



British Geological Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

Gateway to the Earth

Tracking pathways for pathogen contamination in urban groundwater supplies in Africa: novel application of qPCR techniques

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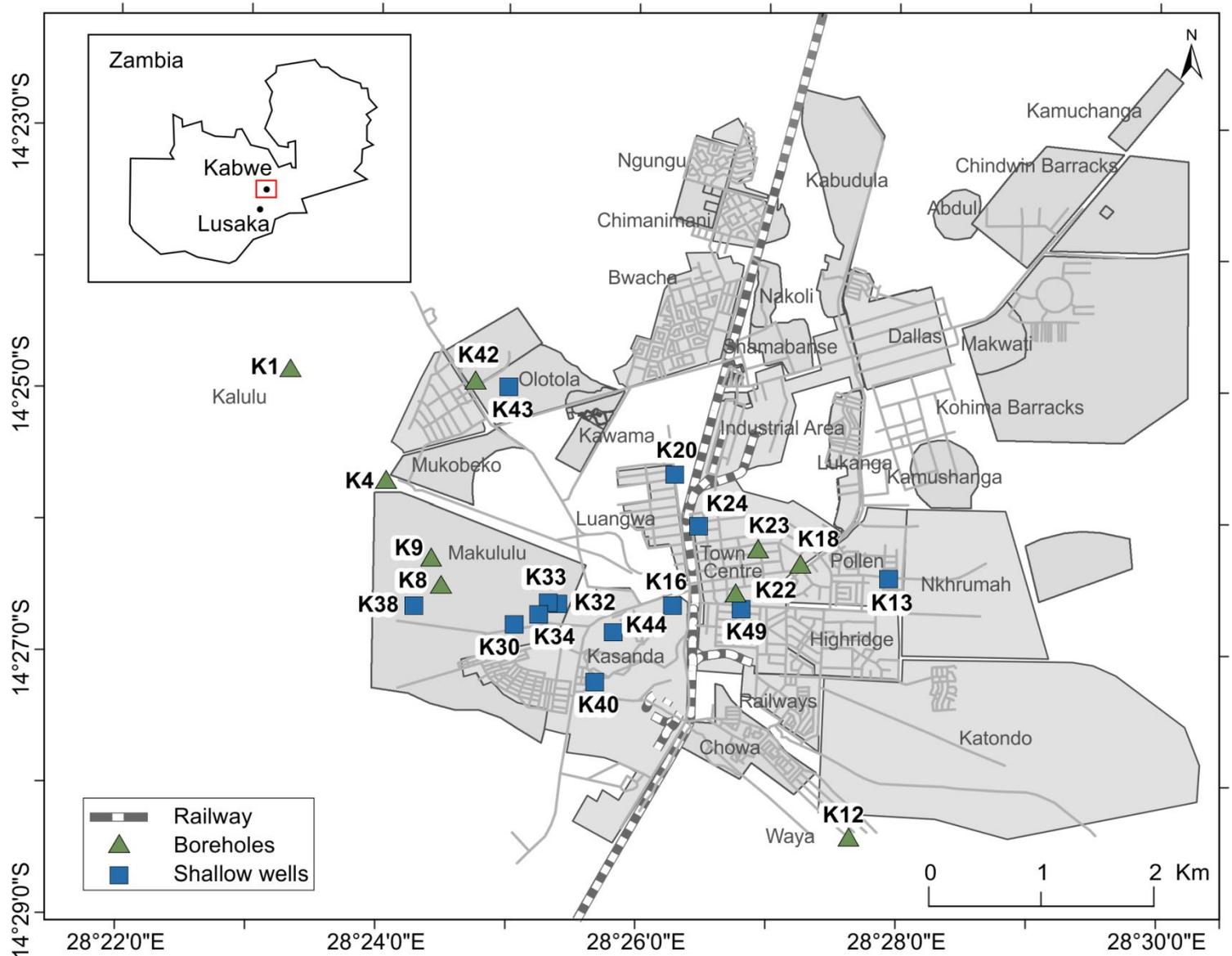
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Motivation

