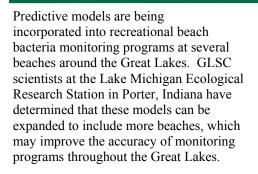# Studies of Indiana and Chicago Beaches Demonstrate Area-wide Understanding of *E. coli* Contamination

Great Lakes Science Center (GLSC) scientists have developed E. coli *predictive models for up to 23 Lake Michigan beaches that are as accurate as many models used at single beaches for managing swimming activities.*

View of Chicago from Indiana Dunes

Predictive models are being incorporated into recreational beach bacteria monitoring programs at several beaches around the Great Lakes. GLSC scientists at the Lake Michigan Ecological Research Station in Porter, Indiana have determined that these models can be expanded to include more beaches, which may improve the accuracy of monitoring programs throughout the Great Lakes.

E. coli as an Indicator
Problem: Current recreational water monitoring protocols require 24 hrs. for results.
Current solution: Individual beaches use models to predict when *E. coli* concentrations are too high for swimming.
Future solution: Region-wide models can be used to predict high *E. coli* counts at numerous beaches simultaneously.

In order to provide real-time results, GLSC scientists and others have developed predictive models that are being employed at several beaches around the Great Lakes. These models incorporate weather and water conditions and, based on historical patterns, predict the concentration of *E. coli* in the beach water.

Expanding Models to a Region
Scientists at the GLSC have determined that much of the variation in *E. coli* counts can be explained for numerous beaches simultaneously. Using historical data from a 35-km stretch of Indiana's Lake Michigan beaches, two measurements could be used to explain the fluctuations in *E. coli*. By measuring wave height and turbidity in river outfalls, and their association with wind direction, the predictive model could predict *E. coli* counts at 12 beaches with as much accuracy as some of the models developed for individual Great Lakes beaches. In another exercise, *E. coli* counts could be predicted with similar accuracy for 23 Chicago beaches using five hydrometeorological variables.

Regional models rely on the similarities in *E. coli* fluctuations between beaches, so the area of consideration may be limited by external influences that affect a limited number of beaches, such as river outfalls, breakwalls, or land use. In the Indiana model, some beaches are impacted by rivers and creeks, and others are not, indicating that some of the variation in *E. coli* counts at all beaches is due to factors independent of these sources. For the Chicago beaches, there are no river influences, but there are many breakwalls.

Usefulness of Regional Models
In many cases, a regional model may assist beach managers in assessing a number of beaches simultaneously, and significant insight into the dynamics of *E. coli* can be gained from the model results. By examining the coastline from a broader perspective, region-wide characteristics and fluctuations in *E. coli* can be assessed. GLSC scientists believe that, with this information, potential sources can be eliminated, community comparisons can be made, and swimming advisories can take into account neighboring beaches.

Aerial view of southern Lake Michigan, including Indiana and Chicago beaches.