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LARGE MAMMAL CENSUS OF PALABORWA COPPER MINING COMPANY AND NEIGHBOURING LAND, OCTOBER 2016

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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 2016. This was a repeat of a survey conducted in 2015, at a similar time of year and using the same method. The purpose is to monitor changes in 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 following areas were flown, all on the 27th September 2016:

- Operational areas of PMC, including Dump 4 (the “rock dump”) and the tailings complex.
- Cleveland (including Vereeniging).
- A neighbouring part of the Kruger National Park (KNP), adjacent to Cleveland and incorporating the same habitats.
- The fenced portion of Pompey.

The first three sections above were flown between 7am and 12pm, and the Pompey section between 1pm and 3pm.
Crocodile and Hippo seen within the Olifants and Selati Rivers, where these border the sections above, were included.

Almost all trees had lost all their leaves at the time of the counting, and grass cover was very sparse. A few deciduous tree species (*Cassia abbreviata, Peltophorum africanum*) had flushed new leaves, but these species are rare, and overall visibility was very good – probably as good as it could be give the density of woody vegetation in the area. The counting team reported that visibility was very good.

RESULTS AND DISCUSSION

PMC mine area

Figure 1 shows the area flown around PMC mine, as well as the distribution of the most common species recorded 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. Locations of sightings of the five most abundant species recorded during the helicopter count of September 2016. Red dots show locations in 2016, and green dots in 2015. The size of the dots is proportional to the number of animals recorded per sighting.

