# *E. coli* fluctuations in Last Mountain Lake from May to September

**Title**: *E. coli* fluctuations in Last Mountain Lake from May to September

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**Author Contributions:** Laura Schnell conceived of the study, conducted the analyses, and wrote the original, and revised drafts of the manuscript.

**Data Availability:** The data and code that support the findings of this study are openly available on GitHub at https://github.com/Laura-Schnell/ARCHIVE-mini-proj-Healthy-Beaches.

**Conflict of Interest statement**

No conflicts of interest

**Acknowledgements:** We would like to thank microbes, the Saskatchewan Government Healthy Beaches program data archive for being available to plunder, and lakes.

# Abstract

1. Beaches provide important ecosystem and recreational services but we don't want to get sick or die when we swim in them - that would suck.

2. Luckily, the Healthy Beaches Program run by the Saskatchewan Health Department measures *E. coli*, a potentially pathogenic bacteria, and microcystin, a liver toxin, levels at popular recreational areas around the province. I have downloaded the data from 2019, 2020, 2022, and 2023 to perform exploratory visualization.

3. Very unsophisticatedly managed to view the *E. coli* level at Last Mountain Lake popular beaches. This showed that often, *E. coli* increased in water during August.

4. This exploration has given me a lot of ideas of future things that one could look at. For example, is this due to human inputs and only occurs in the popular beaches? The unpopular beaches are sampled less, so how can we know?



**Key-words**: beaches, E. coli, microcystin


# Introduction

## Here is the background info about the thing…

People go into water at beaches and therefore interact with things in the water. Blue-green algae can produce microcystin which is a liver toxin able to cause death in low doses (Zhou et al., 2021). Exposure to E. coli in recreational waters can cause health issues and is therefore regualrly monitored in many places (Weiskerger and Phanikumar, 2020). In Saskatchewan, this is done by the Healthy Beaches program ("Healthy Beaches Program | Environmental Health," n.d.).

# Methods

To perform exploratory data analysis, I collected archived beach sampling data from 2019, 2020, 2022, and 2023. Original copies of data in pdf format can be found here: https://publications.saskatchewan.ca/#/categories/4324.

Data was converted to csv format and the data of all four years was collected in the same document.

Data was cleaned by removing white spaces before and after input values and converting datatypes as many were imported incorrectly. Additional columns were added for year, month, and day data to be held separately as well as a month-day column for easier data visualization.

Data was subset to just look at *E. coli* amounts at popular sampling sites on Last Mountain Lake. To visualize the data, ggplot2 was used.

We used R version 4.3.1 (R Core Team, 2023) and the following R packages: cowplot v. 1.1.1 (Wilke, 2020), flextable v. 0.9.3 (Gohel and Skintzos, 2023), grateful v. 0.2.0 (Francisco Rodríguez-Sánchez et al., 2023), palmerpenguins v. 0.1.1 (Horst et al., 2020), rmarkdown v. 2.25 (Allaire et al., 2023; Xie et al., 2020, 2018), tidyverse v. 2.0.0 (Wickham et al., 2019).

All code along with the simulation algorithms used are available on GitHub here: https://github.com/Laura-Schnell/ARCHIVE-mini-proj-Healthy-Beaches

# Results

*E. coli* levels fluctuate over the course of the summer **??**. Some recreational areas fluctuate more than others. In most cases, *E. coli* rises in August if it raises at all. This is the most seen with the more sampled beaches **??**.

# Discussion

Potential reasons for the *E. coli* fluctuations over the course of the summer. Ideas for future sampling that could illuminate this trend/allow us to look for relationships.

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# Figure Captions

**Figure 1**. *E. coli* at beaches at Last Mountain Lake that have been sampled at least 5 times over four years.

**Figure 2**. *E. coli* at the two most sampled beaches at Last Mountain Lake.

# Figures

Figures inserted using the basic URL style: ### First the basic URL style insert:

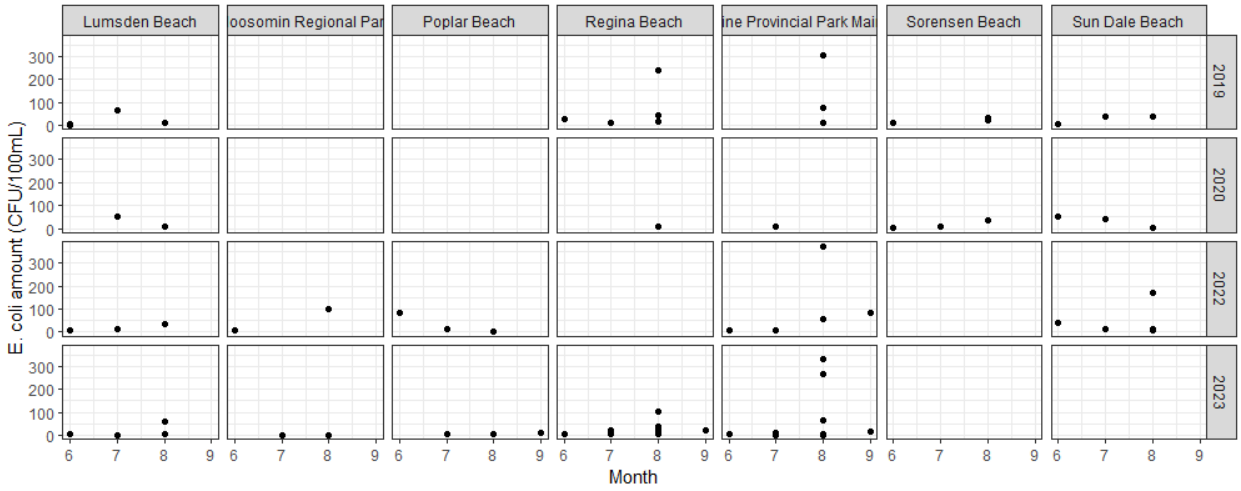


Figure 1: Figure 1 caption text: - *E. coli* at beaches at Last Mountain Lake that have been sampled at least 5 times over four years..

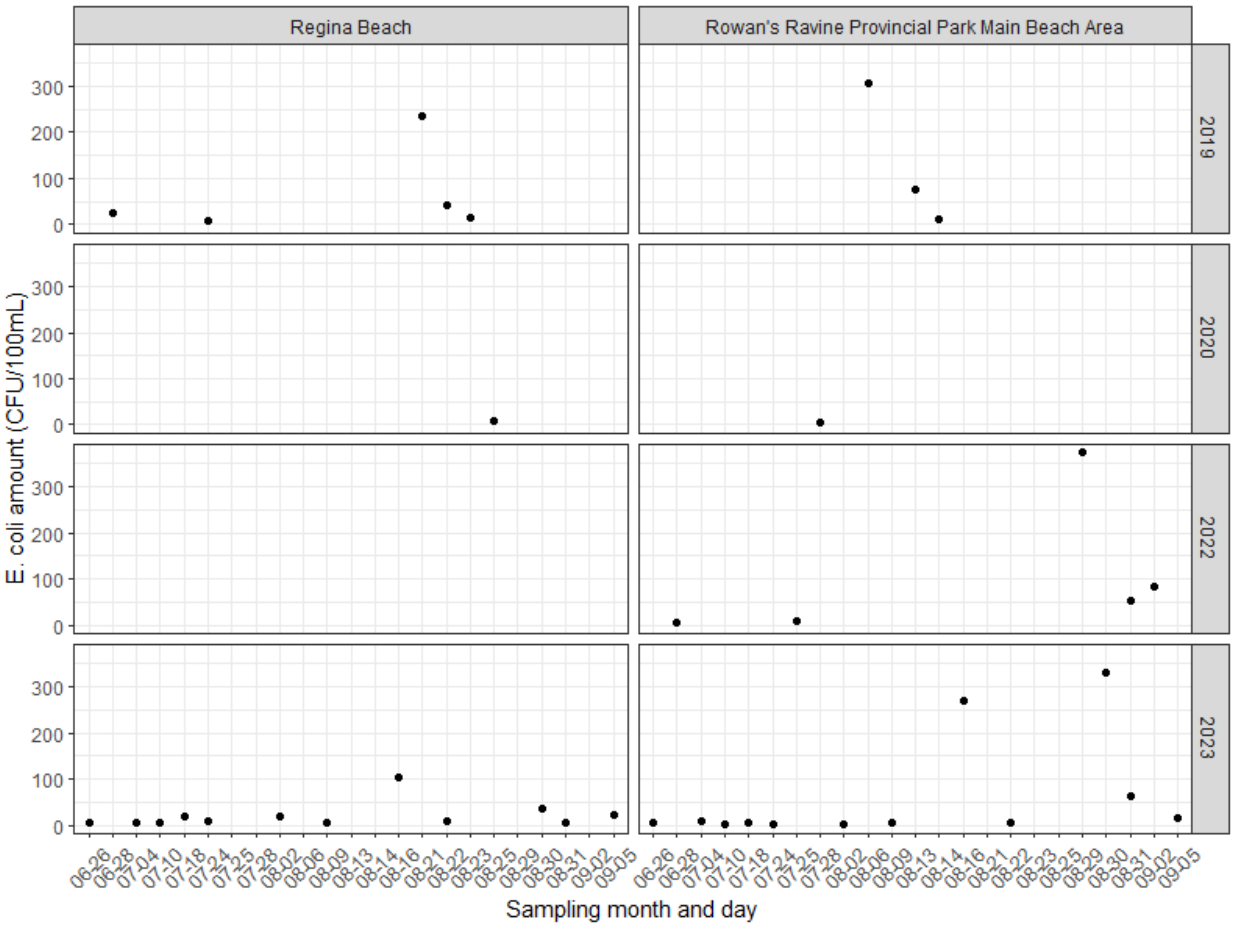


Figure 2: Figure 2 caption text: - *E. coli* at the two most sampled beaches at Last Mountain Lake…

# Appendices