2019

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FBFW 2019

6th Fresh Blood for Fresh Water Conference

23-27 April 2019

Hotel Panoráma, Tihany, Hungary

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#FBFW #FBFW2019

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Welcome

The 'Fresh Blood for Fresh Water' is a meeting opportunity for early-career professionals in limnology. The FBFW community represents both newcomers to the field and also those who still (or forever) feel themselves “fresh blood”. The aim of the meeting is to provide a friendly atmosphere for enthusiasts in limnology to meet, present new findings, and exchange ideas.

The FBFW community — as anything else in ecology — functions and performs best in case of high diversity. We are happy to welcome all of you from over 20 countries at the 6th FBFW conference, organised by junior members of the MTA Centre for Ecological Research in Tihany, Hungary.

More on past FBFW meetings:

2017, 5th FBFW, Biology Centre CAS, České Budějovice, Czech Republic

2015, 4th FBFW, Center for Limnology, University of Innsbruck, Mondsee, Austria

2013, 3rd FBFW, WasserCluster Lunz, Lunz am See, Austria

2011, 2nd FBFW, WasserCluster Lunz, Lunz am See, Austria

2009, 1st FBFW, WasserCluster Lunz, Lunz am See, Austria

Certificate of attendance

Please let us know at the registration desk if you would need a printed certificate of your attendance at the 6th FBFW.

Currency

The official currency is Hungary is Forint (HUF). Most of the places (banks & restaurants) accept any types of credit cards. Though Hungary is a member of the European Union, only a limited number of shops and restaurants take Euros (EUR). You may change currency at the airport, railway stations, travel agencies, and banks. The closest ATM to the venue in Tihany is "OTP Bank", which locates at Kossuth Lajos u. 10, Tihany.

Internet

Wifi: Panorama-Guest

Password: keletiszel

Electricity

The electricity is 230 V, 50 Hz from German-style CEE7/4 plugs, which accepts also CEE7/16 “Europlugs“.

Telephone

The international code for Hungary is

+36, local area code for Budapest is +36 1, Tihany is +36 87. If you call a Hungarian mobile phone, type +36, then mobile codes 20, 30, or 70 followed by a 7-digit phone number. To make an international call, first dial 00 or + and the country code.

Important phone numbers

Emergency 112

Organizers

+36705390756 /or/
+36303019544

Hotel

+3687538220

Time

Central European Summer Time (CEST) Zone.

Weather and clothing

We expect an air temperature above 15°C, with rain and sun:

https://weather.com/weather/tenday/l/HUVE0765:1:HU

The conference venue is on the shore of Lake Balaton, bring a swimsuit if you swim in water over 13 °C. :)

Tuesday (23 April)

15:30 - 17:30	Shuttle bus (to Tihany)
16:00 - 19:00	Registration
19:00 - 21:00	Ice-breaker (cheese and wine tasting) and cinema

Wednesday (24 April)

8:00 - 9:00	Breakfast
8:30 -	Registration
9:30 - 10:00	Opening ceremony
10:00 - 10:45	**Plenary I.: Marco Scotti**
10:45 - 11:00	Coffee break
11:00 - 12:30	**Session I.**
12:30 - 14:00	Lunch
14:00 - 15:30	**Session II.**
15:30 - 15:45	Coffee break
15:45 - 16:30	**Plenary II: Mia Bengtsson**
16:30 - 18:30	**Poster session I.**
19:00 -	'Discover Tihany!' Dinner

Thursday (25 April)

8:00 - 9:00	Breakfast
9:30 - 10:15	**Plenary III: Maria Stockenreiter**
10:15 - 11:15	**Session III.**
11:15 - 11:30	Coffee break
11:30 - 12:30	**Session IV.**
12:30 - 14:00	Lunch
14:30 - 16:00	**Workshop I. (BLI+Hotel)**
16:00 - 16:30	Coffee break

16:30 - 18:00	**Workshop II. (BLI+Hotel)**
18:00 - 19:30	**Poster session II.**
19:30 -	Social dinner

Friday (26 April)

8:00 - 9:00	Breakfast
9:30 - 10:15	**Plenary IV: Jeremy J. Piggott**
10:15 - 11:15	**Session V.**
11:15 - 11:30	Coffee breaks
11:30 - 12:30	**Session VI.**
12:30 - 14:00	Lunch
14:00 - 15:00	Closing ceremony (BLI)
15:00 - 15:20	Facultative visit of the mesocosm facility
15:30 - 17:30	Shuttle bus (to Budapest)
19:00 -	Dinner (facultative)

