IOWA'S WATER
Ambient Monitoring Program

Bacterial Monitoring of Iowa's Beaches – 2000

The purpose of Iowa's Ambient Water Monitoring Program is to develop and deliver consistent, unbiased information about the condition of Iowa's surface and groundwater resources so that decisions regarding the development, management, and protection of these resources may be improved. Monitoring of Iowa's state-owned swimming beaches is one component of this program.

George Wyth State Park (Black Hawk County)

In 1999, the Iowa Department of Natural Resources Division of Parks, Recreation and Preserves monitored ten of Iowa's public beaches for bacterial contamination. Iowa State University monitored two additional beaches as part of an intensive study of Clear Lake. Recent appropriations by the Iowa Legislature have enabled significant expansion of the state's ambient monitoring program.

In 2000, beach monitoring was expanded to thirty-one Iowa beaches. From May through September, the beaches were monitored each week in order to obtain bacteria levels and determine the weekly variability of bacteria levels at each beach (Figure 1). Other goals were to identify factors that impact the bacteria levels and assess the risk of each beach to bacterial contamination. In addition to weekly monitoring, four beaches were sampled twice daily from late May through early July to determine the daily variability in bacteria levels at these beaches.

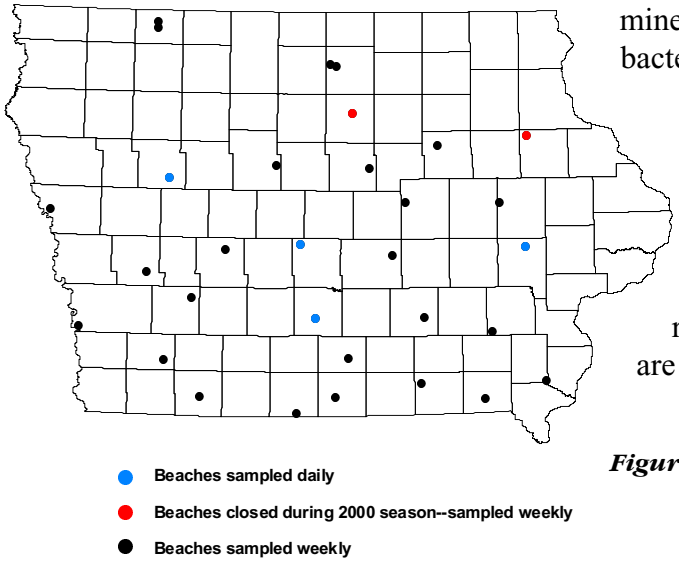

Figure 1. *Location of 31 Iowa beaches monitored in 2000.*

All beaches were monitored for three bacterial indicators: fecal coliform, enterococci, and *E. coli*. The presence of indicator bacteria in water suggests that disease-causing organisms, or pathogens, may be present. As the number of indicator bacteria rises in water, so does the likelihood that pathogens are present. The most frequent sources of pathogens are

Springbrook State Park (Guthrie County)

Red Haw State Park (Lucas County)

sewage overflows, malfunctioning septic systems, animal waste, polluted storm-water runoff, and boating wastes. Children, the elderly, and people with weakened immune systems have a greater chance of becoming ill when ingesting contaminated water.

The U.S. Environmental Protection Agency (EPA) has established bacterial guidelines for Class A waters. All of Iowa's state beaches are Class A waters. These are surface waters designated for primary contact recreation such as swimming or water skiing. To determine bacteria levels, water samples are cultured in a laboratory in order to see how many colonies of bacteria grow. These colonies are counted and reported as colony forming units per 100 milliliters of water, or CFU/100 ml. The EPA Class A water guideline for fecal coliform is 200 CFU/100 mL, 126 CFU/100 ml for *E. coli*, and 33 CFU/100 ml for enterococci. These guidelines do not apply to one-time measurements. Instead, results are compared to the guidelines by calculating a geometric mean of at least five samples taken at equally spaced intervals within a 30-day period. The EPA has established that the geometric mean is the most appropriate method for determining whether or not bacteria levels at a beach are unacceptably high.

Generally, the bacteria levels were below the EPA guidelines for most of the state beaches (Table 1). However, results from the weekly sampling showed a large range in bacteria levels, not only between beaches, but from week to week at a given beach (Table 2). Most elevated bacteria levels were reported in the day following rainfall of one or more inches. This suggests that heavy rainfall may raise the bacteria levels at a beach by contributing runoff that is contaminated with fecal bacteria. Weekly sample results for the 31 beaches can be accessed at the DNR Parks, Recreation and Preserves internet site at www.state.ia.us/dnr/beach2000.htm.

Although high bacteria levels occurred intermittently at many of the beaches, only the beaches at Backbone Lake and Beeds Lake routinely exceeded EPA guidelines during the 2000 season. As a result of repeatedly high bacteria levels, the beach at Backbone Lake was closed to swimmers from June 29 to July 21, 2000, and the beach at Beeds Lake was closed the week of July 17, 2000.

