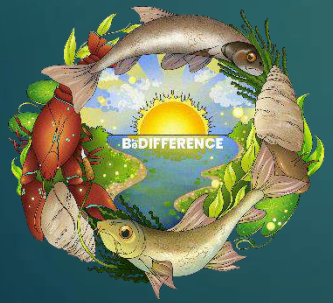
An overview of the project activities during the first project year

(5th December 2025 to 4th December 2026)

Dr. Zrinka Dragun



HrZZ project BeDIFFERENCE
1th annual project meeting
Zagreb, 16th November 2026

Project logo

- *Ira Andrea Potnar, univ. mag. of visual communications and graphic design*





Communication with end-users

- *Međimurje Nature – Public Institution for Nature Protection*

Changes to project team



Prof. dr. Krešimir Žganec
University of Zadar
since 3/2026

Dr. Saranda Bakija Alempijević
Ruđer Bošković Institute
since 7/2026





Dr. Hamza Benrahma
Ruđer Bošković Institute



since 10/2026

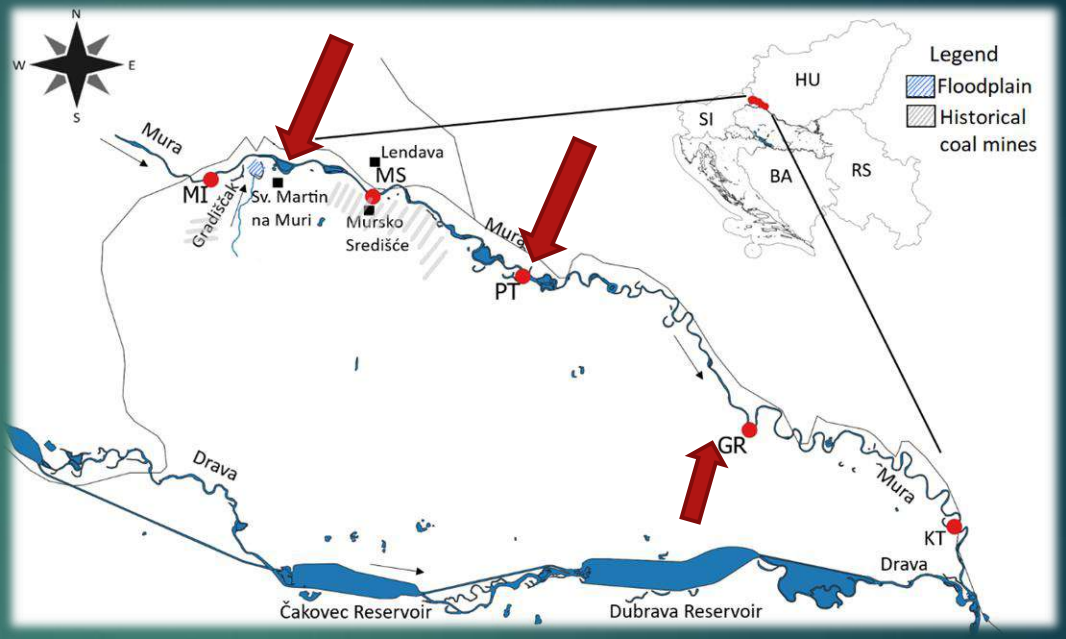
Dr. Tomislav Kralj

Ministry of Environmental Protection and Green Transition, since 1/2026

Field work

Sampling sites at the Mura River:





Five main sites

- *MI – initial point*
- *MS – Mursko Središće*
- *PT – Podturen*
- *GR – Goričan*
- *KT – Kotoriba*

Additional sites

- *SM – Sveti Martin*
- *SMC – Sveti Martin side-channel*
- *PTC – Podturen side-channel*
- *Trnava Stream*

Field work

Long-term water monitoring:

- *monthly, since November 2025 (12 samplings)*
- *five main sites*
- *in situ measurement of physico-chemical parameters (water temperature, pH, dissolved oxygen, conductivity)*
- *water samples for dissolved element analysis, turbidity, and hardness*

  - *seasonally (4 samplings)*
  - *five main sites*
  - *water samples for nanoparticulate element analysis, nutrients (total phosphorus and nitrogen, nitrates, and amonnium), and chlorophyll a*

Analyses completed



Field work

Fish sampling campaigns:



Winter sampling

- *9-14 March 2026*



Autumn sampling

- *21-26 September 2026*
  - *sampling sites: SM, MS, GR*

Fish species

- *European chub (Squalius cephalus)*
- *barbel (Barbus barbus)*
  - *organs: liver, gonads, muscle*
  - *blood (serum samples & smears)*
  - *scales & fins*



