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.