16. EXTENT OF \textit{ESCHERICHIA COLI} CONTAMINATION OF CAGAYAN DE ORO RIVER AND FACTORS CAUSING CONTAMINATION

ABSTRACT

The study determined the extent of fecal contamination of Cagayan de Oro River stretching along the nine river barangays. Sampling sites include upstream, midstream, and downstream areas. The Multiple Tube Fermentation Technique (MTFT) was used to identify total coliform, fecal coliform, and \textit{Escherichia coli} in water samples. Average coliform values from sampling sites exceeded acceptable values set by the Department of Environment and Natural Resources, indicating contamination of the river water quality guidelines at 1000 fecal coliform organisms/100 ml. The factors that contribute to high fecal contamination were high proportion of riverbank dwellers using the river as public toilets, direct connection of pipes from toilets to the river, high mobility of migrant settlers, and lack of water supply for illegal settlers. Temporal variable is a critical differentiating factor in the concentrations of total coliform across sampling areas and in the concentrations of fecal coliform across sampling sites by month. The spread of coliform was similar in the upstream, midstream, downstream sections of the river, indicating that sources of contamination are prevalent.

KEYWORDS

Fecal Contamination, \textit{E. Coli}, River Quality, Human And Animal Wastes

INTRODUCTION

Every year 700,000 people die from food or waterborne diseases in the Asia-Pacific region alone, including the Philippines (WHO, 2010). A gram of human feces has 10 million viruses, one million bacteria, one thousand parasite cysts and 100 parasite eggs, thus humans and animals are not safe in contaminated rivers (DENR, 2004). Excessive exposure to the natural elements and the need for food and water are critical issues that need to be addressed. After a flood or water disaster, waterborne transmission of agents, such as \textit{Escherichia coli}, is common and cause widespread disease (Smeltzer, \textit{et al.}, 2008). Widespread contamination of rivers has been evident in many areas in the Philippines. As people become aware of the conditions of the environment, they also become conscious of their actions toward the environment. They begin to find time to reflect about their
relationship with nature, to think of ways and means to protect the environment, and to analyze environmental phenomenon in their local community. They become more concerned about their surroundings (Deauna and Dorado, 1996).

Cagayan de Oro City is the capital of Misamis Oriental, Philippines. To the south, the city is bordered by Bukidnon and Lanao del Norte (Iligan City). The Municipality of Opol, Misamis Oriental, borders the city on the west and Tagoloan, Misamis Oriental, to the east. To the north lies Macajalar Bay facing the Bohol Sea. Its total land area is 488.86 km² representing 13.9% of the entire Misamis Oriental. According to the 2007 census, the city has a total population of 553,966. There are 80 barangays composing Cagayan de Oro City, 14 of which are situated along the river banks.

The Cagayan de Oro River is a major river of Cagayan de Oro City and surrounding barangays. Its contribution to the growth of the city and the role it plays to sustain the city’s development cannot be overemphasized. The river is rich and abundant in natural resources specifically aquatic organisms. It also serves as a means of livelihood for some people. Improper waste disposal greatly affects the river ecosystem.

Throughout the history of Cagayan de Oro City, the Cagayan de Oro River has been used for bathing, washing clothes, as food sourcing and recently, ecotourism activities, such as white-water rafting, has been recognized by many foreign and local tourists. With the increase in population of residents along the river system, as a consequence of urbanization, comes the question of proper sewage disposal and fecal contamination in the river. However, despite this growing threat and rapid developments in the city, not much attention has been given to the Cagayan de Oro River as few studies have been carried out to assess the water quality. Studies to date are concerned with the physico-chemical properties of the water (Calingin, 2000). One approach to assess water quality of Cagayan de Oro River is to determine the extent of fecal contamination in the river. This is essential in providing information on sanitation and for health-improvement.

Coliform analysis of rivers and other water systems in Misamis Oriental have been conducted, but not for the Cagayan de Oro River. This study was inspired by the study of Alvarez et al (2008) and is part of a continuing effort to assess the fecal pollution level in the river. Detection of *E. coli* provides a better understanding of the potential public health risks to barangays located along Cagayan de Oro City. This study aims to provide insights for disease prevention, health promotion, and health maintenance. Results of the study should offer awareness of disease-causing contaminants and suggestions for an effective waste management system.

The study was aimed at determining the extent of *Escherichia coli* contamination in the Cagayan de Oro River stretching along nine barangays. Specifically, this study was conducted to: (i) determine the MPN index of total coliform, fecal coliform, and *E. coli* in the water samples obtained from the river system, (ii) determine whether the MPN index of total coliform, fecal coliform, and *E. coli* is acceptable according to specific standards, and (iii) determine the possible factors that contributed to *E. coli* contamination.