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SAEON REPORT ON THE AMPHIBIAN (ANURAN) DIVERSITY OF PALABORA MINING COMPANY AND NEIGHBOURING LAND TYPES

Results of the 2016 surveys

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SUMMARY

- Amphibians are surveyed annually to determine differences between the various land units of PMC, and monitor changes over time.
- Active searches were employed to survey frogs at a diverse array of sites (22) in Cleveland, PMC operational areas, Kruger National Park and surrounding rural rangelands.
- Drier conditions resulted in certain survey sites being dry during the 2016 surveys and consequently less species encountered.
- No Red Data species were encountered and the Plain Grass Frog was the most common species encountered overall.
- It is important to continue monitoring the amphibians of adjacent land types, to better understand local effects of contaminants from the mining area.

INTRODUCTION

Long-term monitoring of animal communities can assist in understanding the processes that govern community patterns over time. However, "…amphibian declines have been an ongoing global phenomenon, first reported as such in 1990 and gathering in number with increasing quantities of studies and interpretations" (Blaustein & Wake 1990; Houlahan et al. 2000; in Measey, 2011). These reports highlighted the complexity of the global extent of amphibian decline together with numerous factors in both pristine and disturbed habitats. South Africa only contain a single order of the class Amphibia: order <u>Anura</u>, referring to frogs and toads (Measey, 2011).

The aim of this monitoring project is to:
1. Accurately describe differences in amphibian community composition on two of the major land types of Palabora Mining Company (PMC), Kruger National Park (KNP) and rural rangelands outside Phalaborwa town
2. Detect these differences, if any, over time;
3. Identify any species of special concern that would require more intensive monitoring, i.e. monitoring at the population level.

METHODS

Anuran (of the class Amphibia, specifically frogs and toads) surveys were conducted during the month of November and December 2016. More rain had fallen by then compared to the time of the 2015 surveys. This needs to be taken into account when comparing 2016 results with that of previous years since Anurans are after all water-/moisture-dependent even though some species live in terrestrial habitats. Ideally, Anurans should be surveyed within a few days after ~40 mm of rain.

As with previous surveys, active searches were employed to search for Anurans along known water bodies only, i.e. terrestrial habitats were excluded (we assumed to find no frogs in terrestrial habitats due to the dry). This method entailed walking along the water's edge and recording all amphibians aurally and visually. No cut-off distance was used for recording calls or sightings. As long as a frog could be heard it was

recorded and assumed to use that specific survey site. Species were recorded until the observers perceived saturated species richness.

A total of 20 survey sites were surveyed once in 2016. These were located as follows: four inside PMC, two inside Pompeii and six inside Cleveland Game Park. The site, *frog05* inside PMC, was not surveyed. The reduction in Cleveland survey sites by one is ascribed to the persistent dry conditions at the specific site from year to year. Surveying took place at five widely spaced sites in the Kruger National Park with another three sites around rural Makhushane/Namakgale (Figure 1). The current but, rapid survey design will continue in the future with the possibility of adding more sites in the different land types.

Data analysis

Only average species richness is compared between land types and years. Due to the active search survey design employed, the dataset does not lend itself to statistical analyses.
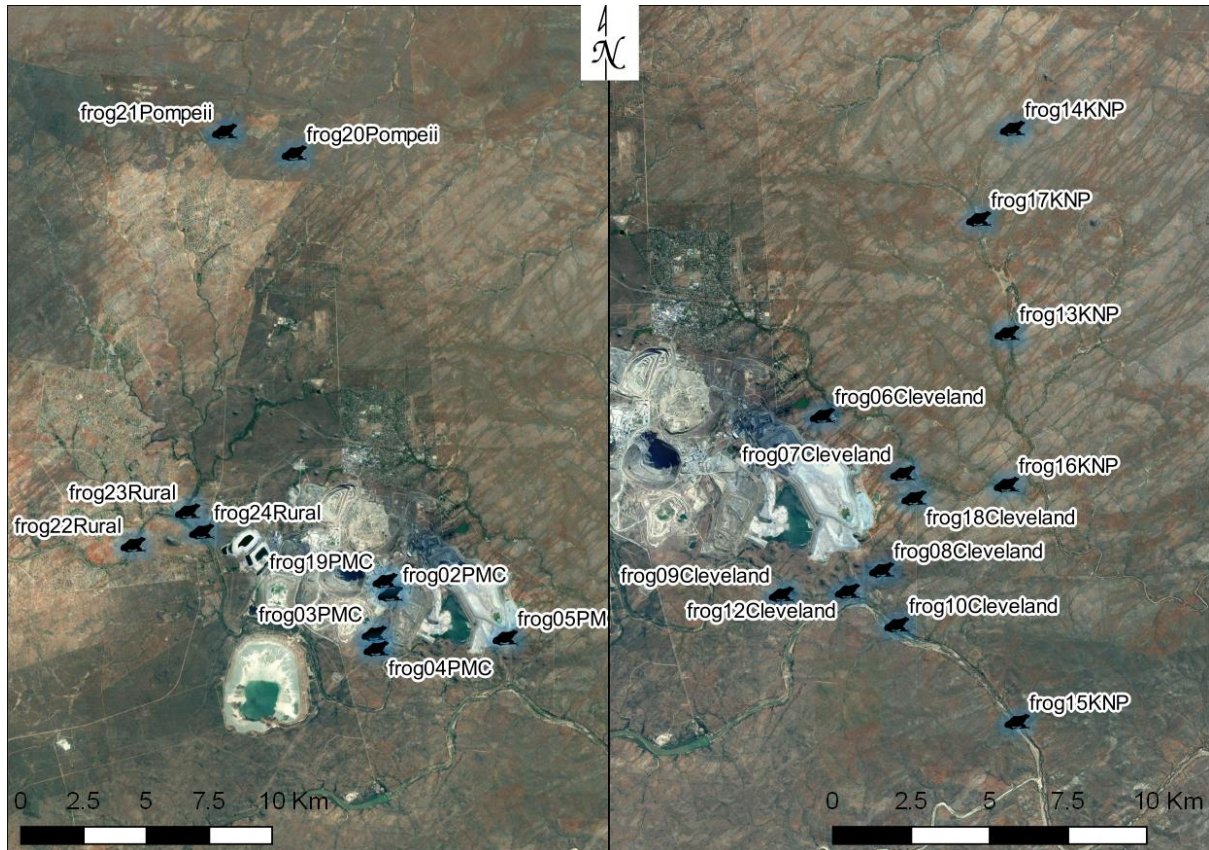

