

Report for 2005PA42B: Source Water Protection from Infectious *Cryptosporidium* spp. Oocysts

Publications

- There are no reported publications resulting from this project.

Report Follows

Methods Modifications

1. The original proposal indicated that one surface water sample would be filtered and processed in the Jellison lab for both genotyping and infectivity status.

Modification: Each surface water sample was filtered by the Philadelphia Water Department into two separate Gelman Envirochek sampling capsules. One sampling capsule was sent to the Jellison lab for genotyping and phylogenetic analysis, and the other sampling capsule was sent to Jennifer Clancy's lab (Clancy Environmental Consultants, Inc., Saint Albans, VT) for infectivity analysis.

2. The original proposal indicated that 5 surface water sites would each be sampled once per month, and that watershed fecal samples would be collected once per month.

Modification: Two (2) surface water sites were each sampled twice per month during baseflow (dry weather) conditions. These 2 sites were each sampled a third time per month during wet weather conditions (weather permitting). Several months into the project, one wastewater treatment plant effluent sample was also collected and analyzed once per month. Watershed fecal samples were collected seasonally rather than once per month.

Project Scope/Timeline Modifications

The scope of this project has extended beyond the initial year of watershed sampling funded by the PA WRRC grant. Two additional grants from the Pennsylvania Department of Community and Economic Development have been obtained for this work:

Pennsylvania Department of Community and Economic Development.
"Source Tracking of Infectious *Cryptosporidium* spp. Oocysts in
Wissahickon Creek." December 2005-March 2007. \$46,083.

Pennsylvania Department of Community and Economic Development.
"Source Water Protection from Infectious *Cryptosporidium* spp. Oocysts."
April 2005-March 2006. \$30,400.

Source water and watershed fecal sampling will continue in the Wissahickon Creek watershed until March 2007 at the earliest. Additional funding for sampling beyond March 2007 will be sought. Given the extended nature of this project, the submission of a peer-reviewed journal paper reporting findings from this study will be delayed until Spring 2007.

Principal Findings and Significance

- Multiple *Cryptosporidium* genotypes were frequently found in a single surface water sample (Table 1), indicating that (i) multiple oocyst sources are impacting a single surface water location, and/or (ii) a single host may be shedding multiple genotypes of *Cryptosporidium* into the watershed.

- The genotypes detected suggest that human, agricultural, and wildlife inputs are all present in the Wissahickon Creek watershed (Table 1). Thus, a variety of watershed management strategies targeting each of these sources will likely be important to protect the Wissahickon Creek from *Cryptosporidium* oocyst contamination.
- Novel genotypes were identified on each sample date that *Cryptosporidium* oocysts were detected, and likely oocyst sources were determined based upon the known *Cryptosporidium* genotypes to which the novel genotypes were most closely related phylogenetically (Table 1). The inclusion of a second genetic locus for genotyping and phylogenetic analysis would enable more conclusive determinations of the likely oocyst sources in the watershed.
- Watershed fecal samples were collected on 7/20/05 (3 sheep, 5 geese, 3 deer, 4 cows, 1 racoon, and 3 horses) and 12/5/05 (1 cat, 4 dogs, 5 deer, and 5 ducks). No *Cryptosporidium* oocysts were detected in any of the watershed fecal samples collected, so the phylogenetic analysis was performed using *Cryptosporidium* genotypes in the GenBank database.
- No seasonal trend associated with human, agricultural, or wildlife sources of *Cryptosporidium* was observed. More extensive sampling (currently being performed) and stronger genotype resolution (e.g., by using a second genetic locus) may help to elucidate seasonal trends.
- No particular hydrologic condition (baseflow vs. wet weather events) was associated with human, agricultural, or wildlife impacts on Wissahickon Creek water quality. More extensive sampling during wet weather events will help determine if a correlation exists between hydrologic condition and watershed source of oocysts.
- Water quality data from the Philadelphia Water Department and infectivity data from the Clancy lab need to be compiled and analyzed to identify (i) correlations between water quality data and *Cryptosporidium* presence in Wissahickon Creek and (ii) the public health risk associated with the oocysts detected in this study. These data will be compiled in the near future and again upon completion of the study.

Table 1. Summary of surface water sampling results in the Wissahickon Creek watershed.