Saturday (27 April)

8:00 - 9:00	Breakfast
9:30 - 12:30	Networking excursion game
12:30 - 14:30	Outdoor picnic (lunch)
14:30 - 16:30	Shuttle bus (to Budapest)

Hotel
Hungary 8237, Tihany, Lepkesor 9.
https://goo.gl/maps/sABKebgWJSk

Budapest Airport
https://goo.gl/maps/DuEencPzdQm

Shuttle bus departure/arrival site
Hungary 1085, Budapest, Blaha Lujza tér
(Blaha Lujza square parking lot)
https://goo.gl/maps/tnU92PEokX22

BLI: Balaton Limnological Institute, MTA Centre for Ecological Research
(Some of the workshops will be held here)
Hungary 8237, Tihany, Klebelsberg Kuno u. 3.
https://goo.gl/maps/m7RNjmeji8r

Nearest ATM to the Hotel
Hungary 8237, Tihany, Kossuth Lajos u. 10.
https://goo.gl/maps/SNSP84ENFV32

A few recommended restaurants:

The 5% discount in the selected restaurants applies only if you have your conference badge with you.

Stég Pizza & Restaurant

Hungary 8237, Tihany, Kossuth Lajos u. 18

https://goo.gl/maps/yiUbgSUc6WTxAEva8

Tihany Retro Pizza (5% off)

Hungary 8237, Tihany, Mádl Ferenc tér

https://goo.gl/maps/U9qUNjoLK9NADdjY8

Gulyás udvar Restaurant (5% off)

Hungary 8237, Tihany, Mádl Ferenc tér 2

https://goo.gl/maps/eChTrLwHaevU6FKb9

Garda Restaurant (5% off)

Hungary 8237, Tihany, Kossuth Lajos u. 27

https://goo.gl/maps/prFWZ61DXsYZpZUr7

Pedro | coffee & drinks (PUB)

Hungary 8237, Tihany, Kossuth Lajos u. 24

https://goo.gl/maps/BhyFkJkiaHuytpt16

For those who paid for breakfast, lunch or dinner for the 26th of April, the meals will be served at the Hotel Panorama. Vegetarian options will be available. For those who did not pay, the hotel can also serve food if they pay for it there. If you want anything else (e.g. alcoholic drinks), it can be purchased at the bar.

Ice-breaker

On the 23rd of April, there will be a cheese and wine tasting event as an ice-breaker at the Hotel. That evening dinner will not be served, please make dinner arrangements yourself.

"Discover Tihany" dinner

On the 24th of April, we would like the participants to discover Tihany's restaurants and pizzerias, and will prepare some suggestions on what to visit, where to eat or drink this evening. The participants can walk up the hill to the village, or we can rent a mini train. Discounts will be available to participants in some of the recommended restaurants and can pay with cash or credit card. See the recommended list of restaurants in the Locations section.

Qualitative assessment of human impacts on Black Sea ecosystem

Marco Scotti

GEOMAR Helmholtz Centre for Ocean Research Kiel

Since the 1950s the Black Sea ecosystem has been exposed to multiple human-induced stressors, which include overfishing, excessive nutrient load, climate change and invasion of non-native species. The interplay between these factors culminated with the shift from the classical grazing chain to a food web with large quantities of energy transferred to jellyfish. Due to the concurrent action of multiple stressors and their spread through the complex architecture of the food web it is difficult to disentangle the cause-effect mechanisms responsible for regime shift. Moreover, the construction of highly parameterized food web models is impaired by the lack of complete datasets about the biomass trends of the main trophic groups that compose the Black Sea food web. In presence of poor data availability the qualitative method of loop analysis represents an ideal tool to identify the processes that lead to system-level changes. Loop analysis was applied to determine how the biomass changes that occurred in the Black Sea were caused by

the diffusion of human-induced stressors through the food web. First, it clarified that although overfishing of small pelagics started in the 1970s their decline was delayed due to nutrient enrichment. Second, it showed that warmer winters and overfishing were crucial for the outburst of *Mnemiopsis leidyi* in the years 1989-1994. This work illustrates the value of loop analysis for integrated understanding of ecosystem-level dynamics.

