ABSTRACT

Escherichia coli is widely used as an indicator of fecal contamination of waterways. Most *E. coli* strains are harmless to humans, but some pathogenic strains are also present. While recent reports suggest that *E. coli* can become "naturalized" to soils in tropical and subtropical area, there is only a limited number of studies done to investigate the ecology of *E. coli* in soils in temperate environments. In this dissertation, the presence of naturalized *E. coli* was examined in temperate soil, sand, and sediment, in Lake Superior watersheds. The distribution of potentially pathogenic *E. coli* in the environment and among diverse animal hosts was also investigated. The occurrence of other human pathogens such as *Salmonella* and *Campylobacter* was also studied on macroalgae *Cladophora* in nearshore water of Lake Michigan.

A three-year field experiment showed that *E. coli* can be repeatedly isolated from temperate soils, and these naturalized strains had distinct DNA fingerprint patterns from animal-borne *E. coli*. Laboratory experiments showed that *E. coli* can grow in soil, provided that abiotic factors, such as temperature and moisture, are within their tolerance limits. Naturalized *E. coli* strains were also found in sand and sediment at Duluth Boat Club (DBC) beach where wastewater effluent and waterfowl are the two major sources of *E. coli*. One strain of potentially pathogenic *E. coli* was also identified on the DBC beach. The distribution of Shiga toxin-producing *E. coli* (STEC) was also different among animal hosts; sheep, goats, and deer harbored majority of the STEC identified. However, potential enteropathogenic *E. coli* (EPEC) were found in many animal hosts, and that is probably why EPEC were most frequently identified in the environment, including the DBC beach. In addition to *E.*

coli, other enteric pathogens, including *Salmonella* and *Campylobacter,* were also found in association with *Cladophora* in nearshore water of Lake Michigan.

These results suggested that *E. coli* and enteric pathogens are distributed more broadly in the environment than previously thought. The presence of naturalized populations of *E. coli* in temperate soil, sand, and sediment may confound the use of this bacterium as an indicator of fecal contamination.