



# Town of Atlantic Beach

## Preliminary Surface Water Bacteria Monitoring Program

May 31, 2007


Presentation to ABACOWS



## Presentation Agenda




- Introduction with Town Goals and Scope of Study
- Dr. Rachel Noble – Description of work and results to date
- Conclusions and next steps







## Town Goals

1. Establish benchmark for stormwater runoff water quality
2. Anticipate EPA NPDES Phase II requirements
3. Prioritize areas for treatment of stormwater runoff



## Scope of Initial Study

1. Study 3 rain events, at 8 sample locations
2. Review results with Town
3. Continue with three more rain events after adjusting sampling plan based on initial results
4. Focus on preliminary information, not comprehensive contaminant identification








## Scope of Initial Study



Test for four bacterial contaminants and secondary indicators of human bacterial contamination:

- Total Coliform
- E. Coli
- Enterococcus
- Optical Brightener



## How far along are we in the study?

- Started February 22, 2007
- Collected 5 (of targeted 8) samples on March 2
- Not able to collect in April 15 rain event (high winds, surf advisory)
- Collected 8 samples on May 6
- One more storm event needed to complete preliminary round of testing, hampered by rain shortfall



# Investigating stormwater in the Town of Atlantic Beach

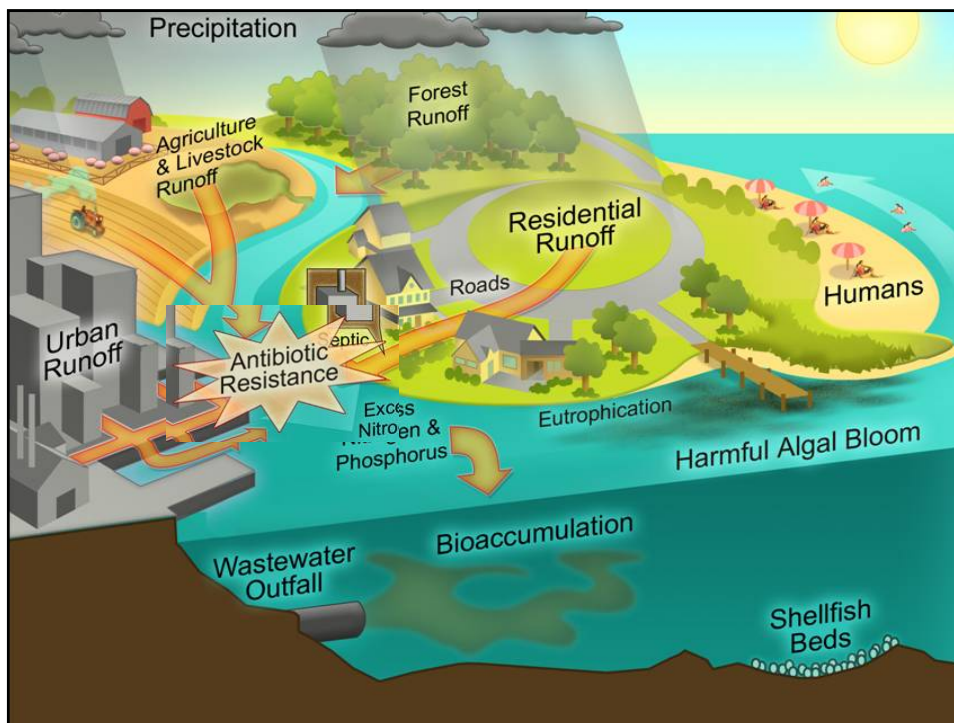
Rachel T. Noble  
UNC Chapel Hill Institute of Marine  
Sciences

## Research Program

- Ph. D. Microbial Ecology USC, background molecular biology
- Ecology of Infectious Disease Project-Neuse River Estuary (NSF/NIH)
- Stormwater contamination-Dare County, Carteret County, Los Angeles County (USDA, USEPA, State of CA)
- Modeling for shellfish harvesting water restoration (USEPA)
- On site wastewater system research-fate and transport of microbial contaminants (USEPA)
- Quantification of fecal contamination markers for epidemiology studies (CICEET, SCCWRP)
- Water quality assessments for Camp LeJeune, Emerald Isle, Jumping Run Creek

