

Student Scientific Conference:

BRNO RESERVOIR – CYANOBACTERIA AU REVOIR? (SCIENCE AT PRÍGL)



2014

16th May, Brno, Czech Republic

Conference Book

Masaryk University
Brno

Brno Reservoir - Cyanobacteria Au Revoir

“Science at Prigl”

16th May 2014

Masaryk University, Faculty of Science
Brno, Czech Republic



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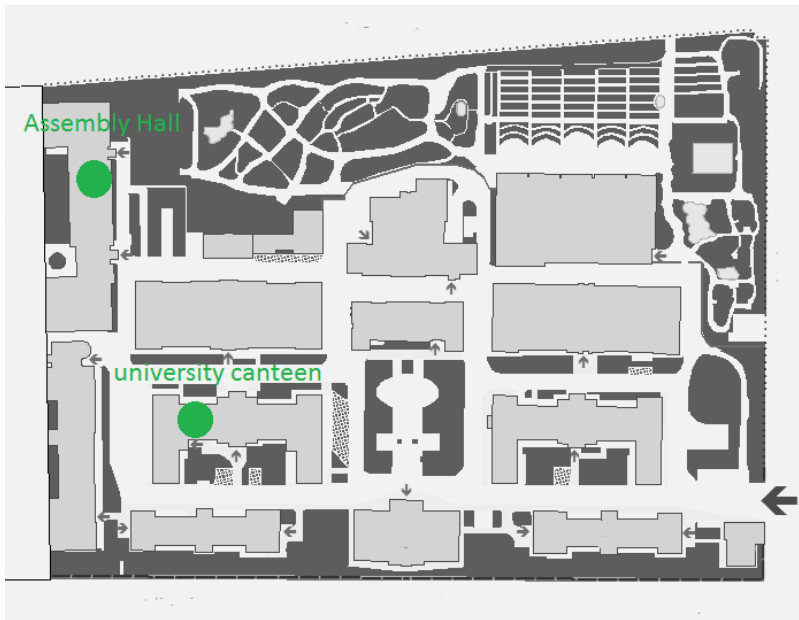
Brno 2014

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1● info

Date: Friday 16th May 2014
Address: Masaryk University
Faculty of Science
Kotlářská 2, Brno
Room: Assembly Hall
A 01026



2 • preface

This multidisciplinary scientific conference is organized by the students of the 'English for Scientists' course held at the Faculty of Science, Masaryk University. It deals with topics related to the Brno reservoir and aims to support a multidisciplinary approach to this issue by bringing together students of a wide range of study branches, perspectives, and backgrounds. The conference is also intended to contribute to students' professional communication and presentation skills development, which will be required in their future careers.

3 ● committees

Scientific committee

Mgr. Tomáš Kuchovský, Ph.D.

Mgr. Zdeněk Hromádka, Ph.D.

Mgr. Jarmila Burianová, Ph.D.

Mgr. Pavla Řezníčková, Ph.D.

Mgr. Dominik Heger, Ph.D.

Ing. Petra Rozehnalová

Language committee

PhDr. Hana Němcová

Mgr. Eva Čoupková , Ph.D.

James Edward Thomas, M.A

Mgr. Jana Kubrická

Mgr. Robert Helán, Ph.D.

Mgr. Věra Hranáčová

Mgr. Jana Kollárová

Mgr. Markéta Kovaříková

Organizing committee

Katarína Mlynáriková

Pavλίna Víšková

Bc. Martin Kubeš

Soňa Dvořáková

Dajana Snopková

Dominika Fialová

Karolína Klempířová

Pavla Plachtová

4 ● programme

7:30 – 8:00 **Registration, check-in**

8:00 **Opening**

Session 1 – Washing, washing up and what it leads to

Chair: Eva Lukáčová

Presenters: Soňa Dvořáková (BI)

Matěj Sklenář (BCH)

Pavλίna Víšková (BCH)

Matouš Janča (BI)

8:50 **Session 2 – Phosphorus sources**

Chair: Eva lukáčová

Presenters: Tomáš Fiala (OCH)

Martin Kubeš (BI)

Pavla Plachtová (E-TOX)

9:30 Coffee Break, Refreshments, and Poster Display

Posters: Floods in Brno - Dajana Snopková (GE)
Brno reservoir as a place for sport and recreation
- Martin Musil (GE)

9:50 Session 3 – Functions of Brno reservoir

Chair: Tomáš Fiala
Presenters: Marta Šlapanská (FY)
Dominika Fialová (EN)
Vladimír Sedláček (M)

10:30 Session 4 – Cyanobacteria

Chair: Tomáš Fiala
Presenters: Katarína Mlynaríková (BI)
Eva Lukáčová (BI)

10:55 Session 5 – Management measures

Chair: Tomáš Fiala
Presenters: Karolína Klempířová (BI-M)
Ľuboš Sokol (GE)
Pavína Vyletová (M)

11:15 Awards and Farewells

5 • biosketches

Soňa Dvořáková

Soňa Dvořáková is a second-year student of the Bachelor's degree programme. Her field of study is Molecular Biology and Genetics. Her Bachelor thesis will be describing principles that lead to programmed cell death. She is also interested in legislative precautions that consider current biology research and health service.

