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Stockholm *Junior* Water Prize

HUNGARY

2023

ABOUT THE STOCKHOLM JUNIOR WATER PRIZE

The Stockholm Junior Water Prize (SJWP) was established in 1997 and is an annual competition open to young people between ages 15 and 20, who have conducted water-related projects focusing on local, regional, national or global topics of environmental, scientific, social or technological importance. The Stockholm International Water Institute administers the Stockholm Junior Water Prize and it serves as its secretariat (www.siwi.org/prizes/stockholmjuniorwaterprize/).

The Stockholm Junior Water Prize consists of two parts: the National Competition and the International Final. All participating countries organize their own National Competition. The winner proceeds to the International Final in Stockholm. As a result of the competitions, thousands of young people around the world develop personal interests, undertake academic studies and often pursue careers in water or environment-related fields.

The International Final takes place during the World Water Week in Stockholm, an ample event where water people from all over the world meet. This generates many opportunities for networking and exposure. The efforts of the participating countries are highlighted globally. The winner of the Stockholm Junior Water Prize receives a 15,000 USD award, a crystal prize sculpture, a diploma, as well as the stay in Stockholm. Nevertheless, the participation is what genuinely matters.

H.R.H. Crown Princess Victoria of Sweden is the Patron of the Stockholm Junior Water Prize.

HUNGARY AND THE SJWP

Hungary joined the SJWP in 2013. Dr. János Áder, the former President of the Republic, has been the patron of the competition since 2014. The national organizer of the SJWP is the GWP Hungary Foundation in agreement with the Stockholm International Water Institute. Details of the competition are available at www.ifivizdij.hu.

Previous winners of the national competition

2013: Dézi Kakas, János Béri and Péter Polák Jr. (Fényi Gyula Jezsuita Gimnázium és Kollégium, Miskolc) – Project title: The Importance of the Szinva Stream: Biological and Chemical-Physical Examinations

2014: Claudia Li, Lívia Mayer and Nikolett Sebestyén (Eötvös József Gimnázium és Kollégium, Tata) – Project title: Our Water is Our Future

2015: Márton Czikkely, Tamás Gergely Iványi and Tamás Márkus (Városmajori Gimnázium, Budapest) – Project title: The Secrets of Drinking Water – How to Combat Polyethylene Terephthalate

2016: Dávid Kovács and Ákos Iván Szűcs (Kecskeméti SZC Kada Elek Technikum, Kecskemét) – Project title: What Can We Gain by Using Grey Water?

2017: Anna Tari, Kristóf Stefán and Nikolett Szabó (Kőbányai Szent László Gimnázium, Budapest) – Project title: „Tanks of Water"

2018: Bence Zsolt Rappay (I. Béla Gimnázium, Szekszárd) – Project title: „Hillside water management and possibilities of melioration in the Csatári-valley"

2019: Eszter Kun (Móricz Zsigmond Gimnázium, Szentendre) – Project title: „Growing plants, growing minds with educational aquaponics system"

2020: Dóra Alexandra Gyémánt and László Török (Radnóti Miklós Kísérleti Gimnázium, Szeged) – Project title: „Detecting the toxin production of the Microcystis species in hungarian lakes"

2021: Emília Kovács (Kisvárdai Bessenyei György Gimnázium, Kisvárda) – Project title: „Fermentation of alfalfa brown juice and its environmental friendly reusing"

2022: Balázs Andócsi and Olivér Herceg (Béla I. Grammar School, Szekszárd) – Project title: „Development of a Protection Method Against Soil Erosion and Water Conservation in Szekszárd"

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The Hungarian Prize 2023

Jury members during the national final

Eight entries were received for the 2023 Hungarian National Competition. Altogether, there were eleven secondary school students involved, participating either as individual contestants, or as teams of two members. The projects were written in English, according to the requirements of the call and dealt with different topics, such as water reuse, the quality of drinking water and of surface waters, environmental awareness, eutrophication, wastewater treatment. Six projects were selected by the jury for the national final on the basis of the SJWP judging criteria. The Hungarian National Final was organised at the Hungarian Water Utility Association (MaVíz) in Budapest on the 20th of May 2023. The finalists were requested to prepare a Power Point presentation displaying the results of their project.

