

# The Challenges of Investigating Groundwater Ecosystems Using Boreholes



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## Our UK groundwater ecosystem

The ecosystem comprises an array of microorganisms, and uniquely adapted meio- and macro-fauna. These may provide important ecosystem services such as biogeochemical cycling, pollutant attenuation, and maintaining open flow paths. The fauna also have potential as water quality indicators and contribute to biodiversity, e.g. a new UK species of invertebrate was discovered in 2010. However, their relative importance is often speculated upon, with limited understanding of these ecosystems or their functioning. This is a result of the inaccessibility of the subsurface where boreholes are frequently used as the sole sampling window into aquifers.

## The study

- Investigated the differences between borehole and aquifer hydrochemistry, bacteria, and invertebrates at different depths beneath the surface.
- Packers were deployed to isolate three potential aquifer habitats (fractures/conduits) intercepted by two Chalk boreholes.
- Hydrochemical, microbiology and invertebrates samples were then taken progressively with pumping. Net samples for invertebrates were also taken from the borehole.

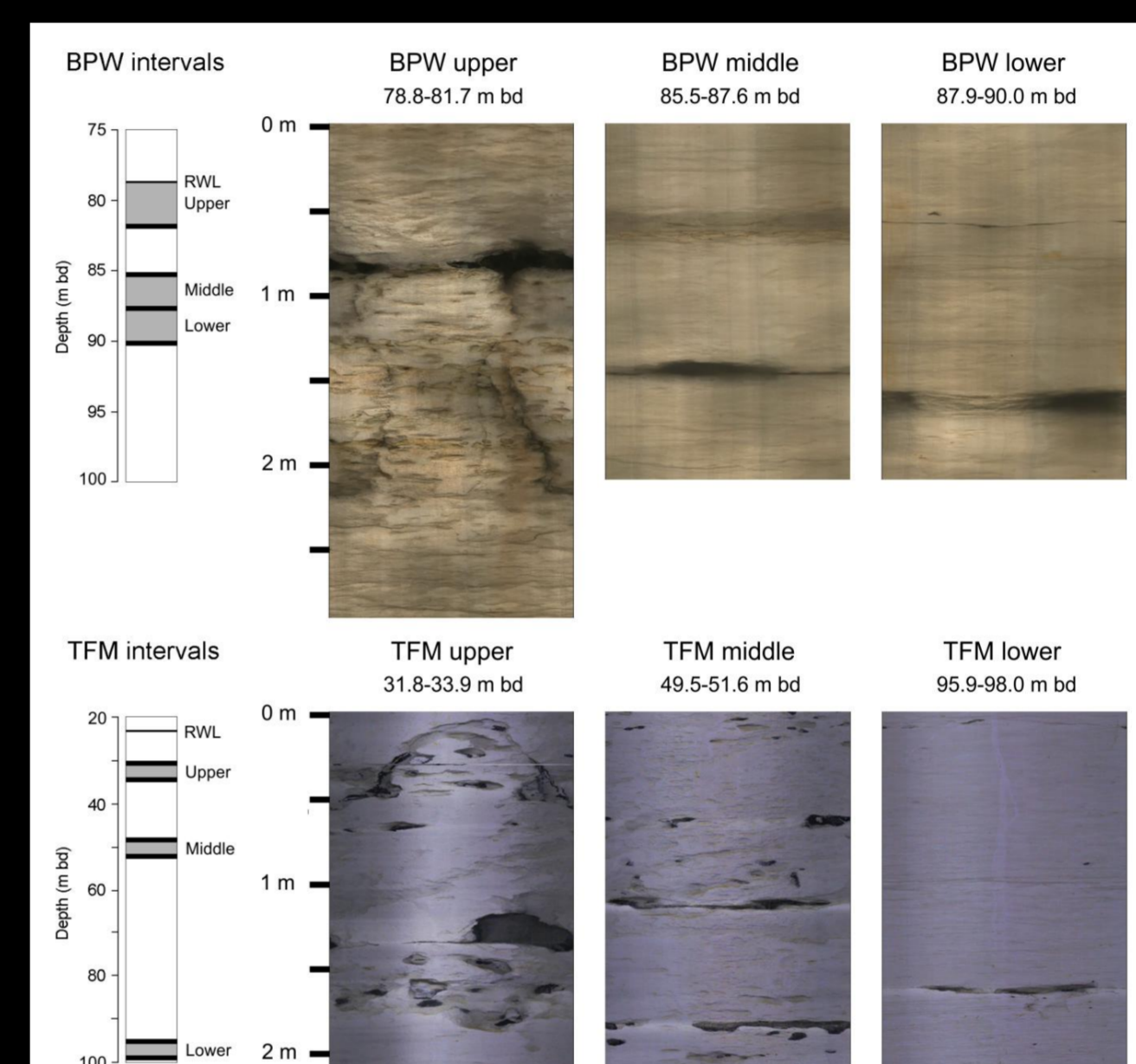


Figure 1: Optical images of packer intervals at Beche Park Wood (BPW) and Trumplets Farm (TFM)

