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LARGE MAMMAL CENSUS OF PALABORWA COPPER MINING COMPANY AND NEIGHBOURING LAND, OCTOBER 2015

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INTRODUCTION

A helicopter count was conducted of all PMC lands, as well as an adjacent strip of the Kruger National Park at the end of the dry season in 2015. The purpose was to provide baseline data for monitoring the size of herbivore populations utilizing the area, to compare herbivore densities to a natural area within the Kruger National Park, and to gain insight into herbivore movements across the area.

METHODS

The count was conducted by Sunrise Aviation using a Bell Jetranger helicopter, with 3 observers (the ARC team led by Mike Peel) and one pilot (Mike Pingo). Doors were removed to improve visibility for the observers. A complete transect was flown over the focus area (see Fig 1), using continuous strips, at an altitude of 40m and a speed of 40 knots per hour (~ 70 km/h). Counting bars were attached to each side of the helicopter, to aid in delineating strips of 300-500m width. Animal sighting data (location, species, number, and gender where possible) were captured directly onto a GPS-enabled laptop using CAPTURE software.

The operational areas of PMC, including Dump 4 (the “rock dump”) and the tailings complex, as well as Cleveland (including Vereeniging), and an neighbouring part of the Kruger National Park (KNP) was flown on the 28th September, between 8am and 2pm. The portion of KNP was included to get a better idea of whether herbivore densities on PMC lands are comparable to those found in a natural ecosystem. The boundary of the KNP land type was selected to cover an area of similar size to Cleveland and to include the same habitats. The fenced portion of Pompey was flown on the 29th September, between 7am and 8am.

Some trees had already began to flush new leaves at the time of the counting, due to early rains in September. These were mainly *Combretum apiculatum* on the uplands. Many *Colophospermum mopane* had not yet flushed, while those that had were still in the early stages of canopy development. The counting team reported that visibility was acceptable.

RESULTS AND DISCUSSION

PMC mine area

Figure 1 shows the area flown around PMC mine, as well as the distribution of elephants and buffalo on the day of the census. Table 1 provides totals per species according to each of the major land types indicated in Figure 1.

Figure 1. Area counted by the helicopter census flown on the 28th September 2015. Land types used to summarize sightings are shown with hatchings. Only elephant and buffalo sightings are indicated, with the size of the shaded area providing an indication of herd size.

