REPUBLIC OF MOZAMBIQUE

MINISTRY OF LAND AND ENVIRONMENT

MARROMEU COMPLEX WILDLIFE CENSUS REPORT

JUNE 2020

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ADMINISTRAÇÃO NACIONAL DAS ÁREAS DE CONSERVAÇÃO

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MARROMEU COMPLEX WILDLIFE CENSUS REPORT

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JUNE 2020

SUMMARIZED REPORT

Wildlife management requires knowledge of the size and spatial and temporal distribution of the populations. In the Marromeu Complex (MC), wildlife is managed mainly for: (i) conservation, (ii) sustainable use through safari hunting and (iii) mitigation of the human-wildlife conflict. A wildlife survey was undertaken in the MC from 24th November to 4th December 2019, at the end of the dry season. The objectives of the census were as follows: (i) to obtain estimates of the size of populations of wildlife, (ii) to determine the spatial distribution of wildlife, (iii) to document the type and spatial distribution of human activities, and (iv) to determine the conservation status of species selected for monitoring by the Mozbio II project, namely buffalo and sable antelope. The census is part of the activities of component two of the project, whose objective is to strengthen the management of target conservation areas and monitor the status and distribution of wildlife.

The census was conducted using a combination of aerial and ground survey. The total area of the MC is 9 703 km^2, of which 8 155 km^2 were covered by the aerial survey, 1 263 km^2 by the ground survey and 285 km^2 were excluded because these are degraded by human activities. The MC was divided into two strata. The aerial census was used in the stratum consisting of floodplain, open deciduous forest, deciduous shrubs and areas covered by a mosaic composed of open and dense forests, where visibility is good to moderate. The ground survey was used in the stratum consisting of an extensive patch of dense forests, where the visibility of animals using aerial survey is low (Figure 1).

