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New Jersey Agricultural Experiment Station

Examining Optical Brighteners as an MST Screening tool

Cara Muscio et al.

Rutgers Cooperative Extension

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New Jersey Agricultural
Experiment Station
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Our Mission

Rutgers New Jersey Agricultural Experiment Station (NJAES) Cooperative Extension helps the diverse population of New Jersey adapt to a rapidly changing society and improve their lives and communities through an educational process that uses science based knowledge. Through science-based educational programs, Rutgers Cooperative Extension truly enhances the quality of life for residents of New Jersey and brings the wealth of knowledge of the state university to local communities.

Problem

Water quality degradation by pathogen sources presents:

- A potential health issue for both residents and tourists
- A loss of income to the coastal recreation and tourism industry
- Reduced economic opportunities for the shrinking shellfishing industry
- An economic impact on shore communities depending on the above two revenue sources

This issue hits where it hurts!

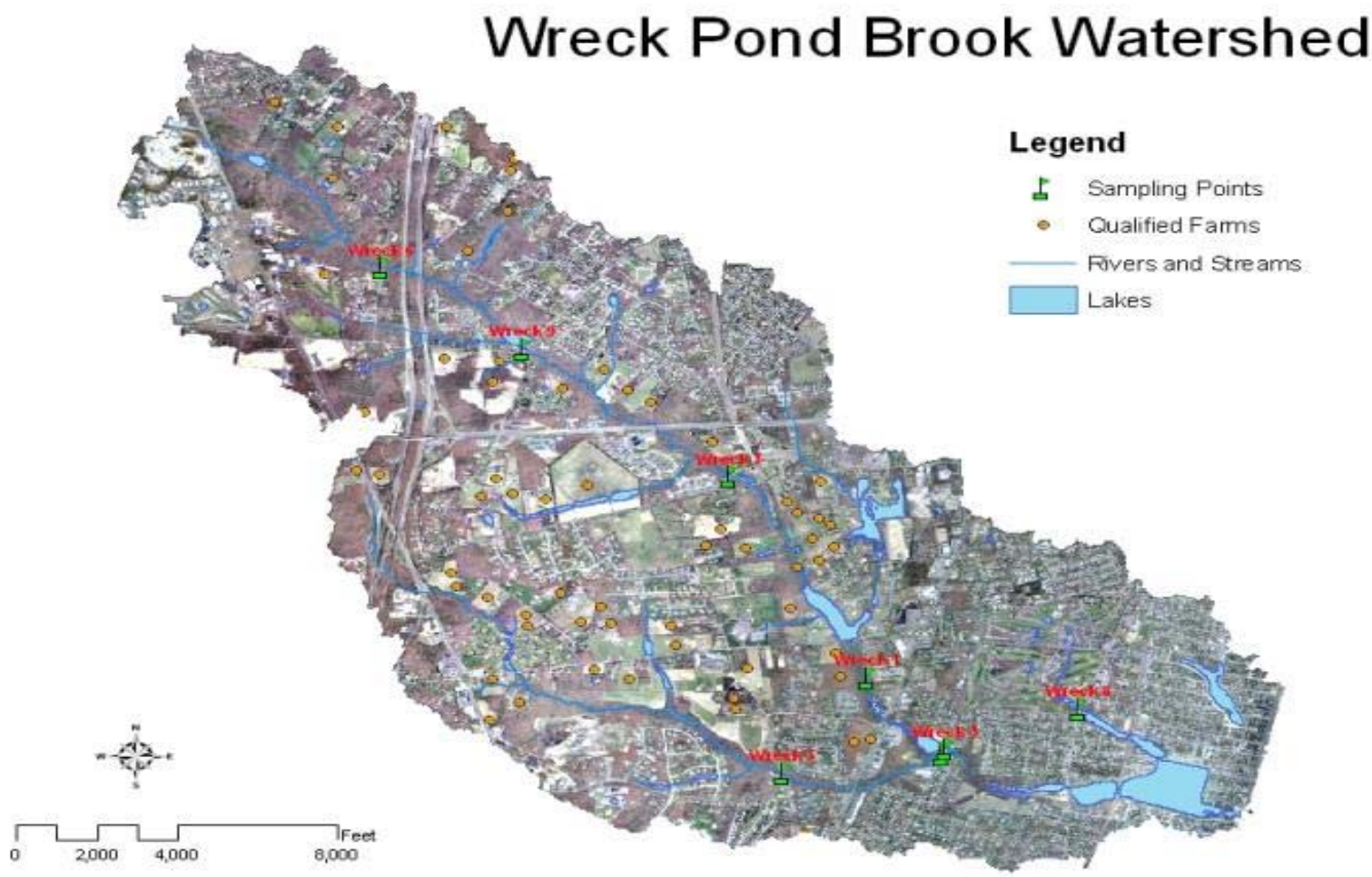
Current State of Monitoring

- E. coli and Enterococcus monitoring by both the New Jersey Department of Environmental Protection and the County Health Departments
- Development of microbial source tracking methods:
  - qPCR
  - MAR analysis
  - Coliphage
- Work in problem areas with infrastructure mapping

Slow Progress

