

Source Tracking *E. coli* in Multiple Watersheds with Different Land-Use in BC.

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Introduction

Water is central to all life. Concerns with water quality have increased in recent years, in part due to contamination of drinking water by *Cryptosporidium*, *Giardia*, and *E.coli* 0157:H7. Health concerns relating to water quality, and multiple-use in watersheds have created conflicts between user groups and their demands on land and water resources. Non-point source pollution is often difficult to quantify and source, and therefore opposing interest groups often point the finger at others for causing the problem. Resolution of conflicts and the adoption of better management practices and policies require sound scientific data on the sources of bacterial pathogens and knowledge of their life history and survival in watersheds.



Results

Table 1. Total and percentage (in parenthesis) of *E. coli* for each source by stream for 2003 and 2004.

	BX	Deer	Duteau	S.Fortune	Sum		BX	Deer	Duteau	S.Fortune	Sum
2003						2004					
Avian	220 (26.5)	81 (10.1)	201 (21.4)	107 (40.7)	609 (21.5)	131 (24.3)	145 (28.1)	161 (24.7)	85 (32.0)	522 (26.4)	
Bear	65 (7.8)	136 (17.0)	56 (6.0)	15 (5.7)	272 (9.6)	28 (5.2)	22 (4.3)	57 (8.7)	21 (7.9)	128 (6.5)	
Bovine	11 (1.3)	72 (9.0)	87 (9.2)	13 (4.9)	183 (6.5)	103 (19.1)	103 (20.0)	130 (19.9)	25 (9.4)	361 (18.3)	
Canine	202 (24.3)	134 (16.7)	191 (20.3)	37 (14.1)	564 (19.9)	33 (6.1)	58 (11.2)	55 (8.4)	18 (6.8)	164 (8.3)	
Deer/Elk	159 (19.1)	169 (21.1)	266 (28.3)	33 (12.5)	627 (22.1)	37 (6.9)	33 (6.4)	61 (9.3)	30 (11.3)	161 (8.2)	
Feline	31 (3.7)	5 (<1)	16 (1.7)	3 (1.1)	55 (1.9)	0 (0)	0 (0)	3 (<1)	0 (0)	3 (<1)	
Horse	26 (3.1)	2 (<1)	2 (<1)	0 (0)	30 (1.1)	6 (1.1)	0 (0)	0 (0)	0 (0)	6 (<1)	
Human	4 (<1)	14 (1.7)	8 (<1)	0 (0)	26 (<1)	1 (<1)	2 (<1)	2 (<1)	0 (0)	5 (<1)	
Moose	0 (0)	0 (0)	0 (0)	1 (<1)	1 (<1)	10 (1.9)	22 (4.3)	5 (<1)	4 (1.5)	41 (2.1)	
Rabbit	2 (<1)	2 (<1)	0 (0)	2 (<1)	6 (<1)	1 (<1)	1 (<1)	1 (<1)	0 (0)	3 (<1)	
Raccoon	21 (2.5)	11 (1.4)	29 (3.1)	6 (2.3)	67 (2.4)	29 (5.4)	36 (7.0)	22 (3.4)	10 (3.8)	97 (4.9)	
Rodent	65 (7.8)	47 (5.9)	55 (5.8)	35 (13.3)	202 (7.1)	97 (18.0)	59 (11.4)	118 (18.1)	60 (22.6)	334 (16.9)	
Squirrel	1 (<1)	0 (0)	0 (0)	1 (<1)	2 (<1)	2 (<1)	5 (1.0)	5 (<1)	0 (0)	12 (<1)	
Unknown	24 (2.9)	129 (16.1)	30 (3.2)	10 (3.8)	193 (6.8)	62 (11.5)	30 (5.8)	33 (5.1)	13 (4.9)	138 (7.0)	
Sum	831 (100)	802 (100)	941 (100)	263 (100)	2837 (100)	540 (100)	516 (100)	653 (100)	266 (100)	1975 (100)	

Sources of *E. coli*

- 1) The sources of *E. coli* varied significantly with stream, although a wide range of *E. coli* sources were found in the samples taken throughout the study.
- 2) There were no noticeable differences between the main sources identified between sites within a watershed.
- 3) The dominant source contributors were similar for the watersheds studied with only minor variations.
- 4) The dominant sources of *E. coli* changed from one year to the next in the 4 watersheds.
- 5) The majority of isolates classified in 2003 came from deer/elk, avian, and canine, whereas the majority of isolates classified in 2004 came from avian, bovine, and rodent sources.
- 6) Overall, wildlife was the largest contributor of *E. coli* to the watersheds in both 2003 (>84%) and 2004 (>73%).



Methods

Fecal contamination and water quality was quantified and compared in 2003 and 2004 between 4 watersheds with different land-use in the North Okanagan, BC. In this study, 2200 water samples were collected, and 4812 isolates were classified, making this the largest known source tracking case study in the world to date.

Objectives

- 1) Understand and quantify the concentration of fecal coliforms at various locations within the 4 watersheds.
- 2) Identify the sources of fecal contamination at different sites in 4 watersheds using ribotyping (a molecular fingerprinting technique).

Summary of Major Findings

Fecal coliform concentrations

- 1) The concentration of fecal coliforms varied significantly by year, month, and site, for each of the streams sampled.
- 2) Higher fecal coliform numbers tended to be at the mid and lower elevation sites compared to the headwater sites.
- 3) Even though there was higher precipitation in 2004 vs. 2003, only 2 of the 4 streams had higher fecal coliform counts indicating that the amount of precipitation in a year may only have a minor effect on fecal coliform counts and other factors may be equally or more important such as stream flow and disturbance of sediment, subsurface flows to the stream, and direct deposit by wildlife and livestock in the riparian zone.

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