

IOWA'S WATER

Ambient Monitoring Program

Iowa's Beach Monitoring Program – 2006

If you have gone to the beach or paid attention to the news, you may have heard phrases like "The water is contaminated!" or "Don't go in the water!" Beach monitoring programs, not only in Iowa but across America, try to get out messages about what the real water quality is like. More often than not, however, good news about water quality isn't newsworthy. It is usually after a beach has a high sample result that press releases, newspaper articles, and advisory signs appear, while little notice is paid to the good results for the weeks before and after these intermittent high samples. Because of this challenge, the public often only hears about the bad results at beaches and might be led to conclude that Iowa's beaches are always contaminated and unsafe for swimming.



The beach at Lake Macbride State Park in Johnson County is crowded with beachgoers on warm summer days.

Results

In reality, most Iowa state park beaches have few or no problems with fecal contamination in the form of indicator bacteria called *E.coli*. During the 2006 swimming season, most state park beaches had more than 50 results reported between April and October. During that time, 12 of the 37 beaches in the state had no samples exceeding state water quality standards of 235 colony forming units per 100 ml for individual samples or 126 colony forming units per 100 ml for geometric mean results (a calculation based on five consecutive weeks of samples), while another nine only had one such result. At the same time, only five beaches had consistently high bacteria levels, as illustrated in Figure 1.

Moreover, since Iowa's Beach Monitoring Program began in 2000, weekly bacteria results for *E.coli* have been below the level that the Environmental Protection Agency deems safe 91.5% of the time. Additionally, 2005 saw the fewest advisory postings at Iowa state park beaches since 2003.

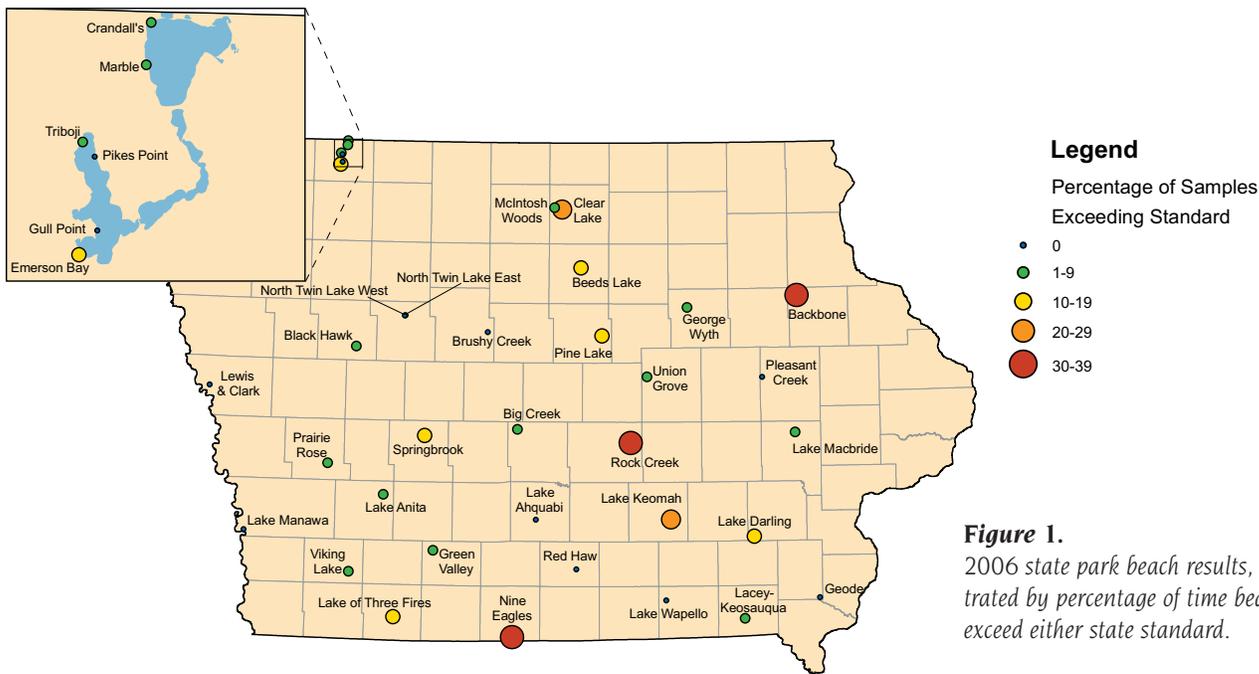


Figure 1. 2006 state park beach results, illustrated by percentage of time beaches exceed either state standard.

Locally Managed Beaches

Since 2004, the Beach Monitoring Program has included locally managed beaches from around the state. This monitoring includes county, city, or other public beaches wishing to participate in the voluntary program. Over the past swimming season most beaches submitted weekly samples over a 16-week period from Memorial Day through Labor Day. A total of 35 beaches participated in the program.

Results for locally managed beaches are derived in the same manner as state-owned beaches, yet high results at locally managed beaches occurred less frequently (Figure 2). The probable reason for this is the irregular sampling patterns at many of these beaches. With uneven sampling, geometric mean values often can not be calculated due to lack of data. To give an accurate representation of locally managed beach results, only beaches collecting at least 13 out of the 16 weekly samples are displayed.

Watershed Studies

One question often asked when beaches have spikes in their bacteria numbers is "What is done to determine the cause of the problem?" Each year Beach Monitoring personnel conduct intensive investigations on numerous beaches across the state. Although the state of Iowa does not receive funding from the Environmental Protection Agency through the federal BEACH Act of 2000 (www.epa.gov/waterscience/beaches/act.html), there has been a great deal of support within the state through research institutes, public health laboratories, and from within state government itself. Because of this high interest level, a variety of creative techniques to determine bacterial sources have been employed over the last six years at a number of beaches across the state. Two are highlighted below.

