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AMPHIBIAN (ANURAN) DIVERSITY OF PALABORWA COPPER MINING COMPANY AND NEIGHBOURING LAND TYPES

Results of the 2015 surveys

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SUMMARY

- The monitoring project aims to accurately describe the amphibian communities of the different land types and any changes over time.
- The dry conditions during the February surveys resulted in less species encountered.
- Active searches were employed to survey frogs at important sites (12) in Cleveland and PMC operational areas.
- Cleveland had the most frog species with ~58% of those found at PMC.
- Drier conditions than 2011/2012 resulted in certain sample sites parched during the 2015 surveys and consequently less species encountered.
- No Red Data species were encountered but, the Plain Grass Frog was the most common species encountered, overall.
- Since long-term frog monitoring at Hans Merensky golf course were stopped, it is important to continue monitoring the amphibians of adjacent land types especially where exposed to the effects of mining.

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);
2. Detect these differences, if any, over time;
3. Evaluate the effectiveness of the current method for monitoring amphibian diversity;
4. 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 February however, since only 54% of the Phalaborwa regions' average rainfall was received by end of January 2015, the results of this survey depicted these dry conditions. The latter needs to be taken into account when comparing 2015 results with that of previous years since Anurans are after all water-/moisture-dependent even though some species live in terrestrial habitats. Ideally, Anurans need to 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 sample site. Also, no specific distance was traversed along the water's edge. Species were recorded until the observers perceived saturated species richness.

Anurans use sound to attract females for mating. However, during the 2015 surveys visual records were mostly the result as few species were calling during the drier conditions.

A total of 12 sample sites were surveyed: five inside PMC and seven inside Cleveland Game Park (Table 1). Additional sample sites (10, 11 and 12) were included during the 2015 survey due to flood conditions preventing previous surveys from accessing these areas. Site 9 was generally inaccessible and dangerous to survey due to Hippopotamus activity hence, it was moved Northwards and upstream the Selati (Ga-Selati) River (Table 1 and Figure 1).

Data analysis

Only total species richness and estimated abundance values are compared between sites and years, in this report. Due to the sampling design employed, the dataset does not lend itself to statistical comparisons.

Figure 1: Satellite image depicting the various sampling sites where Anurans were surveyed. Dark bars indicate species richness and light-coloured bars indicate abundance. North Dam and South Dam were dry and no surveys took place there during 2015.

Table 1: Sample site descriptions, Latitudinal, Longitudinal locations and species richness. Sample site names correspond to Figure 1.

	Sample site number	Sample site name	Latitude	Longitude	Species richness
Palabora Copper mine	1	Sewage Works	-23.980139	31.149694	2
	2	Rock Dump South-West Weir	-23.999500	31.147972	3
	3	Loole Dam	-24.013639	31.141611	1
	4	Loole Weir	-24.019083	31.142361	4
	5	South Paddock Sump	-24.015139	31.192889	4
Cleveland Game Park	6	North Dam	-23.978972	31.181889	
	7	South Dam	-23.995472	31.207028	
	8	Fountain	-24.023083	31.200444	7
	9	Ga-Selati River	-24.030066	31.168993	5
	10	Eastern Olifants River	-24.036849	31.202455	9
	11	Western Olifants River	-24.034533	31.176800	4
	12	Seep	-24.029173	31.189711	5