## Human exposure: Contact and consumption

- Recreational Contact: surfing, swimming, SCUBA, sailing, boating, waterskiing
- Skin or wounds, ear and sinus, GI or systemic infections
- Linkage with contamination difficult to make
- Both viral and bacterial pathogens from fecal contamination are the culprits
- Filter-feeders, fish and shellfish
- Often eaten whole and raw or partly cooked
- Global problem, millions of cases per year



## NC coastal water quality: the issues

- Receiving waters are typically designated as beneficial use for recreation and/or shellfish harvesting
- Impervious surface coverage increased 5 fold over last decade
- Septic tanks (on site wastewater) majority of waste treatment along coast (68% average, versus nationwide average of 51%)
- Stormwater runoff large portion of contamination signal
- Need quantitative approaches to partition sources of the contamination
- Need improved metrics for protecting public health, but also need to protect and restore resources and economics

## The science

- “Traditional” fecal indicators
- Measured using IDEXX technology, Colilert-18 and Enterolert™
- Demonstration of technology used
- Conventional PCR
- Quantitative (sometimes referred to as real-time) PCR
- Sequence based analysis
- Integration with flow and loading information

**EPA mandates testing for E. coli and Enterococci in recreational waters**  
**ISSC oversees shellfish harvesting waters management with fecal coliform standards**

Indicator bacteria:

- 1) Routinely monitored
- 2) The basis for all EPA mandates and subsequent management
- 3) Come from a wide variety of organisms
- 4) Found in a wide variety of environments
- 5) Don't give indication of source of fecal contamination

*E. coli*: is exclusively of fecal origin, fecal coliform group, which are thermotolerant, aerobic and facultatively anaerobic gram-negative, non-spore forming, rod shaped bacteria