- Many of the newer tracking methods are still being refined for use in New Jersey waters
- Many are currently expensive to implement
- Funding and staff resources are always limited
- Only highest priority problems are addressed
- Many areas may not have adequate data as of yet
- None of these new methods are currently utilizing the sizable state volunteer monitoring network

An expensive study



An opportunity

What if a source tracking method existed that …

- Identified human contributions when used with pathogen testing
- Was inexpensive
- Was easy to implement
- Was relatively easy to comprehend and analyze
- Could utilize existing agencies to provide technical and training support for volunteers

Optical Brighteners

- Fluorescent white dyes added to laundry detergents and paper products to produce a “brighter white”
- Fluoresce under ultra violet light
- Are a definitive HUMAN indicator
- Persist in the environment, for a limited time
- Are present in wastewater effluent from septics and combined sewer
- Can indicate the presence of untreated human effluent in water

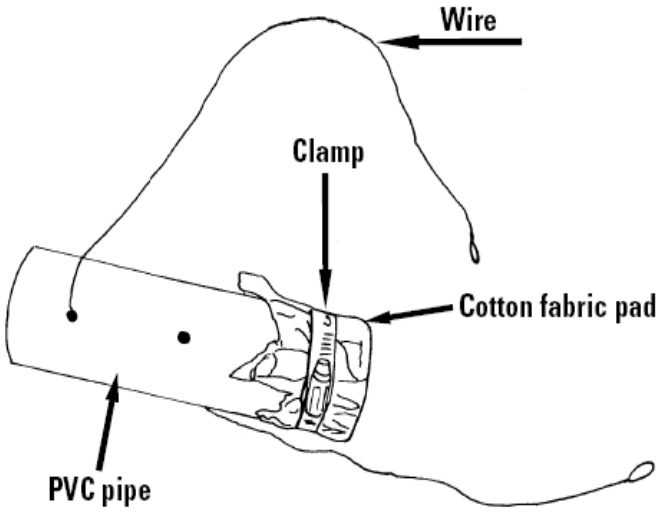
A “Brilliant” idea

The optical brightener trap:

- Either a 6” length of pvc

Or a wire mesh cage

- A swatch of unbleached cotton
- A fastener
- Costs about $2/per sampler
- Samplers are reused
- Only cloth needs replacement



http://www.longwood.edu/cleanva/images/Sec5.opticalbrightlesson.pdf

Targeted Sampling

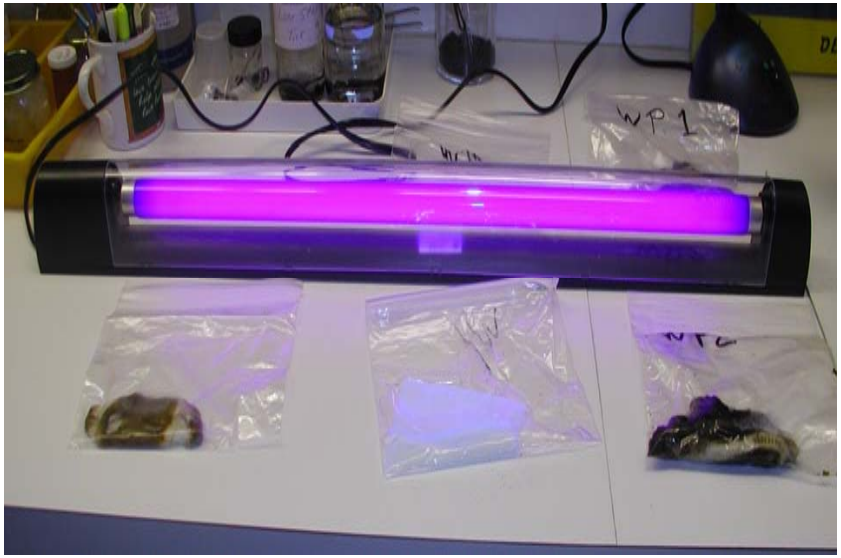
- In conjunction with bacterial indicator samples
- Storm and baseflow samples
- Can “track down” inputs