It's all about the genes... A group of methods used to determine the source of fecal contamination in waters applies genotypic techniques, which look at the DNA of microorganisms. These methods help determine sources of fecal pollution by comparing genetic similarities between *E.coli* DNA isolated from water, with that of known animal sources (usually wildlife, livestock, and human). These methods are typically very expensive and have yielded mixed results. Because of this, the Iowa Department of Natural Resources (IDNR) has only worked minimally with these techniques until recently.

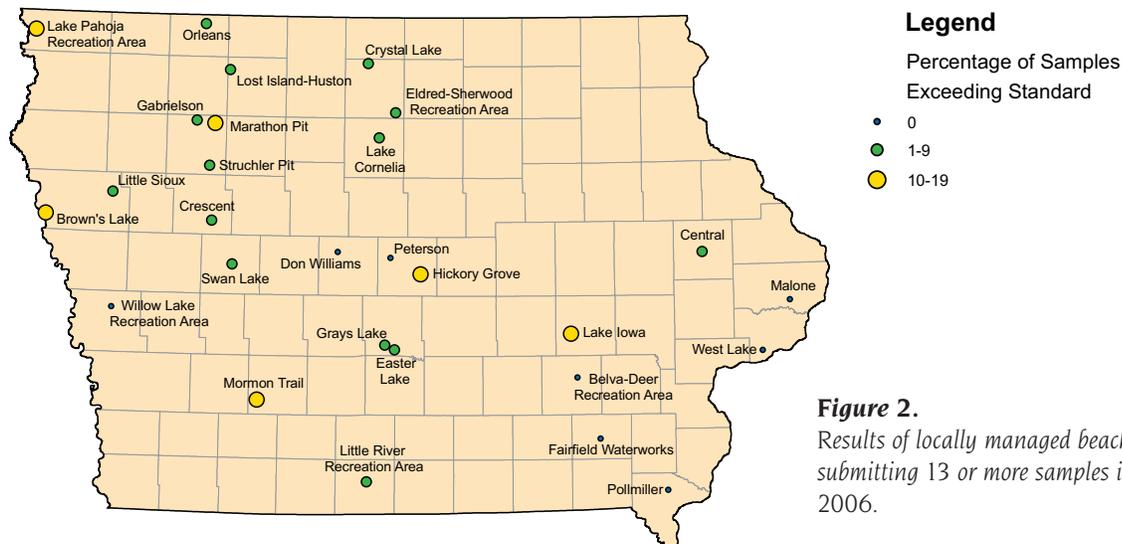


Figure 2.
Results of locally managed beaches submitting 13 or more samples in 2006.

In 2005, the IDNR began collaborative work on one of the largest regional comparative DNA databases ever created. Phase I of this research was finished in November 2006. In cooperation with Marshall University, three regions throughout the country were selected for a U.S. Dept. of Agriculture sponsored study to determine the regional variations in *E.coli* for the same host organisms, as well as looking at any changes in the DNA from these hosts over time. For the study, 2700 *E.coli* isolates from seven different species were collected from each of the three regions. Specific segments of the genetic makeup of these microorganisms were analyzed by a method called NotI PFGE.

Currently, researchers at Marshall are analyzing these results to determine the amount of genetic variation among bacteria collected in each of the three regions. If study results show little or no regional difference, these large comparative DNA databases may be more widely applicable and less costly techniques than previously thought. For example, researchers would ask "Does *E.coli* DNA isolated from a cow in Iowa look similar to that isolated from a cow in West Virginia?" If the answer is yes, we would not need to go through as large of a watershed-specific sample collection process when investigating fecal contamination. Rather, more time and effort could be spent focusing on collecting additional water samples to compare to DNA libraries. It is also quite likely that the library created for this project could be used for microbial source tracking projects across most of eastern Iowa, as that is where the majority of the sample collection for the regional comparative DNA database occurred.

It doesn't have to be complex... Despite the complexity of many microbial source tracking methods, there are also some techniques that can be used to drastically reduce the need for developing a full source tracking project. Over the last year, the IDNR has experimented with a technique called fluorometry to help determine the presence of human fecal contamination. This method is based on the idea that most direct sources of human contamination that may influence a water body also contain detergents, which have optical brighteners as an active ingredient. These optical brighteners are the compounds that allow laundry detergents to make your "whites whiter and brights brighter." Through a process called excitation fluorometry, these optical brighteners can be detected



Sampling for optical brighteners at Clear Lake using the Turner Designs 10-AU Field Fluorometer.

at very low levels in water. This process is analogous to holding a recently washed item of clothing under a black light and having the spot where detergent had been poured onto the clothing emit a radiant glow.

To date, this process has been used as a gauge of human fecal contamination at five beaches and their watersheds, as well as a few streams across the state. One such location that this process has been used is Clear Lake. During multiple sampling events within the lake, the highest concentrations of optical brighteners from detergents have been noted along the shorelines, specifically near the cities of Ventura and Clear Lake.

Additional sampling is scheduled in 2007 at Clear Lake, as well as at a number of other locations around the state to try to better pinpoint any sources of contamination using fluorometry.

A Look into the Crystal Ball

The major change to the Beach Monitoring Program anticipated for 2007 involves how data will be provided to the public. It is anticipated that by the time beach monitoring begins, a new lakes information database will be available. This database will function as an information warehouse for nearly all information related to lakes in Iowa. Beach monitoring data is set to be one of the first items put online in the new lakes information database in early 2007.

Go to the beach and have a safe, fun time!

Acknowledgements

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Iowa Water Monitoring Program Web Site – wqm.igsb.uiowa.edu



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