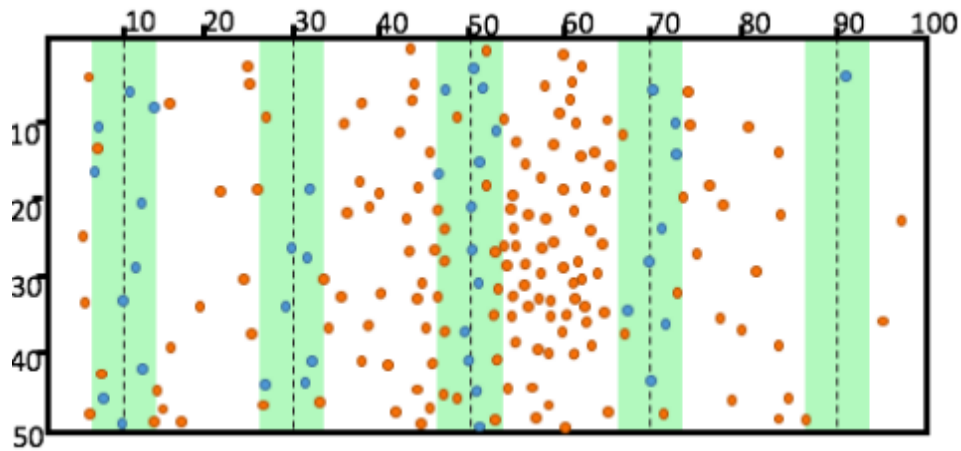


FIGURE 8 - DISTANCE SAMPLING AREA AND ANIMAL DISTRIBUTION EXAMPLE

The perpendicular distance of the animal to the transect line is obtained by a simple trigonometry calculation which makes use of the information on the angle. The distance between the animal and observer was measured with a laser rangefinder. The angle between the transect line and the animal position was measured with a compass. Binoculars were used to confirm number and species of animals.



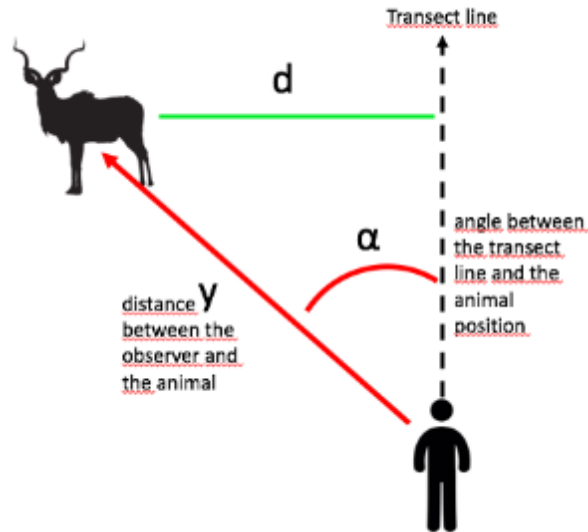


FIGURE 9 - DISTANCE SAMPLING OBSERVATION SCHEME

The equation to calculate the perpendicular distance is then:

$$d = y \times \sin(\alpha)$$

The number of animals is given by the following equation:

$$N = \frac{A \times n}{a \times P}$$

Where,

N= estimated number of animals in a given area

A = total study area

n = number of observed animals

a = covered area within the study area =  $L \times 2 \times w$

L = total distance of the transects =  $k \times 50$

k = number of transects done

w = half-width of the transect strip

P = is the proportion of detected animals on the covered area – calculated when analysing data with the software *Distance*.

## 4.6 DUNG PILES COUNTS

For ungulates, the use of indirect methods such as dung pellet group counts is widely used in the estimation of a species density. To calculate density from the counts, the defecation rate of the animals and decay time of the pellets must be known. This technique has been applied to estimate densities of a wide range of vertebrates' groups, including lizards, rabbits, large and small ungulates, kangaroos and elephants (Barnes, 2001).

Using methods outlined by Marques et al. (2001), the survey team decided to make use of strip transects. The method involved one observer and one recorder. The observer walked a straight line of 250m long and 2m wide (or 1.5, depending on the ground conditions), looking for pellet groups on either side. The transect consisted of lines of varying length (10 to 50 m) due to habitat constraints. In some cases, a series of connected straight-line segments that totalled the desired length was used to accommodate the terrain (Anderson et al. 1979). It is assumed that all dung pellets existing in the strip are detected.



FIGURE 10 - DUNG PILE COUNTS

A pellet group was defined as a dung-heap of 10 or more pellets of similar shape that appeared to have been deposited at the same time. The pellet groups encountered were counted and identified to species.



FIGURE 11 - SOUTHERN REEDBUCK PELLET GROUP

The following equation was used to calculate a density of animals per km<sup>2</sup> (modified from Marques et al., 2001):

$$D = \frac{n \times \left( \frac{1,000,000}{A} \right)}{d \times t}$$

Where,

n = number of pellet groups

A = area of strip transect (m<sup>2</sup>)

d = defecation rate expressed in groups per day

t = decay rate expressed in days

1,000,000 = conversion factor to express area in km<sup>2</sup>

D = density expressed in number of animals per km<sup>2</sup>

Defecation rates of pellet groups per day were found in the literature for blue duiker (4.9 groups/day; Koster, 1988) and bushbuck (19.0 groups/day; Plumtre, 1995). For common duiker, the team used a mean value for the defecation rates of male and female (4.15 groups/day; Lunt, 2011).

In the estimation of species density, researchers usually use mean defecation rates, but estimates may be biased if subsets of the population defecate at different rates (Lunt et al. 2007). Given the correlation between defecation rate and gender, it is recommended to proceed for a calibration of the method under field conditions, ideally in areas with known populations during the dry season. The time frame of the survey and the absence of knowledge of populations numbers in the surveyed area, did not allow for this calibration to be done and a mean value for the defecation rates was used instead, associated with the appropriate error.

The decay rates used for this survey were extracted from a similar study conducted in the region (Ellis, 2003) and represent  $222.5 \pm 49.7$  days for Bushbuck and  $237.5 \pm 98.5$  days for Common duiker. For blue duiker the same decay rate estimate was used as for Common Duiker.

## 5 RESULTS AND DISCUSSION.

### MAMMALS PRESENCE, STATUS AND THREATS

#### 5.1 SURVEY EFFORT

Camera trapping, opportunistic direct and spoor observations, large carnivore spoor transects, dung piles counts, distance sampling and population interviews were the methodologies applied, that combined, provided the necessary data to complete the survey. This section describes the effort put on each of these techniques.

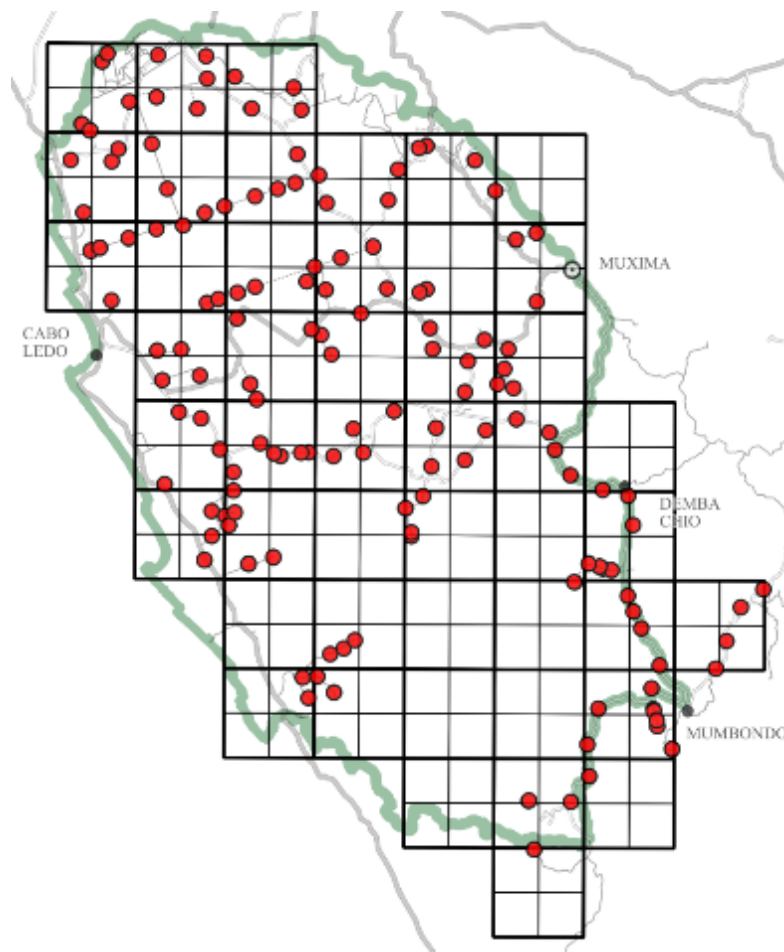


FIGURE 12 - CAMERA TRAPS LOCATION (RED DOTS) AND AUXILIARY 15 KM (DARK LINES) AND 7.5KM (LIGHT LINES) GRIDS

Camera trapping was the main method utilized to determine mammal's distribution and abundance along all the park extension. A total of 154 camera traps were deployed along the park area, as evenly as possible, using the 225 km<sup>2</sup> grid and its quarter grids (56.25 km<sup>2</sup>), as explained on Figure 4. Eight cameras were stolen, one burned, and three malfunctioned. When detected on time, some of the stolen or malfunctioning cameras were replaced. The total camera trap survey effort was of 4418 Camera Trap nights distributed between 142 recovered and functioning camera traps (average 31 days/camera, ranging 4 to 69 days) that obtained a total of 101.824 images. Figure 12 shows the distribution of the Camera Traps and the auxiliary grids used in the survey for their placement.

A total of 7.500 km was driven by car, motorcycle, quad bike or covered by foot to survey as much area as possible, inside and in some surrounding areas of the park, searching for tracks. In total, 688 direct observations (counting 1.440 individual animals), 374 dung piles, 288 tracks and 24 carcasses were recorded for wild mammals (See Figure 14).

Tracks and Dung were recorded for key species such as elephants, forest buffalo and large carnivores (leopards) while traveling along the park. Also, for kudu outside the SCA, spoor was recorded, to assess the range this alien species is covering since it started spreading out of the fenced area. For other mammals, tracks and dung was recorded opportunistically and when possible to obtain presence/absence data of each species and systematically along the spoor and dung transects (See Figure 14 C and D).

Specific dung piles count transects (See Figure 13 – Map C) were made in the North, Central and Southern parts of the park to serve as a reference for animal densities. Species considered with this technique were bushbuck, common duiker, blue duiker and bushpig, following the methodology described in section 4.6

Distance Sampling technique was applied on the SCA but not considered for the other park areas due to the low density of direct observations, that would make the calculation of species densities statistically unviable. A total of 90.5km were surveyed using this technique in the SCA (Figure 13 - A).

Spoor transects for large carnivore tracks were also made in the South East area of the park following the methodology explained in section 4.3. Substrate quality and road accessibility with a tracking vehicle was limited and in total only 45 km were covered as shown in Figure 13, Map B.

A total of 65 interviews were made in different populated areas within the park area as shown in Figure 15. Interviews provided important information regarding the mammal population existence, their former presence and the current human wildlife conflicts. This data was used along this report to complement the survey techniques described above.

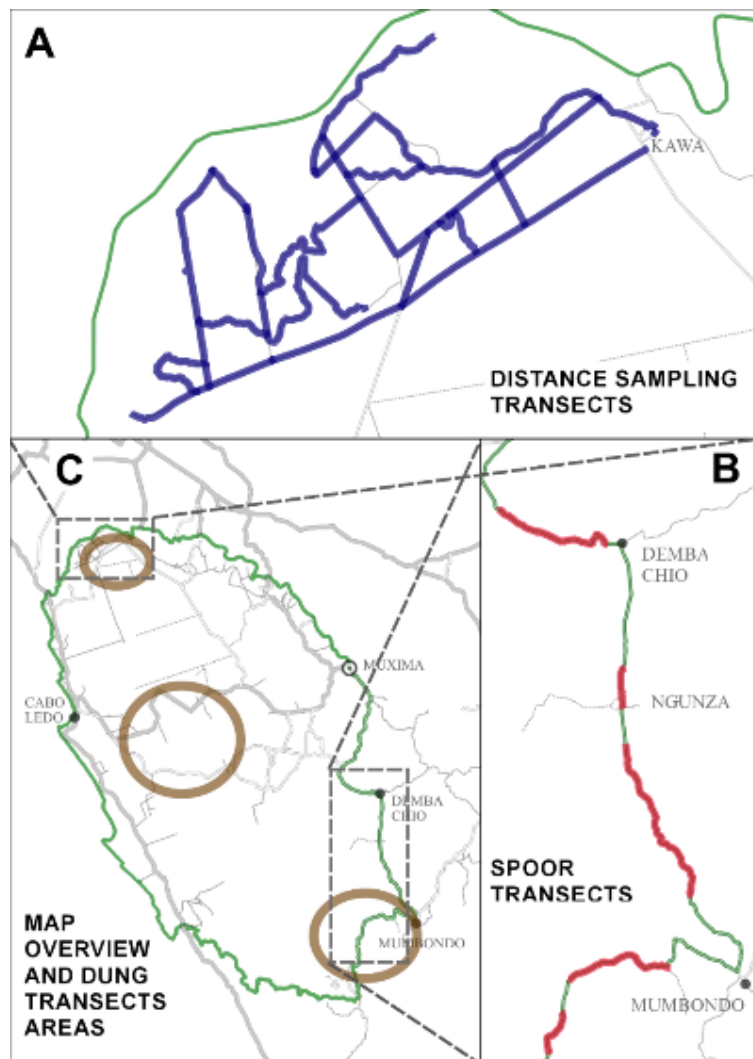


FIGURE 13 - A - DISTANCE SAMPLING TRANSECTS ON THE SPECIAL CONSERVATION AREA, B - SPOOR TRANSECTS ON THE SOUTH EAST OF THE PARK, AND C - MAP OVERVIEW AND DUNG TRANSECTS AREAS (IN BROWN CIRCLES) ON THE NORTH, CENTRE AND SOUTH OF THE PARK.

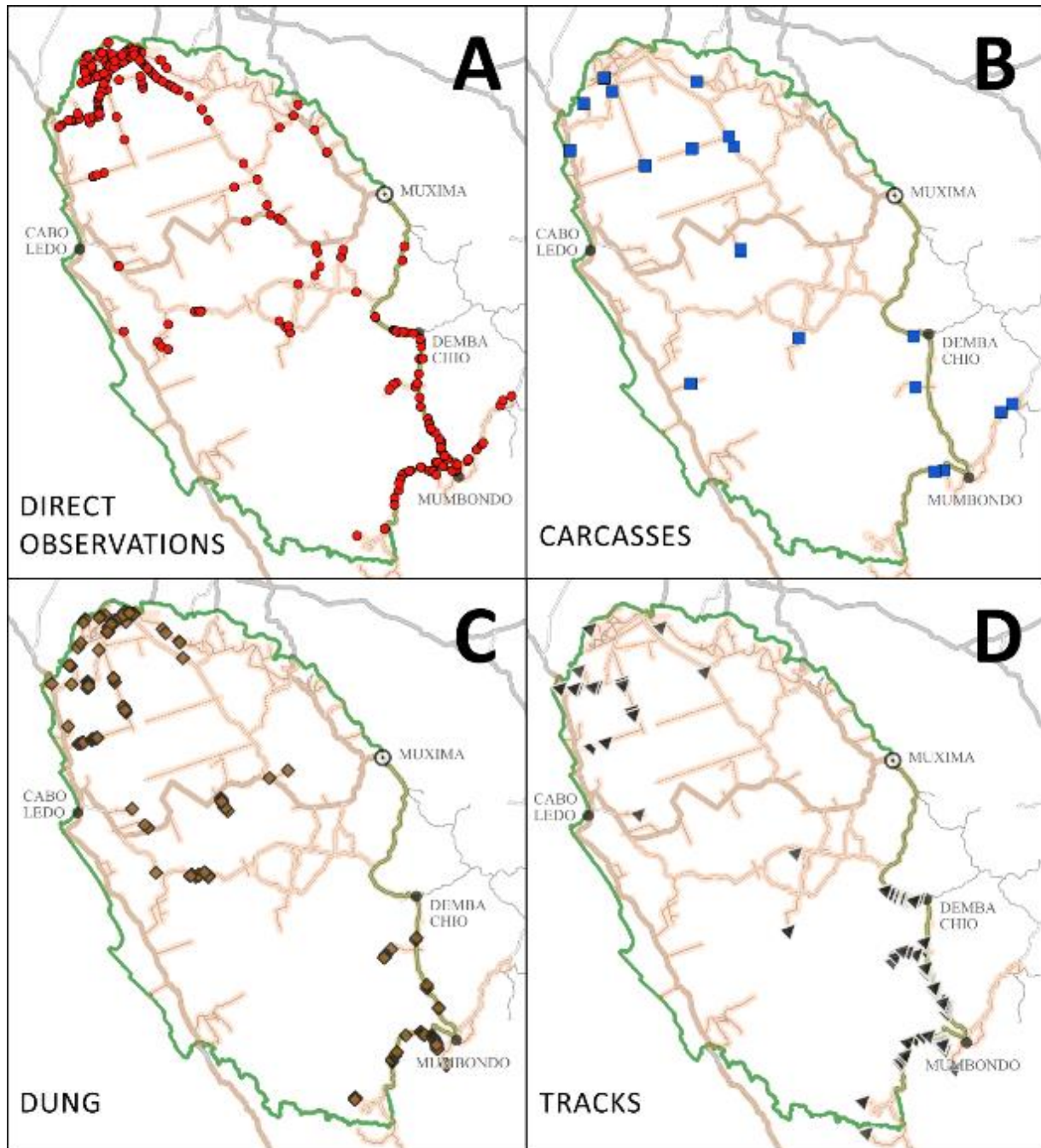


FIGURE 14 - OVERALL SURVEY OBSERVATIONS RECORDED: A - MAMMALS DIRECT OBSERVATIONS, B - MAMMAL CARCASSES FOUND, C - MAMMAL DUNG, AND D - MAMMAL TRACKS RECORDINGS. ALL TRACKS USED FOR TRANSECTS AND WILDLIFE OBSERVATIONS ARE SHOWN IN ORANGE.





FIGURE 15 – HUMAN POPULATION SURVEY, INTERVIEW AREAS

## 5.2 OVERALL RESULTS - MAMMAL COMMUNITY

The current Quiçama National Park large and medium sized terrestrial mammal community is composed of a total of 42 species, being 31 native and from the original population and detected in this survey, 2 reintroduced native species and 9 alien introduced species, as indicated in Table 6. Regarding the elephant population in the park, there are two distinct groups: the reintroduced elephants that came from South Africa and therefore belonging to the savannah elephants species (*Loxodonta africana*), and the remnant native elephants, now confined to the south-east areas of the park, whose species could probably be both *Loxodonta africana* and *Loxodonata cyclotis* (forest elephant) but is not possible to determine based only on morphological characteristics and without DNA analysis (Dr. Holly Dublin pers. comm, 2018) and therefore in this report are globally referred as African elephant (*Loxodonta africana*). Small mammals such as the smaller rodents were not included in this report but, due to their frequent appearance on camera traps, African savanna hare and marsh cane rat were considered. Tree pangolin (*Phataginus tricuspis*) was not recorded by direct or indirect observations, but local population interviews made its presence reliable. Otters, probably spotted-necked otter (*Hydrictis maculicollis*) whose identification confirmation was not possible as no evidence was obtained, and west African manatee (*Trichechus senegalensis*) were reported on some population interviews, close to the riverine areas but these species were not considered in depth for this study due to their aquatic habitat. Zorilla (*Ictonyx striatus*), African striped weasel (*Poecilogale albinucha*) as well as several mongoose species (*Ichneumia albicauda*, *Herpestes sanguineus*, *Mungos mungo* or *Helogale parvula*), might be present in the park despite no evidence being found, but since these were not the main target of this study and no consistent confirmation could be obtained from local population, they have been excluded from this report. Taxonomic designations followed Kingdon (2016).

TABLE 6 – MAMMAL SPECIES DETECTED BY THE DIFFERENT METHODS USED IN THE SURVEY

Species	Direct Observation	Camera Trap	Spoor or Dung	Population Interview
African elephant - <i>Loxodonta africana</i> (Native + Reintroduced)	X	X	X	X
Hippopotamus - <i>Hippopotamus amphibius</i>	X	X	X	X
Forest buffalo - <i>Syncerus caffer nanus</i>		X	X	X
Common eland - <i>Taurotragus oryx</i> (Reintroduced)	X	X	X	
Southern reedbuck - <i>Redunca arundinum</i>	X	X	X	X
Bushbuck - <i>Tragelaphus scriptus ornatus</i>	X	X	X	X
Common duiker - <i>Sylvicapra grimmia</i>	X	X	X	X
Blue duiker - <i>Philantomba monticola</i>	X	X	X	X
Bushpig - <i>Potamochoerus larvatus</i>		X	X	X
Warthog - <i>Phacochoerus africanus</i>	X	X	X	X
Leopard - <i>Panthera pardus</i>	X	X	X	X
Spotted hyaena - <i>Crocuta crocuta</i> *				X
Side-striped jackal - <i>Canis adustus</i>		X		
Serval - <i>Leptailurus serval</i>	X	X	X	X
African civet - <i>Civettictis civetta</i>	X	X	X	X
Blotched genet - <i>Genetta maculata</i>	X	X	X	X
Honey badger - <i>Mellivora capensis</i>		X	X	X
Wild cat - <i>Felis silvestris cafer</i>	X	X	X	X
Ichneumon (Egyptian) mongoose - <i>Herpestes ichneumon</i>	X	X		
Marsh mongoose – <i>Atilax paludinosus</i>		X		
Ansorge's cusimanse – <i>Crossarchus ansorgei</i>	X	X		
Blue (Pluto) monkey - <i>Cercopithecus mitis mitis</i>	X	X	X	X
Vervet monkey - <i>Chlorocebus pygerythrus</i>	X	X	X	X
Angolan talapoin - <i>Miopithecus talapoin</i>	X	X	X	X
Greater galago- <i>Otolemur crassicaudatus</i>	X	X		X
Cape porcupine - <i>Hystrix africae australis</i>	X	X	X	X
Aardvark - <i>Orycteropus afer</i>		X	X	X
Tree pangolin - <i>Phataginus tricuspis</i>				X
Marsh cane Rat – <i>Thryonomys swinderianus</i>	X	X		X
African savanna hare – <i>Lepus victoriae</i>	X	X	X	X
West African manatee - <i>Trichechus senegalensis</i>			-	X
Spotted-necked otter - <i>Hydrictis maculicollis</i> **			-	X

Species	Direct Observation	Camera Trap	Spoor or Dung	Population Interview
Greater kudu - <i>Tragelaphus strepsiceros</i> (Introduced)	X	X	X	-
Blue Wildebeest - <i>Connochaetes taurinus</i> (Introduced)	X	X	-	-
Burchell's /Common Zebra - <i>Equus quagga burchellii</i> (Introduced)	X	X	-	-
Giraffe - <i>Giraffa camelopardalis</i> (Introduced)	X	X	-	-
Impala - <i>Aepyceros melampus</i> (Introduced)	X	X	-	-
Hartebeest - <i>Alcelaphus buselaphus</i> (Introduced)	X		-	-
Southern Oryx - <i>Oryx gazella</i> (Introduced)	X		-	-
Nyala - <i>Tragelaphus angasii</i> (Introduced)		X	-	-
Blesbok - <i>Damaliscus pygargus</i> (Introduced)	X	X	-	-
Waterbuck - <i>Kobus ellipsiprymnus</i> (Reintroduced)	X		-	-

\*Last reliable record is from 2015    \*\* Species not confirmed

### 5.2.1 Camera Trap Results

Camera traps detected a total of 35 mammal species, being 28 native (2 of those native reintroduced, the Elephant from the SCA and the Common Eland) and 7 introduced to the park. Table 7 shows the summary results for each carnivore species detected with camera traps while Table 9 shows the results for non-carnivore native (including the reintroduced native species) and Table 8 for introduced alien species. Camera traps also captured a significant number of photos of other animal groups such as birds, bats or domestic animals, as well as a significant amount of 'false positives' where humans, vehicles or wind triggered images. Unfortunately, some pictures had to be classified as 'unknown' when burned by the camera flash or when only a partial image of the animal was captured making its identification impossible (See

Table 10).

Variables utilized on tables mentioned above and represented below are:

- Number of Camera traps: The number of cameras that captured images from the species

- Number of Photos: The total number of photos of the species captured by the cameras
- Camera Trap Captures: This variable takes into account the total number of individuals on each photo and discards the records of the same species happening on the same camera within an interval of 30 minutes to avoid repetitions and taking into account the maximum number of individuals counted in that period on a single image. This is considered a single observation event. The number of camera trap pictures for a single species is then calculated as the sum of individuals count for all observation events.
- Nocturnal (%): Percentage of the images captured during the night period.
- Observations/100 Nights (RAI): Relative Abundance Index calculated as number of camera trap captures per 100 camera trap nights.

TABLE 7 – CAMERA TRAP SUMMARY RESULTS FOR CARNIVORES

Common Name	N° of Camera Traps	N° of Photos	Camera Trap Captures	Nocturnal (%)	CT Captures /100 Nights (RAI)
African civet	65	615	487	96.3	11.023
Blotched genet	42	379	301	93.36	6.813
Serval	55	291	171	81.87	3.871
Leopard	15	128	85	83.53	1.924
Wildcat	18	60	57	94.74	1.29
Honey badger	17	59	41	90.24	0.928
Egyptian mongoose	20	54	32	18.75	0.724
Side-striped jackal	2	4	4	100	0.091
Marsh mongoose	2	6	4	100	0.091
Ansorge's cusimanse	1	3	2	0	0.045
<b>TOTAL</b>		<b>1599</b>	<b>1184</b>		

TABLE 8 - INTRODUCED NON-NATIVE MAMMAL SPECIES CAMERA TRAP SUMMARY RESULTS

Common Name	N° of Camera Traps	N° of Photos	Camera Trap Captures	Nocturnal (%)	CT Captures /100 Nights (RAI)
Blue wildebeest	3	978	358	31.01	8.103
Kudu	6	243	83	26.51	1.879
Plains zebra	3	135	45	80	1.019
Nyala	3	49	17	35.29	0.385
Impala	1	54	13	7.69	0.294
Giraffe	1	76	10	10	0.226
Blesbok	1	3	1	0	0.023
<b>TOTAL</b>		<b>1538</b>	<b>527</b>		

TABLE 9 - CAMERA TRAP SUMMARY RESULTS FOR NON-CARNIVORE NATIVE MAMMALS (INCLUDING THE REINTRODUCED NATIVE SPECIES)

Common Name	N° of Camera Traps	N° of Photos	Camera Trap Captures	Nocturnal (%)	CT Captures /100 Nights (RAI)
Blue duiker	64	2772	898	22.61	20.326
Bushbuck	89	2125	852	61.15	19.285
African savanna hare	38	221	185	95.68	4.187
Common duiker	33	391	127	39.37	2.875
Cape porcupine	34	154	114	98.25	2.58
Elephant	7	405	105	22.86	2.377
Bushpig	17	76	62	87.1	1.403
Vervet monkey	22	204	56	0	1.268
Blue monkey	14	153	55	3.64	1.245
Common eland	2	133	54	27.78	1.222
Aardvark	18	58	40	100	0.905
Great cane rat	13	54	37	86.49	0.837
Angolan talapoin	7	61	17	0	0.385
Southern reedbuck	4	28	15	100	0.34
Other rodents	6	18	14	85.71	0.317
Forest buffalo	2	7	11	100	0.249
Thick-tailed galago	4	9	8	100	0.181
Warthog	2	6	5	80	0.113
Hippopotamus	1	6	4	100	0.091
<b>TOTAL</b>		<b>6881</b>	<b>2659</b>		

TABLE 10 - OTHER CAMERA TRAP RESULTS: FALSE POSITIVES, UNKNOWN, DOMESTIC ANIMALS, BIRDS AND BATS

Description	N° of Camera Traps	N° of Photos	Camera Trap Captures	Nocturnal (%)	CT Captures /100 Nights (RAI)
False positive	142	89460	14696	17.2	<b>332.639</b>
Unknown	73	669	232	86.64	<b>5.251</b>
Domestic cow	8	1145	211	16.59	<b>4.776</b>
Bird species	66	434	160	6.25	<b>3.622</b>
Dog	26	168	83	13.25	<b>1.879</b>
Bat species	10	17	16	100	<b>0.362</b>
Goat/sheep	4	23	5	40	<b>0.113</b>
Donkey	1	3	1	0	<b>0.023</b>
Pig	1	1	1	0	<b>0.023</b>
<b>TOTAL</b>		<b>91920</b>	<b>15405</b>		

Figure 16 shows the native or reintroduced mammal diversity detected by camera traps on the 225 km<sup>2</sup> grid. The most diverse areas of the park are both the North surrounding the Special Conservation Area and the South East (a more forested area) while the areas close to relative big villages or towns such as Muxima, Cabo Ledo or Longa, are the less diverse.