Fecal Bacterial Numbers		Optical Brightener		Likely Result
High		High		Failing onsite waste disposal system or leaking sewer pipe
High			Low	Human (e.g., outhouse) or other warm-blooded animals
	Low	High		Gray water in storm water system
	Low		Low	No evidence of fecal contamination

http://pghartel.myweb.uga.edu/

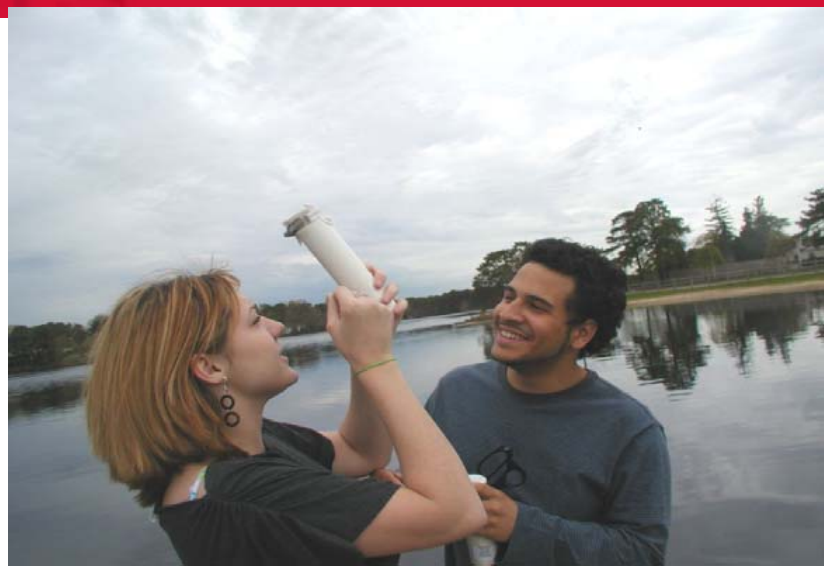
The Process

- Set in surface water or at outfall pipe for 5-7 days
- Rinse and remove pad into plastic bag
- Test for “glowing” under a UV/black light
- Uniform glow confirms OB presence
- Suggested use with bacterial indicator monitoring



A local impairment

Results



- Cages were difficult to work with
- PVC samplers did provide a cleaner inside surface
- Samplers were vandalized/washed away/ mysteriously disappeared - particularly in summer
- High fouling of pads, even with rinsing
- Very subjective…relative glow?
- No positives in any sample
- Only wastewater influent tested positive