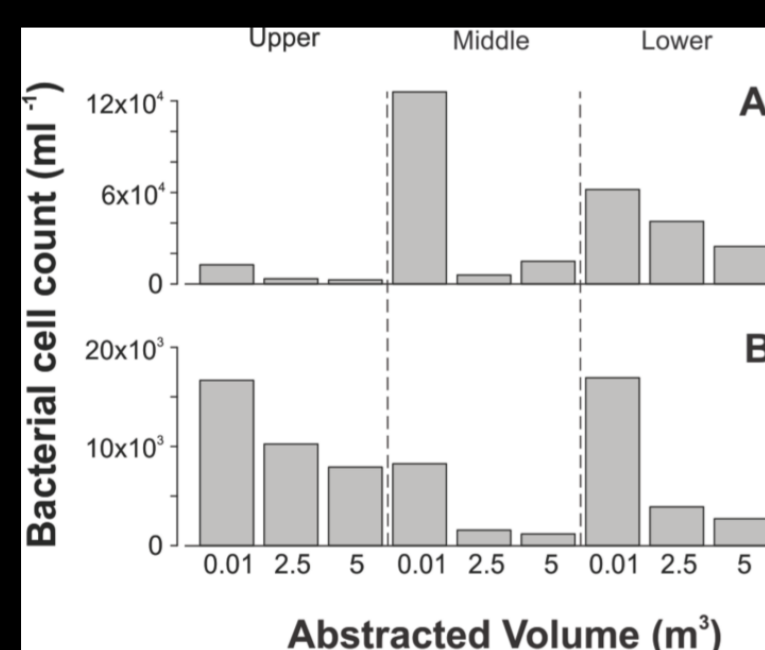


Figure 2: Bacterial counts in (a) BPW (b) TFM

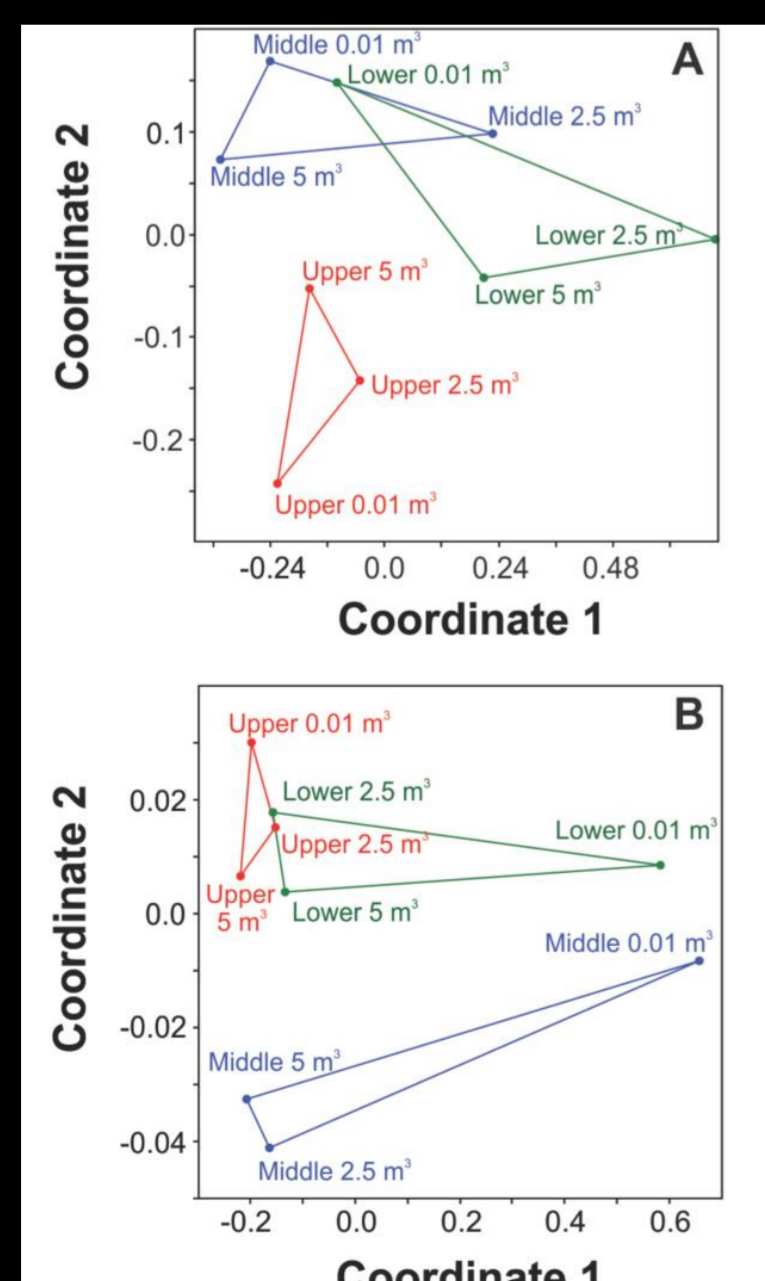


Figure 3: Differences in bacterial community (a) planktonic bacteria (b) particle associated bacteria.

## Results

- Within the borehole there was a greater abundance of bacteria and invertebrates
- Dissolved organic carbon and nitrate were higher within the boreholes, whilst bioavailable soluble reactive phosphate was lower
- Evidence for a different bacterial community structure within the borehole

