



# An Investigation into the prevalence, quantification, and survival of *Escherichia coli* in stormwater basin sediment of Withers Swash, Myrtle Beach, SC

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## BACKGROUND

While the presence of fecal indicator bacteria such as *Escherichia coli* in urban stormwater has been well documented, their occurrence and propagation in sediments are not well understood. Traditionally, fecal bacteria such as *E. coli* are thought to have short lifetimes in the environment. Recent research suggests that *E. coli* can accumulate in the soils, sands, and sediments and can act as a fecal bacterial reservoir within a watershed. In this study, we investigate the presence, concentration, and survival of *E. coli* in a variety of sediment types within the Withers Swash tidal creek stormwater catchment area as part of a microbial source tracking project. By examining the effects of physical and climactic conditions as well as biological inputs we hope to better understand the factors influencing bacterial success in drainage basin sediments.

## PURPOSE AND HYPOTHESES

The purpose of this investigation is based on the need to better understand the factors contributing to bacterial contamination of ambient surface water and stormwater. Locally, we will examine the impacts of stormwater as it enters Withers Swash, a 303(d) listed tidal creek for fecal indicator bacteria (FIB) that drains an urbanized section of Myrtle Beach, South Carolina. This research will focus on the contribution of drainage basin sediments, and their potential to act as a bacterial reservoir, to the quality of overlying stormwater entering Withers Swash.

### HYPOTHESES

- *E. coli* will be ubiquitously present in drainage basin sediment during dry weather sampling
- Drainage basin sediments comprised of smaller particles and more organic material will sustain and transport greater concentrations of *E. coli* between rainfall events
- Rainfall will suspend and transport *E. coli* adsorbed to sediment particles, resulting in decreased bacterial counts immediately after rain
- Mobilized bacteria from sediment will contribute to overall bacterial counts in stormwater