Fluorometric analysis

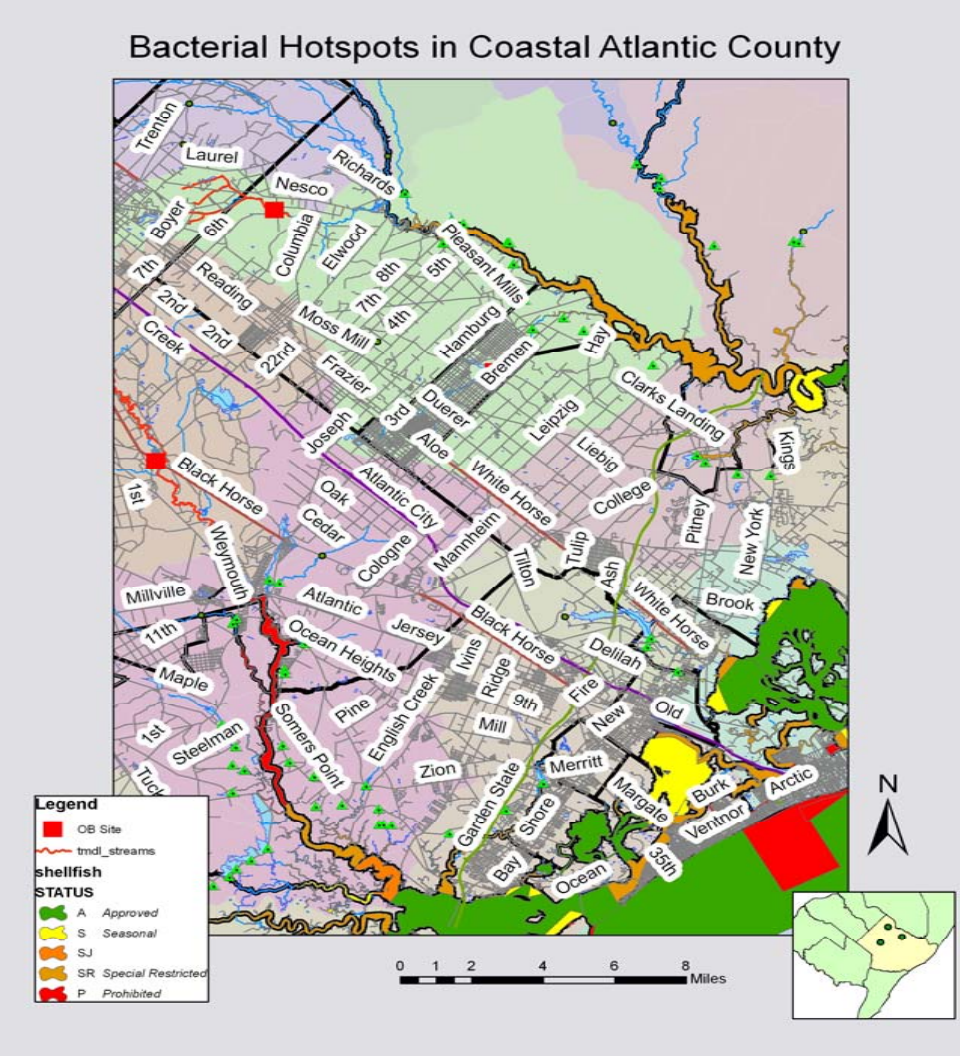
- More quantitative method
  - Set scale rather than visual discrimination
  - No “fouling” interference
- Used Turner Aquaflor Hand held Fluorometer
  - Channel A set to 445 nm wavelength
  - Some published work using this instrument
  - Reasonably affordable