During the final, the contestants presented their main findings and answered the jury's questions. Approximately 15 minutes per team were allocated. The presentations and the interviews were conducted in English.

THE JURY OF THE SJWP – HUNGARY 2023

Chair:
•*András Szöllősi-Nagy,* professor, National University of Public Service

Members:
•*Sándor Baranya*, associate professor, Budapest University of Technology and Economics

•*Anna Bérczi-Siket,* consultant

•*Adrienne Clement,* associate professor, Budapest University of Technology and Economics

•*Tamás Gampel*, business development director, Xylem Water Solution Hungary

•*Veronika Major,* vice president, MaSzeSz

•*Edit Nagy,* secretary general, Hungarian Water Utility Association

•*Szilvia Szalóki*, vice president, Hungarian Energy and Public Utility Regulatory Authority

•*Danka Thalmeinerova*, consultant

Secretary:
•*Monika Jetzin*, GWP Hungary Foundation

ACTION PLAN: PRESENTATION OF THE ROLE OF THE WHITE LAKE OF GÁTÉR AND ITS CLIMATIC EFFECTS ON THE REGIONAL WATER SYSTEM AND THEORETICAL EXAMINATION OF THE POSSIBILITIES OF FLOODING IN THE SITES ALONG THE FÉLEGYHÁZI WATERCOURSE

János Szécsényi, Eliza Nagy – Déli ASzC -Kiskunfé-legyházi Mezőgazdasági és Élelmiszeripari Technikum, Szakképző Iskola és Kollégium, Kiskunfélegyháza

"The area of White Lake Gátér is an ex lege protected area belonging to the Natura 2000 network. In the first part of our work, we would like to present the common characteristics of these protected areas, with special regard to the characteristics of our examined sites.

Nowadays, due to agricultural work and pollution, as well as climate change, groundwater levels and the level of our standing water are constantly decreasing. In the second part of our action plan, we would like to present the problems that have led to anomalies in water management in these protected areas. The life-giving water provides the vital conditions for nutrition and reproduction for many living creatures, including many native species. In this section we would also talk about these species, with special regard to the area of White Lake Gátéri. The protection of our waters is the responsibility of every person, so in our last final chapter we would like to outline the solutions we propose to the problems identified above. Mainly on flooding methods of grasslands and agricultural areas in Natura 2000 areas and White Lake Gátéri, as well as other protection measures."

RELATIONS BETWEEN COMPOSITION OF FISHES AND HYDROMORPHOLOGICAL VARIABLES IN A VERY LARGE RIVER

Benedek Jandó – Veres Pálné Gimnázium

„Today, in any field of science, we can observe interdisciplinary directions, which are born from the fusion of related disciplines. By combining scientific fields and at the same time comparing the methods of different fields, we can get answers to new questions that go beyond a single subject. Understanding the niche model of ecology gives a new dimension to the complex study of the composition of living communities. The habitat of each population is determined by biotic and abiotic factors. The examination of biotic variables is the task of ecology, while abiotic variables cannot be examined with ecological methods, as the scales often used for their evaluation are too robust for detailed analyses. The measurements carried out by hydrologists and hydraulic engineers can provide a much more accurate description of these abiotic variables, so by combining the two, we can discover new relationships. In this study, we assigned the data of the 20 most common fish species in the Hungarian section of the Danube River from 2004 to 2022 to the data of hydrological datasets and hydrodynamic simulation models, and looked for patterns among them using Machine Learning (ML). Among the nine abiotic factors used as independent variables in the analysis, the average depth velocity, water depth and bed material composition were the most decisive variables, which aligns with the results of previous research. In addition, with our Random Forest model, we were able to predict the number of individuals of the 20 most common fish species in the given conditions in the entire Hungarian section of the Danube. These estimates refer to optimal habitat for fish species according to abiotic variables. The model gives accurate values only in a narrow range, the so-called hydromorphological optimum, where our variables determine the abundance of fish. The results of the studies showed that in most cases biotic factors are more dominant than abiotic variables. In addition to the ML analysis, we showed the possibility of using the Danube fish faunistic database, which covers a large area and time, to investigate the relationships of the population (for example, the relationship between invasive and native species) using classical statistical methods. The results found here are in many cases consistent with the Random Forest model, but give reason to extend the model with additional independent variables in order to better understand the ecology of the Danube fish species."