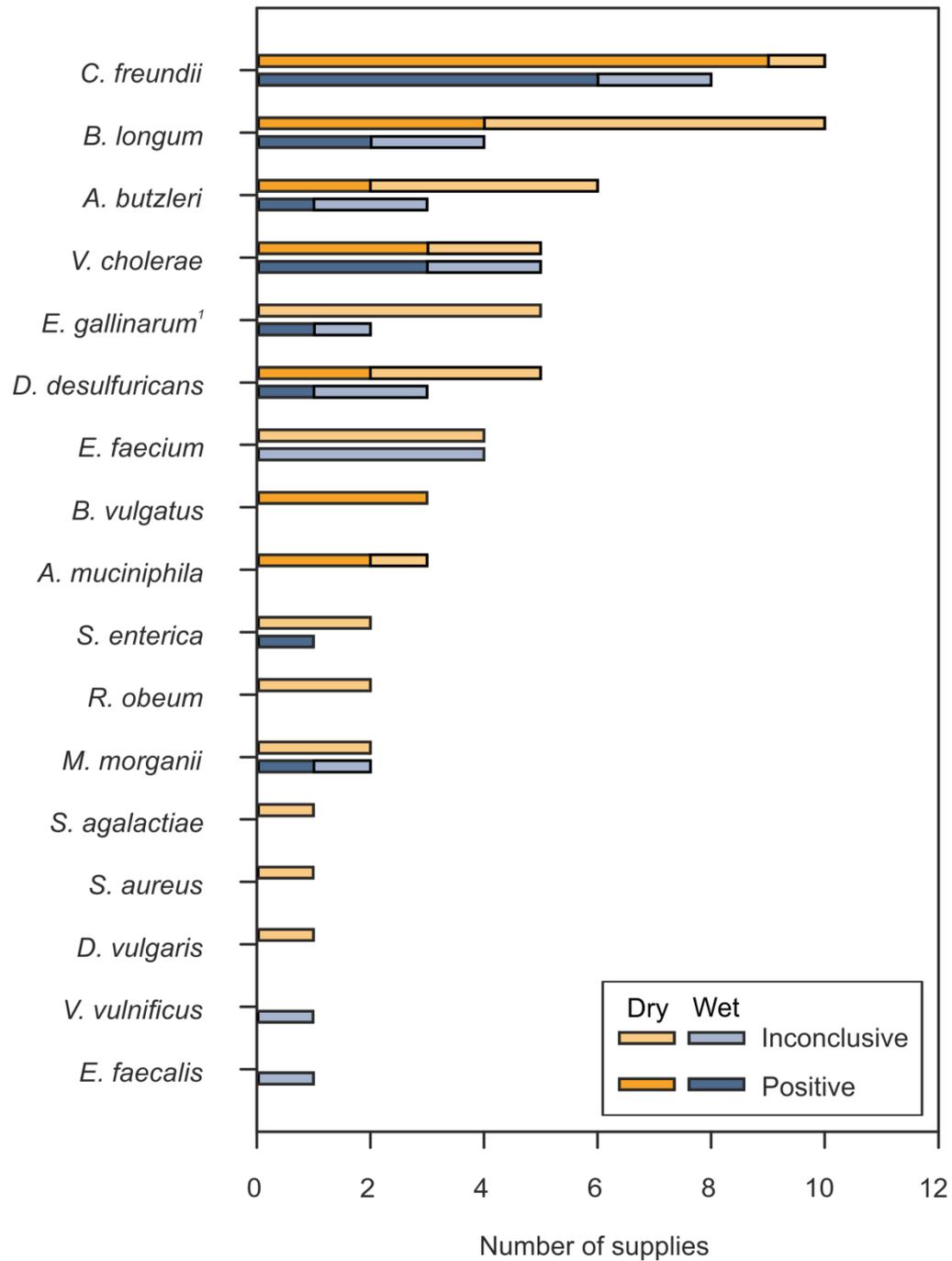
- Globally 1.8 million people/a die due to pathogen related illness
- 90% of these are below 5 years of age
- Globally Sub-Saharan Africa is where most people (320 Million) do not have access to safe water
- Various transmission routes including water-borne transmission
- Inferred from surrogate thermo-tolerant coliforms (TTC)
- Almost no data exists on actual pathogen occurrence in GW for either bacterial or viral pathogenic strains
- Many shallow sources are vulnerable to pathogen contamination due to rapid pathways