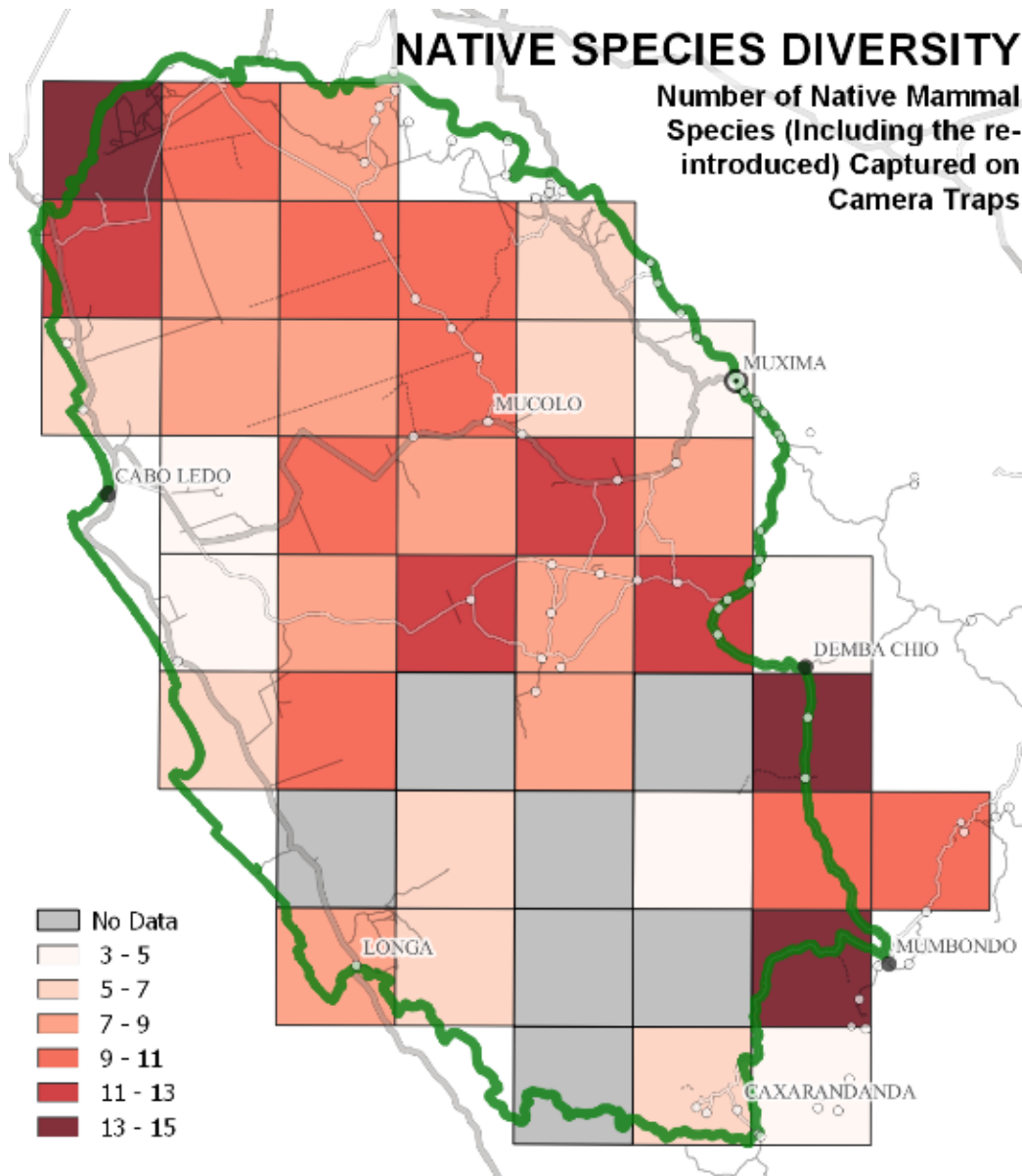


FIGURE 16 - SPECIES DIVERSITY MAP SHOWING THE NUMBER OF DIFFERENT MAMMAL SPECIES CAPTURED ON CAMERA TRAPS (ONLY FOR NATIVE SPECIES (INCLUDING REMNANT POPULATIONS AND REINTRODUCED NATIVE SPECIES))

### 5.2.2 Direct Observations

A total of 688 direct observations (counting 1440 individual animals) were made (Table 10). The most observed mammal was bushbuck with 332 individuals observed in total, followed by vervet monkey (192 individuals), blue wildebeest (163), blue duiker (132), common duiker (109), Angolan talapoin (104), common eland (89), greater kudu (84), blue monkey (63), elephant (53) and giraffe (44).

Distance estimates of the direct observations were always recorded as shown on Table 11 and can serve as indicator of the pressure the animals suffer from hunting, if compared with other studies. SCA ‘Distance sampling observations’ average distances are bigger due to the fact that these observations were made from the roof rack of a car, giving the observer a much longer detection range. Also, the vegetation in the south east area of the park, where the peak of the observations outside of the SCA were made, is very dense, and most of the direct observation records are from animals crossing the road, therefore distances are much lower.

TABLE 11 - SUMMARY OF MAMMAL DIRECT OBSERVATIONS WITH NUMBER OF SIGHTINGS, NUMBER OF ANIMALS OBSERVED AND AVERAGE DISTANCE THE ANIMALS WHERE OBSERVED. THE TABLE INCLUDES: WILDLIFE OBSERVATIONS, DISTANCE SAMPLING IN THE SCA DIRECT OBSERVATIONS AND TOTALS

Species	WILDLIFE OBSERVATIONS			DISTANCE SAMPLING OBSERVATIONS (SCA only)			TOTAL DIRECT OBSERVATIONS		
	Sightings	Animals	Avg Distance	Sightings	Animals	Avg Distance	Sightings	Animals	Avg Distance
<i>Bushbuck</i>	115	<b>152</b>	36	150	<b>180</b>	69	265	<b>332</b>	54
<i>Blue Duiker</i>	100	<b>126</b>	40	6	<b>6</b>	58	106	<b>132</b>	41
<i>Common Duiker</i>	74	<b>90</b>	40	19	<b>19</b>	54	93	<b>109</b>	43
<i>Greater Kudu</i>	8	<b>10</b>	17	35	<b>74</b>	100	43	<b>84</b>	85
<i>Blue Wildebeest</i>	5	<b>42</b>	122	29	<b>121</b>	125	34	<b>163</b>	124
<i>Vervet Monkey</i>	26	<b>159</b>	37	3	<b>33</b>	84	29	<b>192</b>	42
<i>Blue Monkey</i>	22	<b>63</b>	33				22	<b>63</b>	33
<i>Eland</i>	4	<b>27</b>	31	15	<b>62</b>	153	19	<b>89</b>	128
<i>Giraffe</i>	10	<b>37</b>	28	7	<b>7</b>	104	17	<b>44</b>	59
<i>Angolan Talapoin</i>	14	<b>104</b>	26				14	<b>104</b>	26
<i>Elephant</i>	4	<b>36</b>	150	7	<b>17</b>	341	11	<b>53</b>	272



<i>Egyptian Mongoose</i>	9	<b>11</b>	49				9	<b>11</b>	49
<i>Thick-tailed Galago</i>	5	<b>7</b>	25				5	<b>7</b>	25
<i>Blesbok</i>	1	<b>2</b>	50	2	<b>6</b>	252	3	<b>8</b>	184
<i>Reedbuck</i>	1	<b>2</b>	60	2	<b>3</b>	35	3	<b>5</b>	43
<i>Impala</i>	1	<b>5</b>	35	1	<b>2</b>	225	2	<b>7</b>	130
<i>Serval</i>	2	<b>2</b>	35				2	<b>2</b>	35
<i>Ansorge's Cusimanse</i>	1	<b>12</b>	20				1	<b>12</b>	20
<i>Hippopotamus</i>	1	<b>8</b>	80				1	<b>8</b>	80
<i>Defassa Waterbuck</i>	1	<b>2</b>	20				1	<b>2</b>	20
<i>Leopard</i>	1	<b>2</b>	20				1	<b>2</b>	20
<i>Bushpig</i>	1	<b>1</b>	35				1	<b>1</b>	35
<i>Honey Badger</i>	1	<b>1</b>	80				1	<b>1</b>	80
<i>Warthog</i>	1	<b>1</b>	35				1	<b>1</b>	35
<i>Wild Cat</i>	1	<b>1</b>	7				1	<b>1</b>	7
<i>Oryx</i>				1	<b>1</b>	120	1	<b>1</b>	120
<i>Ostrich*</i>				1	<b>1</b>	50	1	<b>1</b>	50
<i>Red Hartebeest</i>				1	<b>5</b>	112	1	<b>5</b>	112

\*Despite not being object of this survey, observations were included as it belongs to the alien group of animals introduced in 2001.

### 5.2.3 Large Carnivores – Leopards – *PANTHERA PARDUS*

Leopards were the only large carnivore species detected in the park and it is confined to the south east area. Spotted hyena occurred in low density in recent years and it is probable that there are sporadic occurrences of this species but cannot be considered resident in the park area. Lions, cheetahs and African wild dogs previously existed in the area but were extinct probably more than a decade ago.

#### 5.2.3.1 Spoor Transects

Due to the limited road network in the area, its poor road conditions for quad bike driving (the vehicle available for spoor transects), the bad quality of substrate for detecting tracks (vehicle damaged clay soils with sand patches) and the intensity of vehicle traffic in the roads (the

heavy duty trucks would erase all carnivore tracks while travelling most nights), only 45 km of spoor transects were conducted (see Figure 13 -B) with quadbike or by foot during 3 days (avg 15km/day). Nevertheless, this 45 km produced a total of 8 independent set of tracks for leopard following the expected distribution and density as per the camera trap results (see Figure 56). Therefore, as a minimum number of 19 tracks is recommended for reliable results by Fuston et al (2010), the model in Winterbach et al (2016) could not be applied to obtain density estimates.

### 5.2.3.2 *Leopard Range and Relative Density Areas*

Despite the fact that the spoor transects could not provide a reliable indication of leopard density in the park, the combination of results from the different methodologies applied (including the spoor transects, camera traps, dung records and population interviews) and the tree cover density (forested areas tend to have larger densities of leopard directly related to larger density of prey) made possible the elaboration of a relative leopard density map (see Figure 17), where 2 areas can be distinguished, low density and medium to high density zones for leopard within the park.



FIGURE 17 - LEOPARD DISTRIBUTION AND RELATIVE DENSITY IN QUIÇAMA NATIONAL PARK RESULTING FROM THE COMBINATION OF RECORDS OBTAINED FROM THE DIFFERENT TECHNIQUES USED

### 5.2.4 Dung Piles Counts

Specific dung pellet count transects (See Figure 13 - Map C) were conducted in the north, central and southern parts of the park to serve as a reference for animal densities. Species taken into account with this technique were bushbuck, common duiker, blue duiker and bushpig, but this last species was excluded from this analysis due to the minor number of dung piles found. The south spoor survey results were not taken into account for this analysis as it was considered that the sample effort could not be comparable to the north and central surveys due to the lack of access or representative sampling areas on foot outside the gravel roads (thorn thicket or tall dense grasses) to conduct a proper sampling. The methodology followed, as well as the values used for defecation and decay rates in this study, are described in the methods section of this report. Sampling effort on the central area was higher than in the northern area in order to obtain a representative amount of pellet counts due to the lower density of animals in the area. Results are as shown in Table 12.

Despite results from dung pellets counts are more conservative from those obtained on the SCA by distance sampling methods (See Table 13), they can be used to compare among densities between the northern and central areas of the park.

**TABLE 12 - DUNG PELLETS COUNTS RESULTS FOR BUSHBUCK, COMMON DUIKER AND BLUE DUIKER IN THE NORTHERN AND CENTRAL AREAS OF THE PARK**

Species	Sampled area (km <sup>2</sup> )	Number of Pellets	Density (D) (animals/km <sup>2</sup> )	D Max	D Min
<b>North</b>					
	3722				
Bushbuck		134	<b>8.52</b>	10.97	6.96
Common Duiker		56	<b>15.27</b>	26.09	10.79
Blue Duiker		11	<b>2.54</b>	4.34	1.80
<b>Center</b>					
	8900				
Bushbuck		32	<b>0.85</b>	1.09	0.69
Common Duiker		25	<b>2.84</b>	4.85	2.01
Blue Duiker		6	<b>0.58</b>	0.99	0.41

### 5.2.5 Distance Sampling at the Special Conservation Area

The 90.5km survey using Distance Sampling technique conducted at the Special Conservation Area (See Figure 13 - Map A) resulted in the number of observations seen on Table 11. Bushbuck was the most observed species with 150 cluster observation (n=150), followed by greater kudu (n=35), blue wildebeest (n=29), common duiker (n=19), eland (n=15), and blue duiker (n=6), besides other less observed species. Densities and species number estimates are show on Table 13, showing only those with more than 30 observations (including wildebeest with 29) being the minimum number of observations recommended for statistical reliable results (Thomas et al., 2010).

**TABLE 13 - DISTANCE SAMPLING RESULTS FOR ANIMAL DENSITY AND NUMBER OF ANIMALS ESTIMATED INSIDE THE SPECIAL CONSERVATION AREA. ONLY SPECIES WITH ENOUGH NUMBER OF OBSERVATIONS FOR DISTANCE SAMPLING CALCULATIONS WHERE INCLUDED.**

Species	Density Estimated (animals per Km <sup>2</sup> )					Number of Animals Estimated in SCA (105 Km <sup>2</sup> )				
	Point Estimate	Standard Error	Percent coef. Of Variation	95% Confidence Interval		Point Estimate	Standard Error	Percent coef. Of Variation	95% Confidence Interval	
Bushbuck	20.863	3.6711	17.6	14.474	30.074	2206	388.17	17.6	1530	3180
Greater Kudu	5.2763	1.6524	31.32	2.8376	9.8107	558	174.76	31.32	300	1037
Blue Wildebeest	4.2782	1.9415	45.38	1.7941	10.202	452	205.12	45.38	190	1078

### 5.3 ELEPHANTS – *Loxodonta africana*

Two main elephant groups exist in the park. The first one derives from 30 animals reintroduced in 2001 and 2002 (see Figure 18) and was until 2015 confined to the Special Conservation Area (SCA), now estimated to be composed by about 100 individuals (Carmignani, 2015). The second is a native group that survived the intensive poaching during the civil war and now hides in the dense forests from the southern part of the park and into the wilderness area south east of its border.



FIGURE 18 – A YOUNG ELEPHANT FAMILY ON THEIR WAY TO A WATERHOLE IN THE SPECIAL CONSERVATION AREA

### 5.3.1 Status of the Reintroduced Elephants in the SCA

The current population of elephant derived from the reintroduced animals was estimated to be 100 individuals in 2015 (Carmignani, 2015). Since 2015, when the electric fence in the SCA stopped working, elephants started breaking out and are regularly seen outside the fenced area. Figure 25 shows the camera trap independent captures (A) and spoor observations made during the survey in the park (B), for elephant. This evidence plus the interviews performed with the park scouts indicate that solitary males or small groups of up to 4 individuals move regularly several km away from the fenced area as shown on Figure 21: until the tar road near the *Barra do Cuanza* bridge but never crossing the road; on the track that leads to the agriculture area, east of the main camp but never reaching the crops; 25km south of SCA close to the Sangano area; and on the gravel road close to Binge, the first village south of the main camp.

Until now, no conflicts have been recorded between humans and elephants, but the risk of this happening is elevated as northern elephants start covering more ground outside the SCA. According to the park scouts, one elephant was killed for ivory in March 2018 inside the SCA. This is the first elephant poaching incident reported to date for the northern part of the park and there is a high risk of perpetuation of poaching outside the SCA area, where patrolling is less frequent and new elephant routes are becoming regular.

One last note on the elephants' movements is regarding the area chosen by the park administration to implement the '*Horta dos Fiscais*'. As seen on Figure 19 and Figure 21, the area chosen to plant crops that will serve as food for the scouts' team and staff of the park, is inserted on an area that is already known to be part of the elephant route. Implementing a crops field in this area will most likely prove to be unsuccessful due to destruction of crops by elephants and will enhance the probability of human-elephant conflict. Due to the already high number of agriculture farms implemented further southeast of the area, a suggestion is that MINAMB gets to an agreement with farmers and have them supply crops and meat to the park staff, as a partial fee for having invaded an important habitat area of the park.



FIGURE 19 - DETAIL MAP OF 'HORTA DOS FISCAIS' LOCATION



FIGURE 20 - ELEPHANTS FEEDING IN THE PAPYRUS MARGINS OF THE CUANZA RIVER OUTSIDE THE SPECIAL CONSERVATION AREA. CALOMBO VILLAGE ON THE BACKGROUND ON THE OTHER SIDE OF THE RIVER.

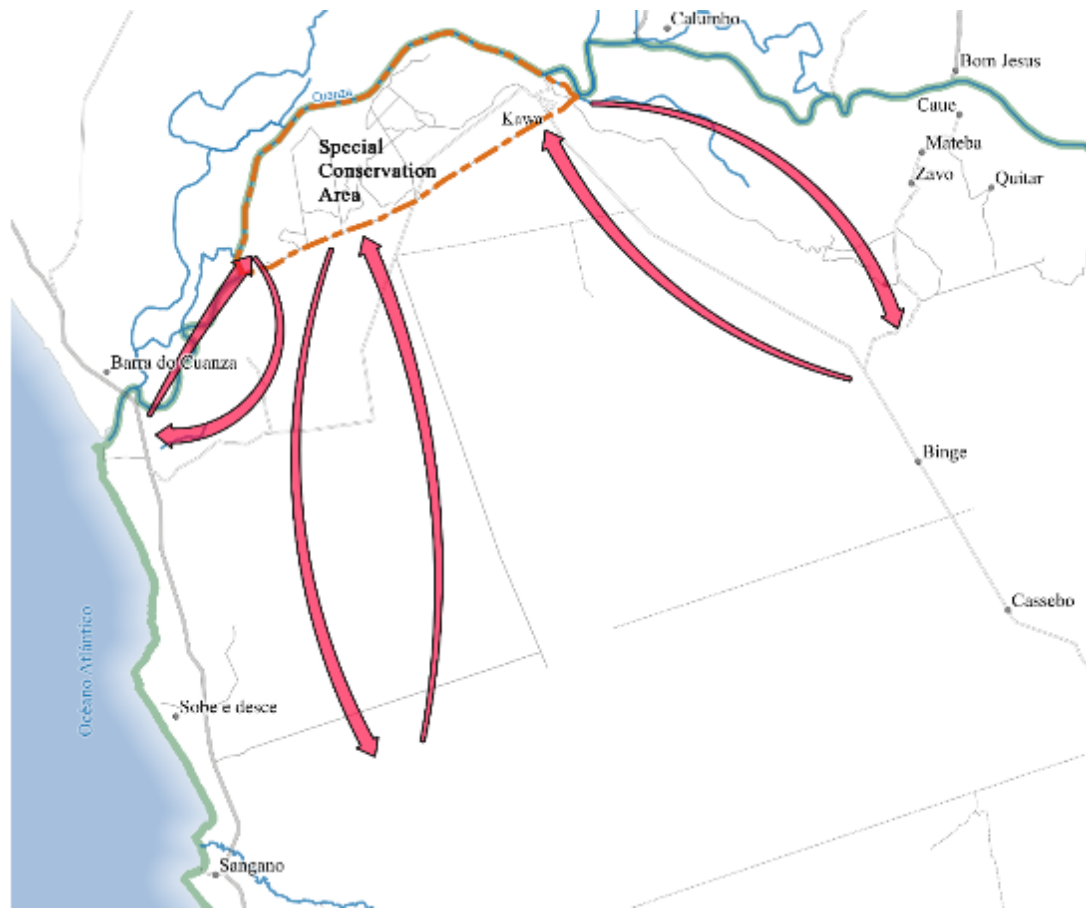


FIGURE 21 - ELEPHANT MOVEMENTS DETECTED (RED ARROWS) OUTSIDE THE SPECIAL CONSERVATION AREA

### 5.3.2 Status of the Native Elephants in Southern Quicama

The south east area within the park and the adjoining forested areas south east of the park borders, host a significant remnant population of elephants. Access limitations and limited field work time made impossible a proper assessment of these populations. Also, elephant dung that can be used to assess the population density is rarely found since locals use it for medicinal purposes (Braga-Pereira, 2017). Nevertheless, some spoor evidence on the ground was gathered, as well as a single camera trap picture at the gravel road near Mumbondo village (see Figure 23 and Figure 25 -A). It is important to note that this picture was taken on the night of 23th of August 2017, the only night where there was no circulation of vehicles in this area. The complementary interviews with local populations in the park made possible to

better understand the elephant presence and movements in the area and Figure 22 represents the areas where they have been seen or known to have passed through, in the last five years.

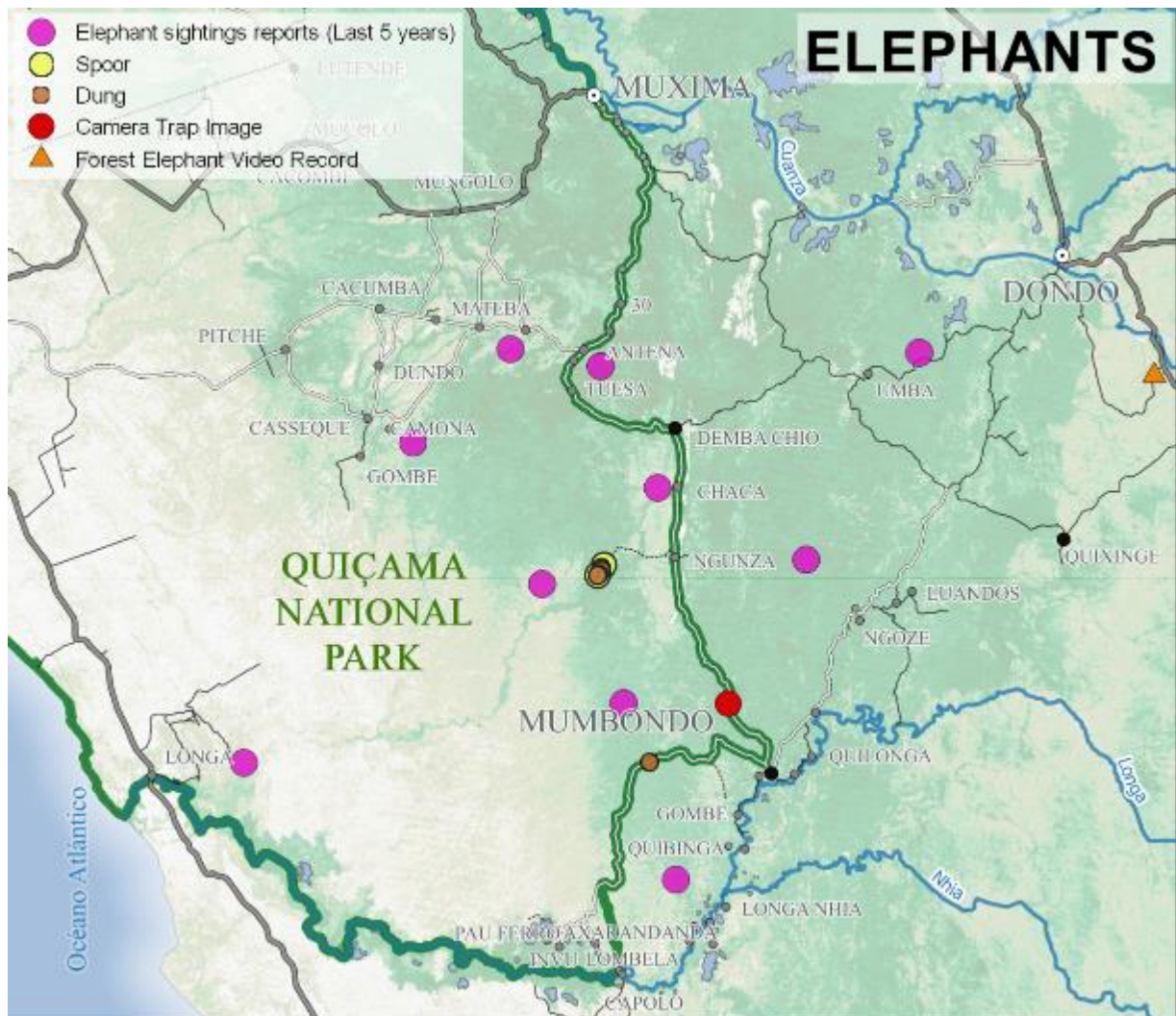


FIGURE 22 - ELEPHANTS EVIDENCE IN SOUTH QUIÇAMA N.P, INCLUDING POPULATION SIGHTINGS RECORDS IN THE LAST 5 YEARS (PURPLE CIRCLES)





FIGURE 23 – CAMERA TRAP ELEPHANT PARTIAL PICTURE TAKEN NEAR MUMBONDO.

There is an elephant population known for spending the dry season in the south east of the park, near the Omba river where they visit pools that retain water until the late dry season. These elephants and their spoor (see Figure 24) are regularly seen by poachers at NgoloNgolo hunting camp. Based on the spoor observed by the field team and the reports from poachers, it is estimated that this group of elephants consists of at least 10 individuals, but since the access to the area for spoor detection is extremely limited, there is a high probability of a bigger sized population.

Other elephant populations or areas where these have been seen in the last 5 years according to the population interviews (see Figure 22) include: A solitary elephant in 2016 in Samba, near Longa village in the south-west corner of the Park; a solitary elephant in Chaca village in August 2017; a solitary elephant in Culemba (near Mateba) and in Antena in 2016; a herd of elephants that crossed Cacumba village in the rainy season of 2016; a herd of elephants known to be resident near Uмба (abandoned) village; another herd frequently seen by poachers north of the road that goes from Mumbondo to Caxarandanda and also in the dense forest between Ngunza and Luandos. A recent record, appeared on the media, of elephant was included for Cambambe dam, 40km east of the QNP border, and it is probable that it comes from the eastern side of the park populations showed on Figure 22.



FIGURE 24 - SOUTH EAST QUIÇAMA, NGOLONGOLO HUNTING CAMP POOLS WHERE ELEPHANT SPOOR WAS FOUND

A significant population of elephants are known by the locals to exist in the forested areas and lagoons that lay outside the park borders on the south east, near the Cuanza river. This is probably where most of the elephant take refuge during the dry season due to the availability of water in the lagoons and the protection and food from the dense forests. The area is remote, and access is limited, therefore we recommend further research in that area to properly assess these populations.

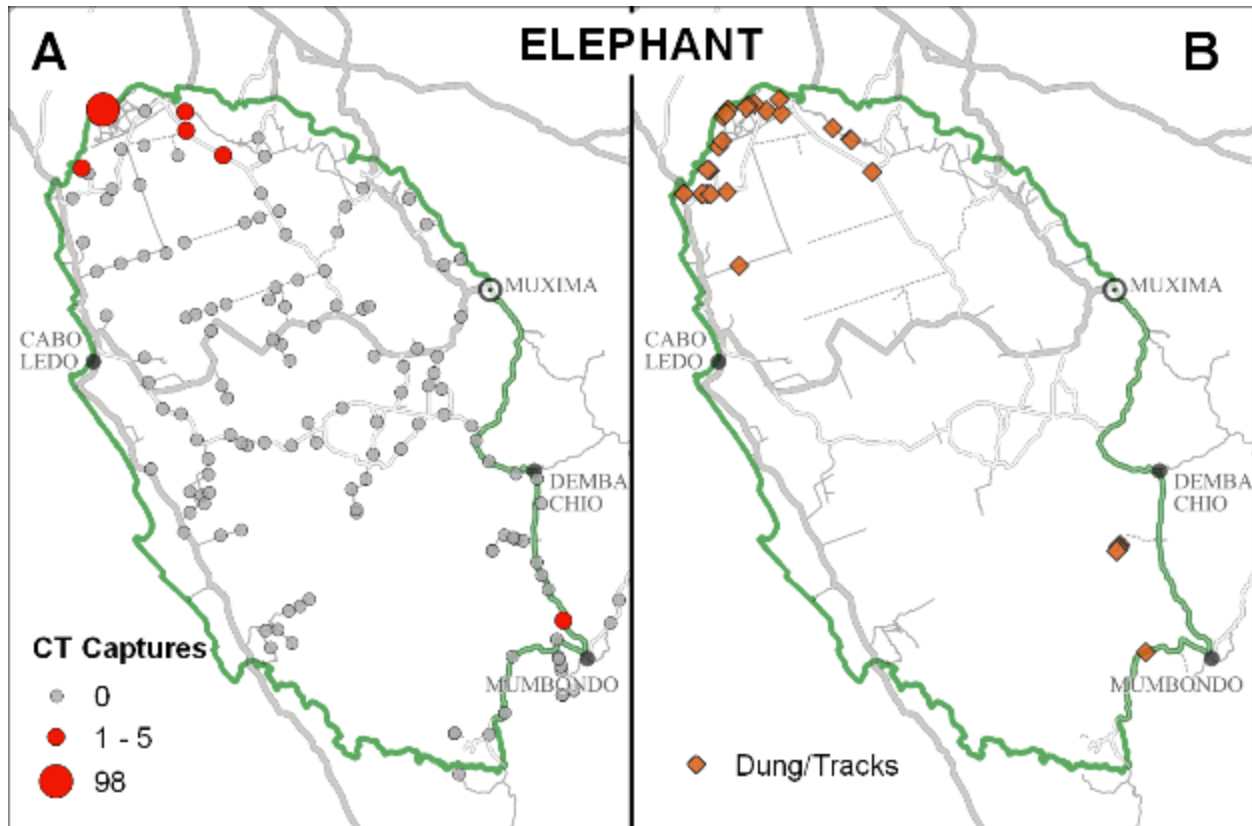


FIGURE 25 – ELEPHANT CAMERA TRAP CAPTURES (A) AND SPOOR (DUNG OR TRACKS) RECORDS (B).