NAVIGATING THE WATERS OF PUBLIC AWARENESS: AN AI-ASSISTED ANALYSIS OF ONLINE WATER MANAGEMENT EDUCATION IN HUNGARY AND OUTLOOK TO DEVELOPING COUNTRIES

Márton Reich – Toldy Ferenc Gimnázium, Budapest

"This work aims to investigate the society's role in water management. By focusing on social aspects, the author seeks to understand how online information influences public awareness and behavior.

By utilizing AI tools like ChatGPT, the digital content on water's importance, quality, and management in Hungary has been analyzed and evaluated by comparing it to a reference document, the National Water Strategy, also chosen by the AI. The paper also recommends a strategy to extend this research method for developing countries as future research."

THE IMPACT OF THE EURASIAN BEAVER (CASTOR FIBER) ON THE WATER LEVEL AND WATER QUALITY OF RIVERS

Sára Barta – Szombathelyi Nagy Lajos Gimnázium, Szombathely

"When the Eurasian Beavers were returned to the continent by WWF, they have produced significant alterations to the environment, which has resulted in the need for more research to evaluate the impact that they have had.

Beavers are sometimes referred to as the "engineers of the ecosystem", and this reputation is supported by the fact that the quality of the water and, consequently, the lives of other organisms in the ecosystem have been modified as a direct and indirect result of the changes that beavers have brought about. Taking water samples from both above and below dams in order to do a side-by-side comparison has allowed researchers to demonstrate unequivocally that dams have a filtration impact on the water.

