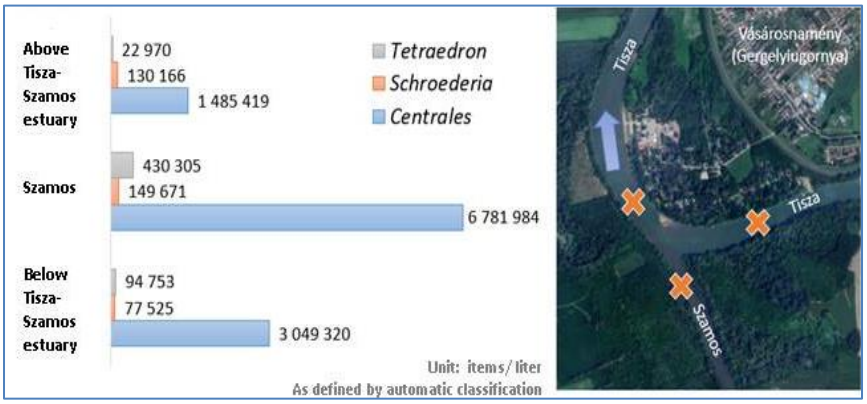
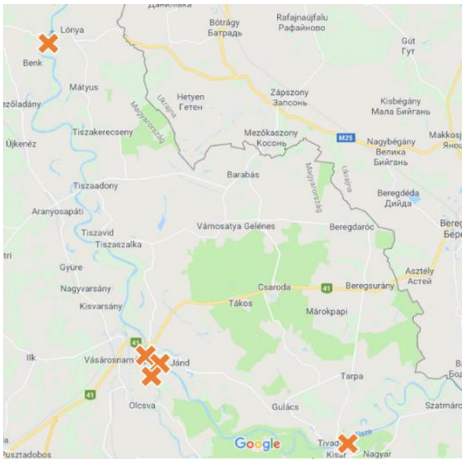
MICROALGAE IN THE TISZA RIVER – SCIENCE IN PRACTICE DURING THE PLASTIC CUP 2018

PLASTIC Cup, (https://petkupa.hu/) a flagship race event in the fight against plastic pollution on the Upper Tisza (Hungary's second biggest river), also aims to monitor the health of the river by using various scientific and even innovative solutions. In 2017 Wessling Hungary Ltd. was the first to investigate the microplastics contamination of the Tisza. In 2018, the state of the art algae monitoring device, WaterScope, was used at several locations along the route to get an idea of the type of microalgae populating in the river.

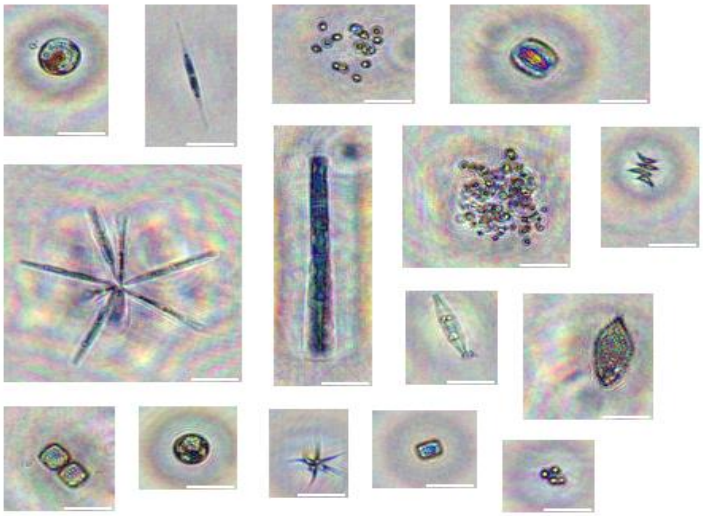


WaterScope (www.waterscope.eu) is a unique, Hungarian innovative device that can continuously determine the amount and types of microorganisms in the water. Working within a given size limits, identification is based on the morphological properties of the creature group (taxon). Because bacteria fall outside of the device's detection parameters, WaterScope is especially suitable for identifying algae and diatoms. A significant advantage of the device is its ability to identify a single cell directly, and not based on indirect parameters that only indicate its presence. Another advantage is that the results are available immediately, within a couple of hours – without the need for microbiological expertise or skills in using the microscope. Such speedy results are possible thanks to artificial intelligence (AI) based taxon recognition. Using holographic imaging technology, WaterScope presently is able to distinguish 19 taxa.

