



What are the implications of Iowa's current beach monitoring results?

Susan S. Brown, Extension Program Specialist/Water Quality, Iowa State University

Backbone Lake has recently gotten a lot of press because water testing at swimming beaches has frequently found high counts of fecal coliform bacteria there. Everyone is concerned about unsafe conditions. Iowa Department of Natural Resources (DNR) has prohibited swimming at Backbone State Park beach and at Beeds Lake due to persistent elevated bacteria levels. Recent tests have occasionally shown elevated numbers of fecal coliform and enterococci bacteria at other Iowa beaches as well.

Yet, on a recent trip to Strawberry Point, near Backbone, residents were saying, "These bacteria must have been in the water at our beach for years. We just didn't know it. Now DNR has started sampling and people are afraid to come here. But nobody's ever gotten sick from it. What do these bacteria levels really mean, what is the risk?"

Good questions. In the past two years, DNR has been monitoring fecal bacteria in water at Iowa beaches. This year they are testing 31 beaches on a weekly basis. The U.S. EPA has also recently started a Beaches Environmental Assessment, Closure, and Health (BEACH) Program in response to the growing concern about public health risks posed by polluted bathing beaches. However, the EPA focus is mainly on coastal areas near large cities, while Iowa's swimming lakes are usually surrounded by farmland and small towns.

Under Iowa's water quality standards, a lake or river designated as Class "A" means it may be used for "full body contact" recreation, such as swimming, tubing and skiing. Iowa DNR has established microbial standards for bacteria in Class "A" water as not more than 200 fecal coliforms detectable per 100 ml. Standards are established based on research, to insure swimmers against unreasonable risk of contaminant-related intestinal illness. DNR is also considering changing to standards based monitoring enterococci and E. coli bacteria, to conform to recent EPA recommendations.

These standards, however, do not mean one-time measurements, but rather geometric means of at least 5 samples taken equally spaced over a period of about 3 to 4 weeks. The geometric mean averages the logarithms of microbial counts at each sample time. Microbial numbers are calculated this way so that a single high reading does not cause the overall average to be high. As a general comparison, the numbers of coliform bacteria detectable in raw sewage can be thousands of times higher than the current standards for Class "A" water.

These standards are different than those for drinking water. According to current EPA and Iowa standards, any detectable fecal bacteria at any time in drinking water is considered unsafe.

The occasional detection of high levels of bacteria at beaches is not necessarily dangerous, and

in fact it is likely after heavy rains. However, when bacteria levels exceed the EPA standards - meaning that tests are high for prolonged periods or singles sample are several times the limit - DNR will issue warnings or close the beaches. So far, this has occurred at Backbone Lake and Beeds Lake. *Current DNR beach monitoring results can be found at the web site <http://www.state.ia.us/dnr/beach2000.htm>. You can also contact the park management or local health department for this information.*

Bernie Hoyer, supervisor of the Water Monitoring Section of the Iowa DNR Geological Survey Bureau, has said that, overall, the DNR monitoring program "...is not an effort to warn the public as much as it is to educate them and ourselves" about baseline conditions in our recreational lakes. The press, on the other hand, has played up any detection of fecal bacteria as a deadly health threat. It is not surprising that people feel confused.

The fact is that we really don't know how microbial pollution in our lakes and rivers compares to many of the areas assessed by EPA. The bacteria being monitored at our beaches are so-called "indicator species", rather than actual pathogens (disease-causing microbes), which would be very dangerous to culture in laboratory tests. According to an EPA BEACH fact sheet, indicator species are "microorganisms that are easy to collect and analyze for, safe to handle, representative of the pathogen of concern for characteristics like growth, and always present when pathogens are present." Increasing numbers of indicator bacteria therefore mean increasing RISK that pathogens are also present. But it doesn't prove they are there.

EPA has collected statistical data since the 1970s on the association between various enteric (gut) bacteria and the incidence of swimming-related intestinal illness. They believe that enterococci and E. coli populations are the best indicators of risk at freshwater beaches. These microbes are normal inhabitants of the intestine of warm-blooded animals but do not normally cause disease in humans. Swimming-related illness is generally thought to be due to enteric viruses. Protozoans such as cryptosporidium and giardia are also mentioned. Rarely, dangerous strains of E. coli occur, but the tests do not measure the presence of these directly. All of these organisms live in the gastrointestinal tract and are shed in animal feces.

Beach monitoring of "indicator species", therefore, is really measuring the amount of water contamination by animal feces. The gut of all warm-blooded animals, for example, is normally colonized by millions of E. coli bacteria which actually help keep us healthy by making most of the vitamin K and B vitamins we absorb. Before getting panicky about bacteria in water, it is important to remember that there are plenty of bacteria around us, in us, and on us all the time. Most are either not harmful, or we have developed an immunity to them. Many of them are symbiotic, that is, both the bacteria and the host animal benefit from the association. Many are responsible for natural processes we depend on - such as breakdown of organic wastes, fixation of nitrogen for plants, even fermentation of foodstuffs. The current popularity of antibacterial soaps and cleaners creates the false impression that all, or most, microbes are "bad", whereas the truth is the opposite. "Germ-free" animals raised in laboratories are weak and sickly.