Making sense of microbial jungles – molecular tools, tricks and triumphs

Mia Bengtsson

University of Greifswald

Aquatic microbial communities are responsible for ecosystem services that are so fundamental to humans that they are sometimes taken for granted. Algae are responsible for producing roughly half of the oxygen we breathe, and form the basis of complex foodwebs supporting fisheries. Bacteria recycle nutrients and organic matter, thereby ensuring clean water for drinking and recreation. However, these ecosystem services rely on the impressive diversity of microorganisms. This diversity may appear unlimited, and during the last decades molecular tools have revealed astronomical numbers of individual taxa and a glimpse of their intricate interactions. Microbial communities in lakes, streams and oceans are like jungles. They are marvels of biodiversity, yet difficult to penetrate and understand with our limited methodological capacities (machetes don't come in microscopic sizes!). In order to "see the jungle behind the trees", I used molecular techniques

such as metatranscriptomics and high-throughput amplicon sequencing to reveal the taxonomic and functional diversity of microbial jungles found in streambeds, i.e. stream biofilms, and in lake plankton. Using microcosm and mesocosm experimentation, I investigated how these jungles respond to different aspects of environmental change. On this journey, I discovered that stream biofilms respond to changing light conditions through structure-function adaptations on several trophic levels. In lake plankton, I learned that the biodiversity and function of algae, bacteria and consumers in mesocosms was dependent on dispersal from regional lakes. Most importantly, my research illustrates that microbial diversity and the ecosystem services that it provides is multifaceted, but should not be taken for granted.

Upscaling community ecology experiments in aquatic systems

Maria Stockenreiter

Ludwig-Maximilians-Universität Munich

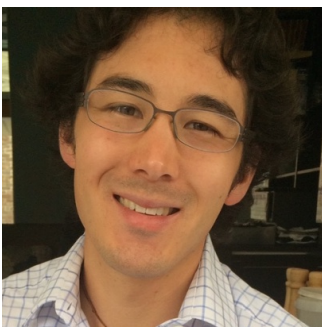
There is a substantial body of studies regarding changes in foodwebs to altered environments in well controlled and highly replicated small scale microcosm experiments. However, their realism is limited and the extrapolation to natural systems is often difficult. Hence, large-scale mesocosm experiments allow a more realistic setting and can be a valuable tool in upscaling approaches. With mesocosm studies, it is possible to experimentally investigate ecosystems at a higher complexity, including several trophic levels, although the replication and control may be more limited compared to small-scale experiments. For example, mesocosm studies can be used to investigate if traits those are responsible for biodiversity - ecosystem functions in laboratory plankton communities also relevant for natural field populations of plankton. Consequences of losses of important ecophysiological traits can then not easily be predicted from laboratory studies alone, in particular, if complex interactions and feedback loops occur. I

will present an overview of several mesocosm studies regarding biodiversity loss effects and dynamics in community assembly in aquatic systems.

Stressed Out? - Multiple Stressors in Freshwaters (and Academia) under Global Change

Jeremy J. Piggott

Trinity College Dublin



Climate change and its impacts are likely to be the dominant driver of biodiversity loss and changes in ecosystem functioning by the end of this century. But how the various drivers of climate change will interact with the multiple stressors already impacting ecosystems remains the largest uncertainty in projections of future biodiversity change. This body of research has sought to understand how climate and land-use related stressors interact to affect biodiversity and ecosystem function in freshwaters. In particular, how multiple stressors interact to create 'ecological surprises' in the form of complex, non-additive effects such as synergisms (amplified effects) or antagonisms (reduced effects). Investigations have studied multiple stressors in streams across a range of spatial scales using multi-factorial manipulative field experiments to disentangle complex interactive effects from genes to ecosystems. This knowledge is essential

for effective freshwater management and policy, and to advancing multiple-stressor theory and prediction in the face of global change. Within this research context, I will also discuss some of the "multiple stressors" faced by early-career researchers and associated challenges and opportunities in academia and beyond.

Meta-analysis workshop

Péter Batáry

MTA Centre for Ecological Research, Vácrátót, Hungary

Ecological questions can be answered by systematic reviews that identify, appraise, select and synthesise all high-quality, relevant research evidence. They often use meta-analysis as a statistical technique to combine results of the eligible studies. During the workshop the following analytical methods and problems will be discussed and used with real ecological data: calculation of effect sizes, cumulative effect size and heterogeneity, fixed- and random-effect meta-analysis, biases. We will start with a theoretical introduction then continue with practices in R.

