Cooperative Stream Investigations (CSI's)

Water Quality Volunteer

Missouri Department of Natural Resources

MISSOURI STREAM TEAM

Poster Abstract
Cooperative Stream Investigation (CSI) Volunteer Monitoring

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This poster describes the methodology that the Stream Team Program will use to gain additional water quality information utilizing volunteer collected samples for analysis by the State Environmental Laboratory within the Missouri Department of Natural Resources. The Volunteer Water Quality Monitoring (VWQM) Program component of Stream Teams provides education and training regarding water quality. Volunteers are taught to monitor physical, biological, and chemical parameters of Missouri's rivers and streams.

There are currently five levels of training available to volunteers: Introductory, Level 1, Level 2, Level 3, and Cooperative Stream Investigations (CSI). CSI was added in March 2005 to facilitate additional collection of *Escherichia coli (E. coli)* bacteria from state waters. Training has produced many volunteers who are capable of collecting water samples for analysis by the Missouri Department of Natural Resources Environmental Laboratory. Volunteers who have successfully completed VWQM Program classes through Level 2 may be eligible to participate in CSI monitoring. CSI Volunteers will be trained to collect and properly handle samples according to Missouri Department of Natural Resources protocols. Volunteer data collected in this manner will be of a high and documented quality, comparable to agency data, and can play an important role in the department's decision making process relating to TMDL studies, permit evaluations, and for long-term resource studies.

Cooperative Stream Investigation's (CSI's)

The purpose of a CSI is to foster cooperation between the Department of Natural Resources, Watershed Management Committees and Volunteers in performing sampling for special projects. The primary focus of CSI sampling will be *Escherichia coli* (*E. coli*). CSI volunteers will also sample other parameters as deemed necessary by Missouri Department of Natural Resources representatives and watershed committee members. The groups will work together to develop a sampling plan suited to the scope of the watershed project, availability of volunteers and the ability of the Department to analyze the samples.
Representatives of Missouri Department of Natural Resources and members of the watershed committee will select sampling sites that best fit the goals of the particular investigation.

All CSI volunteers will be required to be trained to Stream Team Level 2 or higher, and have consistently submitted credible data. Volunteers will also be required to attend the Department's Basic Sampling class, where they will learn sampling techniques, safety precautions, proper transportation procedures and chain of custody procedures. Missouri Department of Natural Resources will provide appropriate sampling containers and equipment to volunteers for *E. coli* sampling. All samples will be analyzed at a Missouri Department of Natural Resources authorized lab.
Volunteers and/or Stream Teams must make a commitment for sampling during the duration of the watershed project. The commitment and extra effort of these volunteers will give their data a higher level of credibility when evaluating the results of a project.

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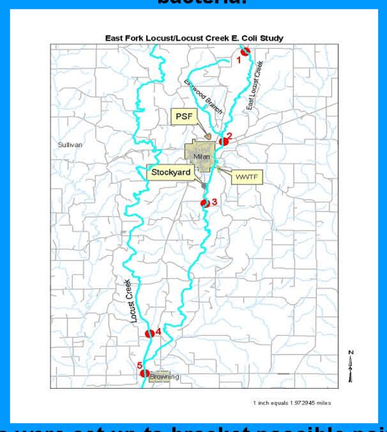
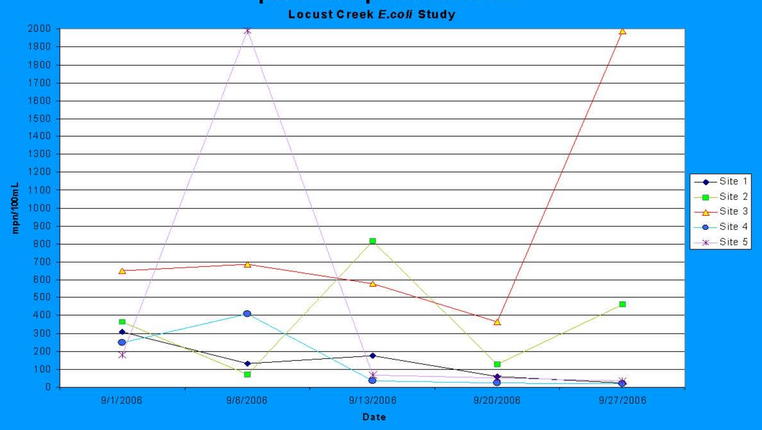
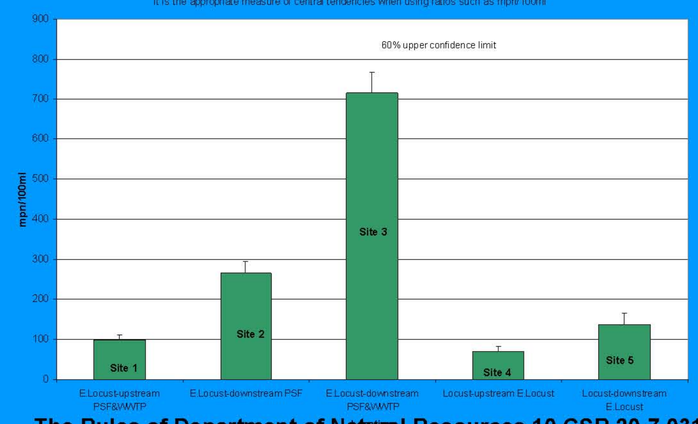
One example of a project carried out by Missouri Department of Natural Resources staff that may have been appropriate for CSI volunteers is a recent study of *E. coli* in the East Fork of Locust Creek. This study was designed to investigate the source of high *E. coli* levels in a stream with multiple point and non-point sources of bacteria.