Additional sampling

- *water*
- *sediment (five main sites)*

Field work

Invertebrate sampling campaigns:





Spring sampling

- *23-26 March 2026 (molluscs & gammarids)*
- *10-11 May and 18-20 May 2026 (crayfish)*



Summer sampling

- *10-13 September 2026*

Sampled organisms

- *molluscs (several species)*
- *gammarids (Gammarus fossarum & Dikerogammarus villosus)*
- *signal crayfish (Pacifastacus leniusculus)*

- *sampling sites: SM, MS, GR*

- *whole specimens (GF, DV)*
- *hepatopancreas, gonads, & muscle (PL)*

Additional sampling

- *water*

Laboratory analyses

Tissue processing and measurements – winter/spring samplings:

- *soft tissue samples (except fish muscles) of all sampled organisms*
- *homogenization & centrifugation*
  – to obtain samples for metal, biomarker, & HPLC analyses
- *digestion of all tissue homogenates and S50 fractions set aside for metal analyses*
- *ICP-MS measurement of total and soluble concentrations of metals and metalloids*

Fish blood – both samplings:

Analyses completed

- *serums sent to UK (WellFish Tech Ltd.)*
- *measurement of 21 blood biomarker*

Analyses completed

Analyses outside Croatia (planned for second project year):

- *fish blood smears from both samplings sent to North Macedonia*
  – for analyses of micronucleus and nuclear abnormalities
- *various tissues (fishes, invertebrates) from all samplings sent to Spain*
  – for analyses of nanoparticulate metals
- *fish liver samples from second sampling sent to Canada*
  – for analyses of subcellular metal distribution

Samples sent

Laboratory analyses

Sediments – winter sampling:

- *grain size analyses*
- *organic matter content*
- *metal and metalloid concentrations in fraction <2 mm*
- *metal and metalloid concentrations in fraction <0.63 mm*
- *microbial genes for metal resistance*

Analyses completed

Water, additional analyses:

- *pesticides & antibiotics (March and August-September 2026)*
- *five main sites*
- *NZJZ „Andrija Štampar"*

Analyses completed

- *eDNA for fishes (September & October 2026)*
- *five sites*
- *Labena*

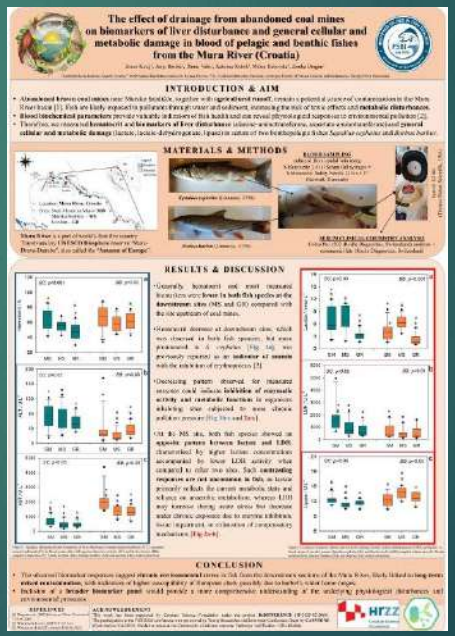
By the end of November

Conferences

1. *Fisheries Society of the British Isles (FSBI) Annual Symposium*
   27-31 July 2026
   Southampton, UK

   Zoran Kiralj, Josip Barišić, Damir Valić, Katerina Rebok, Milica Ristovska, Zrinka Dragun (2026) ***The effect of drainage from abandoned coal mines on biomarkers of liver disturbance and general cellular and metabolic damage in blood of pelagic and benthic fishes from the Mura River (Croatia).*** *(poster presentation)*





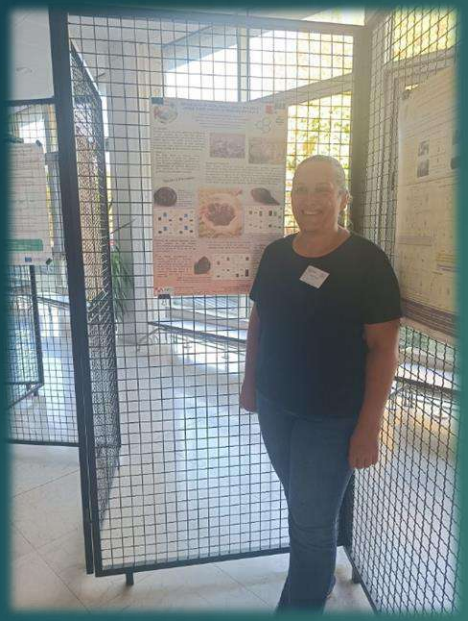


Young Researcher and Innovator (YRI) Conference Grant - COST action CAPSTONE

Conferences

2. *Annual Meeting of E-NICHE COST-action*

7-9 September 2026
Zagreb, Croatia



Zrinka Dragun, Zoran Kiralj, Nausicaä Falconnat, Lore Graulus, Dušica Ivanković, Jasna Lajtner, Krešimir Žganec (2026) ***Differences in metal bioaccumulation ability among three species of freshwater snails****. (poster presentation)*