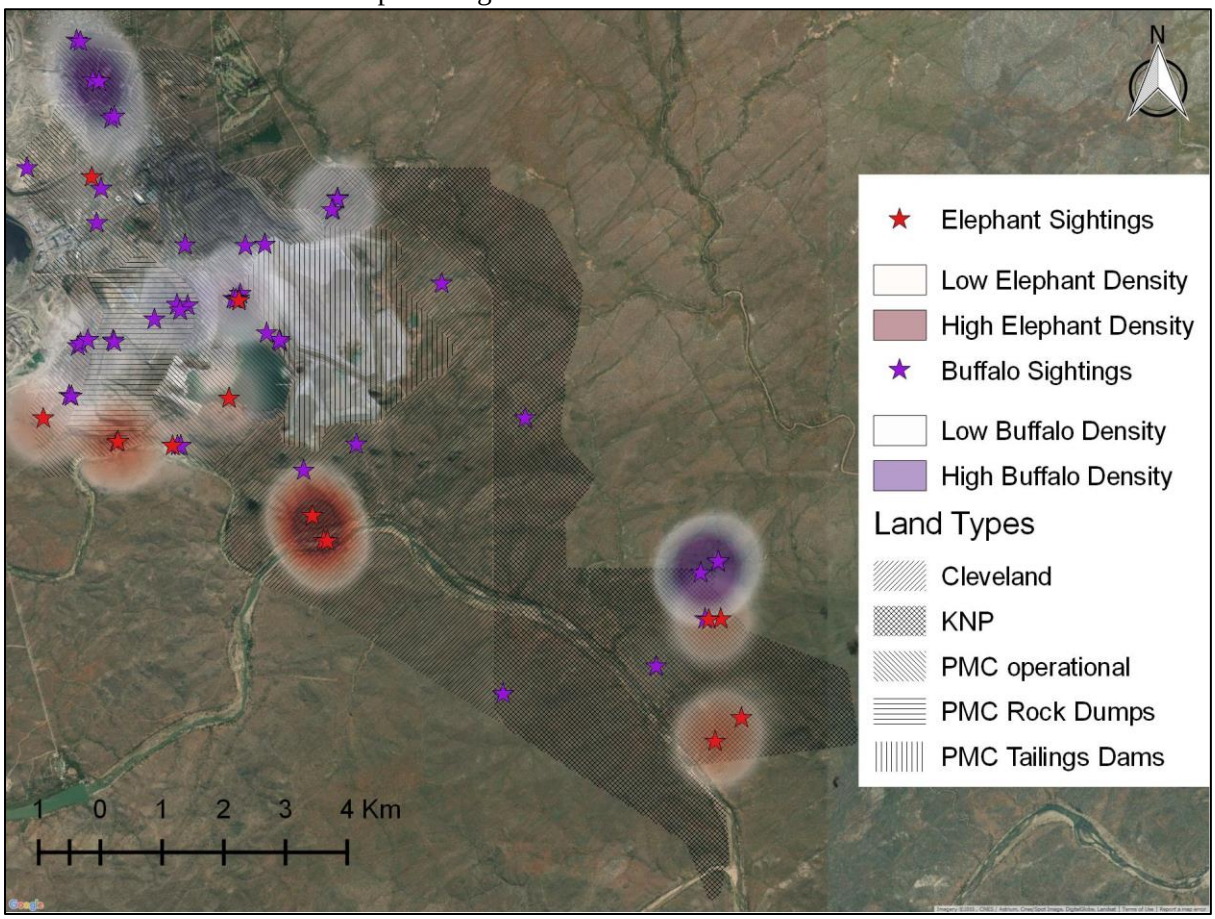


Table 1. Numbers of animals recorded during the helicopter census flown on the 28th and 29th September 2015, for five land types around the mine, and the fenced portion of the Pompey property.

Species	Cleveland	KNP	PMC Operational	PMC Rock Dump	PMC Tailings	Pompey
Baboon Troops	0	0	2	0	0	0
Blue Wildebeest	12	19	0	0	0	0
Buffalo	47	117	245	60	2	20
Bushbuck	6	0	15	0	0	0
Crocodile	13	5	17	0	0	0
Duiker	3	4	0	1	0	25
Elephant	32	18	32	0	0	21
Giraffe	16	0	4	0	2	2
Hippo	21	15	28	0	1	1
Impala	255	455	394	33	26	102
Klipspringer	10	0	0	0	0	2
Kudu	49	49	24	0	4	6
Leopard	1	0	0	0	0	0
Sharpe's Grysbok	3	5	0	0	0	0
Steenbuck	2	2	0	0	0	14
Warthog	5	4	19	0	5	5
Waterbuck	12	38	57	14	5	4
Zebra	10	5	0	0	3	0

Comparisons of numbers per land type make more sense when differences in the area of each land type are taken into account (Table 2). Many species occurred at greater density on the operational and rehabilitation areas of PMC, than in Cleveland and the neighbouring part of Kruger National Park. Buffalo densities were far greater than on Cleveland and KNP, with many individuals and small herds sighted on the Rock Dump and along Loole Creek, and a very large herd found west of the PMC entrance road. A similar pattern is evident for Waterbuck with greatest densities occurring on the Rock Dump. The lack of Kudu sightings for the Rock Dump was surprising, considering how often they are observed from the ground in that land type. Elephant bulls were seen throughout the area, but large herds were restricted to site along the Olifants and Selati Rivers, resulting in their density value being greatest in Cleveland. The Tailings Complex had relatively few animals. The most abundant species here was Impala, but these were at considerably lower density than the other land types.

Table 2. Density of animals recorded during the helicopter census flown on the 28th and 29th September 20 15. Values are animals per km^2, with areas for each of the land types determined using Google Earth.