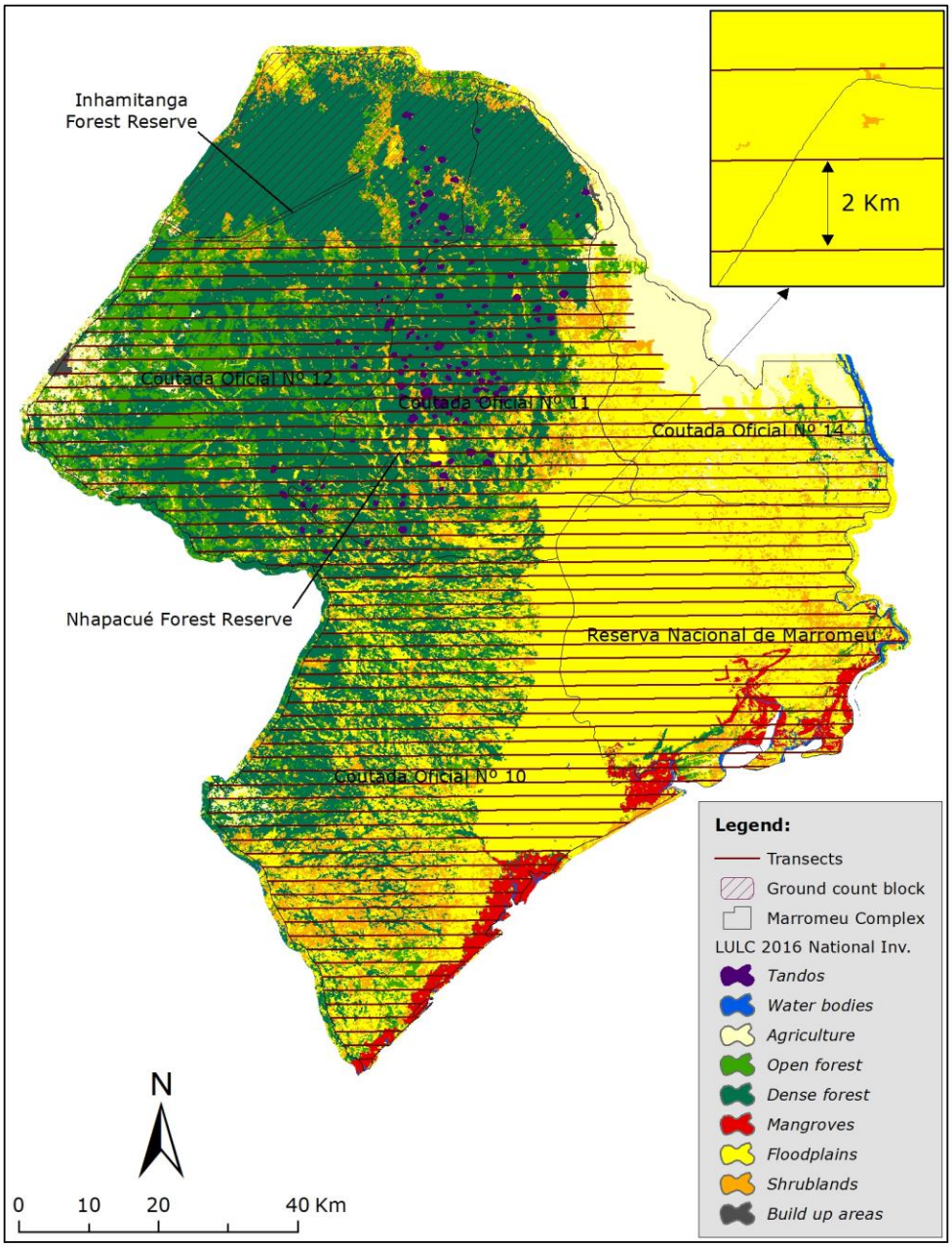

Figure 1. Transects for wildlife aerial in the Marromeu Complex, overlaid on the land use and cover map.

For the aerial survey, a sample area count approach was adopted by setting 60 systematic transects 400 m wide, spaced by 2000 m, which covered an area of 1 642 km^2, resulting in a sampling intensity of about 20%. For buffalo and elephant and hippopotamus a total area count was conducted. A Robbison 44 (R-44) helicopter was used. The total distance covered by the flight was 4 105 km at a constant speed and height of 160 km/h and 90 m (300 feet), respectively. The search rate of animals in the transects was 1.07 km^2/minute of flight. During

the flyover, the following data were recorded: species and number of individuals in each observation, habitat type and human activities. Only mammal species with body weight ≥ 5 kg were considered in the survey. The population estimates and the precision of the estimates were determined using the Jolly II method. The distribution mapping was done using graduated symbols in the ArcMap 10.2.2 software.

In the ground survey, 25 transects of 5 km in length and 100 m in width of the observation strip were covered on foot, covering an area of 12.5 km^2 in a patch of 1 263 km^2 covered by dense forests, which resulted in a sampling intensity of 1%. Throughout the transects, species were documented through direct identification of individuals and through the identification of indirect evidence of their occurrence, such as pellets. Evidence of human activities were also recorded throughout the transects. The density and abundance of each species were estimated using the DISTANCE program.

Twenty one species of mammals were documented during the aerial survey and 23 species during the ground survey. The most abundant species in the MC are waterbuck, buffalo, reedbuck, elephant, sable antelope, hartebeest, warthog, zebra, eland and nyala, which make up 98% of the total number of 85 554 animals estimated by the aerial survey (Table 1). The populations of nyala, bushbuck, red duiker were underestimated by aerial survey due to the difficulty of detecting and counting animals in dense forests. The populations of most wildlife species have grown since the aerial survey conducted in 2016 and have already reached the sizes recorded before the civil war (1976-1992). The estimated total number increased from 68 891 animals in 2016 to 85 554 animals in 2019 and the density increased from 7.29 animals/km^2 to 10.49 animals/km^2.

The buffalo population, a species selected for monitoring by the Mozbio II project, grew from 18 620 individuals in 2016 to 21 384 in 2019, at annual rate of exponential growth of 4.6%. In woodlands and forest habitats such those covering parts of the MC, total area counts often result in underestimates of population size. Therefore, this absolute number is the minimum number of buffaloes in the MC. The result of the survey for sable antelope, another species selected for monitoring by the Mozbio II project, shows an unrealistic reduction of its population. The underestimation of the population of this species was caused by its dispersion to low visibility miombo woodlands that retained abundant water and green pasture by the time of the survey, as a result of cyclone Idai and the first rains of 2019.

