ZAMBEZE DELTA ECOLOGY
HOLISTIC ECOSYSTEM RESEARCH PROJECT

QUARTERLY REPORT
AUGUST 2019

RESEARCH IN THE ZAMBEZE DELTA

THE Zambeze Delta is a vast, open landscape along the coast of central Mozambique which holds great conservation significance. It is the largest wetland system in the Zambezi catchment and supports a mosaic of vegetation types such as palm savanna, mangrove forests, sand forests, open grassland and papyrus swamps. The seasonally flooded grasslands support abundant wildlife populations, including endangered bird species such as the wattled crane. The floodplain area also provides spawning grounds for riverine fish species and the coastal mangroves and estuaries support prawn fishing (Beilfuss, Dutton & Moore, 2000).

Of particular importance is the Coutada/Marromeu Complex which covers 11 270km² in the southern half of the delta. In 2003, this Complex was declared as the country's first and only *Wetland of International Importance* at the Ramsar Convention (Beilfuss *et al.*, 2010). The area, which consists of four hunting concessions (Coutada 10, 11, 12 and 14) as well as the Marromeu Game Reserve, has seen a steady population growth of most wildlife species
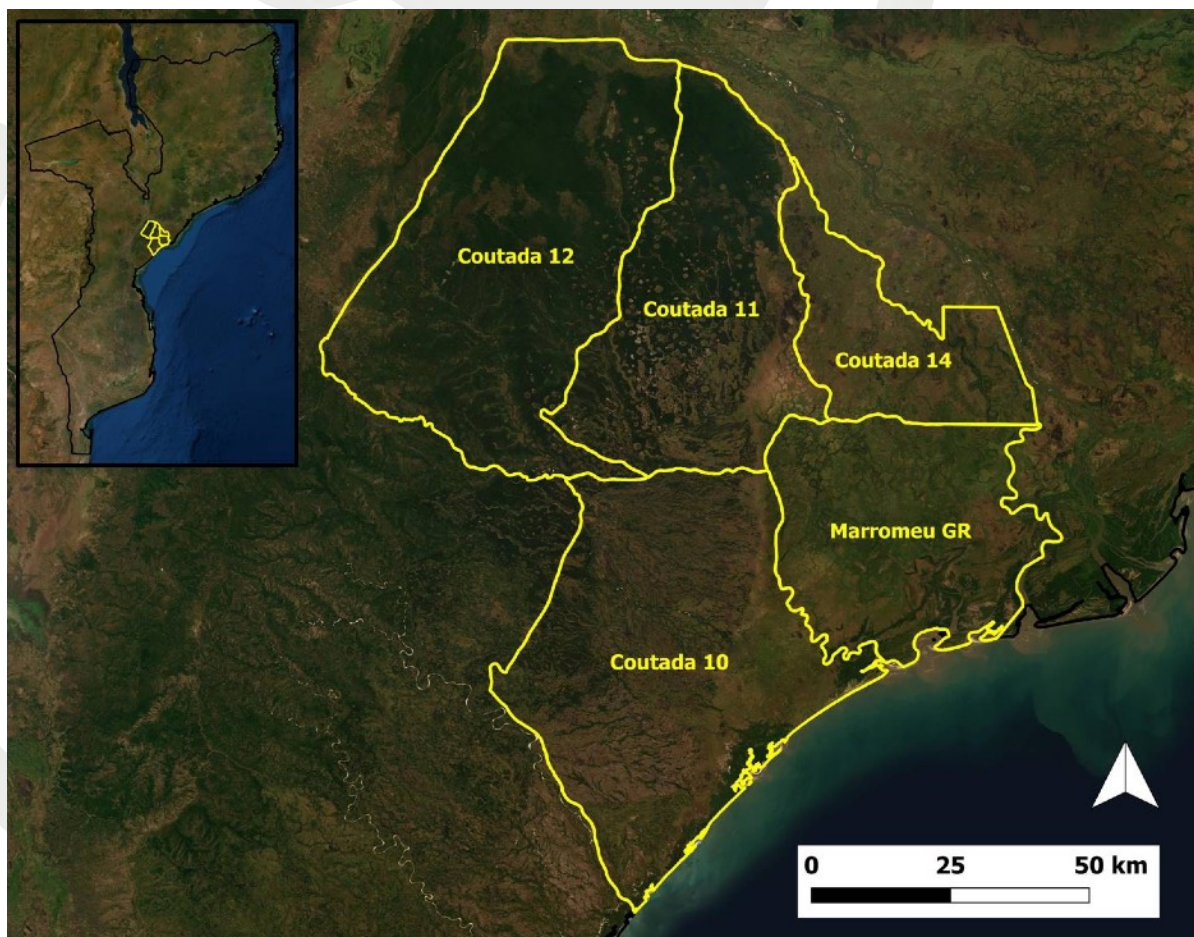

Figure 1. Map of the Coutada-Marromeu Complex in central Mozambique.

since the late 1990s, with more than 20 000 individuals estimated in 2009 (Beilfuss *et al.*, 2010). Despite the above mentioned, little research has been done in the area, which is partly due to the wetland system being inaccessible.

