

Are All Microbes Created Equal?: Indicator Organism and Pathogen Partitioning in Urban Stormwater

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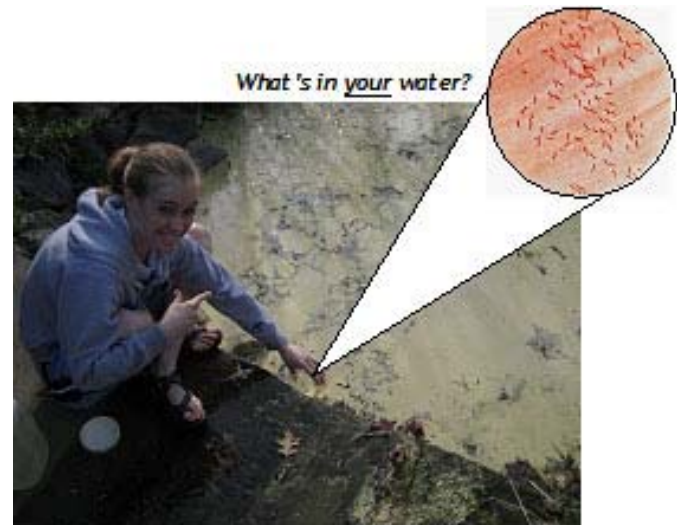
Wednesday, March 26, 2008

0001 MHRC

12:00 - 12:50 p.m.

ABSTRACT

Over 8,500 water bodies in the US are currently designated as impaired due to high indicator organism concentrations and require total maximum daily load (TMDL) development. The computer models used to evaluate and regulate impaired watersheds generally assume that these indicator organisms are transported to and within receiving waters as individual free cells, though growing observational evidence suggests that microbes in stormwater actually partition between free and particle-associated phases. Understanding this microbial scale behavior is essential to improving watershed-scale modeling accuracy and to assess the effectiveness of sedimentation-based best management practices (e.g. detention basins, wet ponds) which may be useful in reducing particle-associated indicator organism loadings. However, simulation of indicator organism partitioning behavior and removal will be of limited use in improving water quality if the actual pathogens of concern do not exhibit similar behavior.



In the present study, the partitioning behavior of a suite of indicator organisms and the human pathogens *Salmonella* are investigated. Both dry weather and storm samples were collected from detention basins and stream sites in an urban watershed in Durham, NC that drains into Jordan Lake. Samples were separated into unassociated and particle-associated fractions using a calibrated centrifugation technique and analyzed for microbial, particle, and total organic carbon concentration. *Salmonella* spp. were recovered from 22 of 33 (67%) dry weather samples and 45 of 48 (94%) stormwater samples, including thirteen samples meeting the U.S. Environmental Protection Agency's recommended criteria for recreational contact. *Salmonella* presence was correlated with the presence of fecal coliform, *E. coli*, enterococci, and somatic coliphage. Roughly equally fractions (25-45%) of *Salmonella* and fecal indicator bacteria were categorized as particle-associated, suggesting that these indicators are a reasonable surrogate for *Salmonella* behavior in hydrologic models. Although measurable fractions of indicator and pathogenic organism concentrations were identified as particle associated, there was little reduction between influent and effluent concentration in the two detention basins analyzed.