

# INTEGRATED RESTORATION OF WATER BODIES USING MICROBIAL BIOTECHNOLOGY

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## Introduction

The water bodies of Ukraine are an important source of biological resources that constantly ensure the population's food security and livelihood and provide the country's income and social development. However, Russian armed aggression in Ukraine has led to serious environmental consequences, due to which the quality and quantity of aquatic biological resources will suffer significant losses. Actions carried out during war harm natural ecosystems by destroying their stability and habitats, reducing biodiversity, and modifying ecosystem services. This will ultimately lead to significant economic losses and make it impossible to quickly provide the country's population with protein food products.

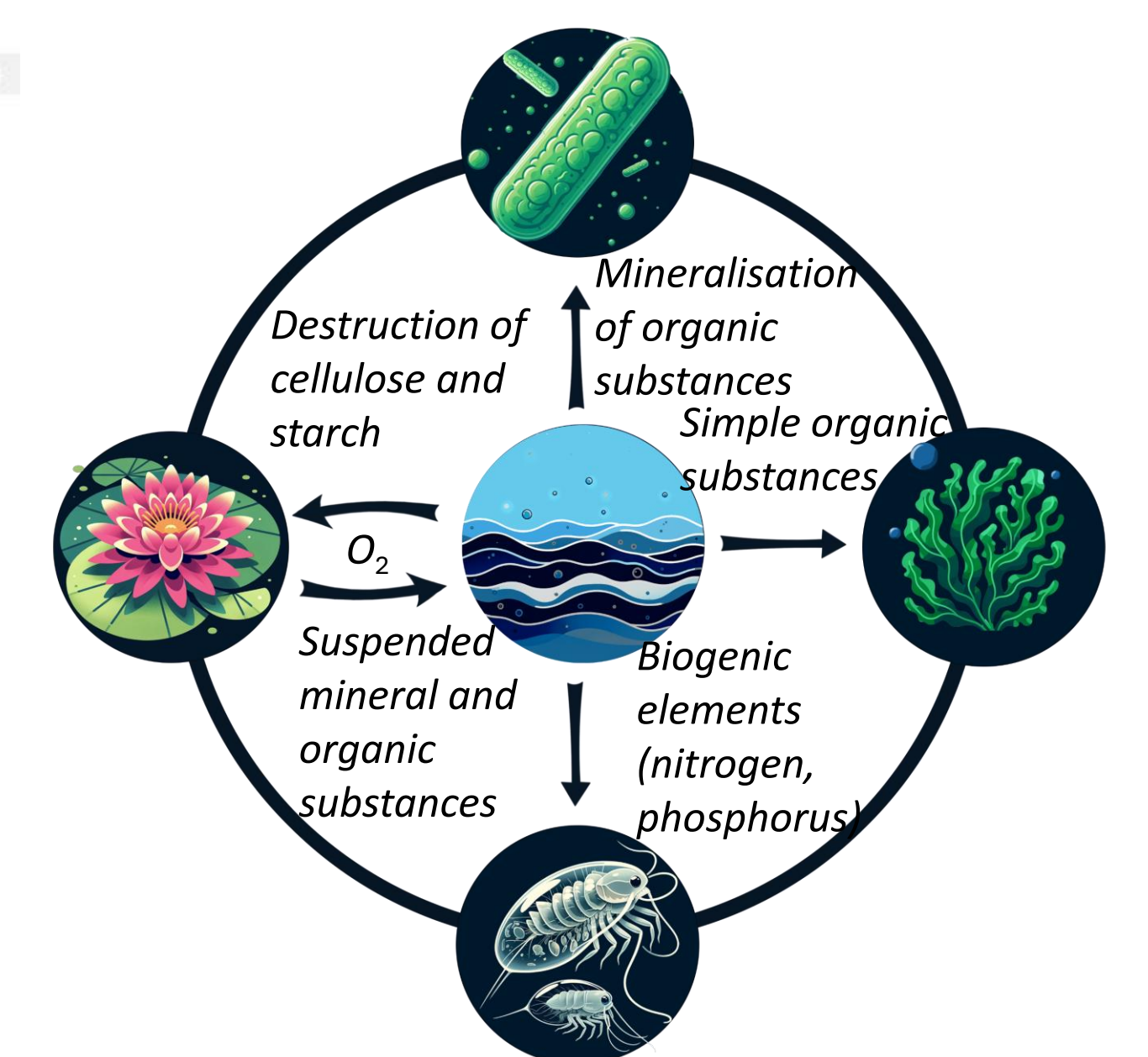
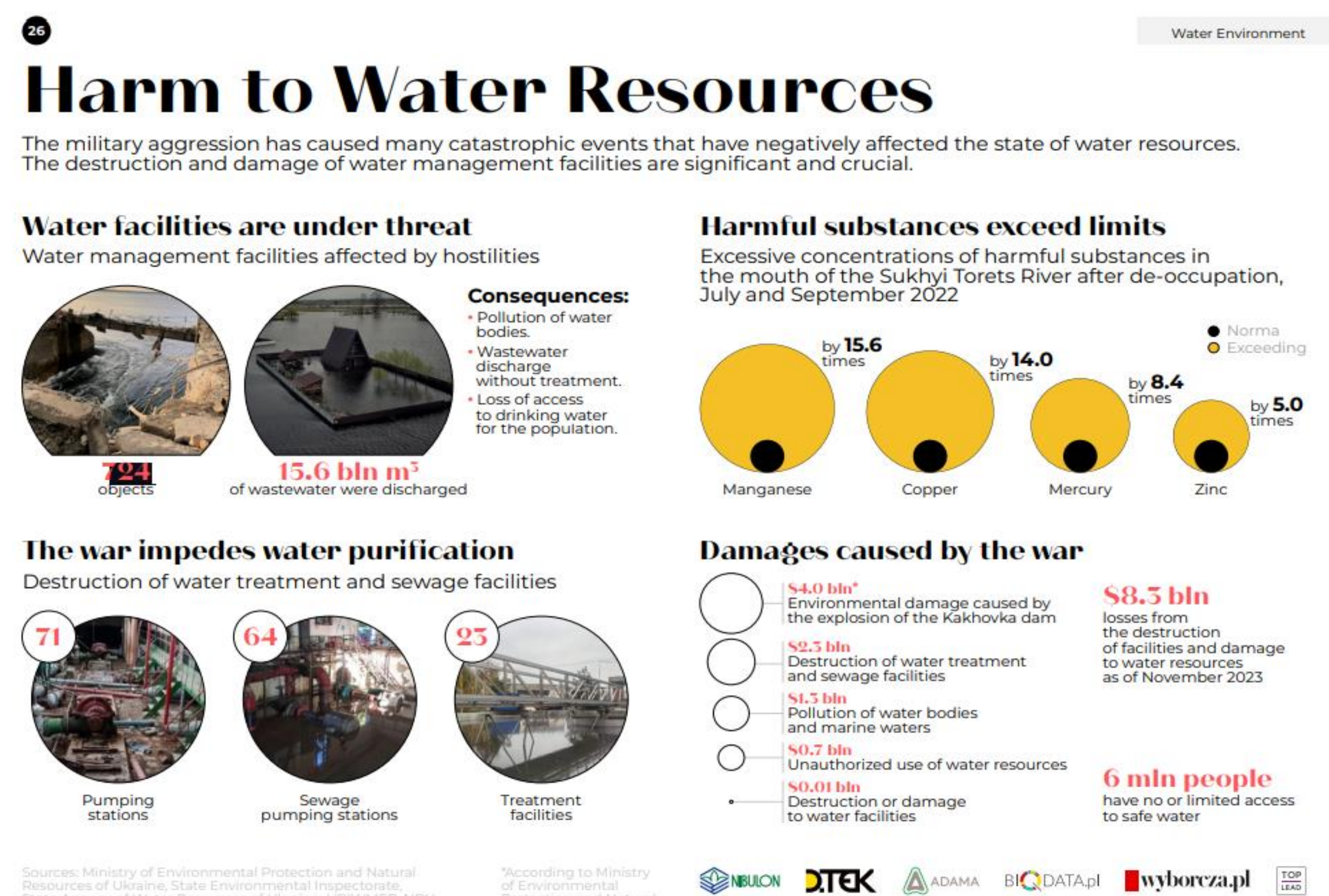
During the war, various toxic substances, including metals, petroleum products, explosive residues, and related compounds, contaminated components of the ecosystem. Additionally, water bodies were contaminated with biogenic substances, such as biogenic amines and other substances derived from the decomposition and improper burial of large numbers of human and animal corpses, as well as the mass death of fish (Guo et al., 2022).<sup>1</sup>