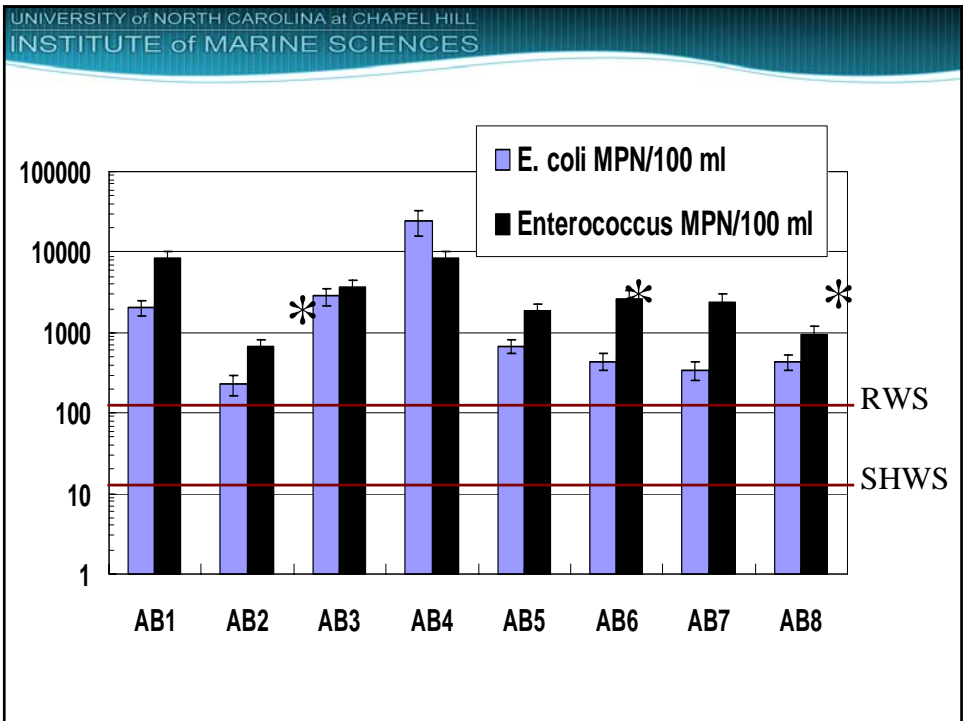
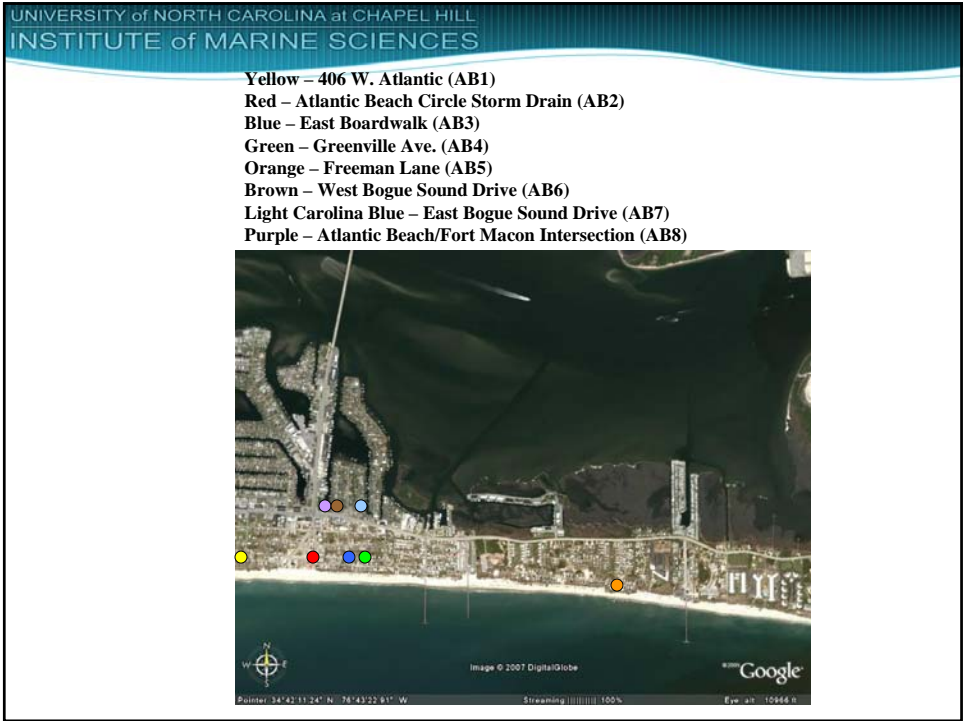
Facultative anaerobic gram positive cocci that appear singly, in pairs, and in short chains  
 Grows at 10 to 45°C and in broth containing 6.5% NaCl  
 Produces leucine aminopeptidase and hydrolyzes esculin in the presence of 40% bile salts

**ENTEROCOCCI SPECIES:**  
*asini, avium, casseliflavus<sup>a</sup>, canis, cecorum, columbae, dispar, durans, faecium, faecalis, flavescens<sup>a</sup>, gallinarium, gilvus, haemoperoxidus, hirae, malodoratus, moraviensis, mundtii, pallens, phoeniculicola, psuedoavium, porcinus<sup>b</sup>, raffinosus, ratti, saccharolyticus, serolicida, solitarius, sulfureus, villorum<sup>b</sup>*