## STUDY AREA



Myrtle Beach, SC with Withers Swash highlighted in blue

## MATERIALS AND METHODS

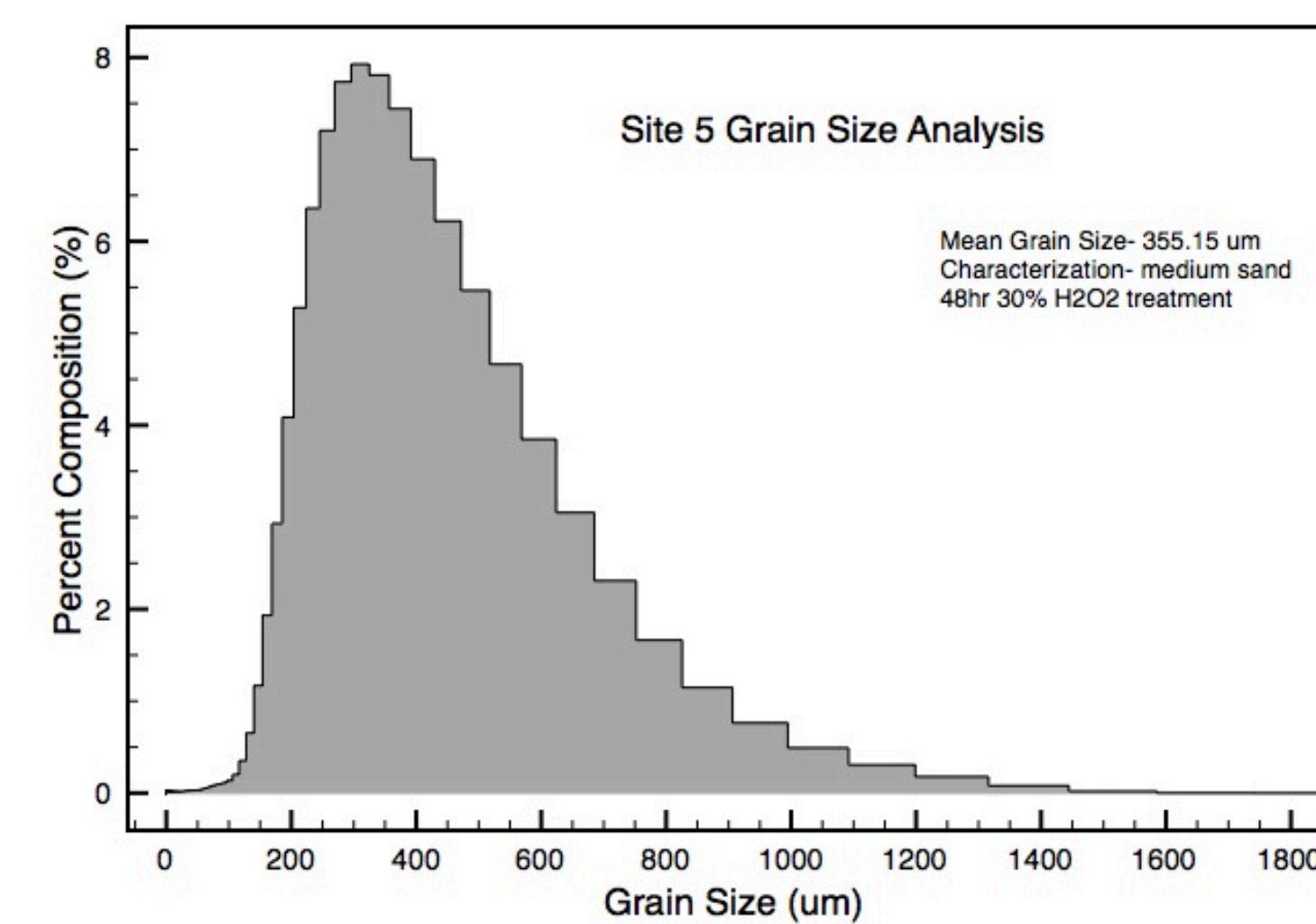
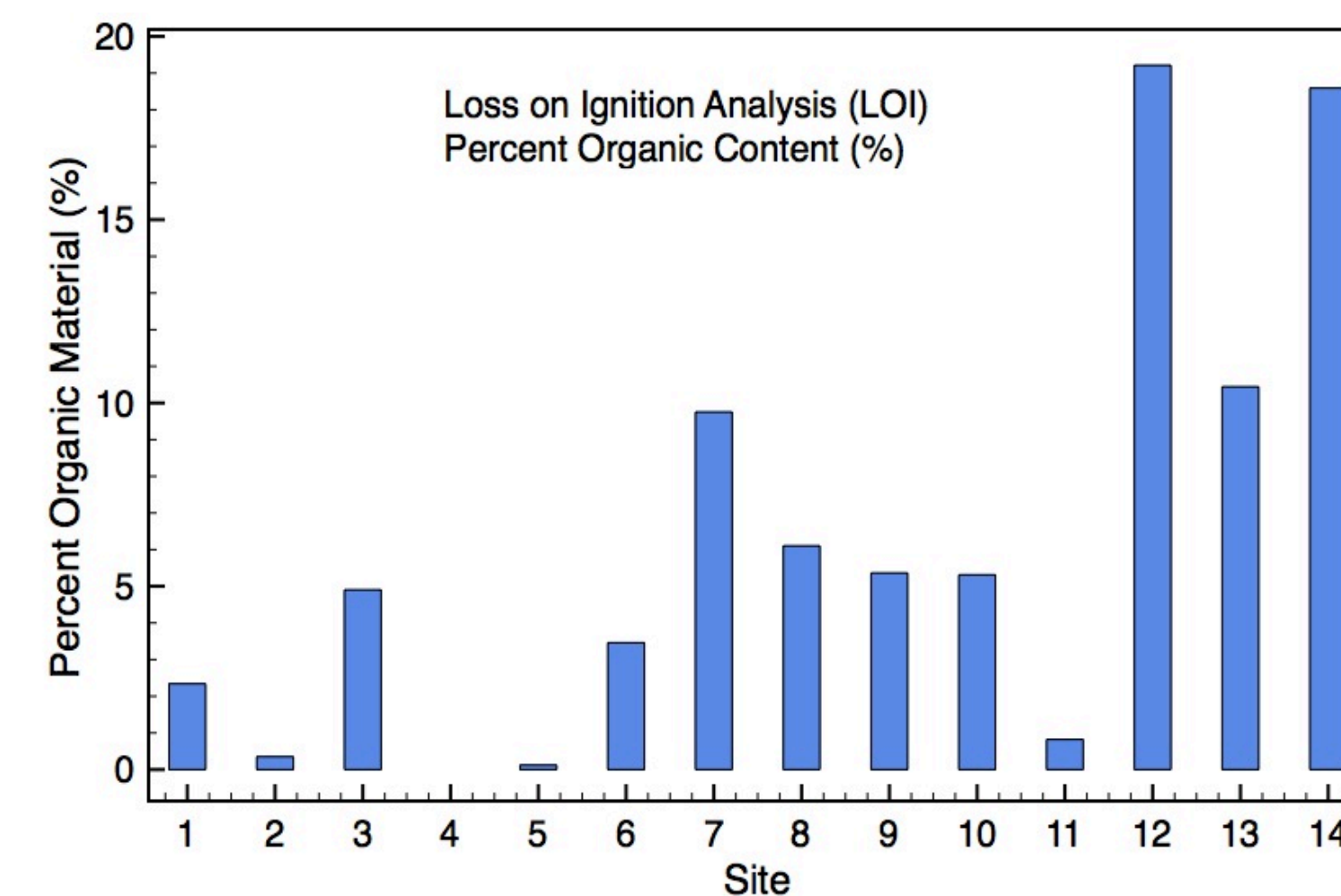
### Sampling Methodology

- Sediment samples collected before, during, and after rainfall event
  - Rainfall event- 72 hours dry conditions prior to rain and at least 0.25" accumulation
- Stormwater samples collected during multiple dry and wet weather events
- 3 sub-samples collected from the top 2-5cm at each sampling location, composited into 1 container for transport and analysis
- Sediment and overlying water samples analyzed for presence and quantity of *E. coli* and total coliform bacteria



### Physical Characteristics of Sediment

- Laser diffraction grain size analysis performed on sediment samples from all sites
- Loss on ignition analysis to determine percent organic content



### Benchtop Investigations

Parallel laboratory study investigating environmental factors affecting bacterial success in a microcosm setting

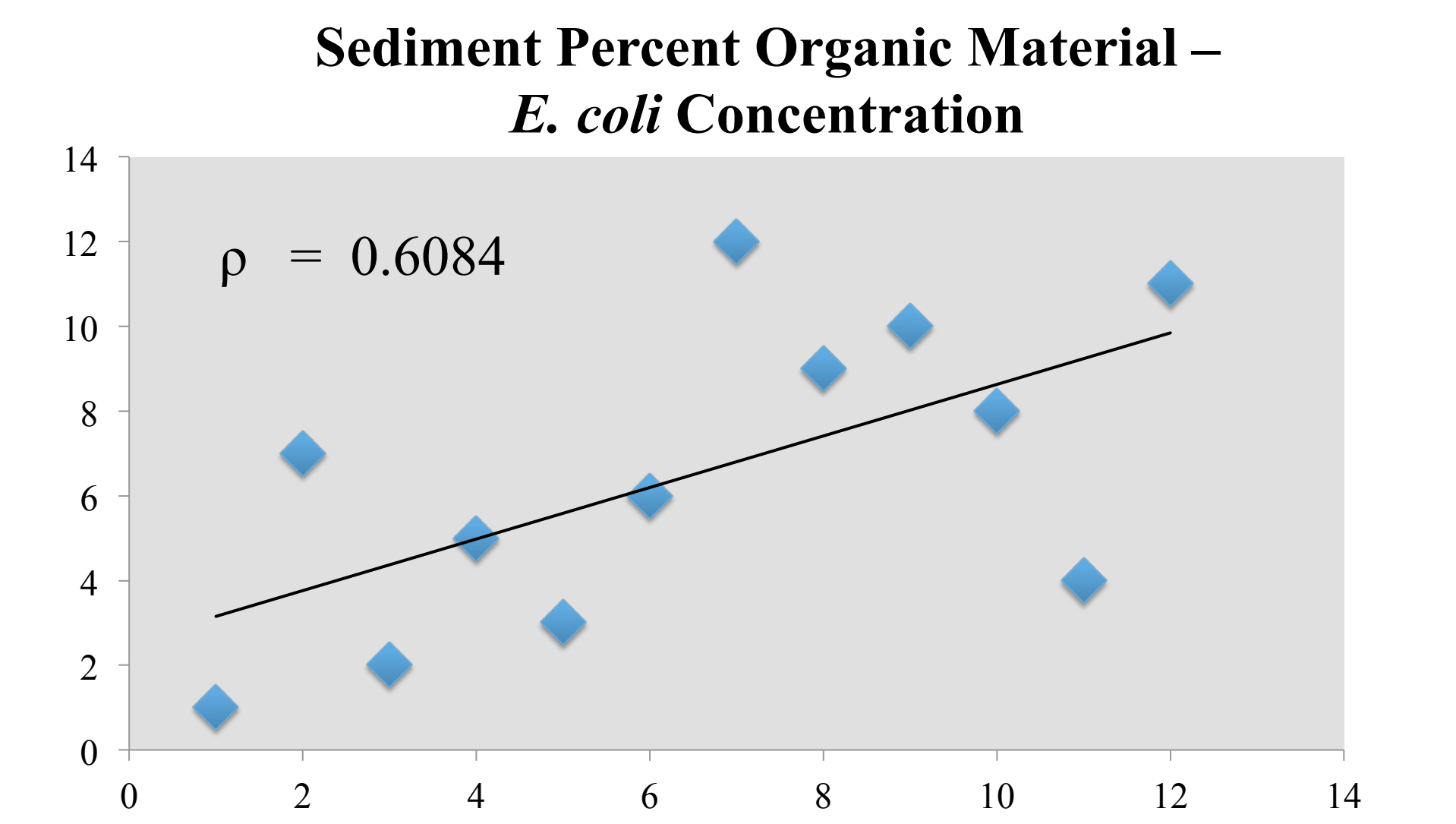
- bacterial reservoir/flushing phenomena examined
- the influence of grain size and percent organic material on bacterial recruitment/diffusion
- spiking experiments examining species specific die off curves



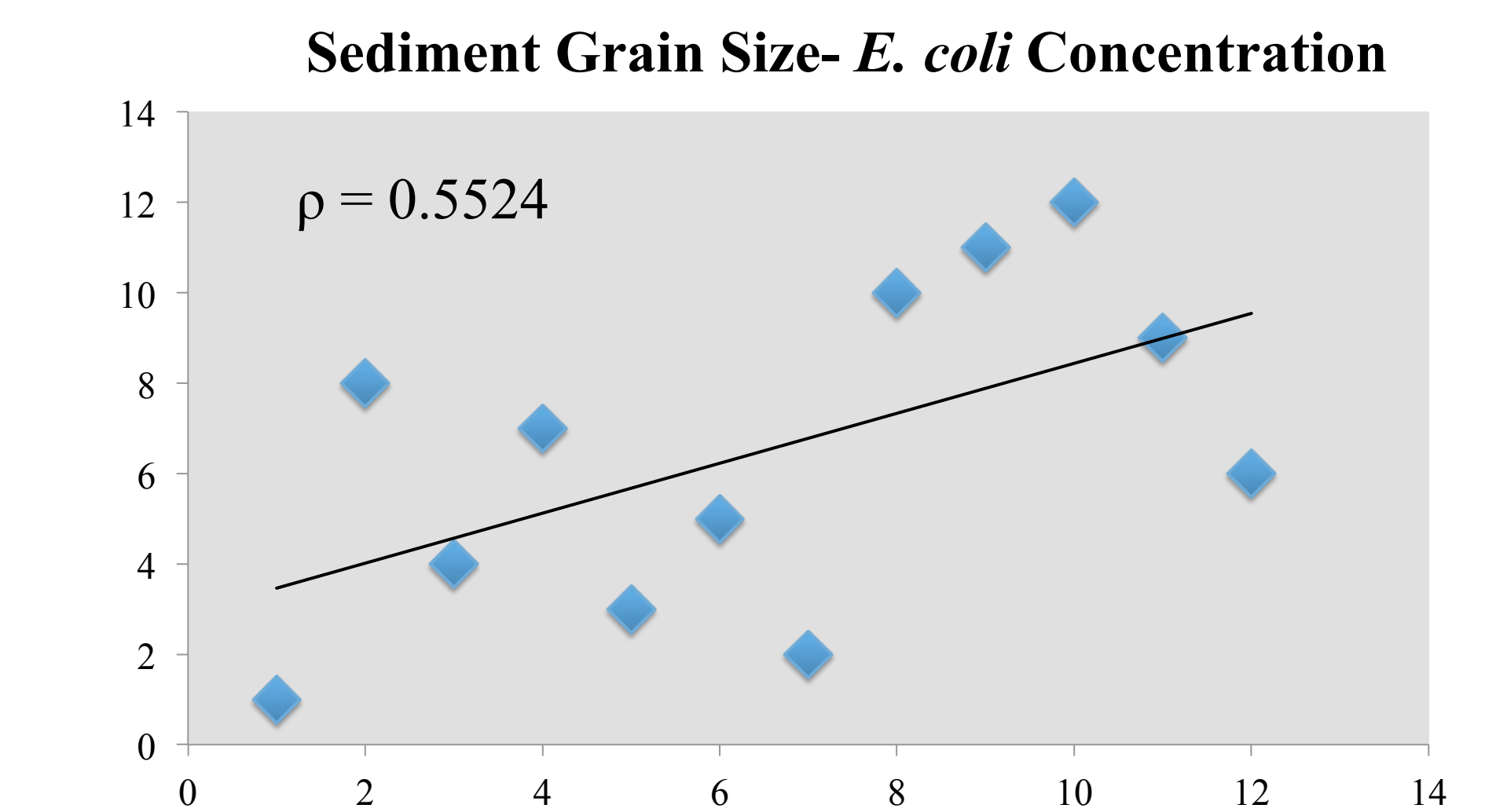
## PRELIMINARY RESULTS

### The Relationship between Sediment Grain Size and Percent Organic Content of Sediment to *E. coli* Prevalence

Initial result suggest there could be a relationship between both streambed sediment particle grain size, percent organic content, and the prevalence of *E. coli* bacteria in our study area.

