Your Friend the Microbe:

Is there a Difference in Locality and Frequency of *Enterococcus faecalis* Among Three Different sites in the Hudson River?

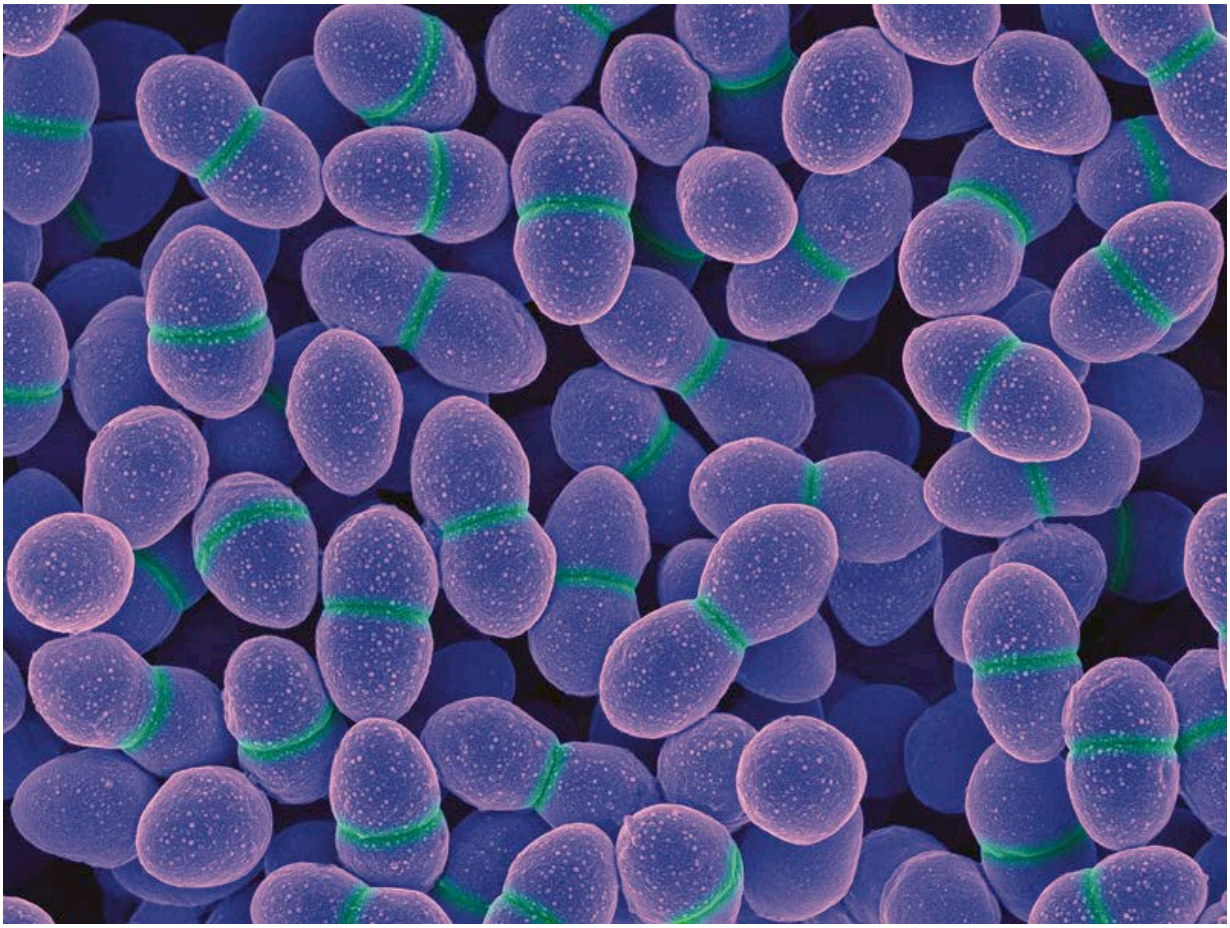


Photo Credit: https://ehp.niehs.nih.gov/wp-content/uploads/119/11/ehp.119-a489b.g001.png

