Reducing Human Sources of Bacteria to Storm Drains, Creeks, and Beaches

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Measure B
Lodging tax rate from 10% to 12%, effective January 2001.

Mission
Improve creek and ocean water quality and restore natural creek systems

Creeks Advisory Committee
Representatives from the hotel/lodging industry, business community, and environmental field meet monthly to provide advisory role.
How can we reduce indicator bacteria at beaches, creeks, and storm drains?
Early Water Quality Improvement Projects

- Ultraviolet (UV) disinfection of storm drain discharge
  - Indicator bacteria at background levels 200 ft downstream
- Low-flow storm drain diversions to sanitary sewer
  - Conflict with restoration goals
- Bioswales
  - Insufficient contact time

Funding from Measure B and Clean Beaches Initiative (Props 40, 50, 84), managed by Clean Beaches Task Force
• Why are there so many fecal indicator bacteria at this beach, creek, or storm drain?
• Are the fecal indicator bacteria from human or animal waste?
• What is the risk?
Microbial **Source** Tracking

- Professor Patricia Holden, UCSB
- Molecular revolution
- Human waste *was not* detected at some project sites
- Human waste *was* detected in some storm drains
- Indicator bacteria did not correlate with human waste markers

Pause ….

- Proposed to Creeks Advisory Committee to focus on human waste due to risk
Microbial Source Tracking


Laguna Watershed Study and Microbial Source Tracking Protocol Development Project (Funded by Clean Beaches Initiative), collaboration with UCSB and Geosyntec

(Sercu et al. 2011, ES&T)

Geosyntec consultants

UC SANTA BARBARA
Video of Storm Drains

Wastewater Infiltration
GIS Tools

- Model for identifying at-risk locations where aging sewer lines cross above storm drains.
- Tested all high risk areas with dye and/or video.
Sewage Sniffing Dogs

Environmental Canine Svc., LLC

UCSB

Van De Werfhorst et al. 2014, Wat. Env. Res., Funded by WERF
Microbial Source Tracking
High Hanging Fruit

• UCSB & Geosyntec, funded by Clean Beaches Initiative
• Two additional SB beaches, extensive hypothesis testing
• Frequent, low-level detections of human waste marker (HF183)
• Infrequent, low-level pathogen detection
• Many hypotheses ruled out
• Two were not …
Swimmers and treated wastewater effluent

Highlights

• Dogs and seabirds were sources of fecal indicator bacteria in surf zone water.
• HF183 human markers were low but chronic in surf zone water over three study years.
• Watersheds did not supply HF183 to surf zone water.
• Higher levels of HF183 occurred in afternoons than in mornings.
• WWTPs possibly contributed, but swimmers correlated to HF183 markers directly.

Additional support:

• Li et al. 2021, Front. Micro. (Goleta Beach)
• Toubiana et al. 2021, Front. Micro. (France)
• Li et al 2022, Wat. Res. (Bacterial community sequencing)
• Li et al 2022, J. Appl. Micro. (HF183 in skin and urine microbiomes)
Microbial Source Tracking – Current Work

• Annual surveillance (“New Sources”)
  – Including wet weather, chemical markers
  – Community sequencing

• Quantitative Microbial Risk Assessment
  – Pilot project in response to Boehm and Soller, 2020
  – Co-occurring gull and human waste marker (HF183)
How to reduce human waste?

• Focus on human waste
• Well-funded, nimble water quality program
• Remove feces directly
  – $200,000 toward cleanup of creeks, beaches, and homeless encampments (5,544 piles of feces/yr)
  – $20,000 for trash cans and porta-potties
• Locate sources, fix immediately
  – Science-driven, adaptive program
  – Conduct research internally
  – Partner with top academics and consultants
• Community support, transparent communication
What does it mean to be safe to swim?

1,000 Surf Sessions

Healthy surfer

Illness, not from surfing

Excess illness from surfing

SCCWRP, 2014 Surfer Health Study
## Public Health vs. Individual Risk

<table>
<thead>
<tr>
<th>Exposure Scenario</th>
<th>Excess Annual Illnesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surfs twice per month, more often in wet weather</td>
<td>Nearly the same as background.</td>
</tr>
<tr>
<td>Surfs twice weekly</td>
<td>0.5 GI bug, 1 earache/ear pain, 1 sinus pain/infection.</td>
</tr>
</tbody>
</table>
What about other risks?

Odds Ratios (all published before Covid)

1.6 - 2.0 – Common for ocean swimming studies
1.5 – Influenza after attending child’s checkup
3.5 – *Campylobacter* for baby in shopping cart near raw meat
3.5 – GI illness in child attending preschool
10 – Virus when living with sick family member
20 – Cold due to air travel
What are we giving up while we continue weekly FIB indicator bacteria tests and postings?
Unbridled Joy

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Will Rogers State Beach
Rustic Canyon Creek Estuary
Will Rogers State Beach
Santa Monica Canyon low-flow diversion
Swimming banned
Environmental Justice: Creating Undue Fear of Free Recreation, Connection, Exercise

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