Ukraine receives significant amounts of fish from both natural water sources and the aquaculture sector. The infrastructure of the latter was damaged or destroyed during the war, making it even more vulnerable to the devastation of water resources caused by armed conflicts. This poses a threat to safety and social stability.

Today, experts from leading Ukrainian scientific institutions have joined forces to solve acute problems of biodiversity restoration in Ukrainian water bodies through the introduction of new microbial technologies: the Institute of Fisheries of the National Academy of Agrarian Sciences of Ukraine and the Institute of Microbiology and Virology named after D.K. Zabolotny of the National Academy of Sciences of Ukraine.

## Strategy for Assessing and Restoring War-affected Aquatic Ecosystems

Development of innovative microbial biotechnology for accelerated remediation of freshwater reservoirs after the effects of pollution with toxic, chemical, and biogenic substances resulted from military actions.

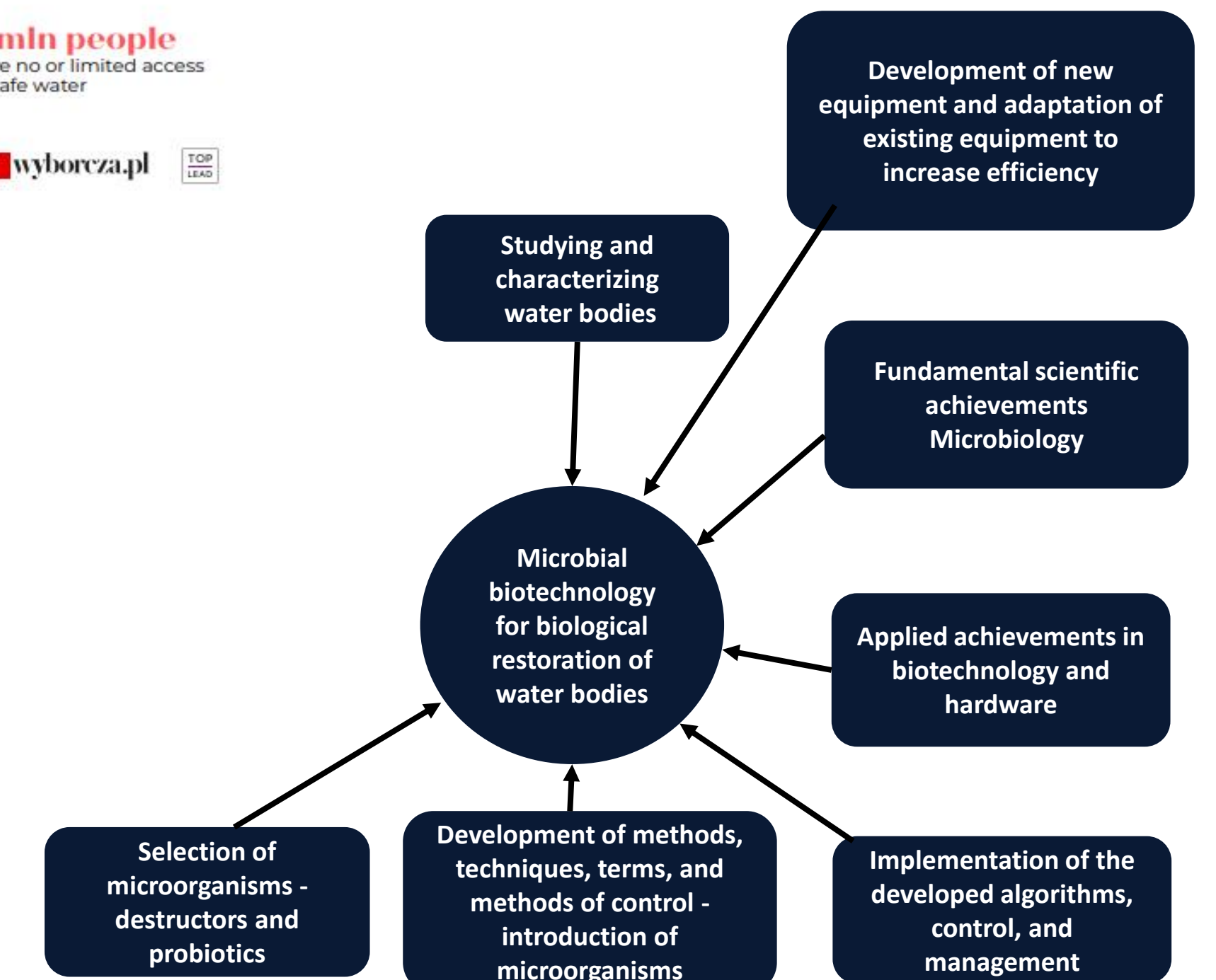


### The project aims to:

- Develop an approach that includes quick and cost-effective evaluation of aquatic ecosystem status, risk identification, and bioresource restoration;
- Develop the tools for water purification in aquatic habitats and aquaculture employing a complex of microbial destructors;
- Provide recommendations for algorithms for rapid qualitative and quantitative assessment of damage to freshwater ecosystems due to military actions;
- Create recommendations for the appropriate use of microbial destructors to minimize harmful compounds in the environment.



"Creating a Strategy for Assessing and Restoring War-affected Aquatic Ecosystems"



