

Examining FIB Contamination of the Santa Monica Pier

Z. Accuardi, J. Corbin, M. Reuter, A. Saltzman, G. Imamura, J. Jay

CENS, Jay Lab - <http://research.cens.ucla.edu/>

Introduction: Storm drains contribute to high FIB levels posing health risk

Beach Monitoring Legislation

- Over 30 billion gallons of unfiltered urban runoff enter Santa Monica Bay annually via the storm drain system
- AB411, passed in 1997 by the State of California, mandates the monitoring of water quality from April to October (dry season)
- Santa Monica Pier exceeded Bacteria Total Maximum Daily Load for summer dry weather 126 times in 2009



Implications of FIB at Beaches

- E.Coli and Enterococci, fecal indicator bacteria (FIB), come from humans, other mammals and birds
- FIB indicates an increased likelihood of other pathogens being present
- Exposure to high FIB levels may be linked to skin rash, respiratory infection, and gastrointestinal infection

Problem Description: FIB levels consistently high during dry season

Objectives

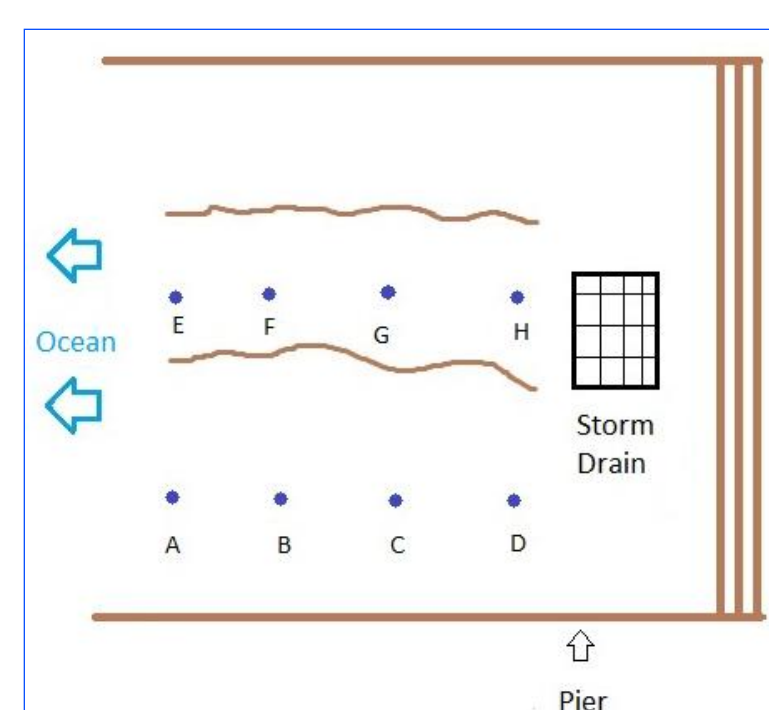
- Characterization of FIB levels & spatial distribution under Santa Monica Pier
- Determine effects of shading on FIB survival in sediment



Proposed Solution: Analyze effects of UV and location on FIB concentration

Transect Microcosm

- One time point (9:00)
- 8 locations, water, sediment, and duplicate samples taken
 - Inside Channel (stagnant water), E through H
 - Outside Channel, A through D, groundwater collected at a depth of approximately one foot
- Salinity, FIB concentrations and moisture content analyzed



- No statistically significant difference between FIB concentrations in sediment samples from inside and outside the channel as determined by t-test ($p > 0.1$).
- E.coli concentrations in water samples were consistently higher inside the channel ($p = 0.02$).
- Outside channel sediment samples contained significantly higher FIB concentrations than water samples (Figure 1; $p = 0.002$), but within the channel no significant difference in concentration was observed.
- Within the channel, FIB levels start high, drop, then increase moving away from the drain (Figure 2), possibly because water flow in the channel washes FIB down the channel, causing buildup. Outside channel levels do not show any obvious trends (Figure 3).
- Storm drain likely remains a factor in high FIB levels.