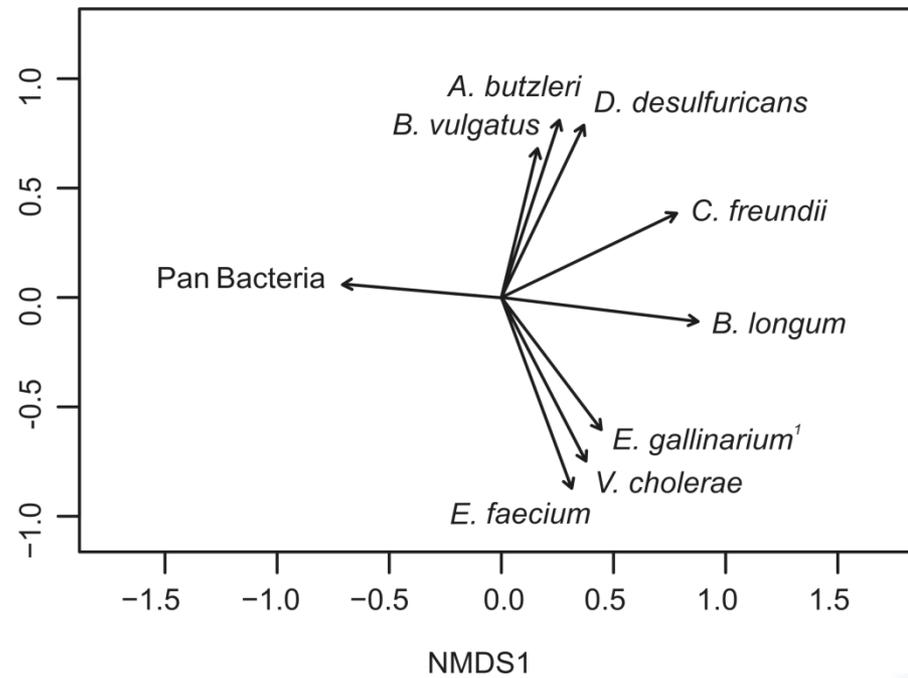
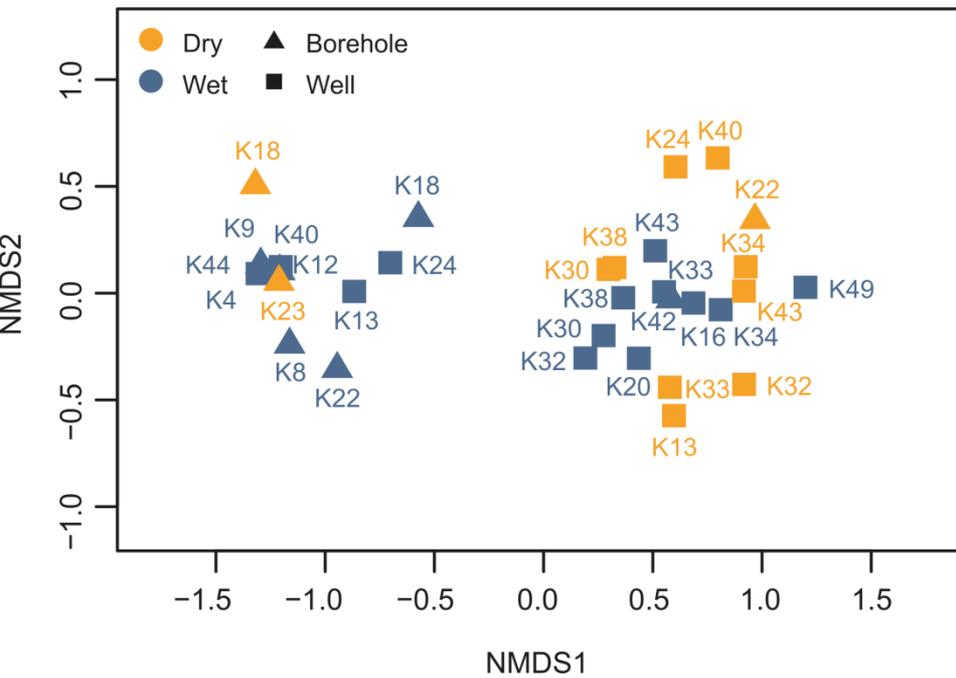
Study area

