Escherichia coli and total coliform concentrations around a sanitary sewer overflow in Trout Brook in West Hartford, CT
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Background
- The presence of *E. coli* in streams in urban areas is often caused by point source pollution from sewage outflows, as well as runoff from impervious surfaces with animal waste (Bannerman et al., 1993; Cinotto, 2005; Petersen et al., 2005).
- Hartford is a post-industrial city with an outdated sewer system.
- Sanitary Sewer Overflows (SSOs) prevent the wastewater treatment plants from being overwhelmed during high flow events.
- During heavy flow events, wastewater and untreated sewage are released into Trout Brook.

Study Site
During heavy flow events, wastewater and untreated sewage are released into Trout Brook in West Hartford, CT. Hartford is a post-industrial city with an outdated sewer system. Sanitary Sewer Overflows (SSOs) prevent the wastewater treatment plants from being overwhelmed during high flow events. The presence of *E. coli* in streams in urban areas is often caused by point source pollution from sewage outflows, as well as runoff from impervious surfaces with animal waste (Bannerman et al., 1993; Cinotto, 2005; Petersen et al., 2005).

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Methods

Field Sampling Methods
- We ran a preliminary indicator test to detect the presence of *E. coli* in Trout Brook and our results were positive.
- We collected 2 samples at each of the 6 study sites (Fig. 1).
- We measured stream flow and temperature at Sites US40, SSO, and DS40.

Lab Methods: HACH Method

Image above is a plate from the SSO-SJ, red colonies are total coliform and blue are *E. coli*.

Equation below was used to calculate bacteria concentration.

\[
\frac{\text{# colonies}}{\text{mL sample}} = 100 = \text{cfu} / 100\text{mL}
\]

Conclusions and Recommendations
- The West Hartford SSO is a point source for *E. coli* and total coliform pollution in Trout Brook.
- *E. coli* concentrations exceeded the EPA threshold on multiple days across multiple sites and there was a strong correlation between increasing bacteria concentration and increasing stream temperature.
- Bacteria presence upstream of SSO and in the pond suggests upstream pollution, possibly from non point sources like animal feces (Bannerman et al., 1993; Cinotto, 2005; Petersen et al., 2005).
- Upstream and downstream concentrations were statistically similar, suggesting bacteria is rapidly dispersing and/or binding to stream sediments (Garzio-Hadzick et al., 2010; Pachepsky and Shelton, 2011).
- There is a clear public health crisis in Trout Brook, especially during summer months. More immediate action must be taken before the MDC removes all SSOs by 2023.

Recommendations:
- Year round monitoring of *E. coli* and total coliform concentrations throughout Trout Brook, especially around rain events.
- Public health notices to warn residents who use Trout Brook for recreation.

Results

Bacteria Concentrations Across Sites and Days

- There were strong positive correlations between bacteria concentration and temperature for *E. coli* in SSO and at SSO SJ and for total coliform at US40 and at SSO SJ.
- There was no significant correlation between stream flow and bacteria concentration.

Correlations
- There were strong positive correlations between bacteria concentration and temperature for *E. coli*. In SSO and at SSOSJ for total coliform and temperature for *E. coli*. In SSO and at SSO SJ for total coliform (71000 ± 189000 cfu/100mL) and total coliform (95000 ± 39000 cfu/100mL) concentrations were significantly greater than any other site on all sample days (E. coli: F = 10, df = 6, p < 0.001, Total coliform: F = 4.3, df = 6, p = 0.0068).
- October 10 had the highest mean (± SE) *E. coli* (4500 ± 1100 cfu/100mL) and total coliform (71000 ± 189000 cfu/100mL) concentrations (E. coli: F = 6.2, df = 3, p < 0.001, Total coliform: F = 8.7, df = 3, p < 0.001).
- There were no significant differences in *E. coli* and total coliform concentration among sites excluding inside the SSO or among days excluding October 10.

Works Cited