## 5.4 UNGULATES

The Quiçama National Park ungulate community is composed by hippopotamus, forest buffalo, common eland, southern reedbuck, bushbuck, common duiker, blue duiker, bushpig, warthog and aardvark. The ungulates introduced to the SCA, with exception for common eland and waterbuck that formerly existed in the area, are not considered in this section and are covered below. Despite roan antelope is not present in the park, a small section about this species is included since is the only large ungulate missing from the Quiçama system. This section summarizes the survey results and status for each species. Figure 26 represents the periods of activity for a selection of ungulate species according to the camera trap captures. The values in the graph are relative for each species and the total number of camera trap pictures is shown at the bottom of each column.

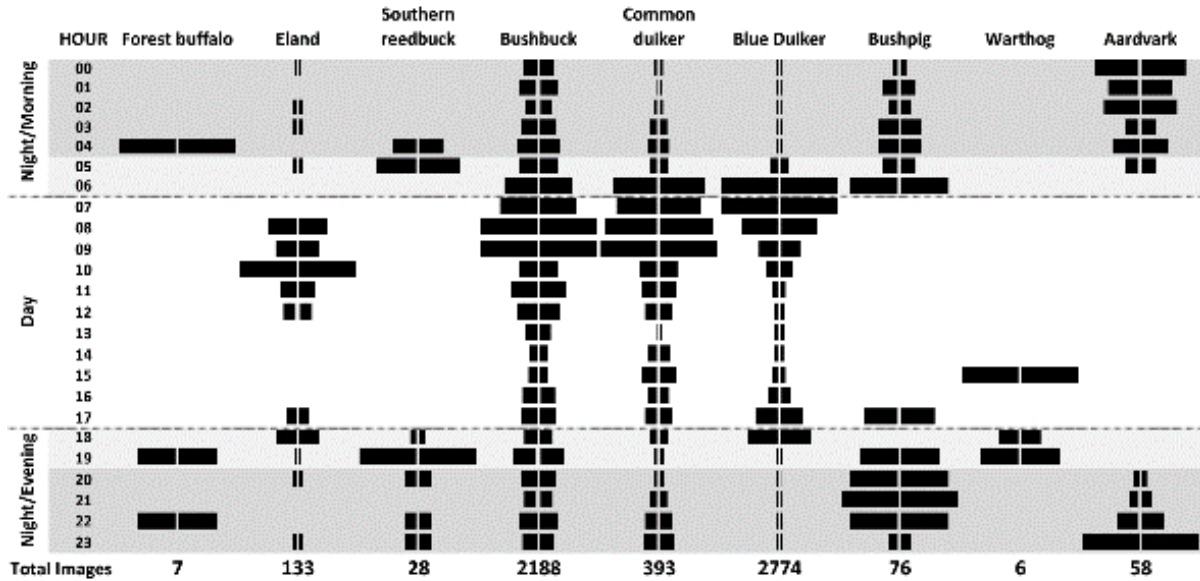


FIGURE 26 - UNGULATES HOUR PATTERNS ACCORDING TO CAMERA TRAP CAPTURES.

#### 5.4.1 HIPPOPOTAMUS – *Hippopotamus amphibius*

Hippopotamus populations in Quiçama National Park are small and highly threatened. In the northern area of the park the hippos are confined to the Cuanza river and its adjacent lagoons. The westernmost hippo population might be one reported by local inhabitants at Calumbo, on a large lagoon next to the Cuanza river and north of the base camp. At the “Hippo lagoon”, a few km east from the main camp, a group of 8 hippos (see Figure 27) was directly observed in two different days and in both occasions they ran (swam) away as soon as they noticed our presence more than 300m away. At least two calves were observed in the lagoon, indicating recent breeding. Local population reported hippos’ presence up the river, in some of the lagoons where they usually fish. Also, close to the Cuanza bridge at Cabala, locals reported regular destruction of crops by these animals. Hippos are persecuted for this reason and poached with wire snares and even firearms traps. The park scouts reported an incident where a local fisherman was killed few years ago by firearm trap designated to kill hippos, near the Hippo lagoon.



FIGURE 27 - HIPPO FAMILY AT THE HIPPO LAGOON

In the southern part of the park, hippos exist in the Longa river lagoons system. A single solitary hippo was recorded on camera trap image in a lagoon south of the Longa river (see Figure 28). According to local population, hippos are mostly seen alone or in pairs and we found no record of big groups. Local population in the south of the park openly claim to poach hippo with wire snares to protect crops and for meat. This indicates that the remnant populations of hippos in the Longa system are threatened and may end up extinct in the near future if no action is implemented.



FIGURE 28 - CAMERA TRAP IMAGE OF HIPPO IN A LONGA RIVER LAGOON

#### 5.4.2 FOREST BUFFALO – *Syncerus caffer nanus*

The remnant population of forest buffalo (Pacaça) in Quiçama National Park is small and restricted to the south-east area, but mainly to forested areas outside the park boundaries. In between Mumbondo, Caxarandanda and the Longa river, further to the east of Mumbondo, west of Ngunza and outside the park to the south, between the Longa and Nhia rivers (see Figure 29). According to local population, the forest buffalo was severely decimated by massive hunting activities taken place mainly by military operatives during the civil war. Herds of dozens of animals were shot at a time from the ground or from helicopters to serve as

meat supply for the armed forces. After the war and to the present date, due to the lack of administration and patrolling in the southern areas of the park, the forest buffalos are still under a severe poaching pressure and have therefore developed a cryptic behaviour, grazing and accessing water during the night and hiding in the dense woodlands during the day. According to human population interviews, spoor and camera trap images, there are several very small herds of forest buffalos composed of 6 individuals on average. The location of these herds during the dry season is restricted to the proximity of permanent water in the Teque river near Ngunza and the lagoons of the Longa river. Figure 29 show the location of the detected herds according to spoor, camera traps and local population reports.

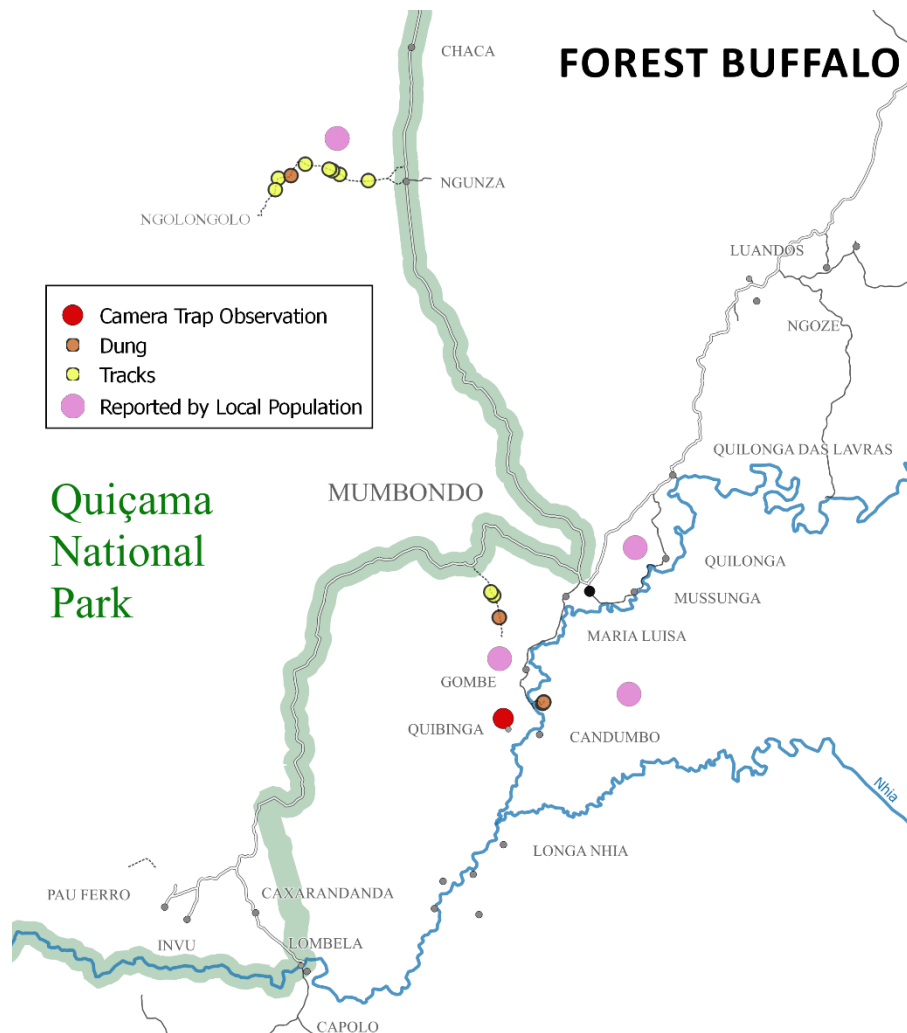


FIGURE 29 - EVIDENCE COLLECTED FOR FOREST BUFFALO IN THE SOUTH-EAST OF THE PARK.

Local population interviews in the north-east side of the park reported the existence of forest buffalo tracks near the Cuanza river, on its eastern bank. The veracity of those could not be confirmed and the probability of being confused with cattle tracks is considerably high. Further research in that area should be conducted to confirm the presence of this species.



**FIGURE 30 - FOREST BUFFALO WOUNDED BY WIRE SNARE. CAMERA TRAP PICTURE.**



**FIGURE 31 - CAMERA TRAP PICTURE WITH 5 FOREST BUFFALO RUNNING AWAY.**

The remnant population of forest buffalo in QNP can be considered highly threatened and requires immediate attention and action. The buffaloes are nowadays being persecuted with wire snares to protect beans crops and Figure 30 confirms this information as shows an animal with a wire snare wound on the front leg. Local population interviews also revealed regular visits from poachers coming from cities and equipped with professional hunting rifles targeting for forest buffalo. Figure 31 shows a small buffalo herd with 5 individuals where some look younger, indicating that recent breeding has occurred.

To our knowledge, the captured images are the first obtained for forest buffalo in the last 44 years in Quiçama National Park. Previous surveys suggested its extinction in the area (Carmignani, 2015) while others mentioned the possibility of its presence but without visual confirmation (Ron, 2015; Braga, 2017; Huntley, 2017, p.347).

The capture of these images was only possible thanks to the collaboration of Mr. Alcides, from Caxarandanda village (see Figure 32)



FIGURE 32 - MR. ALCIDES FROM CAXARANDANDA.

#### 5.4.3 ELAND – *Taurotragus oryx*

Common eland was historically present in the park, nonetheless, there are currently no elands in the whole area other than those coming from the 8 Livingstone's elands (*Taurotragus oryx livingstonii*) reintroduced in 2000, that were estimated in 140 individuals in 2008, and the 16 individuals (subspecies not mentioned on official documentation provided by the park administration) reintroduced in 2014, all resident in the SCA. The species is reproducing well and, given that it is native to the park and used to be present, could be released outside the fenced area to repopulate other areas once the necessary protection and management is provided. These animals can be easily seen in the SCA (see Figure 33) in herds of up to 20 individuals. Solitary males are regularly seen, and some are very comfortable with human



presence and stand around the main camp in the quiet evenings. No signs of eland were seen outside the SCA but the park scouts affirm that some are already breaking out the fenced area.

According to the local population survey, eland became extinct due to massive poaching in the park many years ago during the civil war.



FIGURE 33 - A COMMON ELAND HERD IN THE SPECIAL CONSERVATION AREA.

#### 5.4.4 DEFASSA WATERBUCK – *Kobus ellipsiprymnus*

As mentioned in the introduction, this species was not found in the park on the early 1970's (Huntley, 1971). The official documentation provided by the park administration stated that a group of 16 animals termed 'burro do mato' were introduced in late 2014. Historical records account the Portuguese term 'burro do mato' as *Kobus ellipsiprymnus defassa*. A single direct sighting was made of this species inside the SCA but this was not enough to determine the subspecies. Nevertheless, the *Kobus ellipsiprymnus* historical records for Angola include a record from Capello et Ivens from Quiçama National Park area in 1890, again not referring to the subspecies (Bocage, 1890).

#### 5.4.5 ROAN ANTELOPE – *Hippotragus equinus*

Big herds of roan antelope were commonly seen in the park before the civil war started. As with the forest buffalo or eland, these large antelopes suffered from severe poaching during and probably after the civil war. No presence of this species was found on the ground or from local population's interviews. According to the Human population survey results, it is likely

that a remnant population survived until the 2000's, but thereafter the species became locally extinct un the park.

#### 5.4.6 SOUTHERN REEDBUCK - *Redunca arundinum*

There are currently two (and a probable third) main populations of southern reed buck in Quiçama National Park, all confined to permanent water access and protected habitats. The first one is located at the north-west section close to the Cuanza river and the SCA. Despite being well protected, the population is shy and difficult to see, contrary to other mammals in the area such as bushbucks or common duikers. Reedbucks were never detected by camera traps in this northern section of the park and were directly spotted in only 3 occasions in the north (see Figure 34). Further east, on the Cuanza margin grasslands, close to the Cabala-Muxima tar road, an important population of southern reed buck used to exist but ended up extinct about 3 years ago (2014) due to the occupation of the park by commercial farmers and cattle ranches. This information was confirmed by local population interviews, where people remember well the presence of this species prior to the tar road construction in 2012 and the years after, before the farms were settled in the area.

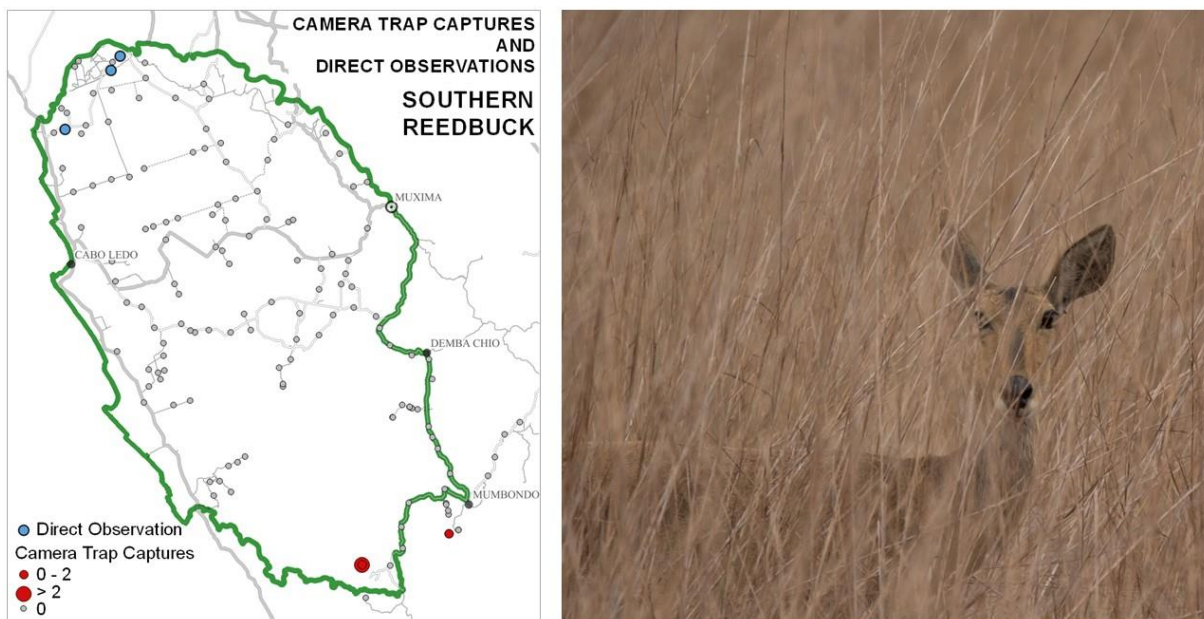


FIGURE 34 – LEFT: SOUTHERN REEDBUCK CAMERA TRAP CAPTURES AND DIRECT OBSERVATIONS. RIGHT: REEDBUCK FEMALE HIDING BEHIND THE TALL GRASSES OF THE SPECIAL CONSERVATION AREA.

The second confirmed population is located at the grasslands around Caxarandanda in the very south of the park (mainly in the Dongo grasslands, according to local population) and use the permanent lagoons system in the area to access water. Three (3) camera traps placed in the area captured southern reedbuck images and several fresh spoor was found confirming the abundance of this species in the area. Local population agreed that southern reedbuck bushmeat is highly desired among them for consumption and bushmeat selling, and they hunt it regularly using shotguns. The hunting of reedbuck peaks during the dry season when hunters burn the grasses to approach the area forcing reedbucks to access specific areas in order to reach the margins of the lagoons. Despite the relative abundance of this species in that area, it should be considered as threatened as it might have only survived due to the vast extension of the high and inaccessible grasslands that still make difficult its hunting.



**FIGURE 35 - SOUTHERN REEDBUCK FEMALE WITH YOUNG LAMB AT THE SPECIAL CONSERVATION AREA.**

The potential third site for southern reedbuck is the south west area of the park, on extended grasslands of the Longa river (and its lagoons) margins. Here, the presence of this species was

never confirmed on the ground, nor by spoor or camera trap images, but local population interviews revealed that they might still be present in the area. If this is a reliable information, the southern reedbuck population in this area is highly endangered as this part of the park has started to be invaded by cattle ranchers in the last years and poaching is more frequent and easy due to the proximity to the tar road and the fact that there is no patrolling or park administration presence reported in the area.



FIGURE 36 - SOUTHERN REEDBUCK MALE NEAR CAXARANDANDA. CAMERA TRAP PICTURE.

The park scouts were aware of the presence of southern reedbuck in the central west part of the park, in an area called Cabo São Braz some years ago, but no recent records exist, and all indicates that this species population in the area has become extinct, probably due to poaching and occupation of that area by cattle ranches.

#### 5.4.7 BUSHBUCK – *Tragelaphus scriptus ornatus*



FIGURE 37 - HABITUATED BUSHBUCK IN THE SPECIAL CONSERVATION AREA

Bushbucks are one of the most widespread and abundant ungulate species in Quiçama National Park, occurring in every forest, thicket and forest edge or grassland with enough cover but excluding the surroundings of the most populated areas. Figure 38-Left shows the camera trap captures and Figure 38-right the relative abundance index derived from the camera trap independent observations. Their expanded distribution and abundance may derive from their ability to survive obtaining water from dew, phenomena that is common in the park due to its proximity to the Atlantic Ocean, allowing them to survive without a permanent source of water. There are two main areas of high density for bushbuck, one in the north, in and around the SCA, and one in the southeast, where the density of this animal is surprisingly high despite the tremendous intensity of hunting suffered in the area. This may be due to the dense thickets and forests that provide them with the necessary food, as well as the perfect refuge and where access for humans is limited if not impossible, allowing these animals to survive the butchery. Their bushmeat is in high demand by people for consumption and bushmeat selling. More than 30 bushbucks at a time have been found drying in hunting camps in this area (See Figure 95). Most of the bushbuck hunting is done with wire snares but also shotguns are used regularly for this purpose.

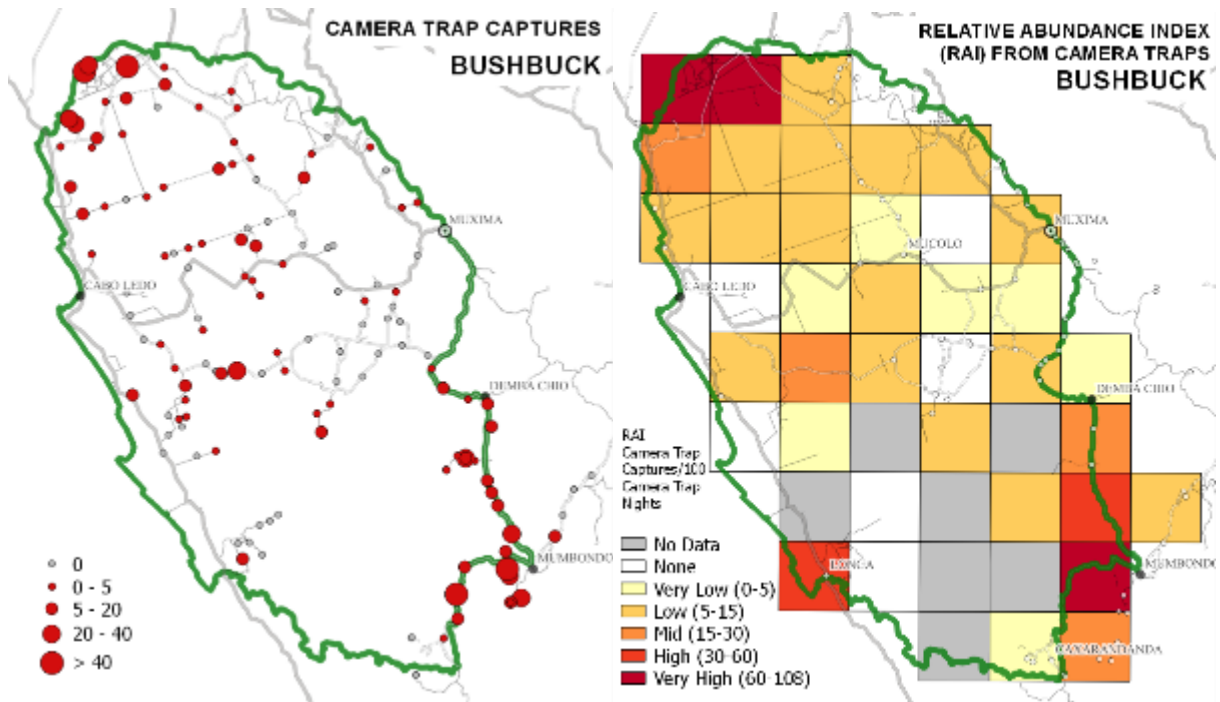


FIGURE 38 - LEFT: BUSHBUCK CAMERA TRAP CAPTURES. RIGHT: RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR BUSHBUCK.

Despite their usually secretive habits and cryptic behaviour, bushbucks are one of the most directly observed mammals in the park (See Figure 39). They can easily be seen from the gravel roads in the mornings and afternoons both in the north and the southern areas of the park and Figure 26 shows their hourly activity pattern according to the camera trap captures. Their flight distances and sometimes standby behaviour after detecting human presence are long enough to make the delights of the tourists, even in the southern areas where hunting levels are intense. In the SCA, where poaching pressure has been almost non-existent for the last 15 years, bushbuck can be carefully approached by foot up to 20 meters' distance without being disturbed.

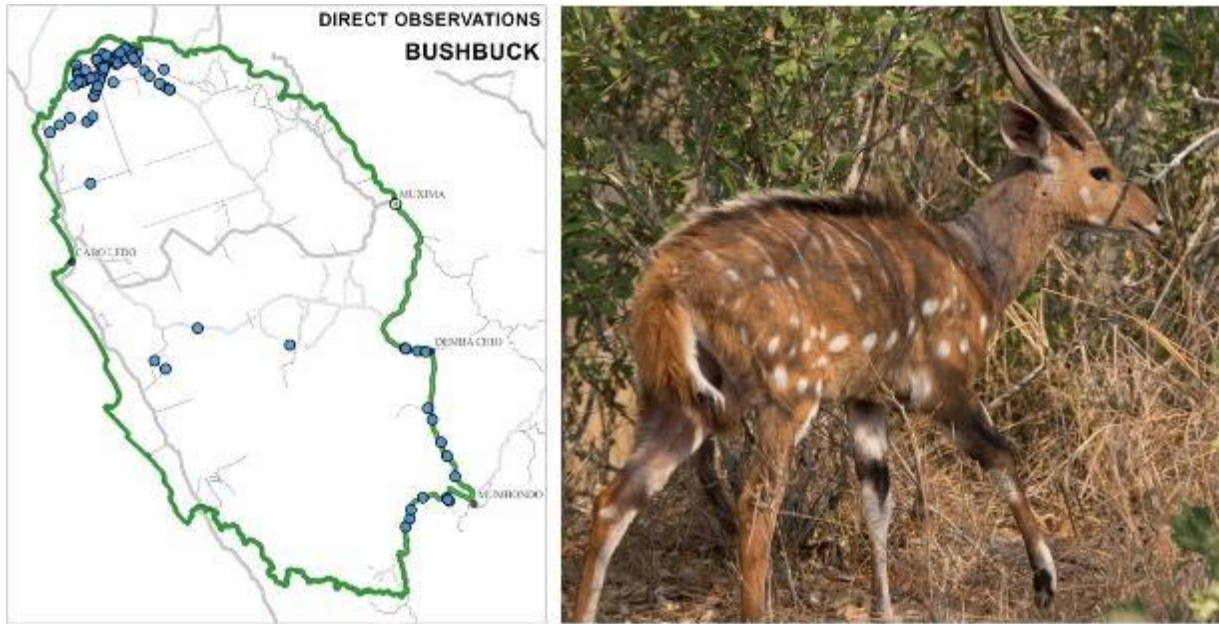


FIGURE 39 – LEFT: BUSHBUCK DIRECT OBSERVATIONS. RIGHT: BUSHBUCK MALE IN THE SPECIAL CONSERVATION AREA.

Its conservation status in the park can be considered as of least concern but special attention should be paid to the intense poaching in the southern areas. The fact that there is no control on the number of poached animals may contribute to lower significantly the density of this species in the following years. Poachers in the south-east commented the numbers used to be higher and this could be attributed to the hunting upsurge in the last three years due to the financial crisis the country is facing.

#### 5.4.8 BLUE DUIKER – *Philantomba monticola*

Blue duiker is the most abundant and widespread ungulate species in the park, occurring virtually everywhere with exception of the extended south west tall grasslands. It is also one of the most, if not the most, poached mammals in Quiçama N.P. mainly for personal-consumption but also for bushmeat selling. Poachers use mostly wire snares. Figure 40 show the camera trap captures and the relative abundance index derived from them. In the northern areas, close to the SCA, despite the constant protection from poaching, this species occurs in much lower density than in the southeast, where the habitats are more suitable for the species, making these an extremely resilient animal in the park. Every year, especially during the dry

season, thousands of blue duikers are poached in the park for bushmeat consumption even by small kids that learn how to place wire snares from a young age (Figure 42 left) but also hundreds if not thousands rot in the wire snares that poachers have no capacity to check as regularly as they get caught (Figure 42 right).