The Twenty Four Lions Reintroduction Project has provided a gateway to conducting holistic ecosystem research in the Coutada/Marromeu Complex of the delta. The research, initiated by the Cabela Family Foundation (CFF), Ivan Carter Wildlife Conservation Alliance (ICWCA) and Zambeze Delta Safaris (ZDS), is centred on monitoring the success of the twenty four lion reintroduction, which is largest lion movement in history. Given the size of the Complex, this lion population has the potential to contribute a significant part to the overall status of lions in Africa. Moreover, this holistic ecosystem approach extends into all other aspects of the natural environment including the local people. Ultimately, the research goal is to highlight the importance of this unique wetland ecosystem and provide scientific-based research to better conserve the Zambeze Delta.

TWENTY FOUR LIONS

ONE YEAR IN & GOING STRONG

August brings up the one-year mark since the official release of the twenty four lions into the Zambeze Delta. The reintroduction project has been a major success thus far as the lion population has almost doubled since the release, with the addition of 17 cubs! All of the delta lions have settled into their new home and currently occupy stable areas within Coutada 10, 11 and 14 concessions.

Lions are currently listed as *Vulnerable* on the IUCN Red List of Threatened Species and continue to show a decreasing population trend, particularly in unfenced systems (Bauer *et al*., 2016). The threats they face are largely anthropogenic in nature, with habitat loss and fragmentation being the most important threats. Given the role of lions as apex predators in the ecosystem, conserving these animals in large, unfenced systems is a priority as they are of great ecological significance (Creel *et al*., 2013). Therefore, the reintroduction of lions into the Coutada/Marromeu Complex has been a major leap for allowing the sustainability of the ecosystem and for lion conservation.

WILDLIFE COLLAR DATA
SPATIAL MOVEMENT OF LIONS & THEIR PREY

Spatial movement is an important aspect of an animal's ecology and the use of GPS satellite collars allows us to get very detailed information on how animals move across the landscape. This data is useful both from a monitoring and research perspective, as the collars provide users with regular GPS locations which can be used to view not only their movement but also potential behaviour. For example, an animal returning to the same location at similar times every day could represent a water point where the animal drinks water.

The Holistic Ecosystem Research Project have deployed 72 collars on nine different wildlife species since 2016 and currently, 35 collars (17 lion collars & 18 potential lion prey collars) are actively providing the team with regular GPS locations. This data provides important insights into their movements which can be utilised to better understand the ecology of these animals and for better conservation management of wildlife across the landscape. The following collar data represents the past three months of animal movement in the delta.

Table 1. Average core and home range areas of collared wildlife in the Zambeze Delta. Home ranges were calculated in R version 3.5.2 (R Core Team, 2018).

Species	Core area (50%)	Home range (95%)
Lion ($n=17$)	13.9 km^2	64.7 km^2
Elephant ($n=6$)	257.1 km^2	385.1 km^2
African buffalo ($n=2$)	47.1 km^2	99.6 km^2
Sable ($n=4$)	3.0 km^2	9.5 km^2
Lichtenstein's hartebeest ($n=1$)	3.1 km^2	11.1 km^2
Reedbuck ($n=3$)	0.1 km^2	0.2 km^2
Warthog ($n=2$)	0.4 km^2	1.2 km^2

AFRICAN LION
PANTHERA LEO

Based on data from the 17 collared lions, average lion home range over the past three months was 64.7 km^2. Male home ranges (120.4 km^2) were larger than those of females (50.8 km^2), which is normal as dominant males patrol larger areas to defend their prides from intruding males and nomadic males have unstable ranges until they take over a pride (Schaller, 1972). Several females also had cubs which reduces the female home range size as the mothers do not move far while the cubs are still young. As expected, the lion home ranges found here are similar to those recorded in other mesic environments with high prey biomass (Ogutu & Dublin, 2002; Schaller, 1972; Winterbach & Winterbach, 2002; Yamazaki, 1996).

