Are our creeks safe? Investigating the presence of bacteria in Village Creek, Everman, TX.

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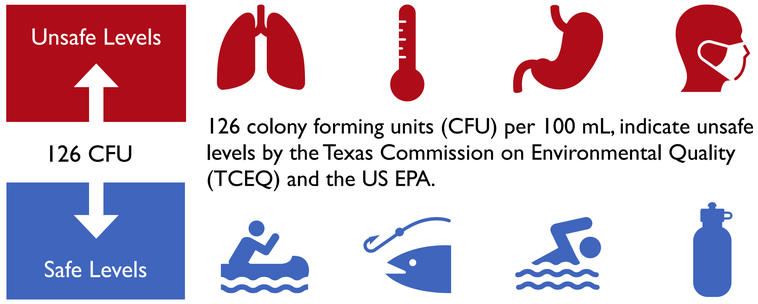
Introduction

Village Creek is a part of the Trinity River in north-central Texas, and it is classified as "impaired" for recreational use by the US Environmental Protection Agency (EPA). In Texas, the top reasons for impairment for rivers and streams are bacteria and microbes, to which *Escheria coli* (*E. coli*) contributes heavily.

Figure 1. Model of *E. coli* USGS)



126 colony forming units (CFU) per 100 mL, indicate unsafe levels by the Texas Commission on Environmental Quality (TCEQ) and the US EPA.

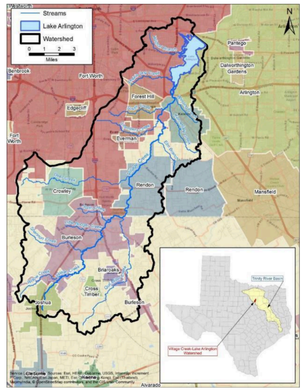


Figure 2. Village Creek watershed in Everman, TX (USGS)

Objective To investigate the relationship between streamflow changes and the prevalence of *E. coli* in Village Creek.

Methodology

Figure 3a.

Figure 3b.

Figure 3c.

Figure 3d.

Figure 3e.

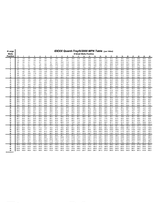


Figure 3f.

1. Take two 100 mL water samples every month from the middle of the river for minimal sediment (Figure 3a).

2. At the lab, add Colilert reagent to sample; dilute sample if *E. coli* levels are high (Figure 3b).

3. Move the sample with reagent into Colilert Quanti-Tray, used when quantifying coliform. Seal with Quanti-Tray Sealer (Figure 3c)

4. Place samples in the incubator and let incubate for 24 hours at 35 °C (Figure 3d).

5. Determine if the sample is more yellow than the comparator and fluoresces; this indicates presence of total coliform and *E. coli* (Figure 3e).

6. Use the MPN chart to determine how many *E. coli* CFU are in the sample (Figure 3f).

Colilert Tests use Defined Substrate Technology (DST) to detect total coliforms and *E. coli*.

Nutrient indicators ONPG and MUG are major sources of carbon; coliform and *E. coli* enzymes metabolize them during incubation.

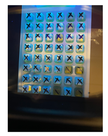


Figure 4a.

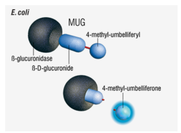


Figure 4b.

Figure 4c.

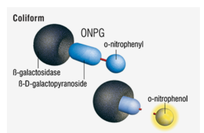


Figure 4d.

Results

Table1. Descriptive Statistics

Sample statistics	Streamflow (ft^3/s)	*E. coli* (CFU)
No. observations	36.0	36.0
Min	0.0	0.0
Max	31.0	1620.0
Mean	4.8	215.0
Std. error	1.1	63.1
Stand. dev	6.6	378.5
Median	2.0	78.6
25th percentile	0.6	16.1
75th percentile	8.7	196.6
Skewness	2.2	2.8
Kurtosis	6.2	7.6
Coeff. var	137.2	176.1

Table 2. Normality Test

Normality Tests		Streamflow (ft^3/s)	*E. coli* (CFU)
No. of observations		36.0	36.0
Shapiro-Wilk		0.7	0.6
	p-value	*0.000*	*0.000*
Anderson-Darling		3.1	5.8
	p-value	*0.000*	*0.000*
Lilliefors		0.3	0.3
	p-value	*0.000*	*0.000*
Jarque-Bera		67.6	105.6
	p-value	*0.000*	*0.000*

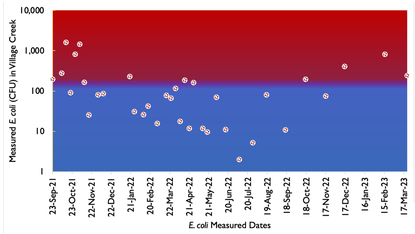


Figure 6. Observations of *E. coli* and Streamflow

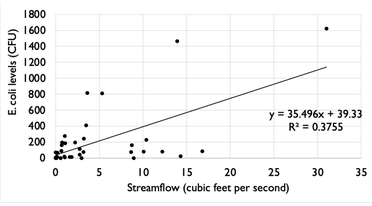


Figure 5. Regression Line

The relationship between streamflow and *E. coli* concentration in Village Creek was tested. Pearson's correlation indicated a significant moderate positive relationship between the two variables ($r_{(34)} = 0.61$, *p-value* $= 0.00007$, $r^2 = 0.38$).

The strength of the relationship indicates that only about 38% of the variability in *E. coli* concentration in Village Creek can be explained by streamflow.

Conclusion

Out of 36 samples, 13 (or about 36%) exceeded the safe threshold level for *E. coli* levels per the US EPA and TCEQ standards for water.

The next step is to identify the sources for e coli and what effects its levels. By exploring different variables and how they affect *E. coli* levels, we can better understand how to stop the input of contaminants.

Through this research in the Water and Society Lab at TCU, more information about the causes of *E. coli* levels in Village Creek can help mitigate impairment.

Acknowledgements & References

Firstly, I would like to thank Grace Turner, who created this project, and Morgan Washington for introducing me as well as showing me how to continue it.

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References