



Use of the aquatic protozoa to formulate a community biotic index for an urban water system

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Abstract

Protozoan were collected from 16 stations in water system of Changde City (China) using the PFU method. Sampling programs were conducted on a yearly basis, with seasonal frequency at diverse sites in the water system and 488 species of protozoa was identified. At the same time, Water sampling from these stations was conducted and various water chemical parameters, including DO, COD, BOD₅, NH₃, TP, and Volatile Phenol, were analyzed. The aim of the research was, on one hand, using chemical method to take an investigation to the water pollution status of Changde City; on the other hand, using protozoan to make an evaluation to the water quality. With the chemical water parameters and protozoa data, a biotic index was derived for the investigated region. The species pollution value (SPV) of 469 protozoa species was established, and the community pollution value (CPV) calculated from SPV was used to evaluate water quality. The method of the biotic index was tested and the result showed that CPV calculated from SPV had a close correlation with the degree of water pollution ($p < 0.00001$). This indicated that the method of the biotic index is reliable. The water quality degrees divided by CPV were suggested.

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1. Introduction

Protozoa has long been used as a bioindicator of water pollution and widely applied for the biological evaluation of water quality (Sladeczkova and Sladeczek, 1966; Cairns et al., 1968; Cairns et al., 1969;

Sladeczek, 1973; Madoni and Ghetti, 1981; Grabacka, 1985; Albrecht, 1986; Foissner, 1988; Madoni, 1993; Foissner, 1997; Thongchai and Orathaim, 1997; Johanna et al., 1999; Pascoe et al., 2000; Nicolau et al., 2001; Xu et al., 2002; Luiz et al., 2003). Therefore, protozoa communities could provide valuable information on ecosystem health since: (a) protozoans are comparatively world widely distributed organisms that make them more applicable; and (b) because protozoa are characterized by relatively

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short generation times and react rapidly to the changing of water environment. Hence, protozoa are a better indicator of water quality in indicating the abrupt change and continuing changes over a short period of time.

The potential of faunal communities to serve as environmental quality indicators has long been recognized by freshwater biologists and particularly fluvial ecologists have a long tradition in application of biotic indices based on protozoa community characteristics (Sladeczek, 1973).

Over recent decades, there has been considerable interest in the development of meaningful indices to express, evaluate, and monitor the environmental quality of aquatic ecosystems (Fano et al., 2003). However most biotic indices are suitable for the areas from which they were devised; their application to other areas has often resulted in an incorrect conclusion (Washington, 1984).

With this aim in mind, the present study develops a new biotic index, the species pollution value (SPV) and community pollution value (CPV) which is based on the water chemical parameters and protozoa community and is intended to overcome the above cited problems, and to provide a tool for environmental managers and policymakers who require simple, manageable methodologies for the classification, evaluation and monitoring of the ecological

condition of natural and degraded urban water system.

2. Materials and method

2.1. Description of the water system

Changde City is in the province of Hunan in China with about 200,000 population. Water system of the city has several kinds of biotopes including river, pond, lake, ditch, etc. (Fig. 1). Except sanitary waste, other kinds of industrial wastes of textile, printing and dyeing, tobacco, pharmaceuticals industry, and food handling were discharged into moat, from there diffused to whole water system of the city. The releases of industrial effluent and sanitary waste were 5×10^4 – 6×10^4 t/d and 2.0×10^4 t/d, respectively, most of them were untreated and directly input to the three drainage systems of moat, River wulong and Lake Jiajiahu into corresponding lake and river, with little into River Yuanjiang. The total coliform (TC) density exceeded the state standard III degree of surface water quality by 4 orders of magnitude, and according to WHO recreational water standard, the FC density exceeded by 3 orders of magnitude. Furthermore, the enteric pathogenic bacteria such as *Salmonella* sp. were found in moat. Bacterial contamination in other

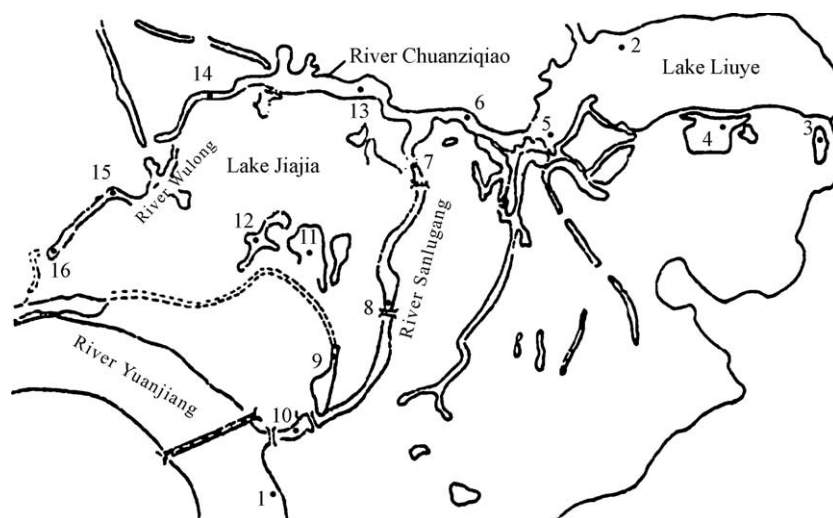


Fig. 1. Water system of Changde City and sampling stations.

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