The distribution of species did not change between 2016 and 2019. The floodplain and the ecotone between this and the forests are the habitats with the highest concentration of animals,

mainly in the Marromeu National Reserve, Southeast of Hunting Concession (*Coutada Oficial*) nº 11 and Northeast of Hunting Concession nº 10 (Figure 2).

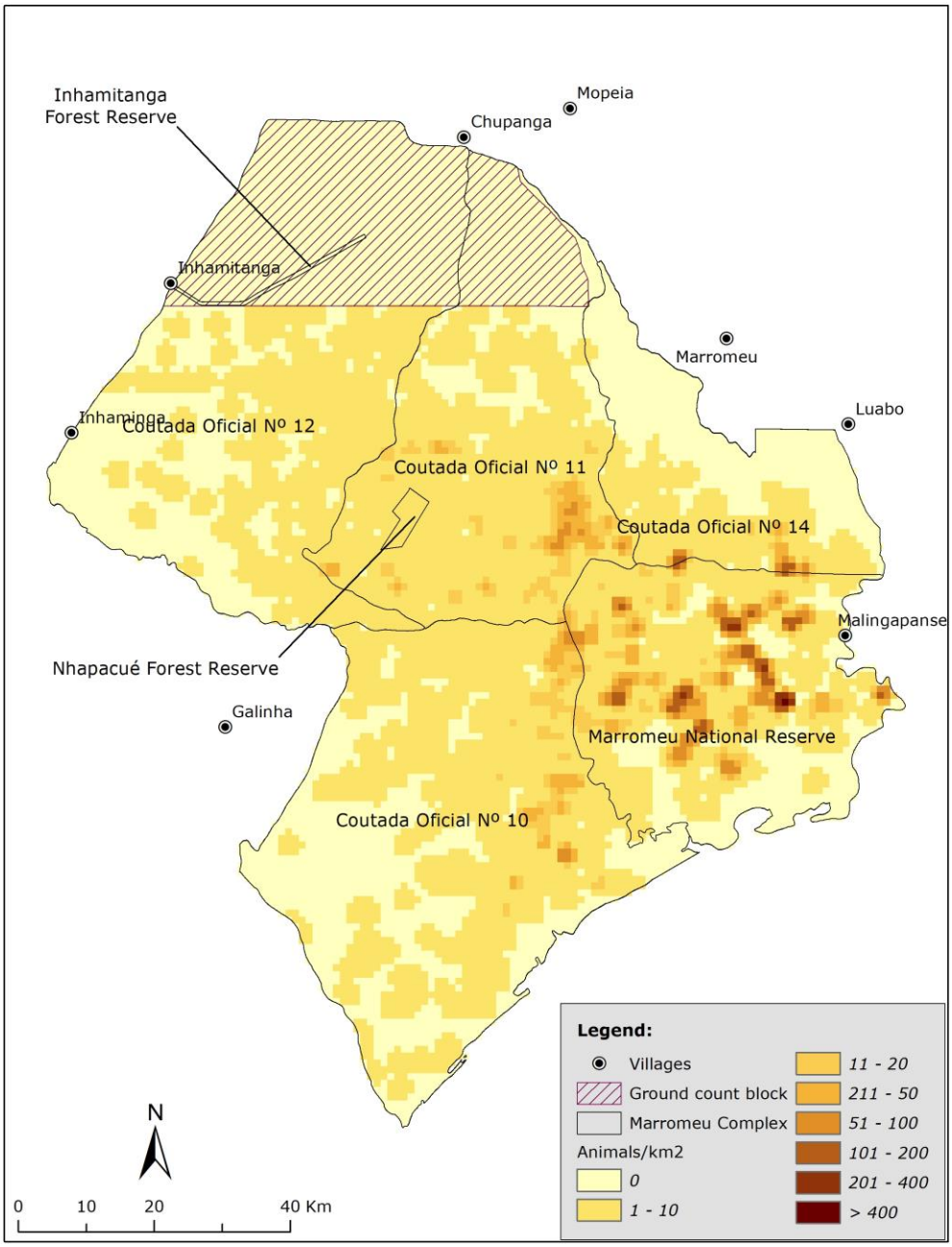

Figure 2. Distribution of wildlife density in the Marromeu Complex

The difference in the areas covered, equipment used, methods and sampling intensity with surveys carried out before 2016 makes it difficult to robustly analyze the trend of population sizes and their distribution in the MC. Table 1 shows the summary of the number of animals observed, population estimates and the precision of the estimate (95% confidence limit).