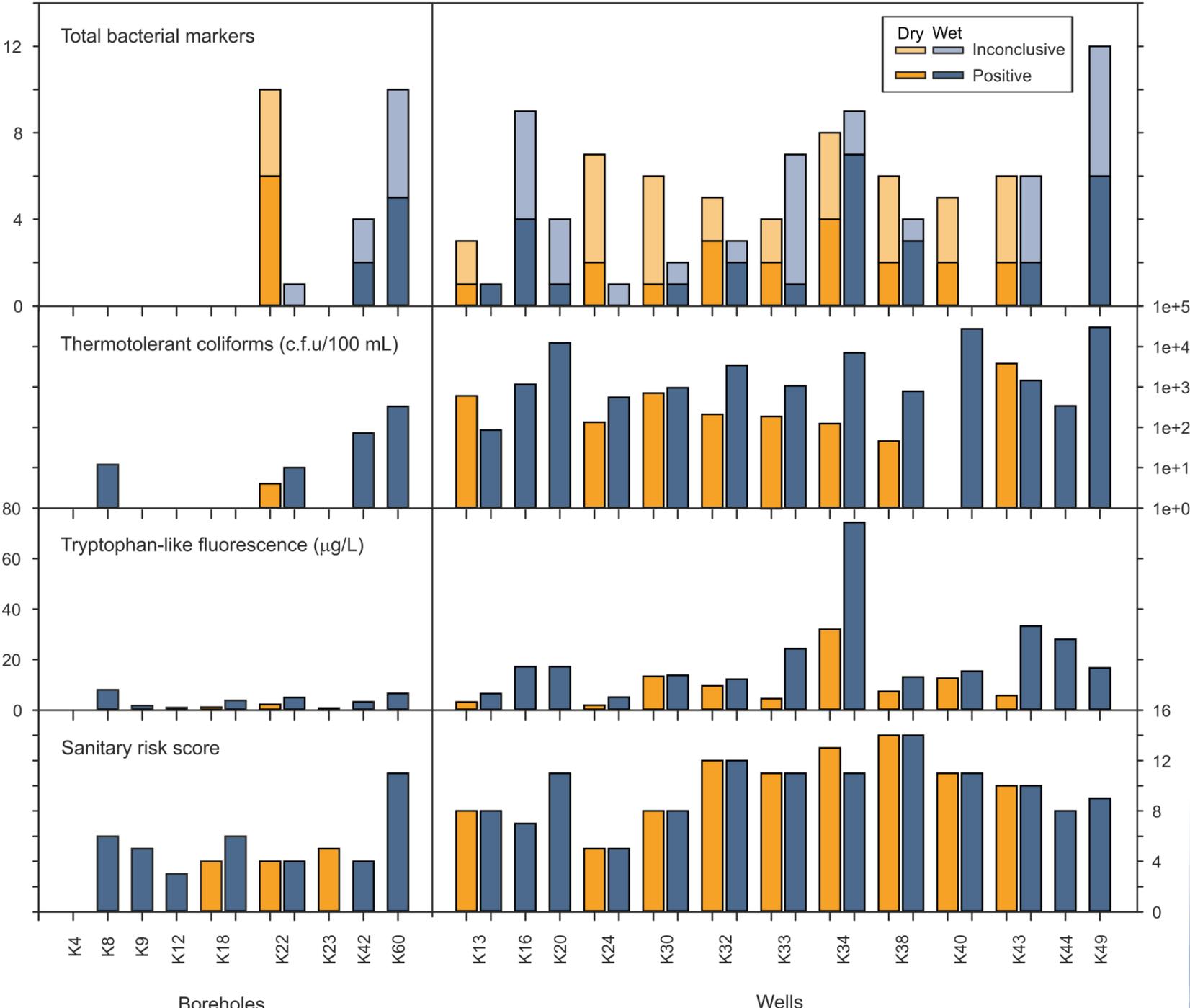


Methods

- Samples for molecular analyses were collected by positive pressure filtration of 2 L of water onto 0.22 µm Sterivex polyethersulfone or PVDF filter cartridges (same yield)
- 2 – 3 ml of DNA/RNA Shield (Zymo Research, USA) was added to preserve the sample
- Stored at -20 °C until DNA extraction
- DNA was extracted from whole sterivex filters using the PowerWater DNA isolation kit (MO BIO Laboratories Inc., USA)
- Used the commercially available microbial DNA qPCR Array for water analysis (Qiagen Ltd., UK)
- Specific assays used for 45 different bacterial targets







Preliminary results

- Pathogen markers were only found in sources within the urban landuse settings
- No evidence of lateral transport to the municipal sources located out of town
- DNA markers were most prevalent in shallow wells in laterite/saprolite reflecting rapid pathways to subsurface and increased sanitary vulnerability
- Thick laterite/saprolite horizon is not a sufficient barrier to microbiological contamination (supported by other data also)
- First evidence for a widespread perennial inland freshwater reservoir of *Vibrio cholera* (40% of shallow sites)
- Tryptophan-like fluorescence is an indicator of enteric bacteria markers

Further remarks

- Are we observing viable DNA, non-viable or a mixture?
- What about virus occurrence – is tryptophan a good proxy?
- Small sample size in this study, we need to start to build a more comprehensive picture of enteric pathogens in water supplies
- Cost for these types of methods are coming down all the time

