E. coli Plagues Local Pond

By Kate Harris, City of Boise

You may have seen the "Pond Closed" signs at City of Boise ponds this year due to high *E. coli* bacteria levels or heard about the City's decision to close the parks to dogs. The City closed both Quinn's Pond and Esther Simplot Park ponds on June 21 due to *E. coli* concerns. Quinn's Pond actually did not exceed the Idaho state water quality standard for recreational uses that include swimming and wading (30 day geomean), but concentrations are higher this year than in previous years and it was closed as a preemptive measure while we confirmed that levels were not trending upward. Quinn's Pond was reopened on June 30th, while Esther Simplot Park ponds remain closed. The City of Boise has a robust water quality sampling program in place and staff are working hard to reduce bacteria concentrations and reopen Esther Simplot Park ponds as quickly as possible.

Here is a brief description of our program, results and plans for further investigation.

Program description

The City of Boise worked with the Idaho Department of Environmental Quality and Central District Health in 2013 to formalize monitoring, reporting, and public notification protocols. The City collects *E. coli* bacteria samples in City owned ponds specifically designated for swimming weekly, April 1 – September 30th. *E. coli* concentrations are evaluated based on Idaho water quality standards.

For water to meet Idaho water quality standards for recreational uses that include swimming and wading, the geometric mean of 5 *E. coli* samples collected 3-7 days apart over a 30-day period is required to be less than 126 colony forming units (CFU)/100 mL. There is a second part of the criterion that addresses single sample values. The thought is that if a water sample exceeds the *E. coli* single sample maximum, it likely exceeds the geometric mean. The exceedance of the single sample value is not alone a violation of water quality standards; it initiates the requirement for more samples to be collected to calculate the 30-day geometric mean. The single sample value for waters specified as public swimming beaches in Idaho is 235 *E. coli* organisms per 100 mL. The standards also state "Single sample counts above this value should be used in considering beach closures".

The heavier recreation season typically begins in May and by beginning sampling in April we are able to calculate the 30-day geometric mean before use increases substantially. If a sample exceeds 235 CFU/100 mL, or exceeds the geometric mean of 126 CFU/100 mL the City increases the sampling frequency (daily M-F) to closely monitor bacteria levels.

The City currently monitors Esther Simplot Park ponds, Quinn's Pond and recently added Veteran's Park pond although it is not specifically designated for swimming. The City also monitors *E. coli* concentrations on the Boise River during the peak floating season (June 1 through September) at one location as well and at several other locations year round to satisfy NPDES permit monitoring requirements.

Overall data summary

Monthly ranges of E. coli concentrations (MPN/100 mL) in City of Boise monitoring locations.

	Quinn's Pond	Esther Simplot Park pond	Boise River at Ann Morrison
April	<1.0 to 23.1	<1.0 to 19.7	
May	4.1 to 410.6	1 to 218.7	
June	2 to 365.4	5.2 to 4950	4.1 to 165.8
July (through 7/21)	4.1 to 260.3	5.2 to 1203	35.5 to 90.5

E. coli samples in Quinn's Pond above 235 MPN/100 mL collected were retested immediately. Confirmation samples did not show *E. coli* levels above 235 MPN/100 mL, although they are included in this data summary.

Additionally, the 4,950 value recorded in Esther Simplot Park pond was **after** the pond was closed to swimming and wading. Prior to closure, the maximum June value recorded was 365.4 MPN/100 mL.

Microbial Source Tracking Summary

In addition to more frequent *E. coli* sampling and site investigations, the City of Boise contracted with a laboratory that performs microbial source tracking (MST) (also called bacterial or fecal source tracking) to help determine the sources of fecal bacteria in Quinn's Pond and the ponds at Esther Simplot Park. The basis for these source tracking techniques is that there are characteristics unique to the fecal bacteria from a particular animal and these characteristics allow for the identification of a source.

The contract laboratory, Source Molecular, used fecal Bacteroidetes, a phylum of bacteria found primarily in the intestinal tracts and mucous membranes of warm blooded animals for source tracking, to identify the fecal bacteria sources. For example, certain categories of Bacteroidetes have been shown to be predominantly detected in dogs while others are predominantly detected in geese, so the laboratory uses those categories to identify a source. The laboratory also runs positive and negative controls alongside its analysis for quality control purposes.

