

Bacteria Fact Sheet for the Maine Healthy (Coastal) Beaches Program

Why monitor beach water quality?

As growing numbers of people move to Maine's coastal areas and pollution continues to threaten the waters in which we swim and play, many visitors could risk illness from exposure to contaminated recreational waters. The goal of this program is to significantly reduce that risk through water quality monitoring and assessment, notification, and education for the public.

The most frequent sources of disease-causing microorganisms are from sewage overflows, polluted stormwater runoff, sewage treatment plant malfunctions, boating wastes, malfunctioning septic systems and human practices at the beach.

Pollution in beach water is often much higher during, and immediately after, rainstorms because water draining into the beach may be carrying pollutants from overflowing treatment systems, runoff from lawns, farms, streets, and construction sites. Many of these pollutants can end up in the water and affect water quality at Maine's beaches.

What are pathogens?

Pathogens are defined as disease-causing microorganisms. Microorganisms are found everywhere in terrestrial and aquatic systems. Most microorganisms are beneficial assisting in decomposition, which provides food sources and essential components of various biological cycles. The small subset of microorganisms that cause human diseases, known as human pathogens, can cause gastrointestinal illness or even death. The source of these human pathogens is usually the feces of humans and other warm-blooded animals. The pathogens most commonly associated with waterborne illnesses can be grouped into three categories: bacteria, viruses, and protozoans.

Disease-Causing Organisms in Sewage	
Microorganisms	Some Illnesses and Symptoms
Bacteria	Gastroenteritis (includes diarrhea and abdominal pain), salmonellosis (food poisoning), cholera
Viruses	Fever, common colds, gastroenteritis, diarrhea, respiratory infections, hepatitis
Protozoa	Gastroenteritis, cryptosporidiosis and giardiasis (including diarrhea and abdominal cramps), dysentery

What are bacteria?

Bacteria are single-celled organisms that lack a nucleus and do not contain chlorophyll. They have a single chromosome and typically reproduce by splitting into two organisms. Few bacteria are pathogenic, and most are benign or beneficial to humans. Bacteria are often maligned as the cause of human and animal disease. However, certain bacteria

produce antibiotics; others live symbiotically in the guts of animals (including humans), or convert nitrogen into a usable form on the roots of certain plants. Bacteria help to break down dead organic matter and they make up the base of the food web in many environments. Bacteria are critically important because of their flexibility and their capacity for rapid growth and reproduction. Waste from warm-blooded animals is a source of many types of bacteria found in waterbodies, including the coliform group and streptococcus, lactobacillus, staphylococcus, and clostridia.

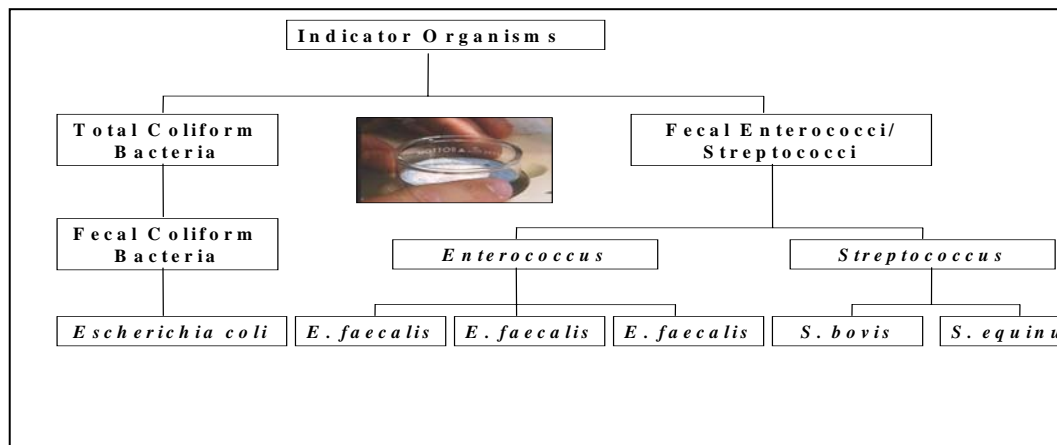
What is an indicator organism?

Indicator bacteria are used to inform us of the quality of the water in which we swim or recreate. A straightforward definition of an indicator organism is one used to measure for the pathogenic organisms that might be present in the same environment as the indicator. Also, the pathogenic organisms are too many, too difficult and costly to measure and do not occur in recreational waters on a consistent basis. Therefore, an indicator organism provides evidence of the presence or absence of a pathogenic organism that survives under similar physical, chemical and nutrient conditions. Good qualifications for an indicator organism include: it is consistently associated with feces, easy to measure, relatively harmless to humans, and found in greater numbers than the pathogens.

What is the indicator of choice for coastal recreational water quality and why?

In the case of marine recreational waters, ***Enterococci***, is the established bacterial indicator for designated recreational coastal waters in Maine. It indicates fecal contamination and the possible presence of pathogens.

Diagram showing the relationship between indicator organisms



Conclusions from studies conducted over the past two decades have shown that *Enterococci* survive longer in salt water compared to *fecal coliform* bacteria, and that *Enterococci* is the indicator showing the best correlation with adverse health effects for marine waters.

What are the criteria for monitoring marine water quality for Maine's coastal beaches?

Briefly, samples are collected in sterile containers and stored on ice (kept at 4°- 10° C) until analyzed. Samples cannot be held longer than six hours prior to being analyzed. For analysis of the samples, two test methods have been approved by EPA. One method uses a membrane filtration (MF) procedure that provides direct counts of *Enterococci* in the water sample. It is based on the number of colonies that develop on the surface of a membrane filter. The other method currently being used by the MHB Program, called Enterolert, is a multiple tube fermentation procedure using a kit for determining most probable number of bacteria. The standard criteria for Maine for a single marine water quality sample, collected and analyzed, is **104** colony-forming units/most probable number of bacteria per 100 milliliters of water. When a sample exceeds that standard, resampling at that site is recommended and an advisory is posted, according to the other conditions present.

How is this accomplished in Maine's Healthy (Coastal) Beaches Program?

Coastal towns and state parks monitor their coastal beaches. Training, educational resources and ongoing support are provided by the University of Maine Cooperative Extension/Sea Grant. Regional laboratories process the samples and provide the results to the towns and parks that have local authority for notifying the public. For more information, please go to:

www.mainehealthybeaches.org/

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References:

National Beach Guidance and Required Performance Criteria for Grants; June 2002, EPA

EPA's Ambient Water Quality Criteria for Bacteria-1986

Improved Enumeration Methods for the Recreational Water Quality Indicators: *Enterococci* and *Escherichia coli*; USEPA March 2000; EPA/821/R-97/004

