

Selecting Sewage Indicators for Nearshore Coastal Waters: Strategies and Perceptions

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How widespread is the problem?

About 26,000 closings in 2006, when high-risk beaches in the U.S. were contaminated 25% of the time.

What are the major causes?

Stormwater runoff events and sewer system leaks; however, synergistic effects of chemicals possible.

Is the water testing adequate?

Few pathogens/pollutants are analyzed and turnaround times are often too long to provide warnings.

[According to NRDC data]

How widespread is the problem?

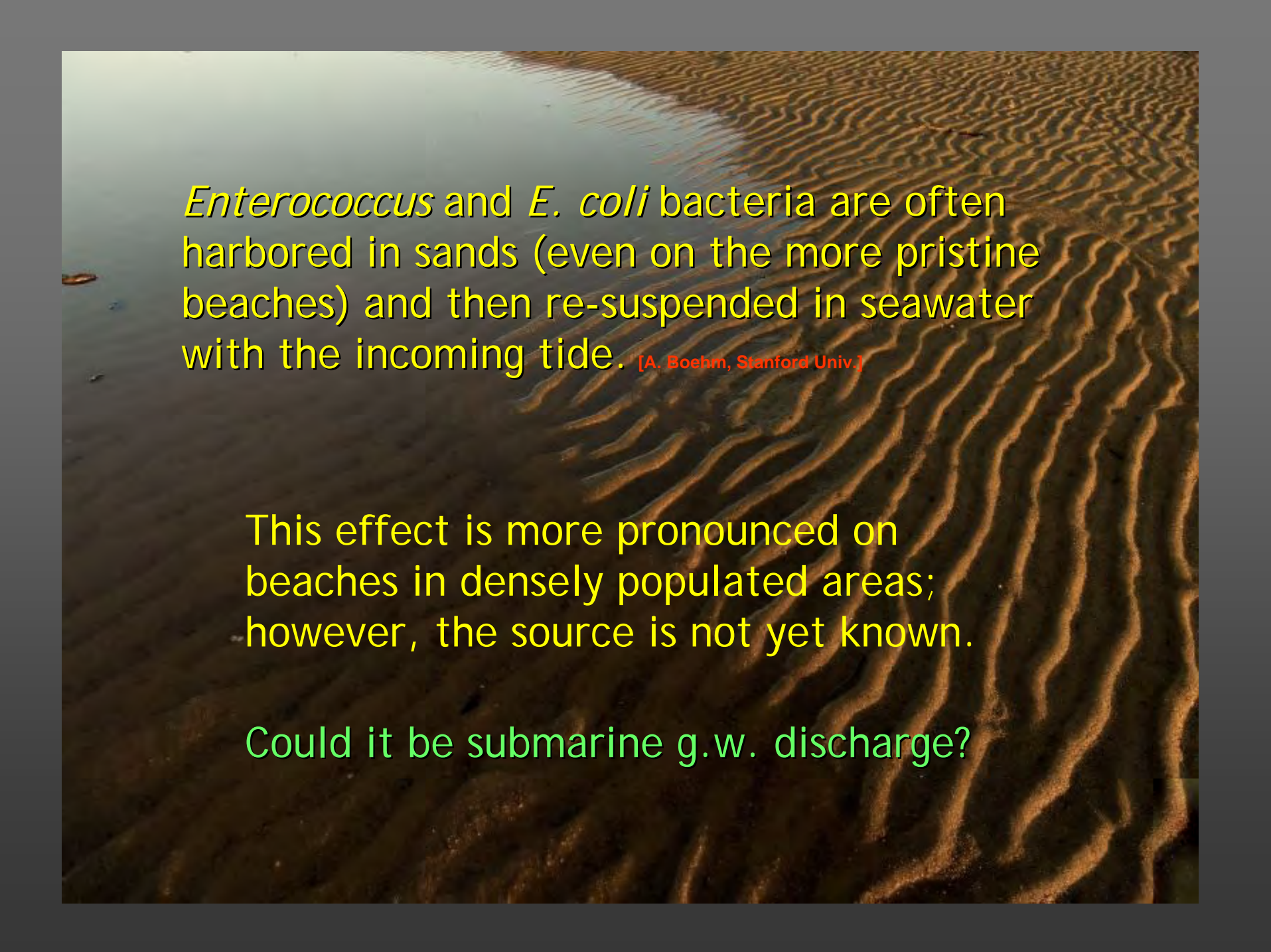
Ocean pollution in L.A. is bad and getting worse; 45% claim that pollution keeps them from swimming.