All lions have hunted successfully since their release and continue to make regular kills. In terms of their diet, most confirmed kills were of abundant species such as warthog and reedbuck, although larger species such as hartebeest, sable antelope and waterbuck have also been recorded.

Figure 2. Two female lions with their cubs photographed from the helicopter.

AFRICAN ELEPHANT
LOXODONTA AFRICANA

Of all the collared species in the delta, elephants certainly have the largest home ranges (385.1 km²). The six collared elephants move in herds that currently range between Coutada 14 and the Marromeu Game Reserve and seem to enjoy the swamp and papyrus beds. The research team has been able to get regular visuals of these herds, with several young calves observed from the helicopter. Having collars on these animals present us with very useful information about these enormous creatures in a unique wetland system.
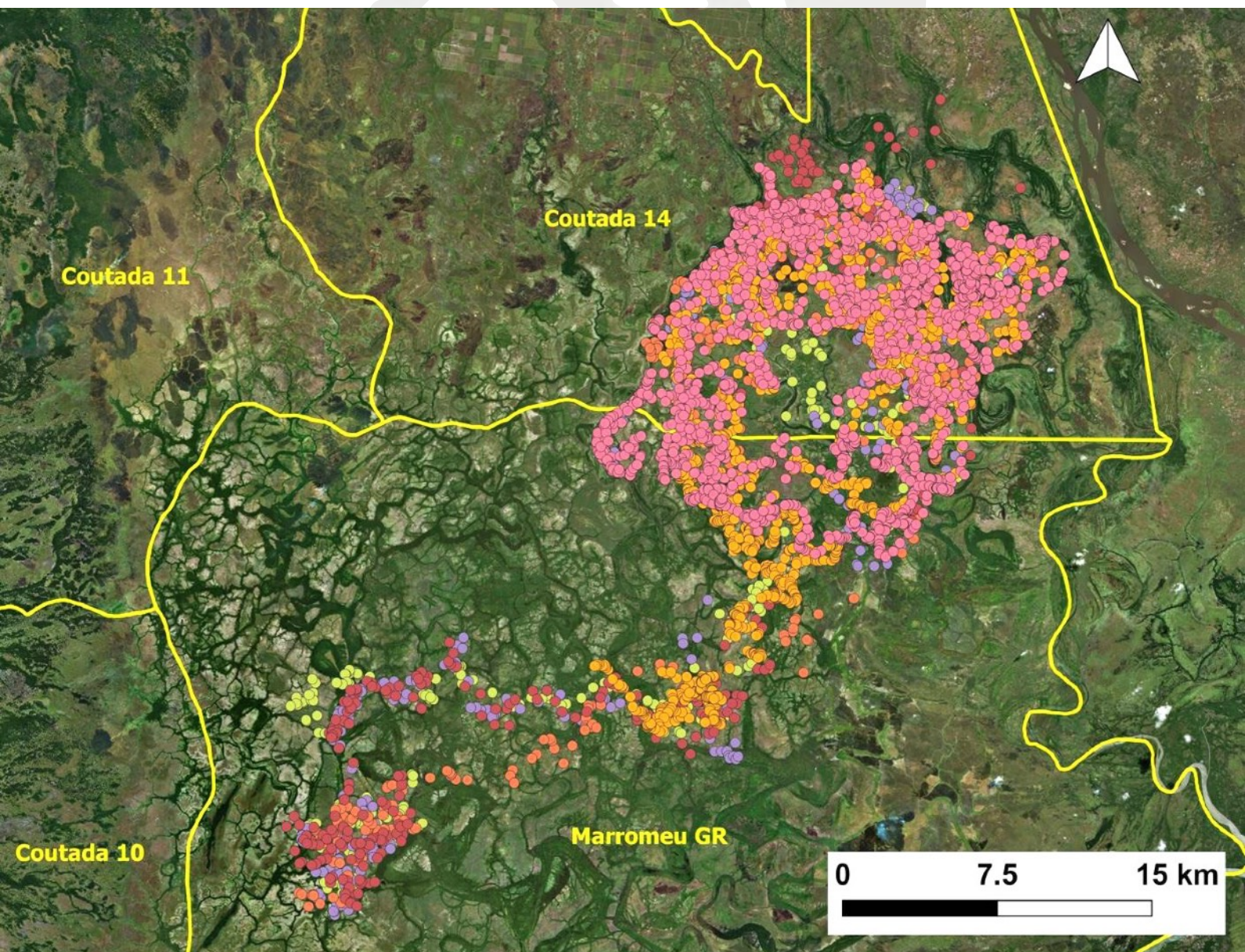
Figure 3. Map of the spatio-temporal data from the six collared elephant for the May-August.

