

COMPOSITION AND DYNAMICS OF THE BACTERIAL COMMUNITY IN BOVAN RESERVOIR

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ABSTRACT. Investigations of composition and dynamics of bacterial community in Bovan reservoir were implemented from June 2005 to December 2006. The purpose of this research is to determine the composition and dynamics of the bacterial community in Bovan reservoir, and to give us a real picture about the quality of the water and biocoenose as a whole, on the basis of microbiological parameters significant as indicators of water quality. On the basis of results gained in this research, water in Bovan reservoir varies from relatively clean to moderately polluted water. Composition of bacterial community varies in the function of physico-chemical features, the state of other fact in biocenosis, eutrophication as well as anthropogenic influence. The total number of the bacterial community was $1,35 \times 10^6$ - $6,15 \times 10^6$ bacteria/cm³, changing during the season, in correlation with physical and chemical properties of the water as well as with other relevant factors in ecosystem. Chemoorganotrophs were dominant physiological group in the bacterial community, with maximum number in late summer – early autumn (August, September), and minimum number during winter season (January). This indicates correlation between the amount of organic matter in the water and the number of these bacteria. The value of T/H index, the percentage of heterotrophic bacteria in overall bacterial community as well as presence of indicators of coliform pollution, confirm earlier findings of strong anthropological influence, and the need to develop adequate monitoring system, and plan future steps in preservation and protection of the reservoir.

INTRODUCTION

Microorganisms are widely spread in lakes, actively taking part in transformation of organic matter, and as such they have a significant role in functioning of water ecosystems, in general. Present conditions in the community of microorganisms are true indicators of diverse and specific biochemical processes vital in valuation of quality, predicting the status and undertaking necessary actions in protection and improvement of aquatic ecosystems.

Bovan reservoir was built on the Moravica River in 1984 on level 261, 5 meters with maximum length 7.5 kilometers and width 550 meters. The total area of the lake is 4.15 square kilometers. The primary purpose of Bovan Reservoir was arrestment of

aqueous deposit sediment, irrigation and electricity [1]. Nowadays, it serves for water supply of Aleksinac Municipality. Earlier research, related to sanitary conditions [2] and water quality showed that Bovan Lake is highly influenced by anthropological pollution, and thus, in need of permanent monitoring [3,4].

The purpose of this research is to determine the composition and dynamics of the bacterial community in Bovan reservoir, and to give us a real picture about the quality of the water and biocoenose as a whole, on the basis of microbiological parameters significant as indicators of water quality.

MATERIAL AND METHODS

Microbiological explorations of the community of microorganisms in Bovan reservoir were being carried out from June 2005 to December 2006; water samples were collected monthly.

The samples were collected with a 2-liter Ruttner sampler from depths of 0.5, 10m and 30 m in Brana locality.

The following microbiological parameters were measured:

- Total number of bacteria/cm³ [5]
- Number of heterotrophic bacteria/cm³ [6]
- Index T/H
- *Escherichia coli*/100ml

Water quality classification was performed according to Tumpling [7], Sladaček [8], Kohl [9] and Ambrazene [10].

RESULTS AND DISCUSSION

Comparative view on the number of microorganisms, composition and dynamics of bacterial community in Bovan reservoir are shown in Fig 1-3.

The Total number of bacteria

Results gained by the investigation of the total number of bacterioplankton show its variations according to season and space (Fig .1). Values ranged from minimal $1,35 \times 10^6$ bact/cm³ measured in January 2006 to maximal $6,15 \times 10^6$ bact/cm³ in July 2006. Total number of bacteria was highly influenced by temperature and precipitation. According to the categorization by Ambrazane [10] the water in Bovan reservoir can be classified as insignificantly polluted water.

The community of aerobic heterotrophs

Heterotrophs (chemoorganotrophs) are widely spread group of bacteria in terms of metabolism. For them, organic matter is the source of carbon and energy and the donor of electrons as well [11]. They are the first link in the chain of decomposition of organic matter. They are of crucial importance in aquatic ecosystems as regulators of carbon cycling and other important nutrients like nitrogen and phosphorus [12]

According to the results of the research, it is concluded that the number of aerobic heterotrophs vary with seasons and depth. Minimal number was registered in April 2006 when there were 1430 heterotrophs/cm³ at a depth of 0,5m, and maximum 17200/cm³,

counted in August 2006 at a depth of 10 m. Average monthly values ranged from 2106/cm³ in April 2006 to 12933/cm³ in August 2006. According to the categorization of Kohl [9] the water of Bovan reservoir belongs to II and III class of water quality. According to the categorization of Tumlping [7], it belongs to II class, and according to categorization given by Sladaček [8] to II class. The maximal number of heterotrophs was registered in August due to the influx of sewage water coming from weekend settlements around the lake.