Bc. Tomáš Fiala

Tomáš Fiala obtained his Bachelor's degree in Chemistry from Masaryk University in 2013. In the same year, he published his first scientific article titled Synthesis of Norbornahemicucurbiturils in the impacted journal Synlett. He is currently pursuing his Master's degree with prof. Vladimír Šindelář. His present research concentrates on supramolecular chemistry of macrocyclic molecules, especially their interactions with organic phosphates.

Dominika Fialová

Dominika Fialová is a second-year student of the Bachelor's degree programme of Mechanical Engineering at the Faculty of Mechanical Engineering, Brno University of Technology. In 2013, she participated in the project Partnership in the energy sphere. Her research focused on creep resistant materials, and was carried out in cooperation with the company VÍTKOVICE ÚAM a. s. and NETME Centre at BUT. Her present work concentrates on thermal-hydraulic simulations of heat exchangers.

Matouš Janča

Matouš Janča is a Bachelor's degree student of Environmental and Evolutionary Biology and his field of interest is zoology. It is his second semester, so he has not started any Bachelor thesis yet. Also his scientific life is incomparable with his fulfilling and energetic student life. He is really lucky, because all of these beautiful scientific topics and studies are still ahead of him.

Karolína Klempířová

Karolína Klempířová is in her first year of teacher studies of Mathematics, Faculty of Science, and Music Education, Faculty of Education. As she has been playing the cello and the double bass for many years, her main topic of interest is how education in music influences study skills in other subjects.

Bc. Martin Kubeš

Martin Kubeš is a student of the Master's degree programme of Molecular Biology and Genetics at Masaryk University. He focused on the endothelial glycocalyx research in his Bachelor studies, and now he concentrates on the relationship between gamma delta T – lymphocytes and multiple myeloma at the Department of Pathophysiology, the Faculty of Medicine. Besides that he attended the programme supporting talented students in the South Moravian region. He was also a participant in the StarCube programme organised by the South Moravian innovation centre.

Eva Lukáčová

Eva Lukáčová is a second-year student of Masaryk University. She studies Medical Genetics and Molecular Diagnostics at the Faculty of Science and Faculty of Medicine. Her Bachelor thesis will deal with the prenatal genetic diagnostics of monogenic hereditary diseases.

Katarína Mlynáriková

Katarína Mlynáriková is a Master student of Microbiology and Molecular Biotechnology at Masaryk University. She has been participating in research projects at the Department of Microbiology of the Faculty of Medicine and St. Anne's Faculty Hospital since her first year of studies. Her work focuses on clinically important yeasts and their diagnostics. She is currently investigating the possibilities of rapid detection of virulence factors in yeasts.

Martin Musil

Martin Musil is a first-year student at the Faculty of Science at Masaryk University in Brno. His field of study in the Bachelor course is Applied Geography and Geoinformatics. In his future scientific research he will focus on sustainability. His specialization will be centered on landscape ecology and land-use. Aim of his research is to study the negative impacts of society on landscape and nature, and how to prevent these negative effects.

Pavla Plachtová

Pavla Plachtová earned her Bachelor's degree in Biochemistry at Masaryk University in 2011 and her Master's degree in Environmental Chemistry in 2013. That year she joined the doctoral program in Ecotoxicology and started working on her dissertation thesis at the Institute of Botany of the Academy of Sciences. She focuses on ecotoxicity of nanomaterials, especially iron complexes intended for the purification of the contaminated water and the soil remediation. She published her research in the international journal Sustainable Chemistry & Engineering.

Vladimír Sedláček

Vladimír Sedláček is a second-year student of the Bachelor's degree programme at the Faculty of Science, Masaryk University. His field of study is Mathematics; he is interested especially in Algebra and Number Theory. Among his recent accomplishments there is the second place in the Nationals SOČ 2012 (Středoškolská odborná činnost), and the bronze medal in IMC 2013 (International Math Competition). He is also a member of JČMF (Jednota českých matematiků a fyziků), and organizes BRKOS (Brněnský korespondenční seminář) and BRLOH (Brněnská logická hra) competitions for younger students.