What are the major causes?

Trash and industrial wastes.

Is the water testing adequate?

Could not identify the County's most polluted beaches.



Enterococcus and *E. coli* bacteria are often harbored in sands (even on the more pristine beaches) and then re-suspended in seawater with the incoming tide. [A. Boehm, Stanford Univ.]

This effect is more pronounced on beaches in densely populated areas; however, the source is not yet known.

Could it be submarine g.w. discharge?



People recognize gross differences in the appearance of seawater; however, subtle differences usually go unnoticed.

Biological pathogens and toxic chemicals are transported primarily on particulates—not dissolved in seawater.



Is there relevant legislation?

Raw Sewage Overflow Community Right to Know Act (HR 2452)

Beaches Environmental Assessment and Coastal Health Act of 2000
(BEACH Act)

How do most people perceive the issue?

The appropriate governing agencies both protect water quality and advise people of health hazards.

Is this collective perception accurate?

Not really—the task of protecting water quality is shared, and people most often manage their own health risks.

Hanalei Bay, Kauai, Hawaii



Bay Water Quality Issues

- High *Enterococcus* and *Coliform* counts associated with wet weather and major runoff events
- Sewage-like or hydrogen sulfide odors occasionally detected near surf break
- Periodic, but persistent, algal blooms during dry weather conditions
- Reports of failing septic tanks and cesspools in Hanalei town (<200 m from shore)

An aerial photograph of a tropical bay with a sandy beach, numerous sailboats, and a pier. In the background, there are large, forested mountains under a cloudy sky. The image is overlaid with several text labels in pink and yellow.

Recharge

Wetland (shallow
water table)

Shallow Submarine
(g.w.) Discharge

Holding Tanks on Boats

Surface Water
Discharge

Potential Indicators

- Temperature and Salinity
- Fecal Sterols (coprostanol)
- Steroidal Estrogens (pharmaceuticals)
- Household Surfactants (LAS)
- Caffeine (natural vs. anthropogenic)
- Highly-Soluble Nutrients (N, P, F)
- Coliphages (bacteria-borne viruses)
- Chelating Agents (EDTA)
- Heavy Metals (Pb, Hg, Cd)

Sensory Indicators of Possible Polluted Coastal Waters

- Proximity to river or stream mouths and discharge pipes for stormwater or industrial facility
- Unusual odors or “feeling” of the seawater
- Clarity of water (both sediment and plankton)
- Interfaces between waters of different clarity, temperature, or floating debris (scum lines)
- Relative abundance of fish and marine mammals
- Dissipation of foam from breaking waves
- Appearance of sand just above tidal line
- Other stuff

Selection Criteria—G.W. Source

- Indicative of household waste streams
- Relatively high aqueous solubility
- Resistant to photo- and bio-degradation
- Resistant to filtration or sorption by sands
- Present at reasonable concentrations relative to seawater background
- Easily and/or economically detected

Challenges for Demonstrating Submarine Discharge of G.W.

- Magnitude and location are variable
- Modeling has not proven reliable
- Various tracers (Rn-222, exotics)
- Seepage flux meters, thermometers, and collector vessels on floor of Bay
- Well points installed on beach and on upgradient properties

The water crises cannot be solved via regulation, legislation, technological fixes, or other solutions oriented approaches.



Different actions and outcomes result from changed perceptions—most fundamental are water's myriad roles.

