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OF THE REPUBLIC OF NORTH MACEDONIA,
WITH INTERNATIONAL PARTICIPATION**

ABSTRACT BOOK

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Phytoplankton response to the mass removal of black bullhead in the Ponjavica River

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Allochthonous and invasive species are among the main factors leading to biodiversity loss which further threatens the ecosystem functioning, stability and resilience. A modern way of life and climate changes accelerated and increased the spread of invasive species. Although many ecosystems are facing this problem, the most endangered ones are slow-flowing/stagnant shallow waters. The black bullhead (*Ameiurus melas*) is recognized as one of the most successful non-native fish species in European freshwaters. Regarding its mitigation, selective mass removal is considered as an effective method to reduce the abundance of the local population. This biomanipulative measure undoubtedly affects other ecosystem components, so monitoring of organisms from different trophic levels is crucial for assessing the impact and success of the whole process.

The aim of this study was to detect and examine the changes in phytoplankton structure and abundance, as a response to the mass removal of the black bullhead.

Selective removal took place in the lowland Ponjavica River in the same-named Nature Park in Serbia with the domination of black bullhead and urgent need for biodiversity recovery. The removal project was conducted from June to October 2018 and April to October 2019. The removal process was conducted at three localities along the protected part of the Ponjavica River. Along with fish removal, phytoplankton samples for qualitative and quantitative analyses were collected by plankton net and Van Dorn bottle, respectively. The taxonomic literature was used for qualitative analysis, while the Utermöhl method was conducted for the assessment of phytoplankton abundance.

More than 200 algal taxa were detected in Ponjavica phytoplankton. Phytoplankton abundance at each of the localities showed similar dynamics ranged from minimal 156914 cell/ml in June, to maximal 1038946 cell/ml in August 2018. Cyanobacteria were the dominant group with more than 98% in total cell number from August to October. Three invasive and potentially toxic cyanobacteria (*Raphidiopsis raciborskii*, *Sphaerospermopsis aphanizomenoides*, *Raphidiopsis mediterranea*) were registered with 61% in total cell number in August, 59% in September and 38% in October 2018. Phytoplankton abundance decreased (by almost half) in the second year of the project, together with the share of invasive and potentially toxic cyanobacteria in the total cell number and particularly a number of individuals.

The black bullhead and *Raphidiopsis raciborskii* are considered as the most successful invasive species among fish and cyanobacteria, respectively, and both are detected in the Ponjavica River. Our results showed that mass removal of black bullhead caused a decrease in phytoplankton abundance



and also portion of present invasive cyanobacteria without newly occurred ones, while in the case of ichthyofauna other species increased the population abundance due to free niche.

Great efforts are being made to find adequate solutions for invasive species removal but a unique and successful method has not been found so far. The selective mass removal is the best method to decrease the black bullhead abundance and the results of this research indicated that the process could have a positive effect on decreasing the abundance of invasive species at the base of the trophic chain.

Key words: biomanipulation, invasive species, potentially toxic cyanobacteria, the Ponjavica Nature Park