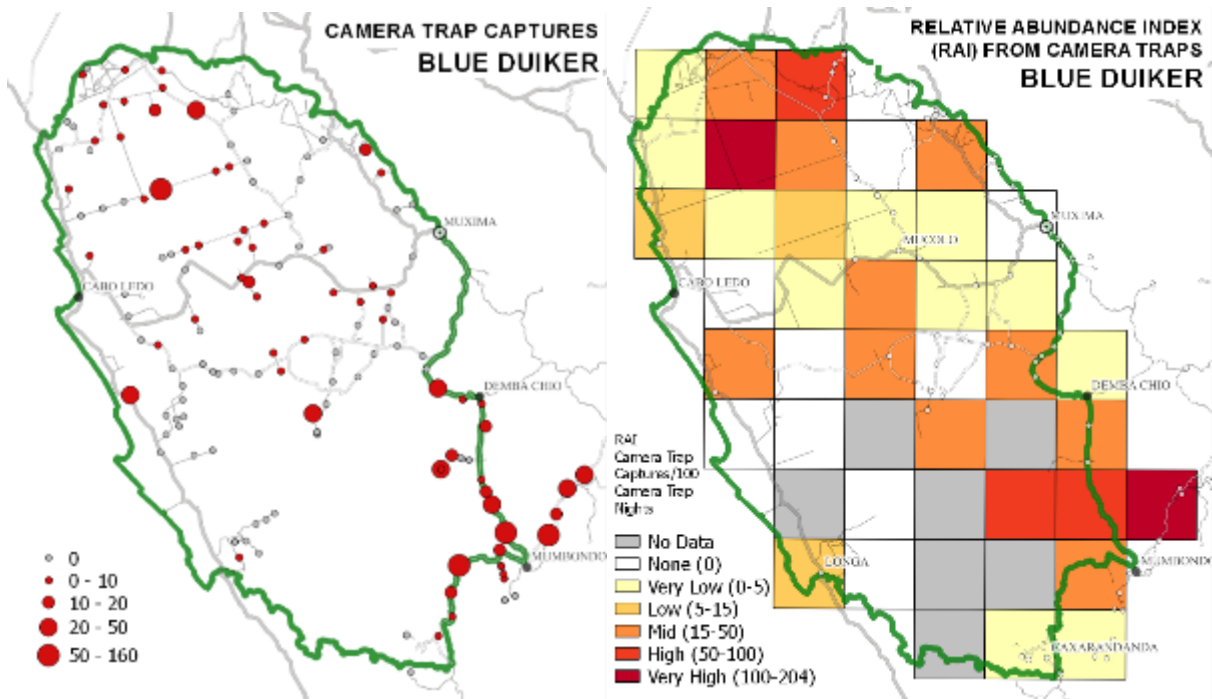


FIGURE 40 - LEFT: BLUE DUIKER CAMERA TRAP CAPTURES. RIGHT: RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR BLUE DUIKER

It is common to see blue duikers crossing the gravel roads while driving during the early mornings and late afternoons especially in the south eastern part of the park. They have been regularly seen in the south east areas of the park scavenging at the same places where talapoin monkeys' groups are, probably taking advantage of the fallen fruits left by the monkeys when foraging on top of the trees.





**FIGURE 41 - BLUE DUIKER FORAGING TOGETHER WITH ANGOLAN TALAPOIN MONKEYS NEAR MUMBONDO, QUIÇAMA NATIONAL PARK.**



**FIGURE 42 - LEFT: BLUE DUIKER POACHED BY KIDS NEAR MUMBONDO. RIGHT: BLUE DUIKER CARCASS LEFT TO ROT IN THE SAME AREA.**

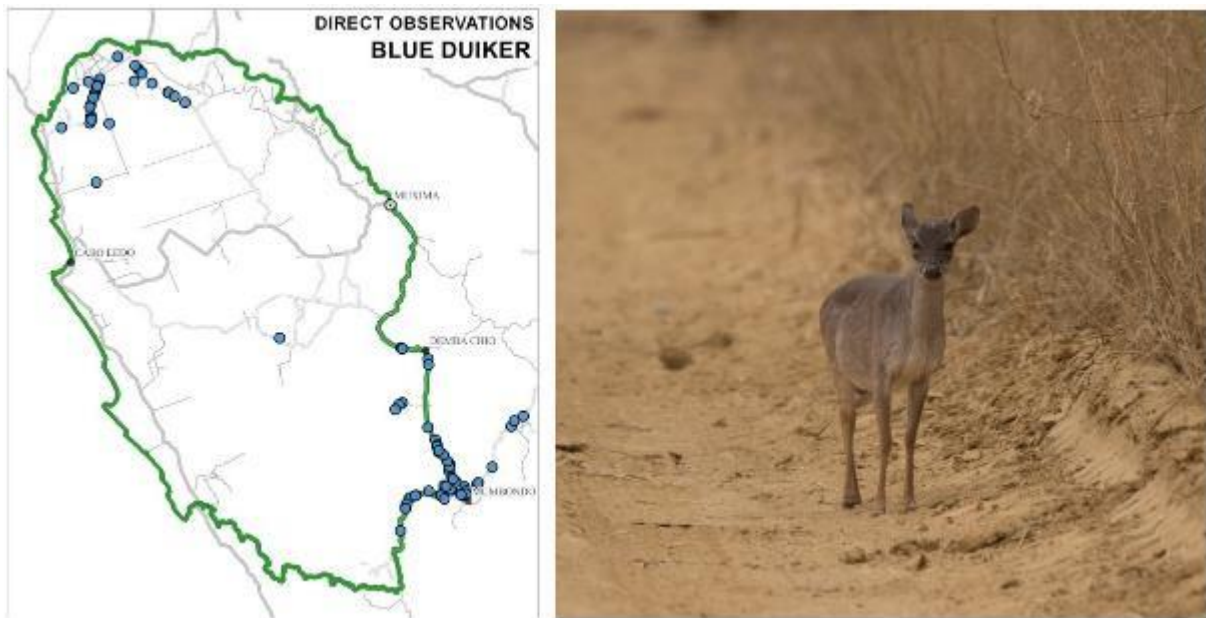


FIGURE 43 - LEFT: BLUE DUIKER DIRECT OBSERVATIONS. RIGHT: BLUE DUIKER STANDING ON THE ROAD NEXT TO MUMBONDO.

#### 5.4.9 COMMON DUIKER – *Sylvicapra grimmia*



FIGURE 44 - COMMON DUIKER IN THE SPECIAL CONSERVATION AREA.

Common Duiker is frequently found in the grasslands and savannah woodlands, therefore mostly confined to the western side of the park. It is absent from the main populated areas probably due to excessive poaching for bushmeat that is mainly done with shotguns by local population and sporadically visiting hunters. Figure 45 shows the camera trap independent observations and relative abundance index for this species and Figure 46-left the direct observations for this species.

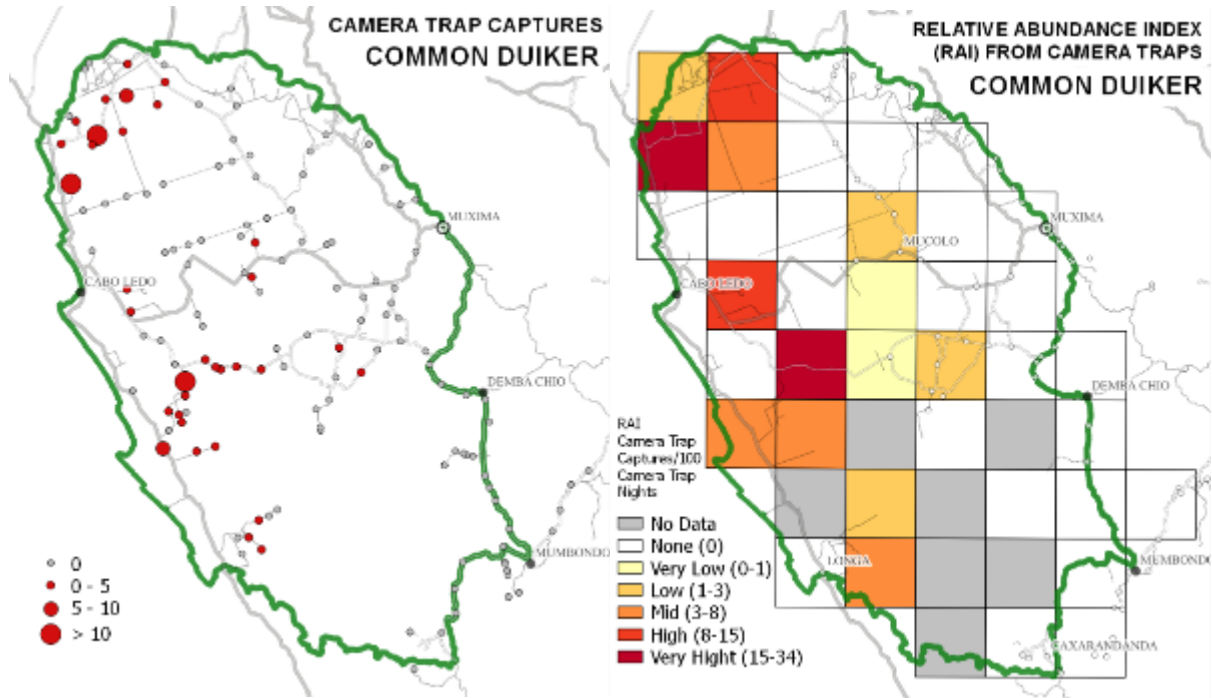


FIGURE 45 - LEFT: COMMON DUIKER CAMERA TRAP CAPTURES. RIGHT: RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR COMMON DUIKER.



FIGURE 46 – LEFT: COMMON DUIKER DIRECT OBSERVATIONS. RIGHT: A COMMON DUIKER NEAR THE SPECIAL CONSERVATION AREA.

#### 5.4.10 BUSHPIG – *Potamochoerus larvatus*

These animals are common but not abundant and are one of the most pursued species for bushmeat hunted mainly with shotguns and lanterns during the night as well as wire snares, especially around crops in order to protect them. Their behaviour in the park is completely nocturnal (see Figure 26). Their presence in the central areas of the park is low as compared with the northern and south-east areas (see Figure 47), probably because of the higher poaching pressure they suffer in this area and the lack of permanent water.

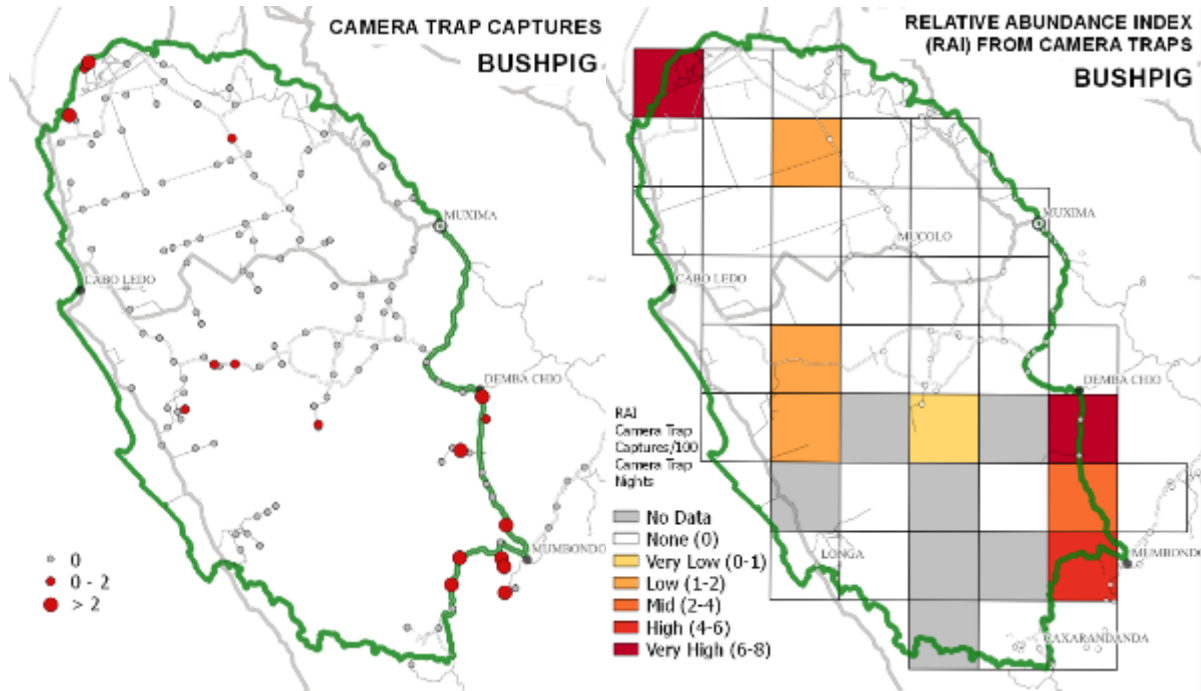


FIGURE 47 - LEFT: BUSHPIG CAMERA TRAP CAPTURES. RIGHT: RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR BUSHPIG.



FIGURE 48 - A BUSHPIG FAMILY GROUP FORAGING DURING THE NIGHT NEAR MUMBONDO

5.4.11 WARTHOG – *Phacochoerus africanus*

Warthogs are also a high value species for bushmeat, but their numbers are very low and the species might end up disappearing from the park soon if poaching levels continue. Poachers look for them in the extensive grasslands of the western part of the park, specifically near and south of Cabo Ledo where they hunt them with shotguns. Only 5 independent observations on 2 camera traps were made of this species (see Figure 49). Also 1 direct observation of this species was made in the south-west grasslands.

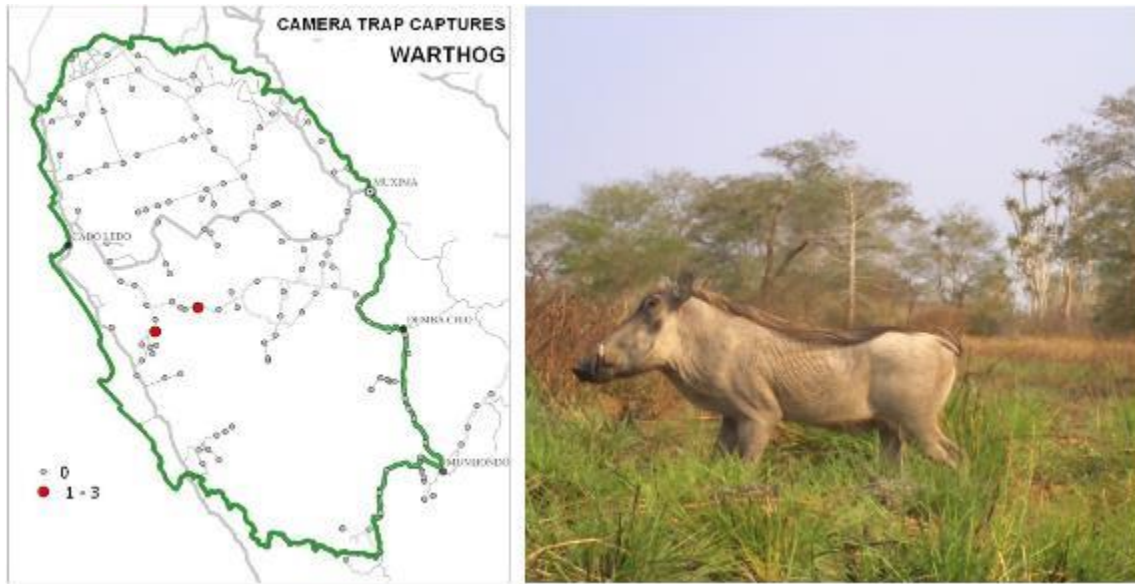


FIGURE 49 - LEFT: WARTHOG CAMERA TRAP CAPTURES. RIGHT: WARTHOG CAMERA TRAP PICTURE, SOUTH WEST QUIÇAMA NATIONAL PARK.

#### 5.4.12 AARDVARK – *Orycteropus afer*

Aardvark seem to be relatively common in the western side of the park, where extensive open grasslands occur (Figure 50). They are completely nocturnal and only their burrows can be observed during the day. No indication of persecution of this species was found, although opportunistic poaching may occur.

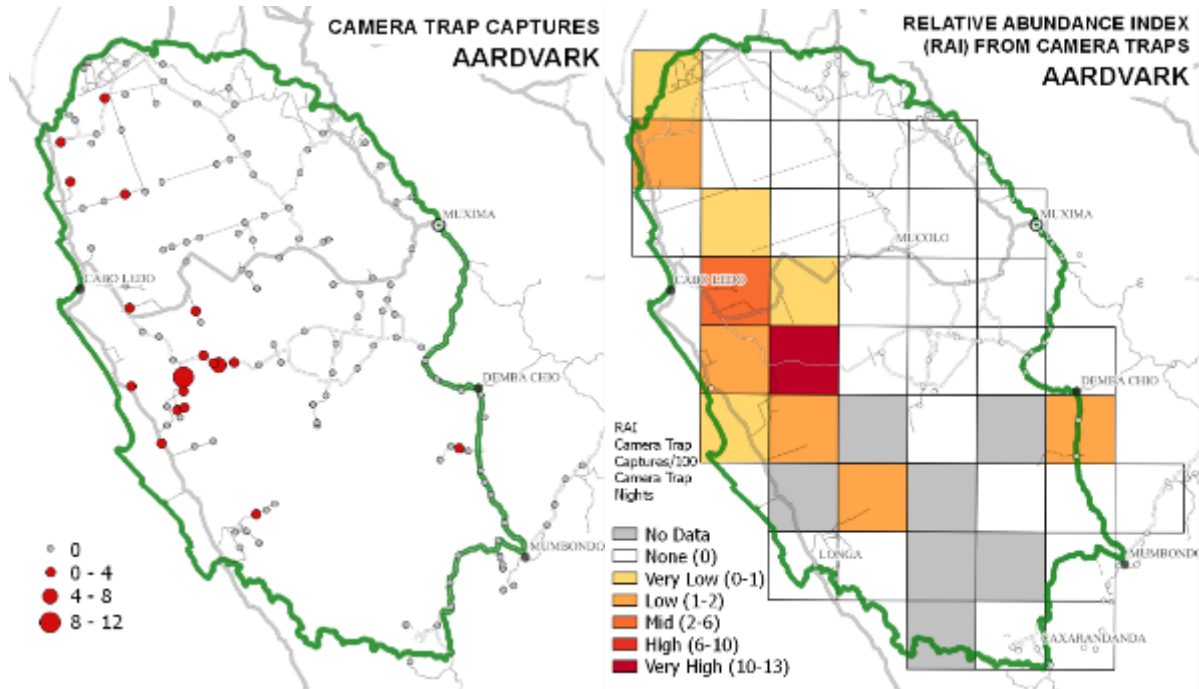


FIGURE 50 - LEFT: AARDVARK CAMERA TRAP CAPTURES. RIGHT: RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR AARDVARK.



FIGURE 51 - AARDVARK CAMERA TRAP PICTURE IN CENTRAL-WEST QUIÇAMA

### 5.5 CARNIVORES

Leopard is the only large carnivore species still present in the park and is confined to the south-east area. All other carnivores have become extinct in the area. The last one to disappear was the spotted hyena and preceded by African wild dogs, lions and cheetahs. Massive

persecution for large carnivores has occurred in the park over the last decades, even in the years before the Country’s independence, as they were supposed a threat to the cattle activities carried out in the western side of the park. This may have forced these animals to move towards the south-east, where dense forested areas and lower human population densities provided better protection but where, due to the extensive poaching during the war years, the lack of large prey animals made lions (and other large carnivore species) disappear.

Regarding small carnivores, most of the expected species for the area are represented in the park: side-striped jackal, serval, African wildcat, African civet, blotched genet, honey badger, Egyptian mongoose and marsh mongoose. Even though these are sometimes persecuted by the local population for killing small livestock, no significant threats to these species were detected.

Figure 52 shows the periods of activity for a selected group of carnivore species using the data from the camera trap captures.

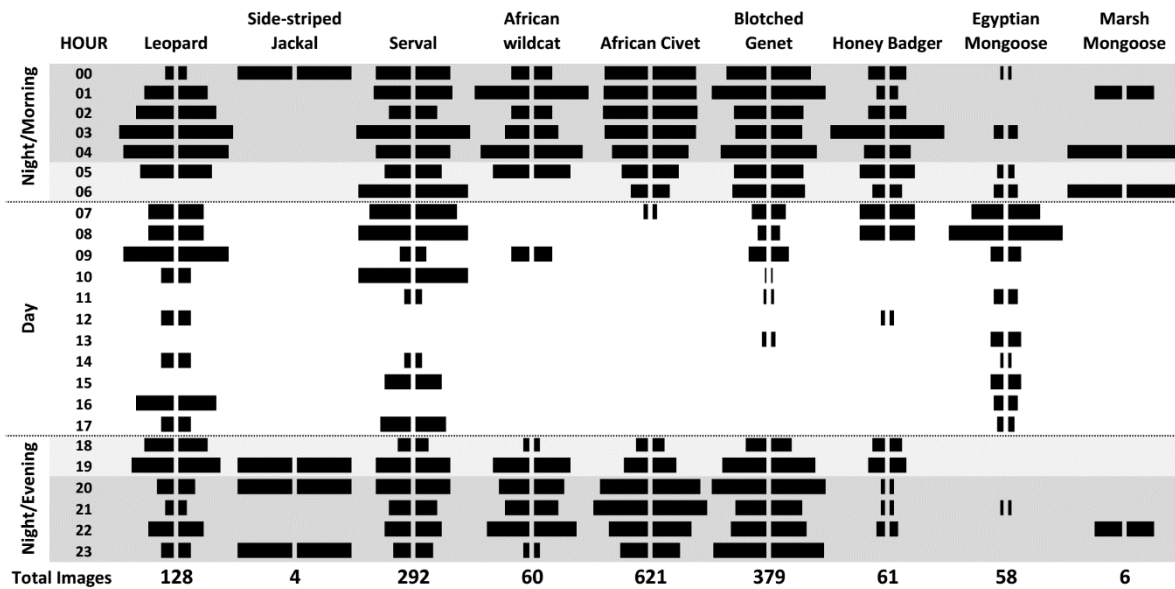


FIGURE 52 - CARNIVORES HOUR PATTERNS ACCORDING TO CAMERA TRAP CAPTURES



### 5.5.1 LEOPARD – *Panthera pardus*



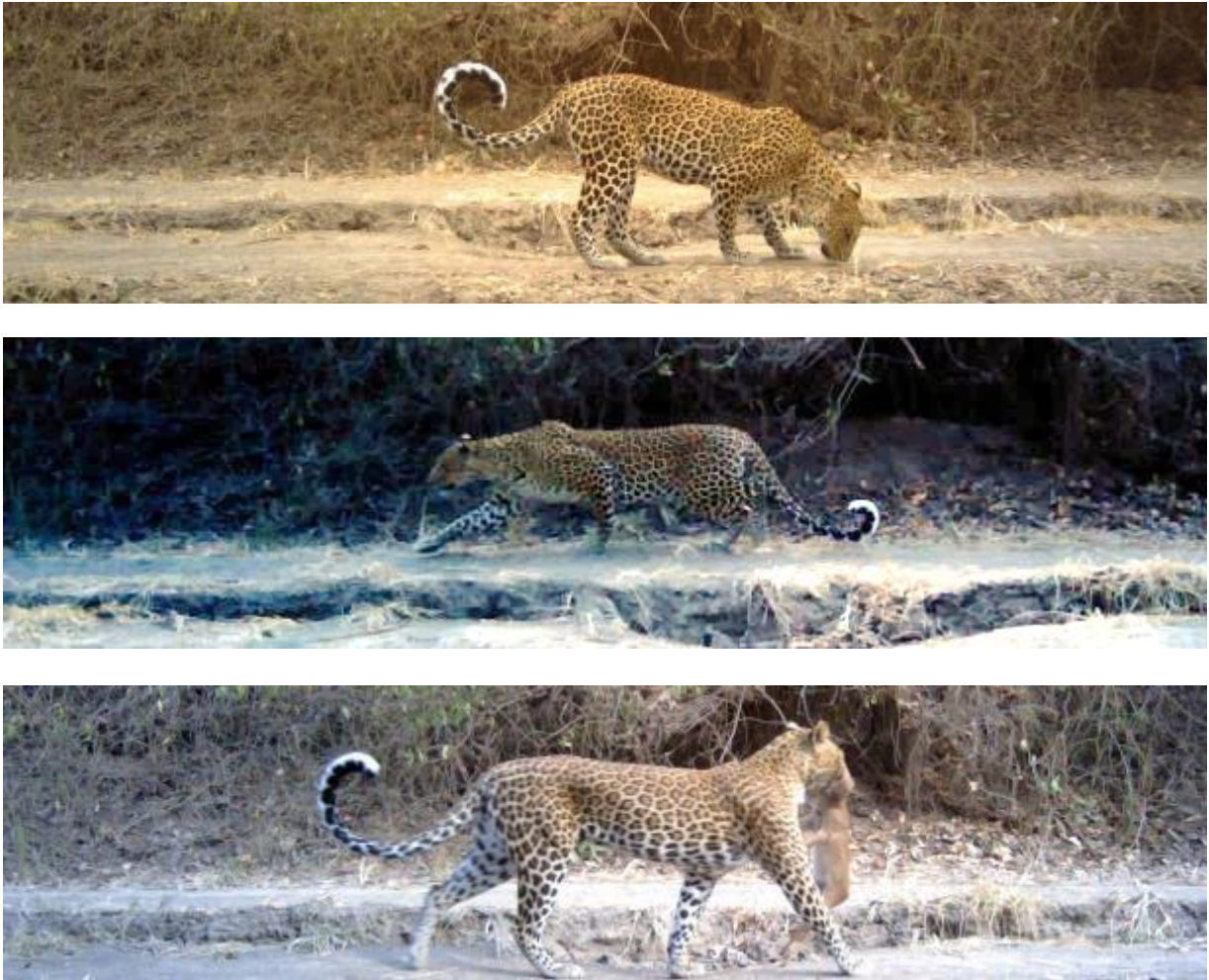
FIGURE 53 – HEALTHY LEOPARD MALE NEAR MUMBONDO. CAMERA TRAP PICTURE.

Leopard is the only large carnivore remaining in the park. There is a relatively healthy population in the south-east area of the park as it can be seen on the maps from Figure 56 and the density map on Figure 17. Camera traps, direct sightings and spoor revealed the presence of leopard cubs (see Figure 54), indicating breeding is happening within the park population.



FIGURE 54 - LEOPARD FEMALE WITH CUB NEAR MUMBONDO. CAMERA TRAP PICTURE.

For some reason still undefined, leopards, as well as other large carnivores, are absent from the north and western areas of the park. Prey abundance is high in the SCA and in some of the western areas of the park and leopards' adaptability and resilience to human dominated habitats would leave to think they should be present. On the other hand, the north and west areas are known for livestock activities and are closer to Luanda or tar roads, making leopard persecution and skin selling easier and this is maybe the reason that lead to their extinction in those areas. There is a huge potential for repopulation of this large carnivore in the SCA and northern parts of the park due to the abundance of prey and good protection. This could bring some balance since there are currently no predators for the large number of antelopes in the SCA and potentially enhance tourism attraction to the area.



**FIGURE 55 - LEOPARDS USE STALK-AND-POUNCE METHOD TO HUNT FOR PREY. CAMERA TRAP PICTURES OF A SUCCESSFUL HUNT FROM THE SAME FEMALE LEOPARD NEAR MUMBONDO.**

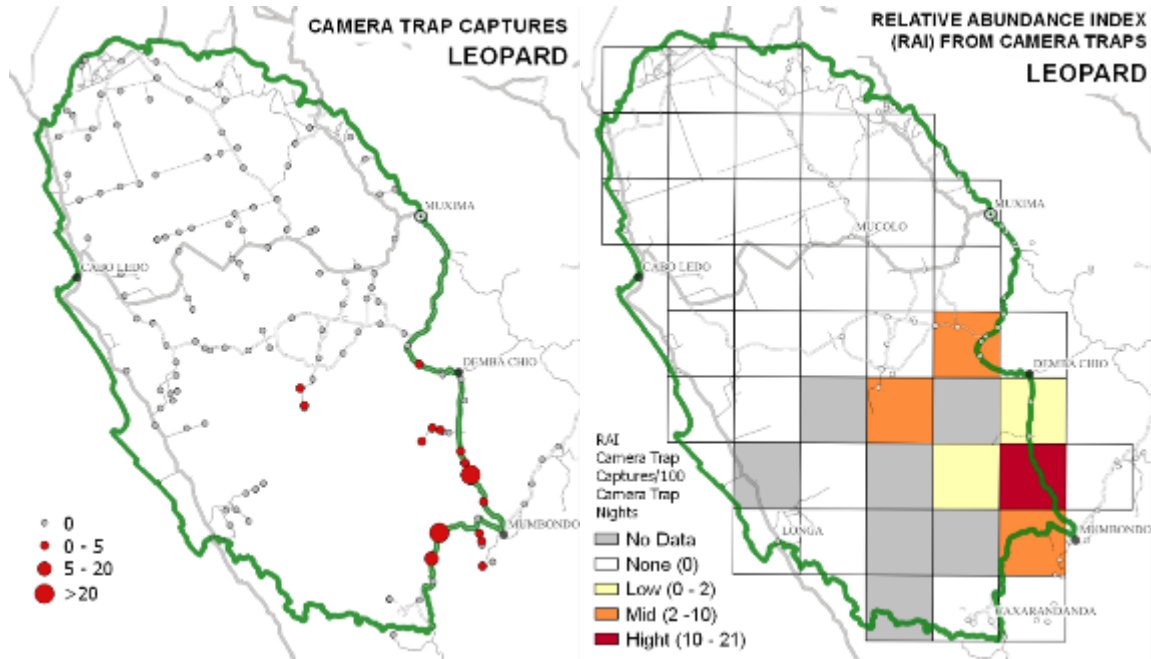


FIGURE 56 – LEFT: LEOPARD CAMERA TRAP CAPTURES. RIGHT: RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR LEOPARD.