RESULTS AND DISCUSSION

A total of 12 species were recorded during the 2015 surveys, this amount at Cleveland only but, seven of these were recorded at PMC. A site not possible to survey during 2015, North Dam, had 13 species recorded during past surveys, in itself. For 2015, the sample site with the most species was the Eastern Olifants River and the lowest, Loole Dam. Compared to 2011/2012, all sites' species richness was lower during 2015 (Figure 2). Rainfall data from the 2011/2012 October-February period shows that more than double the amount of rain was received compared to 2015. In this light it was expected that the 2015 surveys would yield less Anuran species.
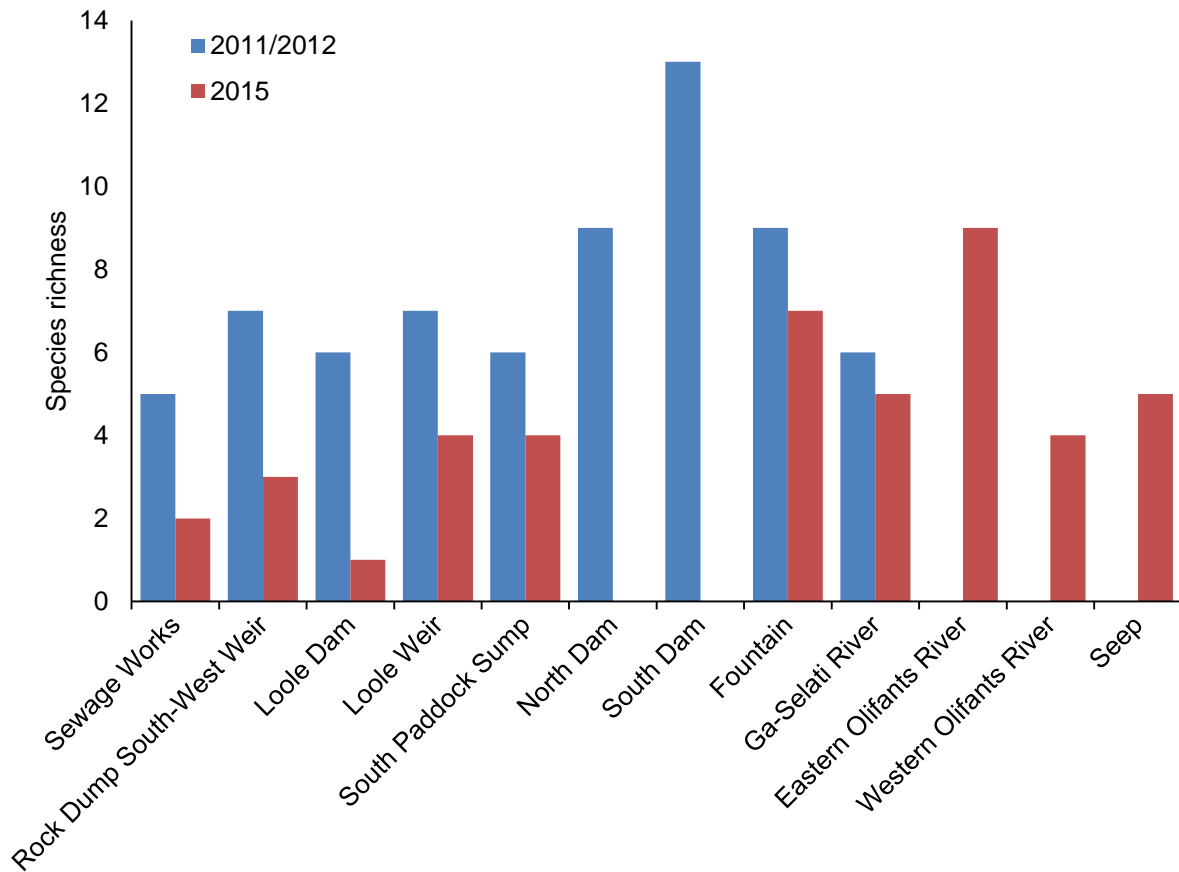
Figure 2: Species richness values at the various sample sites for 2011/2012 and 2015 surveys. North- and South Dam were not surveyed during 2015 due to drier conditions.

The most common species in Cleveland Game Park and PMC was the Plain Grass Frog *Ptychadena ancietae* (Figure 3). Some individuals have red backs (not displayed here). 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 these surveys.

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

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' but, 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. But, 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 community. Only monitoring will be able to determine which species are more sensitive to varying water quality and -quantities. Also, nationally, Anurans have become more threatened from 2004 to 2010 (Measey, 2011).

The current sampling and survey designs are being reviewed for Anurans and future surveys will deliver more comparable results among sites and seasons.

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.

Anuran (Frog and toad) species recorded in the various land types. Numbers 1-12 correspond to sampling sites in Table 1. Sample sites six and -seven could not be sampled in 2015 due to dry conditions.

Species (Latin name)	Palabora Copper							Cleveland Game Park				
	1	2	3	4	5	6	7	8	9	10	11	12
Amietia quecketti		✓		✓				✓	✓	✓	✓	✓
Amietophrynus garmani								✓		✓		
Amietophrynus maculatus				✓					✓	✓	✓	
Chiromantis xerampelina					✓					✓		
Hemisus marmoratus								✓	✓			✓
Hyperolius marmoratus			✓		✓				✓	✓	✓	
Kassina senegalensis										✓		
Phrynobatrachus mababiensis		✓		✓	✓			✓		✓		✓
Ptychadena anchietae	✓	✓		✓	✓			✓	✓	✓	✓	✓
Tomopterna cryptotis								✓				
Tomopterna marmorata								✓				
Xenopus muelleri	✓									✓		✓