Species	Cleveland	KNP	PMC Operational	PMC Rock Dump	PMC Tailings	Pompey
Baboon Troops	0.0	0.0	0.1	0.0	0.0	0.0
Blue Wildebeest	0.6	0.6	0.0	0.0	0.0	0.0
Buffalo	2.2	3.9	8.8	14.2	0.2	2.0
Bushbuck	0.3	0.0	0.5	0.0	0.0	0.0
Crocodile	0.6	0.2	0.6	0.0	0.0	0.0
Duiker	0.1	0.1	0.0	0.2	0.0	2.5
Elephant	1.5	0.6	1.1	0.0	0.0	2.1
Giraffe	0.7	0.0	0.1	0.0	0.2	0.2
Hippo	1.0	0.5	1.0	0.0	0.1	0.1
Impala	11.9	15.1	14.1	7.8	3.1	10.0
Klipspringer	0.5	0.0	0.0	0.0	0.0	0.2
Kudu	2.3	1.6	0.9	0.0	0.5	0.6
Leopard	0.0	0.0	0.0	0.0	0.0	0.0
Sharpe's Grysbok	0.1	0.2	0.0	0.0	0.0	0.0
Steenbuck	0.1	0.1	0.0	0.0	0.0	1.4
Warthog	0.2	0.1	0.7	0.0	0.6	0.5
Waterbuck	0.6	1.3	2.0	3.3	0.6	0.4
Zebra	0.5	0.2	0.0	0.0	0.4	0.0

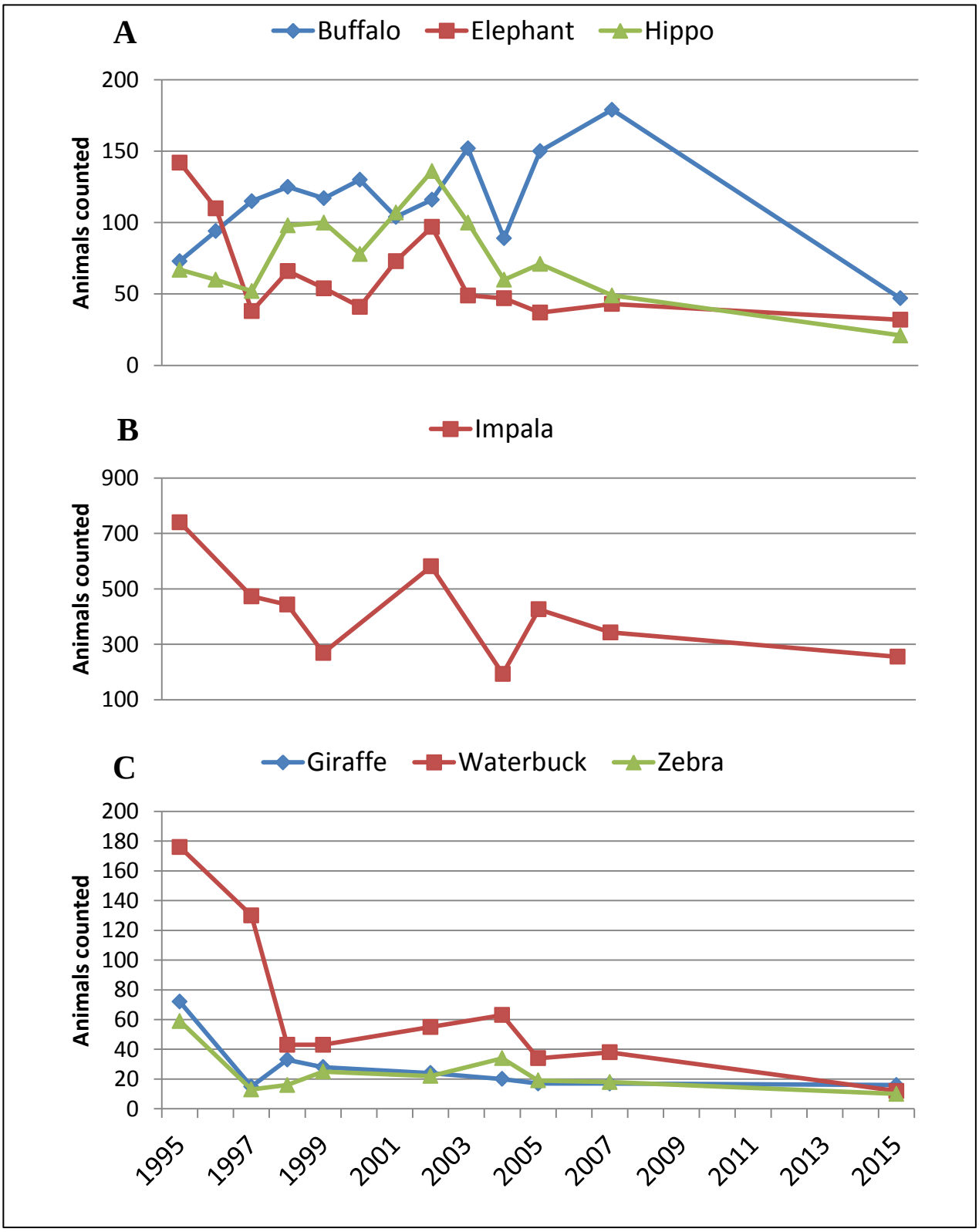
When interpreting these numbers, it must be remembered that the area counted is an open system for large herbivores, and that all species recorded can and do move between the various land types. Densities per land type will change from day to day, and from season to season. The numbers in Table 1 and 2 cannot therefore be considered as representative for the entire year. Multiple counts per year, including both the wet and dry seasons, are needed to get an accurate account of the distribution of each species across the land types, and to monitor trends within each land type over multiple years. Nevertheless, these results do provide strong support for the on-the- ground observations that buffalo, and to a lesser extent Waterbuck, favour the operational areas of the mine and the Rock Dump during the dry season,