Table 1. *Comparison of bacteria results with EPA guidelines at state beaches, 2000.*

Type of indicator bacteria	Percent of geometric means that meet EPA Guidelines at 31 State of Iowa beaches
Fecal coliform	97.1%
E. coli	96.5%
Enterococci	92.9%

Table 2. *Weekly bacteria levels measured at 31 beaches monitored from May 22- September 18, 2000.*

Beach name (county); N[#]	Fecal coliform (CFU/100 mL)			*E. coli* (CFU/100 mL)			Enterococci (CFU/100 mL)		
	High[&]	Median[+]	Overall geometric mean[~]	High	Median	Overall geometric mean	High	Median	Overall geometric mean
Backbone (Delaware); 18	13,000	285	279	13,000	210	213	36,000	95	73
Beeds (Franklin); 17	9,000	30	61	7,700	20	44	21,000	10	34
Big Creek* (Polk); 17	1,200	20	21	1,100	10	18	740	<10	11
Black Hawk* (Sac); 17	600	10	15	600	<10	12	140	<10	10
Bobwhite (Wayne); 18	3,200	20	37	2,000	20	31	770	<10	17
Brushy Creek (Webster); 17	10	<10	<10	10	<10	<10	110	<10	<10
Clear Lake* (Cerro Gordo); 18	60	<10	<10	60	<10	<10	80	<10	<10
Geode (Henry); 18	2,200	<10	13	2,200	<10	11	7,500	<10	11
George Wyth* (Black Hawk); 18	1,700	35	38	1,200	25	30	690	15	20
Gull Point* (Dickinson); 17	40	<10	<10	40	<10	<10	20	<10	<10
Lacey – Keosauqua (Van Buren); 18	50	<10	<10	30	<10	<10	200	<10	<10
Lake Ahquabi (Warren); 18	330	15	17	300	10	16	360	10	15
Lake Anita (Cass); 18	82	<10	<10	64	<10	<10	170	<10	<10
Lake Darling* (Washington); 17	1,100	20	25	1,100	20	20	1,000	10	19
Lake Keomah (Mahaska); 18	600	20	26	400	10	21	140	10	10
Lake Macbride* (Johnson); 18	80	<10	<10	70	<10	<10	80	<10	<10
Lake Manawa* (Pottawattamie); 16	160	10	16	140	10	12	50	<10	<10
Lake of Three Fires (Taylor); 17	240	<10	12	180	<10	<10	260	<10	<10
Lake Wapello (Davis); 18	82	<10	10	82	<10	<10	82	<10	<10
Lewis & Clark (Monona); 17	80	10	15	70	10	11	130	10	12
McIntosh Woods* (Cerro Gordo); 18	2,100	38	34	2,100	28.5	28	250	20	21
Nine Eagles* (Taylor); 18	270	20	19	170	15	17	510	10	14
Pikes Point (Dickinson); 17	710	<10	<10	650	<10	<10	20	<10	<10
Pine Lake (Hardin); 17	7,500	10	16	6,000	10	14	1,800	<10	12
Pleasant Creek* (Linn); 18	100	<10	<10	64	<10	<10	10	<10	<10
Prairie Rose (Shelby); 18	130	<10	<10	120	<10	<10	18	<10	<10
Red Haw* (Lucas); 18	150	<10	<10	150	<10	<10	120	<10	<10
Rock Creek (Jasper); 18	120	<10	<10	110	<10	<10	20	<10	<10
Springbrook (Guthrie); 15	320	<10	<10	320	<10	<10	380	<10	<10
Union Grove (Tama); 18	150	<10	10	100	<10	10	110	10	14
Viking Lake (Montgomery); 18	260	<10	11	230	<10	10	250	<10	11

*Also monitored in 1999.
#N represents the number of samples analyzed at a given park during 2000.
&The range of results for each bacteria goes from below the detection limit (<10) to the high listed in the table above.
+The median is the number in the middle of a set of numbers arranged numerically from low to high; that is, half the numbers have values that are greater than the median, and half have values that are less.
~The Environmental Protection Agency (EPA) has determined that the geometric mean is the most appropriate method for calculating whether or not bacteria levels at a beach are unacceptably high.

What are indicator bacteria?

Fecal bacteria have been used as an indicator of the possible presence of pathogens (disease-causing organisms) in lakes and streams. Contact with contaminated water can lead to ear or skin infections, and breathing contaminated water may cause respiratory diseases. Pathogens causing these diseases live in the intestines of warm-blooded animals and are passed along in feces.

Because of difficulties analyzing for and detecting many possible disease-causing organisms, fecal coliform, enterococci, and *E. coli* are used as the primary indicators of fecal contamination. These indicator bacteria were chosen because they are easy to collect, relatively safe to handle, and usually present when pathogens are in the water. A rise in the level of indicator bacteria means an increasing risk of contact with pathogens. When the number of indicator bacteria is above the EPA standards, the health risk from waterborne disease is unacceptably high.

Reference: EPA Office of Water, Bacterial Water Quality Standards for Recreational Waters (Freshwater and Marine Waters) Status Report; EPA-823-R-98-003, May 1998.

Ahquabi Beach
(Warren County)

Elevated bacteria levels were also found at the four beaches monitored daily (Lake Macbride, Lake Ahquabi, Big Creek, and Black Hawk Lake). However, the elevated bacteria levels were short-lived, persisting for 24 to 48 hours following runoff-producing rains. In other words, beach bacteria levels rise quickly in response to heavy rains and drop quickly once the rain stops. Overall results from beach monitoring show that bacteria levels were low at the majority of Iowa beaches. Rain appears to be one of the most important factors in predicting whether or not bacteria levels will rise at a beach. Heavy rains that cause runoff may contribute high levels of bacteria to our lakes and beaches. Further monitoring in 2001 may show whether or not rain is a consistent factor in elevated bacteria levels at our beaches.

Minimize your potential health risks associated with swimming:

- Avoid swimming after a heavy rainfall.
- Avoid ingesting lake water.
- Keep clean diapers on children who are not toilet trained.

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Photos from DNR photo files