Strategies to identify sources of bacterial pollution impacting coastal beach water quality

US EPA Sanitary Survey Webinar

Keri Kaczor
UMaine Cooperative Extension

March 25, 2014

Funding provided by: US EPA/Maine DEP
Maine Healthy Beaches

- 60 beach management areas
- Diverse partners
- “Home Rule” state; voluntary program
Addressing Bacterial Contamination

Municipal Guide To Clean Water:
Conducting Sanitary Surveys to Improve Coastal Water Quality

- Identify
- Eliminate
- Prevent

Maine Healthy Beaches Program
March 2010
Sources of Bacterial Pollution

- Faulty infrastructure/cross connections
- Wildlife feces
- Livestock feces
- Runoff from impervious surfaces
- Combined sewer overflows
- Overboard discharges
- Pet feces
- Vessel sewage discharges
- Bird droppings
- Failing septic systems

Disease-causing pathogens can enter Casco Bay coastal waters from multiple sources, leading to potential public health risks.

Illustration by Waterview Consulting including symbols adapted from the Integration and Application Network, University of Maryland Center for Environmental Science.
Watershed Health = Beach Health
Addressing Bacterial Contamination

- Risk Assessment Matrix
- Circulation studies
- Pollutions source tracking toolbox
- GIS risk analysis
- Sanitary (wastewater) surveys
Risk Assessment Matrix

- Similar to US EPA Sanitary Survey
- Focus on shoreline
- 60 completed by local managers/MHB staff
- Informs tiered monitoring plan
- Identifies priority areas
Pollution Source Tracking Toolbox
## Pollution Source Tracking Toolbox

<table>
<thead>
<tr>
<th></th>
<th>High Bacteria</th>
<th>Low Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>**High Optical</td>
<td>Black water (e.g. human sources-malfunctioning septic system, sanitary sewer cross connection)</td>
<td>Grey or Gray water (e.g. laundry, wash water)</td>
</tr>
<tr>
<td>Brightener</td>
<td></td>
<td></td>
</tr>
<tr>
<td>**Low Optical</td>
<td>Human or non-human sources</td>
<td>Potentially low or no fecal contamination</td>
</tr>
<tr>
<td>Brightener</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pollution Source Tracking Toolbox
Pollution Source Tracking Toolbox

Pharmaceutical and personal care products

Figure adapted from A. Boxall, EMBO reports Vol. 5, No. 12, 2004
Pollution Source Tracking Toolbox

Microbial Source Tracking

500 mL water sample

Filter – discard water

DNA Isolation

- Detect human Polyomavirus DNA
- Detect human Bacteriodales bacterial DNA
- Detect ALL Bacteriodales bacterial DNA
Pollution Source Tracking Toolbox

Canine Detection Services

BACTERIA SOURCE TRACKING AND CANINE DETECTION

LONG SANDS BEACH, SHORT SANDS BEACH, AND THE CAPE NEDDICK RIVER

YORK, MAINE

JULY 30, 2013

Prepared for:
Town of York
186 York Street
York, ME 03909

Prepared by:
FB Environmental Associates
1950 Lafayette Road, Suite 102
Portsmouth, NH 03801

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1950 Lafayette Road, Suite 102
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# Pollution Source Tracking Toolbox

## Pharmaceutical & Personal Care Products

<table>
<thead>
<tr>
<th>PPCP</th>
<th>Description</th>
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<tbody>
<tr>
<td>Atenolol</td>
<td>Control high blood pressure</td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>Pain killer</td>
</tr>
<tr>
<td>Cotinine</td>
<td>Metabolite of nicotine</td>
</tr>
<tr>
<td>1,7-Dimethylxanthine</td>
<td>Caffeine breakdown (after goes through body)</td>
</tr>
<tr>
<td>Caffeine</td>
<td>Stimulant</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>Control seizures</td>
</tr>
<tr>
<td>Metoprolol</td>
<td>Control high blood pressure</td>
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</table>

<table>
<thead>
<tr>
<th>MONITORING STATION</th>
<th>ENT ≥ 33 MPN/100ml</th>
<th>OB ≥100 µg/l</th>
<th>+ Dev. from ENT Mean</th>
<th>+ Dev. from OB Mean</th>
<th>≥4 PPCPs ng/l</th>
<th>+ Canine Det.</th>
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<tbody>
<tr>
<td>GFB-01</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
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<td>GFB-01-0</td>
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<td>N</td>
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<tr>
<td>Saco-00</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>-</td>
<td>N</td>
</tr>
</tbody>
</table>
GIS: Risk Analysis

Enterococci + Optical Brightener Risk Ranking
- Green: Low
- Yellow: Medium
- Red: High
GIS: Risk Analysis

- Transforms data to usable information
- Priority survey areas

- Within 250’ of coast/river/tidal zone
- Slope > 20%
- Within 250’ of Waterbody/wetland
- Within 250’ of an Impervious Surface
- Within 75’ of a Stream
Sanitary Survey

- **Explore ALL bacterial pathways**
- **Target humans sources first!**
- **Tiered approach**
- **Malfunctioning septic systems**
- **Leaky sewers/cross connection**

Gary Curtis
Subsurface Wastewater Disposal

- Property surveys
- Role of trained professionals
- Best tools = eyes and nose!
Subsurface Wastewater Disposal

No Two Malfunctions Are Exactly Alike!
Illicit Discharge Detection and Elimination

New Salt Rd Tributary
(Goosefare Brook)
The Path to Clean Water is Turbulent

- Sources are difficult to find
- Requires collaboration
- Wastewater disposal is costly & options are limited
- Need for monitoring, maintenance, & expansion of wastewater infrastructure

ME DEP (J. Glowa)
The Path to Clean Water is Turbulent

- Sources are removed, new ones emerge
- Over-development & impervious surfaces
- Warmer, wetter climate

M. Warneke
Now What?

- Intensified rainfall and source tracking studies
- Precautionary rainfall advisories
- Develop beach specific management plans
- End of pipe treatment?
- Prevention

<table>
<thead>
<tr>
<th>48 hr at .25 inch threshold</th>
<th>48 hr at .5 inch threshold</th>
<th>48 hr at 1 inch threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>1= High Bac, Low Rain: 12%</td>
<td>1= High Bac, Low Rain: 12%</td>
<td>1= High Bac, Low Rain: 21%</td>
</tr>
<tr>
<td>2= High Bac, High Rain: 19%</td>
<td>2= High Bac, High Rain: 19%</td>
<td>2= High Bac, High Rain: 10%</td>
</tr>
<tr>
<td>3= Low Bac, High Rain: 18%</td>
<td>3= Low Bac, High Rain: 13%</td>
<td>3= Low Bac, High Rain: 11%</td>
</tr>
<tr>
<td>4= Low Bac, Low Rain: 51%</td>
<td>4= Low Bac, Low Rain: 56%</td>
<td>4= Low Bac, Low Rain: 58%</td>
</tr>
</tbody>
</table>
Sanitary (Shoreline) Surveys

- Useful assessment tool
- Important first step!
- Informs priorities and next steps
- Standardized format = transferrable data

E. Stancioff, 2003
Questions?