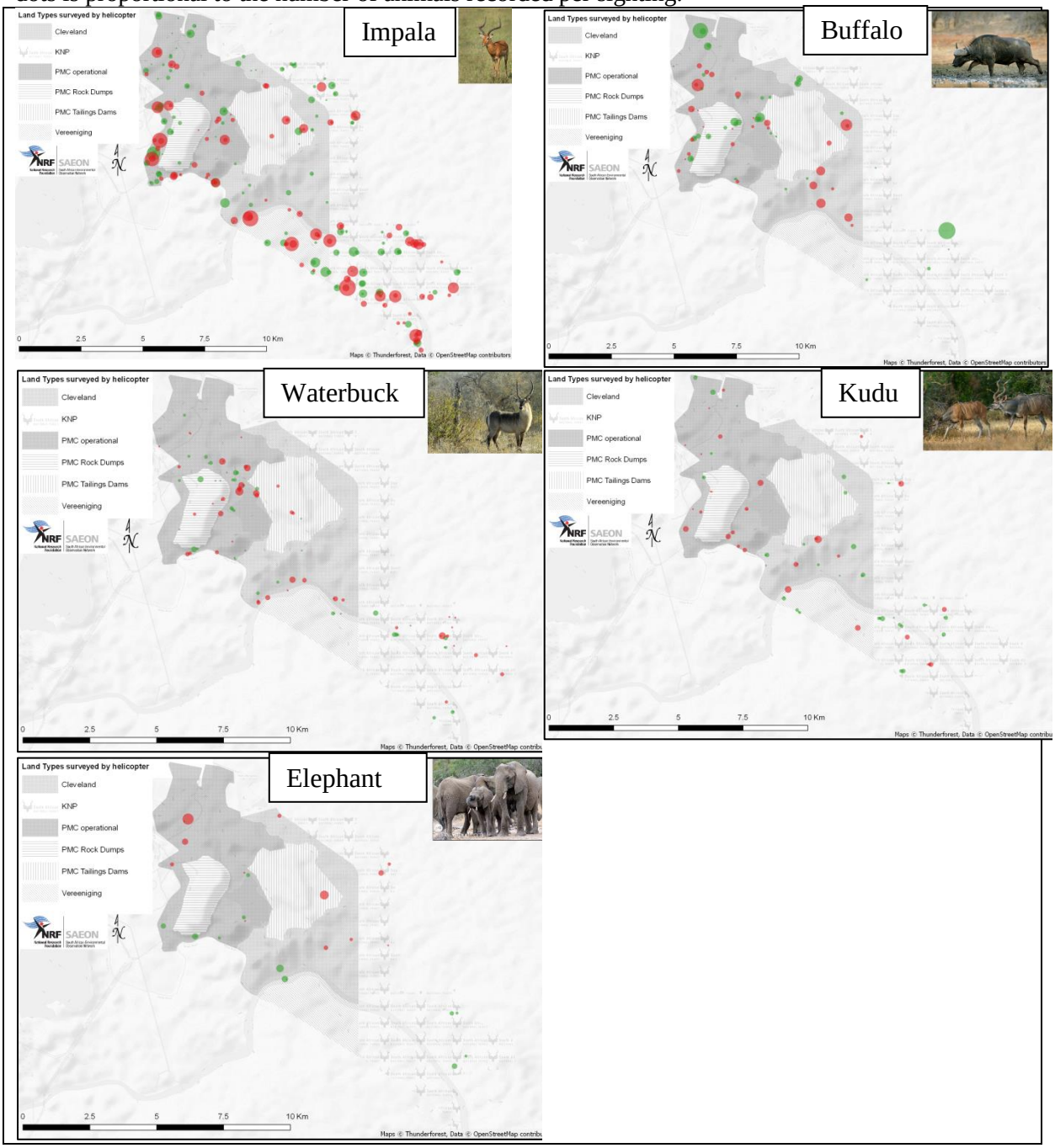


Table 1. Numbers of animals recorded during the helicopter census flown on the 27th September 2016, for five land types around PMC mine, and the fenced portion of the Pompey property.

Species	Cleveland	KNP	PMC Operational	PMC Rock Dump	PMC Tailings	Pompey
Baboon Troops	1	3	1	0	0	1
Blue Wildebeest	0	13	1	0	12	0
Buffalo	115	0	113	2	6	9
Bushbuck	1	0	7	0	0	0
Crocodile	37	9	22	0	1	0
Duiker	5	4	0	0	0	9
Elephant	9	9	40	0	17	3
Giraffe	12	3	0	6	0	1
Hippo	28	39	12	0	1	0
Impala	267	606	387	30	50	39
Klipspringer	1	0	2	0	0	0
Kudu	40	28	46	2	0	5
Leopard	1	2	0	0	0	0
Sharpe's Grysbok	5	10	0	0	0	0
Steenbuck	1	0	0	0	0	7
Warthog	6	9	35	3	7	3
Waterbuck	31	28	87	7	7	2
Zebra	21	5	5	0	8	0

Table 2. Densities of animals recorded during the helicopter census flown on the 27th September 2016. 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	0.05	0.10	0.04	0.00	0.00	0.09
Blue Wildebeest	0.00	0.43	0.04	0.00	1.45	0.00
Buffalo	5.37	0.00	4.05	0.47	0.73	0.81
Bushbuck	0.05	0.00	0.25	0.00	0.00	0.00
Crocodile	1.73	0.30	0.79	0.00	0.12	0.00
Duiker	0.23	0.13	0.00	0.00	0.00	0.81
Elephant	0.42	0.30	1.43	0.00	2.06	0.27
Giraffe	0.56	0.10	0.00	1.42	0.00	0.09
Hippo	1.31	1.30	0.43	0.00	0.12	0.00
Impala	12.47	20.16	13.86	7.12	6.05	3.51
Klipspringer	0.05	0.00	0.07	0.00	0.00	0.00
Kudu	1.87	0.93	1.65	0.47	0.00	0.45
Leopard	0.05	0.07	0.00	0.00	0.00	0.00
Sharpe's Grysbok	0.23	0.33	0.00	0.00	0.00	0.00
Steenbuck	0.05	0.00	0.00	0.00	0.00	0.63
Warthog	0.28	0.30	1.25	0.71	0.85	0.27
Waterbuck	1.45	0.93	3.12	1.66	0.85	0.18
Zebra	0.98	0.17	0.18	0.00	0.97	0.00

Comparisons of numbers per land type make more sense when differences in the area of each land type are taken into account (Table 2). For most species densities were similar to 2015, and the most common species showed a similar distribution across the PMC and KNP sections (Figure 1). Again, some species occurred at greater densities on the operational and rehabilitation areas of PMC, than in Cleveland and the neighbouring part of Kruger National Park, although patterns were not the same as in 2015. This year Elephant were most abundant on the Tailings and Operational areas, while Waterbuck were most abundant on the Operational areas and Buffalo showed their highest densities in Cleveland rather than on the Rock Dump. These differences could simply be due to chance, as all these species move extensively, and their occurrence in any one section could vary from day to day. However, for both 2015 and 2016, Elephant, Buffalo and Waterbuck densities have been higher on at least one of the PMC sections compared to the neighbouring part of KNP. These data are therefore now providing clear evidence that some aspect of PMC operations is attracting large herbivores onto PMC at the end of the dry season. This is likely to be because of any or all of the following factors:

- The abundant surface water available in the Return Water Dam and Loole Dam
- The phenology of the grasses on the Rock Dump and Tailings, which generally stay greener longer into the dry season compared to the surrounding areas
- Increased concentrations of nutrients in the vegetation, although this has yet to be analysed.

