Analyzing Watersheds to Determine Sources of Bacteria at Two of Iowa’s Beaches

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Photo by Ray Anderson
Indicator Bacteria

• Indicator bacteria are used to suggest the presence of pathogens (disease-causing organisms) in water

• Pathogens can come from the feces of any warm blooded animal

• Indicator bacteria are easy to collect and analyze, relatively safe to handle and usually present when pathogens are present

• These indicator bacteria are harmless
  – Fecal coliform, *E. coli*, enterococci

• Intensive watershed investigations help to identify the sources of indicator bacteria
Intensive Watershed Analysis

- Watershed:lake ratio
- Land use
- Type of water body
- Possible sources
- Response to rainfall
- Pattern of high bacteria levels
Watershed: Lake
89:1
Watershed: Lake 919:1

Photo by Ray Anderson
Intensive Watershed Analysis

- Watershed:lake ratio
- Land use
- Type of water body
- Possible sources
- Response to rainfall
- Pattern of high bacteria levels
Intensive Watershed Analysis

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- Land use
- Type of water body
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Type of Water Body

**George Wyth**
Borrow Pit for Highway 380
- Little flow
- Little dilution
- Fewer sources

**Backbone**
Lake Created by Damming River
- All water flows past beach towards dam
- Dilution of sources
- More sources
Intensive Watershed Analysis

- Watershed:lake ratio
- Land use
- Type of water body
- Possible sources
- Response to rainfall
- Pattern of high bacteria levels
Possible Sources

George Wyth
• Geese
• Human (sewage pipes ruled out, but not effects from bather density)

Backbone
• Geese
• Domestic animals
• Wild animals
• Manure spread on farm fields
• Septic systems
• Sewage lagoons
• Human (bather density)
Intensive Watershed Analysis

- Watershed:lake ratio
- Land use
- Type of water body
- Possible sources
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George Wyth 2003 Beach Monitoring

Colony Forming Units/100mL

Rainfall (inches)

E.coli
One-Time Maximum
Rainfall
Intensive Watershed Analysis

- Watershed:lake ratio
- Land use
- Type of water body
- Possible sources
- Response to rainfall
- Pattern of high bacteria levels
Pattern of High Bacteria Levels

George Wyth
- High Ankle Zone
- Decreased levels in knee and chest zone

Backbone
- High everywhere at beach, especially in chest zone
Summary

• Analyzing many characteristics of a watershed help to determine the sources of bacteria
• Intensive watershed investigation is one tool used to identify the source of bacteria
• Other experimental source tracking tools are being used at Iowa’s beaches (DNA ribotyping, Antibiotic resistance analysis)
Acknowledgements

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Extra Slides
How to prevent pathogens from entering water

- Use toilet facilities whenever possible
- Keep clean diapers on children
- Do not swim if you have diarrhea
- If you have a septic system, make sure it is working properly
- Install buffers and fences to keep livestock out of creeks
To minimize your risk of becoming ill while swimming

- Avoid swimming after heavy rainfalls
- Avoid swallowing the water
- Shower/wash hands after swimming
Status of State-Owned Beaches

Beach Status (days)

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<th>Year</th>
<th>Below EPA Geometric Mean Guideline for E. coli</th>
<th>Exceeded EPA Geometric Mean Guideline for E. coli</th>
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<tr>
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<td>0%</td>
</tr>
<tr>
<td>2003</td>
<td>96.7%</td>
<td>0%</td>
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</tbody>
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Swimming Season

2000 2001 2002 2003