Session 7: Tracking Bacterial Water Pollution to Its Source: New Tools and Applications

Integrating Microbial Source Tracking Tools Into Local Remediation Strategies in the Goosefare Brook Watershed

Meagan Sims
UMaine Cooperative Extension-Maine Healthy Beaches

Maine Beaches Conference
July 14, 2017
Maine Beaches: Important Economic Asset

Visitors spent $6B (2016)
• 6% increase over 2015

Coastal tourism/recreation
• $2.5B to Maine’s gross domestic product (2014)

York County
• 11.5 million+ visitors, contributing >$1.6B to local economies (2014)
Maine Beaches: Important Economic Asset

Ogunquit Beach  
Old Orchard Beach

John Patriquin-Portland Press Herald  
Gary Curtis
Welcome! This beach is part of the Maine Healthy Beaches Program.

Bacteria levels are routinely monitored for your safety and health

Think Healthy. Act Healthy. Swim Healthy.

Symptoms of water-related illnesses can include stomachache, vomiting, diarrhea, and infections of ear, eye, and skin. If you have any of these symptoms within seven days of swimming and suspect they were due to water contact at a Maine Beach, notify your physician and contact the Maine Department of Health & Human Services (800) 821-5821. Risk of illness may be greater for people with compromised immune systems. Water quality can change unexpectedly. Swim at your own risk.

MaineHealthyBeaches.org

MAINE Beach Status and Data

Today's Beach Status

CONTAMINATION ADVISORY
Bacteria levels may be unsafe. Water contact is not advised.

RAINFALL ADVISORY
Rainfall can increase bacteria levels. Water contact is not advised.
Build local capacity to identify & address pollution sources

Faulty infrastructure/cross connections
80.6% do not seek WQ information (ME)

Those that do…. news media - over 60% for ME/NH

2/3 respondents highly rate water quality on beaches

Advisory response: 38% of respondents 0-49% illness risk
Goosefare Brook Watershed Partners & Scope

DEP
EPA
MHB
Ocean Park CS
OOB CC
Saco CC
FBE
YCSWCD
Thorton Academy
Goosefare Brook Watershed
Old Orchard Beach

Popular (residents and visitors)
Seasonal population increase

Beach exceedances

2009 (Mouth of Brook)
2010-2011 (Watershed wide)
2012-2016 (NSRT)
Goosefare Brook
Saco/OOB

Toolbox Approach (2010-17)
- Enterococci
- Optical brighteners
- Pharmaceutical & personal care products
- Canine detection

Priority hot spots

Source identification

Prioritize resources
Goosefare Brook
Saco/OOB

Potential Bacteria Sources

- Goosefare Brook Outlet
- Malfunctioning Septic Systems
- Stormwater Runoff
- Residential/Commercial Development
- Sanitary Sewer Outfall
- Boats
- Bathers
- Wildlife
- Pet Waste
Limitations of Fecal Indicator Bacteria

Inconsistent correlation with pathogens/human health risk

Extreme variability

Next day results

Can persist and regrow

Doesn’t differentiate source(s)
Sources Matter
Sources Matter

Seepage to Surface

Lush Grass Growth

Seepage to Surface

Saturated soils

Trench Flooding

Sludging of Drainlines

Sealing of Drain Trench

Reduced flows through Biomat

Thickening of Bio-mat

kingcounty.gov

clermonthealthdistrict.org
Sources Matter

Fred Dillon

http://lowerraritanwatershed.org

thenewmainetimes.org

Maine.gov
Sources Matter

Chesapeakebay.net

Fred Dillon
Goosefare Brook
Saco/OOB

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Priority hot spots

Source identification?

Microbial Source Tracking (2016/17)
Microbial Source Tracking (MST)

Goal: Identify specific fecal sources present

Targets alternative organism (Bacteroides sp.)
Anaerobic environment required
Wide range of source targets
Well developed and field tested
Complements FIB methods
MST in GFB

Source(s)
Persistence
Seasonal trends
Strength of source
Human health risk
Prioritize efforts
Confirming “hot-spots”

New Salt Rd Tributary
(2012-2015 Priority Sites)

Fecal Indicators
- Mammal
- Human
- Bird

Log MPN or Copy Number/100mL

OOB Marshes
GFB-01

Monitoring Sites
- Priority Sites
- New Salt Rd. Tributary
- Head of Tide

Data Source: ME Healthy Beaches, MEDEP
Created By: Maegan Sumer, July 2016
Confirming “hot-spots”

Sources

- Mammal
- Human
- Bird
- Dog
- Ruminant
Seasonal Trend at Brook Outlet

The graph shows the seasonal trend of fecal indicators (ENT, Mammal, Human, and Bird) at Brook Outlet. The data is represented by a log MPN or copy number per 100 mL and is plotted against the dates from May 25 to October 5. The trend for Mammal fecal indicators is highlighted with an arrow, indicating a notable increase during the summer months.
Refining “hot-spot” Location

Strength of source (qPCR)

Human health risk

Prioritize efforts
Using Data to Inform Management Efforts

Municipalities  Beach Managers  Education/Outreach

Meagan Sims  Gary Curtis
Transforming Data Into Action

Supporting evidence = increase stakeholder buy-in

Target human sources
Cross connections, cracks, Intrusions
IDDE and I&I studies
  - Dye
  - CCTV
  - Smoke

Property surveys/septic inventory

Prioritize infrastructure upgrades/expansions

kingcounty.gov
Target human sources

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IDDE and I&I
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Transforming Data Into Action
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Transforming Data Into Action

Items to consider…

Potential sources & watershed characteristics

Method
- Cost
- Specificity
- Technical expertise

Priority sites

Target audience(s) & transforming data $\rightarrow$ information $\rightarrow$ solutions
Recommendations

Delineate sub-watershed areas; sewer/stormwater infrastructure

Maintain septic inventory/assess pump out records if possible

MS4 plans/permit-build water quality investigations into this

Permanent signage & PRAs

Use priority sites to inform investigations

Follow up on smoke test issues
2017 Plans

Continue source tracking to track & verify source removal

Assist prioritizing ongoing efforts (focus on human)

Refine hot spots.

Explore regrowth/persistence in sediments

Education/outreach

Taylor Mason
Beaches & Maine Coastal Residents

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Using Data to Inform Management Efforts

Municipalities       Beach Managers       Education/Outreach

Meagan Sims       Gary Curtis
Education & Outreach

**Healthy Boating Equals Healthy Beaches**

Clean up after your pets and do your part to keep our water resources healthy!

**A Guide to Safer Swimming in Maine**

Think Healthy. Act Healthy.

**Septic System Inspection**

Please...don’t feed waterfowl.

Regular feeding can be harmful to waterfowl.

**Use your HEAD**

PUMP IT, DON’T DUMP IT!

Help us eliminate boat sewage as a pollution source.

**The beach is not your bathroom.**

Please keep our beaches healthy.

**Swim Healthy.**

Practice Healthy Beach Habits!
APRIL STOOLS DAY & COMMUNITY CLEANUP

SABBATURDAY, APRIL 23 • 9:00 AM TO NOON
KIDS AND PETS WELCOME!

Along with spring's arrival comes our 24th annual April Stools Day. As a community effort, please join in helping clean up the park and neighborhood of rubbish, refuse and dog waste.
Questions

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(Maine Healthy Beaches)
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Providing Context to Copy Numbers

Add copy number for human feces & mammal (human sample)
Add bird feces as well