Date	Location*	Wet/ Dry	<i>Cryptosporidium</i> sp. Detected?	Genotype(s)**	Likely Source(s)
5/23/05	Wiss 140 Wiss 410	Dry	No No		
6/6/05	Wiss 140 Wiss 410	Dry	No No		
6/27/05	Wiss 410	Dry	No		
7/8/05	Wiss 140 Wiss 410	Wet	No No		
8/3/05	Wiss 140 Wiss 410	Dry	No Yes	Novel (<i>C. hominis</i>)	Human
8/22/05	Wiss 140 Wiss 410	Dry	No No		
9/6/05	Wiss 140 Wiss 410	Dry	No Yes	Novel (<i>C. parvum</i> bovine)	Human, Agriculture
9/26/05	Wiss 140 Wiss 410	Dry	No No		
10/3/05	Wiss 140 Wiss 410	Dry	Yes No	Novel (Goose genotype, <i>C. andersoni</i>)	Agriculture
10/8/05	Wiss 140 Wiss 410	Wet	No No		
10/24/05	Wiss 140 Wiss 410	Dry	Yes Yes	2 Novel (1- <i>C. hominis</i> ; 1-Goose genotype, <i>C. andersoni</i>) 2 Novel (1- <i>C. hominis</i> ; 1- <i>C. parvum</i> animal genotype [deer, pig])	Human, Agriculture Human, Wildlife
11/1/05	Wiss 140 Wiss 410	Dry	No No		
11/28/05	Wiss 140 Wiss 410	Dry	No No		
12/6/05	Wiss 140	Dry	Yes	2 Novel (1- <i>C. hominis</i> ; 1- <i>C. meleagridis</i>)	Human, Wildlife
1/3/06	Wiss 140 Wiss 410	Wet	No Yes	3 Novel (1- <i>C. parvum</i> bovine; 1- <i>C. wrairi</i> ; 1- <i>C. parvum</i> animal genotype [deer, pig])	Human, Agriculture, Wildlife
1/23/06	Wiss 140 Wiss 410 Abbington WWTP	Wet	No No No		
2/6/06	Wiss 140 Wiss 410	Dry	Yes Yes	3 Novel (1- <i>C. wrairi</i> ; 1- <i>C. parvum</i> animal genotype [deer, pig]; 1- <i>C. meleagridis</i>) 2 Novel (1- <i>C. wrairi</i> ; 1- <i>C. meleagridis</i>)	Wildlife Wildlife

*See Appended Figure 1 for sampling locations within the Wissahickon Creek watershed.

**If novel genotype detected, the most closely related genotype(s) according to phylogenetic analysis is indicated in parentheses.

Lehigh University Crypto Sampling Locations
in the Wissahickon Creek Watershed

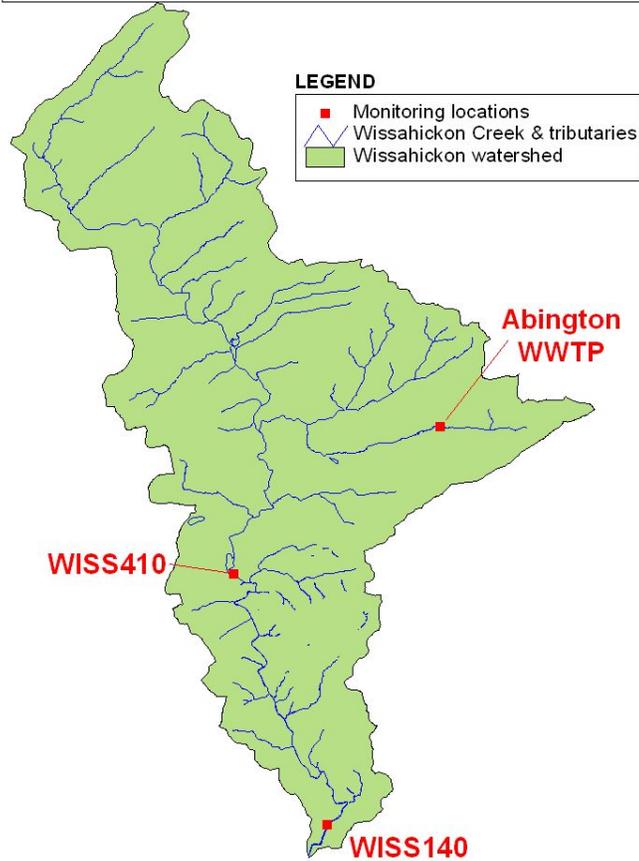


Figure 1. Sampling locations in the Wissahickon Creek watershed.

Students Supported

Joseph Ziemann

M.S. Civil and Environmental Engineering (expected August 2006)

Presentations/Information Transfer Activities

Jellison KL. "Cryptosporidium spp. Oocyst Source Tracking in the Wissahickon Creek Watershed, May 2005-June 2006." Report to the Philadelphia Water Department, *to be submitted July 2006*.

Jellison KL. "*Cryptosporidium* spp. Oocyst Source Tracking in Drinking Water Source Watersheds Serving Boston, MA and Philadelphia, PA." American Water Works Association International Symposium on Waterborne Pathogens, Atlanta, GA, March 17, 2006.

Jellison KL. "Source Tracking of *Cryptosporidium* spp. Oocysts in Drinking Water Source Watersheds." Invited Speaker, The W. Harry Feinstone Department of Molecular Microbiology and Immunology Seminar Series, Bloomberg School of Public Health, Johns Hopkins University, March 9, 2006.

Jellison KL. "Genetic source tracking of *Cryptosporidium* spp. oocysts in Boston and Philadelphia drinking water supplies." Invited Speaker, Water Quality in Urban Environmental Systems (WaterQUEST) Workshop, Carnegie Mellon University, December 8, 2005.

Jellison KL. "*Cryptosporidium* spp. Source Tracking Using PCR, Sequencing, and Phylogenetic Analysis of the 18S rRNA Gene." Invited Speaker, Pathogens Workshop for the Interstate Commission on the Potomac River Basin, June 28, 2005.

Awards

The following two research grants were awarded to PI Jellison to support further work on the current project:

1. Pennsylvania Department of Community and Economic Development. "Source Tracking of Infectious *Cryptosporidium* spp. Oocysts in Wissahickon Creek." December 2005-March 2007. \$46,083.
2. Pennsylvania Department of Community and Economic Development. "Source Water Protection from Infectious *Cryptosporidium* spp. Oocysts." April 2005-March 2006. \$30,400.