Poachers and local population interviews indicated that leopards are not being specifically persecuted and there are very few conflicts with humans or livestock. The few human-leopard conflicts were reported by poachers and usually related to a leopard falling into a trap, either wire snare or gin trap, and then attacking the poacher. In Demba-Chio locality, all three generations of poachers in a family were found with face scars provoked by leopard attacks while hunting. In the Caxarandanda area, there was a report of leopards attacking goats and gin traps being placed to prevent that.

Camera trap revealed photos of leopards carrying blue duiker ( Figure 55), which is probably a significant part of their diet due to the abundance of this species on the area.

Poachers indicated that, when a leopard get caught and killed on a wire snare, they sometimes use their meat for own consumption but rarely sell the skin, as there is no market for it in the area.

### 5.5.2 OTHER LARGE CARNIVORES

Other large carnivores were found to be absent from the Quiçama National Park system:

**Spotted Hyena (*Crocuta crocuta*)** was the most recent large carnivore to disappear from the park. Only a single credible record of its presence from two years ago in the south east (near Caxarandanda) was obtained by a local poacher who claimed capturing one in a wire snare. It was the first time he saw a hyena. Also, according to the park scouts, the spotted hyenas used to be heard during the night from some of the SCA outposts few years ago. A single evidence of a very dry/old dung potentially belonging to a spotted hyena was found near the SCA. Apart from that, no evidence in form of spoor, tracks, images or local population interviews was found for this species. Since the park area started being occupied by cattle ranchers and commercial farmers mainly along the tar roads, it is possible that hyenas have been persecuted and extirpated due to the use of poison. Several times, local population interviews revealed that the communal and municipal veterinary services have provided poison to cattle owners in order to kill hyenas in the past. On two occasions, the people said they assumed that hyenas disappeared because they were poisoned when feeding on cattle that had been consuming pesticide protected crops.

It is possible that the hyena reports from scouts and population were from remnant populations of resident animals that turned out as not viable and have become extinct recently. The probability of hyenas still existing in neighbouring areas around the park is significantly high and they may end up returning to Quiçama if the area is properly protected and if regulation for the usage of poison is applied.

Regarding **lions (*Panthera leo*)**, no evidence was found during the survey and only a couple of unreliable reports were obtained from human population surveys about recent lion's presence in the south of the park. This species has been most likely out of the Quiçama N.P. system since the 1990's but occasional visits from solitary lions may have occurred since then, mainly coming from the east. No adequate prey for this species, as large game, is currently present in the park (outside the SCA) and therefore its reintroduction would not be viable in a near future.

Evidence of **African wild dogs** (*Lycaon pictus*) was also not found in the park. From local population interviews it is probable that this species became extinct from the system in the 1980's. Nevertheless, some more consistent information was obtained from local communities indicating their presence in the last 10 years in the area east of the park, between Mumbondo and Dondo, in the dense forested areas, but further research is needed to confirm this information.

No information was obtained, or evidence found for the presence of **cheetah** (*Acinonyx jubatus*) in the park. This species most likely disappeared in the 1980's and barely any of the interviewed locals could even differentiate it from the leopard. Although cheetah are notoriously difficult to capture on camera traps or in spoor surveys, and easily evade human detection, there is at this stage nothing to suggest they are still resident in the park, despite it being within their historical range and but further research is recommended, most specifically in the south of the park where it occurred historically (Crawford-Cabral et al, 1990).

### 5.5.3 MEDIUM AND SMALL CARNIVORES

**Side-striped jackal** (*Canis adustus*) was found only in two camera traps (see Figure 57). From the population interviews it can be understood that it is rarely seen and that conflict with livestock such as chickens is not known to happen. This species was better known to the older residents than to the youngest, indicating probably higher abundance in the past. It was concluded that some people call this species 'Mabeco', local name mostly designated for African wild dog and can generate confusion.



FIGURE 57 - SIDE-STRIPED JACKAL CAMERA TRAP PICTURE AT THE CENTRAL EAST SIDE OF THE PARK

When Frade first surveyed the park in 1956, he mentioned the presence of a carnivore named ‘raposa’ in portuguese that he assumed to be the bat-eared fox (*Otocyon megalotis*) (Crawford-Cabral, 1989). Since the area is out of bat-eared fox range, Crawford-Cabral (1989) suggested the carnivore Frade referred to is most probably the side-striped jackal, also known as ‘raposa’ but was not able to collect or record any specimen on its survey. Recently, Braga (2017) also mentioned the presence of a fox only this time the cape fox (*Vulpes chama*), but Quiçama is also out of cape fox distribution range. To our knowledge, this is the first verifiable record of the presence of *Canis adustus* in Quiçama National Park.

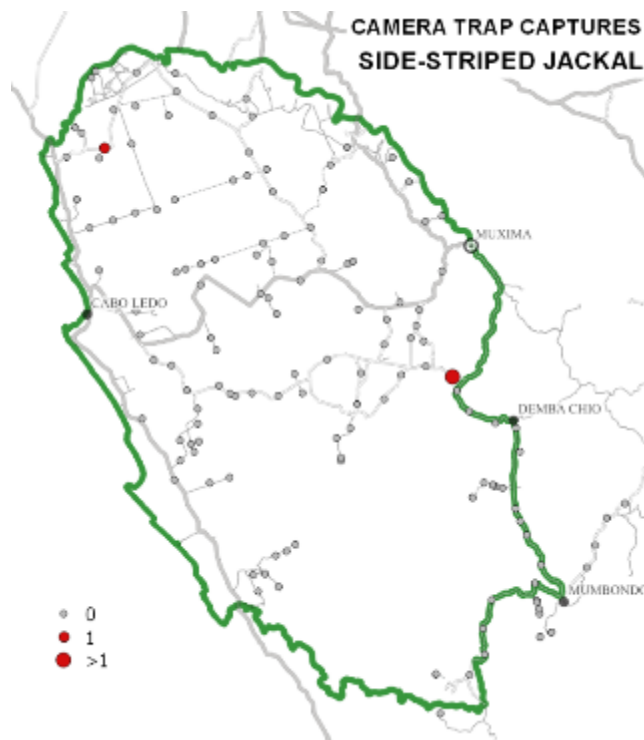


FIGURE 58 - SIDE-STRIPED JACKAL CAMERA TRAP CAPTURES

**Serval** (*Leptailurus serval*) is one of the most widespread carnivore species in the park and is only absent in the denser forest and thickets from the south-east (See Figure 60- top). Some conflicts have been recorded with livestock (mainly chicken) but the species is not specifically persecuted for this reason.



FIGURE 59 - SERVAL PICTURES DURING THE NIGHT (TOP) AND DAY (BOTTOM) FROM CAMERA TRAPS.

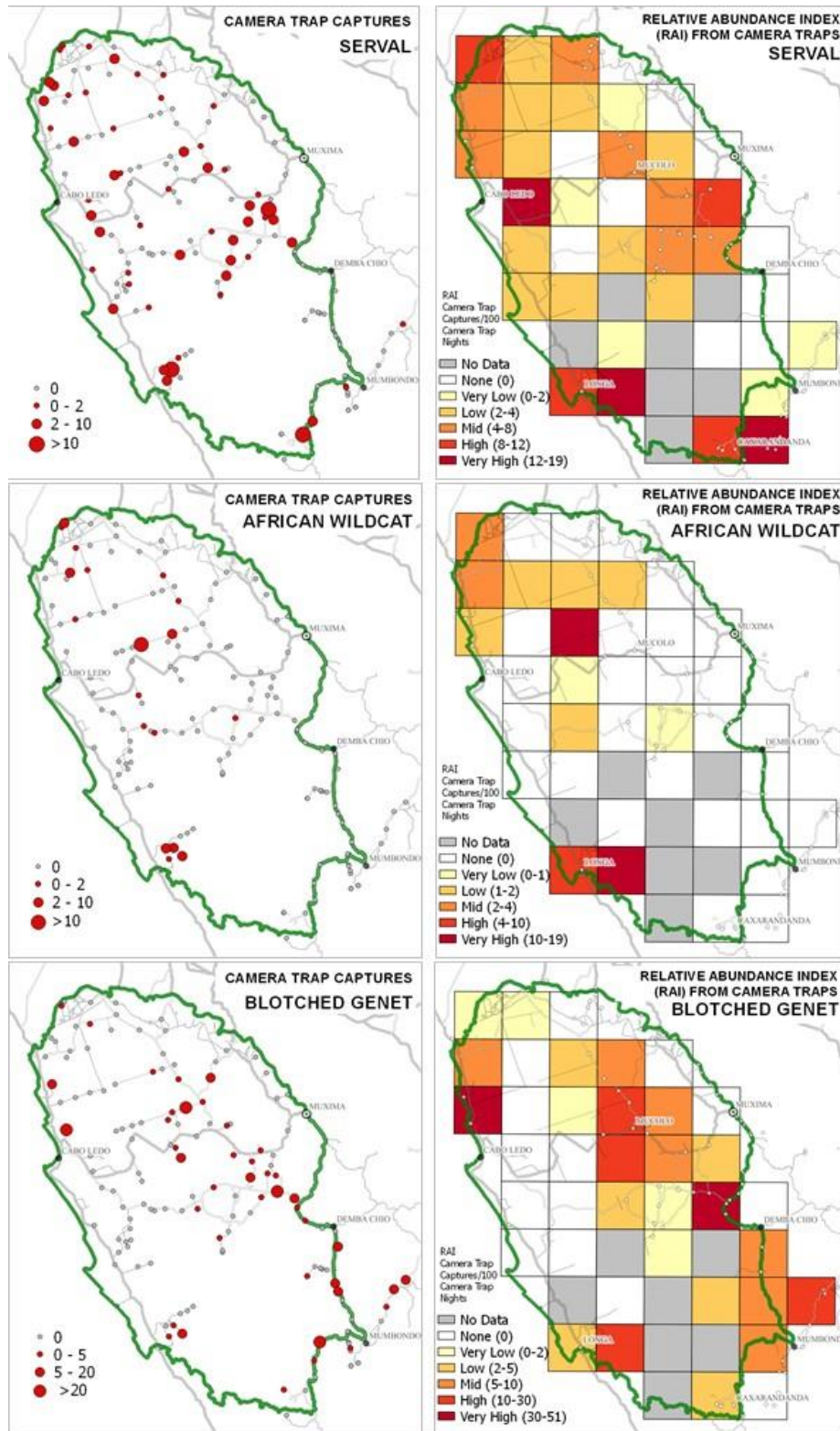


FIGURE 60 - CAMERA TRAP CAPTURES AND RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR SERVAL (TOP), AFRICAN WILDCAT (MIDDLE) AND BLOTCHED GENET (BOTTOM).



**African wild cat** (*Felis silvestris cafer*) was found across the park in low densities with exception of the south-east where is mostly absent. Regular conflicts with chickens were reported by local population but it is not specifically persecuted.



FIGURE 61 - AFRICAN WILDCAT. LIVE PICTURE AT QUIÇAMA N.P.

**Blotched genet** (*Genetta maculata*) is also a widespread species but avoids the large open grasslands from the eastern side of the park (see Figure 60 - bottom). Is one of the most persecuted small carnivore species among local population due to its taste for small livestock and theft habits. It has even been reported several times to enter inside people's houses to steal food.

**African civet** (*Civettictis civetta*) is probably the most widespread and abundant carnivore species in the park. (see Figure 65). Despite its pure nocturnal habits (see Figure 52) its presence can be easily detected by their tracks along the sandy roads and massive latrines here and there (see Figure 64)



FIGURE 62 - BLOTCHED GENET CAMERA TRAP PICTURES



FIGURE 63 - AFRICAN CIVET CAMERA TRAP PICTURES.



FIGURE 64 - AFRICAN CIVET DUNG.

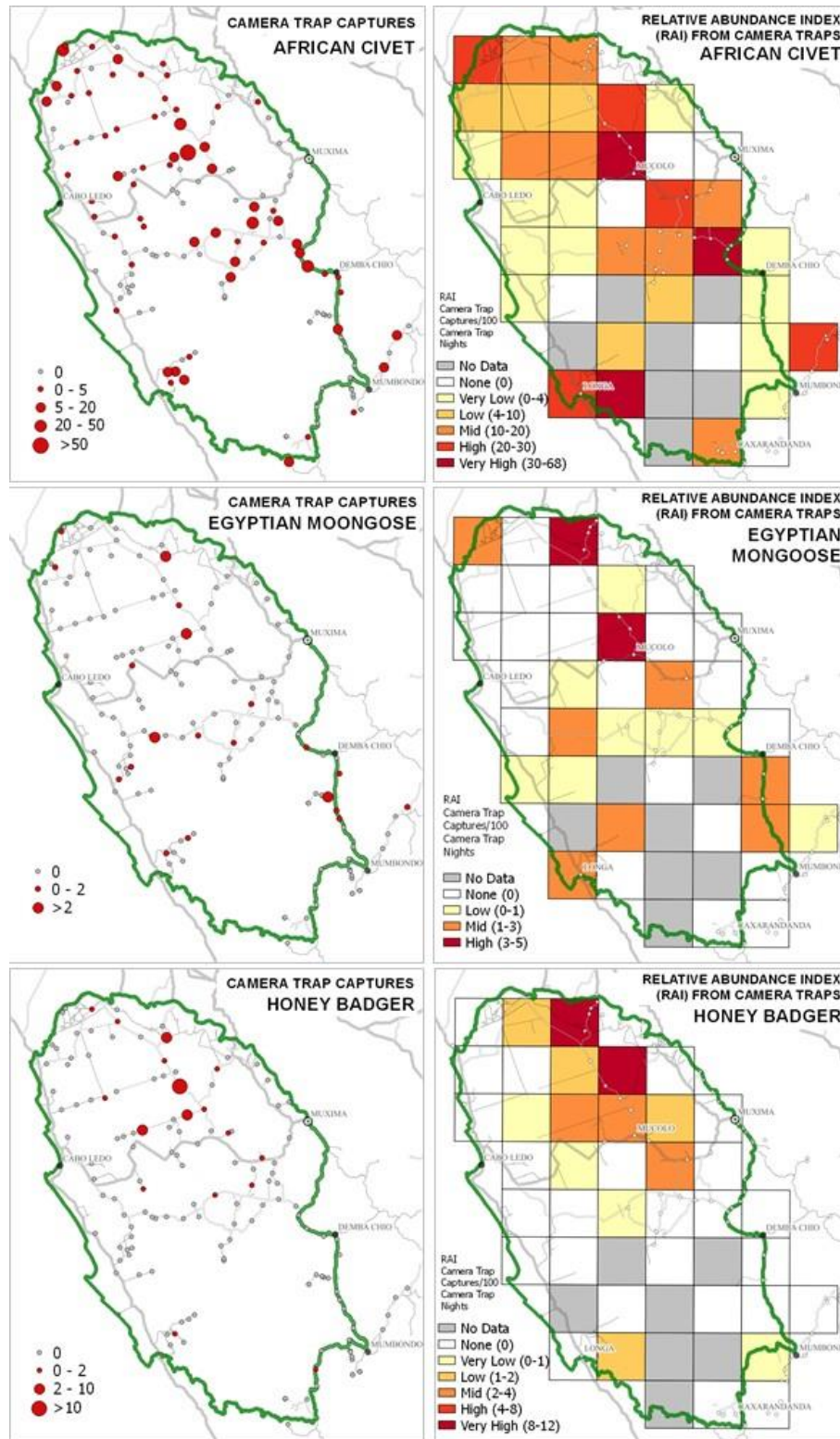


FIGURE 65 - CAMERA TRAP CAPTURES AND RELATIVE ABUNDANCE INDEX (NUMBER OF CAMERA TRAP CAPTURES PER 100 CAMERA TRAP NIGHTS) FOR AFRICAN CIVET (TOP), EGYPTIAN MONGOOSE (MIDDLE) AND HONEY BADGER (BOTTOM).

**Honey badger** (*Mellivora capensis*) is commonly found specially in the northern half of the park (Figure 65) but was rarely directly observed and **Egyptian Mongoose** (*Herpestes ichneumon*) are also common (Figure 65) and were observed crossing the gravel roads in several occasions. **Marsh Mongoose** (*Atilax paludinosus*) was only capture by 2 camera traps, one near Catalangombe outpost in the north and one near the Teque river close to Ngunza in the south-east.



FIGURE 66 - HONEY BADGER CAMERA TRAP PICTURES.



FIGURE 67 - EGYPTIAN MONGOOSE CAMERA TRAP PICTURE.



FIGURE 68 - MARSH MONGOOSE NEAR A PERMANENT STREAM IN NGUNZA. CAMERA TRAP PICTURE

Two **Ansorge's Cusimanse** (*Crossarchus ansorgei*) camera trap images (see Figure 69) were obtained in the south-east as well as a direct observation of a group on about a dozen individuals was made by the field team in the same area. Identification was confirmed by Dr. J. Kingdon and this is a valuable record for Angola since this species is only otherwise known in the country from a single record collected in 1908, at the southernmost part of the Dembos Forest, north of the Cuanza River (Hill et al, 1941; Crawford-Cabral, 1987). Due to the importance of the record, the survey team is preparing a publication together with INBAC.



FIGURE 69 – ANSORGE'S CUSIMANSE CAMERA TRAP PICTURE NEAR CHACA, QUIÇAMA NATIONAL PARK.

## 5.6 PRIMATES

The primate species community in Quiçama National Park is composed by 3 monkeys and 1 galago: the blue monkey, vervet monkey and the Angolan talapoin and the thick-tailed bush galago. It is possible that other galago species exist in the area, but they were never detected. Figure 70 show the camera trap and direct observations distribution for the 3 monkey species.

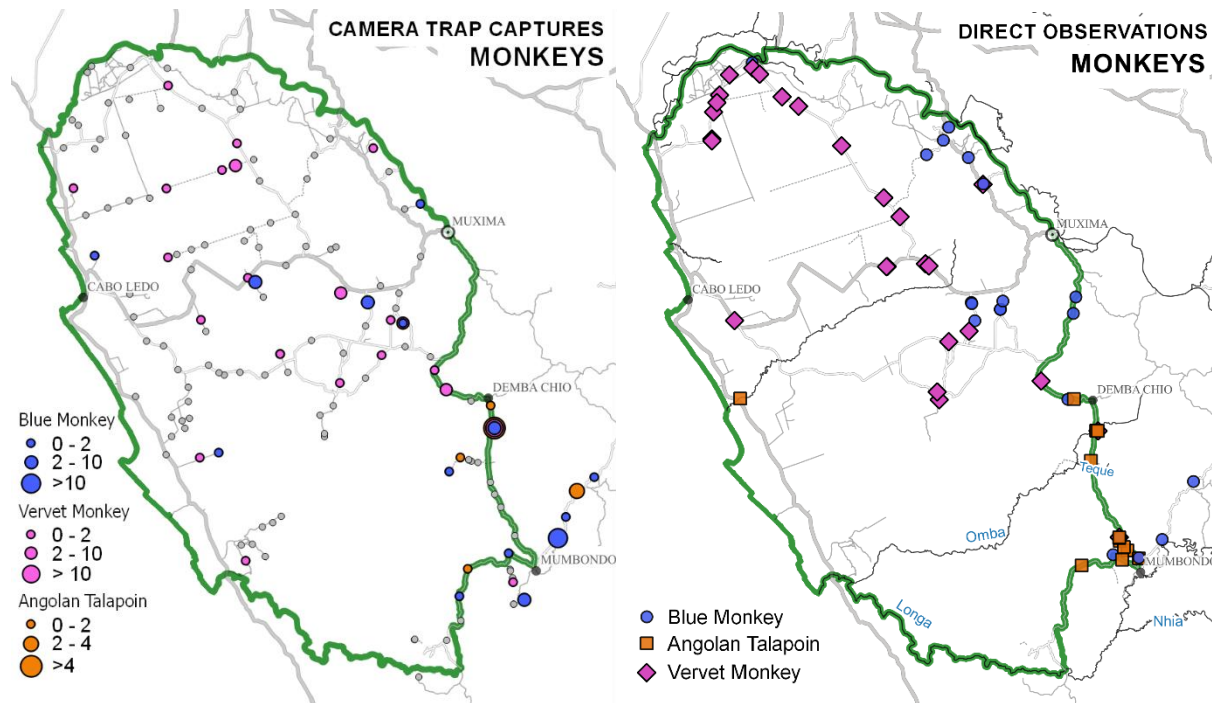


FIGURE 70 – LEFT: MONKEYS SPECIES CAMERA TRAP CAPTURES. RIGHT: DIRECT OBSERVATIONS FOR MONKEYS SPECIES.

**Blue (Pluto) monkey (*Cercopithecus mitis mitis*)** were in general elusive but could be easily observed in the eastern dense forests (see Figure 71). It is the preferred primate species for bushmeat among local population, but this habit was only detected in the north-east area.



FIGURE 71 - BLUE MONKEY NEAR THE SPECIAL CONSERVATION AREA.

**Vervet Monkeys (*Chlorocebus pygerythrus*)** were easily observed across the park preferring savannah woodlands and dry river forest corridors. At the main camp, Cáuá, vervet monkeys have become a problem and are constantly scrapping for food on the litter and among the tourist facilities and kitchens and pose a serious health issue and contribute to the litter dissemination among the whole camp.



FIGURE 72 - VERVET MONKEY SCAVENGING AT THE PARK HEADQUARTERS HOUSES.

**Angolan (southern) talapoin (*Miopithecus talapoin*)** is certainly one of the most emblematic species existing in the park. They are not common but despite their elusiveness, it is not rare to see groups (average 10 individuals) of talapoins in the baobab and commiphora forests of the south-east of the park. Some solitary individuals were also seen foraging in the south-east. A



single group of 15 individuals was observed on the Mienguenge dry river bed forest corridor in central-west side of the park (see Figure 70 - right).



**FIGURE 73 - ANGOLAN (SOUTHERN) TALAPOINS NEAR MUMBONDO.**

**Thick-tailed galago (*Otolemur crassicaudatus*)** is the most elusive primate species due to its arboreal and nocturnal behaviour. Nevertheless, it was observed on 5 occasions while driving during the night due to the bright red glow of their eyes in the car lights and was also captured in 4 camera traps along the central and south-east areas of the park (see Figure 74).

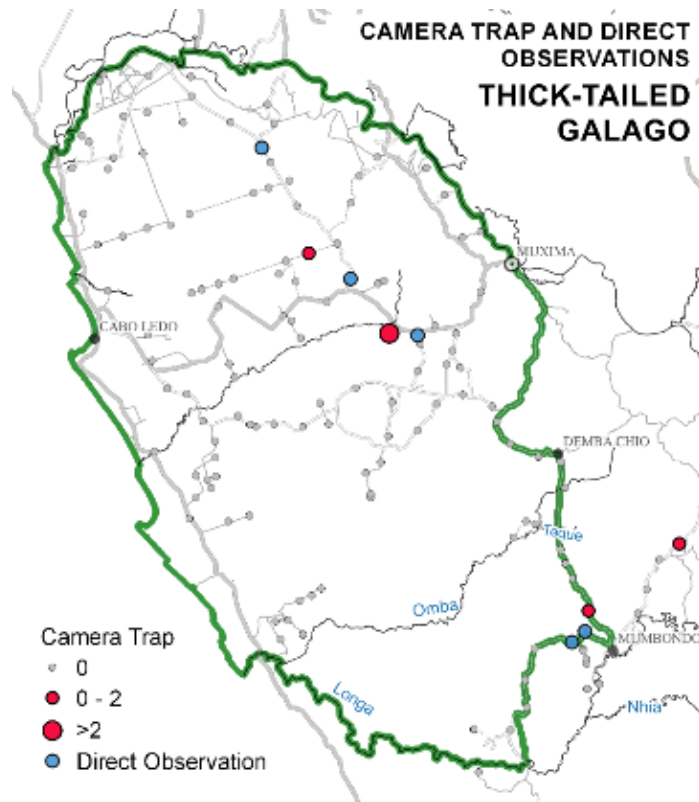


FIGURE 74 - THICK-TAILED GALAGO CAMERA TRAP CAPTURES AND DIRECT OBSERVATIONS.



FIGURE 75 - A THICK-TAILED GALAGO CAPTURED BY A CAMERA TRAP NEAR MUMBONDO



FIGURE 76 - THICK-TAILED GALAGO PICTURE TAKEN NEAR MUNGOLO.

## 5.7 RODENTS AND HARES

Cape Porcupines (*Hystrix africaeaustralis*), Marsh cane rats (*Thryonomys swinderianus*) and African savanna hare (*Lepus victoriae*) are common and present in most of the park areas (see Figure 78) and are easily observed during the night while traveling through the park gravel roads. They are all occasionally hunted for bushmeat by local people and also to prevent crop destruction.



FIGURE 77 - CAPE PORCUPINE CAMERA TRAP PICTURES.

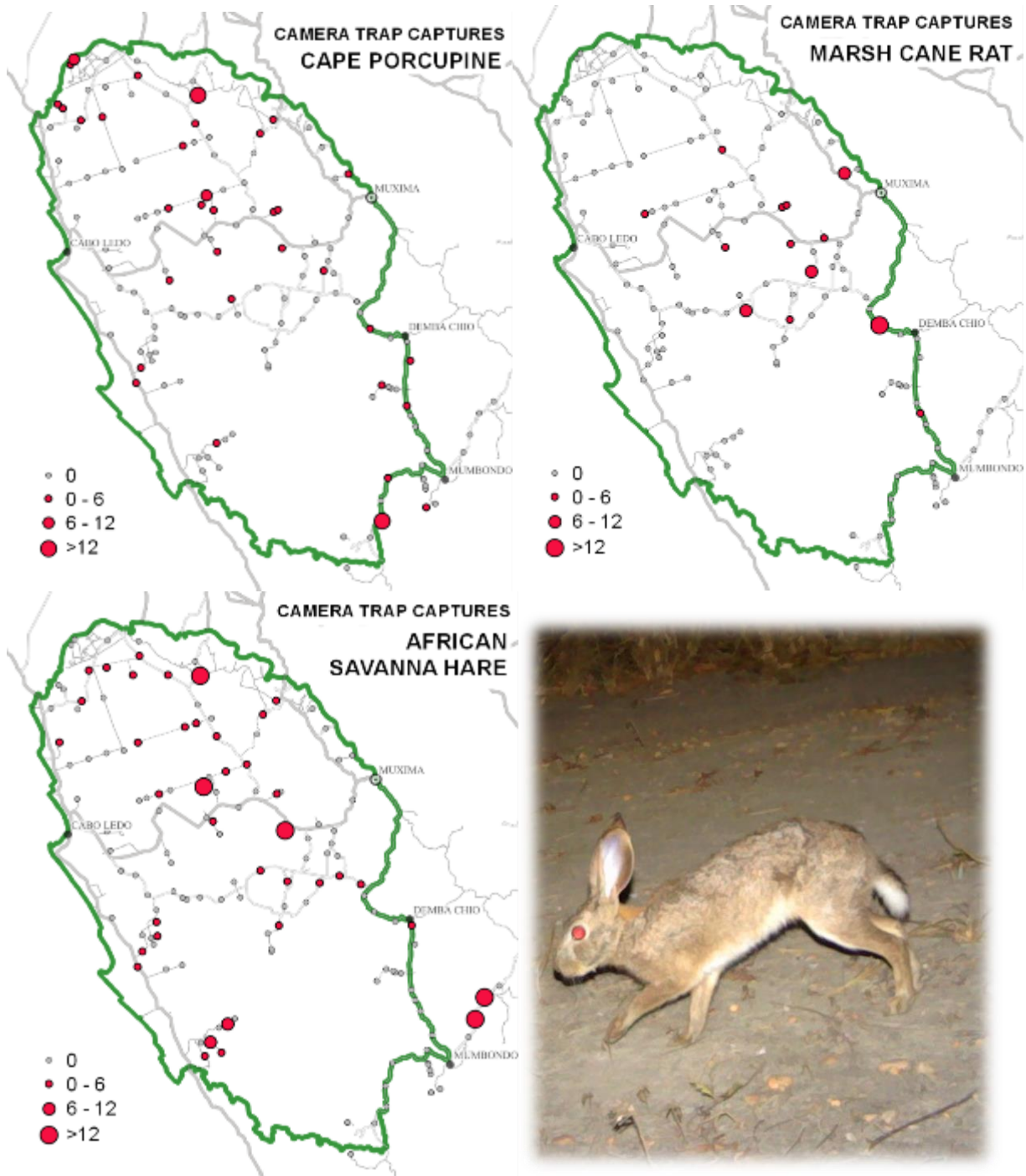


FIGURE 78 - CAMERA TRAP CAPTURES FOR CAPE PORCUPINE, MARSH CANE RAT AND AFRICAN SAVANNA HARE. BOTTOM RIGHT: AFRICAN SAVANNA HARE CAMERA TRAP PICTURE.



