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LESSON LEARNED FROM THE APPLICATION OF A CATCHMENT-SPECIFIC CONTINUOUS SURFACE WATER QUALITY MONITORING SYSTEM

Zsófia KOVÁCS[1,2], Piroska TÓTH [1,2], Zoltán ZSILÁK[3], Sándor BALOGH [4]

[1]Sustainability Solutions Research Laboratory, Research Centre for Biochemical, Environmental and Chemical Engineering, University of Pannonia, Veszprém, Hungary;
[2]National Laboratory for Water Science and Water Security, University of Pannonia, Veszprém, Hungary,
[3]Research Group of Environmental and Inorganic Photochemistry, Center for Natural Sciences, University of Pannonia, Veszprém, Hungary
[4]Aqua-Terra Lab Ltd. Veszprém, Hungary
e-mail: kovacs.zsofia@mk.uni-pannon.hu

INTRODUCTION

Water quality control is one of the most important priorities of environmental policies. The catchment-specific continuous surface water quality monitoring and automatic sampling system provide invaluable information on the state of water bodies. It supports sustainable water management by providing real-time data on pollutant concentrations, enabling immediate response.
The **aim of the research project** is to present the role of the **modular automatic Water Quality Monitoring System**, to discuss experiences, challenges, and future plans, as well as to demonstrate the informational potential inherent in the time series data collected in the database.

METHODOLOGY- „COOKBOOK"

Modular continuous water quality monitoring and sampling system.
- ✓ Designation of sampling points „hot spot"
- ✓ Design of the monitoring system
- ✓ Measurement frequency

Detection of seasonal changes in water chemical parameters and anthropogenic pollutants in surface waters (rivers, lakes) in water and sediment phases, understanding the dynamics and characteristics of stress caused by extreme weather conditions, and identifying watershed-specific patterns.
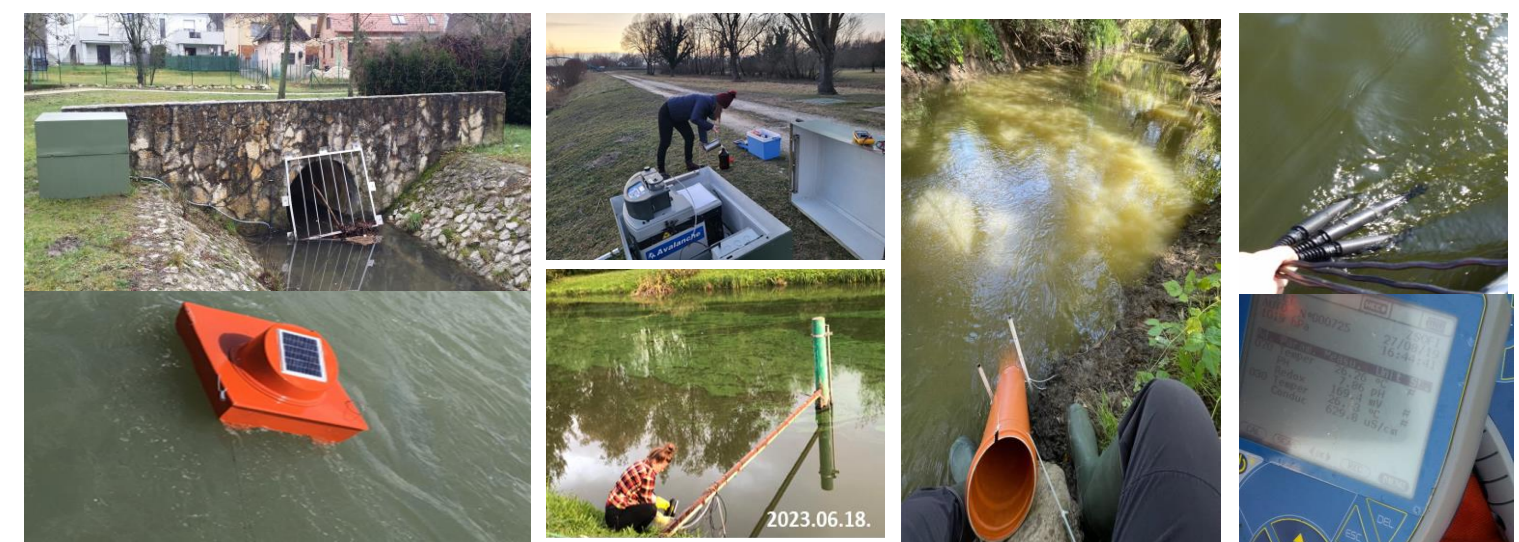