Initial issues

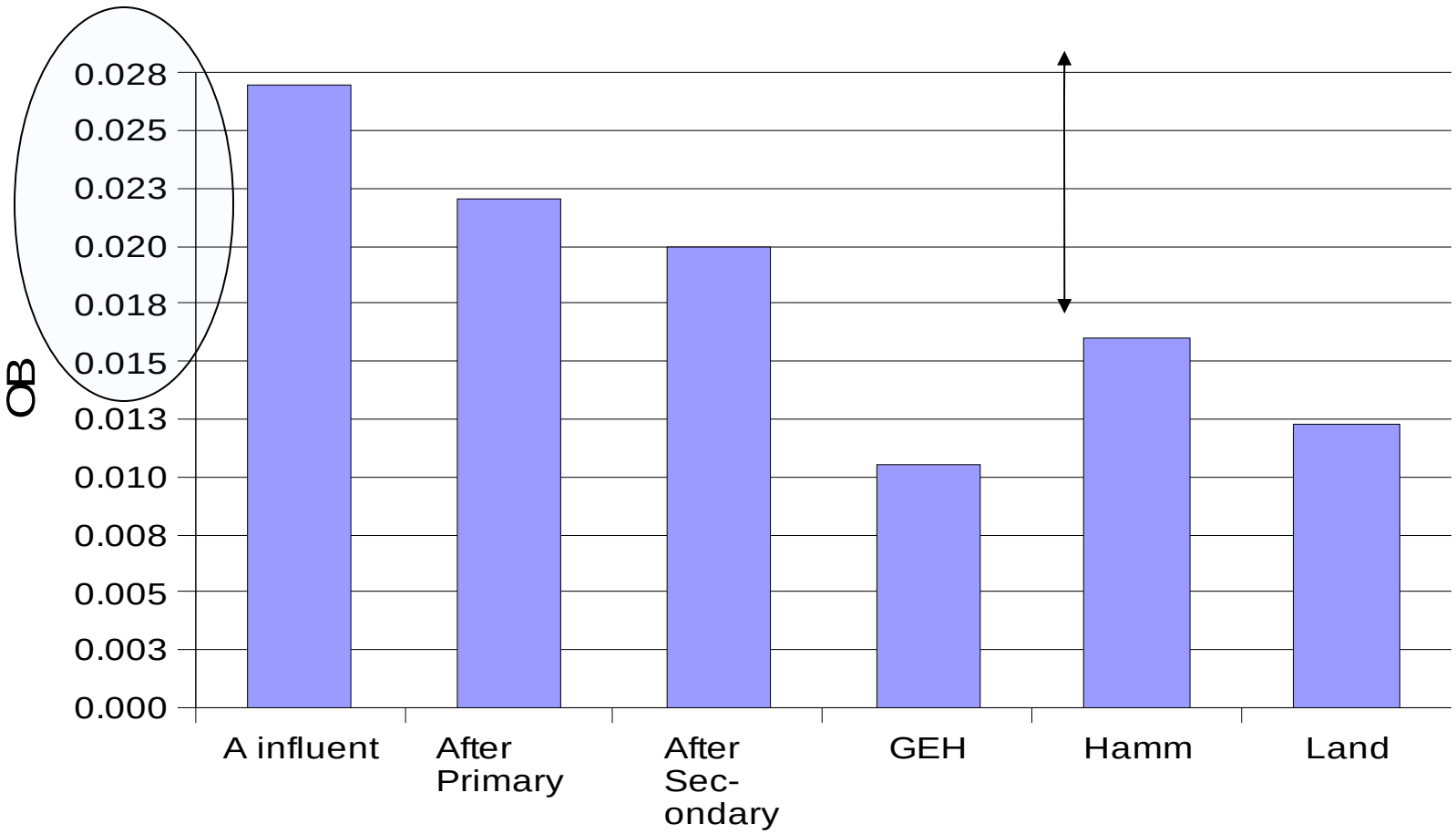
- What type of detergent?
- What concentration of detergent to use?
- What would “high” concentrations look like?
- What is the concentration of OB's in natural waters?
- What types of things interfere?

Another short study

- TMDL areas
- Upstream from closures
- Summer study
- Utilized PVC traps
- Hand held Fluorometer
- Detergent and DI standard
- Tested Wastewater samples



