Category III: Water Quality

Fecal Indicator Bacteria and Pathogen Persistence in Dry Sand and Sediment Biofilms at Two Southern California Beaches: Implications for Water Quality

PRINCIPAL INVESTIGATOR

Jennifer Ayla Jay
Civil and Environmental Engineering Department
University of California, Los Angeles
Email: jjay@seas.ucla.edu
Phone: 310-267-5365
Fax: 310-206-2222

EXECUTIVE SUMMARY

Southern California beaches are an important recreational and economic resource. However, the beaches are subject to frequent swimming advisories and closings due to microbial contamination of surf zone water, mainly due to stormwater runoff. Swimming near storm drains has been associated with increased risk of cold, fevers, chills, sore throats, diarrhea, and other symptoms of respiratory and gastrointestinal illness (Haile et al., 1999). Enclosed ocean beaches, which are ideal for children due to the sheltered environment, are particularly notorious for having poor water quality.

Standard microbial water quality testing involves analysis for the fecal indicator bacteria (FIB) total coliform bacteria, *Escherichia coli*, and enterococci, whose presence points to contamination of the water from fecal sources. Due to the difficulty in detecting specific pathogens, these measurements are often used as surrogates.

However, there are important concerns with using FIB to indicate the presence of pathogens. In general, the survival of these indicator organisms in the environment can be very different from that of the pathogens of interest. Secondly, growth of indicator bacteria in the environment weakens the connection between FIB and pathogen, and may lead to overestimation of risk. In fact, one hypothesis proposed to explain the recently observed strong correlation between water quality exceedances and the spring tide (Boehm and Weisberg, 2005) at many Southern California beaches is that FIB regrowth and remobilization of FIB from sand may result in erroneous water quality postings.

Our recent work has shown extremely high levels of FIB in sediments at enclosed beaches, and a high potential for regrowth in sediment biofilms. We propose to test the implications of this finding at local beaches by studying both the regrowth of enterococci throughout a lunar cycle (which could lead to exceedences at the spring tide) and the survival of pathogens (enterovirus, *Campylobacter* and *Salmonella*) as well as FIB in sediment from an enclosed and an open beach.

The specific aims are summarized below.

Specific aim 1: Test through both field and laboratory microcosm studies the hypotheses that enhanced water quality exceedances during spring tide may be due to regrowth and resuspension of fecal indicator bacteria (FIB) or nutrients in surf zone sediment.

Specific aim 2: Test the hypothesis that sediments may increase the persistence of pathogenic enteric viruses and bacteria, as well as FIB, in the field at our open and enclosed beach sites. The factors influencing survival in sediment will be tested in laboratory microcosms.

Expected benefits. This work is expected to have direct and important benefits for improved monitoring of and understanding of FIB and pathogens at local beaches. Expected outcomes of this work include: 1) a greater understanding of the suitability of the use of FIB to indicate pathogen contamination in coastal waters; 2) information on how knowledge of tidal cycling can inform interpretation of water quality based on FIB measurements; 3) data on pathogen survival in local sediments; and 4) an understanding of how sediment biofilms at an enclosed and an open beach differ in ability to prolong the survival of pathogens.