The ground survey allowed the recording of species that were not documented by the aerial survey, in areas with dense forest cover, namely blue duiker, as well as higher counts per unit area of other species that prefer densely wooded habitats such as suni, red duiker and bushpig than the aerial survey. The ground survey also made it possible to detect the occurrence of elephants in areas covered by dense forests, where the species was not detected by the aerial survey. The harvest quotas applied in the hunting concessions are below the ecologically sustainable limits.

Table 1. Population size of medium and large mammal species estimated by aerial survey in the Marromeu Complex in 2019 and the confidence limit of the estimate

	Species	**Observed number**	**Estimated number**
1	Buffalo[1*]	21384	21384
2	Elephant[1*]	432	432
3	Hippotamus (MC)	164	164 – 248
	Hippotamus (Zambeze river)	37	37 – 60
4	Crocodile[1] (MC)	40	40
	Crocodile[1] (Zambeze River)	13	13
5	Waterbuck	4769	23689 (14950 – 32428)
6	Reedbuck[*]	3635	18056 (12389 – 23723)
7	Warthog[*]	1508	7490 (5185 – 9796)
8	Sable antelope[*]	936	4650 (2998 – 6301)
9	Hartebeest	764	3795 (2108 – 5481)
10	Nyala[*]	543	2698 (1737 – 3657)
11	Zebra	232	1153 (114 – 2191)
12	Elande	107	532 (107 – 1094)
13	Oribi[*]	81	402 (199 – 605)
14	Impala[*]	75	373 (75 – 769)
15	Bushbuck[*]	61	303 (190 – 416)
16	Red duiker[*]	41	204 (123 – 284)
17	Baboon[2*]	40	199 (121 – 276)
18	Bushpig[*]	25	124 (26 - 223)
19	Suni[*]	10	50 (10 – 106)
20	Kudu[*]	7	35 (7 – 95)
21	Common duiker[*]	2	10 (2 – 24)
22	Blue duiker[**]		
23	Samango monkey[*]	2	10 (2 – 24)
24	Elephant carcass	1	5 (1 – 15)
25	Wattled crane[3]	107	532 (107 – 1095)
26	Crown crane[3]	35	174 (55 – 293)
	Total of animals, excluding birds and primates	34 855	85 554

[1]the count was total

[2] the estimate is of the number of troops and not of the population

[3]bird species
[*]species identified during both aerial and ground survey
[**]species identified only during the ground survey

The MC suffers from an increasing encroachment of human activities, mainly fishing in the coastal zone and in the floodplain, human settlements, shifting cultivation, charcoal production and illegal logging (Figure 3). The central zone of the Marromeu National Reserve, southeast of Coutada nº 11 and northeast of Coutada nº 10 is the area least affected by human activities and it is where the highest densities of most wildlife species were recorded. The reduction in the area of the MC effectively available for wildlife, caused by the encroachment of human activities, combined with the hydrological changes that occur in the Zambezi Delta, reduces the total number of animals that can be sustained in the long term.

Only one fresh elephant carcass and thirteen buffalo carcasses were found during the survey. Buffaloes probably died from drowning during Cyclone Idai. This result suggests that poaching that affects parts of the MC aims to obtain bushmeat for consumption or sale and targets species smaller than elephant and buffalo.