FIGURE 79 - A MARSH CANE RAT FAMILY. CAMERA TRAP PICTURE.

## 5.8 WEST AFRICAN MANATEE – *Trichechus senegalensis*

As an aquatic mammal, the west African manatee was not directly studied in this survey. However, a complete study on this species population at the Cuanza river was conducted by Morais et al (2006) and concluded that the population numbers are in fast decline. The main threat is direct poaching as its meat is very valuable among the local population, but also indirect killings by fishing nets happen with frequency. During the population interviews, it was clear that there is still a manatee population in most of the kwanza lagoons and part of the river, but poaching remains a reality and this species must be considered with special attention in the future.

## 5.9 EXOTIC INTRODUCED MAMMALS IN THE SPECIAL CONSERVATION AREA

The introduction of mammal species into the SCA took place in 2001, 2002 and 2014 as detailed in the introduction of this report. A total of 9 exotic species were introduced and this section details the relevant findings about those animals.



FIGURE 80 - A SELECTION OF THE SPECIAL CONSERVATION AREA EXOTIC INTRODUCED MAMMALS. TOP TO RIGHT: YOUNG GIRAFFES, BLESBOKS, BLUE WILDEBEEST, GREATER KUDU, HARTEBEEST, COMMON ZEBRA, NYALA AND IMPALA.

10 **Greater kudu** (*Tragelaphus strepsiceros*) (previously non-native to the park) were introduced in 2000, in 2008 the estimated population was of 50 animals (see Table 3) and in 2014, 14 more animals were introduced into the SCA. Since 2015, when the electric fence stopped working and elephants broke it down in several points, the kudus have been spreading out the SCA. The total population of kudu estimated using distance sampling is of 558 (see Table 13), but this number might be higher since a significant number of animals are now out of the fenced area and this estimate considered only the SCA. Figure 81 shows the kudu tracks and dung, carcasses, camera trap and direct observations in the park, and shows how far south this alien species has been spreading. The carcass found was only from the head, indicating that the animal was most probably poached.

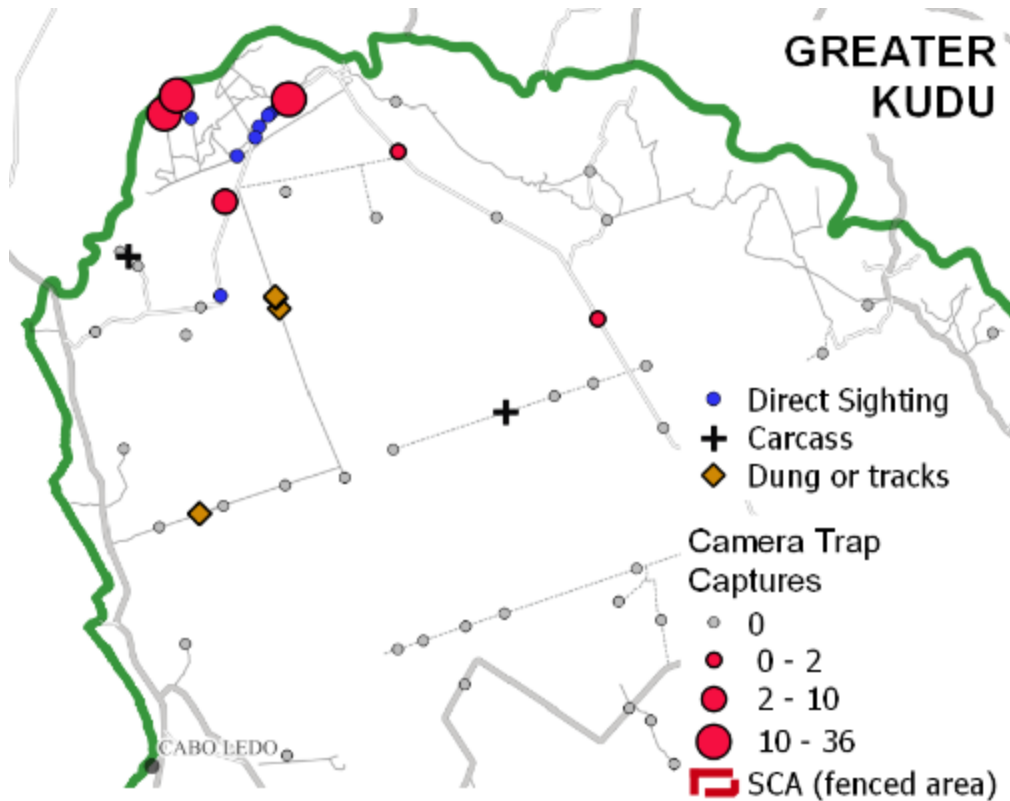


FIGURE 81 - GREATER KUDU OBSERVATIONS SHOWING ITS SPREAD OUTSIDE THE SPECIAL CONSERVATION AREA.

12 **Blue wildebeest** (*Connochaetes taurinus*) (originally non-native) were introduced in 2001. By 2008 their population was estimated at 48 individuals (see Table 3) and 16 more wildebeest were brought in 2015. Our distance sampling estimated a current population of 452 individuals inside the SCA. Only one dung record of blue wildebeest outside the SCA was made, near Catalangombe outpost, indicating some animals are spreading outside the fenced area towards the west.

**Common Zebra** (*Equus quagga burchellii*) (originally non-native) were introduced in 2001, when 14 individuals were transported to the SCA (2 were later reported dead in the river; see Table 2). In 2008, the population was estimated at 45 individuals (see Table 3) and in 2014 sixteen more common zebra were introduced into the SCA. The small number of direct sightings did not allow the estimate of its density. They appeared regularly on the camera traps and despite the broken fence, zebras seem to remain inside the SCA.

**Giraffes (*Giraffa camelopardis*)** (originally non-native) were introduced in the SCA in 2001 with 4 individuals, and in 2008 they had increased to about 11 (see Table 3). The number of observations were insufficient for a current estimate using distance sampling, but evidence of recent reproduction was observed, and the giraffe population is slowly growing. No signs of giraffe breaking outside the SCA were found.

**Impalas (*Aepyceros melampus*), Hartebeest (*Alcelaphus buselaphus*), Waterbuck (*Kobus ellipsiprymnus*), Gemsbok (*Oryx gazella*), Nyala (*Tragelaphus angasii*) and Blesbok (*Damaliscus pygargus*)** that come from the group of South African animals introduced in December 2014, were observed to be present inside the SCA but their low densities and reduced sightings did not allow us to estimate their population.

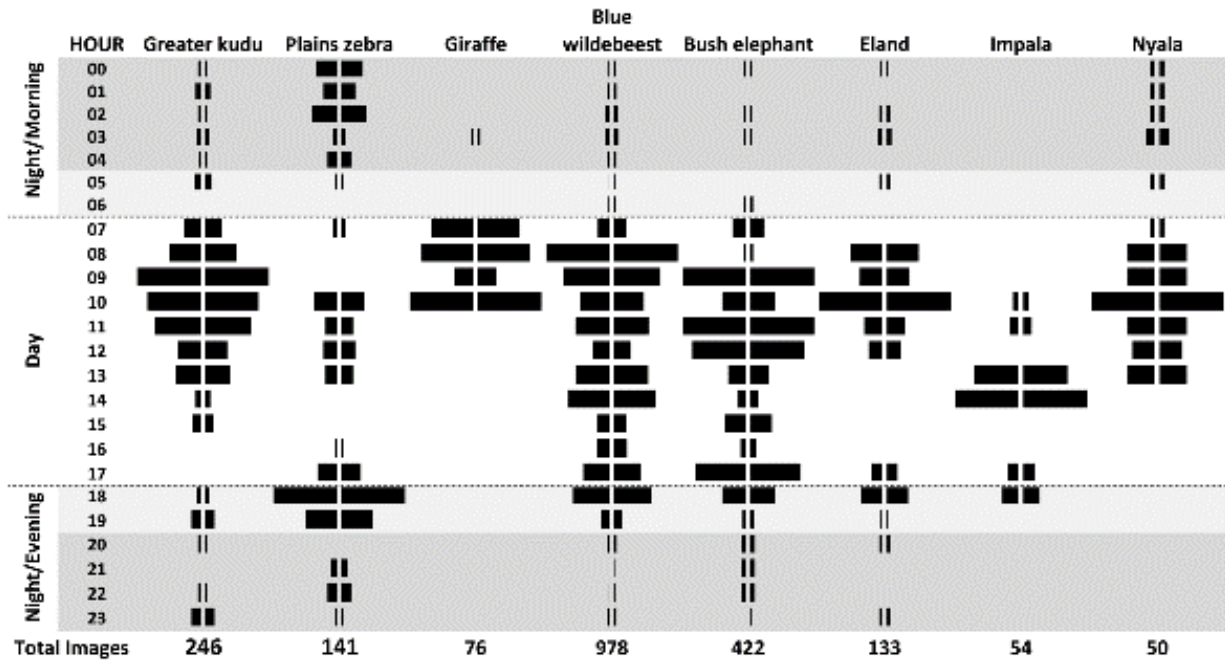


FIGURE 82 -SPECIAL CONSERVATION AREA UNGULATES HOUR PATTERNS ACCORDING TO CAMERA TRAP CAPTURES



## 5.10 COLLATERAL DATA

During the survey period, the team also collected data on bird species present in Quiçama National Park. The dataset on Quiçama avifauna obtained during the survey, consists of 104 records of 66 species and include among others: Martial Eagle (*Polemaetus bellicosus*) (Vulnerable); Bateleur (*Terathopius ecaudatus*) (Near Threatened); the endemic White-fronted Wattle-eye (*Platysteira albifrons*) (Near Threatened); the endemic Gabela Bush-shrike (*Laniarius amboimensis*) (Endangered); Lappet-faced Vulture (*Torgos tracheliotos*) (Endangered), as well as (White-backed Vulture) *Gyps africanus* (Critically Endangered) (IUCN website was used for information on status). The taxonomic identifications of the birds pictures were made or confirmed by Christopher Hines and the compiled list was published by INBAC, through Dr Sango de Sá, on the Global Biodiversity Information Facility – GBIF - and can be accessed in: <https://www.gbif.org/dataset/35f47748-8f91-4cca-9d2c-573ab66078cc>

FIGURE 83 - PIED KINGFISHERS GUARDING THE CUANZA RIVER.



## 6 CATTLE

On the north-west of the park, from the entrance in Bravo 1 to Cabo Ledo, the presence of cattle in Quiçama National Park is an issue that goes back to the 1940's.

When describing his arrival at the park in 1971, Brian Huntley records ‘... in addition to elephant, pacassa, roan, eland, bushbuck and reedbuck, we saw many hundreds, indeed thousands, of cattle grazing on the sweet *Eragrostis superba* grasslands of the prime game areas. All head belonged to one man – Sr. Eurico Abrantes da Mota Veiga... He and his company – Pecuária da Barra do Cuanza (PBC) – had illegally occupied over 100 000 hectares of the park.’ (p. 83). According to the same source, in the 1970's begun what proved to be a long battle to expel the company from the park and ‘on 9 June 1973 the decree expelling PBC from Quiçama was published in the *Boletim Oficial*’ (Huntley, 2017, p. 97).

In 2017, during the survey, the team still found the PBC company and its cattle grazing in the same area. According to the currently ‘self-proclaimed’ PBC manager, Miss Laura, when Mr. Mota Veiga left the country, he gave all documents of the company to its most trustful staff Mr. José Calamba. Mr. Calamba managed PBC without much success until 2015 or 2016 (no precise information) when he passed away. The heirs, his brother and sons, tried to sell the company but were stopped by Miss Laura with the help of the Cabo Ledo police.

Miss Laura, is a Namibian born daughter of one of the older shepherds of the company (no longer alive), and decided PBC was her property but, apparently, has no documentation supporting the fact.

The area occupied by PBC was then divided in two. The side where the stables are, was given away to locals and the current owner is now the same as of the slaughter house ‘Songo’, located in Ramiro locality on the way to Luanda. He holds more than 100 head of cows and an unknown number of goats. The other side of PBC, including what is called the ‘white-house’ and the area extending from the Rio Seco bridge almost until Barra do Cuanza, belongs to Miss Laura and, for the moment, she claims to keep only 40 cows and 40 goats, belonging to General Cruz (that helped her keep the land), but is ‘happy to receive more, just needs a solar

pumped waterhole to be provided by the cattle owner'. Additionally, there is an owner from Luanda that has a great amount of pigs in the same area.

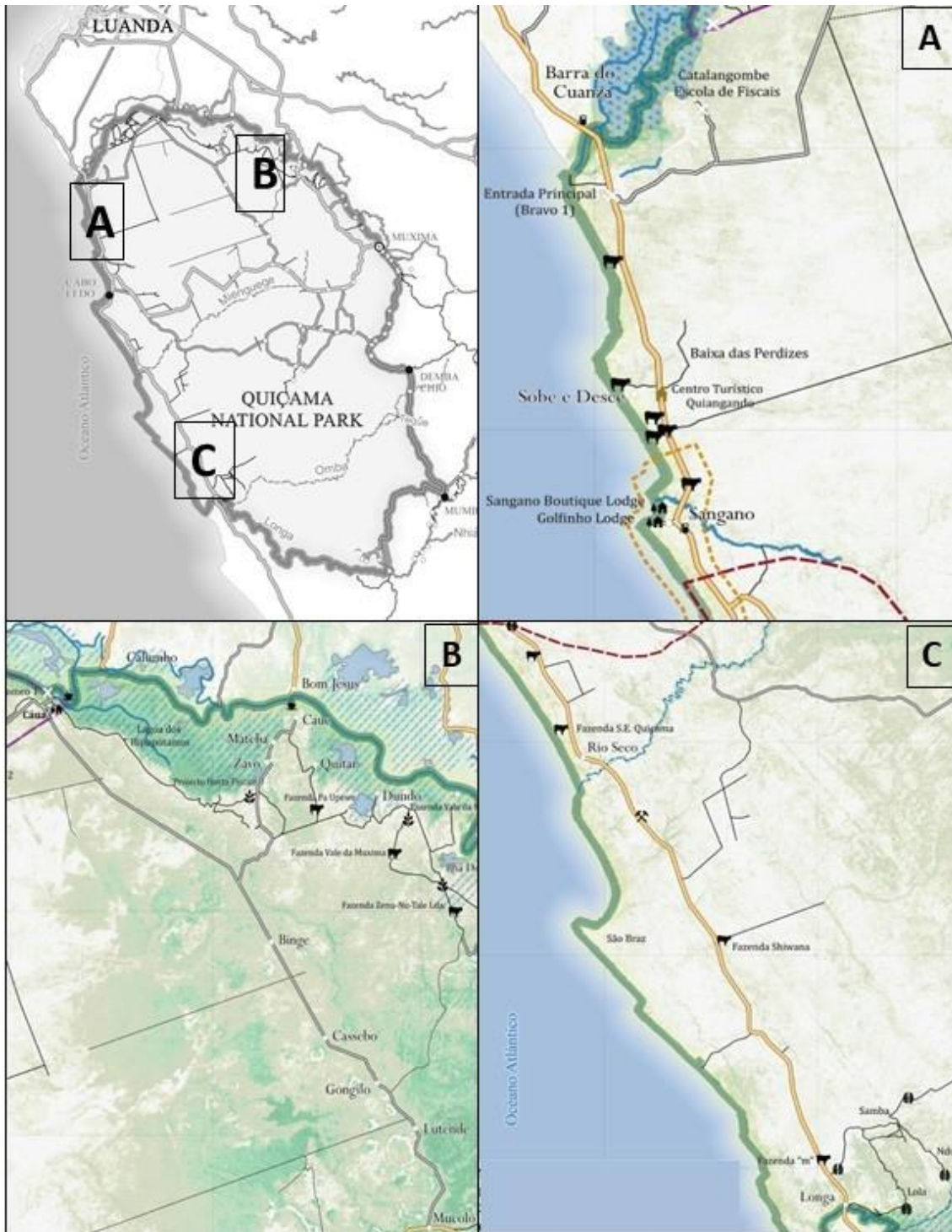


FIGURE 84 - MAP DETAILS FOR THE MAIN CATTLE AREAS IN THE PARK

The number of goat owners in the area is increasing exponentially. During the period of the survey, new farms were being fenced and an estimation of two hundred 200 head of cows and four hundred 400 goats now exists just in the Sobe e Desce area (Figure 84 – Map A)

The number of cattle heads on the gravel road from Cáua to Mucolo is increasing. Most of the kraals are away from the road but the team observed cows in Gongilo and Lutende reported having around 100 goats. The area has around 11 *cacimbas* (natural/human made waterholes) providing water all year round (Figure 84 – Map B).

Since late 2016, the north-east area of the park from Muxima to Bom Jesus, has received an estimated number of at least 2000 head of cattle. The area from Quibala to Bom Jesus reported difficulties with keeping the number of cattle. The farms have no veterinary support or anyone with enough knowledge to diagnose causes of death. As an example, Fazenda Vale da Muxima started with seven hundred fifty (750) goats and suddenly lost about three-hundred (300); Fazenda Pa Upewe started with fifty (50) head of cows and forty (40) died; all without known cause (Figure 84 - Map C). This alerts the concern on the existence of a spreading disease that could potentially affect (or is already affecting) wildlife, therefore proper veterinary control of the commercial farms should be assured if they are to stay in the National Park area.



FIGURE 85 - UNHEALTHY HORSES AT FAZENDA VALE DA MUXIMA

The south-east of the park is characterized by its ‘dry thicket and forest (see Figure 86 and Figure 2) in which the dreaded glossinas – tsetse flies - made their home’ (Huntley, 2017, p.96). The glossinas – ‘*Glossina palpalis*, *G. fuscipes*, *G. morsitans* – are vectors of the parasite *Trypanosoma brucei* that causes *nagana* (sleeping sickness) in cattle’ (Huntley, 2017, p.30), so this area was never traditionally occupied by cattle owners. The survey team

experienced the unpleasant presence of glossinas, many times. The area maintains the absence of cows, a low density of human population and a relatively abundant wild mammal population.



**FIGURE 86 - SOUTH-EAST DRY THICKET AND FORESTS. THE TSETSE FLY HABITAT.**

The south-west of the park, from Rio Seco all the way down to Longa river, is increasing the number of commercial cattle farms. According to information provided by the traditional authority (Soba) in the area, there is an estimated total of 8000 head of cows but this number is increasing every day (Figure 87).

Some of the cattle spends all year round in farms implemented in the area, other cattle come from Kwanza Sul in certain periods of the year to graze in the park, being accommodated in improvised kraals.



FIGURE 87 - CATTLE GRAZING IN THE SOUTH-WEST OF THE PARK

The survey team would like to stress that: 1) this industry doesn't seem to be creating jobs in the local community since almost all the shepherds are from Huíla province; and 2) this activity is contributing to an enlargement on the numbers of people living in the park, since these shepherds mostly decide to stay in the area and start a family.

Also, some of the owners from Kwanza Sul are now negotiating to acquire land inside Quiçama National Park to implement cattle farms, as an attempt to avoid the transhumance.

TABLE 14- NUMBER OF LIVESTOCK IN NORTH, CENTRAL AND SOUTHERN AREAS OF THE PARK

<b>Area</b>	<b>Reported N° of Cows</b>	<b>Reported n° of Goats</b>
North - From Cuanza River to Muxima – Cabo Ledo road	771	1357
Centre – Populated strip south of the Cabo Ledo – Muxima road, along the gravel road.	-	-
South (From Rio Seco, to Longa River)	8000	300

## 7 BUSHMEAT, HUNTING AND POACHING

Poaching is a common practice throughout the park area. Traces of firearms were found along the central and southern areas of the park, with shotgun cartridges (27 in total) being the most commonly found, but also AK bullet shells. 137 wire snares were also found widespread along the park (Figure 88) targeting mainly blue duiker and bushbuck, and when possible, they were removed by the field team. Additionally, the camera traps caught almost 500 pictures of hunting or poaching activities. Figure 89 shows the location and frequency of these activities caught on camera and Figure 90, Figure 93, Figure 96 and Figure 98 show a selection of those images.

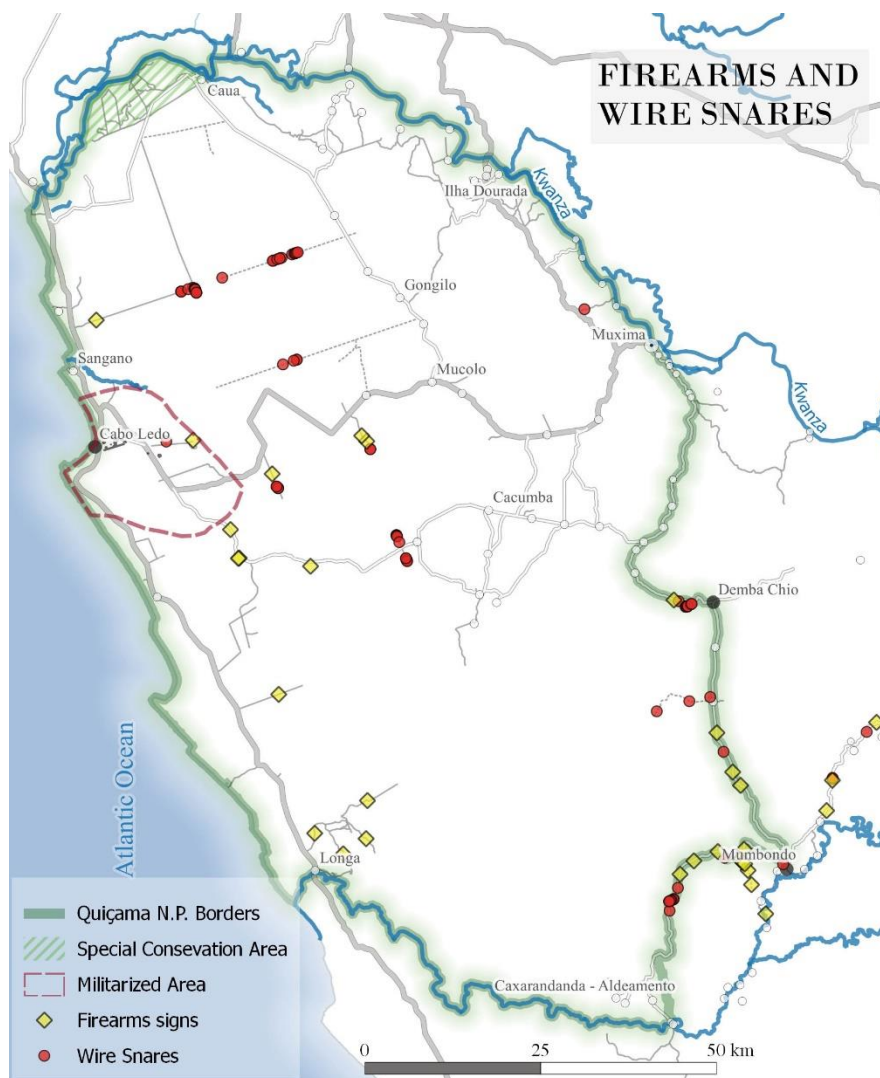


FIGURE 88 - FIRE ARMS AND WIRE SNARES DETECTED DURING THE SURVEY.

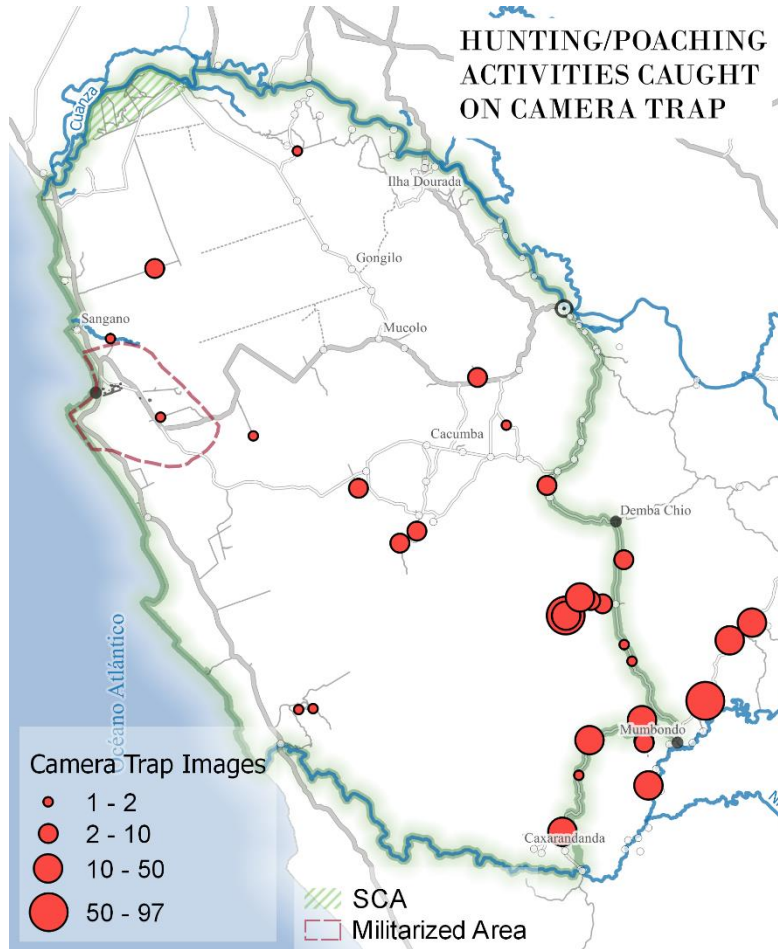


FIGURE 89 - POACHING OR HUNTING ACTIVITIES CAUGHT ON CAMERA TRAP.

The south east area, especially in the Comuna of Mumbondo, is considered as a hunting reserve even by the local administrators. The team observed an AK-47 bullet shell on the floor, just outside the administration. Hunting with wire snares and shotguns is a common accepted activity and carried out by the population as if it was legal. Poachers affirm to have a hunting license expended by local police. Blue duiker, bushbuck and bushpig are the main species poached in the area, but forest buffalo, hippos and reedbucks are also pursued. Any other animal that falls into wire snares are taken for bushmeat as is the case of porcupines, civets or even leopards. Some of the population also have AK war weapons but, opposite to the shotguns, they hide them as they are not ‘legal’ to possess. The hunting activity is extremely organized in this area. Each village has a specific area to hunt and poachers respect each other’s traps, mainly because traps are protected by traditional methods (witchcraft).





FIGURE 90 - POACHERS WITH AK RIFLES AND BUSHMEAT IN NGOLONGOLO.

Many active hunting camps with several drying racks can be found along the park (Figure 91 and Figure 95), with the south east ones being the biggest and most active. The largest hunting camp found is located on a 17 km walk west of Chaca, in a place called NgoloNgolo, where the Omba river keeps small water pools over the dry season. More than forty (40) bushbuck and thirty (30) blue duikers were found drying at just one of the at least 5 detected NgoloNgolo camps. Elephants also use those water pools during the dry season.