Fig.1: Potential toolkit (modular monitoring stations, buoy, sensors)

KIS-BALATON WATER PROTECTION SYSTEM (KBWPS)

Measured parameters:
- ✓ Temperature, pH, redox-potential, Conductivity, DO, DO%, Turbidity, flow rate

Biofilm formation

**Measurement frequency: 15 min
Data upload: hourly
Operation: battery and solar panel
Event control: Turbidity value (limit value 900 NTU)
Maintenance and standard water sampling**

Installed online Water Quality Monitoring Stations 4T and 21T
Lake Balaton
KBWPS
Zala-River

4T sampling point: Zala (between two reservoirs)

21T sampling point: Zala estuary

Fig.2: Placed two monitoring stations for one year, 2023
(4T: 4 sensors, flow meter, automated water sampler, communication box; 21T: 4 sensors, 3 ion selective sensors, communication box)
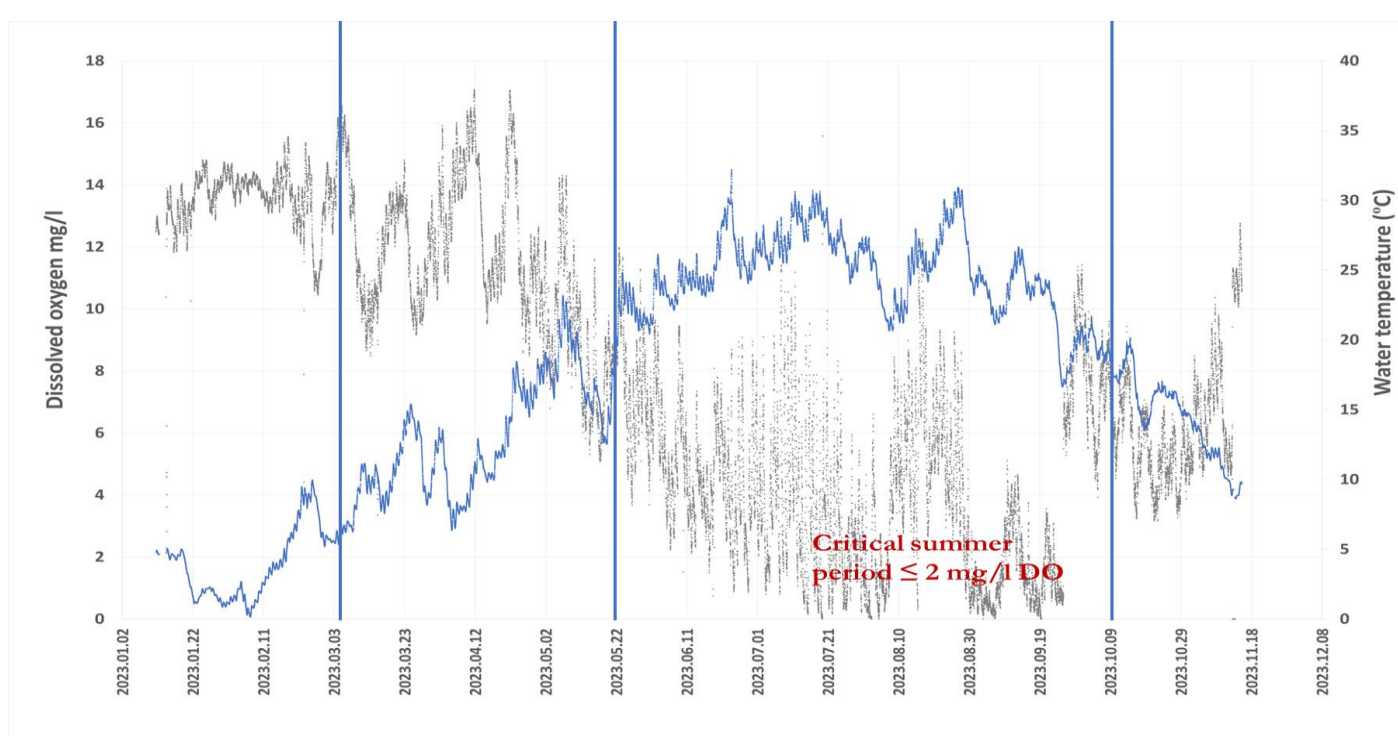

Fig.3: Change in dissolved oxygen seasonally with temperature, 2023

AUTOMATED ONLINE WATER QUALITY MONITORING AND SAMPLING STATION

- ✓ The Lake Balaton is the largest shallow lake in Central Europe. Its water quality is affected by its biggest inflow, the Zala River. During the late 20th century, a wetland area named the Kis-Balaton Water Protection System (KBWPS) was constructed in the hopes that it would act as a filter zone and thus ameliorate the water quality of Lake Balaton.
- ✓ Two sampling points were designated taking into account specific parameters of the location, where periodic on-site and event-driven water sampling of changes in observed weather conditions took place using an automatic sampling system.
- ✓ In addition to the initial basic settings, we will finalize the signal and alarm values based on the results of the measurement series.
- ✓ During operation, we look for cause-and-effect relationships, such as the detected turbidity extreme concentrations.
- ✓ In the case of regular maintenance, water samples were taken in parallel with standard sampling, during which we provided a volume of 5 liters/site for further laboratory processing.
- ✓ Our tests were carried out and in addition to the general water chemistry parameters (N and P forms), our analysis focused on specific pollutants (Cd, Cu, Pb, Zn).
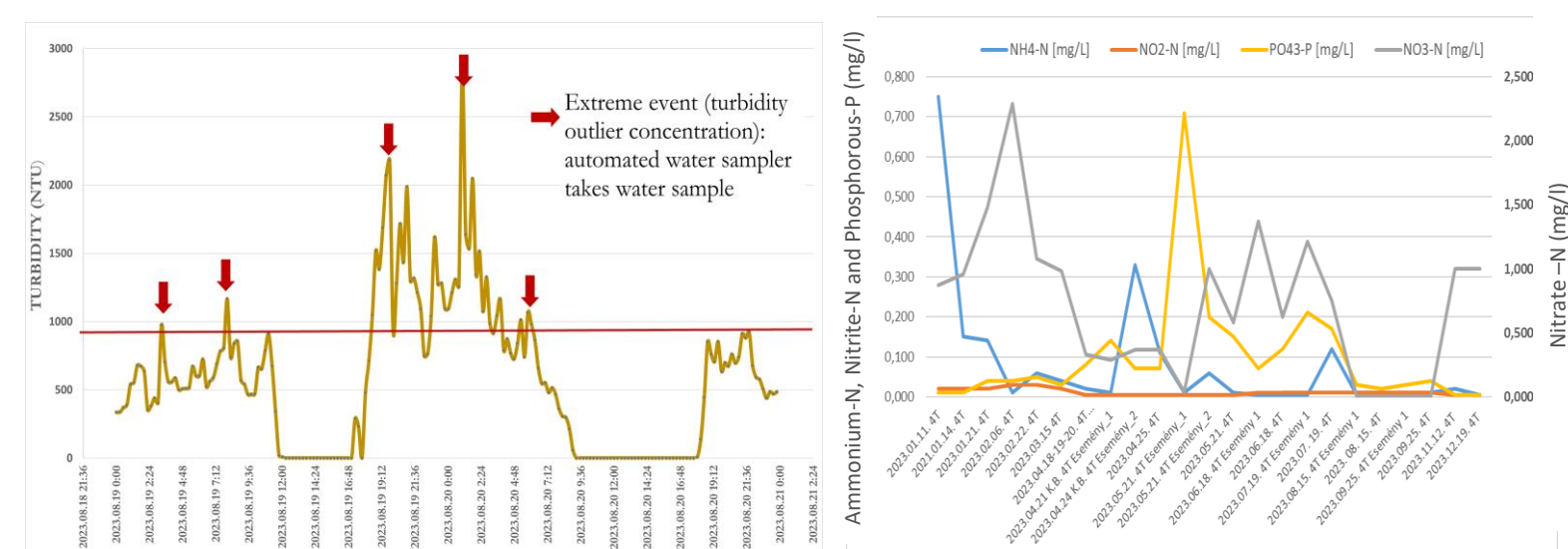

Fig.4: Change in Turbidity, Ammonium-N, Nitrite-N, Nitrate-N and Phosphorous-P, 2023

CONCLUSION

From the data set of the measurement results, we examined the periodicities and outliers, from which patterns characteristic of the sampling sites are obtained.