The hydro-geomorphological impact of dam building is then evaluated both locally and at the landscape scale, revealing the extremely considerable change in the process that is generated by beaver. This article is mostly based on investigations conducted in Hungary. Nonetheless, further self-administered tests have been conducted to confirm the results of the previous ones."
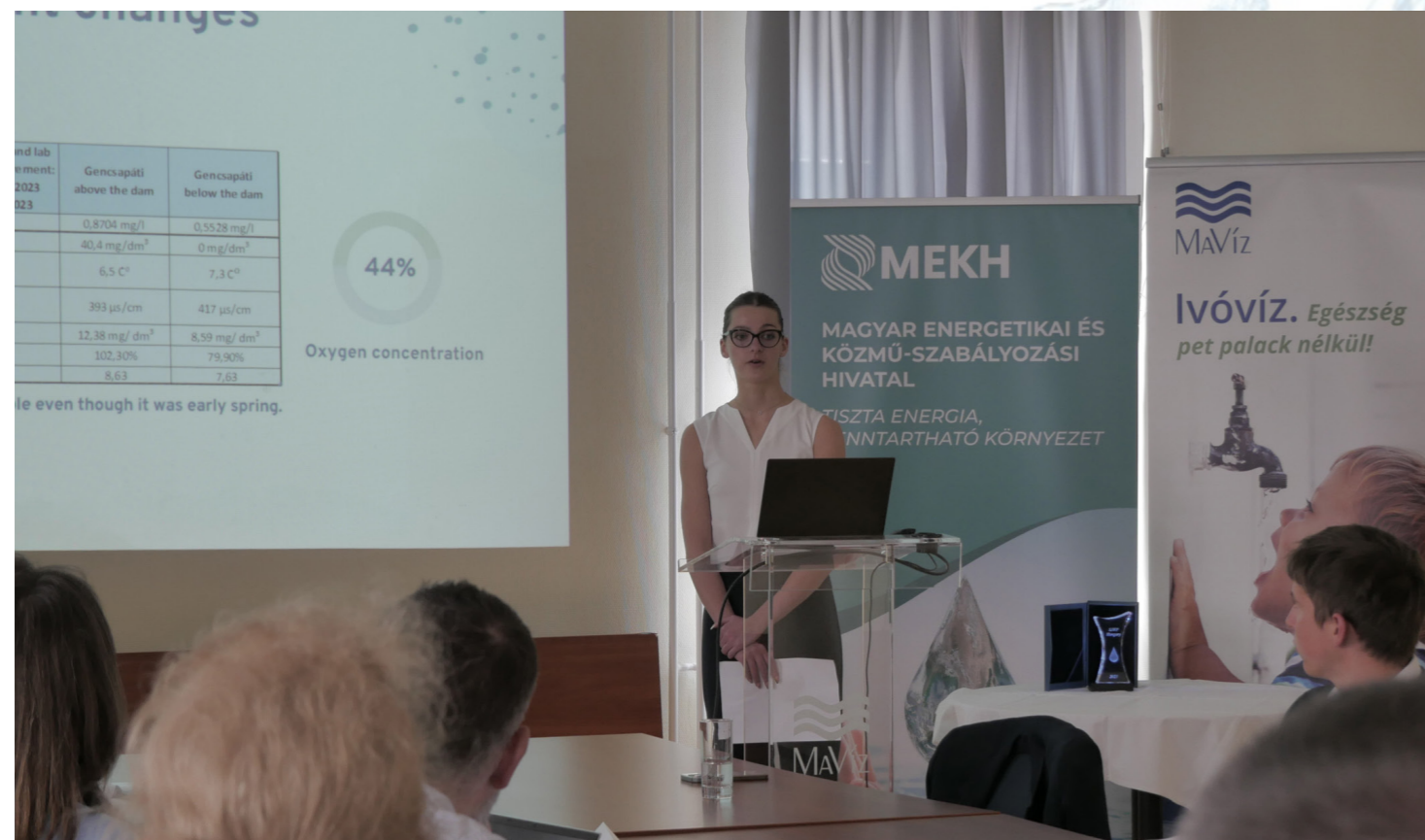
EFFECT OF PLANT GROWTH-STIMULATING BACTERIA ON THE DEVELOPMENT OF CHLORELLA VULGARIS MICROALGAE CULTURES

Boglárka Gáspár, Balázs Kristóf – Kisvárdai Bessenyei György Gimnázium és Kollégium, Kisvárda

"One of the most distressing problems in the world is overpopulation mainly because of world hunger. The protein from animals is far from enough for the human needs. Due to this, a lot of people do not have the required amount of food that they need.

Microalgae in general are known to have a high protein level and it has already been used as Super-Foods. Chlorella vulgaris can be an effective source of protein for both humans and animals.

Besides that, the global warming and greenhouse effect ever-increasing problem. Natural waters are extremely contaminated, and the wildlife faces many challenges. Our future is also threatened by depletion of non-renewable energy sources.

A solution to these problems can be found with the cultivation of microalgae. In our study Chlorella vulgaris was tested as a potential solution and its development was examined for the effect of growth-promoting bacteria strains."

THE RESULT OF THE NATIONAL FINAL

The jury decided on the winner in a closed session and announced the result on the spot. The decision was based on the same judging criteria used during the international final (Relevance, Creativity, Methodology, Subject Knowledge, Practical Skills, Report and Presentation), considering both the written project and the presentation, including the interview. The winner of the Stockholm Junior Water Prize – Hungarian competition 2023 is:

Benedek Jandó (Veres Pálné Gimnázium) with the project: "Relations between composition of fishes and hydromorphological variables in a very large river"

The winner of the SJWP Hungary 2023

This year, the Diploma of Honor went to *Sára Barta* (Szombathelyi Nagy Lajos Gimnázium, Szombathely) for the projct: „The impact of the Eurasian beaver (Castor fiber) on the water level and water quality of rivers"

The winner of the Diploma of Honor 2023

The Jury and Finalists of the National Contest

The Stockholm Junior Water Prize 2023 edition is held in person. This year, representatives from 31 countries competed for the SJWP: Argentina, Australia, Bangladesh, Benin, Brazil, Canada, Cyprus, Czech Republic, Denmark, Germany, Hungary, Israel, Italy, Japan, Kazakhstan, Mexico, Netherlands, Nigeria, Norway, Republic of Korea, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Arab Emirates, United Kingdom and the United States of America.