that Elephant occur commonly on the operational areas, and that all species generally avoid the Tailings Complex.

No comparable data are available to determine long-term trends in densities for the area as a whole. However, a comparison of the results for Cleveland with previous data available for that land type (Figure 2) does provide some insights into trends, as well as the limitations of counting this particular area only once a year. Figure 2 indicates that numbers of all the most abundant herbivore species have declined since the last count in 2007, with Elephant, Buffalo, Hippo and Zebra currently at their lowest levels since 1995.

Without knowing how and at what time of year the previous counts were done, it is difficult to interpret these trends. It seems likely that the numbers for 1995 were over-estimates, as it is difficult to imagine an ecological cause for such a dramatic decline in the abundances of all species except Buffalo (which increased) between 1995 and 1997. Alternatively, it is possible that the extremely dry summer of 1991/2, and below average rainfall of 1993/4 and 1994/5 resulted in catastrophic declines of these species, and an influx of buffalo from KNP.
Fluctuations between 1997 and 2015 could simply be a result of sampling error (i.e. differences in detection probabilities or due to seasonal movements of animals in and out of Cleveland). It is likely that in years of below-average rainfall for the preceding summer (such as 2015), many herbivores move into the operational areas during the end of the dry season, resulting in lower sightings on Cleveland at the time of counting.

Figure 2. Differences in animal numbers recorded by aerial census of **Cleveland** between 1995 and 2015, for three largest herbivore species (A), the most abundant species (impala; B) and remaining abundant herbivore species (C). Data for 2007 are taken from the ARC Vegetation Report for Cleveland (2007). Data for all previous years are taken from a draft of the PMC Biodiversity Action Plan (2007). For all counts except 2015, the method used and the exact boundaries of the area counted is not known. Data are only shown for species for which sightings were recorded for most or all years.



Pompey

Fewer species and numbers were recorded on Pompey than expected (Table 1). With the exception of smaller species, specifically Duiker, Steenbuck and Warthog, densities were lower than on Cleveland KNP, at least for species which were recorded in both land types (Table 2). Both Elephant and Buffalo were found within Pompey, which confirms the regular movement of these species into the reserve from Letaba Ranch when the fence between these two reserves is broken. The low densities or absence of larger herbivores (Blue Wildebeest, Zebra and Eland) may be a result of these species moving out of Pompey and into Letaba Ranch, although poaching within Pompey is also likely to have played a role.

A comparison of these results with the only previous count data available for Pompey also indicated declines for most species (Figure 3). Differences in impala numbers are not likely to be significant, and could easily be a result of sampling error. However, the large differences in numbers of Giraffe, Kudu, Warthog, Waterbuck, Blue Wildebeest and Zebra indicate that the herbivore community has changed dramatically over the past 8 years, and is now less diverse. Declines in these species have been partially offset by the recent increase in Buffalo and Elephant, in terms of overall herbivore abundance. The relatively high densities of Duiker and Steenbuck, and the large increase in their numbers since 2007, may reflect reduced competition from the larger herbivores.

Figure 3. Numbers counted for all species recorded on the 2007 and 2015 game counts over the fenced portion of **Pompey**.