

# Microbes in NC Coastal Waters

North Carolina's coastal areas are valued for their economic, ecological, and cultural significance. Our coastal counties rely on both fishing and tourism for their economic health. For example, in 1999, visits to local beaches accounted for approximately 24% of total state tourism, with 11 million visitors to the North Carolina coast<sup>1</sup>. These visitors and residents expect clean waters for commercial fishing, recreational fishing, boating and swimming. Anything that indicates that water is polluted has a detrimental affect on local economies.



**Figure 1.** These signs denote (a) waters closed to shellfish harvesting and (b) recreational swimming advisories, due to elevated levels of indicator bacteria.

In many places along the coast, visitors see signs prohibiting shellfish harvesting (Figure 1a). Data from the National Shellfish Registry shows that 364,000 acres of shellfish beds in North Carolina have been closed since 1995 due to elevated levels of indicator bacteria<sup>2</sup>. Beaches have also been posted with swimming advisories (Figure 1b), which warn swimmers of possible health risks due to fecal contamination. 72% of swimming advisories in North Carolina in 2001 were due to elevated levels of indicator bacteria<sup>1</sup>.

## References

- <sup>1</sup> North Carolina Department of Commerce: <http://www.nccommerce.com>
- <sup>2</sup> Potts, J.D. Personal Communication. 2003. Environmental Health Program Specialist, Shellfish Sanitation & Recreational Water Quality Section, Division of Environmental Health, NC Department of Environment & Natural Resources
- <sup>3</sup> Center for Watershed Protection, 1999. Microbes and Urban Watersheds: II. Concentrations, Sources and Pathways. Watershed Protection Techniques. Vol. 3, No.1, pp. 549-620.
- <sup>4</sup> Mallin, M.A., K.E. Williams, E.C. Esham, and R.P. Lowe. 2000. Effect of human development on bacteriological water quality in coastal watersheds. Ecological Applications, 10(4), pp. 1047-1056.

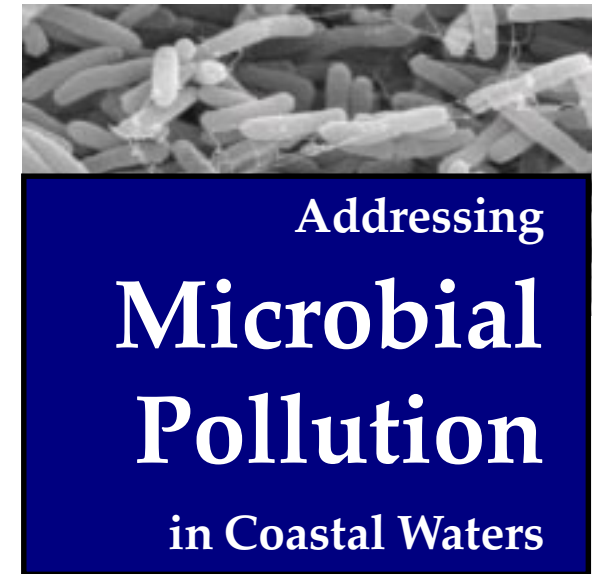
**A reference document and a technical paper with more details about Microbial Pollution in NC Coastal Waters is available through:**

North Carolina National Estuarine Research Reserve,  
Education Office  
135 Duke Marine Lab Road  
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## Improving Environmental Quality in Coastal North Carolina



**Produced for  
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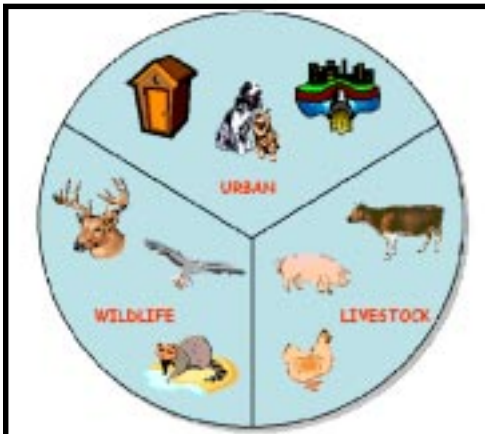
*Picture: Escherichia coli (E. coli), a common rod-type fecal coliform bacterium. Source: Shirley Owens and Michigan State University*

# Microbe Basics

**What are microbes?** Microscopic organisms including protozoa (single celled organisms), bacteria and viruses.

**Are all microbes harmful?** No. Actually most are beneficial or harmless to human health. But some are pathogenic, causing a variety of diseases.

**Where do pathogenic microbes come from?** The feces of warm-blooded animals (birds and mammals).



**Figure 2.** Three major source groups of fecal contamination in coastal waters

**How do microbes get into surface waters?** Point and nonpoint source pollution. Human sources of microbes are usually associated with point source pollution (i.e. a discernible, confined, and discrete conveyance, such as a pipe or ditch). Non-human sources are usually associated with nonpoint source pollution (i.e. stormwater).

**What is "Source Tracking"?** "Source Tracking" is a new and developing field of research that determines the source of fecal contamination (Figure 2).

# Source Tracking Methods

**Microbial Source Tracking (MST)** uses intestinal bacteria and viruses that are often associated with pathogenic microbes to assess the level of microbial contamination at a site.

**Chemical Source Tracking (CST)** detects by-products of human activities. Chemicals tracked include caffeine, coprostanol (by-product of cholesterol breakdown), and chemicals used in laundry detergents (i.e. whitening agents and optical brighteners).

**MST & CST methods are still relatively new, but may eventually become commonplace in water quality management at the local level.**



Stormwater outfalls, like this one on a NC beach that empties onto the beach, are noted during a shoreline survey.

**Shoreline surveys** are routinely conducted by the North Carolina Shellfish Sanitation Section to map the sources of pollution to local waters for the safety of swimming waters and consumption of shellfish. Conducted at the local level, a shoreline survey is a non-technical way to determine the sources of microbial pollution. A shoreline survey can take on many forms, from driving through the survey area to a more complete door-to-door survey.

# How Can I Prevent & Reduce Microbial Contamination?

Stormwater runoff is the main delivery mechanism of microbes to surface waters. An analysis of 34 urban stormwater monitoring studies conducted by the Center for Watershed Protection has shown that most stormwater runoff samples exceed bacteria water quality standards by a factor of 75 to 100<sup>3</sup>. The following are ways you can control stormwater runoff, and microbial pollution:

**GET INVOLVED-** Let your local government know you support development projects that channel stormwater in vegetated areas, use minimal impervious surfaces and use alternative paving methods that allow water infiltration.

**REDUCE IMPERVIOUS SURFACES-** The abundance of fecal coliform bacteria in surface waters is associated with the percentage of impervious surface coverage in a watershed<sup>4</sup>. Alternative paving surfaces include washed stone or gravel, paver blocks and bricks set in sand, and grass pavers.



Proper disposal of pet waste will help reduce microbial pollution.

**IMPLEMENT STORMWATER BEST MANAGEMENT PRACTICES (BMPs)-** These include rain barrels, rain gardens, pervious surfaces and vegetated buffers.

**PROPER DISPOSAL OF PET WASTE-** Do not leave pet waste to be washed into surface waters by rain. Instead bury pet waste in your yard or throw it away with household trash.