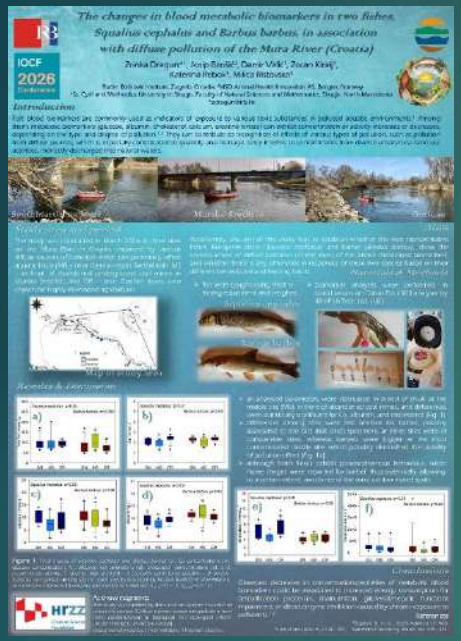


Zoran Kiralj, Jasna Lajtner, Krešimir Žganec, Tatjana Mijošek Pavin, Nausicaä Falconnat, Lore Graulus, Damir Valić, Josip Barišić, Katerina Rebok, Milica Ristovska, Zrinka Dragun (2026) ***Accumulation of selected metal(loid)s in three freshwater organisms occupying different trophic levels****. (poster presentation)*

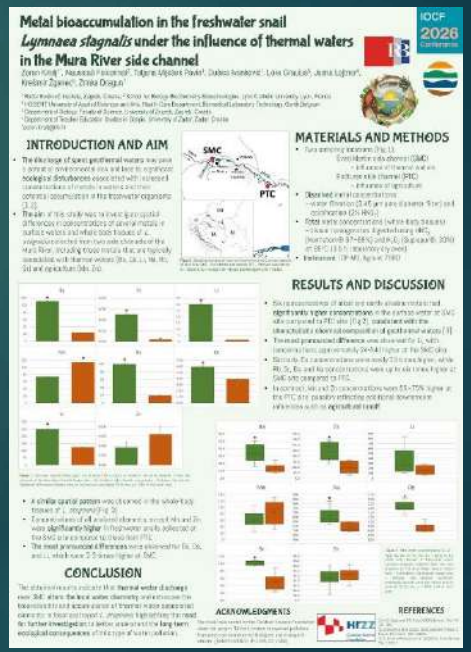
Conferences

3. *The 1st International Online Conference on Fishes (MDPI)*

5-6 November 2026
online



Zrinka Dragun, Josip Barišić, Damir Valić, Zoran Kiralj, Katerina Rebok, Milica Ristovska (2026) ***The changes in blood metabolic biomarkers in two fishes, Squalius cephalus and Barbus barbus, in association with diffuse pollution of the Mura River (Croatia)****. (poster presentation)*



Zoran Kiralj, Nausicaä Falconnat, Tatjana Mijošek Pavin, Dušica Ivanković, Lore Graulus, Jasna Lajtner, Krešimir Žganec, Zrinka Dragun (2026) ***Metal bioaccumulation in the freshwater snail Lymnaea stagnalis under the influence of thermal waters in the Mura River side channel****. (poster presentation)*

Conferences

4. *26th European Meeting on Environmental Chemistry (EMEC26)*

   24-27 November 2026
   Klaipėda, Lithuania

Zoran Kiralj, Krešimir Žganec, Zorana Kljaković-Gašpić, Danijela Bogner, Zrinka Dragun (2026) ***Metal bioaccumulation in hepatopancreas of signal crayfish along the Mura River in association with sediment exposure****. (poster presentation)*

Hamza Benrahma, Zoran Kiralj, Nausicaä Falconnat, Lore Graulus, Tatjana Mijošek Pavin, Dušica Ivanković, Krešimir Žganec, Jasna Lajtner, Zrinka Dragun (2026) ***Rare earth elements accumulation and Eu-anomaly in three freshwater gastropods from two side channels of the Mura River, Croatia****. (poster presentation)*

