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Understanding Beach Health Throughout the Great Lakes

Overview of the USGS Beach Health Initiative

Great Lakes Beach Health Association October 2010

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U.S. Department of the Interior
U.S. Geological Survey

Some Key Questions

- Are there better ways to inform the public of the health risk of swimming at a beach?
- How do new rapid analytical methods compare to traditional methods for determining concentrations of fecal-indicator bacteria at beaches?
- Are pathogens present at beaches? If so, how do they get to the beach, and what is their source?

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Key Questions - continued

- What are the best indicators of pathogenic microorganisms?
- With so many potential sources of fecal contamination at a beach, what methods can be used to distinguish the contributions from humans?
- How do sand movement and wave action on the beach affect fecal-indicator-bacteria and pathogen concentrations in the lake water?

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Mission of USGS Beach Health Initiative

- Provide science-based information and methods that will allow beach managers to more accurately make beach closure and advisory decisions
- Understand the sources and physical processes affecting beach contaminants
- Understand how science-based information can be used to mitigate and restore beaches and protect the public

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Four Science Elements

- Real-time assessments
- Pathogens and microbial source tracking
- Coastal processes
- Data analysis, interpretation, and communication

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Real-time Assessments

Predictive models and rapid analytical methods

- Predictive models use easily measured variables, such as rainfall and turbidity, to estimate current water-quality conditions, allowing the beach manager to better evaluate the need for an advisory or closing
- Rapid analytical methods such as quantitative polymerase chain reaction (qPCR) and immunomagnetic separation/adenosine triphosphate (IMS/ATP) can provide analytical results within 2–3 hours.

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Real-time Assessments

Activities:

- **Exploring the use of new variables that explain physical and biological processes affecting fecal-indicator bacteria concentrations.**
- **Testing alternative statistical techniques to improve the accuracy of model predictions.**
- **Providing an automated modeling system to better enable technology transfer to beach managers.**
- **Providing training and technology transfer to beach managers to apply and evaluate rapid analytical methods.**

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Pathogens and microbial source tracking

Determine the occurrence of microbial source tracking (MST) markers and pathogens of concern for human health at beaches susceptible to various sources of fecal pollution

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Pathogens and microbial source tracking

Activities:

- Developing and applying sampling strategies and analytical methods for MST markers and bacterial, protozoan, and viral pathogens.
- Identifying the relationship between fecal-indicator bacteria concentrations and pathogen or MST marker detections or concentrations.
- Identifying environmental conditions that are associated with pathogen occurrence, such as rainfall, wave frequency and magnitude, and contributions from streams that empty into coastal waters.

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Coastal Processes

Characterize the transfer of bacterial indicators, pathogens, and MST markers to the nearshore waters, sediments, groundwater, and lake water

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Coastal Processes

Activities:

- Determining the role of groundwater as a source of bacterial indicators and pathogens to lake water.
- Evaluating the role of surface and buried beach debris and algae on concentrations of bacterial indicators in foreshore beach sands and submerged sediments.
- Determining the relations between various environmental conditions and sediment dynamics.
- Expanding the geographic extent of studies of coastal processes over a range of beach types

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Beach-data analysis, interpretation, and communication

Compile recreational-water-quality data on Great Lakes beaches into comprehensive databases and a Geographic Information System (GIS) that will facilitate the assembly of USGS data and enhance the communication of this information to beach managers and the public.

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Beach-data analysis, interpretation, and communication

Activities:

- Developing a publicly accessible, Web-based, interactive GIS that allows visualization of Great Lakes-wide water-quality and environmental data associated with beaches.
- Developing a comprehensive database to assemble environmental data collected at Great Lakes beaches.
- Developing a comprehensive database that integrates real-time data (such as rainfall) from additional sources.
- Exploring ways to use an integrated, central database in development of predictive models.

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Examples

- **Real-time assessments**
  - **Does modeling improve protection and access for swimmers at Chicago beaches?** Meredith Nevers
  - **Comparing rapid and standard methods at inland and Great Lakes Beaches** Rebecca Bushon
  - **A Partial Least Squares Approach to Beach Water Quality Modeling** Mike Fienen
  - **Beach Mobile Phone Applications for Accessing Advisory and Water Quality Data** Susan Phillips

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Examples

- **Pathogens and microbial source tracking**
  - **Bacterial pathogens and MST markers at Great Lakes beaches—2010** Sheridan Haack
  - **Comparison of filtration methods for pathogens** Donna Francy, Erin Stelzer
  - **Testing for staphylococci and Methicillin Resistant Staphylococcus aureus (MRSA)** Angela Brennan

Examples

- **Coastal processes**
  - **Numerical assessment of bacterial transport and deposition at a Chicago beach** Zongfu Ge
  - **Hydrogeographic variables that may influence Great Lakes beach water quality** Lori Fuller
- **Data analysis and communication**
  - **Data support for beach managers, researchers, and modelers** Susan Phillips
  - **Web-Based Tools, including GIS, to Expand Access to Beach Water Quality Monitoring** Richard S. Jodoin, Wesley Brooks

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Collaboration and Coordination

USGS Science Centers' work, as well as those of our federal, state and local partners is based upon beach managers input and needs

- 2005 USEPA,USGS, NOAA Stakeholder meeting at GLBA conference used to define the four elements of the Initiative
- Formation of the federal Beach Health Interagency Coordination Team increases communication and the identification of collaboration opportunities

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Funding

Funding for USGS beach projects and research in the Great Lakes comes from a variety of sources:

- the Ocean Research Priority Plan, the USGS Coastal and Marine Program
- the Great Lakes Restoration Initiative, U.S. Environmental Protection Agency (USEPA)
- many state and local partner agencies and organizations throughout the region.

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Questions?

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