Figure 1: Satellite images depicting the various survey sites where Anurans were surveyed in 2016. Site codes correspond to the first two columns in Table 1 but, here land types and survey site names are fused.

Table 1: Survey site descriptions, latitudinal- and longitudinal coordinates where frogs were surveyed. Sites code numbering is not logical and site *frog05* was removed due to no surveying taking place in 2016. Survey site codes and land types correspond to Figure 1.

Site code	Land type	Latitude	Longitude
frog02	PMC	-23.9995	31.14797
frog03	PMC	-24.0136	31.14161
frog04	PMC	-24.0191	31.14236
frog06	Cleveland	-23.9790	31.18189
frog07	Cleveland	-23.9955	31.20703
frog08	Cleveland	-24.0231	31.20044
frog09	Cleveland	-24.0301	31.16899
frog10	Cleveland	-24.0388	31.20513
frog12	Cleveland	-24.0292	31.18971
frog13	KNP	-23.9554	31.23974
frog14	KNP	-23.8969	31.24143
frog15	KNP	-24.0665	31.24288
frog16	KNP	-23.9987	31.23953
frog17	KNP	-23.9227	31.23084
frog18	Cleveland	-24.0025	31.21057
frog19	PMC	-23.9948	31.14584
frog20	Pompeii	-23.8419	31.11024
frog21	Pompeii	-23.8341	31.08297
frog22	Rural	-23.9819	31.04710
frog23	Rural	-23.9700	31.06847
frog24	Rural	-23.9772	31.07401

RESULTS AND DISCUSSION

A total of 18 species were recorded during the 2016 surveys. This species count is somewhat more than 2015 (14) but it is due to additional surveying sites in different land types. Figure 2 shows the average species richness for each land type across the different years.
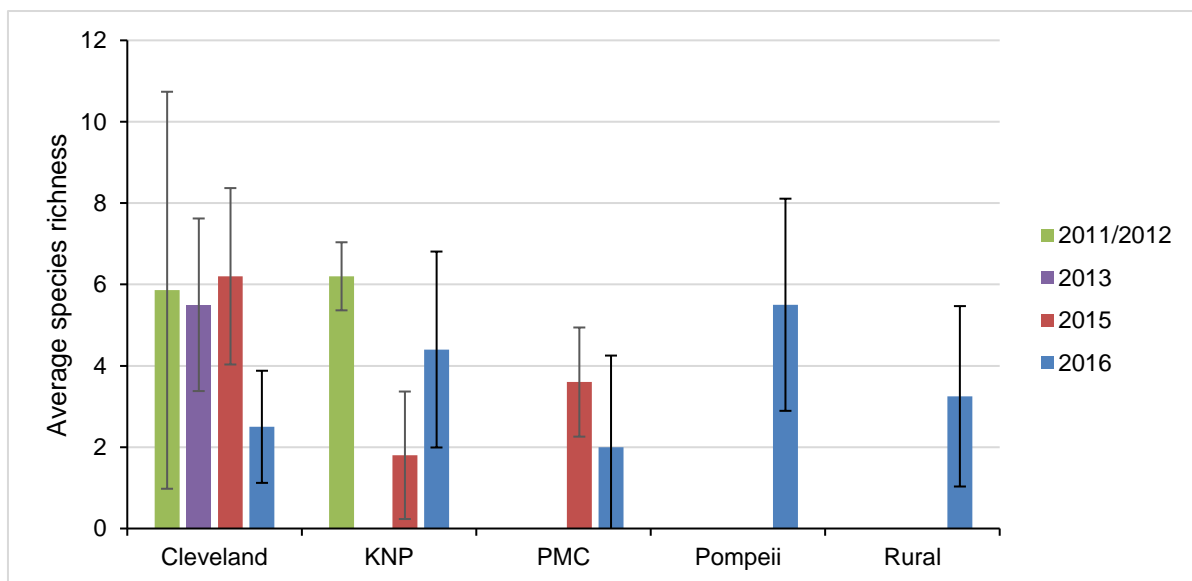