Conferences

5. *23rd IWA International Conference on Diffuse Pollution and Eutrophication (DIPCON 2026)*

24-27 November 2026
Vienna, Austria

Matej Kristan Mirković, Snježana Kazazić, Tomislav Kralj, Damir Valić, Zoran Kiralj, Dušica Vujaklija, Zrinka Dragun (2026) ***Biodiversity decrease of culturable bacteria in the Mura River sediments: potential association with diffuse sources of environmental contamination****. (poster presentation)*

Scientific papers

1. *In preparation*

   Matej Kristan Mirković, Snježana Kazazić, Zorana Kljaković-Gašpić, Tomislav Kralj, Damir Valić, Karla Bogdan, Zoran Kiralj, Dušica Vujaklija, Zrinka Dragun (2026) Biodiversity decrease of culturable bacteria in sediments of a large river: association with environmental contamination.

   - submission: 12/2026 or 1/2027

2. *Completed data sets:*
   - *sediment contamination*
   - *fish blood biomarkers*
   - *metal bioaccumulation in certain molluscs*

Laboratory trainings – Erasmus+

1. ***Lore Graulus**, Gent, Belgium*
   - *Hogeschool Gent, University of Applied Sciences and Arts*
   - *2-6/2026*





2. ***Nausicaä Falconnat**, Lyon, France*
   - *Lyon Catholic University*
   - *4-8/2026*

3. ***Laura Vromant**, Gent, Belgium (in 2027)*
   - *Hogeschool Gent, University of Applied Sciences and Arts*

Student theses

1. ***Lore Graulus, bachelor thesis***

- *the study programme bachelor of Biomedical Laboratory Technology at Hogeschool Gent, University of Applied Sciences and Arts (Gent, Belgium)*
- *supervisors:* ***Dr. Zrinka Dragun*** *and* ***Dr. Leen Puimège***
- *direct supervisor:* ***Dr. Zoran Kiralj***
- *title: Bioaccumulation of rare earth elements in freshwater amphipods (Gammarus fossarum complex) as indicator of diffuse metal pollution of the Mura River (Croatia)*
- *date of defense: 8th June 2026*

2. ***Nausicaä Falconnat, second year report***

- *undergraduate assistant engineering study in Biology, Biochemistry, and Biotechnology at Lyon Catholic University (Lyon, France)*
- *supervisor:* ***Dr. Zrinka Dragun***
- *direct supervisor:* ***Dr. Zoran Kiralj***
- *title: The influence of spent thermal waters and agriculture on metal bioaccumulation in freshwater snail Lymnaea stagnalis from the two side-channels of the Mura River*
- *submitted and graded: 28th September 2026*

New collaborations and submitted projects

1. ***Foundation of Croatian Academy for Sciences and Arts (HAZU)***
   - *principal investigator:* ***Dr. Zoran Kiralj***
   - *title: Influence of diffuse contamination of the Mura River on reproductive tissue of signal crayfish (Pacifastacus leniusculus): metal bioaccumulation and biomarker responses in gonads*
   - *status:* ***submitted in April 2026***

2. ***Ministry of Science, Education and Youth of the Republic of Croatia***
   - *Croatian-Slovenian bilateral scientific research cooperation*
   - *principal investigators:* ***Dr. Zrinka Dragun & Dr. Janez Ščančar*** *(Jožef Stefan Institute)*
   - *title: Against the current: retracing the increased tungsten concentrations in the Mura River*
   - *status:* ***submitted in May 2026***

3. ***University of Debrecen, Hungary***
   - *new cooperation*
   - *investigators:* ***Dr. Herta Mária Czédli & Dr. Boglárka Döncző***
   - *subject: analysis of metal bioaccumulation in scales and fins of barbel and chub from the Mura River*
   - *planned submission of Croatian-Hungarian bilateral scientific research cooperation*

Other activities - dissemination

- ***Invited lecture by Dr. Zoran Kiralj in Croatian Ecological Society:***
  Invisible threats, visible effects: diffuse pollution of river ecosystems
  29th April 2026





- ***Invited lecture by assoc. prof. dr. Herta Czédli at Ruđer Bošković Institute***
  Water Scarcity and Climate Change: What Does Biomonitoring Reveal About the Condition and Resilience of Wetlands?
  15th September 2026

- ***web page – RBI***
- ***https://www.linkedin.com/company/111353477***


Thank you for your attention ☺