Matěj Sklenář

Matěj Sklenář is a student of Biochemistry at Masaryk University. He is in the first year of the Bachelor's programme. He worked at Microbiology and Molecular Biology departments at the Laboratory of metalomics and nanotechnologies at Mendel University with prof. René Kizek for two years. He succeeded in the high school scientific competition SOČ – he obtained the first place at the national exhibition with the study The Use of Nanotechnologies As Modern Tools to Treat Infections Caused by

Multiresistant Bacteria Strain. Then he achieved the second place at the MendelNet PhD conference with an analogous thesis. He has recently started working at the laboratory of associate prof. Omar Šerý where he is going to work on his Bachelor thesis.

Dajana Snopková

Dajana Snopková is a first-year student of the three-year Bachelor course programme of Geographical Cartography and Geoinformatics at the Faculty of Science at Masaryk University in Brno. Although she has no previous experiences in the field, she would like to dedicate herself to further scientific research. Her specialization will probably be geospatial analysis of natural phenomena and their cartographic representation.

Bc. et Bc. Ľuboš Sokol

Ľuboš Sokol is a Master student of Geology at Masaryk University. In his studies he focuses on tectonics and structural geology. In 2012 he obtained a Bachelor degree in Geology and a Bachelor degree in Archaeology. His Bachelor thesis in Geology deals with tectonics in the Low Tatra Mountains, and his Bachelor thesis in Archaeology discusses antler hammers of otomany-fuzesabony culture from the older Bronze Age. In 2013 he spent 5 months at the University of Oviedo (Spain) improving his knowledge of Structural Geology and Economic Geology. Currently he continues with his work on tectonics of the Low Tatras with associate prof. Rostislav Melichar. In 2012 and 2014 he participated in conferences of the Central European Tectonic Groups.

Marta Šlapanská

Marta Šlapanská is a second-year student of the three-year Bachelor course in General Physics at the Faculty of Science at Masaryk University in Brno. Her current research focuses on the study of solids. It is also the theme of her Bachelor thesis.

Pavλίna Vίřková

Pavλίna Vίřková is a student of Biochemistry - currently a second-year student of the Bachelor's degree programme at the Faculty of Science, Masaryk University in Brno. She is interested in Molecular Biology and Biochemistry in medical use – diagnosis or possible cure for human diseases. This year she participated in an internship aimed at the RealTime PCR methods and, recently, she has joined a research team at CEITEC (Central European Institute of Technology) where she has started studying chemical signalling cascades and interactions of proteins which may later become the starting point of her Bachelor thesis.

Pavλίna Vyletová

Pavλίna Vyletová is a third-year student of a multi-branch Bachelor study at the Faculty of Science and Faculty of Economics and Administration, Masaryk University. Her field of study is Applied Mathematics and Economics. In her Bachelor thesis she focuses on convergence among European Union countries in terms of energy intensity levels.

6 • abstracts

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Sources of phosphorus and pollution

Soňa Dvořáková

Excess phosphorus is a concern for all ecosystems. In natural environment, the amount of phosphorus is restricted. Its absence limits the growth of plants, fungi, and bacteria. Agricultural areas surrounding Brno reservoir affects phosphorus levels and disrupts the natural equilibrium. Due to human activities the level of phosphorus rises and pollutes aquatic ecosystems, the Brno reservoir being no exception. This presentation will review the sources of phosphorus pollution and divide them into categories. It will also provide basic information about the incorporation of phosphorus into natural matter, and difficulties that arise from this.

Notes:

Phosphorus in detergents

Matěj Sklenář

This study defines the composition of dishwasher and laundry detergents used daily in millions of homes. It briefly describes the mechanism of tensides. In addition, it summarizes the main commercially available detergents by arranging them in a table with the trade name, producer, content of phosphorous, and price. Another part of the study compares two ways of cleaning dishes: dishwasher use and manual washing-up. The comparison illustrates two points of view: 1) economical aspects and 2) ecological aspects. The analysis showed that using a dishwasher is more economical than washing-up manually. When phosphate free detergents are used, there is no negative ecological impact on the environment.

Notes

Laundry and dish washer detergents

– do we care?

Pavλίna Víšková

Laundry and dish washer detergents play an important role in water pollution – including the Brno reservoir. As one of the most significant sources of phosphorus, these detergents have a strong impact on the environment, causing eutrophication. This study aims to demonstrate how the laundry and dish washer detergents influence the environment and to inform about possible alternatives. The second section focuses on the extent to which people are acquainted with the content of detergents that they use in their households and how knowledgeable they are about phosphorus. We conclude with a brief summary of the European Union attitude towards phosphorus and phosphorus-free detergents.

