

Microbial Source Tracking & Identification

A Fact Sheet from the Southern California Coastal Water Research Project



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Finding Sources of Contamination Helps Managers Protect Public Health

California's coastlines host millions of visitors each year. To protect public health, county health agencies and others regularly monitor water quality in streams, coastal discharges, and at beaches. If an area shows chronically high fecal bacteria levels, managers need a way to track the contamination source. Microbial source tracking and identification methods help characterize site-specific issues. With these tools, managers can better allocate resources to reduce public health risk and beach closures over the long run, improving beach access and the local economy.



Examples of Fecal Bacteria Sources & Pathways in Southern California

- Sewage leaks or spills
- Failing septic tanks
- Illegal dumping
- Homeless camps
- Pet waste
- Wildlife
- Livestock waste
- Growth on storm drain channels, sand, soil, decaying plant matter, and beach debris
- Transport in overland runoff/stormwater



Source Tracking

Following bacterial signal back to its source (e.g., a specific storm drain, campground, or leaking sewage pipe)

Source Identification

Characterizing the origin of the bacteria (e.g., human, bird, dog, or livestock fecal material)

Indicators vs. Pathogens

Fecal material often contains pathogens (bacteria, viruses, or other microorganisms that can cause disease). Rather than testing for each individual pathogen, scientists look for the presence of "fecal indicator bacteria" (FIB). These bacteria are often found when fecal contamination is present, but may be associated with non-fecal sources like decaying plant matter. To further enhance public health protection, extensive research to investigate new source-specific monitoring methods is ongoing.

How Does Source Tracking and Identification Work?

Source tracking and identification tests detect evidence of sewage or target specific microorganisms' molecular or genetic material (called "markers"). These tests typically aim to separate human from non-human sources; some are designed to differentiate among individual animal species. Routine source-specific identification and tracking standards do not yet exist, and many newer methods are still experimental.

SCCWRP research develops new source tracking and identification methods, evaluates comparative method performance, and provides scientific guidance for management applications.



Source Identification Protocol Project (SIPP)

The State Water Resources Control Board's Clean Beach Task Force commissioned the SIPP to develop protocols for tracking and identifying bacteria sources at beaches throughout California. SCCWRP is one of four core laboratories implementing the multi-year study, which will produce a standard guidance manual for beach managers.

Source Tracking and Identification Examples			
Method	Evidence Detected	Pros	Cons
Optical Brighteners	Laundry detergent additives found in household wastewater	Low-cost; fast results; linked to human sources	Dissipate in sunlight; low sensitivity
FIB Culture	Growth of fecal indicator bacteria	Method already used at many labs	Slow; not source-specific
Human Markers	A microbe (virus, bacteria, or protozoa) found primarily in humans	Relatively fast results; species-specific	Highly technical; higher cost
Animal Markers	A microbe found primarily in one animal species	Relatively fast results; species/source-specific	Highly technical; higher cost
Community Analysis	Many microbial markers detected simultaneously	May identify dominant source	Highly technical; higher cost

Method Comparison Study

Part of the SIPP calls for a large-scale method comparison study. Samples from multiple fecal sources were prepared at SCCWRP and shipped to researchers around the world for analysis. The results will clarify the performance, benefits, and drawbacks of each method; prioritize research; and set the stage for user-based testing.



Management Application: QMRA

One potential application of source tracking and identification methods is quantitative microbial risk assessment (QMRA). QMRA estimates the relative risk to human health based on information about differential microbial behavior among fecal sources. The US Environmental Protection Agency (EPA) is currently evaluating QMRA as a means for developing site-specific beach bacteria standards. SCCWRP will partner with the EPA to assess its applicability in a southern California pilot study.

For more information on SCCWRP research, visit: www.sccwrp.org