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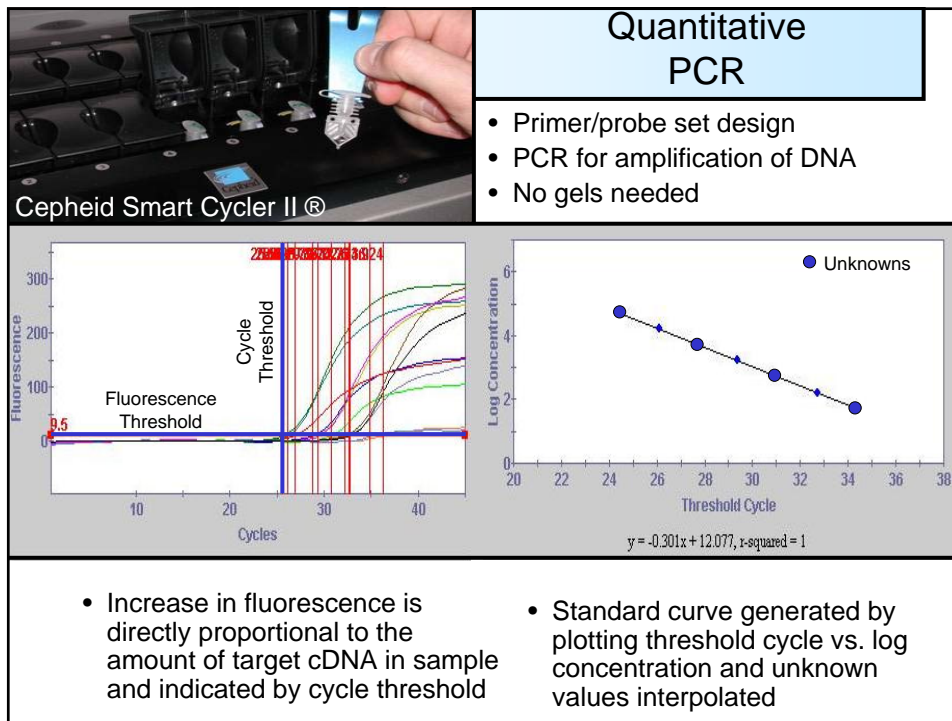
## Site Selection

- Selected to represent across Atlantic Beach with focus on primarily eastern residential areas
- Range of catchments sampled
- Where visible stormwater ponds or flows to ocean or sound
- Range of potential contributors to fecal contamination



## Preliminary Results

- Fecal contamination prevalent as indicated by *E. coli* and *Enterococcus* measurements
- Ten times higher than recreational and shellfish harvesting water quality standards
- Optical brightener results indicate detectable human fecal contamination at three sites, caution with interpretation of data
- Currently little information available as to the potential sources of fecal contamination
- Discussion of ongoing research in the Noble Lab

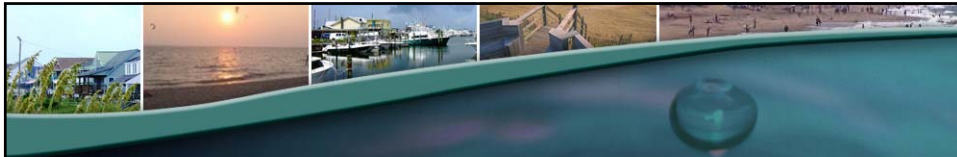


## How can we learn more about the source of fecal contamination?

- QPCR measurements of microbial contaminants
- *Bacteroides thetaiotamicron*
- *Bacteroides* Human Specific marker
- *Enterococcus* sp. speciation
- ESP gene marker of human fecal contamination
- Bird specific contamination markers
- Human pathogenic viruses (E.g. Enterovirus or Adenovirus)
- Range of controls provides full quantification of target, reported as per 100 ml



## Current Applications

- Rapid methods developed in the Noble Lab currently being evaluated by the USEPA for national promulgation
- *Bacteroides thetaiotamicron* rapid QPCR assay selected by USEPA for use in this summers epidemiological studies
- Also selected and funded by CICEET for inclusion in Orange County, CA epidemiological study
- Being utilized for development of coastal pollution models



## Conclusions

- Very satisfied with quality of testing conducted by Carolina Institute of Marine Sciences
- Only have one full data set of eight samples so too early for conclusions
- Stormwater BMPs will need to treat water quality as well as water quantity
- Pray for rain (YTD we are 10-12" below normal)



## Next Steps

- Seek Town feedback on expanding testing scope after initial sampling (3 events) is complete
- Clean Water Management Trust Fund grant funding, if awarded, would facilitate expanded testing program
- August 14, 2007 – CWMTF considers Town grant application
- Complete preliminary study with 6 rain events before determining CWMTF sampling program

