PATHOGENS IN ESTUARINE AND COASTAL SYSTEMS: POTENTIAL IMPACTS ON HUMANS AND ECOLOGY

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Microbiological water quality of coastal zones and estuarine waters is typically determined by measuring indicator bacteria, such as total and fecal coliforms, and enterococci, to infer the presence of microbial pathogens. Bacterial indicators are used to infer the presence of human pathogens associated with fecal contamination, based upon the assumption that the bacteria are present in waters with fecal contamination, and not in those without. However, the use of bacterial indicators is limited in that they sometimes fail to successfully predict the presence of pathogens (bacterial, viral, and protozoan). Several studies have revealed that several dangerous types of viruses can be contracted by swimming in contaminated ocean waters or eating shellfish from contaminated shellfish harvesting beds, and outbreaks of gastroenteritis have been caused by swimming in water with acceptable coliform counts. Also, bacterial indicators are not always a useful as a metric of ecosystem health, but it is possible that a variety of other microorganisms can be used to gauge the condition of certain ecosystems. A relatively new molecular technique, Quantitative PCR (Q-PCR), is a novel primer-based molecular technique that combines the specificity of "traditional" PCR with the quantitative measurement of fluorescence for determination of presence of specific types of nucleic acid in environmental samples. We perform filtration, concentration, and RNA/DNA extraction steps paired with Q-PCR, employing TaqMan™ assays, to detect a weide variety of human pathogens (such as enteroviruses), "sentinel" microorganisms (such as human specific Bacteriodes), and specific species of enterococci (fecal streptococci). In addition, we have also designed primers for the detection of both canine parvovirus and bovine enterovirus as indicators of different types of animal fecal contamination. We are interested in using these molecular techniques to define sources of fecal contamination stemming from non-point source runoff from 3 different land-use types: silviculture, residential, and agriculture. We aim to use this information in conjunction with other available water quality data to build better hydrological models in coastal watersheds, especially in conjunction with the EPA's Total Maximum Daily Load (TMDL) implementation.

Relation to management in Barnegat Bay:

- Provide information relating to development of methods that can be used to mitigate sources of fecal contamination to Barnegat Bay, thereby protecting beneficial uses
- Provide information relating to the development of predictive models that may be useful during certain times (e.g. heavy precipitation) to predict contamination levels
- Provide information on new ways to implement local TMDLs
- Provide information that can link to other metrics of ecosystem condition, within the concept of building a matrix-based decision making system for management of estuarine and coastal waters

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