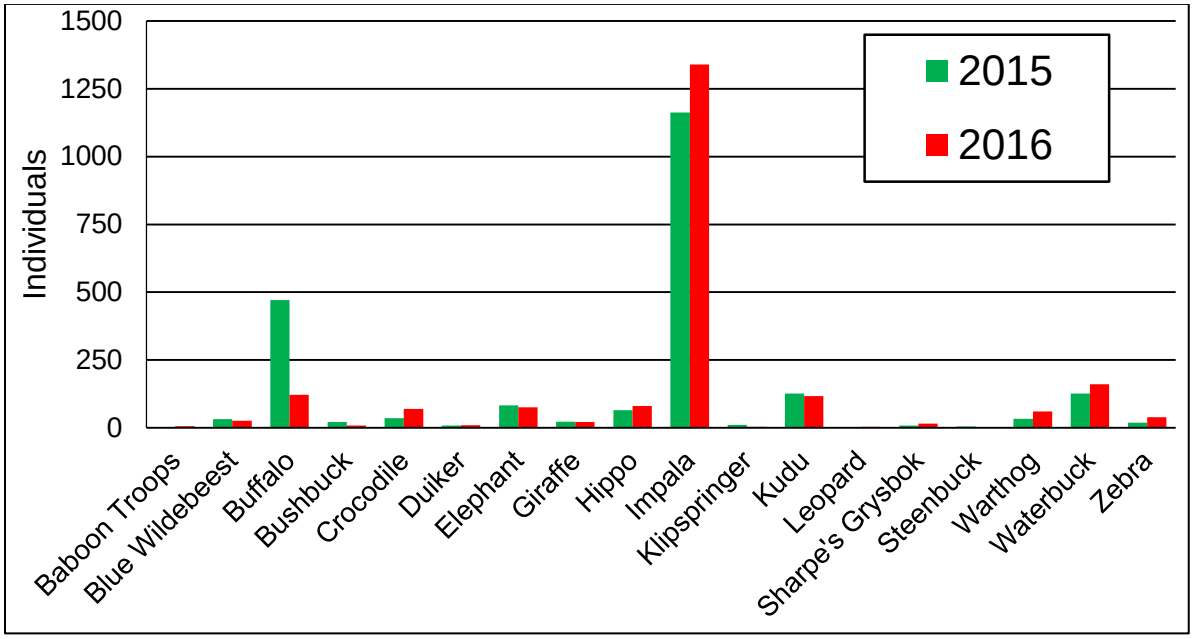
When considering the data combined for all these sections, changes from 2015 to 2016 were small for many species, with the following exceptions:

1. Buffalo decreased dramatically, by about 75% (236 individuals). This may be due to the start of drought-induced mortality, but there have not been reports of so many carcasses in the area counted. Instead much of the difference may be a result of chance, if many of the buffalo counted last year may had moved into a neighbouring area on the day of this years' count.
2. All other grazers except Blue Wildebeest showed large to moderate increases: Zebra by 117%, Warthog by 82%, Waterbuck by 26% and Hippo by 23%. This is perhaps due to these species moving from greater KNP into Cleveland and onto the two dumps. This would have been in response to the grass staying greener for longer on the dumps, and the supplemental feeding provided on Cleveland.
3. Crocodile increased dramatically (by 97%) which is most likely due to individuals being forced to moving out of smaller rivers and dams in the area, as these dried up, and into the Olifants River.

These differences must be treated with caution, as these species are very mobile and can move in and out of the area counted on a daily basis. Therefore a single count on one day of the year provides only a rough estimate of the density of animals within the area over an entire year. Nevertheless the large differences found

for some species does indicate strongly that real changes in local population densities has occurred.

