

Who Pooed in the Sea?

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Stream

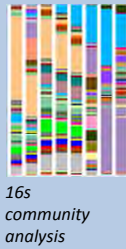
The Industrial Doctorate Centre for the
Water Sector

The problem

Making targeted management and investment decisions to improve water quality requires knowledge and understanding of pollution sources. Current water quality regulations are based on limits of faecal indicator organisms (FIOs), but currently **microbial source tracking (MST)** techniques do not relate to FIOs. Here, we evaluate two MST methods to apportion human pollution through a case study in an impacted catchment. Following mitigation strategies such as swales and slurry tanks in farms in a sub-catchment (Figure 1), improvements in water quality were not as impressive as predicted. **Is human pollution from septic tanks entering the water course? If so, what are the relative contributions of each source?**

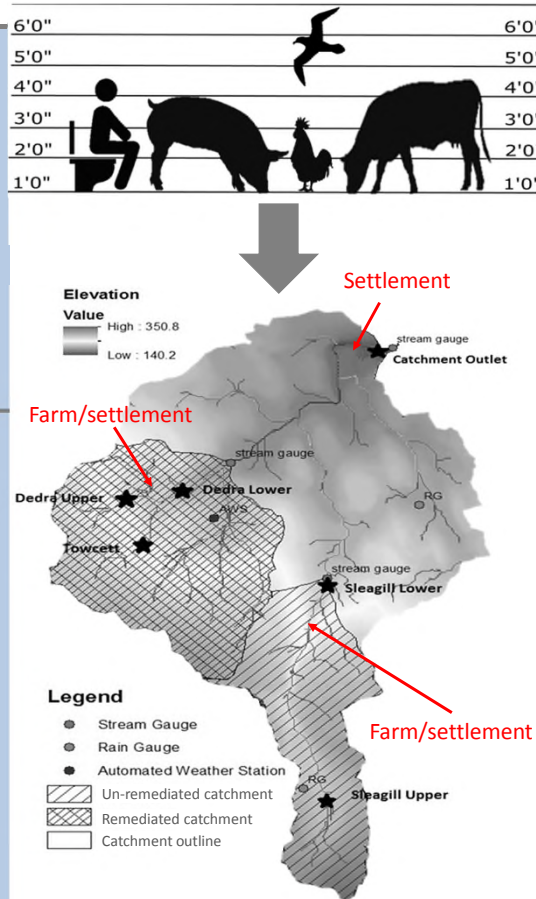
Method 1: Community analysis

1. DNA was extracted from faecal and environmental water samples.
2. The V4V5 region of the 16s gene was sequenced using an Ion Torrent PGM
3. Bacterial communities in faecal and water samples were compared using SourceTracker (Knights et al., 2012)



Results

- Human faecal pollution was the faecal source most commonly identified.
- The **human faecal contribution increased after each farm** and is a likely reason why the efficacy of mitigation efforts was not realised.
- Agricultural faecal pollution increased significantly after each farm.



Method 2: *E. coli* biomarkers

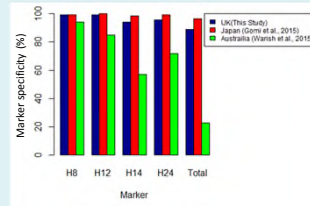


H8, H12, H14 and H24 markers identified through PCR.

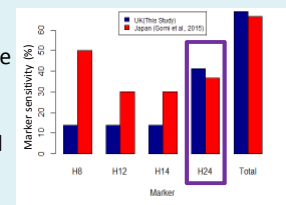
1. *E. coli* were cultured from faecal and environmental water samples.
2. End point PCR was used to evaluate and detect 4 human *E. coli* markers (Gomi et al., 2014)

Results

- All markers had **>95% specificity** to human *E. coli*.
- Geography may be an important factor in biomarker efficacy



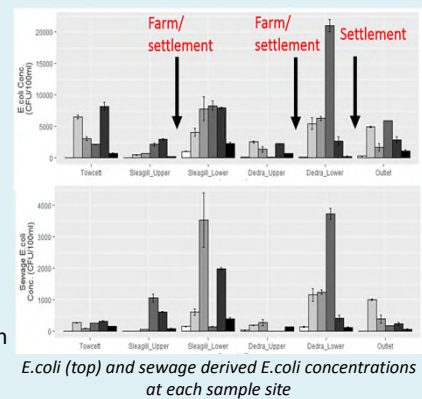
- H24 marker had the highest sensitivity.
- **100% of sewage samples contained the H24 marker.**



Same conclusions but poor correlation

Greater persistence of microbial communities at catchment outlet

- The density of human derived *E. coli* increased following each farm/settlement.
- Septic tanks are likely responsible for mitigation strategies not realising their potential.



Conclusions and future work

- *E. coli* biomarkers can **inform management decisions** based on current regulatory methods.
- Both methods resulted in similar conclusions, although there was no direct correlation between the predicted proportions of human sources.
- Human *E. coli* biomarkers gave more meaningful and easily communicable results.
- Community analysis allows a **large range of pollution sources** to be identified in a single assessment.
- The **rapidity and cost are competing factors** in this method comparison, *E. coli* biomarkers are much cheaper but much more time and labour intensive.
- *E. coli* biomarkers for other animals for use in the UK are being developed.