Title

Visualizing microbial pollution in Santa Monica Bay with Geographic Information Systems (GIS) and through field-testing a rapid, robust, field-portable water detection sensing system

Authors

Lee, Christine
Mika, Katie
Ginsburg, Dave
et al.

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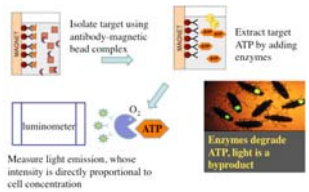
Visualizing Microbial Pollution in Santa Monica Bay with Geographic Information Systems (GIS) and Through Field-testing a Rapid, Robust, Field-portable Method for Quantifying Fecal Indicators

C.M. Lee, K. Mika, D. Ginsburg, V.Thulsiraj, V. Reyes, G. Imamura, W. Kaiser, J.A. Jay
Civil and Environmental Engineering, UCLA

Introduction: GIS and rapid detection: tools for understanding & characterizing water quality

GIS is a powerful mapping tool that is used by a plethora of public agencies, municipalities, consulting and engineering firms so results are translatable among different groups.

Cov-Immunomagnetic separation/ATP Quantification - rapid detection system for measuring bacterial concentrations in water.



• Process flow of method

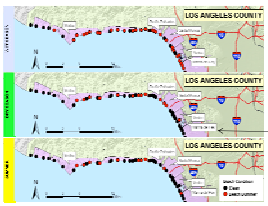
Abstract: Chronic water pollution plague southern California coasts.

Need a tiered, integrated strategy to address a complex, dynamic issue.

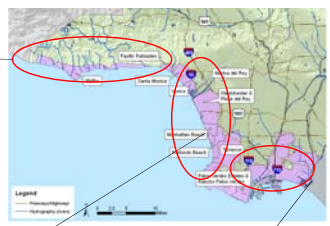
Geographic Information Systems (GIS) is a powerful mapping tool that can be used to reveal spatial and temporal relationships of a criteria of interest. We have used GIS to visualize the seasonal and spatial distribution of microbial pollution obtained from the Heal the Bay beach water quality report (2007). These maps can be used to inform sampling decisions; more specifically, we can use it to identify areas of chronic pollution and areas that can be used as a testbed for a rapid sensing system for bacteria. This rapid detection system can be used to provide higher resolution data and understanding of water pollution as well as assist in understanding/characterizing environmental water quality in specific areas. We propose the subsequent use of an covalently-linked immumomagnetic separation/ATP quantification (Cov-IMS/ATP) assay that is rapid, robust, and field-portable as an instrument to conduct monitoring of *E. coli* and *Enterococcus* in marine and freshwater systems.

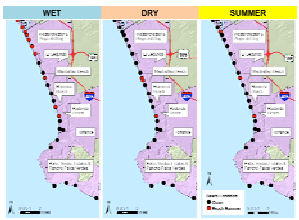
Proposed Solution: Used available tools to identify and characterize hotspots of pollution.

GIS maps reflecting extent of water pollution in Santa Monica Bay

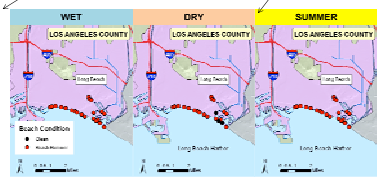


MALIBU





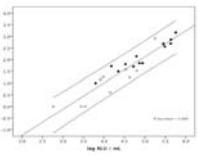
SOUTH BAY



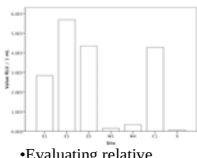
LONG BEACH

Cov-IMS/ATP

•Santa Monica Cyn sites

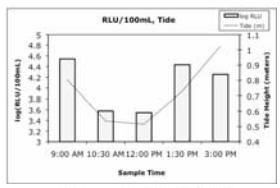


•Relating Cov-IMS/ATP with standard methods.



•Evaluating relative contribution of channels to confluence

We have used Cov-IMS/ATP for in-field adaptive sampling to determine (within one hour) which channel is contributing more fecal pollution (the *E. coli* concentration at Entrada-E6 was twenty-fold greater than that of West Channel-W4) at the confluence. When this model is applied retrospectively to the August 14, 2008 sample date, it is especially evident that there are more and significantly higher inputs of *E. coli* from Entrada than there are along West Channel. Furthermore, a spatial map of these values may help indicate where higher-priority inputs are occurring.



Time	Estimated Log MPN/100mL
9:00 AM	3.6
10:30 AM	2.2
12:00 PM	2.1
1:30 PM	3.4
3:00 PM	3.2

RLU variability mirrors tide height.

Improved packaging:
1. Equipment fits into a Pelican case on wheels;
2. table and stools fold into a suitcase; and
3. samples store in red cooler.

Summary.

- Poorest water quality occurred during wet seasons, near creeks/rivers/outlets, downstream from wastewater treatment plants and near septics.
- We focused our work on Santa Monica Canyon Channel, Will Rogers State Beach, and Marina del Rey, which have high frequency of visitors and are chronically polluted regardless of season.
- Long Beach requires some attention as well.

Summary. Cov-IMS/ATP presents several improvements and assets to water quality monitoring over previous works and approaches:
- the Cov-IMS/ATP antibody-bead complex is more robust than adsorption-based beads;
- the added robustness enables its use as a rapid, field-portable immunoassay for recreational water quality testing in both freshwater and marine systems; and
- Cov-IMS/ATP can significantly improve the efficacy of the tiered approach to source-tracking because it can be used to adaptively sample and identify hotspots of fecal contamination inputs.