

Water Quality & Statistics-Based Precautionary Advisory Tool for York, Maine Beaches

Dr. Stephen H. Jones, Dr. Erin Urquhart, Ms. Julia Guimond
University of New Hampshire, Jackson Estuarine Laboratory

BACKGROUND

The Town of York relies on the weekly monitoring of beach water as part of the Maine Healthy Beaches (MHB) Program. Results of sample analyses for enterococci are compared to the State of Maine's standard level of 104 enterococci/100 ml for marine recreational waters. Next day precautionary advisories are issued if levels exceed the standard level, followed by collection of another sample for lab analysis. Beach advisories are lifted the following day if second day sampling results show enterococci levels below standard levels. Currently, the issue with this approach is that advisories do not reflect real-time beach water quality, which may be of public health concern.



Figure 1: Beach monitoring sites at the four beaches in York, Maine



Figure 2: Drain, catch basin and beach sample sites at Long Sands Beach.

PURPOSE

The goal of the current report is to provide a beach management tool for the Town of York, which would allow for posting precautionary advisories to warn beach goers about elevated public health risks for swimming at York beaches.

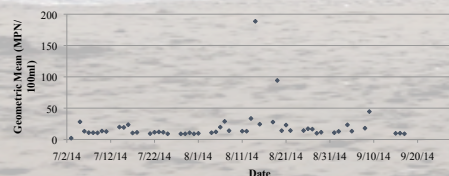


Figure 3: Daily geometric mean of all beach stations.

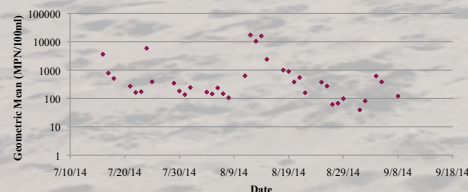


Figure 4: Daily geometric mean of beach drain stations.

RESULTS

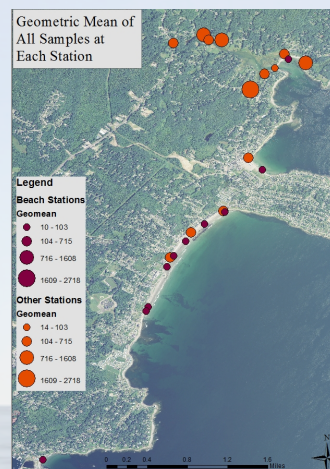


Figure 5: Geometric mean of all stations.

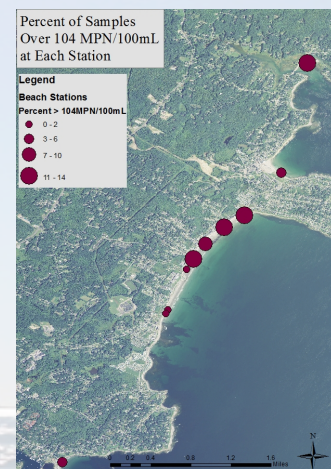


Figure 6: Percent of samples exceeding 104 MPN/100mL.

Table 1: Relationship between management areas and environmental and climatic factors. Numbers in bold are statistically significant.

	Rain 24hrs	Rain 48hrs	Low Tide Height	High Tide Height	Air Temp	Water Temp	Salinity	DO	Gulls
All Sites	0.09	0.14	-0.19	0.14	-0.11	0.16	-0.28	-0.14	0.34
CNR (Site 2)	0.41	0.47	-0.36	0.33	0.07	-0.08	-0.43	-0.16	0.15
SSB (Site 4)	0.2	0.33	-0.3	0.39	-0.3	0.12	-0.51	-0.19	0.09
LSN (Site 6, 8, 10, 11)	0	0	-0.14	0.24	-0.21	0.14	-0.25	-0.07	0.53
LSS (Site 13, 16, 18)	0.08	0.02	-0.34	0.45	-0.33	0.24	-0.05	-0.22	-0.14
YHB (Site 20)	-0.03	0.1	-0.33	0.32	-0.09	0.3	-0.01	-0.15	0.29

Model Results

A Generalized Linear Model (GLM) was used to estimate the probability of enterococci concentrations above the single sample safety threshold (104 enterococci/100 ml). The best developed model included: a.) rainfall amount in prior 48h, b.) salinity, and c.) low tide height. The model suggests that precautionary advisories should be posted at York Beach if $\geq 1.5''$ of rain falls within 24 or 48 hours and shall remain in effect for at least 24 hours, or for two tidal cycles.

Site Specific Summary

Cape Neddick Beach

- Rainfall events may cause increased enterococci concentrations at the beach and simultaneously at some sites in the watershed.
- The 1.5 in/24-48h precautionary advisory is well suited for this site.

Short Sands Beach

- Water quality at Short Sands Beach is, in general, acceptable and better than expected based on previous bacterial levels in previous years.
- The consistent and significant amount of flow from the storm drain at the north end of the beach remains a concern.
- The 1.5 in/24-48h precautionary advisory is well suited for this site.

Long Sands Beach-North

- Three of the sites (6, 8, 10, 11) had relatively high rates of unacceptable water quality.
- At the northern end of this area (site 6), beach water quality was related to storm drain (LS03) water quality ($p < 0.05$).
- The 1.5 in/24-48h precautionary advisory should be used for this area.

Long Sands Beach-South

- This beach management area, including Site 13, show to be the least problematic.
- The 1.5 in/24-48h precautionary advisory would be a protective step for this area.

York Harbor Beach

- No obvious sources of bacterial pollution other than bathers, sea birds, and seaweeds.
- This site fell between the cleanest sites (LSS area) and the more contaminated sites.
- The 1.5 in/24-48h precautionary advisory would be a protective step for this area.

Seaweed

Drift seaweed on Long Sands Beach was a significant cause of elevated enterococci levels during mid-late August, when seaweed presence was at its highest.



"Seaweed Island" off of Long Sands Beach

REFERENCES

1. ASTM D6503-14. Standard Test Method for Enterococci in Water Using Enterolert, ASTM International, West Conshohocken, PA, 2014, www.astm.org.
2. Frick et al. 2013. Cape Neddick River Watershed-Based Management Plan: Town of York, Maine. Albert Frick Associates, Drunlin Environmental LLC, Watershed Solutions Inc.

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