Persistence of indicator bacteria over long periods in beach water, however, should be a concern. Since enteric bacteria are adapted to their environment, they generally don't grow or persist for long outside of an animal. Therefore bacteria numbers at beaches that shoot up after a heavy rainstorm usually drop off after a day or two. After a rain, runoff can carry bacteria from many sources, such as an overflowing sewage treatment system, feedlots, pet waste from streets and yards, or even wildlife waste in some areas. Fecal bacteria also live longer when associated with soil particles - they may enter streams with sediment from fields where manure has been applied.

Bacteria carried by sediment runoff are especially likely to be a problem in places like Backbone Lake, which is a small, shallow lake with a very large, agricultural watershed. Backbone's

watershed has nearly 900 acres of crop and pasture land for every acre of lake. This watershed-to-lake area ratio is much higher than most Iowa lakes and means that controlling high microbial counts at Backbone Lake may be very difficult because of the number of potential sources.

High watershed-to-lake area ratio is not the only potential source of continuing high indicator bacteria levels. There may also be a continuous source of contamination near the water. Such a source might be poorly functioning (or non-existent) private septic systems, livestock with access to the creek or lake shore, septic and other waste disposal from recreational boats and campers, and wildlife areas.

Although there are microbial risks with all sources of waste, the greatest risk of contamination with human pathogens is when human sewage is the source of fecal contamination. That is one reason DNR is now investigating the source of contamination at Backbone Lake. More sophisticated tests are being developed to determine the (animal) source of the indicator bacteria. It is most likely that there are multiple sources in the large watershed, but knowing what they are will help to better estimate the real risk to swimmers.

Now that Iowans are getting regular reports on microbial monitoring of state beaches we are all going to have become a little more educated about bacteria in the world around us. What is a reasonable response to the possibility of microbial contamination at the beach?

First of all, when high fecal bacterial levels have persisted over a month, which indicates a continual source of waste to the water, the risk of illness may be significant and DNR warnings and beach closings should be heeded.

If you are swimming at an untested site, or don't know what tests have shown, consider the following:

- Swimming-related illnesses are typically minor, require little or no treatment and have no long-term health effects. *However, caution should be taken for young children, the elderly, and people with weakened immune systems since they are most likely to be susceptible.*
- The most common problem associated with swimming at sewage-contaminated beaches is intestinal illness from swallowing the water. Therefore, if fecal contamination is suspected, wade or keep your head above water. It would be wise to keep young children out, since they are unlikely to be able to avoid swallowing water.
- For healthy adults, the most important precaution is to wash up after leaving and beware of contaminating food. You are still much more likely to get intestinal illness from improperly handled picnic food at the beach than from being exposed to the water.
- Eye and ear infections are also possible, and infection through open wounds has been reported, although rarely. Therefore, no one should go swimming with open cuts or abrasions.
- If there is no monitoring information for the beach, consider risk to be higher after recent heavy rains. Also avoid swimming in areas where the water is visibly stagnant or where you can see discharge pipes.

Even when beaches are closed for swimming, there are still opportunities for recreation in the park. Should you worry about "catching" anything by picnicking on or near the beach, or from temporary exposure to the water as in boating or fishing? It is important to remember that risk of infection from some source in public places is never zero. But at our Iowa lakes, for healthy people, risk of infection from the water is much lower than many other risks that we take for granted in a trip to the park. It should certainly not keep us from enjoying the outdoors, as long as reasonable precautions are taken for susceptible individuals.

Fish caught in waters that exceed the bacterial standards are safe to eat because the pathogens of concern are not found in fish tissue. They may, however, be in the intestinal tract, which is why people are warned against eating shellfish from water that may be contaminated by animal waste.

More important is to realize that we are all potential contributors to the problem, and take steps to deal with it. When visiting parks and natural areas, use the toilet facilities and keep diapers on young children. When hiking in the back country, properly bury your waste (anyone who has been there knows this basic rule is often ignored). Pick up after your pet at home and at camp. At rural homesites, make sure your private septic system is working. In town, promptly report suspected problems with public sanitary sewers. Help your community face up to the responsibility of dealing with outdated sanitary systems if necessary. There are public sources of assistance to help you. If you are a livestock producer, control your animals' access to creeks, incorporate manure after application, and consider making use of the various federal and state programs available to help control manure runoff more effectively.

Most of us have little awareness of the microbial world around and within us. We know that some bacteria cause illness, and that makes it easy for reports about the beach monitoring program to seem more frightening than they need to be. According to DNR, there are still no documented cases of swimming-related illness in Iowa. We should certainly obey DNR's beach closures. But for visitors to most of Iowa's lakes and streams, the most appropriate response to news about beach monitoring is caution and normal good personal and food hygiene. And because we all live in a watershed, we all need to take responsibility for identifying and helping to control potential sources of fecal contamination from ourselves, our pets and our livestock.

The author wishes to acknowledge valuable assistance from Nancy Hall, Supervisor of Environmental Microbiology, University Hygienic Laboratory, University of Iowa and Liz Shinall, Research Geologist and coordinator of the 2000 Beach Monitoring Project, Water Monitoring Section, Iowa Department of Natural Resources Geological Survey Bureau, for their review and comments on this article.