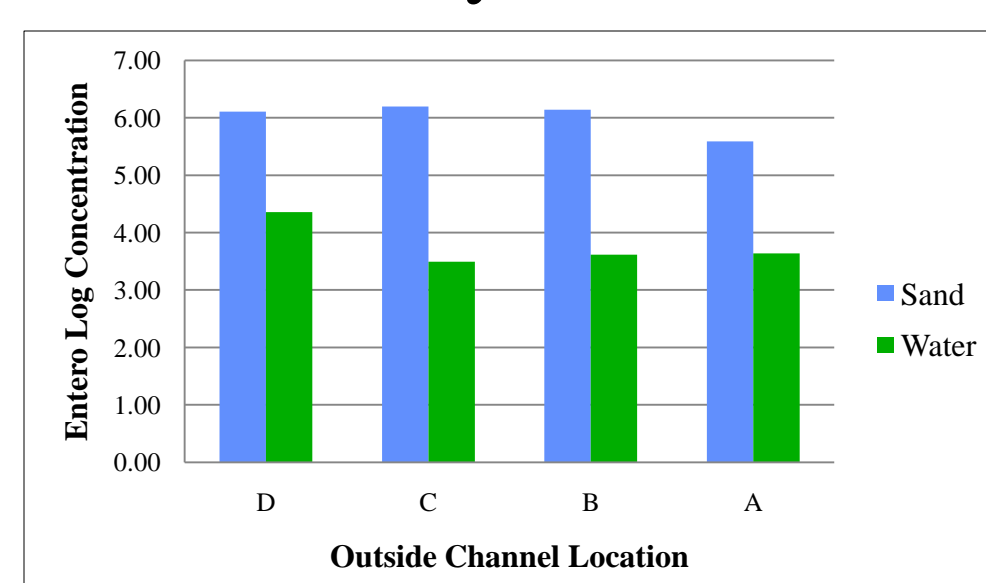


Figure 1. Graph of logged Enterococci concentrations in CFU 100 dry grams⁻¹ for sediment and CFU 100 mL⁻¹ for water outside the channel at locations A through D

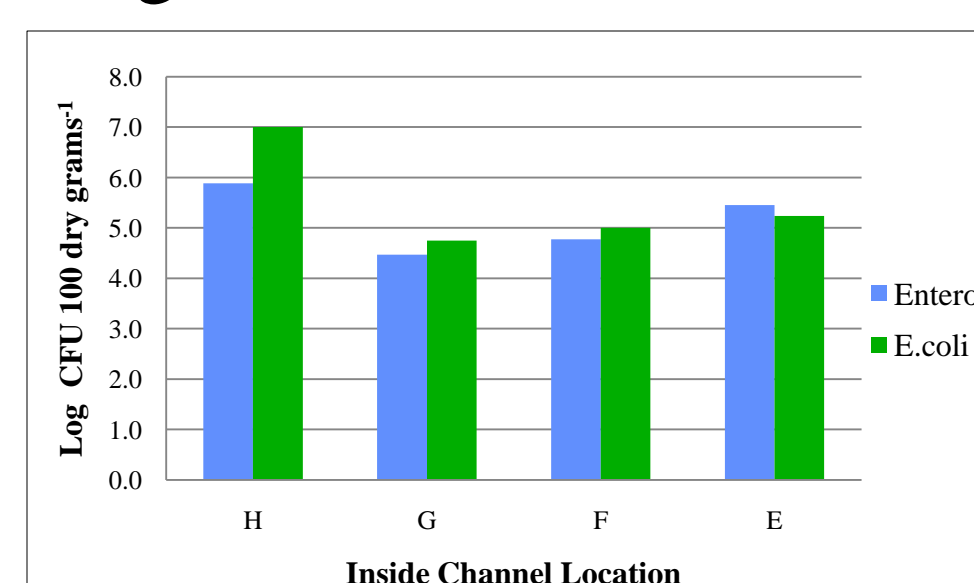


Figure 2. Graph of logged FIB concentrations in sediment for locations A through D, inside the channel.

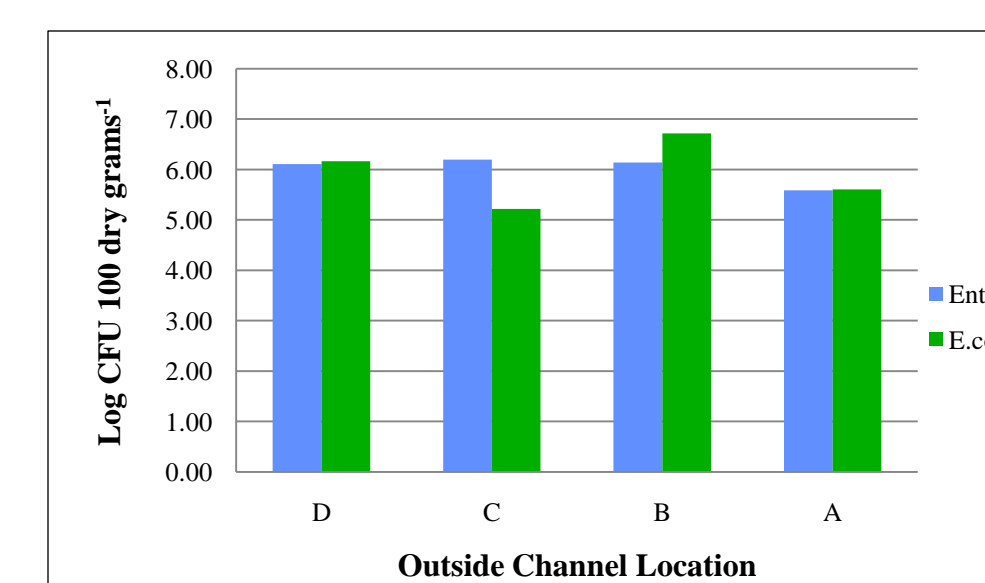


Figure 3. Graph of logged FIB concentration in sediment for locations A through D, outside the channel.