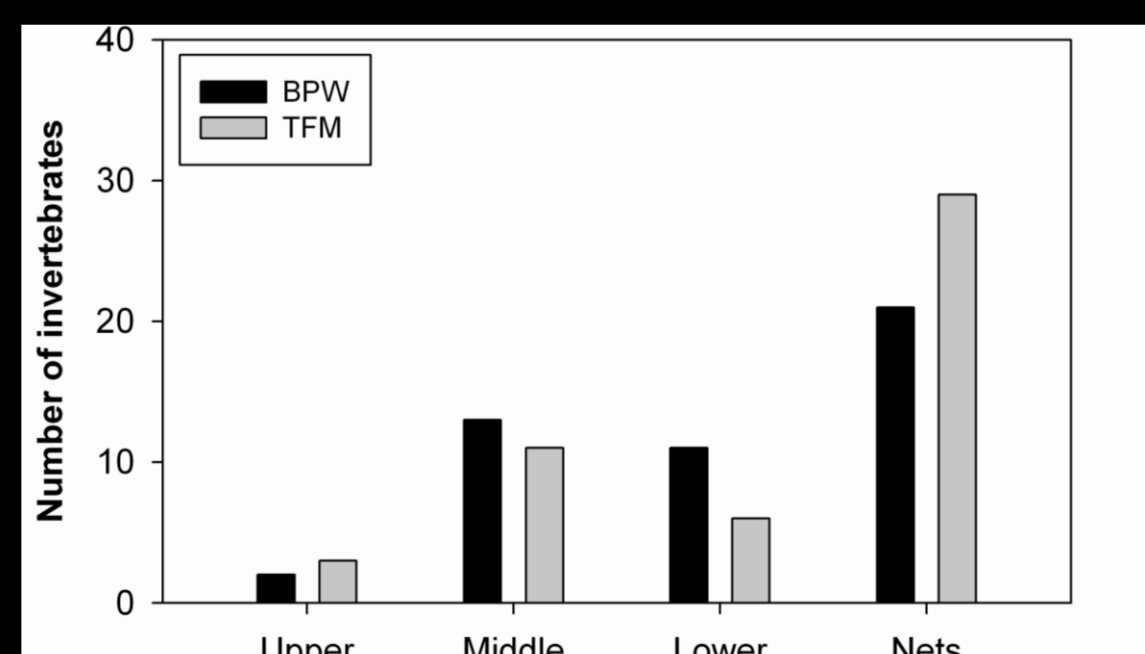


Figure 4: Invertebrate counts

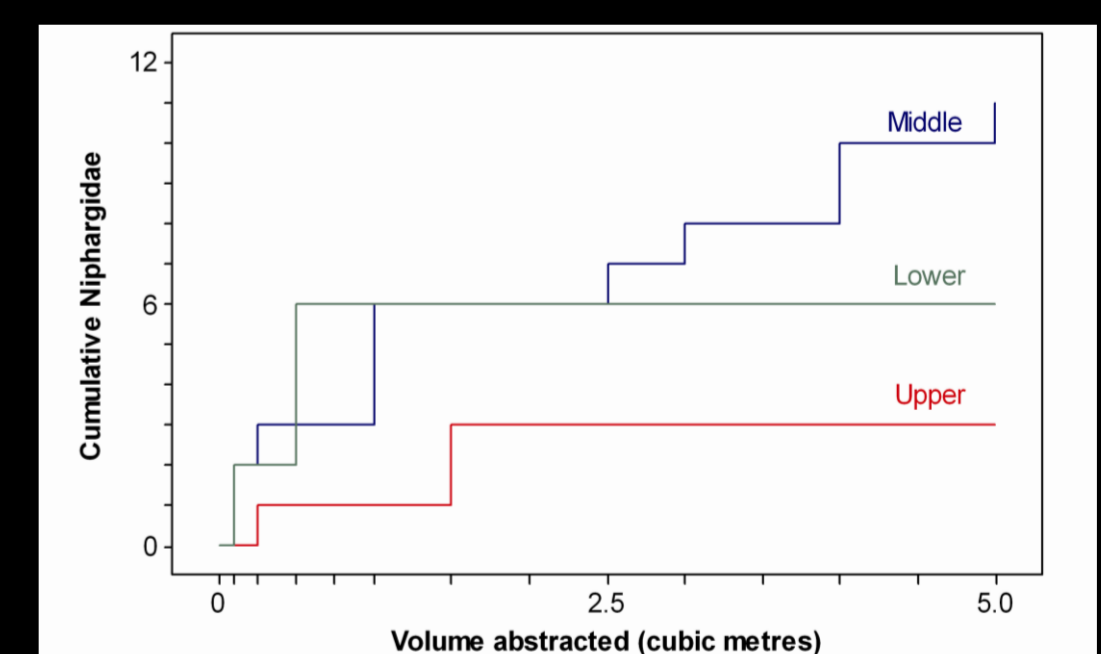


Figure 5: Invertebrates captured with volume at TFM

## Conclusions

- Boreholes are not biologically or chemically representative of the aquifer
- An ecosystem comprising bacteria and invertebrates extends from the water table to at least 70 m below in the Chalk