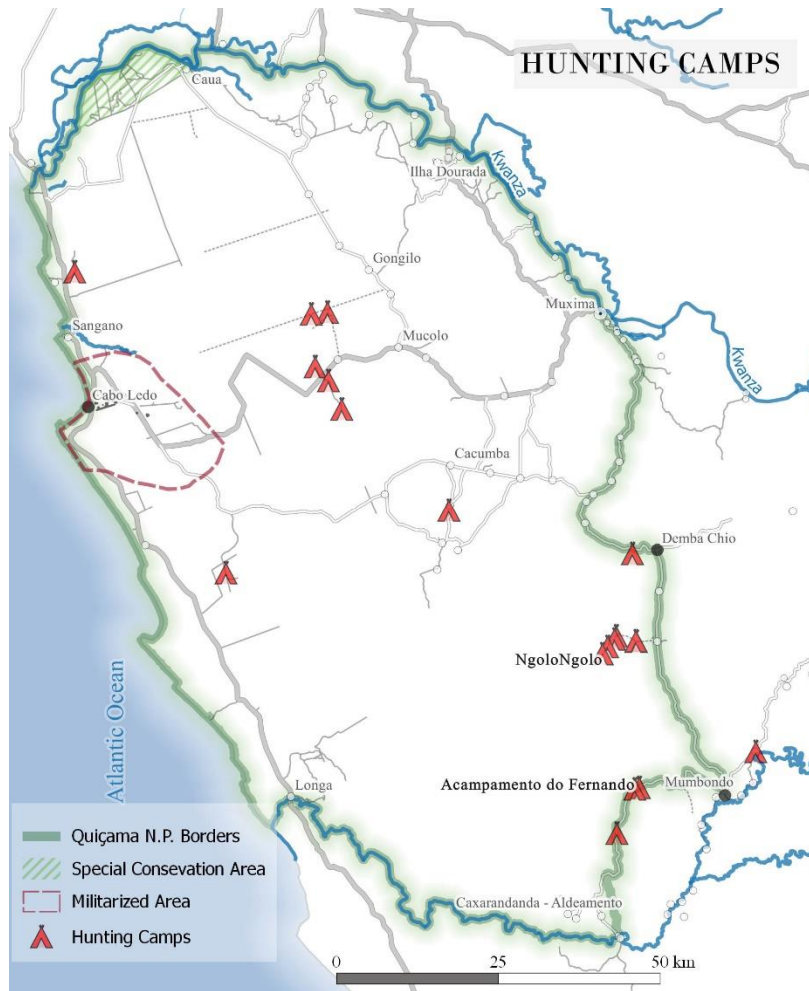


FIGURE 91 - HUNTING CAMPS DETECTED DURING THE SURVEY

Children are initiated early in the art of hunting as can be seen in Figure 92, where the kids were happily saying that since these bikes were offered by the government, they could move and hunt in more distant areas.



FIGURE 92 - KIDS WITH WIRE SNARES NEAR NGUNZA.

'Professional' or trophy hunting activities with hunting rifles takes place in the central and south east areas of the park. According to the local communities, this activity is mainly carried out by Police and Military individuals. Forest buffalo and southern reedbuck are among the preferred targets. To access the area, heavy duty trucks or high clearance vehicles are used along the trails opened few years ago by an oil prospection activity.



**FIGURE 93 - LEFT: MILITARY (ON THE BACKGROUND) WITH AK RIFLE POACHING NEAR CHACA. RIGHT: LOCAL POACHER WITH SHOTGUN NEAR QUILONGA**

Happening at a much smaller scale. But of significant importance, is the poaching occurring inside the Special Conservation Area. Some scouts have clearly identified staff members from the tourism concession that not only poach inside the SCA but are also apparently sending information about patrolling activities to poachers outside the park area. The team did catch on camera trap images a member of the tourism staff riding his bike during the day and night (see Figure 94) on areas that don't lead to the exit. The same staff, that reported to be a scout

previously, was found once, again out of the exit route, and according to him ‘was looking for tracks of an elephant that was moving a lot outside the fenced area’.



FIGURE 94 - CAMERA TRAP IMAGE OF TOURISM CONCESSION STAFF RIDING TO UNAUTHORIZED AREAS



FIGURE 95 - HUNTING CAMP WITH BUSHBUCK AND BLUE DUIKER BUSHMEAT NEAR NGUNZA



FIGURE 96 - POACHING ACTIVITIES CAUGHT ON CAMERA TRAP IN THE SOUTH-EAST

Although some of the poaching is performed by locals for personal consumption, most of the bushmeat is sold to reach bigger markets. Figure 97 shows the main bushmeat hubs and transport routes to the different markets. Luanda has the highest demand of bushmeat while Cabo Ledo, Muxima, Porto Amboim and Dondo have a smaller but significant demand followed by Capolo and Longa. In Luanda, the bushmeat is sold in markets such as ‘Mercado do 30’, among others, and to several hotel restaurants.

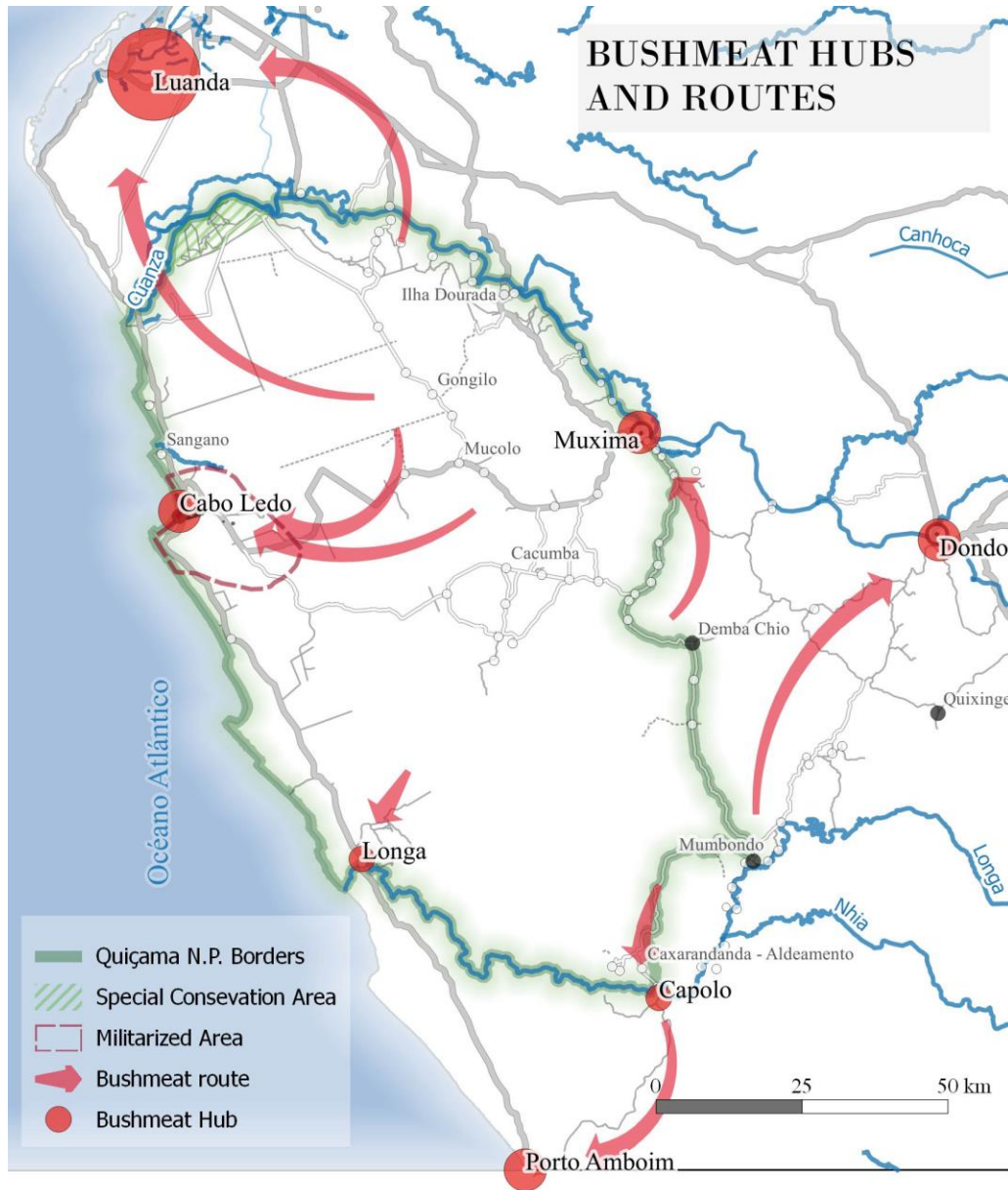


FIGURE 97 - BUSHMEAT ROUTES AND HUBS BASED ON LOCAL POPULATION AND SCOUTS INTERVIEWS



FIGURE 98 - POACHERS CARRYING BUSHMEAT IN QUILONGA

When the poacher is caught by the scouts' team, he is arbitrarily fined by the park administration. By the time of the survey, the administration respected *Diploma Legislativo n° 2873, B.O. I Série, n° 50, de 11 de Dezembro de 1957*, where hunting fines were still defined in 'escudos', the old colonial currency, with a more or less educated exchange rate for kwanzas. Commonly, once a particular fine was defined by the administration, it was negotiated with the family of the poacher as happened in one occasion when a poacher was caught hunting and already carrying four (4) bushbuck, one (1) common duiker and two (2) blue duikers, which were drying on a rack. The fine was calculated in 400.000,00 AKZ (US\$ 1700), negotiated down to 200.000,00 AKZ (US\$ 850), the family ended up paying only 90.000,00 AKZ (US\$ 380) and the man was immediately released.

Quiçama National Park presently has a total force of 30 well trained but poorly equipped scouts, working in shifts of 15 and distributed by the 4 posts inside the SCA (Papa 2, Papa 1, Romeo 1, Cáua) 1 in the main gate 20 km from the fenced area (Bravo 1) and 1 at the school of scouts (Bravo 2 – Catalangombe) in between the main gate and the SCA. There are no other permanent scout bases and patrolling is mainly performed within the SCA and immediate surroundings. To prevent, reduce or eliminate bushmeat poaching in the all park extension,

either a rearrangement of the scouts' team or an increase in the number of scouts will be indispensable. The implementation of an outpost in the Antena settlement would allow the inspection of the heavy-duty trucks (Kamaz/Unimog) coming from the southeast, most probably resulting in the reduction of bushmeat directed to Luanda. It would also be recommended to install checkpoints with sniffer dogs trained to detect bushmeat on all the park exit points.



## 8 LAND OCUPATION AND ECONOMICAL ACTIVITIES

An interview given by the Quiçama Municipality administrator in August 2016 mentioned the poor conditions of roads and the large area occupied by the National Park as the main difficulties of the municipality. For the administrator, the soil in Quiçama is viable to produce everything but access is problematic and a constraint to its economic growth (Angop, 2016).

On the matter of transportation, the team was informed by local administration, that Instituto Nacional de Estradas de Angola (INEA) has plans to rehabilitate and tar the national road EN110 from Muxima to Porto Amboim through Capolo, building a bridge over the Longa River joining Lombela (Caxarandanda) with Capolo. (See Figure 99)

Even with all the difficulties associated with transportation, the area occupied by human population and economic activities inside the national park is increasing exponentially, with the expected negative consequences on the conservation of fauna and flora.

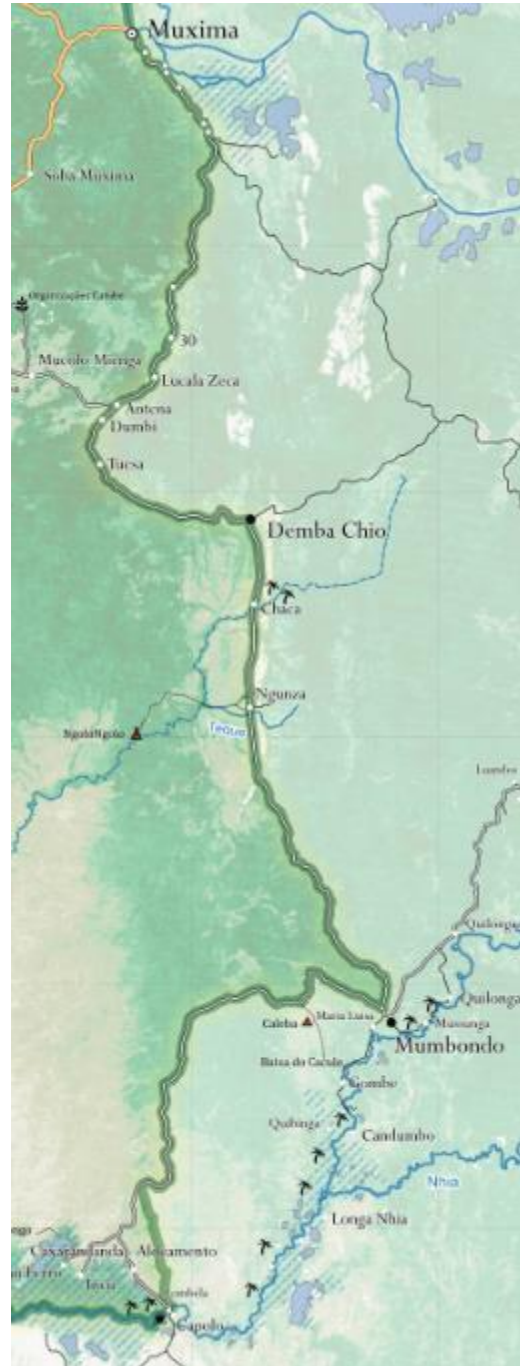


FIGURE 99 - MAP DETAIL SHOWING THE EN110 ROAD FROM MUXIMA TO CAPOLO PLANNED TO BE TARED.

## 8.1 HUMAN POPULATION AND SETTLEMENTS

In the 1970's, around 7000 persons were living in and around Quiçama National Park. Most of these (5500) were concentrated in small villages on the park's borders – Muxima, Chio, Mumbondo, Capolo and along the coast in Cabo Ledo. The rest of the population (1500) was dispersed in small communities of 100 to 250 persons each inside the park borders, concentrated in Galinda, Cassebo, Quimdembele, Mucolo, Cacumba and Gunza Demba (Huntley, 2017, p.33 - See cover map on page 20 for communities' location).

The 2014 census revealed 25086 persons are presently living in Quiçama municipality, which is composed of 5 communities: Cabo Ledo, Muxima, Mumbondo, Demba-Chio and Quixinge. With the exception of the community of Quixinge, all are inside Quiçama National Park.

Even though the larger concentration of human population is on the park's borders, Muxima, Mumbondo, Longa and Cabo Ledo, the number of small communities inside Quiçama has increased as well as the population within each village. Table 15 presents the information given by local authorities regarding the number of persons in each of the small communities visited and where information was provided. According to the different sources, numbers were obtained during the 2014 census and have not been updated but all agreed these should be much higher now due to the high birth rate. The results indicate that the overall population living inside the park as well as the manioc production settlements are growing disorderly.

Infrastructure such as schools or health posts seem to be the main drivers for the growth of population in certain areas. During the survey, the national diamond company of Angola (Endiama) inaugurated a health post and technical school in Chaka, which will most likely lead to an increase in the number of persons in this community in the near future.

Another increase on the population inside the park happened in 2014, when a high number of persons originating from Luanda were translocate to what is now called 'Ilha Dourada'. Most of these population did not adapt well to the area and moved back to Luanda. The remaining are now part of the Caululo community.

**TABLE 15 - POPULATION FOR MOST OF THE COMMUNITIES INSIDE THE PARK ACCORDING TO LOCAL AUTHORITIES INTERVIEWS. INFORMATION ON MUXIMA, CABO LEDO AND LONGA WAS NOT PROVIDED.**

<b>Locality</b>	<b>Area of the park</b>	<b>Population number</b>
Caululo	North	500
Soba Muxima	North	40
Mungolo	North	300
Cassebo	North	30
Mucolo/Cacombe	North	247
Lutende	North	75
Gongilo	North	500
Binge	North	50
Galinda	North	50
Sobe e Desce	North	250
Mateba	North	50
Quitar	North	200
Pitche/Gombe/Camona	Centre	280
Cacumba	Centre	250
Bairro 30	Centre	350
Mumbondo (whole comuna)	South	3596
Rio Seco	South	50
<b>TOTAL</b>		<b>6818</b>

A last note on the human settlements inside the park is related to domestic animals (cats and dogs) which are inevitably part of every small settlement. Most of these animals do not look healthy and have not been vaccinated therefore imposing a health threat not only to humans but also to wildlife.



**FIGURE 100 - UNHEALTHY DOMESTIC DOGS CAN BE FOUND THROUGHOUT THE PARK.**

## 8.2 LARGE SCALE AGRICULTURE: THE CASSAVA PLANTATIONS

The area occupied by farming in Quiçama National Park has increased in the last years. The population clears the land using slash and burn techniques mainly for cassava production. When the soil is exhausted, which can be just after 2 or 3 years from the initial production, the population moves to another area and starts the same process. This is common practice in subsistence farming, where by definition the raised crops are used to maintain the farmer and its family, leaving little surplus for sale or trade, but that's not quite the case in Quiçama. Cassava (*Manihot esculenta*) plantations in Quiçama NP are currently far from being considered subsistence farming. Large areas of the park are being used for production of this crops and its subsequent transformation into flour that nurtures the markets in Luanda.

Along the road from Cabo Ledo to Muxima, the cassava 'lavras' area is increasing in both size and number as shown in Figure 101 - Map A . The population on the gravel road from Cáua to Mucolo has organized in a cooperative and are clearing large areas of forest for agriculture. An even bigger organization, Organizações Catobe, again a cassava business, originated a small village with a bar. A wide gravel road following from close to Soba Muxima to Mucolo-Mienga was implemented to facilitate the transport of products (Figure 102). In the Pitche community (Figure 101 – Sentinel 2 satellite image composites of bands 11-8-2 taken in June 15<sup>th</sup> 2017 showing the cassava plantations extension along 3 different areas of the park: A- the tar road between Cabo Ledo and Muxima; and B – Pitche community in the central area of the park. - Map B), vast areas (more than 70 km<sup>2</sup>) are used for commercial cassava plantations that and most of the resident population are farm workers that came from other provinces.

This business opportunity is favoured and supported by the local administration and is attracting a great amount of potentially new farmers into the area. The owners of the plantations are mainly from Luanda and workers are mostly originated from Huambo and Cuanza Sul provinces, which is contributing for the population growth inside the park but not creating many job opportunities for locals.

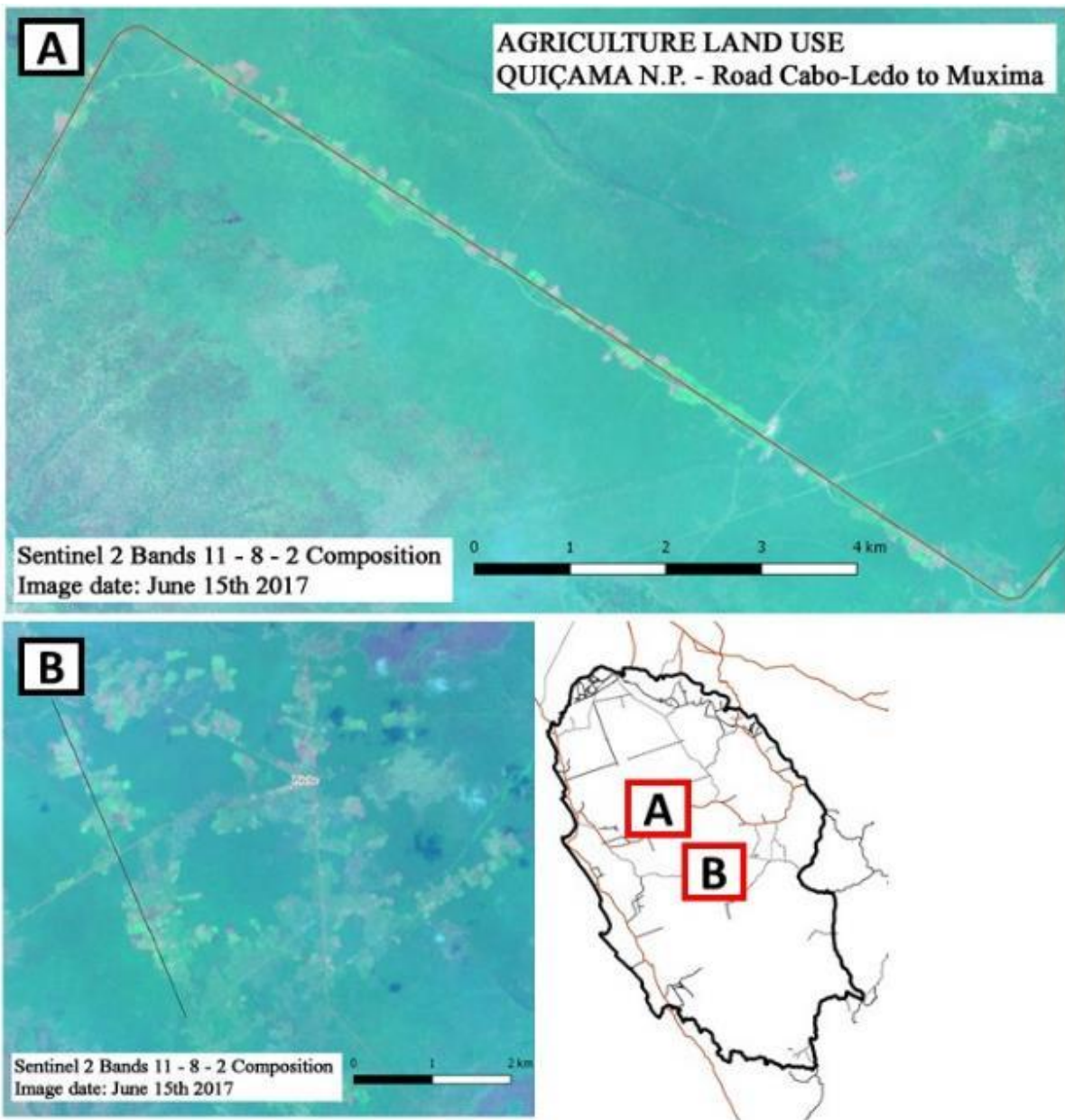


FIGURE 101 – SENTINEL 2 SATELLITE IMAGE COMPOSITES OF BANDS 11-8-2 TAKEN IN JUNE 15<sup>TH</sup> 2017 SHOWING THE CASSAVA PLANTATIONS EXTENSION ALONG 3 DIFFERENT AREAS OF THE PARK: A- THE TAR ROAD BETWEEN CABO LEDO AND MUXIMA; AND B – PITCHÉ COMMUNITY IN THE CENTRAL AREA OF THE PARK.



FIGURE 102 - MAP DETAIL OF ORGANIZAÇÕES CATOBE LOCATION

Closer to rivers, as is the case for Chaka, Mumbondo and Caxarandanda, palm oil, lemon and beans seem to be the main products.



FIGURE 103 - LEFT: MAP DETAIL OF PALM PLANTATIONS IN THE SOUTH-EAST; TOP: ARTISANAL PALM OIL EXTRACTION SYSTEM; BOTTOM: DENSE PALM PLANTATION NEAR CHACA

### 8.3 COMERCIAL FARMS

More recently, by late 2016 according to managers, a collective of commercial farms for cattle and agriculture, has been installed in the northeast of the park (see Figure 105) occupying about 100km<sup>2</sup>. The main products are potato, onions and tomato. All vegetables and meat are frequently transported to the markets in Luanda.



FIGURE 104 - INDUSTRIAL GREENHOUSES IN THE COMMERCIAL FARMING AREA AT THE NORTH-EAST SIDE OF THE PARK

During the survey period alone, the team witnessed the construction in just 2 weeks of a 50km long and at least 10meter wide gravel road, leading to the area of the farms. According to the administrator of the park, farmers did not ask for permission or informed the administration.

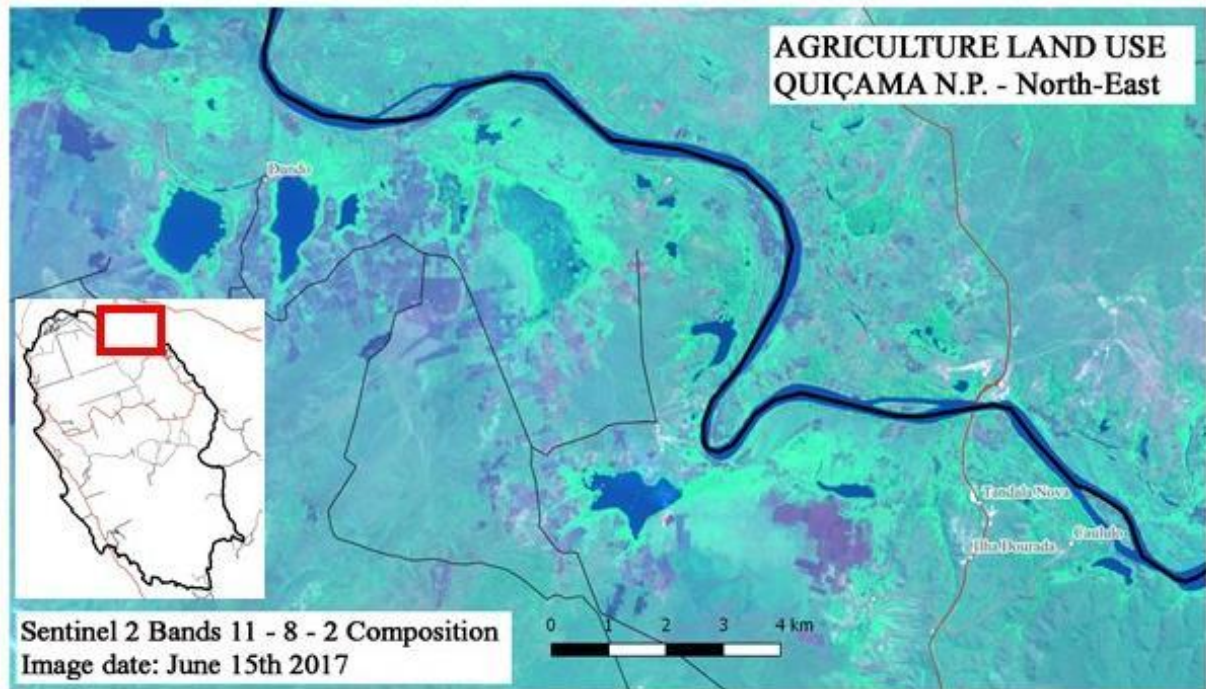


FIGURE 105 – SENTINEL 2 IMAGE COMPOSITE OF BANDS 11-8-2 FROM JUNE 15<sup>TH</sup> 2017 OF THE COMMERCIAL FARMS AT THE NORTH-EAST OF THE PARK.

The team was also informed by a traditional authority that the Muxima administrator has plans to reactivate the industrial cotton production and salt trade inside the park, in Gombe area. Apparently, a team of 15 persons including administration officers visited the salt mines in 2015 to evaluate the possibility of industrial exploitation of the area.

Another largescale agriculture production is also being set up in Ngunza. Fazenda Boa Família is a family business owned by the Demba-Chio administrator with plans for industrial agriculture production and even ecotourism in the near future.



## 9 OTHER HUMAN ACTIVITIES AND IMPACTS

### 9.1 NATURAL RESOURCES EXPLORATION

Baobab fruit and charcoal are two other products being exploited from Quiçama NP. Charcoal is produced in three well defined areas and as expected are provoking great levels of deforestation. The areas close to the military unit are almost exclusively being exploited by the ‘convalescents’ unit. The area south of Rio Seco, has an already diminutive forest that is also been destroyed for charcoal production (see Figure 106 - Left).

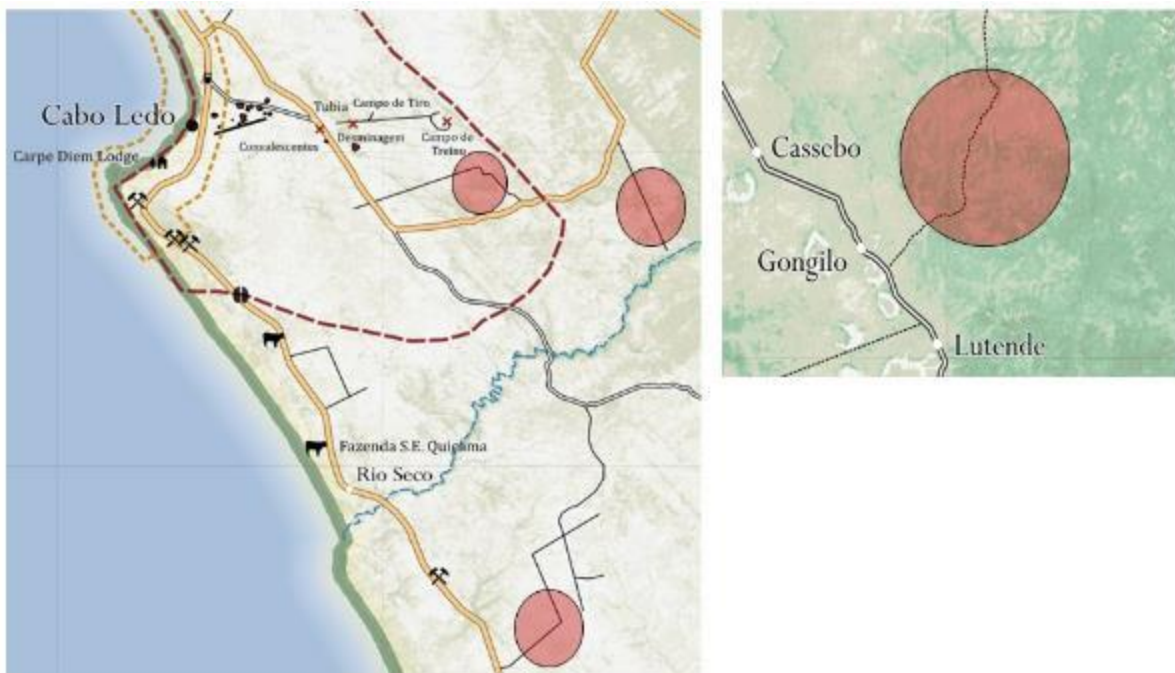


FIGURE 106 - LEFT: INTENSE CHARCOAL EXPLORATION AREAS; RIGHT: ONE OF THE MANY BAOBAB FRUIT EXPLORATION AREAS

Baobab (*Adansonia digitata*) fruit is exploited by the convalescents unit on the same area used for charcoal production and by population on the Cáua-Mucolo road.



