Bacteria Trends at Marine Beaches in Washington State 2003-2014

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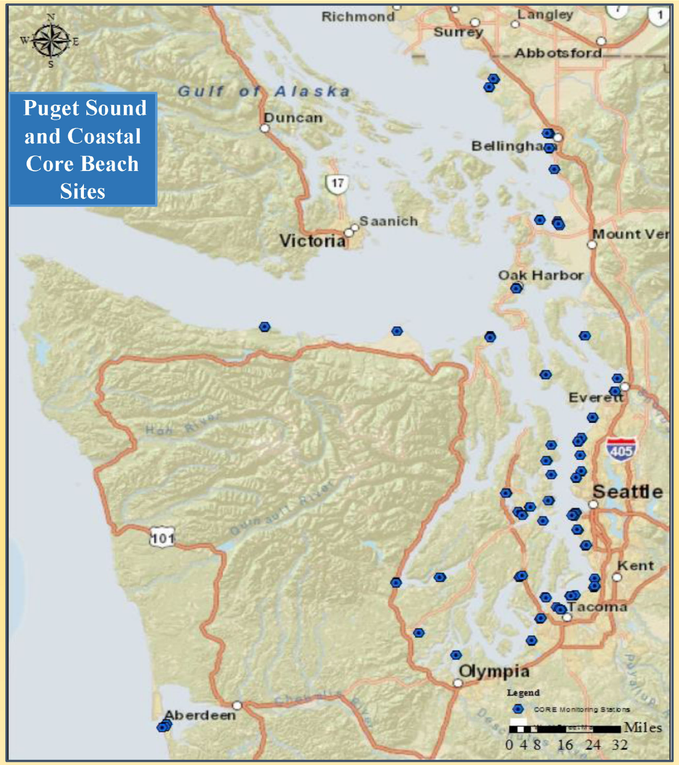
Background

The Washington State Beach Environment, Assessment, Communication, and Health (BEACH) Program is an ongoing monitoring and notification program that ensures saltwater beaches are healthy to swim and play in. From Memorial Day through Labor Day, popular saltwater beaches are tested for Enterococci bacteria. When bacteria levels are high, the public is notified through signage and social media.

The BEACH Program began as a pilot project in 2003. Since then, from 46 to 78 saltwater beaches have been sampled every year by local health departments, tribes, and volunteers. This includes 50 core beaches that are the highest-use and highest-risk beaches. Data from these core beaches were analyzed for trends to determine if bacterial water quality has significantly changed since the start of the BEACH Program.



Data Analysis

The goal of this work was to investigate approaches for determining bacteria trends at core beaches.

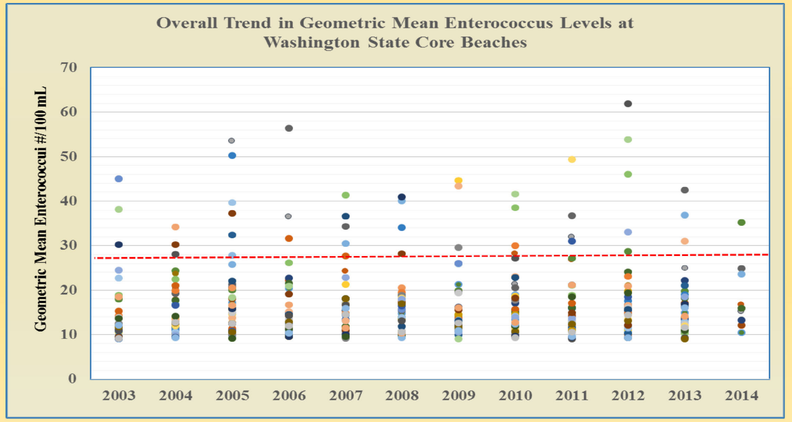
There were two goals for data analysis:

- Determine if there was any change in bacterial water quality at Washington saltwater beaches as a group.
- Determine if there were any changes in bacterial water quality at individual core beaches.

Trend analysis was conducted using the geometric mean (GM) and estimated 90th percentile Enterococci values for the beach season (Memorial through Labor Day sampling). A Regional Kendall test for trend was used to determine if bacterial water quality at core beaches as a group has changed from 2003–2014. This test looks at trends across a region (Puget Sound and coastal core beaches) that are composed of multiple sample sites. To determine changes over time at individual core beaches, correlation analysis (Spearman's rho) was conducted using the seasonal GM and 90th percentile Enterococci data. The statistical package R was used to compute both statistics (R Development Core Team, 2008).

Overall Results

Results of the Regional Kendall test for trend showed no trend, either increasing or decreasing in bacteria levels at Washington core beaches.

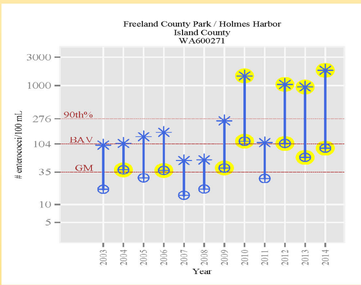


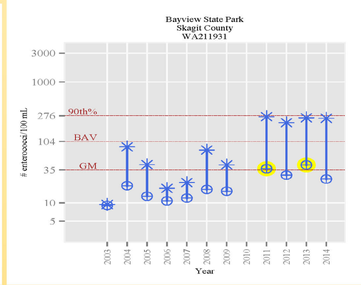
2003-2014 Regional Kendall Trend Results for Seasonal Geometric Mean Bacteria Levels at Core Beaches.

Individual Beach Results

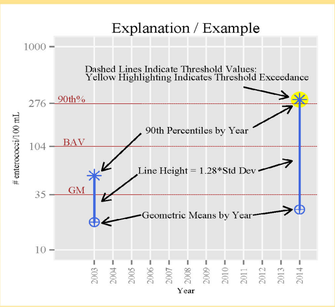
Several core beaches did show increasing or decreasing changes in the geometric mean and/or 90th percentile bacteria levels over time. The results of the correlation analysis, beaches with increasing and decreasing bacteria trends are presented below.

Beach	Years Sampled	Statistic	Trend	Correlation Coefficient
Bayview State Park (Skagit County)	11	Geo Mean	↑	0.76 p<0.01
		90th %tile	↑	0.73 p=0.02
Dash Point Metro Park (Pierce County)	8	Geo Mean	↔	0.71 p=0.06
		90th %tile	↑	0.76 p=0.04
Freeland County Park (Island County)	12	Geo Mean	↑	0.62 p=0.04
		90th %tile	↑	0.69 p=0.02
Richey Viewpoint (King County)	7	Geo Mean	↓	-0.86 p=0.02
		90th %tile	↓	-0.86 p=0.02
Howarth Park Beach (Snohomish County)	11	Geo Mean	↓	-0.74 p=0.01
		90th %tile	↔	-0.43 p=0.19





Increasing bacteria levels over time were seen at Bayview State Park beach, Freeland County Park beach, and Dash Point Metro Park beach (see figures above). During the swim season (Memorial Day through Labor Day) Bayview State Park beach and Freeland County Park beach have numerous swimming closures and advisories, due to high bacteria levels. While there is a trend toward increasing bacteria levels at Dash Point Metro Park, this beach generally meets swim criteria.



This poster was presented at the "2016 Recreational Waters Conference," April 12-15, New Orleans, LA.