

FINAL CONFERENCE OF THE PROJECT EFFECTS OF MULTIPLE STRESSORS ON FRESHWATER BIODIVERSITY AND ECOSYSTEM FUNCTIONING (MUSE)

MARCH **13**
2023

FRESHWATER biodiversity, ecosystem functions and services are changing at an unprecedented rate due to the impacts of vast number of stressors overlapping in time and space. The project aims at advancing our knowledge on effects of emerging contaminants (ECs) and climate change on freshwater biodiversity and ecosystem functioning at the aquatic-terrestrial interface. To this end, we combine field-based (*in situ*) research and laboratory experiments.

We present our results highlighting the role of emerging aquatic insects in the transfer of ECs such as pharmaceuticals and endocrine disrupting compounds between the two ecosystems. We also show that combined effects of increased water temperature and presence of ECs in water cross the aquatic-terrestrial interface as negative impacts on physiology, behaviour and population dynamics of aquatic insects.

SPEAKERS



Prof. Dr.
Mira Petrović



Assoc. Prof. Dr.
Ana Previšić



M. Sc.
Marina Veseli



M. Sc.
Iva Kokotović



Dr. Sc.
Filip Ložek



Assoc. Prof. Dr.
Wolfram Graf

UČINCI VIŠESTRUKIH STRESORA NA BIOLOŠKU RAZNOLIKOST I FUNKCIJE SLATKOVODNIH EKOSUSTAVA

13. OŽU
2023

VENUE:
KRAŠ, Ravnice 48, Zagreb

Time	Topic	Speaker
10:00 - 10:15	— Welcome and introduction	Assoc. Prof. Dr. Ana Previšić University of Zagreb, Faculty of Science
10:15 - 11:00	— Invited lecture 1: Sources, occurrence and fate of emerging contaminants in the aquatic environment	Prof. Dr. Mira Petrović Catalan Institute for Water Research (ICRA)
11:00 - 11:30	— Transfer of waterborne pharmaceuticals and endocrine disruptors in riparian zone through food webs	Marina Veseli, mag. oecol. et prot. nat. University of Zagreb, Faculty of Science
11:30 - 12:00	— Coffee break	
12:00 - 12:20	— Effects of climate change and emerging contaminants on aquatic insects	Assoc. Prof. Dr. Ana Previšić University of Zagreb, Faculty of Science
12:20 - 12:40	— Effects of elevated temperature and selected contaminants on the behaviour of caddisfly larvae	Dr. Filip Ložek University of Zagreb, Faculty of Science
12:40 - 13:00	— Aquatic macroinvertebrates in a multiple stress environment: insights from a mesocosm experiment	Iva Kokotović, mag. educ. biol. et chem. University of Zagreb, Faculty of Science
13:00 - 13:30	— Invited lecture 2: The times are a changing: freshwater ecosystems, stressors and effects on aquatic communities	Assoc. Prof. Dr. Wolfram Graf University of Natural Resources and Life Sciences (BOKU)
13:30 - 13:50	— Discussion on project results and implications	
13:50	— Closing	

Sources, occurrence and fate of emerging contaminants in the aquatic environment



Prof. Dr.
Mira Petrović

Chemicals are part of our daily lives. Our activities emit a myriad of chemicals into the environment that result in continuous exposure of both humans and ecosystems to very complex chemical mixtures that differ across environmental compartments, time, and space. Consequently, surface waters receive complex anthropogenic chemical mixtures from multiple sources, including, but not limited to, urban wastewater, agricultural runoff, and wastewater from livestock facilities. This presentation will give a short overview of emerging organic contaminants, such as pharmaceuticals and personal

care products, household and industrial chemicals, pesticides, being all classified by effects in different contaminants classes such as endocrine disrupting chemical, cancerogenic or mutagenic chemicals. Main sources and processes governing their occurrence in the aquatic environment will be outlined, as well as analytical approaches for their determination and study of their fate and behavior. Emerging contaminants classes, such as micro and nanoplastics will be also discussed.

Transfer of waterborne pharmaceuticals and endocrine disruptors in riparian zone through food webs



M. Sc.
Marina Veseli

Pharmaceuticals (PhACs) and endocrine disrupting compounds (EDCs) present in freshwaters originate mostly from wastewater and can be bioaccumulated in aquatic insects in their aquatic life stages. With emergence of aquatic insects, these compounds are transferred to terrestrial food webs posing a threat to their terrestrial predators. Results of our in situ studies confirmed bioaccumulation of multiple

PhACs and EDCs and their transfer across the aquatic-terrestrial ecosystem border. Furthermore, our research provides new insights on taxa and compound-specific bioaccumulation patterns, as well as novel information on lateral extend of waterborne contaminants in the riparian zone.

