Lake Notes

Waterborne Pathogens

As we all know, there are many kinds of living things in our lakes, ponds, and reservoirs including fish, plants, insects, reptiles, amphibians, and algae. What most of us don't think about, however, are all of the organisms that we can't see in the water but are there by the millions: **microorganisms**. Mircoorganisms are present in all terrestrial and aquatic ecosystems. Many types are beneficial—functioning as food sources, agents for chemical decomposition, and essential components of the nitrogen cycle. Other microorganisms live in the bodies of animals and aid in digestion.

Of the vast number of microorganism species present in the environment, only a small number are human pathogens, typically causing illnesses that affect the digestive system. The source of these harmful pathogens is usually the feces or other wastes of humans and warm-blooded animals.

Because detection of all possible pathogens is very difficult and expensive to monitor, detection of high numbers of harmful microorganisms is accomplished through testing for an **indicator organism.** Such indicator organisms include the fecal coliform bacteria group as a whole, as well as a particular fecal coliform, *Escherichia coli*. The detection of fecal coliforms or *E. coli* indicates that human or animal waste may be present and that other, harmful microorganisms may be present as well.

There will always be some risk associated with swimming in unchlorinated as well as chlorinated water. Measures to decrease this risk should be aimed at reducing the likelihood of fecal contamination of swimming water.

Note to the Reader:
To learn more about testing for indicator organisms and good bathing beach health and safety practices, see another *Lake Notes* publication "Bathing Beach Design and Operation."

There are three types of microorganisms that can cause illness in humans: bacteria, parasites, and viruses. The most common that can occur in Illinois lakes, ponds, and reservoirs are highlighted below.

Bacteria

Escherichia coli (*E. coli*)

There are many strains of *E. coli* that are not pathogenic and are actually an important part of the human digestive tract. However, several *E. coli* strains do cause illness in humans and can produce symptoms such as bloody diarrhea, abdominal pain, vomiting, and fever that can last from 2 to 8 days. An estimated 73,000 cases of *E. coli* infection occur each year in the United States, with about 60 of those resulting in death. Typically, *E. coli* O157:H7 (one of the harmful strains) is a food-borne illness transported by consumption of contaminated food (e.g., undercooked, contaminated ground beef). However, there are also documented cases of infection through consumption of contaminated water while swimming. In 1995, an outbreak of *E. coli* O157:H7 occurred at Rock Cut State Park near Rockford, Illinois. Although 12 children were infected and three were hospitalized, this was only the third lake-related case ever documented in the United States.

Listeria monocytogenes

This bacterium causes an uncommonly diagnosed illness that occurs sporadically in humans. The illness presents as fever, intense headache, nausea, vomiting, and signs of brain infection. Pregnant women, fetuses/newborns, the elderly, and those with compromised immune systems are more susceptible than healthy adults, and a pregnant woman can transmit the bacteria to her fetus. The sources of *Listeria* include soil, water, infected animals, and human feces. The bacteria are typically transmitted through the ingestion of contaminated food or from mother to fetus. Although *Lysteria* is usually food-borne, swimmers can become ill if water contaminated by human or animal waste enters a swimming area.

Salmonella enterica

Typically a food-borne bacterium of animal origin, *Salmonella enterica* causes the sudden onset of headache, abdominal pain, diarrhea, nausea, and sometimes vomiting. Dehydration may be severe, but deaths are uncommon except in the very young, elderly, and those with compromised immune systems. An estimated 5 million cases of this illness occur annually in the United States. The bacteria are transmitted through the ingestion of contaminated food or contaminated feces from an infected person. Although *Salmonella* is usually food-borne, swimmers can become ill if they ingest water contaminated by human or animal waste containing high numbers of the bacteria.

Campylobacter spp.

These bacterial species can cause illnesses of differing severity characterized by diarrhea, abdominal pain, fever, nausea, and vomiting typically lasting 2 to 5 days. An important cause of diarrheal illness in all parts of the world and throughout all age groups, these bacteria cause 5 to 14 percent of all diarrhea worldwide. Carrier organisms include farm and domestic animals, such as poultry, cattle, swine, sheep, puppies, kittens, rodents, and birds. The bacteria are transmitted through the ingestion of undercooked food or contaminated food or water, or through contact with infected pets or farm animals. Chlorination of drinking water will kill *Campylobacter*, but swimming areas can be contaminated through runoff from farms or residential areas with infected animals.

Streptococcus spp.

