USGS Great Lakes Coastal Beach Health Science

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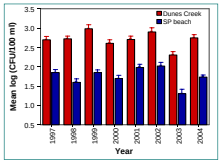
For over 2 decades the U.S. Geological Survey's Great Lakes Science Center has conducted beach health research in the Great Lakes.

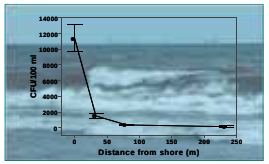
Primary Goal: **Provide beach managers, public health officials, and other stakeholders with the science-based information needed to improve beach monitoring, make accurate beach closure decisions, and better protect public health.**

Key USGS Beach Science Issues: Methods for Improved Beach Monitoring, Predictive Models, Bacterial Source Tracking, Pathogens and Indicators

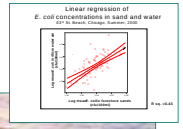
Bacterial Source Tracking

USGS scientists have the tools and capabilities to identify sources of contamination of recreational waters and help beach managers better understand complex environmental processes that affect beach health.

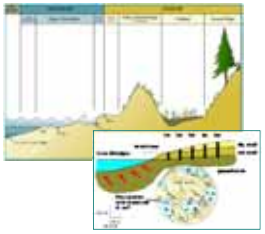


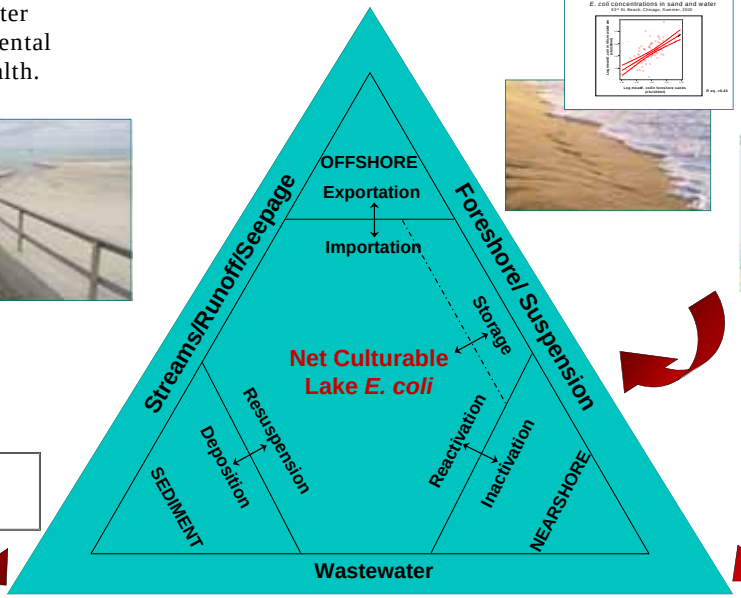


Nearshore energy (waves and currents) defines importation and exportation.

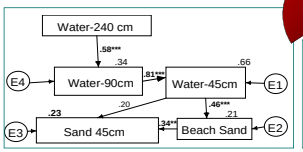


Sand harbors *E. coli* where it may persist and grow, making foreshore sand a potential sink or source to beach water.



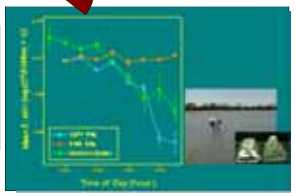


Conceptual diagram of E. coli* on the beach



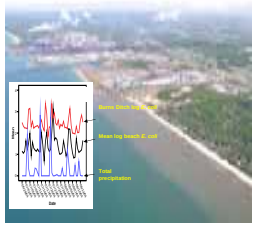
Animal and human waste and bacteria-laden plants can be integrated into foreshore sand. Resuspension can occur through wave action and runoff.

Sunlight inactivates *E. coli*; recovery and net increase from importation may cause diurnal, seasonal, daily and even hourly variation.



Predictive Modeling

Forecasting *E. coli* on a local scale: Impact of Burns Ditch on five beaches



- Model incorporates
  - wave height
  - Burns Ditch turbidity
  - lake chlorophyll
  - lake turbidity
  - precipitation

North winds R^2= 0.635
South winds R^2= 0.320
Combined winds R^2= 0.465

Model incorporated into local management programs

Pathogens and Indicators

USGS scientists have used and tested state-of-the-art lab methods to provide information on the relation between fecal indicator bacteria and specific pathogens at several beach sites.

These methods can be used to detect specific pathogens in water and to determine the DNA fingerprints of *E. coli* from various source materials.

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*Adapted from: Whitman, R. L., M. B. Nevers, and M. N. Byappanahalli. 2006. Watershed-wide distribution of *Escherichia coli* along southern Lake Michigan: An integrated approach. Applied and Environmental Microbiology. 72(11): 7301-7310.