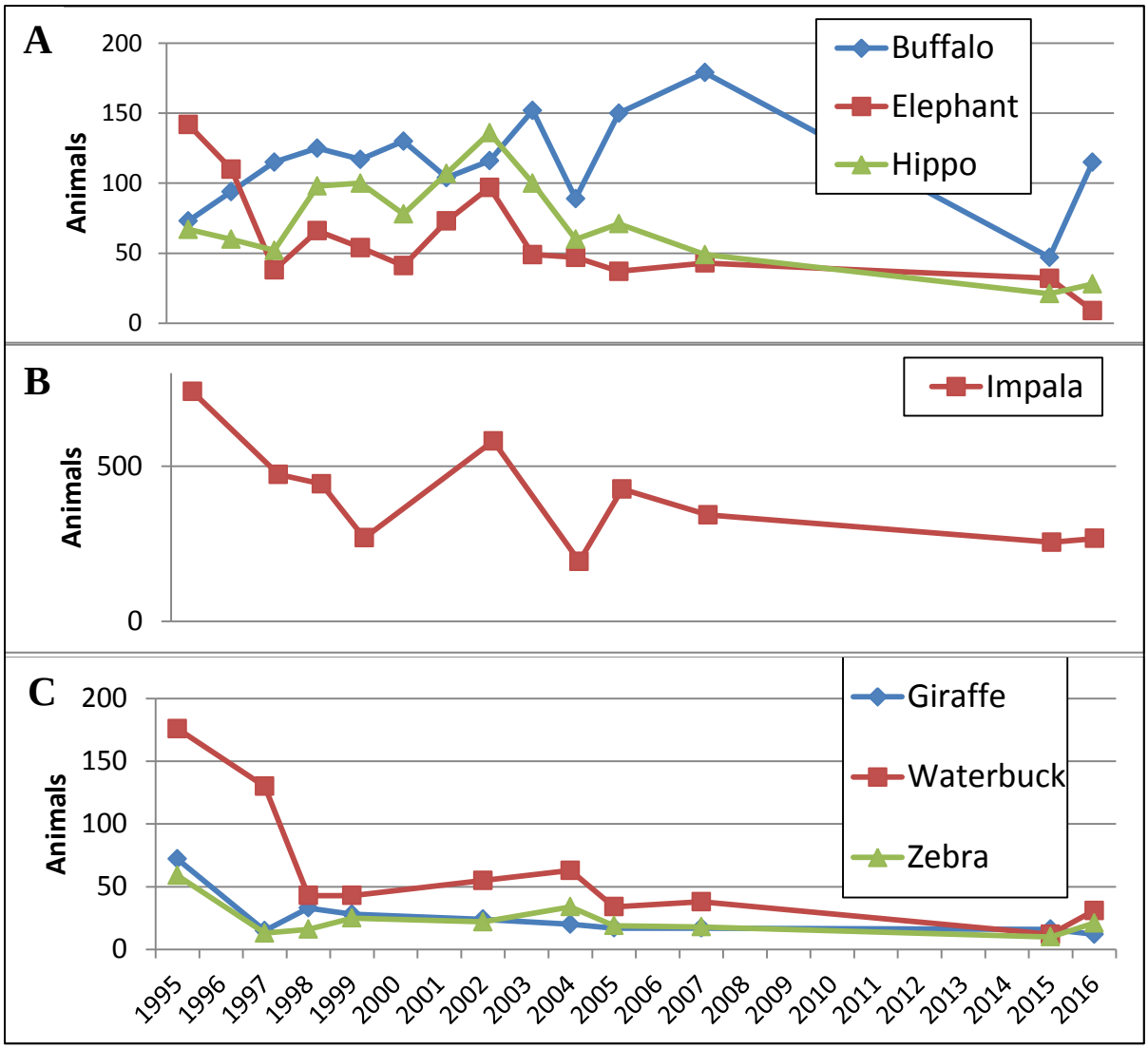
Figure 2. Changes in the numbers of animals between 2015 and 2016 for all sections of the PMC area (Cleveland, Operational, Rock Dump and Tailings) and the neighbouring block of KNP.



Establishing changes over a longer time period is only possible for Cleveland, as historical data are only available for that section. Figure 3 puts the changes over the past year into a long-term perspective. The lower number of Elephants recorded in 2016 apparently reflects a long-term decline of this species on Cleveland. Note that decline in Buffalo over the past year is in contrast to declines in all the sections around Cleveland.

Again these trends must be interpreted with consideration of each value being from a single day of the year in a system in which most species can move into or out of at will. Furthermore, it is not known how, and at what time of year, the previous counts were done. 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.

Figure 3. Differences in animal numbers recorded by aerial census of **Cleveland** between 1995 and 2016, 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). Data are only shown for species for which sightings were recorded for most or all years.



Pompey

Numbers were even lower for Pompey than in 2015, and again far lower than the only survey conducted before that, in 2007 (Figure 4). Declines were recorded for all species present, with decreases from 2016 to 2015 being over 60% for many of them. Poaching apparently continues to reduce herbivore numbers on this property. It is unlikely that the on-going drought is responsible for such large declines over the past year, as grass biomass is still reasonably high within Pompey, and far higher than on Cleveland and in KNP, where no or much lower declines were recorded. Densities on Pompey are now lower than the PMC-Cleveland-KNP section for all species except Steenbuck. Elephant were again recorded within Pompey, which confirms regular breaching of the fence between these two properties.

Figure 4. Numbers counted for all species recorded in 2007, 2015 and 2016 game counts over the fenced portion of **Pompey** game farm.