Undergraduate Internship Project #6 of 10 for FY09

Intern Emily Olson’s project, co-sponsored by the DWRC and the UD’s College of Earth, Ocean, and Environment, was titled “Investigation of Source and Dynamics of Bacterial Contamination in a Tidal Lake in Point Pleasant Beach, New Jersey.” She was advised by Drs. Clara Chan and Holly Michael of the UD’s Department of Geological Sciences.

Abstract

The coliform Escherichia coli is bacterium of the family Enterobacteriaceae. E. coli is the most common facultative anaerobe in the intestines of warm blooded animals and it is found in their fecal matter. When ingested, E. coli can cause gastrointestinal illness. Because of its prominence in fecal matter, E. coli is used as an indicator of fecal contamination in water. An investigation into the amount of fecal contamination and its sources in a tidal lake, Lake Louise in Point Pleasant Beach, NJ, was launched over the summer of 2009. Lake Louise is connected to the Atlantic Ocean through the Manasquan River, and it is also connected to a second lake, Silver Lake, via a conduit. Previous testing indicated high levels of E. coli in the summer season when the population around the lake is at its highest. Lake Louise is commonly used for water sports and recreation, so identifying and controlling sources of potentially pathogenic E. coli contamination in Lake Louise is of particular importance to the lake community. The project utilized microbial sampling and analyses, as well as basic hydrogeologic and geochemical observations to identify sources of contamination and understand how the hydrology of the lake related to contamination levels. Water samples were taken from four sites around Lake Louise and one in Silver Lake adjacent to the conduit from Lake Louise. Groundwater sampling, drain water sampling, and a 7x7 matrix sampling of the lake were performed as well. Samples were tested for E. coli concentration, NO₃ concentration, conductivity, temperature, and pH in order to determine if the source of contamination to Lake Louise was 1) leaking sewers, 2) surface runoff, 3) waterfowl, or 4) Silver Lake. It was determined that groundwater would not likely transport E. coli from a leaking sewer to the lake. Rain events often correlated with spikes in E. coli concentrations at all sites, making rainfall runoff a likely source of contamination to Lake Louise. Based on observation and literature on the subject, waterfowl have the potential to directly contribute E. coli into the lakes by depositing their fecal matter on shore and in the water. The testing site in Silver Lake had consistently higher E. coli concentrations than the sites in Lake Louise, which indicates that water flushed from Silver Lake each tidal cycle is a source of E. coli into Lake Louise. However, calculations show that Silver Lake does not input enough E. coli into Lake Louise to be the sole source of contamination. Further studies into the sources of contamination in both Lake Louise and Silver Lake are recommended.