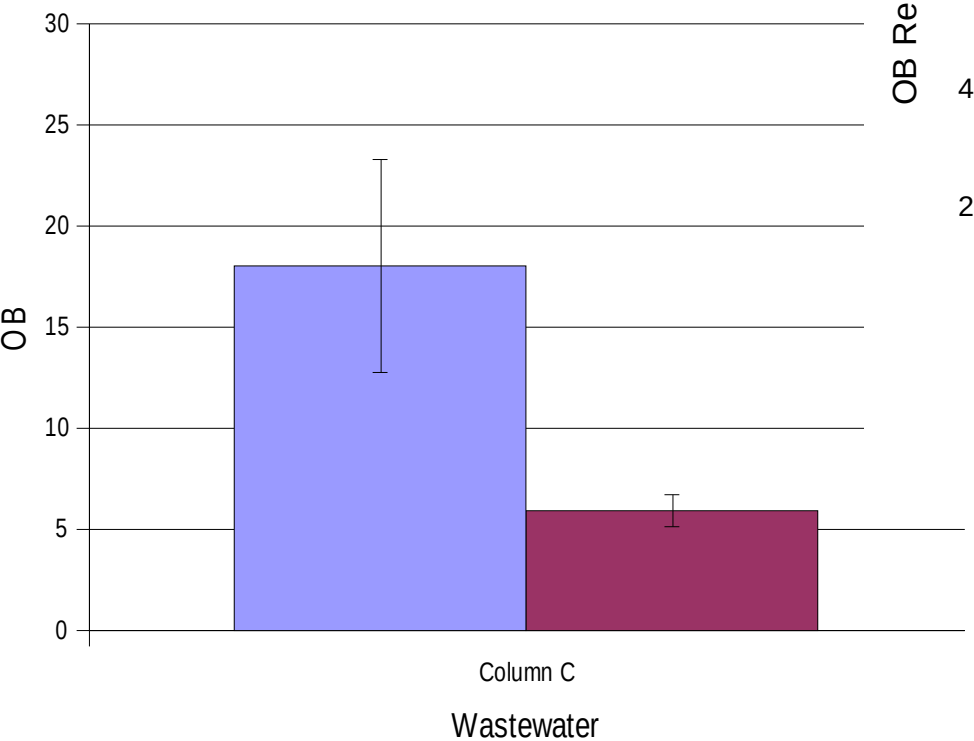
Resolution issues

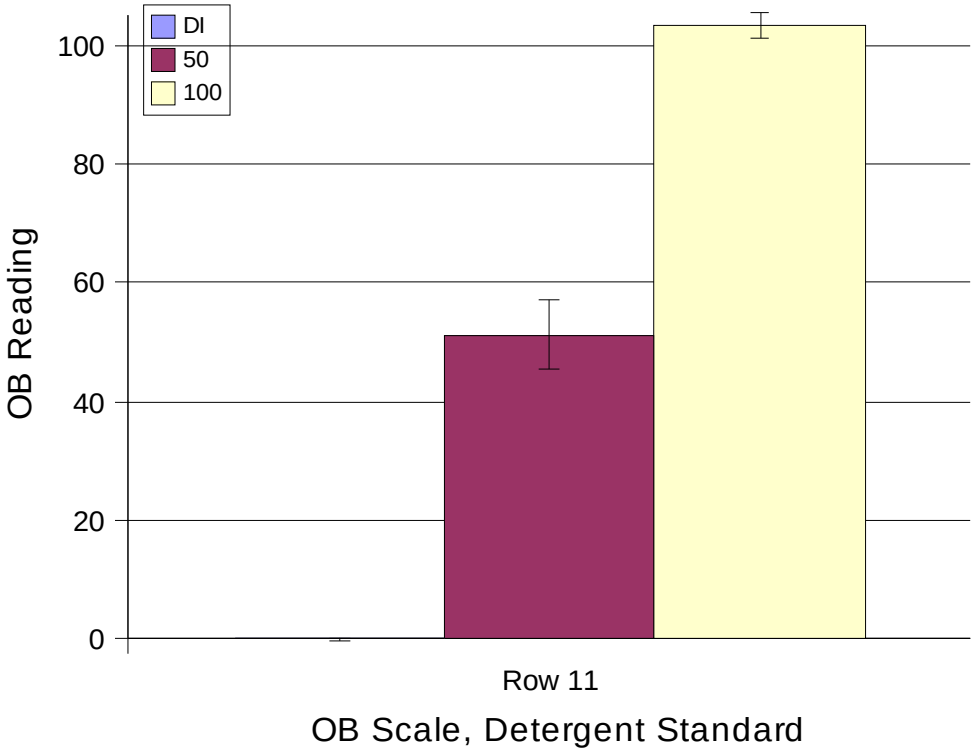


What does it mean?

- Changed the measurement scale to 0-100
  - 0 is distilled water
  - 100 is 0.1% OB containing detergent in water
  - Make an 0.05% solution (50) to test linearity
- More room between influent and effluent numbers
- Easier to understand, deal with
- This is a set scale…no translation to ug/L without further testing