AFRICAN BUFFALO
SYNCERUS CAFFER

Large herds of African buffalo are certainly an iconic feature of the Zambeze Delta floodplain. Once reduced to only 1 000 individuals due to the impacts of the civil war and poaching, the buffalo population has now increased to over 20 000 strong thanks to the efforts of the ZDS Anti-Poaching Unit (APU) (Mark Haldane *pers. comm.*). This population of buffalo is one of the largest contiguous populations in the world and thus a significant species in terms of both local ecology and management within the system. Currently, we have two male buffalo collared that displayed an average home range of 99.6 km², spending the majority of their time in the floodplain area in Coutada 10, Coutada 11 and the Marromeu Game Reserve.
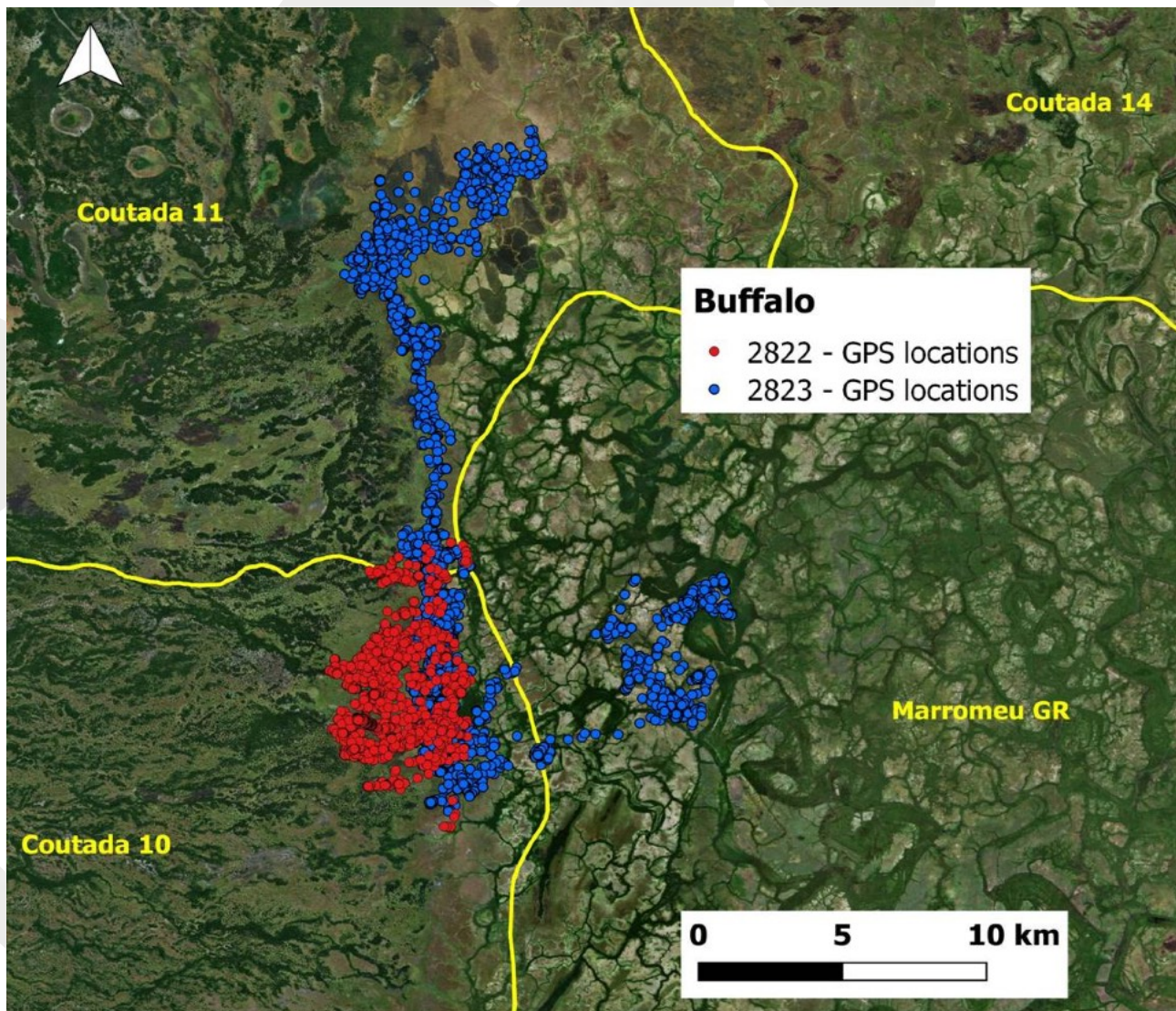

Figure 4. Spatio-temporal data of two collared buffalo between May and August 2019.