**This initiative has the potential to significantly contribute to the restoration of natural aquatic ecosystems and aquaculture farms in Ukraine, as well as reduce the impact of war on global climate change and mitigate its economic and social implications.**

## Protective potential of probiotics with nanoparticles

"Study of the protective potential of probiotics in combination with nanoparticles during long-term exposure of juvenile fish to assess possible risks".

The project aims to investigate the complex effects of nanoparticles (NPs) with probiotics (Pr) on salmonid fish at the juvenile stage, using fish as an element of the trophic chain in the aquatic ecosystem. It is carried out jointly implemented in the Laboratory of Ecotoxicology of the Lithuanian Nature Research Centre (Lithuania) and the base of the Institute of Fisheries of the National Academy of Agrarian Sciences of Ukraine.



## Summary

Implementation of the NATO Science for Peace and Security (SPS) Programme "Establishing a Strategy for the Assessment and Restoration of War-Affected Aquatic Ecosystems" No. SPS G6085, which includes the use of microbial technologies. These developments can become the basis for the restoration of natural aquatic ecosystems and aquaculture farms in Ukraine. The main areas of research include rapid assessment of the state of aquatic ecosystems and aquaculture using low-cost methods, risk identification, restoration of bioresources and ensuring the safe use of natural waters for fisheries and aquaculture in the future. This will not only prevent significant environmental problems and the spread of infectious diseases but will also significantly accelerate the restoration of Ukraine's food security during and after the war.

## Acknowledgments

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