SEASONAL VARIATIONS OF FECAL INDICATOR BACTERIA IN SURFACE WATER

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ABSTRACT

The detection of microorganisms in water is one of the basic concerns of public health. Microbiological impairment of water is assessed by monitoring concentrations of total coliforms, *E. coli, and* Enterococci. Total coliform bacteria are commonly found in the environment (e.g., soil or vegetation) and are generally harmless. However, the presence of *E. coli and* Enterococci, both found in the fecal excrement of humans, livestock and wildlife may pose human health risks. This study compares the presence, absence and abundance of the three indicator bacteria from three surface water sources (Big Spring Park, Brahan Spring Park, and Ditto Landing) located in Madison, County, AL. The analysis was performed using the IDEXX colilert (total coliform, *E.coli*) and enterolert (enterococci) tests. Results confirmed the presence of all three indicator bacteria and revealed seasonal variations in the quantity of the bacteria in the in the water samples. However, one of the samples, Big Spring Park, which is highly populated with ducks, had the highest level of total coliform, *E. coli*, and enterococci for all seasons. Future studies will utilize microbial source tracking techniques to determine the origin of contamination. Understanding the sources of fecal contamination is critical for assessing associated human health risks, for developing management plans to protect recreational waters, and for preserving the integrity of water supplies.

INTRODUCTION

Water quality is the study of physical, chemical, and biological characteristics of water by using established standards set by the U.S. Environmental Protection Agency (EPA). This includes surface water, which is defined as water from lakes, rivers, oceans, and streams. Several variables are often detected to establish water quality such as pH, ammonia-nitrogen, nitrate-nitrogen, fecal coliform bacteria, and temperature. Life-supporting water has a pH of 6.5-8.5 so measuring pH is an important monitoring variable. Temperature is also an important factor influencing bacterial growth. Bacteria are known to grow faster at significantly higher temperatures, but slow drastically at very low temperatures. However, microbial activity varies from system to system. Microbiological impairment of water is then assessed by monitoring concentrations of fecal-indicator bacteria such as fecal coliforms, *E.coli, and Enterococci* (USEPA, 2000). Fecal coliform bacteria are a group of bacteria that are passed through the fecal excrement of humans, livestock and wildlife. The most common member of this group is *Escherichia coli (E.coli)* an indicator bacteria whose presence signifies fecal contamination. *Enterococci* are pathogenic organisms that cause urinary tract infections and meningitis and other life-threatening infections in humans.

OBJECTIVES

- Identify levels of Total coliforms, *E.coli, and Enterococci* in 3 North Alabama surface waters, Big Spring Park, Ditto Landing, and Brahan Spring Park.
- Relate bacterial levels to seasonal changes in temperature and pH.

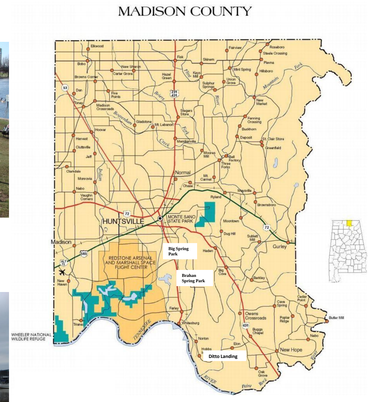
MATERIALS AND METHODS

Sampling Sites

Water samples were obtained from three Huntsville locations, Big Spring Park, Brahan Spring Park, and Ditto Landing.

Big Spring Park

Ditto Landing



Brahan Spring Park

Method of Analysis

Temperature and pH

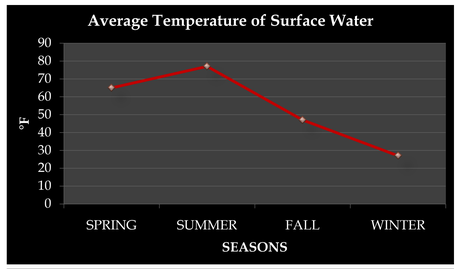
Temperature and pH were measured using a Sonde water monitoring instrument.

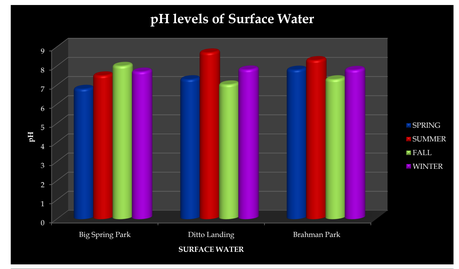
Enumeration Procedures for Bacteria

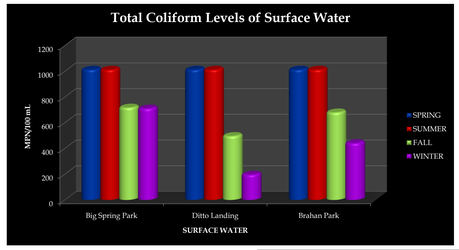
- Colilert® (Total Coliform and E. coli)/ Enterolert ® (Enterococci) test packets were added to 100 mL water samples in a sterilized clear bottle.
- The bottles were shaken until contents of the packet were completely dissolved in the water sample.
- The samples were poured into a Quanti-Tray and sealed in an IDEXX® Quanti-Tray Sealer.
- The sample trays were incubated in tray 35 C (Colilert®) or 41 C (Enterolert®) for 24 hours.
- Results were then compared to a Most Probable Number (MPN) chart.

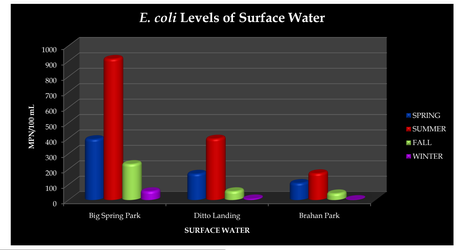
Bacterial controls obtained from the manufacturer were used to assess the results from the tested samples.

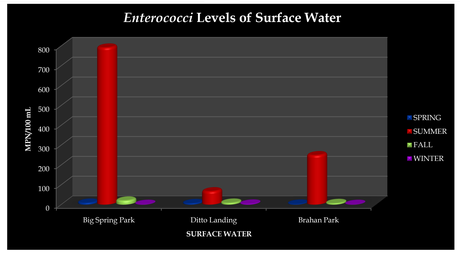
RESULTS











DISCUSSION

- Total coliform levels were above 200 CFU/ 100 mL which is indicative of deteriorating water quality during each season in which the surface water was tested.
- *E. coli* levels exceeded the recommended 5-day geometric mean of 126 CFU/ 100 mL during the spring and summer for Big Spring Park and Ditto Landing but were significantly higher during the summer for all locations:
  - Big Spring Park: 914 CFU/100 mL
  - Ditto Landing: 397 CFU/100 mL
  - Brahan Spring Park: 172 CFU/ mL
- *Enterococci* levels exceeded the 5-day geometric mean of 33 CFU/100 mL for all locations only during the summer months.
- In each of the surface waters sampled, the levels of indicator bacteria increased as the temperature of the water increased.
- pH levels in all samples remained relatively constant over time and location, ranging from 6.8-8.7, with a slight increase during the summer.

WORKS CITED

- USEPA. 2000. **Improved enumeration methods for recreational water quality indicators: enterococci and *Escherichia coli.*** EPA/821/R-97/004. U.S. Environmental Protection Agency, Washington, D.C.