Sampling sites were set up to bracket possible point sources of *E. coli*. Then five sampling events were performed within a one month period to allow calculation of a geometric mean. Sampling revealed that the most likely source of *E. coli* was agricultural runoff, not permitted point sources.





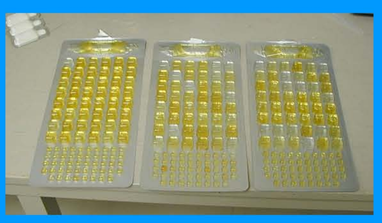
The Rules of Department of Natural Resources 10 CSR 20-7.031 Water Quality Standards state that: as a geometric mean during the recreational season, *E. coli* count shall not exceed 126 mpn/100mL in a stream designated for whole body contact type A, 548 mpn/100mL for whole body contact type B, or 1,134 mpn/100mL in a stream designated for secondary contact. All five study sites are designated for whole body contact type B recreation.

Additional sampling was conducted to investigate point sources. One sample was taken of Milan Lagoon effluent, one sample was taken from Elmwood Creek, and additional samples were taken at sites 2 and 3 to be incubated and analyzed the next day. These incubated samples addressed the possibility that *E. coli* stressed by PSF's treatment process may recover and cause a downstream increase in bacteria. Milan Lagoon effluent yielded 3.0 mpn/100mL, Elmwood Creek, carrying PSF effluent, yielded 146.7 mpn/100mL, and showed no regrowth 24 hours later. It did not appear that regrowth was a significant factor at sites 2 or 3. These results indicate non-point sources influencing East Locust. In particular, a stockyard is located on East Locust Creek between the WWTF and site 3.

Analysis of *E.coli* and Total Coliforms Using the IDEXX Colilert and Quati-Tray Test Method

The Colilert method is an EPA-approved method based on Defined Substrate Technology. The reagent utilizes nutrient indicators that produce color and/or fluoresce when metabolized by total coliforms and *E. coli*, allowing the analyst to determine the most probable number (mpn) of bacteria present. The reagent also effectively suppresses other bacteria that can metabolize the substrate. After the reagent is added to the sample and incubated for 24 hours, it can detect *E.coli* and other coliform bacteria at 1 mpn/100mL with as many as 2 million heterotrophic bacteria present.
A grab sample containing a minimum of 100mL of sample should be collected in a sterile 120mL plastic container. If the water to be analyzed has been disinfected with chlorine, the collection vessel should either contain a small amount of sodium thiosulfate prior to sampling or a small amount should be added to the container after collection to neutralize any remaining chlorine. The sample container should be placed on ice in a cooler after collection. Sample analysis should be conducted as soon as possible after collection. The holding time for non-potable water is 6 hours.
Lab analysis begins by adding one packet of Colilert reagent to 100ml of sample. The sample is shaken vigorously until all reagent dissolves. The sample is allowed to sit while bubbles diffuse, then carefully poured into a Quanti-Tray.

The Quanti-Tray is run through the sealer and incubated at 35°C for 24 hrs. After incubation, the tray is inspected for color change and fluorescence in a viewing cabinet containing an UV light source. The number of yellow wells correlate to the mpn/100ml of total coliform organisms, and the number of fluorescent wells correlate to the mpn/100ml of *E. coli* organisms.

IDEXX Quanti-Tray System

For this method, coliform bacteria are those bacteria that produce a yellow color, and *E. coli* are bacteria that also fluoresce under a 6-watt, 365 nm UV light after incubation at 35°C for 24 hours.