Notes

(Mis)conceptions of the problems associated with Brno reservoir

Matouš Janča

The aim of this study was to find out what local people really know about problems associated with the Brno reservoir. The study focuses on the consumer behaviour and its impact on the environment. The data for this study was collected via an interview. The questions can be divided into three different groups. The first group of questions is about general survey of participants. The second group focuses on consumer behaviour. And the aim of the third group is to find out their personal attitudes to the problem. Based on the results, it can be claimed that the people are mostly unaware that using washing machines is closely related with eutrophication, even though they aware of cyanobacteria in the Brno reservoir.

Notes

Fertilizers - both blessing and a curse

Tomáš Fiala

The mass use of fertilizers in agriculture has been a controversial topic in the past decades. While the amount of fertilizers being applied is increasing due to the high demand for food, new norms and restrictions attempt to minimize the drawbacks of releasing these chemicals into the environment. This presentation will review the basic principles of the functioning of fertilizers, namely providing plants with the key elements, phosphorus and nitrogen. The fate of fertilizers in the environment will also be discussed, with an emphasis on the transport of the chemicals into surface water and the eventual cause of eutrophication.

Notes

Precipitation of phosphorus

Martin Kubeš

Phosphorus is a chemical compound which naturally occurs in water bodies. Because of human activity, the phosphorus level increases in water way below the natural limit. This phenomenon induces several detrimental effects on the water environment. Living organisms concentrate phosphorus in much higher concentrations than water itself and utilize it as a building block of their cells. Small fast-growing organisms, such as cyanobacteria and algae, have enough energy to overpopulate when there is a surplus of phosphorus. This rapid growth leads to an algal bloom. To prevent any algal bloom, it is necessary to know how phosphorus can be precipitated from water bodies to re-establish a natural equilibrium. Using our knowledge of the solubility product equation, it is possible to precipitate phosphorus chemically. This study focuses on the three most used methods of chemical precipitation of phosphorus from water bodies.

Notes

How does a waste water treatment plant work?

Pavla Plachtová

Waste water is any water that has been adversely affected in quality by anthropogenic influence. Municipal waste water is produced every day by human activity – it comes from households, offices, small traders, and others. In addition to sewage contaminated with faeces and urine, municipal waste water also contains rinse water and rainfall runoff. Waste water flows through sewers into urban waste water treatment plants where it is processed before it is discharged into receiving water. This presentation will explain how the Brno-Modřice waste water treatment plant works. It will provide basic information about both waste water treatment and sludge management from toilet flush to the release of treated water into the Svratka river.

Notes

Hydroelectric power plants and their role in our lives

Marta Šlapanská

Hydroelectricity refers to electricity generated by hydropower, i.e. the production of electricity through the gravitational force of falling or flowing water. It is the most widely used form of renewable energy, accounting for 16 percent of global electricity generation. Hydropower is one of the most environmentally friendly energies. One type of hydroelectric power plant is built alongside reservoirs. The dams can be used not only for producing electric energy, but they can also prevent smaller floods, they can be used for recreational purposes or as a source of potable or process water and they are often suitable for river fishing.

Notes

Performance assessment of Brno-Kníničky hydroelectric power plant

Dominika Fialová

Hydroelectric power plants are the most important sources of renewable energy in the Czech Republic even though they are usually designed to overlay higher energy consumption at peaks, which is the main purpose of Brno-Kníničky hydroelectric power plant. The aim of this presentation is to give an overview of the construction and technical parameters of Brno-Kníničky hydroelectric power plant. One type of turbine plays a vital role in the performance of the power plant therefore particular attention is paid to the Kaplan turbine installed at Brno-Kníničky. Consequently, this presentation shows the high value of the power plant that is part of the Brno dam.

Notes

Regulation of the floodgates through fuzzy logic

Vladimír Sedláček

This study focuses on the possibility of controlling the floodgates of a reservoir by means of fuzzy logic. This type of logic introduces an infinite number of truth values that allow one a more realistic descriptions of the world (because they reflect the concept of “vagueness”). This is especially useful in control theory. Linguistic variables are used to create a set of rules which dynamically determine the behaviour of the control unit in dependence on various factors at any given moment. In this case, the control unit are the floodgates, which regulate the amount of the water released, and the factors are the water level and the water outflow. The study concludes with a model that demonstrates this technique on real data from the Brno reservoir.