Prijenos farmaceutika i endokrinih disruptora iz vode u riparijsku zonu kroz hranidbene mreže

Farmaceutici (PhAC) i endokrini disruptori (EDC) prisutni u slatkim vodama potječu uglavnom iz otpadnih voda i mogu se bioakumulirati u vodenim kukcima u vodenim životnim stadijima. Emergenijom vodenih kukaca ti se spojevi prenose u kopnene hranidbene mreže i predstavljaju prijetnju njihovim kopnenim predatorima. Rezultati naših in situ istraživanja potvrdili su

bioakumulaciju više PhAC-ova i EDC-ova, kao i njihov prijenos između vodenog i kopnenog ekosustava. Nadalje, naše istraživanje pruža nove uvide u obrasce bioakumulacije ovisne o taksonomskim razinama, kao i pojedinim spojevima, te nove informacije o dosegu lateralnog prijena onečišćujućih spojeva porijeklom iz vode u riparijsku zonu.

Effects of climate change and emerging contaminants on aquatic insects



Assoc. Prof. Dr.
Ana Previšić

Abstract: The presentation will give an overview of the study aimed at characterizing individual and combined stressor effects such as pollution with pharmaceuticals (PhACs) and endocrine disruptors (EDCs) and increased water temperature on first level consumers in freshwaters. We conducted the microcosm experiment with a simplified freshwater food web containing moss and a shredding caddisfly larvae of *Micropterna*

nycterobia (Trichoptera). Our results show that negative effects of these stressors cross the ecosystem interface and reduce biomass and resource quality for both, aquatic and terrestrial food webs.

Utjecaj klimatskih promjena i onečišćenja na vodene kukce

Predavanje će predstaviti istraživanje provedeno s ciljem utvrđivanja pojedinačnih i kombiniranih učinaka stresora kao što su onečišćenje lijekovima i endokrinim disruptorima te povišena temperatura vode na potrošače u slatkim vodama. Proveli smo eksperiment s pojednostavljenom slatkovodnom hranidbenom mrežom koja se sastojala od mahovina i ličinki

tulara *Micropterna nycterobia* (Trichoptera) koji se hrane kao usitnjivači. Naši rezultati pokazuju da negativni učinci ovih stresora prelaze granice ekosustava i negativno utječu na biomasu i kvalitetu resursa u vodenim i kopnenim hranidbenim mrežama.

Effects of elevated temperature and selected contaminants on the behaviour of caddisfly larvae



Dr. Sc.
Filip Ložek

Climate change together with pollution is among the major anthropogenic stressors in freshwater ecosystems worldwide. The presentation reveals results from a laboratory experiment on how elevated temperature in combination with a mixture of selected contaminants (pharmaceuticals, antioxidants, plasticizers) impact locomotor activity, growth, and mortality of caddisflies *Drusus croaticus* and *Allogamus uncutus*

larvae. Additionally, potential ecological consequences of such stressor combinations will be discussed.

Učinci povišene temperature i odabranih onečišćivala na ponašanje ličinki tulara

Klimatske promjene, kao i onečišćenje, među glavnim su antropogenim stresorima u slatkovodnim ekosustavima diljem svijeta. Presentacija donosi rezultate laboratorijskog eksperimenta provedenog s ciljem utvrđivanja djelovanja povišene temperature u kombinaciji s odabranom

mješavinom onečišćivala (farmaceutika, antioksidansa, plastičnih aditiva) na motoričku aktivnost, rast i smrtnost ličinki vrsta tulara *Drusus croaticus* i *Allogamus uncutus*. Osim toga, raspraviti će se i potencijalne ekološke posljedice ovih rezultata.

Aquatic macroinvertebrates in a multiple stress environment



M. Sc.
Iva Kokotović

Wastewater effluents are one of the main sources of chemical pollutants in freshwater ecosystems. Accordingly, the aim of the current study was to investigate single and combined effects of wastewater effluent and elevated water temperature on model freshwater communities. A mesocosm experiment was conducted with a simplified freshwater food web containing moss and aquatic

macroinvertebrates, feeding as shredders and grazers. Our results show species-specific response to selected stressors and their combination.

Slatkovodni beskralješnjaci u okruženju višestrukog stresa

Otpadne vode su jedan od glavnih izvora onečišćenja u slatkovodnim ekosustavima. Sukladno tome, ovim istraživanjem želimo istražiti pojedinačne i kombinirane učinke onečišćenja uzrokovanih otpadnim vodama i povišene temperature na modelne slatkovodne zajednice. Proveli smo eksperiment s pojednostavljenom slatkovodnom hranidbenom mrežom

koja se sastojala od mahovina i slatkovodnih beskralješnjaka koji se hrane kao usitnjivači i strugači. Rezultati istraživanja pokazuju da različite vrste daju različite odgovore pod pritiskom istih stresora.

The times are a changing: freshwater ecosystems, stressors and effects on aquatic communities



Assoc. Prof. Dr.
Wolfram Graf

The presentation will provide a personal overview of research developments on freshwater ecosystems and effects of stressors on aquatic communities over the past 30 years. It will also open the discussion on prospects of freshwaters under human influence.

PROJECT TEAM MEMBERS

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