Topics for personal discussion:

Living in different countries during the professional career; article reviews from different perspectives.

Trait-based ecology workshop

Zoltán Botta-Dukát

MTA Centre for Ecological Research, Vácrátót, Hungary

The workshop will cover the theoretical basis of trait-based ecology, as well as practical examples based on real ecological data. The practical part will focus on approaches for trait-based functional diversity measures.

Topics for personal discussion:

Trait-based community ecology; use of data from databases.

Metacommunity workshop

Zsófia Horváth

WasserCluster Lunz, Lunz am See, Austria

The workshop will cover the basics of empirical metacommunity analysis in R, together with examples of successful experimental design and potential pitfalls when studying spatial community patterns.

Topics for personal discussion:

Public/social anxiety; being an introverted scientist.

Food webs workshop

Ferenc Jordán

Balaton Limnological Institute, MTA Centre for Ecological Research

The workshop will outline the past, present and future of network ecology. Problems, methods and applications. Speaking about ecological networks will hopefully help to develop a more integrative thinking attitude. Interesting case studies will illustrate the methods and concepts presented. Applications range from marine fisheries to systems-based conservation issues. I gave similar workshops at SCCS Bangalore, SCCS Tihany and various summer schools in Rio de Janeiro, Sete and Parma.

Topics for personal discussion:

Good papers: the author, the viewpoint of the reviewer, the editor and the reader; keystone species; reading old articles.

Science communication workshop

András Zlinszky

MTA Centre for Ecological Research, Tihany, Hungary

The science media communication workshop will address the how and why of communicating scientific results with the general public. Techniques for writing tweets, blog posts, press releases and paper articles will be demonstrated in addition to science communication portals and channels. The workshop will also touch on essential skills for radio and TV interviews and live science communication talks, including communication with journalists before and after an interview. In addition to a lecture and Q&A, participants will be encouraged to write a draft press release of their own.

Topics for personal discussion:

Balancing a research career with a (large) family.

Vote for your favourite on the FBFW website!

1) Participant's favourite talk

The prize will be a gift package from VWR.

2) Participant's favourite poster

The prize will be a gift package from the Municipality of Tihany.

3) Best in microbiology (selected by Mia Bengtsson)

Prize from the Editorial Board of Freshwater Biology. The winner will have the opportunity to submit a paper into FWB with a pre-submission review offered by associate editor Stefan Bertilsson. The FWB prize winner will also have two years of free access to the journal.

4) Best in experimental ecology (selected by Jeremy Jay Piggott)

Prize from the Editorial Board of Freshwater Biology. The winner will have the opportunity to submit a paper into FWB with a pre-submission review offered by associate editor Angus McIntosh. The FWB prize winner will also have two years of free access to the journal.

5) Best in community ecology (selected by Maria Stockenreiter)

Prize from the Editorial Board of Community Ecology. The winner will have the opportunity to submit a paper into COMEC with a pre-submission review offered by Editor in Chief Ferenc Jordán.

6+7) Best talk and best poster (selection by the organizers)

Prizes from the European Federation for Freshwater Sciences (EFFS). EFFS together with 15 EFFS federated Limnological Societies from Europe offer two years of free membership within the society of the winners at the country level.

S1T1 – Assessing the impact of the predatory cladoceran *Bythotrephes longimanus* on zooplankton communities in Alpine lakes

Arthur Pichler[1], Jens C. Nejstgaard[2], Marc E. Frischer[3], Tina L. Walters[3], Adam Petrusek[4], Radka Ptáèníková[5]

1: University of Vienna, 2: IGB, 3: University of Georgia, 4: Charles University, 5: WasserCluster Lunz