Hungary was represented by a one-member team formed of Benedek Jandó (Veres Pálné Gimnázium) with his project "Relations between composition of fishes and hydromorphological variables in a very large river".

The 2023 Stockholm Junior Water Prize was awarded to a student from the United States of America, Naomi Park. H.R.H. Crown Princess Victoria of Sweden announced the winner during a ceremony at World Water Week in Stockholm on 22nd August

The winner of SJWP 2023 receiving the prize from
H.R.H Crown Princess Victoria

Concurrent Removal of Rising, Soluble Ocean Carbon Dioxide and Oil-in-Water Contaminants via Multi-Functional Remediation Framework

Naomi Park
USA

The oceans absorb nearly a third of airborne CO_2 emissions, while concurrently, 1.3 million gallons of crude oil are spilled into oceans every year. Both issues continue to detrimentally affect marine biodiversity, and human health. This research provides a highly efficient/practical method for the concurrent removal of CO_2 and soluble oil-in-water contaminants through the creation of a Multi- Functional Remediation Framework (MF-RF) utilizing hypercross-linked polymers (HCPs), synthesized from Styrofoam. First, Styrofoam HCPs were synthesized according to Dong et al. HCPs alone remediated 88% of the 1.7g/L-soluble-benzene in seawater (via measure of benzene's fluorescence). Regarding CO_2 95% of the contaminant was removed, or $3.12\text{E-5M}[CO_2]=[H+]$ (via pH measure). For the MF-RF, HCP- sponges were constructed on 8x1.3x0.7cm of melamine, with PTFE adhesion, and 450mg HCP for pollutant removal/capture. The MF-RF remediated 92% of the 1.7g/L-benzene contaminant, and 95% of CO_2. Realistic concurrent oceanic experiments with a 0.1pH difference and maximum solubility of benzene highlight 92% remediation of oil, with only 12.6min needed to reach suitable oceanic pH. High- load concurrent removal experiments with 100x more CO_2 demonstrate 71% remediation of oil and 85% remediation of CO_2. Via recycle/reuse studies, the MF-RF may be reapplied until its capacity is reached (5.99g oil/HCP-sponge and 3700ppmCO_2/HCP-sponge) and then simply lifted out for contaminant recovery/recycling.

The Diploma of Excellence was awarded to Ayse Pelin Dedeler from Türkiye for the project: "A Novel Magnetic System with Carbon Nanotubes to Remove Microplastics from Water". The project was: "Microplastic pollution poses a global threat to marine life. Effective and eco-friendly solutions for removing microplastics (MPs) from water are urgently required. This study aims to capture microplastics with magnetic nano-adsorbents and remove them from the water using strong magnets. Magnetic carbon nanotubes (M-CNTs) were synthesized as nano-adsorbents because they can successfully adhere to the surfaces of MPs due to their strong hydrophobicity. The study tested various experimental parameters that affect the adsorption of MPs by M-CNTs, including the amount of adsorbent, contact time, salinity of water, and MP polymer type. The results showed that the water was cleansed of microplastics with an average success rate of ≈98%. Furthermore, for real-life applications, a magnetic water treatment machine using robotics was built."

The winner of the Diploma of Excellence

This was the fouth year the new prize, the People's Choice Award was given to Fernando de Silva Hernández and Carlos Erquizio from Mexico for the project: "Shrimply the best: Understanding the interaction between shrimp production and water resources based on a source-to-sea approach".

The winners of the People Choice Award

Crown Princess and Benedek

Stockholm Junior Water Prize 2023 finalists with H.R.H Crown Princess Victoria of Sweden

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Photo credit: SIWI, GWP Hungary
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