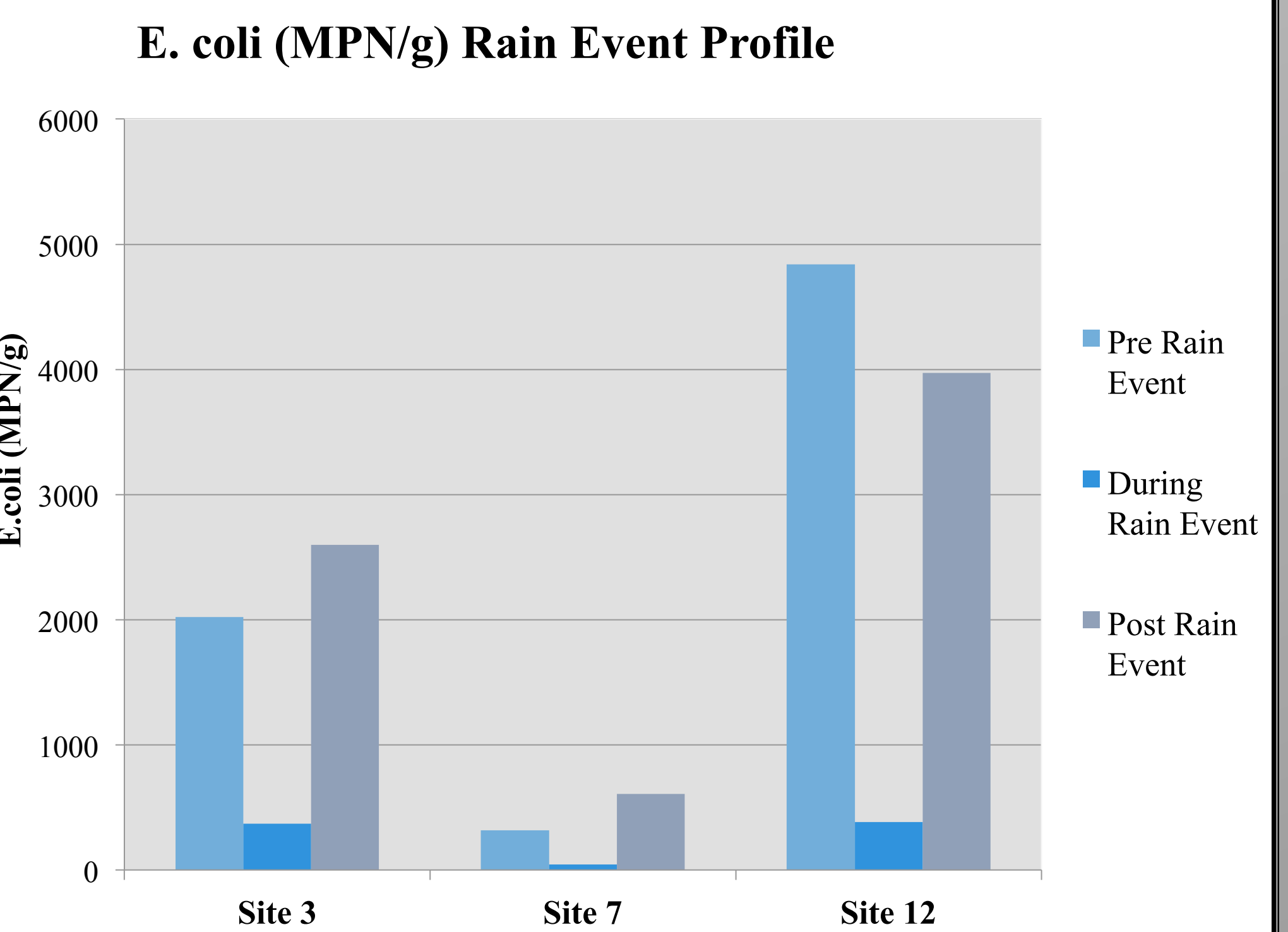


- Spearman rank order test used to identify relationships between non-normally distributed data
- $\rho$  values approaching -1 or 1 are indicative of a strong relationship between parameters



### Bacterial Reservoir and Flushing Effect

Using the data collected thus far we have observed sites that suggest a bacterial reservoir effect may be occurring. If such an effect were present one would expect an accumulation of high bacterial concentration within the streambed sediment environment relative to the overlying water during dry conditions. It has been suggested that the sediment-adsorbed bacteria may then be agitated and resuspended during the increased flow associated with a rain event. Thus streambed sediments, if capable of harboring bacteria in high concentrations, may act as an additional microbial input to a stormwater system.



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