A Toolbox for Faecal Source Tracking

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INTRODUCTION

When waterways become contaminated with faeces, an important step in contamination management is to identify the source of the pollution. Faecal source tracking (FST) is used because standard methods of measuring faecal contamination in water by enumerating faecal indicator bacteria do not identify contaminant sources. Our research team has been developing tools that discriminate among different sources of faecal contamination of water, leading to targeted environmental management interventions. We use molecular and chemical techniques to help identify the source of faecal contamination of water whether it is from farm, domestic or feral animals, humans or birds.

METHODOLOGY

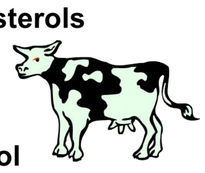
Microbial Marker PCR-based Assays

PCR amplification	Source specificity
Bacteriodetes -General	Indicates non-specific faecal contamination
Bifidobacterium adolescentis	Human
Bacteroidetes -Human	Human
Bacteroidetes - Herbivore	Ruminant
Bacteroidetes – Dog	Dog
Bacteroidetes – Pig	Pig
Bacteroidetes – Horse	Horse
E2 duck marker	Duck (Avian)

Chemical Markers

Faecal Sterols

Each animal type has a similar range of sterols but at different concentrations



Sterol ratio analysis

e.g. Coprostanol/24-ethylcoprostanol

>1.0 indicative of human pollution

<1.0 indicative of pollution from herbivores

Fluorescent Whitening Agents (FWAs)

- Used to "whiten" paper, plastic and fabrics.
- FWAs are added to washing powders.
- FWAs in grey water are human specific indicators.

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- Canterbury Regional Council
- Marlborough District Council
- Northland Regional Council
- Manukau City Council
- Manukau Water
- Southland Regional Council
- Westland Regional Council

A CASE STUDY: Site A-river & Site B-drain

Results of Toolbox Indicators#

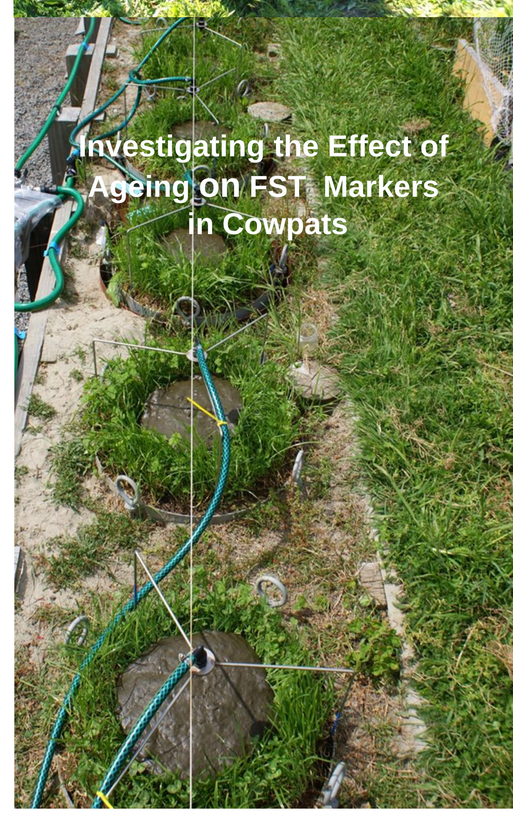
Site	*E. coli* (Total Coliforms)	**FWAs	General faecal PCR	Human PCR marker	Avian PCR marker	Herbivore PCR marker
A	2,909	<0.01	Positive	Not detected	Strong positive	Positive
B	150 (10,000)	0.2	Positive	Positive	Not detected	Not detected

#Volume 100-200mL surface water for PCR markers *MPN/100mL **ppb

Sterol Ratio Analysis#

Sterol ratio analysis	Type of faecal indicator	Site A river	Site B drain
Coprostanol/cholestanol	General faecal pollution indicator	Faecal	Faecal
%Coprostanol/total sterols	Human indicators	Not human	Human
Coprostanol/(coprostanol +cholestanol)		Not human	Human
%coprostanol/coprostanol+ 24-ethylcoprostanol	Human versus herbivore indicator	Herbivore	Human
% 24-ethylcoprostanol /total sterols	Herbivore specific indicator	Herbivore	Not herbivore
24-ethylcholesterol /24-ethylcoprostanol	Herbivore versus plant decay/runoff	Herbivore	Not plant
% cholestanol/(cholestanol+ coprostanol+epicoprostanol)	Avian indicator	Avian	Not avian

#Volume 4L surface water for sterols analysis



Conclusions

	Habitat type	Detection of pollution -toolbox approach
Site A river	• Slow flowing river system • Exotic forestry and agriculture are major inputs	Herbivore and bird faecal pollution
Site B drain	Outlet of a storm-water drain flowing into a river	Human faecal pollution