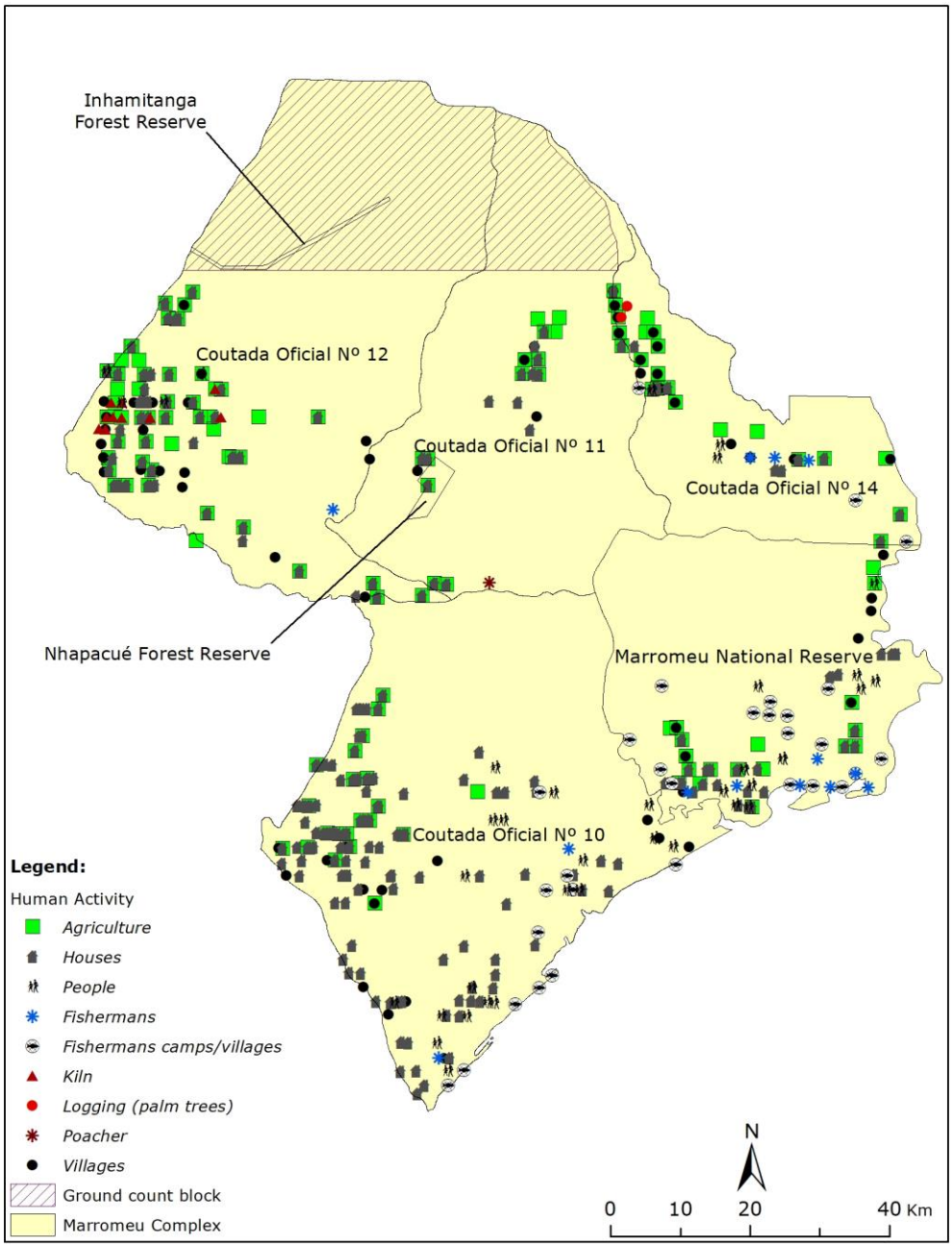

Figure 3. Distribution of human activities in the Marromeu Complex

Recomendations:

- The logistics must be prepared in order to carry out the survey before the first wet season rains expand water distribution and cause dispersal of animals in the landscape;
- The ground survey proved to be useful as a complement to the aerial survey. The strength of its inference depends on its coverage rate, which in this survey was only 1%. To improve population estimates, it is recommended that the sampling intensity in the block designated for ground survey be increased by setting more transects walked

or by adding sampling effort through counting animal along the roads using vehicles, including during night hours;

- To monitor the ecological and productive condition of rangeland in permanent plots established in different habitats. Monitoring will allow the detection of the impacts of the growing animal populations on the habitat;
- To develop and implement land use plans for the districts of Marromeu, Cheringoma and Muanza in order to guide land occupation for social and economic development activities. This will reduce the progressive invasion of conservation areas by local communities, increasing their long-term feasibility;
- To increase the harvest quotas for waterbuck, reedbuck, sable antelope, hartebeest, warthog and nyala in the hunting concessions, to increase the economic benefits of hunting safari to the private sector, the State and local communities.

For details, please consult the Portuguese version of the report.