ESTIMATION OF IRRIGATION WATER QUALITY USING COLIFORM BACTERIA, ZOOPLANKTON AND ZOOBENTHOS AS INDICATORS. **Zorka Dulić**[1], **I. Kljujev**[1], **Vera Raičević**[1], **Ivana Živić**[2], **Z. Marković**[1], **M. Stanković**[1], and **Vesna Poleksić**[1]. [1] *Faculty of Agriculture, University of Belgrade,* 11080 Belgrade, Serbia and [2] *Faculty of Biology, University of Belgrade,* 11000 Belgrade, Serbia

The prevailing conditions of a water source can be estimated using different bioindicator organisms. Coliform bacteria have been used to evaluate the general quality of water. Testing for coliform bacteria is faster and cheaper than testing for specific organisms and pathogens. Monitoring microbial water quality has been conducted for more than a century by measuring indicator bacteria that occupy human intestinal systems, primarily fecal coliforms, *Escherichia coli, Salmonella* spp., etc. Zooplankton and zoobenthos organisms are often used as bioindicators of water quality since they respond quickly to environmental change and may be effective indicators of alterations in water quality (Gannon and Stemberger, 1978). The purpose of this research was to estimate the quality of water for irrigation and aquaculture on the Experimental School Estate of the Faculty of Agriculture (Belgrade) using coliform bacteria, zooplankton, and zoobnethos as bioindicators. These investigations are a part of the EU-financed ongoing WATERWEB FP 6 INCO-West Balkan Project.

Water samples were taken from four different water sources: Šugavac Creek at two sites (where it enters and where it leaves the school estate) and two open wells. Sampling was carried out from April to October over two years of investigation. The number of coliform bacteria (total and fecal) was determined on MacConkey broth using the most probable number method (MPN). The presence of *E. coli* was determined using EMB Agar, that of *Salmonella sp*. using SS Agar. Species of pathogenic bacteria were identified with the aid of an API 20E instrument (Biomerieux, France). Zooplankton and zoobenthos samples were analyzed using keys for determination (Šramek-Hušek et al., 1962; Koste, 1978; Rozkošny, 1980). Based on the quantitative and qualitative composition of zooplankton in the open wells and zoobenthos in Šugavac Creek and occurence of the bioindicators listed by Moog (2002), we determined the saprobity index, a measure of water quality, using the Pantle-Buck method (Pantle-Buck, 1955).

Microbiological analysis of water quality

The highest number of coliform bacteria in the entrance of the Šugavac, near Belgrade, was in April and May of 2005 and in July of 2006. The number of coliform bacteria in the exit of Šugavac was highest in April of 2005 and December of 2006. Indicator coliform bacteria show that the exit of the Šugavac is much more polluted than its entrance. High levels of indicator bacteria suggest the possible presence of pathogens that cause such water-borne diseases as gastroenteritis, bacillary dysentery, etc. (Myers and Sylvester, 1997). The results show that there were more coliform bacteria in open well 2 than in open well 1 during the two years. The highest number of coliform bacteria in the open wells (1 and 2) was in April and July of 2005 and in July and August of 2006. As a result of freshwater beach studies, the U.S. Environmental Protection Agency recommended the use of *E. coli* or enterococci as better indicators of water quality (U.S. Environmental Protection Agency, 1986). *Escherichia coli* was determined in all investigated samples of water. *Salmonella spp.* was identified only in the exit of the Šugavac and open well 2. Specific types of fecal coliform bacteria (such as *Escherichia coli*) are more closely linked with gastrointestinal illness than the more general fecal coliform bacteria (Dufour, 1984).

Analysis of water quality using zooplankton and zoobenthos

In all of the investigated water sources, water quality as determined using zooplankton and zoobenthos was mainly in class II during the two years. In the open wells, water quality was sometimes between classes I and II, while in the exit of the Šugavac it was occasionally in class III. The water of Šugavac Creek had an overall higher saprobity index (S>2) and was generally more polluted than that of the open wells (S<2) in both years of investigation. Wells 1 and 2 showed similar quality, which did not vary from one year of investigation to the next. The difference of water quality between the two sites on the Šugavac was greater than that between the wells. The obtained results showed that water from all of the investigated sources is moderately polluted. This water cannot not be recommended for irrigation without prior treatment, especially not for irrigation of vegetables that are used fresh, but it can be employed as a water supply for experimental carp ponds.

References - Dufour, A. P. (1984). *U.S. Environmental Protection Agency,* EPA-600/1-84-004, 33 pp. – Gannon, J. E., and R. S. Stemberger (1978). *Trans. Am. Microscop. Soc.* **97**, 16-35. - Koste, W. (1978). *Uberordung Monogonta. 2. Auflage. I. Textband,* 645 pp.; *II Tafelband,* 673 pp. Gebrüder Borntraeger, Berlin-Stutgart. - Myers, D. M., and M. A. Sylvester (1997). *U.S. Geological Survey Techniques of Water-Resources Investigations*, **9**, Chapter A7, 49 pp. - Moog, O. (Ed.) 2002. *Bundesministerium*

für Land-und Forstwirtschaft, Umwelt- und Wasserwirtschaft, Wien. -Pantle, E., and H. Buck (1955). *Besondere Mitteilung in deutschen Gewässerkündlichen,* **12**, 135-143. - **Rozkošny, R.** (1980). *Československa Akademie Věd. Praha,* Praha. 524 pp.

-**Šramek-Hušek, R., Straškraba, M., and J. Brtek (1962).** *Fauna ČSR, Československa Akademie Ved,* Praha. **15**, 470 pp. - U.S. Environmental Protection Agency (1986). *Ambient Water Quality Criteria for Bacteria. EPA Publication No..* 440/5-84-002, 18 pp.