Vertical distribution of heterotrophs shows the greatest value in the contact layer, which is a usual thing in lakes with high biochemical activity between free water and sediment [13].

The Percentage of heterotrophs in the total number of bacteria

Percentage values of heterotrophs participation in the total number of bacteria, ranged from 0.06% in March 2005 up to 0.34% in September 2005.

Index T/H

Index T/H represents the relationship between the total number of bacteria (T) measured by direct methods and aerobic heterotrophs (H) determined by indirect growing methods. Index values are measured on the scale from 1 up to over 1000. Found value of T/H index determines the level of water pollution. If the value of the index is smaller, it means that water contains organic matter very much; therefore, it is more polluted. Measured values range from 233 (September 2005) to 2386 (March 2006). According to the classification of water based on T/H index, the water in Bovan reservoir vary from moderately polluted to clean water.

Coliform bacteria in Bovan reservoir

Determining the presence of coliform bacteria in water is another important criterion for valuation of water quality. Most Probable Number (MPN) varied from 220 to 3800, which according to microbiological criteria, responds to water standards provided for water of I-II classes. *Escherichia coli*, as a type of coliform bacteria, is examined in most cases because it is common in human digestive tract and thus, it is a specific indicator of fecal pollution. In most cases *E. coli* was present in summer months, while in winter months it was not determined. Besides *E. coli*, some other sorts of coliform bacteria were found in water specimen. They belong to the genus of *Citrobacter*, *Enterobacter*, *Klebsiella*. Species like *Streptococcus faecalis* and *Proteus* sp. were not found in any water specimen.

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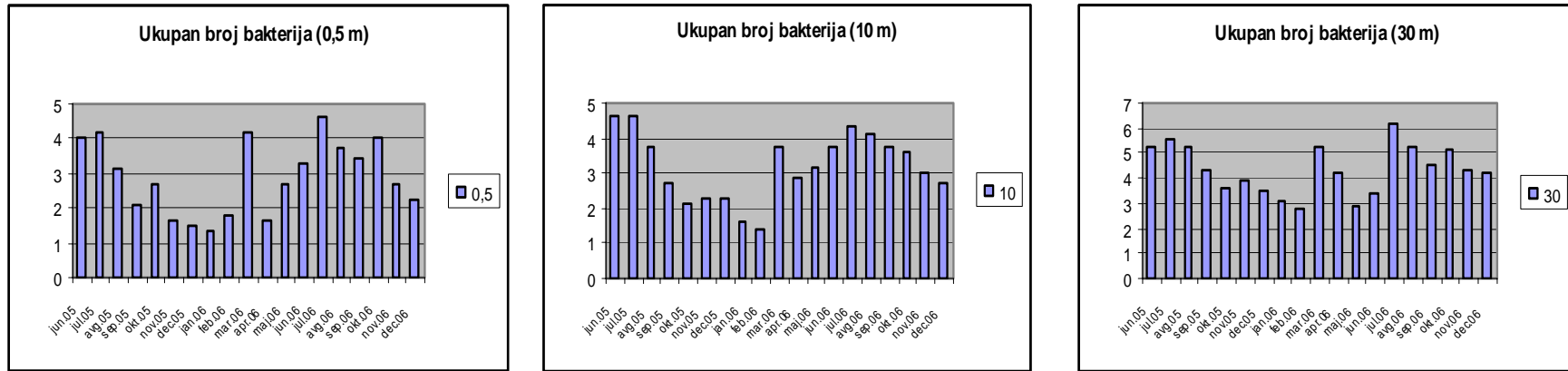