SABLE
HIPPOTRAGUS NIGER

Currently, four sable antelope are collared in Coutada 11 and occupy an average core and home range area of 3.0 km² and 9.5 km² respectively. Their movements have been interesting to observe as all individuals tend to move along the floodplain, open edge of forests and around natural pans, although some individuals regularly move within more closed, wooded areas. These majestic animals were once reduced to a mere 44 individuals, due to the civil war and poaching. However, thanks to effective APU efforts, the sable population has increased to over 4 000 individuals (Mark Haldane *pers. comm.*).
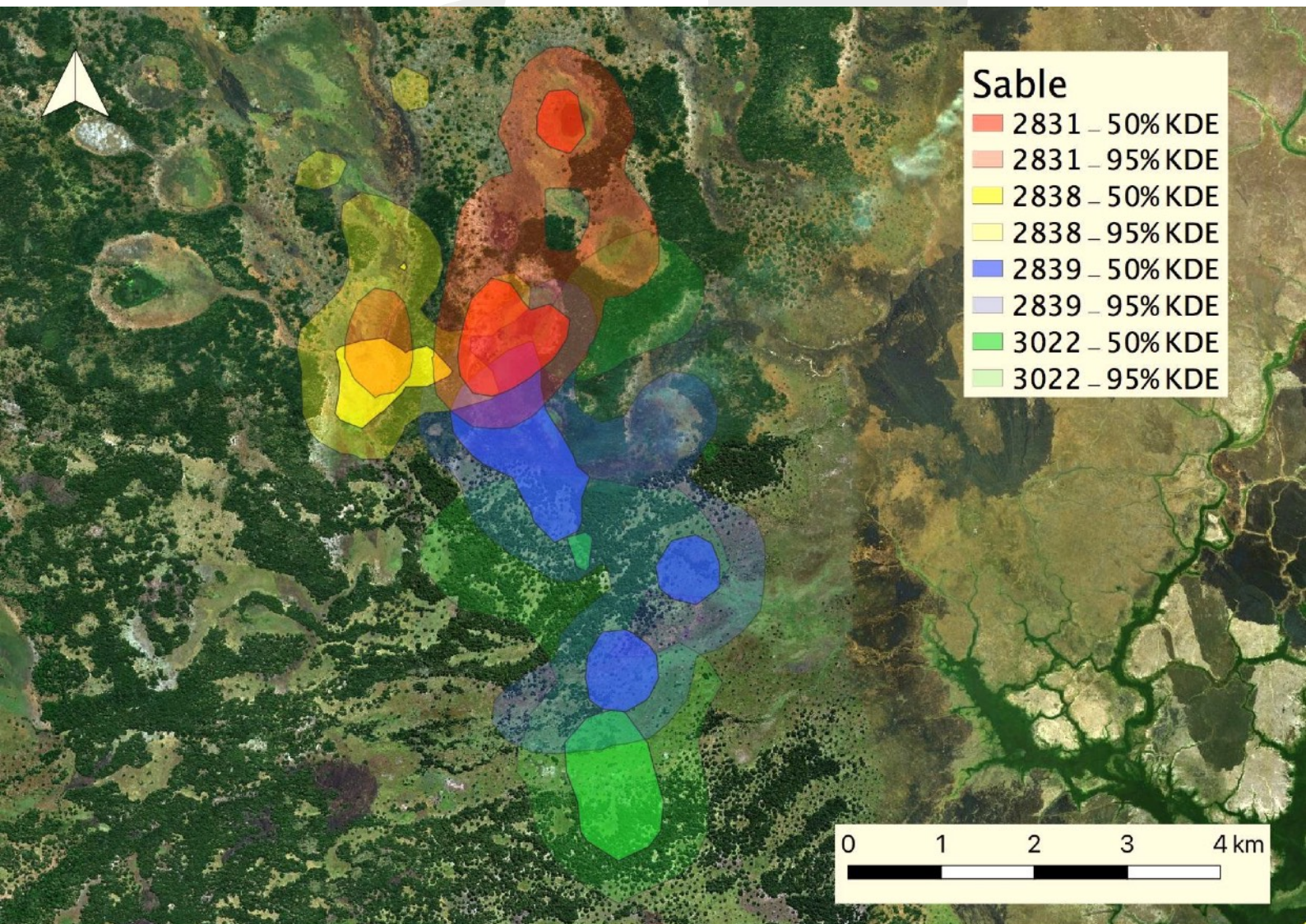

Figure 5. Map of the collared sable core (50% KDE) and home ranges (95% KDE) from May to August.