Group A Streptococci can cause a variety of illnesses including sore throat, skin infection, scarlet fever, septicemia, pneumonia, and tonsillitis. Group A Strep illnesses are passed from person to person through large respiratory droplets or direct contact. A specific species of Streptococci, *Streptococcus pneumoniae,* causes pneumonia, which produces shaking chills, fever, chest pain, and cough. Pneumonia is a leading cause of death in infants, the aged, and those who have had some weakening of the lower respiratory tract. The bacteria are spread by direct oral contact or contact with respiratory discharge. This strain of bacteria is also one of the agents of meningitis which can cause death in 5 to 15 percent of those who contract it. Symptoms include the sudden onset of fever, intense headache, nausea, vomiting, stiff neck, and a rash. Recent outbreaks have been associated with school- and college-aged persons. Transmission of these bacteria can occur in swimming areas through ingestion of water contaminated by other swimmers.

Leptospira spp.

Symptoms of leptospirosis include sudden onset of fever, severe headache, chills, muscle aches, vomiting, and sometimes jaundice, red eyes, abdominal pain, rash, or diarrhea. If left untreated, kidney damage, meningitis, liver failure, and respiratory distress could develop. The illness is often misdiagnosed as encephalitis, meningitis, or influenza; but it can be confirmed by lab testing of a blood or urine sample. Leptospirosis occurs worldwide in both urban and rural areas, and the incidences of death increase with the age of those infected. Outbreaks can occur among those exposed to river, stream, canal, and lake water contaminated by urine and tissue of infected domestic and wild animals. *Leptospira* can be spread through contact with water, moist soil, or vegetation contaminated with these bacteria. The best protection is to avoid swimming in contaminated waters.

Shigella sonnei

This bacterial species causes an illness called shigellosis which develops symptoms such as diarrhea, fever, and stomach cramps typically lasting 5 to 7 days. There are several different kinds of *Shigella* bacteria, but *Shigella sonnei* accounts for over two-thirds of the shigellosis in the United States. Every year, about 18,000 cases of shigellosis are reported in the U.S., and the illness is most common in toddlers. Shigellosis usually can be treated with antibiotics, but individuals with mild infections will typically recover without antibiotic treatment. These bacteria are transmitted through ingestion of contaminated food or water. Their spread can be prevented by diligent hand washing when preparing food and by not swimming in contaminated waters.

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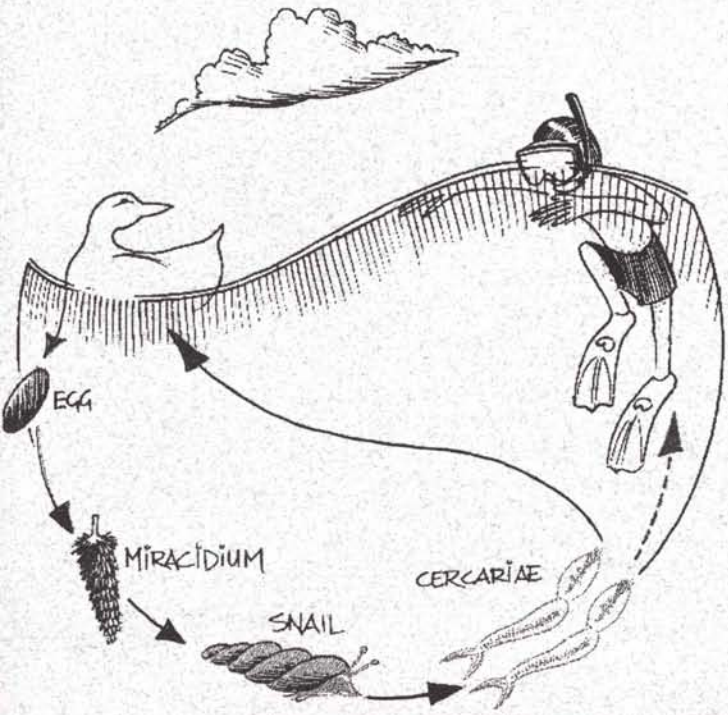
Parasites

Giardia lamblia

Infection with this parasite typically results in chronic diarrhea, abdominal cramps, bloating, fatigue, and weight loss. Children are affected more frequently than adults, and the prevalence of the illness is higher in areas of poor sanitation and in institutions where children are not yet toilet trained. The illness is highly contagious and may be life threatening to those with compromised immune systems. Humans and wild and domestic animals can carry *Giardia,* and it is passed from person to person by hand to mouth transfer from the feces of an infected individual. This parasite has an outer shell that allows it to survive outside the body and in the environment for long time periods. Ingestion of stream and lake waters open to contamination by human and animal feces is a possible source of infection.

Schistosoma spp.

Schistosomes are a group of flatworms responsible for a large number of very serious illnesses in the intestine, bladder, reproductive system, brain, spinal cord, and skin. Fortunately, the species which cause these types of illnesses are not found in the United States. Here in the U.S., the larvae (cercaria) of certain schistosomes of birds and mammals may inadvertently penetrate human skin and cause a skin irritation known as **swimmers' itch**, also called cercarial dermatitis or schistosome dermatitis. (See the diagram below for the lifecycle of this schistosome parasite.) Within the U.S., swimmers' itch is more common in the northern tier states including the Great Lakes region and New England.



The host species of this schistosome are ordinarily waterfowl, aquatic mammals, and snails. When a cercaria penetrates the skin of a human, it is unable to complete its life cycle and the human immune system rapidly kills it. At the same time, the cercaria releases substances that cause inflammation and a pus-filled pimple. Symptoms include tingling, burning, or itching of the skin within minutes or days after exposure. In some people, the allergic reaction may be more widespread, with itching and rash produced over much of the body. Itching may last up to a week or more but will gradually go away. Swimmers' itch is not a serious health threat and cannot be spread from one person to another. The itching can be controlled with an over-the-counter cortizone treatment (the same lotions used for mosquito bites and other itching rashes).

What Can Be Done to Prevent or Reduce Swimmers' Itch?

- Avoid swimming when and where swimmer's itch is a known problem (swimmers itch is typically most prevalent in early summer).
- Avoid swimming or wading for long periods in shallow water.
- Avoid swimming in areas where there is an onshore wind.
- Avoid swimming near or wading in marshy areas where snails are commonly found.
- Do not attract waterfowl by feeding them near swimming areas.
- Apply waterproof sunscreen lotion as this seems to inhibit penetration of the skin by the parasite.
- Vigorously towel off or shower immediately after leaving the water.

Cryptosporidium parvum

Although this parasite causes life-threatening diarrheal disease in those with weakened immune systems, mild infections are common and are a source of infection to others. It has become recognized as one of the most common causes of waterborne illness in the United States. Symptoms of serious infection include diarrhea, cramping, and abdominal pain; symptoms last fewer than 30 days in healthy patients. In healthy individuals, the occurrence is only 1 to 4½ percent, with a higher susceptibility found in children under the age of two. The parasite can be harbored in cattle, humans, and domestic animals and enters water when feces from infected animals or humans come in contact with surface water. *Cryptosporidium* is protected by

an outer shell that allows it to survive for long periods and makes it resistant to chlorine disinfection. Ingestion of contaminated water or contact with an infected individual or animal is the primary means of this parasite's spread.

Viruses

Enteric viruses cause diseases of the intestinal and respiratory tract and are spread only by humans. These include the hepatitis A virus, which causes liver infection; coxsackie, which causes meningitis; and rotavirus, which is responsible for severe diarrhea. The presence of these viruses in water indicates pollution from human sewage. Some viruses are so hardy that they can remain to cause infection for weeks when in cool water and even longer when in bottom sediment. They live longer and can cause symptoms at lower densities than bacteria. Although beach sampling programs have not yet found a cost-effective, reliable way to detect viruses in water, documented cases of waterborne viral infections remain low.

For Further Information

Illinois Department of Public Health, Division of Environmental Health, Springfield
(217) 782-5830
http://www.idph.state.il.us/envhealth/ehhome.htm

County and Municipal Health Departments
Check your phone book for the local health department serving your area.

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention
Their "Healthy Swimming" website offers a lot of information on the types, causes, and prevention of recreational water illnesses:
http://www.cdc.gov/healthyswimming/index.htm

Six "PLEAs" to Promote Healthy Swimming

Everyone can promote healthy swimming by following some common sense actions to help keep germs from getting into pool or beach water in the first place.

- Please don't swim when you have diarrhea.
- Please don't swallow the water, and even try your best to avoid having water get in your mouth.
- Please practice good hygiene—take a shower before swimming and wash your hands after using the toilet or changing diapers.
- Please take kids on bathroom breaks or check diapers often. Waiting to hear "I have to go" may mean it's too late.
- Please change diapers in a bathroom and not at beach- or pool-side. Germs can spread to surfaces and objects in and around the beach or pool and spread illness.
- Please wash your child thoroughly (especially the rear end) with soap and water before swimming.

Lake Notes . . . is a series of publications produced by the Illinois Environmental Protection Agency about issues confronting Illinois' lake resources. The objective of these publications is to provide lake and watershed residents with a greater understanding of environmental cause-and-effect relationships, and actions we all can take to protect our lakes.

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For more information about other publications in this series and to request copies, please contact: Illinois Environmental Protection Agency, DWPC-Lakes Unit, P.O. Box 19276, Springfield, Illinois, 62794-9276; 217/782-3362; www.epa.state.il.us

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