During the PLASTIC Cup, Tisza River samples were immediately analysed locally, thus avoiding possible changes within the sample quality due to transport delay and laboratory preparation. From each of the five sampled sites, six samples were analysed with WaterScope, generating over 5,000 holograms and identifying nearly 12,000 single cells. Results were already available and visible on the day of sampling.



The most interesting observations came from the samples of the estuary of the Szamos River where the higher algae concentration of the Szamos showed up within the Tisza as well. Out of the 16 various algae taxa detected[1], 3 taxa were found in high concentration: *Tetraedron*, *Schroederia*, and *Centrales*. This was probably due to the Szamos' high nutrient and pollutant levels.



The other 13 identified taxa (green algae, diatoms, and cyanobacteria) were detected in a much smaller quantity (5000-30,000 units/liter) and not always present at sampling sites. At the same time, it is important to be able to infer the quality of the water and the character of the river from the presence or absence of indicator species . A good example for this is the *Nitzschia acicular* diatomaceus, which occurs in the fast flowing waters above the mouth of the Szamos in large quantities (both 15,000 pieces/liter at Tivadar and directly above the estuary), but downstream we note some reduction in these quantities, with a detection rate near zero within the Szamos itself. Our results showcasing the influence of the Szamos River on the microalgal and diatom flora of the Tisza were confirmed in an earlier publication by Kiss and Szabó[2] studying geographical changes in phytoplankton concentration of Tisza river.,. This phenomenon is

[1] During the sampling period, we detected and measured the concentration for the following 16 taxa: *Centrales, Monoraphidium unicellular, Nitzschia acicularis, Oscillatoria, Schroederia, Tetraedron, Tetrastrum, Ankistrodesmus, Desmus, Euglena, Pediastrum, Anabaena solitaria, Microcystis, Monoraphidium bicellular, Nitzschia palea, Aphanizomenon*

[2] Kiss, TK; Szabó A (1975) Longitudinal profile investigation in the Tisza and Eastern Main channel. I. quantitative changes in phytoplankton. Tiscia (Szeged) Vol. X:3-14 http://acta.bibl.u-szeged.hu/9743/1/tiscia_010_003-014.pdf

explained not only by the different quality of the waters of the two rivers but also by the slowdown of the Tisza's flow.

One of the greatest benefits of the device, even for laymen, is undoubtedly the fact that it not only detects, but also shows the identified unicellular organisms thanks to the holographic images generated during the measurements. The user can view the pictures and subsequently modifythe machine pre-classification manually. A selection of the best pictures taken during the PLASTIC Cup is shown here, this is a slice of the wildlife of the Tisza as never seen before". The microbiological difference between the water of Szamos and Tisza illustrates the possibility of using the device in the field of water biology for the rapid detection of pollution and unexpected events. Changes in population and species composition, as well as the presence or absence of indicator species, may be important information for decision-makers. Continuous measurements from an on-site installed WaterScope may be suitable for detecting changes in water automatically while simultaneously measuring and comparing results from multiple locations.

Although, without a methodical sampling process, research plan, and lack of multiple measurements, the measurements during the PET Cup are not considered representative, or scientific, nonetheless, it was possible to demonstrate the suitability of this Hungarian innovation. WaterScope not only allows for remote measurements within the field of water monitoring, but it can also be used without special microbiological skills or other laboratory equipment. The results presented here are only to the ones from the artificial intelligence driven shape recognition and not by manual classification. Simultaneously, the machine is not infallible, hence, with the help of the "Evaluation Software" WaterScope allows experts to review and correct how the images are finally classified, thus facilitating increasingly accurate conclusions.

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