Fig.1. Spatial and temporal dynamics bacterial community in Bovan Reservoir

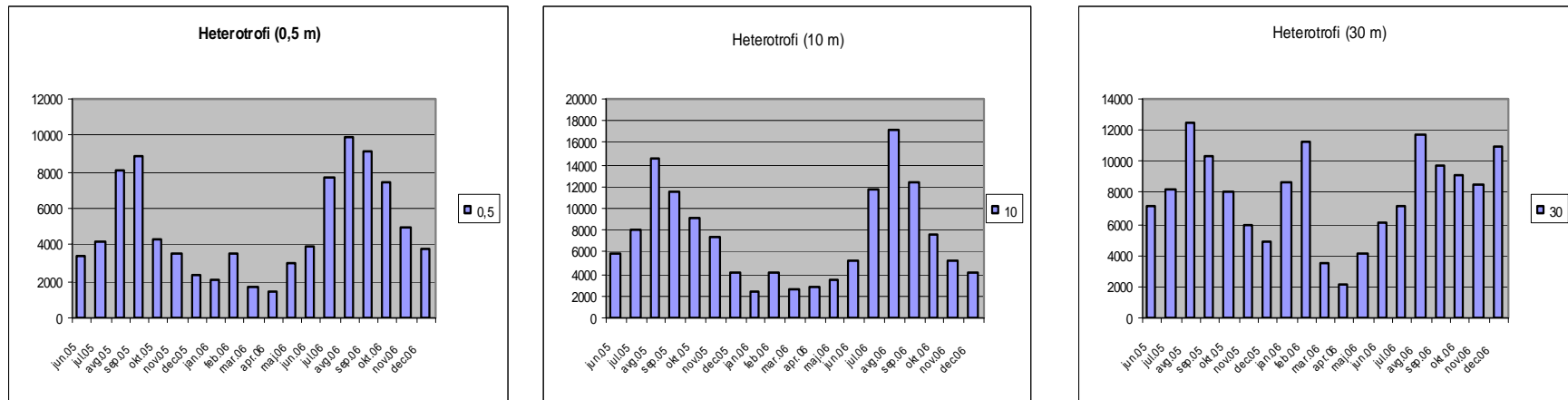


Fig 2. Spatial and temporal dynamics of heterotrophic bacteria in Bovan Reservoir

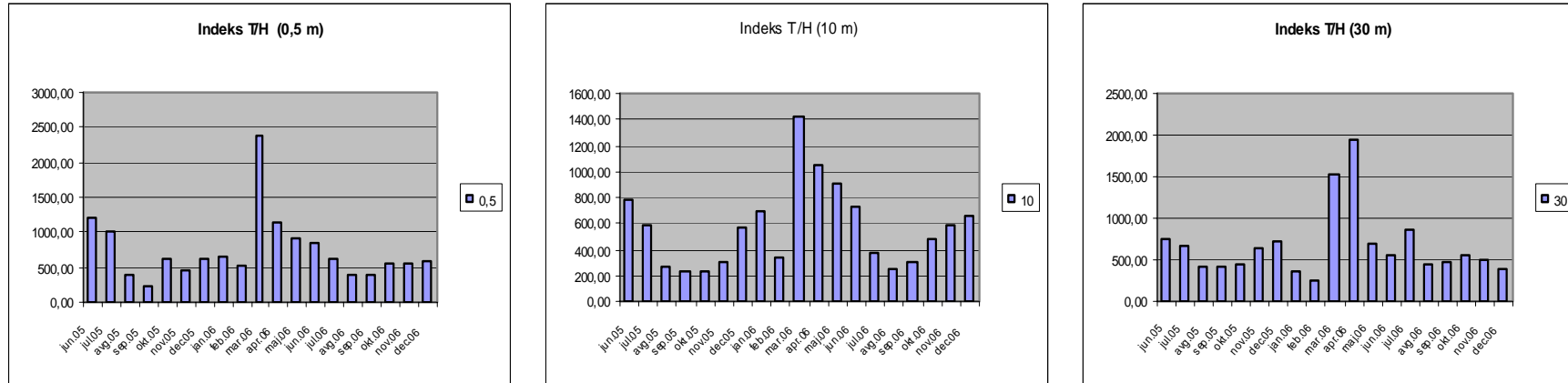


Fig.3. Relationships between total bacterioplankton and heterotrophic bacteria in Bován Reservoir (Index T/H)