LICHTENSTEIN'S HARTEBEEST

ALCELAPHUS BUSELAPHUS

One collar was deployed on a Lichtenstein's hartebeest bull in 2018 and continues to provide regular GPS locations. For the past three months, this hartebeest's core (3.1 km²) and home range area (11.1 km²) have been similar in size to that of the sable. His time is mostly spent in the open floodplain area.
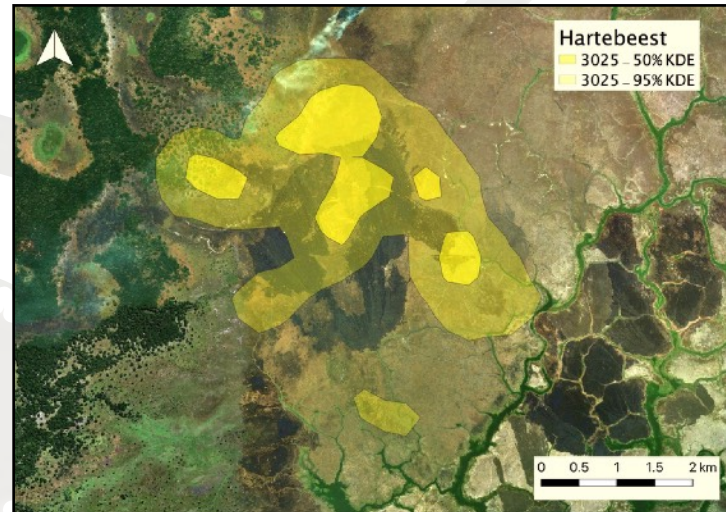

Figure 6. Home range of a collared hartebeest.

REEDBUCK

REDUNCA ARUNDINUM

Common reedbuck are thriving in the Zambeze Delta and are one of the most abundant antelope species. Currently three common reedbuck (two males and one female) are collared and their home ranges (0.2 km²) are certainly the smallest compared to all other collared wildlife species.
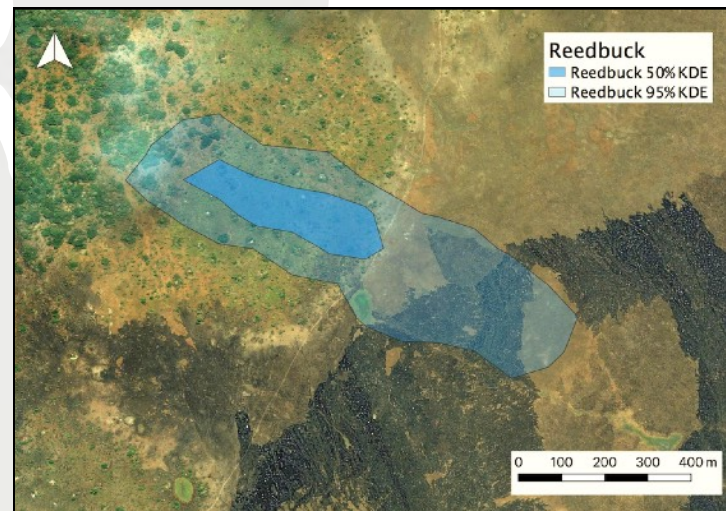

Figure 7. Home range of a collared reedbuck.

