Applying in-situ fluorescence and molecular screening techniques to understand contamination and contributing risk factors in shallow urban groundwaters in sub-Saharan Africa

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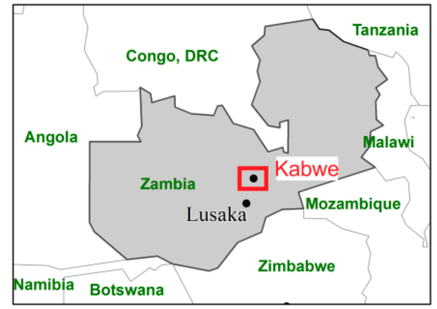
Introduction

Shallow hand dug wells and boreholes are particularly important as local sources of water in sub-Saharan Africa. They are also potentially most at risk from anthropogenic contamination. As such, mapping groundwater contamination and understanding the key risk factors remains a priority. The risk of microbial contamination is often evaluated using sanitary risk assessments and characterised using thermotolerant coliforms and faecal streptococci as indicators. This poster shows preliminary results from a pilot study investigating the use of two novel techniques, in-situ optical fluorescence for tryptophan (a protein waste water marker) and molecular pathogen screening (qPCR) for screening groundwater contamination. Groundwater quality surveys were carried out during the wet and dry seasons at 50 sites (including both shallow hand dug wells and boreholes) across Kabwe, Zambia. Kabwe is a former mining town in Central province with a population of around 200 000 which is largely dependent on groundwater for water supply and has a history of legacy contamination due to mining.



Location of study area

In-situ fluorescence analysis

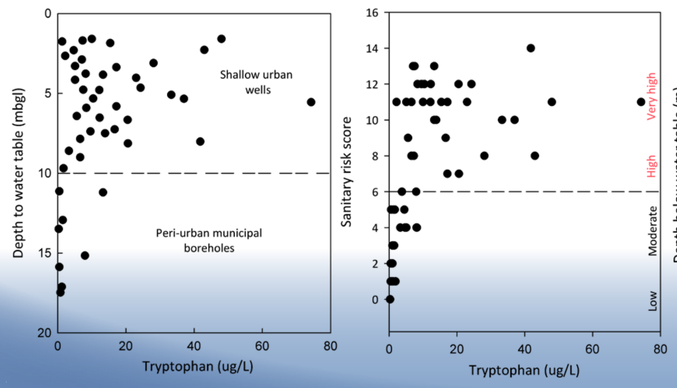
Field measurements of tryptophan concentrations were carried out using a probe which records fluorescence intensity selective for tryptophan (280 nm–360 nm excitation — emission wavelength pair). This was used in a bucket to analyse pumped grab samples and also lowered down a newly constructed borehole to profile changes in tryptophan with depth (slotted PVC casing).

Sampling groundwater for molecular screening by qPCR

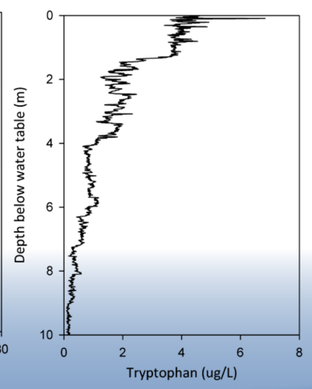
Samples for molecular screening were isolated on to Stervix filters using a home-made pressurised filtration system comprising a bike pump and a 2.5L Nalgene container. Sample DNA was preserved in the field using a preservation solution. Containers were sterilised in the field between samples and rinsed thoroughly before use on the next site. 5L of groundwater was typically pumped through the system to acquire adequate organic material.

Results: Wet season survey

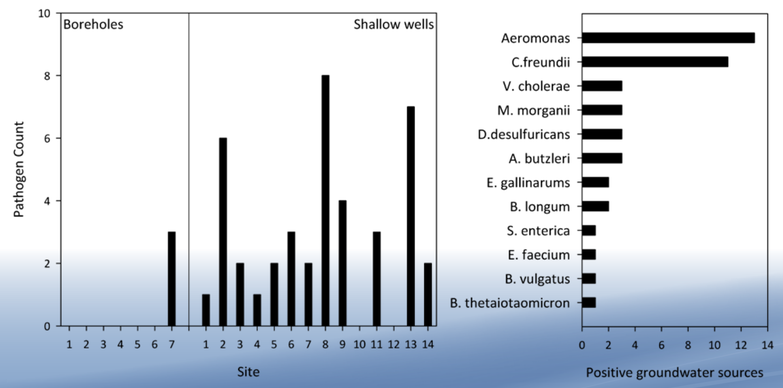
Wet season grab sample survey across Kabwe



Borehole profile



qPCR results for selective pathogens in groundwater



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