Aaniyla Allen Sutherland

Advisor: Mauricio Gonzalez, M.Sc., Robert Buchanan

The Urban Assembly New York Harbor School

New York

2017

Table of Contents

Abstract

Combined Sewage Overflow is a system that discharge raw sewage into local waterways. When it rains the raw sewage flows out into the water and destroys local waterfronts and beaches. When untreated waste is released billions of harmful bacteria along with chemicals that can hurt many ecosystems and local communities. When tested this sets off a bio indication that there was a recent contamination in the water such as the CSO. The purpose of this project is to determine concentration and frequency of *Enterococcus faecalis* among four different sites along the lower Hudson River. This research project will educate the surrounding communities on the concentration and frequency of this commensal bacteria.

Introduction

When there is a presence of a fecal coliform bacteria in an aquatic environment it indicates that the water has been contaminated by waste from a human or warm -blooded animal. When this occurs the source usually is from a human action for instance dumping of wastes into the water. This interaction can hurt and potentially kill the aquatic animals. The presence of a fecal coliform bacteria is a bio indication that there was a recent contamination of the water. The presence is a potential health for individuals exposed to the contaminated water. For example New York City in 1832 there was an outbreak of a waterborne disease called Cholera which killed 3,515 out of a population of 250,000 New Yorkers. Furthermore one of the speculated causes was the way the sewage was be being treated and disposed of (Ahmed 2013). After this incident the city created new regulations and precautions to protect the people from epidemics like this.

This project will test for the amount of a specific commensal bacteria found among four site in the lower Hudson river. The bacteria that will be looked for is *Enterococcus faecalis* which is a commensal bacterium inhabiting the gastrointestinal tracts of humans and mammals. The reason why this research will be done is to inform the communities about this dangerous bacterium and its frequency. And also to promote the reasons why we need a better sewage outfall system.

Background Information

Before New York City created their sewage treatment plants the waste of the civilians was dumped into the water without treatment (DEP 2001).This was the main reasons of the poor quality of the Lower Hudson. The city didn't noticed their errors with throwing the wastes into the water until they noticed a connection with waterborne bacteria and human diseases. When the first sewage treatment plant was created it improved the water quality drastically. Along with over 7,440 miles of sewer pipes;135,000 sewer catch basins; over 495 permitted outfalls for the discharge of combined sewer overflows; 95 wastewater pumping stations that transport it to 14 wastewater treatment plant located throughout the five boroughs(DEP 2001).

When sewage plants were created it came with the combined sewage overflow system, which discharges untreated sewage into local waterways when the plant cannot handle the large amount of sewage. The outfall occurs when it rains as little as a quarter of an inch. On dry day the plants can receive over 250 million gallons of raw sewage (River Keeper 2015). But currently the Federal EPA is trying to find new effective ways to eliminate the amount of discharge per year which is 27 billion gallons (EPA 2016). By using green infrastructures that stop water from making it to the sewage systems and waterways (DEP2016).

As I already stated numerous times my objective for this project is collect quantitative data on the frequency and locality of the bacterium of the commensal microbiota *Enterococcus faecalis.*
E. faecalis is a member of the intestinal and oral microbiota that can cause oral cancers (Wikipedia 2017). This gram-positive and commensal bacterium inhabits the gastrointestinal tract of humans and animals. This bacterium causes life-threatening and infectious diseases. (Hammerum 2012).

Hypothesis

Depending on the location and the recent weather Enterococcus faecalis will have a higher concentration. Furthermore when there is wet weather on previous days the amount of *E. faecalis* will be higher than on

previous days that has dry weather. Or depending on the location if it is closer to an outfall point the number might be higher than an area further from an outfall point.

Methods

This chapter will discuss how to collect samples and how process them.

Collecting the data

You will need-

· 2 Empty Sample Bottle

· Beta-Bottle

· Personal Protective Devices: Gloves, Outer clothing that protect all exposed skin

· Life Vest (Depending on sampling site)

· Team of 2-4 People

Taking the sample:

· With a Team of 2-4 people go to your nearest sampling site. If need use personal flotation device(PFD)

· Put on your gloves on then open your Beta-Bottle.