WARTHOG

PHACOCHOERUS AFRICANUS

Based on GPS collar data, we have seen that warthogs in the delta have very small home ranges (1.2 km²). These warthogs have one or two resting places (either a burrow or under a tree) where they return to every night after spending the day foraging no more than 1.5 km away. Figure 8 shows this by the small and localised core area (50% KDE) usage by two collared warthogs.
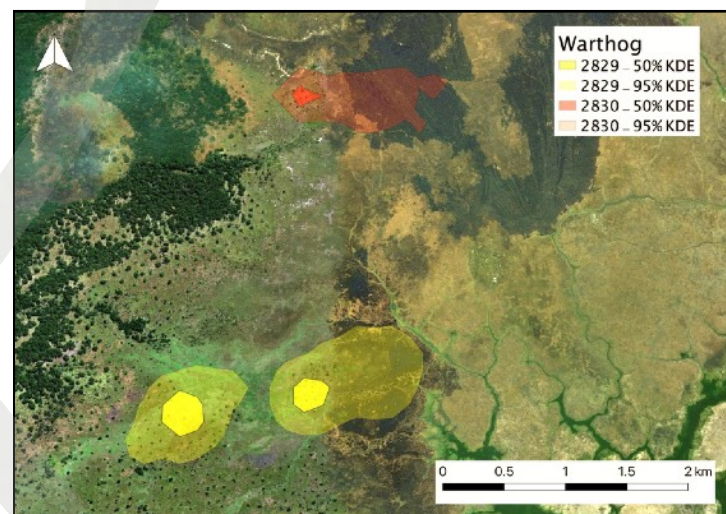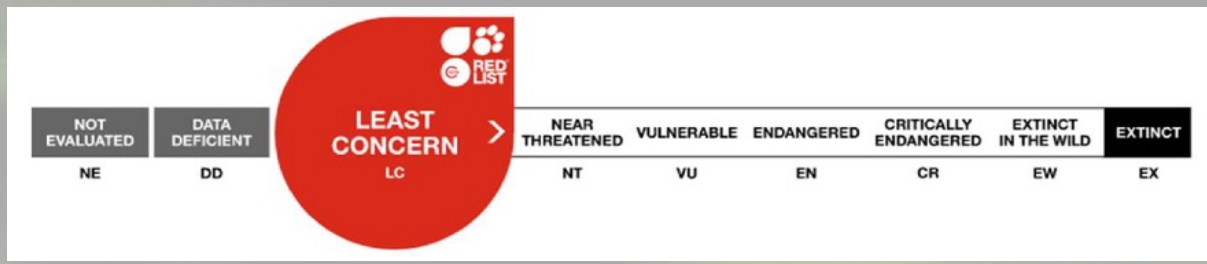

Figure 8. Home ranges of two collared warthog.

DISCOVERING SPECIES OF SIGNIFICANCE

GLYPHAEA TOMENTOSA

N'calangua (Sena)

DESCRIPTION & DISTRIBUTION

Glyphaea tomentosa is a shrub or small tree species that is endemic to the Sofala, Zambezia and Nampula Provinces of Mozambique. The genus *Glyphaea* is in the Malvaceae family which is in the major group of flowering plants (Angiosperms). The species name *tomentosa* means 'densely woolly' and refers to the hairs on both sides of the leaves. This species is very similar to *Grewia* species, except for the distinctive fruit: an elongated brown, ribbed capsule (pictured below, found in Coutada 11).

THREATS & CONSERVATION

G. tomentosa is currently listed as 'Least Concern' on the IUCN Red List of Threatened Species; however, the population trend is unknown and there are currently only 30-40 known locations of this species (Darbyshire & Rokni, 2019). One of the major threats to this species is slash-and-burn agriculture, which is prominent in the Zambeze Delta. Species such as *G. tomentosa* form part of the rich biological diversity within the landscape and are thus important species to conserve.

BT Wursten

Locations in the Zambeze Delta

EXTANT (RESIDENT)
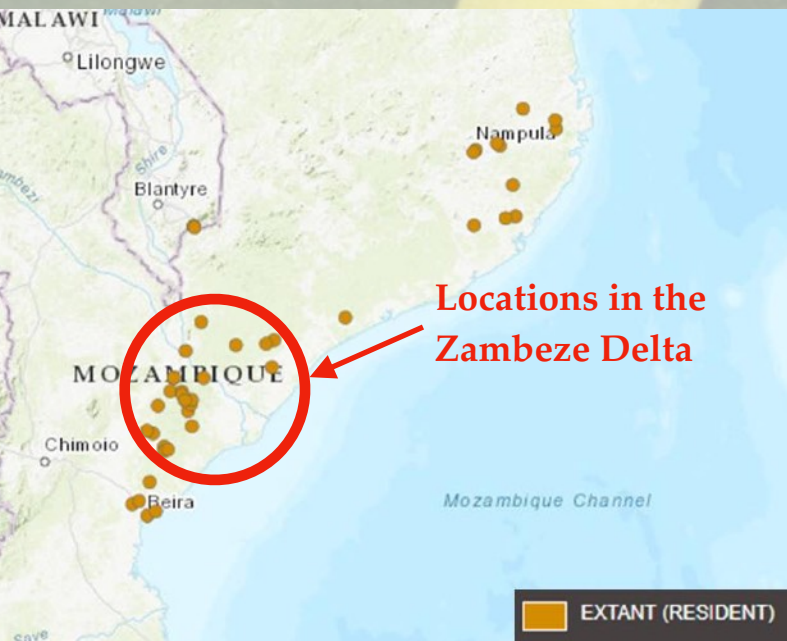
POPULATION TREND
? Unknown

WHAT IS ON THE AGENDA
FOR THE FINAL QUARTER OF 2019

ELEPHANT COLLARING

An important part of collaring wildlife is removing, re-fitting or replacing the collar before the batteries die or the collar gets too tight around the animal's neck. In September 2019, we will remove four elephant collars and collar four other elephants thanks to the ICWCA and ZDS. Based on the collar data we have collected since 2016, elephants have the largest home ranges of the mammals in the Zambeze Delta. We aim to continue collecting and analysing this vital data as well as monitoring this population to better manage them across the landscape.