The City of Boise is still collecting data to complete a robust study, but three consecutive samples (each separated by at least a week) confirmed the presence of dog and goose fecal biomarkers in the ponds.

Microbial Source Tracking summary.

	Waterbody	DNA Analytical Tests Performed	DNA Analytical Results, source detected	Marker Quantified (copies/100 mL)
Week 1 (whole pond) – sampled June 22	Quinn's Pond	Dog Goose Human Ruminant	Dog Goose	< 10 < 10
	Esther Simplot Pond	Dog Goose Human Ruminant	Dog	< 10

Week 2 (targeted shoreline) – sampled June 29	Quinn's Pond	Dog Goose Human Ruminant	Dog Goose	1250 < 10
	Esther Simplot Pond	Dog Goose Human Ruminant	Dog Goose Human	< 10 < 10 < 10
Week 3 (targeted shoreline) – sampled	Quinn's Pond	Dog Goose Human	Dog Goose	<10 <10
	Esther Simplot Pond	Dog Goose Human	Dog Goose	<10 <10

In the first week, dog fecal biomarkers were detected in both Quinn's and Esther Simplot Park pond surveys, while goose fecal biomarkers were only detected in Quinn's Pond.

The second week of sampling concentrated the sample efforts along the pond shorelines. DNA results detected the presence of dog and goose biomarkers in both ponds as well as human biomarkers in Esther Simplot Park pond. While biomarker copies per 100 mL were still low for geese in both ponds, the dog feces biomarker was significantly higher.

The third week of sampling indicated the presence of goose and dog fecal bacteria in both Quinn's and Esther Simplot Park ponds.

The conclusion that dogs are a significant source of fecal bacteria in the ponds and contributed to the high *E. coli* concentrations is based on the facts that dog feces biomarkers were detected in the ponds; that biomarkers indicated that dog feces was the primary source of fecal bacteria in Esther Simplot Park pond one week, and genetic biomarkers for dog fecal bacteria were more prevalent (1250 vs. <10 copies per 100 mL) than other sources in Quinn's Pond the following week.

What else is the City of Boise doing to reduce E. coli in Esther Simplot Park ponds?

As mentioned, the City closed both Bernadine Quinn and Esther Simplot Parks to dogs. As described above, results suggest that dogs are a significant source of fecal bacteria to the ponds. Did you know that one gram of goose poop (1 gram equals approximately the weight of a business card) contains 10,000 fecal coliforms, while one gram of dog poop contains 23 million fecal coliforms? One good size dog pile can have 3 BILLION fecal coliform bacteria in it!!

The City acknowledges that dogs are not the only source of fecal bacteria to the ponds. To reduce the impact of geese, the City has increased geese "hazing" activities in the pond and along its banks. Essentially this means that the geese are herded off of the ponds, and annoyed several times a day in an effort to encourage them to move somewhere else. In addition, poop cleanup activities have increased in the Park, especially along the beaches and areas that runoff into the pond.

People were also identified as a source of fecal bacteria to Esther Simplot Park ponds. The City confirmed that there is no wastewater connection to the City of Boise collection system (sewer) and are working to confirm that private systems in the area are also not contributing sources.

While the major sources have been identified and are being reduced as much as possible, the City is continuing to research all of the ways that the bacteria is entering the pond (stormwater sources in the area, runoff from irrigation, sediment sampling, etc.) DNA studies are also continuing.

The City is investigating the feasibility of moving more water through the ponds in the future.

Cooperation and Gratitude

The City of Boise has been working closely with other agencies to ensure that we are protecting public health, and providing public notification, to investigate potential treatment options, and to reduce the likelihood of elevated E. coli concentrations from entering the ponds in future years. In particular, the City would like to thank Lance Holloway and Idaho Department of Environmental Quality staff, Christine Myron and Central District Health staff, and staff from the Idaho Department of Fish and Game.

Photos

Esther Simplot Park ponds

Dock at Quinn’s Pond