UV Microcosm

- Two days, three time points each day (8:00, 12:00, 16:00)
- Sediment samples taken in triplicate from each location
 - Pier sediment placed outside pier
 - Outside sediment placed under pier
 - Pier sediment control
 - Outside sediment control
- FIB concentrations and moisture content analyzed

- Results from the UV Microcosm yielded no definitive conclusions regardless of bacteria type or origin of sediment (see Figures 4 and 5), suggesting that other factors such as moisture content and temperature may more strongly affect FIB levels.
- FIB concentrations in the sediment taken from under the pier and placed outside were expected to decrease due to their UV exposure, but this trend was not observed.
- FIB concentrations in outside sediment that was placed under the pier remained the same as expected ($p > .4$ for all FIB).
- Further research and more data collection is needed in order to shed light on the relationship between bacterial growth and UV exposure.

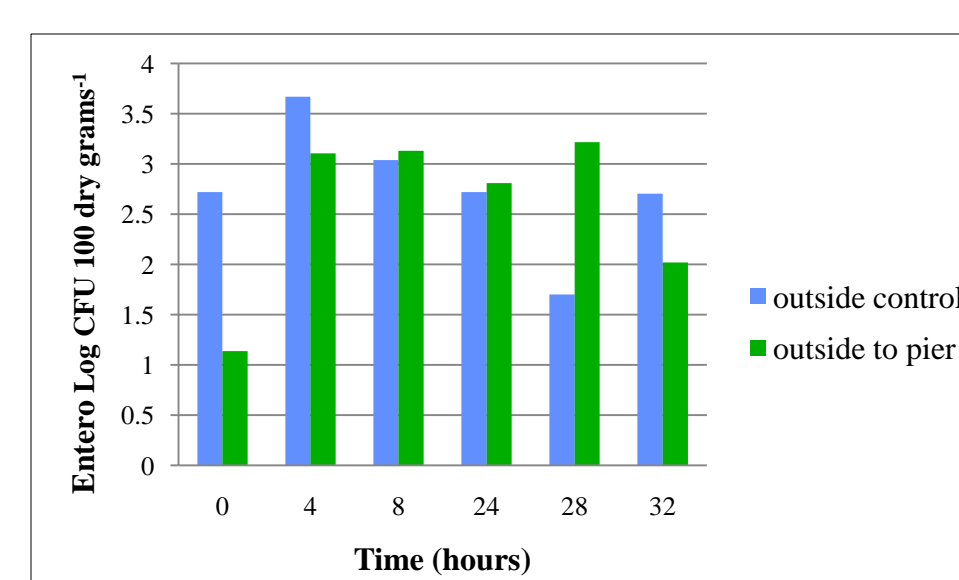


Figure 4. Graph of Enterococci concentrations over the two day sampling period in the outside sediment control and outside sediment placed under the pier.

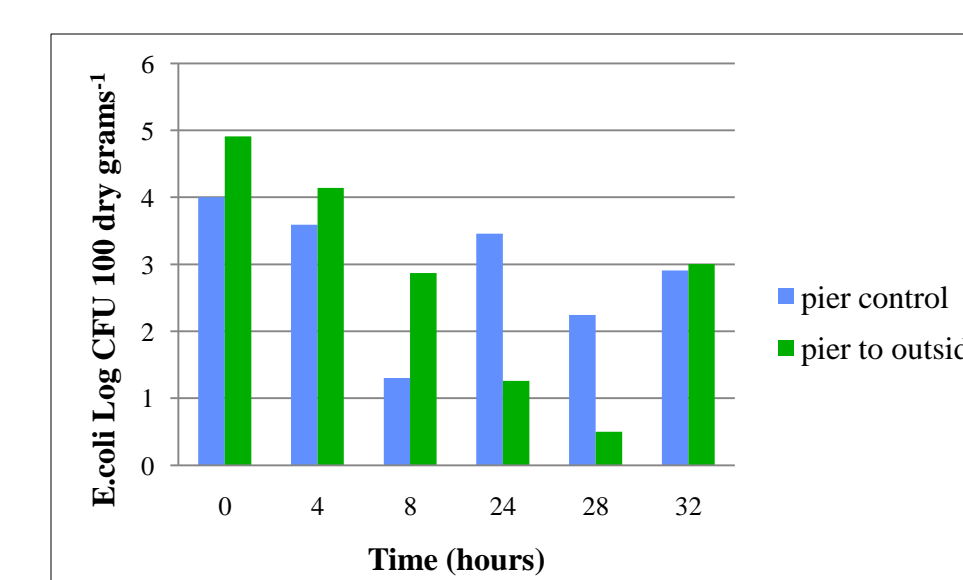


Figure 5. Graph of E.coli concentrations over the two day sampling period in the pier sediment control and pier sediment outside.