· Dip your Beta-Bottle 10 feet below the surface after u have rinsed out the beta bottle once.

·Send down your messenger.

· Bring up your Beta-Bottle and pour into uncontaminated sample Bottle.

Processing the Sampling

· Bring the sample back to the lab as soon as possible.Where u will be using the IDEXX Enterolert testing.

· Once the sample has reached the lab,Dilute sample 1:10 with sterile water (e.g. put 10 ml of original sample in

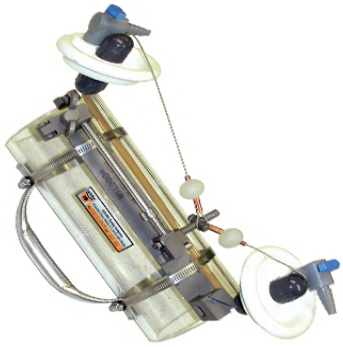
sampling bottle and fill to 100 ml with sterile water).

· Then add regent to the sample.

· Furthermore,Pour into Quanti-tray then seal tray with Quanti-tray sealer.

· Incubate for 24 hours at 41 degrees

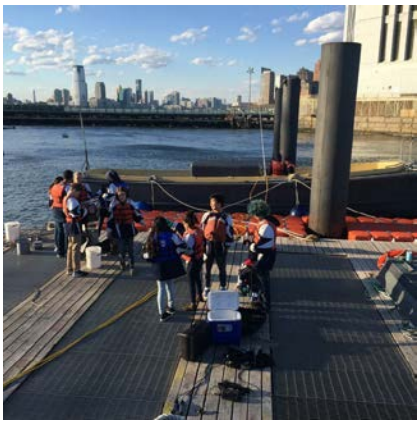
· Then count fluorescent wells and refer to the Most Probable Number (MPN) Chart.



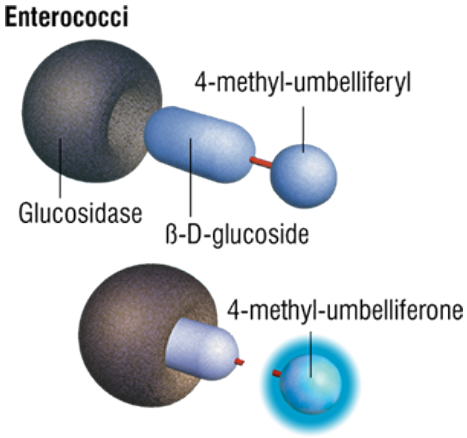
Picture 01: This is a picture of an open beta bottle

Picture 02: This an used sampling bottle

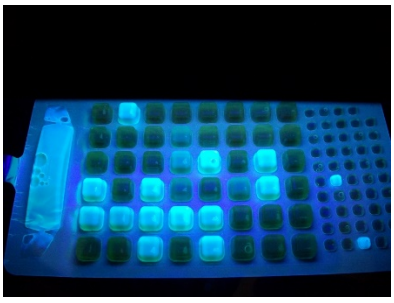
Picture 03: This is a sampling bottle after you have taken your sample



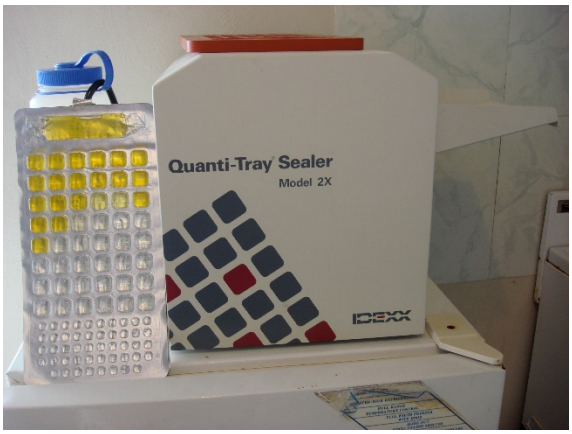
Picture 04: This is a picture of the Harbor Seals these two groups of four people is a good example of an team to sample with.



Picture 05: This is how the IDEXX Enterlort works for to show the presence of the bacterium.



Picture 06: This is a litten up well in the dark which indicates the presence of the bacterium.