Notes

The characteristics, biology, and ecology of cyanobacteria

Katarína Mlynáriková

Cyanobacteria are prokaryotic organisms belonging to the kingdom, *Eubacteria*. They can be found in almost all aquatic and terrestrial environments. They obtain energy through photosynthesis. Oxygen produced during this process in *Cyanobacteria* has contributed to significant changes in the atmosphere and therefore this group of microorganisms has influenced the evolution of many life forms in the Earth. However, a particular species of *Cyanobacteria* can produce toxins which may have a harmful effect on living organisms in the ecosystem as well as on human health.

Notes

Eutrophication

Eva Lukáčová

Eutrophication is a serious water pollution problem which has lasted for decades. It can be either human-caused or natural and it is brought about by nitrogen and phosphates. It is becoming more widespread and, for instance, more than half of the lakes in Europe are eutrophic. Eutrophication may cause cyanobacteria blooms, which is a problem with many negative consequences such as a decrease in water quality, the depletion of oxygen, and the production of cyanotoxins. Some species of cyanobacteria may experience an increase in population that negatively affects other organisms. The negative environmental effect is a reduction in biodiversity. The Brno reservoir, in which a large quantity of cyanobacteria has been found in recent years, illustrates an example of eutrophication.

Notes

Sedimentation velocity due to the radius and density of particles

Karolína Klempířová

The sedimentation of particles from the drainage basin to the bottom of reservoirs may cause serious problems. Stoke's Law, derived from particle buoyancy, describes the relationship between sedimentation velocity in a gravity field, and particle density and size. By adding flow velocity to Stoke's Law, the distance of particle sedimentation is obtained. Applying this new formula to real data, a theoretical model of sediment distribution can be made. Using graphs I will demonstrate that particles of a higher density and bigger size settle faster and in greater distance, and this distance also increases with flow velocity and water level.

Notes

Sedimentation in Brno Reservoir

Luboš Sokol

Artificial lakes and reservoirs, such as the Brno reservoir, act as effective traps for fluvial material. Sedimentation leads to a decrease in the storage capacity of reservoirs. Studies of reservoir deposits also reveal the erosion history of watershed, climatic conditions during sedimentation, the contamination history of the area and past environmental changes. This presentation describes the basic geology of the Svatka river watershed and establishes the size and density of particles deposited in the reservoir. Various methods, such as analysis of grain size, magnetic susceptibility, analysis of isotopes (^{137}Cs , ^{210}Pb , ^{238}U concentrations), were used by Nehyba et al. (2011) to describe the fluvial deposits of Brno reservoir and determine depositional rates. This research showed that sedimentary succession in the reservoir consists of two main units – a lower slightly coarse-grained unit and upper fine-grained unit. Increased concentrations of ^{137}Cs were attributed to the Chernobyl reactor accident in 1986 and atomic weapon testing in 1963, which reveals a mean depositional rate of 3.2 cm year^{-1} . Finally, the presentation compares the depositional rate in the Brno reservoir with rates in other reservoirs.

Notes

Sediment removal – costs and benefits

Pavλίνα Vyletová

Cost-benefit analysis is an approach widely used in the economic effectiveness evaluation of public projects. It helps in decision-making processes to determine the most suitable alternative for a project or policy. This presentation firstly introduces the basic steps of the cost-benefit analysis and afterwards shows its possible applications to the evaluation of sediment management strategies in reservoirs. By way of illustration, it shows a comparison of two alternatives, sustainable and non-sustainable, which does not include sediment removal. In this way, the economic effect of sediment removal can be expressed. Finally, the presentation highlights some of the key parameters influencing the final economical value of both alternatives.

Notes

History of floods and flood risk management on the Svatka river in Brno

Dajana Snopková

The poster analyses the influence of the Brno reservoir on flood situations on the Svatka River in Brno. It focuses on the biggest floods before and after the construction of the Brno reservoir. However, measurement records are available only from 1928, therefore historical annals were used to enable longer-period analysis. This study also provides maps of flood plains and flood risk management in connection with the usage of urban areas, which could be useful to prevent flood damage and casualties. As the poster indicates, floods in the Czech Republic are the most dangerous and frequent natural disasters and therefore it deserves more attention.

Notes:

Brno reservoir as a place for sport and recreation

Martin Musil

The Brno reservoir is situated in Brno-Bystrc and it was designed to protect this district from floods. It accumulates water and generates hydroelectric power. But this does not account for all of its functions: it is also an important place for recreation. The Brno reservoir is a very popular tourist attraction of Brno with thousands of people visiting it annually. The aim of this work is to describe its major leisure activities and events. It focuses on the spatial analysis of sports and activities that are offered in the areas close to the lake.

Notes: