

ESTIMATION OF THE WASTEWATER IMPACT ON THE KRKA RIVER

BY DAPHNID ACUTE TOXICITY TESTING



Vlatka Filipović Marijić¹, Želimir Cvetković², Camille Boucaud³, Ivana Karamatić¹, Damir Valić¹, Tomislav Kralj¹, Tatjana Mijošek¹, Zuzana Redžović¹, Vlatka Mikulec², Dušica Ivanković¹, Zrinka Dragun¹
¹Ruđer Bošković Institute, ²Andrija Štampar Teaching Institute of Public Health, ³University of Côte d'Azur



Introduction

- In addition to chemical water analyses, assessment of water quality might involve toxicity testing, as a biological tool that reflects toxic impact on aquatic organisms. The commonly used testing organism is crustacean *Daphnia magna* Straus, 1820, which is sensitive to a wide range of contaminants and important consumer in the food chain.
- In the present study water quality was assessed in the karst Krka River (Croatia), whose lower part was proclaimed national park due to its exceptional natural beauty. Only 2 km upstream from the northern border of the park industrial and municipal wastewaters from the Town of Knin are released in the Krka River without proper purification and have direct impact on the river water (Filipović Marijić et al., 2018).

Aim

- Assessment of potential toxicity of industrial and municipal wastewaters by application of acute toxicity testing;
- Estimation of pollution impact on aquatic organisms and potential threat to the Krka River and its tributaries;
- Establishment of protection plans for the Krka National Park.

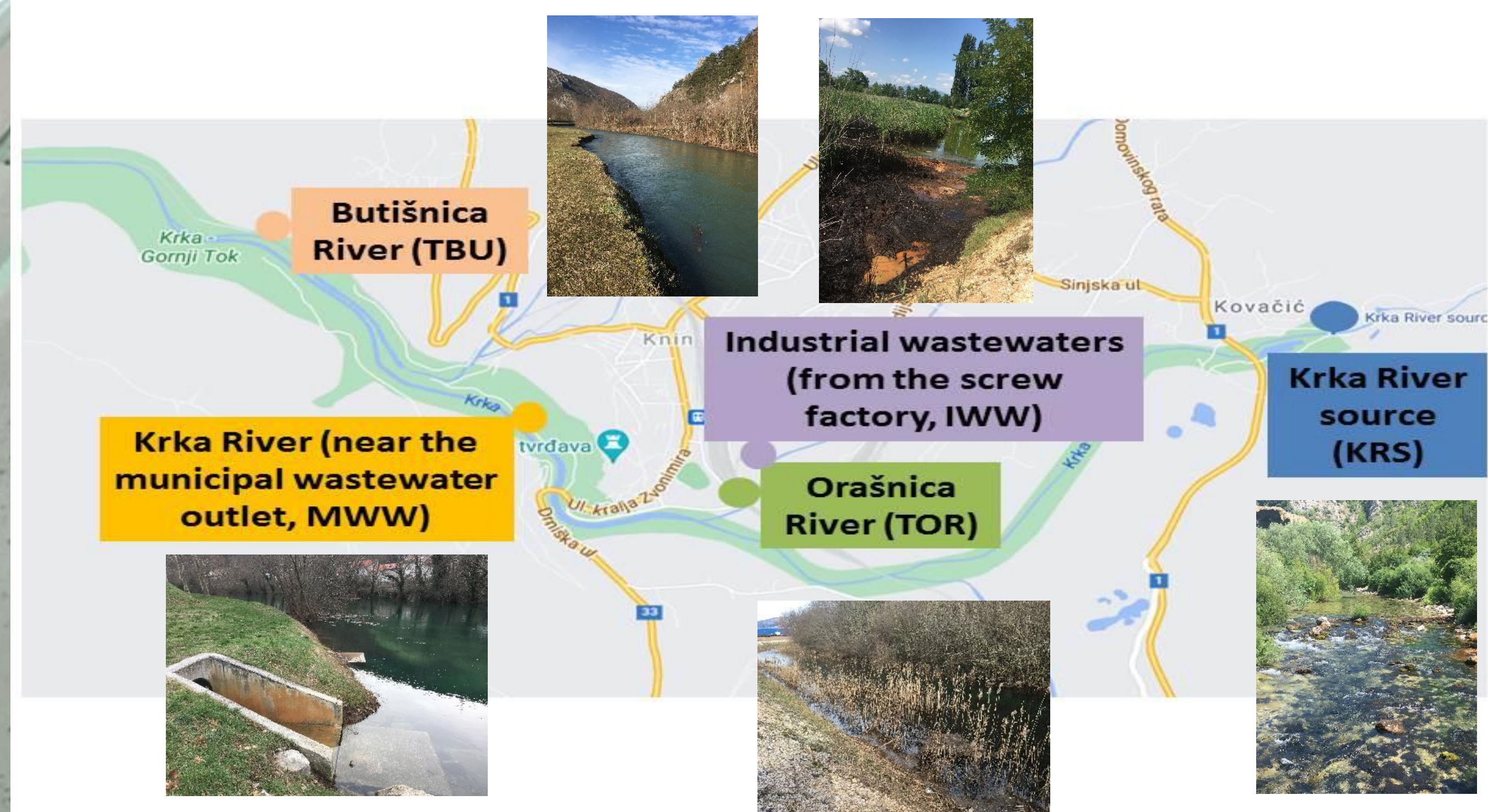
Sampling area



Krka River is a typical karst river in the Dalmatian karst area of Croatia whose lower part was proclaimed National Park in 1985

- Sampling sites: reference site Krka River source (KRS) and four locations downstream of the wastewater impact- industrial (IWW) and municipal (MWW) wastewaters, tributary Orašnica (TOR) and Butišnica (TBU) near outlets

- Sampling campaign: April 2021



Testing organism

Water flea (*Daphnia magna* Straus, 1820)

Phylum: Arthropoda
Subphylum: Crustacea
Class: Branchiopoda
Family: Daphniidae



Laguna Design

- Commonly used as an alert systems in water contaminated with toxic substances
- In this study applied as a sensitive indicator for assessing the potential toxicity of industrial and municipal wastewaters
- Acute toxicity was studied under laboratory conditions by following the rate of survival at 24 hr and 48 hr.

Methodology

Acute toxicity was evaluated after hatching of the ephippia for 72 hr in a specific media supplemented with salt nutrient.



- The obtained neonates were used immediately for ecotoxicity testing of water samples from five sites, which was manifested as an immobilization (meaning death) of the crustacean.
- Potassium dichromate ($K_2Cr_2O_7$) was applied as a reference toxicant.



Probit analysis was used to calculate 50% toxic effect thresholds (EC50) for 24-48 hr exposure and the lowest ineffective dilution (LID) for which at least 90% of daphnids are mobile.



Results

- The percentage of mobile daphnids was up or equal to 90% for all freshwaters except IWW in the first 24 hr in both seasons.
- After 48 hr all daphnids remained alive in water from KRS and TBU, justifying good ecological status of these locations.
- For TOR and MWW, 5% of daphnids were immobile in the 50% diluted and 20% were immobile in the non-diluted freshwater, resulting in LID= 2, which confirmed moderate pollution in sites nearby wastewater outlets, what was all confirmed by the physico-chemical water parameters.



- The highest impact on daphnids was found for IWW, in which a decreasing vitality rate in increasing concentration of the sample was observed.
- The lowest ineffective dilution calculated by Probit analysis was significantly higher compared to the other samples (LID= 18, 48 hr).
- Such higher mortality was in agreement with the poor physico-chemical water parameters and a blackish color, high viscosity and strong odor related to fuel oil at site IWW.

Conclusions

- Industrial wastewater (IWW) showed a statistically significant increase in LID value and higher mortality compared to other locations;
- Moderate pollution was confirmed in sites nearby wastewater outlets (MWW, TOR) and good ecological status in TBU and reference location KRS;
- Testing on Daphnids confirmed them as sensitive bioindicators and pointed to toxic influence of the industrial wastewater from the screw factory and the importance of proper purification before discharging it in the environment;
- Strict and continuous biomonitoring plans must be established if serious consequences want to be avoided on biota and the Krka National Park.

References

Filipović Marijić, V., Kapetanović, D., Dragun, Z., Valić, D., Krasnići, N., Redžović, Z., Grgić, I., Žunić, J., Kružlicová, D., Nemeček, P., Ivanković, D., Vardić Smrzlić, I., Erk, M. (2018) Environ Sci Poll Res 25 (5), 4715-4727.

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