Figure 2: Average number of species recorded across the various land types. Error bars indicate standard deviation from the mean.

Various environmental factors affect anuran detectability and presence. The 2014-2016 drought however, did not seem to affect the amphibian community as much as some other taxa (e.g. land reptiles). The differences in values between 2015 and 2016 cannot be easily explained where e.g. Cleveland had a large drop in species but adjacent KNP showed the opposite (Figure 2). These differences could be due to the aforementioned factors, for example surveying on windy nights or waiting too long after the rains when conducting surveys.

The most common species across the land types was the Plain Grass Frog *Ptychadena anchietae* (Figure 3). This widely distributed species occurring in many different habitats including savanna, is active throughout most of the year (du Preez and Carruthers, 2009). No Red Data (IUCN) species were recorded during the 2017 surveys.

Figure 3: The most common Anuran encountered during the 2015 and 2016 surveys: *Ptychadena anchietae*. Source: http://vmus.adu.org.za/; Photo: A. Coetzer and P. Webb.

A scarcer species not often found but, recorded in KNP only during 2015 and 2016 surveys is *Ptychadena mossambica* (Figure 4). Du Preez and Carruthers (2009) also mentions this species prefers predominantly bushveld habitat rendering it a specialist compared to the generalist *P. anchietae* that is a wider-distributed frog from savanna, glassland, agricultural and urban habitats. The former is probably found solely in KNP due to its preference for natural pans: unique survey sites not surveyed in the other land types. Future surveys might include pan-type sites in the other land types if found as to determine whether this species occurs more widely.

Figure 4: An uncommon species encountered during both the 2015 and 2016 surveys: *Ptychadena mossambica*. Source: http://vmus.adu.org.za/; Photo: Nick Evans.

South Africa (SA) is Africa's 5th most species rich country in terms of Anuran diversity. Major threats to SA amphibians include agri- and aquaculture. Energy production and mining seems to have little effect on species loss with 2.6% of SA's species affected (Measey, 2011). However, this value was generated from pre-2010 assessments. Also, few mines are situated near large river systems such as the Selati' and Olifants' thus, acid mine drainage may have devastating effects on anurans in these rivers downstream of nearby mining activity.

Measey (2011) shows that no priority monitoring sites of the South African National Biodiversity Institute (SANBI) occur within the north-eastern part of SA and that the Hans Merensky Nature Reserve monitoring site was closed. Hence, long-term monitoring of Anurans should continue to be implemented into PMC's biodiversity management plan. As with any other biota, unnaturally high levels of macro elements such as sulphates will have an effect on the amphibian community. Only long-term annual monitoring will be able to determine which species are more sensitive to varying water quality and -quantities. Nationally, anurans have become more threatened from 2004 to 2010 (Measey, 2011).

REFERENCES

DU PREEZ, L. & CARRUTHERS, V. 2009. *A complete guide to frogs of southern Africa*. Struik Nature, Cape Town.

MEASEY, G.J. (ed.) 2011. Ensuring a future for South Africa's frogs: a strategy for conservation research. *SANBI Biodiversity Series 19*. South African National Biodiversity Institute, Pretoria.

APPENDIX

Anuran (frog and toad) species recorded in the various land types during 2016.

Latin name	Cleveland	KNP	PMC	Pompeii	Rural
Amietia quecketti	✓		✓	✓	✓
Amietophrynus garmani	✓	✓	✓		✓
Amietophrynus maculatus				✓	✓
Cacosternum boettgeri		✓			
Chiromantis xerampelina	✓	✓		✓	✓
Hemisus marmoratus		✓			
Hyperolius marmoratus		✓		✓	✓
Kassina senegalensis	✓	✓		✓	
Leptopelis mossambicus		✓		✓	
Phrynobatrachus mababiensis	✓		✓	✓	
Phrynobatrachus natalensis		✓			
Phrynomantis bifasciatus		✓			
Ptychadena anchietae	✓	✓	✓	✓	✓
Ptychadena mossambica		✓			
Tomopterna cryptotis	✓	✓	✓		
Tomopterna marmorata		✓			
Tomopterna marmoratus	✓		✓		✓
Xenopus sp.		✓		✓	✓