LEOPARD COLLARING

Leopards are relatively widespread across much of the African continent (Stein *et al.*, 2016). However, they are extremely elusive by nature, which makes it challenging to study their ecology. In September and October, we aim to collar two female leopards within Coutada 11, which will provide novel movement data on leopards in this part of Mozambique. These females will be collared with two brand new Savannah Tracking GPS collars which were kindly donated by the Metzger Family Foundation. This project aims to improve our knowledge on these big cats in a very unique ecosystem.
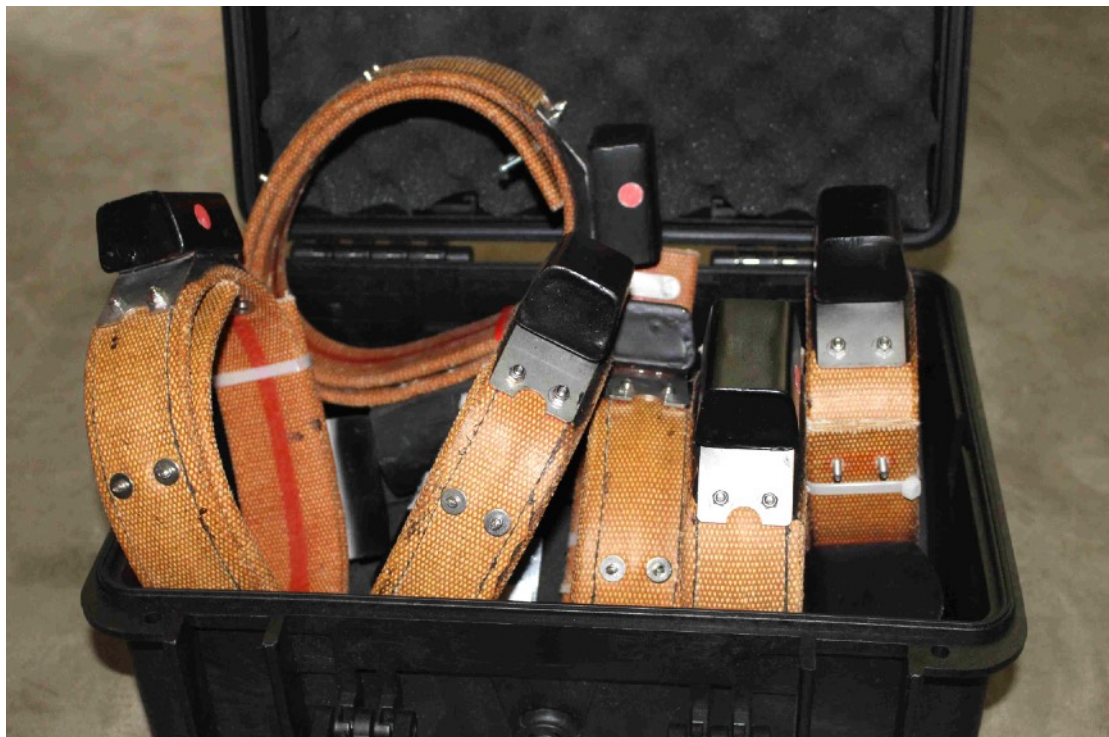
CAMERA TRAP SURVEYS

Camera traps are a versatile monitoring tool that can be used to estimate abundance, density and occurrence of wildlife species in a given area. For animals that have unique coat patterns to identify individuals (e.g. African civet, giraffe, leopard and spotted hyena), spatially-explicit capture-recapture (secr) modelling is typically used. For other species that have no unique individual patterns or markings (e.g. antelope species, caracal, and mongoose species), occupancy modelling is used.

Thanks to the ICWCA, we have over 50 Cuddeback camera traps available to deploy within Coutada 11 to survey wildlife populations, with the focus being on leopards. For this survey, we will design a grid in which we standardise camera trap spacing to satisfy assumptions associated with such camera trap studies. We will deploy these cameras for three months and generate density and abundance estimates for leopards in the Complex. This will allow us to get a handle on the status of the population, and over time, we will be able to determine changes in leopard density in the Zambeze Delta.

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