**FIGURE 107 - CHARCOAL PRODUCTION IN SOUTH-WEST OF THE PARK.**



**FIGURE 108 - CHIEF SCOUT ERNESTO LUBUQUILO DISMANTLING A BAOBAB FRUIT EXPLORATION CAMP**



FIGURE 109 - CHARCOAL AND BAOBAB FRUIT EXPLORATION

## 9.2 MILITARY

In the community of Cabo Ledo, south of the Cabo Ledo-Muxima road, there is a special forces military unit. The area delimited in red in Figure 110 represents the extent of land ‘officially’ controlled by the military forces inside Quiçama National Park. The old mine-clearing camp has now also been occupied by the military.

Some of the training areas are not correctly indicated which can impose a problem for tourists. For example, while camping in the area to place camera traps, the team was exposed to the sound of gun fire exchange, less than 1km away during the night. Military also obstructed the gravel road leading to Pitche and approached the survey team armed with fully charged AK-47, without any uniform and wearing only jeans shorts, saying the team was not allowed to use that road since it belonged to the military unit. They also affirmed the road was closed for 6 months for training purposes and if the team crossed it would risk being shot.



FIGURE 110 - MAP DETAIL OF MILITARY CONTROLLED AREA

During the time frame of the survey, the team used the opportunity to collect information that is relevant to evaluate the impact of the presence of this unit in the park. For example, close to ‘Campo de tiro Tubia’, the team came across a military man, in his uniform, preparing wire snares to be deployed; on one of the camera traps from Chaka, images caught a uniformed soldier poaching; population from the south mentions soldiers are entering in the Samba area - Longa and cross all the way down almost until Caxarandanda to poach reedbuck; population along the central area of the park, mentioned the ‘Quiçama scouts’ would raid the villages looking for bushmeat and when found would take the meat and demand for the fine to be paid in cassava flour. The population did not see any logo of Ministério do Ambiente on the uniforms but they would affirm to be scouts. After questioning the scouts on this subject, the team realized it was most probably soldiers from this unit since the uniform is the same. This fact is contributing for a growing animosity of the population in this area towards the scouts of Quiçama.

Also, coincidentally, from the 8 camera trap stolen, 6 occurrences were in this area, as well as the camera that was burned.



FIGURE 111 - LEFT: BURNED CAMERA TRAP; RIGHT: STOLEN CAMERA TRAP (STEEL CABLE LEFT BROKEN)

During the survey period, the team also observed: a) military helicopters flying at low altitude in the special conservation area, several times; b) military units entering the park in Bravo 1 and heading to Baixa das Perdizes, for training purposes; c) soldiers in uniform exploiting baobab fruit and producing charcoal.

### 9.3 LODGES

Thanks to its strategic position, Cabo Ledo benefits since 2012 from a Tourism Development Centre, which is boosting the tourism developments in the community. A cluster of existing and in-construction lodges, guesthouses and hotels provides a diversified choice for accommodation and tourism activities, most of the them related to the sea. Some of this accommodation proved to have high quality standards.



FIGURE 112 - BEACH RESORT AT SANGANO

More recently, other areas such as the Cuanza riverbank proved to be an interesting area for tourism developments and lodges are being implemented, as is the case for what is known as *Lodge do Bispo*.

#### 9.4 RECENT LAND OCUPATION PRESSURES ON MAMMALS

It is well known that land use intensification greatly reduces the functional diversity of animal communities and, consequently, impairs ecosystem functions that support human well-being (Flynn et al., 2009). The large-scale agriculture perpetuated in Quiçama National Park seems to prove this true by having a negative impact on the mammal communities.

When interviewed about the presence of mammals in the area, farmers could name species that were present at the time of their arrival and would comment that later those same species could no longer be found. For example, in the area from Caululo to Bom Jesus, locals reported the sighting of herds of reedbuck when they first arrived. Nowadays, these animals or other mammals are hardly seen in the area.

Hippos are also under threat because riverbanks and areas surrounding lagoons are mostly used for agriculture. When hippos come to graze at night, crops are destroyed and the unhappy community place wire snares on the exit used by hippos that then drown in the river or lagoon. The meat is usually consumed locally.

Bushpig is a threat to any crops production. Farmers surround fields with wire snares to prevent crops loss. The consequence of this act is the death of a diversity of mammals, not just the target species. The bushpig caught in the snare is either consumed by locals or sold.

Not at the same extent but also negatively affected are the forest buffalo. According to the population in the south, these mammals evolved a special appetite for beans crops, and farmers protect the field with wire snares.

Deforestation provoked by agriculture or charcoal production causes the loss of habitat having for that reason negative effects on mammals' diversity. The habitat loss negatively affects species richness, population abundance and distribution, genetic diversity, breeding and dispersal success, predation rate and other aspects of animal behaviour that affect foraging success (Fahrig, 2003).

## 10 TOURISM POTENTIAL

While conducting the mammals survey in Quiçama National Park the team used the opportunity to identify additional potential tourism sites throughout the park, i.e. locations aesthetically pleasing to tourists. These sites were noted and mapped (see Figure 113) and special focus was made in the southern areas of the park, which are the most unknown. The information is entirely subjective and should only be used as starting point for future exploration. Tourism development in the park should consider not only socio-economic improvement but also wildlife protection. Tourism trails outside the SCA could be implemented passing through some of the highlighted areas below.



FIGURE 113 - TOURIST POTENTIAL SITES: 1 - SALT MINES, 2- CAXARANDANDA LAGOONS, 3- SOUTH-WEST GRASSLANDS, 4 - MUMBONDI AND LONGA RIVER



## Central Area - Salt Mines

The ancient and historic salt mines of the Quiçama tribe in Gombe represent an incredible attraction for tourists, as well as its guarding mount Tuenza. These deposits of rock salt were once the basis of an important commercial system but nowadays serves only for self-consumption to the people living in this area. To access the salt mines, prior permission must be granted by its Soba Mr. Fonseca. Usually, a guide is arranged to help visitors to get to the parking location and a further hike of about 1,5km is required. The road that goes from Pitche to Gombe crosses a stunning baobab forest and once arrived to the parking area magnificent views await for the visitor, especially during the early morning.



**FIGURE 114 - TOP: VIEW FROM THE SALT MINES PARKING AREA. LEFT: SALT MINES. RIGHT: MINGO, THE GUIDE FROM PITCHE.**

### **Southeast Area - Caxarandanda Lagoons**

Caxarandanda region includes a great part of the lagoon system of the Longa river. These lagoons have a high tourism potential due to its beautiful landscape, hospitality from locals and to the numerous possible activities (e.g. bird watching, dragonfly and damselflies photography, traditional canoe riding, etc.)



**FIGURE 115 - FISHERMEN AT CAXARANDANDA LAGOONS.**

### **Southeast - Mumbondo and Longa river**

The riverine banks of Longa river, all the way from Mumbondo until Lombela are an incredible tourism experience. The beautifully refreshing landscape along the river complements the warm hospitality of the local population. The Baobab forests near Mumbondo offer stunning views and some magnificent walks with high probability of mammals such as bushbuck or blue duiker observation and the potential for well-designed camping sites in this area is enormous. Other than traditional canoe riding and walk safaris, bird watching in this area could be a prodigious activity.



FIGURE 116 – BAOBAB (*ADANSONIA DIGITATA*) FOREST NEAR MUMBONDO.

### **Throughout the Park - Viewpoints**

Quiçama National Park has high number of exquisitely beautiful viewpoints, where a vast horizon of unique landscapes can be observed. Seeing these vast plains reverberating with wildlife would be for sure an unforgettable experience for any national, regional or international tourist.



FIGURE 117 - LONGA RIVER CANOE CROSS AT LOMBELA-CAPOLO



FIGURE 118 - VIEWPOINT IN THE SOUTH-WEST GRASSLANDS OF THE PARK.

## 11 CONCLUSIONS & RECOMENDATIONS

As per IUCN's species conservation planning guidelines (IUCN/SSC, 2008), to effectively manage species conservation, basic information is required on population status and distribution, identification of threats as well as trends of the above. The present report intends to be RWCP's contribution to the effective management and conservation of the mammal community in Quiçama National Park, Angola.

Based on the obtained results, the mammal community in Quiçama National Park is severely jeopardized by poaching, encroachment and habitat loss. Nevertheless, the team does believe that with the appropriate management and protection, this community will be able to gradually recover to at least a portion of the African Eden that it once was. The park is highly fragmented and invaded and most of this won't be reversible but there are still large wilderness areas that can accommodate a healthy population of wildlife, provided the co-existence with humans and protection are ensured.

The current Quiçama National Park large and medium sized terrestrial mammal community is composed by a total of 42 species; 33 native, 2 of which had to be reintroduced, and 9 exotic, artificially reintroduced species.

### 11.1 GENERAL RECOMMENDATIONS

Quiçama National Park would strongly benefit from appropriate law enforcement and enforcement of sensible penalties for infractions, whilst at the same time working with communities to provide alterative livelihoods.

It is highly recommended to identify and secure important habitat zones within the park (particularly riverine areas, forests and sweet grasslands) as well as corridors for wildlife to access key drinking and foraging areas with no human developments, important both for biodiversity conservation and tourism development.

Overall, Quiçama National Park would make an excellent candidate for a co-management model relationship with the private sector to help provide funds and other support to manage and protect the park.

## 11.2 RECOMMENDATIONS: SPECIAL CONSERVATION AREA AND FENCING

The mammal population inside the Special Conservation Area is increasing in numbers and seems to have reached its maximum considering the diminutive dimensions of the area (100 km<sup>2</sup>).

Within the native mammals, the bushbuck (*Tragelaphus scriptus*) density of 20,86/km<sup>2</sup> in the SCA is in the order of what is considered as high density (30/km<sup>2</sup>) in localized areas of favourable habitat (Plumptre, 2013).

Most distressing are the estimated densities for greater kudu (*Tragelaphus strepsiceros*) and blue wildebeest (*Connochaetes taurinus*), which are both exotic animals introduced in the park. Ground counts for greater kudu in high density areas are usually in the order of 4,1/km<sup>2</sup>. Based on direct observations and using distance sampling methodology, the team estimated a density of 5,28/km<sup>2</sup> in the SCA of Quiçama NP for this species. The estimated density of blue wildebeest of 4,28/km<sup>2</sup> can also be considered as significantly greater than desirable, considering their alien status. As a comparative measure, density of blue wildebeest in Kruger NP in South Africa is close to 1,3/km<sup>2</sup>, and in Tarangire, Tanzania, density is 3,6/km<sup>2</sup> (Estes, 2013). In Quiçama therefore, these exotic species are already reaching unnaturally high population densities which will have consequences for native species.

Signs of overgrazing inside the SCA are already evident and animals are frequently observed escaping the area, presumably to look for nourishment, and escape overcrowding. Since the fence is no longer electrified, some of the animals escape easily while others, unfortunately, remain stuck in the wires and eventually die or at very least get injured (see Figure 119). More than 10 animal carcasses trapped in the fence wires were observed by the field team on the first day of survey in the area, and scouts reported injured kudu's during the survey period.



**FIGURE 119 – LEFT: BLUE WILDEBEEST STANDING NEXT TO BROKEN FENCE IN THE SPECIAL CONSERVATION AREA. RIGHT: CARCASS OF SAME SPECIES TRAPPED IN THE FENCE**

Among the animals escaping the fenced area are the greater kudu (*Tragelaphus strepsiceros*). Since these are an exotic species to the Quiçama system, the conservation problem associated with this fact should be taken into account. It is acknowledged that non-indigenous ungulate species can alter habitat and ecosystem functionality and potentially hybridize with indigenous species. Non-indigenous ungulate species are also known to promote invasive plant species in addition to provoking extirpation of native plant species (Spear et al., 2009).

If the exotic animals are to be kept in the Quiçama SCA, it is recommended that the fence is repaired to contain the exotic species and prevent further damage. Furthermore, the growth rate of the populations of exotic species should be taken into account and the fenced area should be expanded considering it.

A last note regarding the Special Conservation Area refers to the high number of road kills and uncontrolled movements from visitors and tourism concession staff.

During the survey period in the northern area, the team observed a high number of road kills, coincident with the increase of visitation numbers on weekends (average 2 roadkill animals per weekend). Visitors were observed driving at high speed all the way from Bravo 1 to Cáua. Several blue duikers, common duikers, African civets and genets were run over by cars. Since the road is already wide enough to allow good side visibility of moving animals but accidents are still frequent, it is highly recommended that visitors are incentivized at the entrance to keep up with the regulated maximum speeds. As an additional safety measure, the placement

of effective speed humps along this road, especially in the long straight sections of it is recommended.



FIGURE 120 - ROADKILLS IN THE MAIN ROAD TO CÁUA. LEFT TO RIGHT: GENET, BLUE DUIKER AND COMMON DUIKER LAMB.

Tourists were frequently observed driving and parking the car wherever they found suitable, inside the SCA. The tourism concession vehicle also frequently followed random routes, driving through the bush to follow a particular animal. This behaviour results not just in the damage of the landscape but, in several occasions, on flat tires or other mechanical problems, forcing tourists to walk back, sometimes for more than five km to Cáua, since no communications system was secured.

It is recommended that the administration identifies and clearly marks tourism routes to be used by individual tourists and some more exclusive ones only allowed to appropriately authorized tourism operators, including the one currently managing Cáua.



FIGURE 121 - TOURIST OPERATOR TRUCK BROKE IN SEVERAL OCCASIONS IN THE MIDDLE OF A TOUR



### 11.3 RECOMMENDATIONS: ALIEN MAMMAL SPECIES

It is highly recommended that alien species are removed from Quiçama National Park as far as possible, including greater kudu, blue wildebeest and common zebra in the SCA.

The healthy populations of alien introduced species in the Quiçama National Park system potentially represent a good opportunity for MINAMB for repopulating other Angolan National Parks where historically occurring populations of these species were decimated during the civil war and are now still recovering (see Table 16), provided its historical occurrence in the area is proved and appropriate protection is safeguarded.

TABLE 16 - EXOTIC SPECIES IN QUIÇAMA N.P. AND THEIR HISTORICAL RANGE WITHIN ANGOLA PROTECTED AREAS (PAS).

<b>Exotic species to Quiçama N.P.</b>	<b>Historical occurrence of species in Angola PAs.</b>
Greater kudu ( <i>Tragelaphus strepsiceros</i> )	Bicuar, Iona and Mupa National Parks; Moçâmedes, Mavinga and Luiana Partial Reserves
Zebra ( <i>Equus quagga burchellii</i> )	Bicuar NP, Iona NP, Namibe Reserve
Giraffe ( <i>Giraffa camelopardalis</i> )	Mupa NP, Cuando-Cubango region (Mucusso and Tchimporo)
Blue wildebeest ( <i>Connochaetes taurinus</i> )	Bicuar NP and possibly Cameia NP
Blesbok ( <i>Damaliscus pygargus</i> )	Distribution range does not include Angola. Blesbok was historically confined to South Africa.
Impala ( <i>Aepyceros melampus</i> )	Maving and Luiana Partial Reserves
Nyala ( <i>Tragelaphus angasii</i> )	Distribution range does not include Angola. Nyala's natural range comprises south-eastern Africa: Malawi; Mozambique; South Africa; Zimbabwe
Hartebeest ( <i>Alcelaphus buselaphus</i> )	Mupa NP, Tchimporo
Gemsbok ( <i>Oryx gazella</i> )	Iona NP, Moçâmedes Partial Reserve

\*Consulted bibliography: Estes, 1989; Huntley, 1971

As an alternative, these exotic species could be sold to private wildlife farms, generating revenue for the park to help other conservation activities. It is recommended that roan antelope is reintroduced to the area since is one of the original large mammal species from the park that has already gone extinct.

It is recommended to monitor the expansion of alien species such as kudu outside the SCA.

## 11.4 RECOMMENDATIONS: MAMMAL COMMUNITY OUTSIDE THE SCA AND POACHING

The remnant mammal population outside the SCA is at high risk of becoming extinct in the near future. The population survey results indicate that mainly due to the economic crisis, poaching for consumption or bushmeat sale became the fastest and easiest survival and monetary solution, not just for locals but also for those that had move to the capital (Luanda) and are unemployed.

The area between Cáua and Mucolo is among the areas more frequently patrolled by park scouts due to its proximity to the main camp and to the intensity of poaching perpetuated by locals. The inauguration of a school and health post in Gongilo contributed to the growth of this community, well known for its confrontations with scouts. The hunting habits of the village were well evident by the amount of wire snares the team found in the area. During the survey period, one camera trap was destroyed, and one SD card was stolen from a camera, both occurrences in the area known to be frequented by Gongilo poachers. The theft of just the SD card indicates the thief had some knowledge on how to operate these cameras. Trees were chopped and placed to obstruct trails. Also, on one occasion, the population set fire to the trail the team was using while riding a motorbike to place cameras on a remote area. This community was generally not supportive of the field work and its extreme poaching activity represents a threat to the mammal community and also to the scouts of Quiçama NP.



FIGURE 122 – LADY FROM GONGILO SETTING A FIRE AT THE ROAD NEAR A CROP FIELD

At least 1/3 of the park (south-east) was never patrolled by scouts in the last years and another 1/3 (south-west) is patrolled very sporadically now that a vehicle is available, approximately twice per year. This fact, together with the hunting habits of local inhabitants and military units, has contributed to a pronounced reduction in the numbers of mammals. Even though there are no studies on population densities variation, locals and poachers seem to agree that the density of almost all mammal species is decreasing.

Poaching levels in the south-east are enormous and uncontrolled but believed by locals to be legal. Local police are apparently providing the necessary hunting licenses but these can also be easily requested online on *Portal do cidadão* (<http://www.cidadao.gov.ao/VerServico.aspx?id=334>) and are attributed by Instituto de Desenvolvimento Florestal – IDF, that depends on the Agriculture Ministry.

According to the present *‘Lei de bases da floresta e vida selvagem, Lei nº 6/17 de 24 de Janeiro’* (Diário da República I Série – nº 13, de 24 de Janeiro, p. 217-256), poaching is absolutely prohibited inside conservation areas [Artigo 163.º - Infracções graves, 2. o)]. These laws need to start being enforced properly and carefully and throughout the park.

Currently, hunting outside conservation areas is permitted once the necessary license is attributed. Severe infractions to the law include, among others: a) the mutilation of animals or abandonment of injured animals owed to hunting; b) the hunting of females in reproductive age, pregnant or accompanied by offspring; c) hunting during the reproductive season; d) hunting with traps such as nets, gin traps or wire snares; e) the usage of artificial lights to illuminate the targets; f) ambush hunting, as in at waterholes; g) the usage of high calibre firearms.

While doing the mammal survey in Quiçama National Park, in several locations and occasions, the field team witnessed live, or in camera trap images, to the happening of all these infractions.

Seeing the present scenario in the south-east of the park, where hunting is intense and well accepted among local authorities since the park administration has been absent from the area,

it seems unrealistic to consider forbidding all poaching at once, but the administration could, for e.g. implement environmental awareness programs with the communities in the south, explaining to the resident population why this measure is necessary, prior to any changes on what is now the hunting system. This action should be accompanied by the application of serious penalties on poaching of species such as hippo, forest buffalo, elephant and reedbeek. That list can then slowly be expanded, until all poaching is illegal, and communities have other livelihoods and/or have moved out of the areas.

For this area only and with the right regulation, traditional hunting (with weapons rather than snares could be allowed) – but just enough for meeting local protein requirements. Every effort needs to be made to stop commercial bushmeat hunting and posterior export to towns and cities – these actions may need concurrent effort to prevent establishments in Luanda and any other localities from buying and selling bushmeat.

In the absence of bushmeat, it is imperative to contemplate other livelihoods and protein sources for the resident population. Activities like bee-keeping, keeping poultry, etc. should also be encouraged.

Employing community game guards would help to reduce poaching levels while at the same time create job opportunities. Given the tourism potential of the southern part of the park and if tourism is implemented, it should be mandatory to employ locals as well as encouraging the creation of fully community-owned campsites.

## 11.5 RECOMMENDATIONS: NATIVE ELEPHANT POPULATION

Other than the population of re-introduced elephants in the SCA, southern Quiçama seems to have a significant remnant population of the elephants indigenous to the system. These populations make use of the south east area of the park and the adjoining forested areas south east of the park borders for protection. Water resources on the southeast area of the park and further close to Cuanza river outside the park borders, seem important to sustain these animals during the dry season. It is recommended to pursue further research, making use of DNA

analysis, to determine if this population is composed by *Loxodonta africana* or *Loxodonta cyclotis* (forest elephant) or both. Considering the existing pressures on mammal species in the area, an environmental awareness program would positively contribute to the conservation of this remnant population of elephants.

## 11.6 RECOMMENDATIONS: HIPPOPOTAMUS

The hippo populations in Quiçama National Park are small, dispersed and highly threatened. Hippos are persecuted for crops destruction and consequently poached with wire snares and even firearm traps. In order to improve its conservation status, an awareness project directed to the resident population should be implemented in the northeast and southeast areas of the park, aiming to directly involve the population on the protection of this species. Additionally, patrolling of this area will be essential to ensure protection.

## 11.7 RECOMMENDATIONS: FOREST BUFFALO

One of the emblematic mammals of the Quiçama National Park system is the forest buffalo, being in fact its present symbol. As mentioned in the bibliographic revision, huge herds of this species used to graze in the park. According to the results of this survey, the forest buffalo community in the park, will most likely become extinct in the near future if no action is taken urgently to prevent that from happening. Small sized and dispersed populations of this mammal species are still present in the south east of the park. The team believes that a first and vital step for its conservation would be to ensured protection in the area. Taking into account that the area was never patrolled for the last years, prior to any 'fully armed' presence of scouts, an environmental education program to friendly inform the local population, administrations and traditional authorities, on the parks borders and current legislation, should take place. The population in the south east was extremely supportive of the field work. As an example, when the field team was retracting the camera traps, a member of the southern community came in distress, riding fast on his bike, because he was passing on the road and the cameras were no longer there. A whole group of people was already organizing to go and look for the cameras!

Such proactive and positive attitude, together with the invaluable knowledge some members have on the area, if well guided, are advantages that should be used in favour of the forest buffalo conservation.

If the south east Quiçama forest buffalos are to be relocated to the SCA, a carefully designed plan must be elaborated with a specialist in buffalo and animal relocation. The fact that the forest buffalo population is so fragile and fragmented (herds of 6 individuals maximum) should be considered to ensure the southern population does not become inviable after the removal of some individuals. Therefore, we recommend the implementation of a strong conservation programme in the south prior to any animal relocation and to work directly with the communities in the south since they can easily trace the buffalos and know well their activity patterns.

## **11.8 RECOMMENDATIONS: SOUTHERN REEDBUCK**

As a prevention measure, the remnant population of southern reedbuck should generally be considered as threatened. The population survey made clear the decline on this species density over the years, leading almost to its extinction in the northeast of the park. The species is highly valuable in the bushmeat market and its meat is the preferred for auto-consumption. Patrolling of the areas where the species can be found and ensuring its protection will be essential to improve its conservation status.

## **11.9 RECOMMENDATIONS: ELAND AND ROAN ANTELOPE**

Healthy herds of both eland and roan antelope could be observed in Quiçama NP before the civil war decimated its populations. Since the population of re-introduced elands in the SCA seems to be growing considerably well, these animals could be released outside the fenced area to repopulate other areas. In the future, if existing populations of roan antelope from other protected areas in Angola increase sufficiently in numbers and management of these is necessary, a repopulation of Quiçama NP could be considered. Any of these actions should only be taken into consideration if the necessary protection and management is ensured.

### 11.10 RECOMMENDATIONS: BUSHBUCK, BLUE DUIKER AND COMMON DUIKER

Bushbuck and blue duiker are the most widespread and abundant ungulate species in almost all of Quiçama National Park, while common duiker is mostly confined to the western side of the park. These ungulate species are also the most targeted for poaching, so even though healthy populations seem to exist currently, the results of this survey indicate numbers are declining, and the threat will continue to increase as the human population in the park continues to increase. Intense and continuous patrolling of the areas or routes clearly defined as being used by poachers will ensure the necessary protection and contribute to an increase in populations numbers, which consequently will improve its conservation status. It is also important to mention that higher numbers of wildlife that can be observed by tourists will immensely benefit the park in the near future.

### 11.11 RECOMMENDATIONS: LARGE CARNIVORES

The only large carnivore found in the Quiçama National Park system was leopard. The individual records were not enough to calculate the population density but the species seems to be resilient to the suffered pressures. The results from population surveys indicate that other large carnivores, such as lion, cheetah and African wild dogs, have been absent from the system for at least a decade. Results also express that a few individuals of spotted hyena could still be found a couple of years ago but are now most likely extinct in the park.

Given the endangered or vulnerable global status of cheetah, African wild dogs and lions, the large size of Quiçama National Park, the tourism potential generated by its location and the fact that the area was historical range for all these species, it would be worthy to maintain the idea of an eventual reintroduction of all these three species into the park. It is unlikely this will happen in the next decade or so, as there are numerous challenging problems to be resolved, and prey populations will need time to recover, but nonetheless this should be considered as an eventual goal, once reintroduction guidelines could be met.

In the SCA, where a large amount of prey was observed, no traces of large carnivores were found. The team recommends that, after a proper assessment is conducted, the administration

considers the hypothesis of re-introducing large carnivores such as leopard and hyena in the SCA, to balance the whole system.

### 11.12 RECOMMENDATIONS: MEDIUM AND SMALL CARNIVORES

The more widespread species of medium to small carnivores include serval, African wild cat, blotched genet and African civet. Among these, blotched genet is one of the most persecuted small carnivore due to its taste for small livestock and theft habits. Results for side-striped jackal indicate a possible decline of this mammal species population in Quiçama NP and honey badger seems to be more concentrated in the northern section of the park.

A valuable record was obtained on camera trap for Anson's Cusimane (*Crossarchus ansorgei*) representing the only published record in the last 109 years and the second for the species in Angola. Due to the lack of knowledge on this small mongoose species distribution in Angola, further research is recommended.

Small carnivores can also provide a valuable tourist attraction, and the relative abundance of species such as serval and civet could be used in tourism marketing.

### 11.13 RECOMMENDATIONS: PRIMATES

The primate species community in the Quiçama system is composed of blue monkey, vervet monkey, Angolan talapoin and thick-tailed galago. Even though co-existence of species is frequently found, each species seems to have well defined distribution areas in the park according to their habitat preferences. Angolan talapoin is certainly one of the most emblematic species existing in the park and could be used in marketing for tourism.

### 11.14 RECOMMENDATIONS: FIRE MANAGEMENT

It is urgently necessary that a proper fire management plan is implemented throughout all areas of the park. Some areas could clearly benefit from controlled fires, while in other areas the ecosystem is being destroyed by unmanaged fires, and fire breaks need to be created. The



team recommends that an experienced regional NGO or research group is invited to provide advice on fire management.

### 11.15 RECOMMENDATIONS: RE-GAZETTING AND ZONATION OF THE PARK

A great extension of Quiçama National Park area has been invaded by population, as well as by commercial agriculture and cattle farms. Once it involves sensitive subjects such as food security and social concerns, among others, a re-gazetting of the park or at the very least a zonation of it, will be compulsory. The team will not extend longer on this subject but strongly believes that the information compiled in the survey report will contribute to an informed decision on this matter and is available to any further enquiries.

### 11.16 RECOMMENDATIONS: TRAFFIC MANAGEMENT

An additional issue is related to the tar road, leading from Cabo Ledo to Muxima. This road has an intense traffic of heavily loaded trucks that intend to avoid the weight bridge and the fee of the Cuanza bridge. These trucks represent a threat to the fauna of Quiçama NP since they are driven at high speed, during the day and night. Figure 123 shows the results of high speed driving of trucks on this road. It is recommended that speed humps are implemented as well as a fee applied only to heavy loaded long vehicles using the road.



FIGURE 123 – OVERTURNED TRUCK ON THE CABO LEDO - MUXIMA ROAD

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