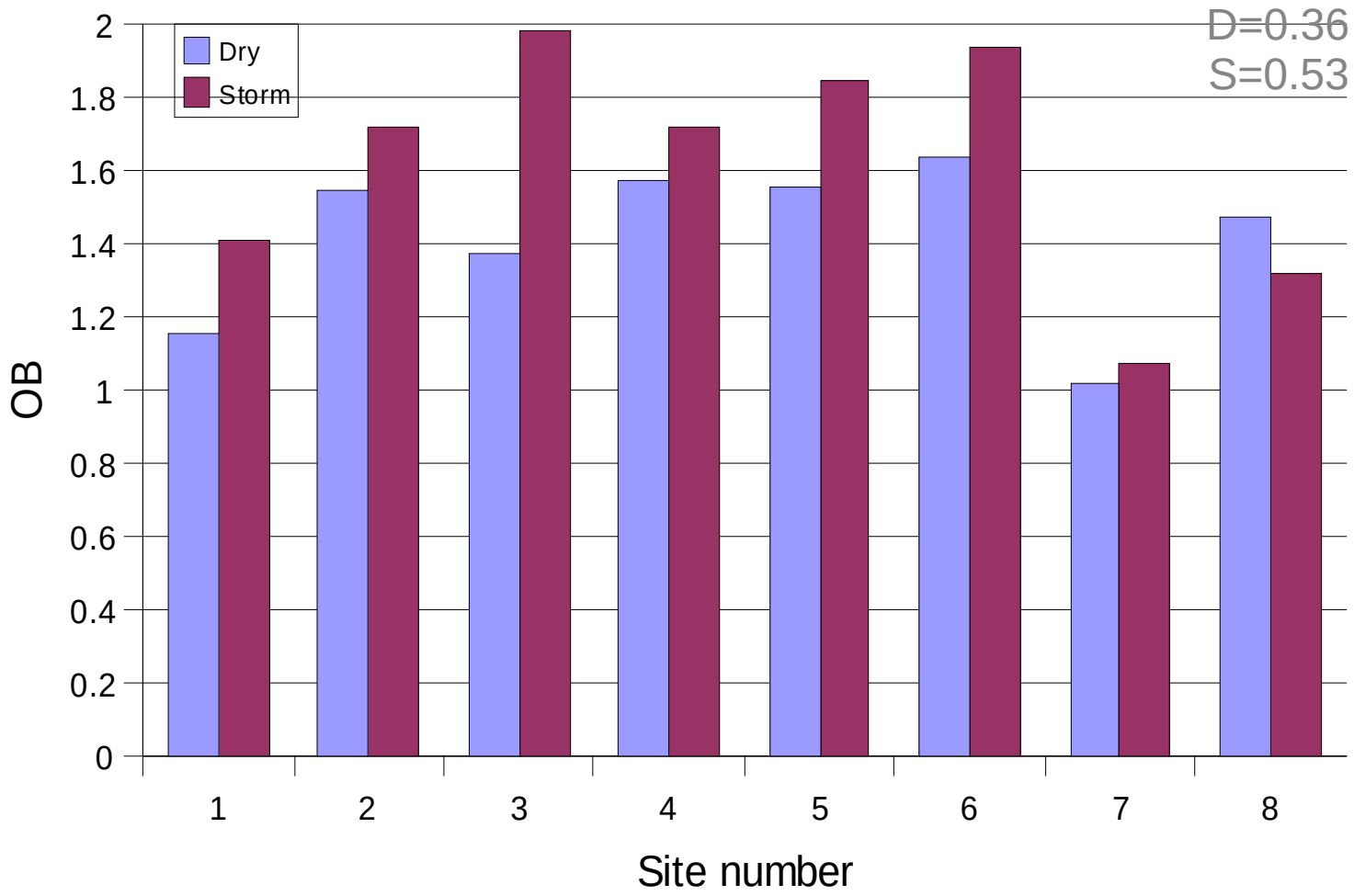
Setting a Scale





Back to the lake

Surface Water Data



Potential interference

- Stormwater debris: paper products
  - Collection of in the field paper products/new products
  - Use COA data for most common types
  - Soak in water 5-7 days and test water
- Human error
  - Another group reported off the chart readings for kimwipes
  - We tested them just like the swatches and got a negligible reading
- Organic matter
- Mammal urine

Where are we going?

- Establishing a statewide framework with standardized procedures
- Volunteers can screen areas for impairment and have more definitive information to take to agencies
- Closures and regulations are still made by coliform and Enterococcus counts
- Much more work remains to be done before attempting integration into current regulatory framework

Partnerships

- New Jersey Department of Environmental Protection, Volunteer Monitoring
- Clean Ocean Action
- Brookdale Community Water watch
- Marine Academy of Technology and Environmental Science
- Ocean County College Water watch
- Re Clam the Bay
- Shellfish industry folk

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