Picture 07: This is the IDEXX Quanti Tray Sealer.

Safety

With the many dangers that come with working with *Enterococcus faecalis*, there is many safety precautions that have to be taken to insure the safety and health of the data collector. When working with this gram-positive bacteria we **must** have on Personal Protective Device. Which requires an apron and thick rubber gloves. Along with no exposed skin and opened shoes. The protocol that we must follow to be able to collect this data in Biosafety Level 2 and to insure the safety of the data collectors we follow the standards from the EPA.

Not only do we have to stay protected inside the lab but we also have to protect ourselves when going to sampling. So to insure the safety of the samplers, we follow EPA guidelines and a Sampling Do's and Don'ts created by the NYC Water Trails Associations.

Data Collection

During this project there will consist collection of quantitative data. Example of Data charts that will be used is shown below.

Date	Location	Team	Sample Code
2/5/17	Pier 101	Phytoplankton	17512E.F.01

Table01: Sample Inventory Example

Date	Location	Sample Name	Time	Fluorescent Wells	MPN	Replicates
-	-	-	-	-	-	-

Tabe02: The Data Collection of the fluorescent wells.

Locality

I picked three cites among the Lower Hudson River based off its distance from a combined sewage overflow outfall site. There is a key provide below of map02 to explain my sites and where are there.

Map 01: Map Of combined sewage over overflow outfall sites in New York City.

Map 02: Map Of combined sewage over overflow sites outfall cites in NYC and Marked with areas that will be sampled.

Key For Map02

- **Governors Islands is the Control (G.I.1)**
- **Brooklyn Navy Yard Industrial Park (E.F.2)**
- **Newtown Creek (E.F.3)**

These sampling sites are not finalized they may change due to Circumstances.

References

- New York Water Systems D.E.P
- "Sewer Altas." N.p., n.d. Web. 16 May 2017. <http://www.dec.ny.gov/chemical/48595.html~http://swimmablenyc.info/?page_id=191>.
- New York Harbor Seals Citizens Scientist Environmental Monitoring of the Hudson Estuary
- *Quartley Reports*. EPA, n.d. Web. <http://www.nyc.gov/html/dep/html/cso_long_term_control_plan/quarterly_progress_reports.s>.
- "Enterococcus Faecalis." *Wikipedia*. Wikimedia Foundation, 12 May 2017. Web. 16 May 2017. <https://en.wikipedia.org/wiki/Enterococcus_faecalis>.
- Cais, Daiane P., Rogério Zeigler, Rinaldo Siciliano, Cristhieni Rodrigues, Dirceu Carrara, Suzi Neres, Sarita Lessa, David Everson Uip, and Tânia M. Varejão Strabelli. "Clustering of Enterococcus Faecalis Infections in a Cardiology Hospital Neonatal Intensive Care Unit." (2006): 1-4. 10 Apr. 2006. Web. 1 June 2017.

Biography

I am Aaniyla Allen Sutherland, I was born on November 23, 2001 (I am fifteen years old). I am from Jamaica and Panama. I live with my single mother Moniphia Sutherland and younger sister Saraiya Phidd in Brooklyn, New York.

My mother raised me and my younger sister by herself since out births and has worked hard since then. My mother always taught me that life is not always fair and things won't be handed to and that if I wanted to be successful I have to work hard for it.

When I was younger I was oblivious to the maritime world and knew nothing about it. I only knew that I had a burning passion for something I was unknown to. At that time I only knew that I had to become a Firefighter which my mother disliked. But during the summer of 2012 I discovered an exceptionally beautiful animal that has its own week. These animals tended to be misunderstood and made out to be monsters. I found that similarity with the sharks were that we were both misunderstood and are sometimes outcast to the world.

After I discovered sharks I kind of knew that I was only at the tip of and huge ice berg. So I started to question the ecosystem and started to wonder how safe it was. So then I dived in deeper into the maritime world that when I noticed how much I loved it. Which led me to New York Harbor High School as a kid from Brooklyn who went to school right around the corner from her house this was a big step into adulthood. But I am very glad I came here to this program and get to experience everything I get to do know.