Biological invasions may have serious ecological and socio-economic consequences. However, detailed knowledge about the biology and ecology of invasive species in their native range is often lacking, but might ultimately be of interest in the management of invaded areas. *Bythotrephes longimanus*, the spiny water flea, is native to lakes of Northern Eurasia and the Alps in Central Europe. In the 1980s, *Bythotrephes* has been introduced to North America, where it has caused significant and lasting changes in zooplankton communities in numerous lakes. In this project, we aim to investigate direct and indirect effects of *Bythotrephes* on zooplankton community structure, biodiversity and behaviour (e.g., increased predator defense). This will be achieved by a combination of intensive fieldwork in Alpine lakes with and without *Bythotrephes*, and experimental work in the laboratory, applying both standard

and novel methods like molecular gut content analyses and in situ plankton imaging. Quantitative PCR was used for the first time to assess the in situ diet of *Bythotrephes longimanus*. A new set of primers targeting short fragments of the mitochondrial COI region was designed specifically for the most abundant crustacean prey species in Erlaufsee and Mondsee and was subsequently applied to analyze the gut content of *Bythotrephes*. Our goal is to increase the understanding of the role of this predacious cladoceran in its native range, as well as the evolutionary adaptations to predation pressure of its prey species.

S1T2 – Relative body size and habitat productivities jointly drive trophic energetic flows

Samuel Dijoux[1], David S. Boukal[1]

1: University of South Bohemia, Faculty of Science, Department of Ecosystem Biology

Eutrophication and habitat homogenising account for main disturbances in freshwaters, affecting separated habitats that are linked by apex predator (multichannel food webs). Such linkage of habitats differing in energy production and community traits shape the energy flows within multichannel food webs, influencing the whole structure and dynamic. However, little is known on how changes within multichannel food webs might affect systems resilience to perturbations. On one hand, the linkage of asymmetric energy channels enhances food web resilience by the presence of fast and slow continuums of energy flows, preventing the collapse of upper trophic levels. On the other hand, arising asymmetries could disrupt the food web stability through an increasing pressure on apparent competing species. Here we investigate how changes within food webs energy partition and consumer relative body sizes affect the structure of food webs. We developed two size-structured population models, i) a tri-trophic chain and ii) a food

web including an apparent competition between two size-structured populations, to link the joint influences of pelagic and benthic habitat productivities and consumer relative body sizes on consumer life history traits and food webs dynamic. Our results provide a strong predictive framework that link both individual size- and food- responses to community level driven by varying consumer body sizes and habitat productivities. We argue that the asymmetric stability of multichannel food web observed in freshwaters result from a compensate modulation of energy flow, which result from asymmetries within energy channels and energy partition between separated habitat.

S1T3 – Impacts of catchment land use change on trophic ecology

Clare Wilkinson[1], Jia Huan Liew[2], Darren C J Yeo[1]

1: National University of Singapore, 2: University of Hong Kong

Land use-change and associated habitat loss and degradation is the single greatest threat to aquatic biodiversity. Freshwater ecosystems are fuelled by allochthonous inputs from surrounding lands and internal lake/stream primary production (autochthony). Helpfully, allochthony, or the incorporation of terrestrial organic matter into aquatic food webs is one of the more well studied ecosystem functions. While the exact role of terrestrial carbon in aquatic ecosystems remains unresolved, changes in the levels and types of allochthonous material are generally thought to have bottom-up influences on aquatic trophic ecology. We conducted a global meta-analysis to characterise the changes in maximum food chain length and/or levels of allochthony (from stable isotope or gut content analysis) in freshwater food webs across anthropogenic disturbance gradients, e.g., comparisons between rivers with intact riparian forests vs. rivers bordering agricultural land. We hypothesise that riparian vegetation and increasing forest cover within catchments increases food chain length within stream ecosystems, but remains more mixed in lakes and

reservoirs. Combining these measures of ecosystem structure and function can help to make better informed management decisions and to develop more focused priorities for mediating the negative effects of anthropogenic impacts on freshwater ecosystems.

S1T4 – Effects of anthropogenic disturbances on aquatic food webs in Singapore's reservoirs

Claudia Tan[1], Clare Willkinson[1], Rayson Lim[1], Jeffrey Kwik[1], Abel Saw[1], Shan Shan Liu[1], Jia Huan Liew[2], Darren Yeo[1]

1: National University of Singapore, Department of Biological Sciences, 2: The University of Hong Kong, School of Biological Sciences

The construction of reservoirs amongst natural freshwater habitats results in the emergence of essentially novel aquatic ecosystems. While subjected to disturbances from multiple anthropogenic activities, the extent and type of disturbance may vary. Some of the reservoirs could also be hybrid artificial-natural habitats due to the presence of natural forest patches along the parts of the shoreline. However, it remains unclear if, and how any anthropogenic activity and/or presence of natural forest habitat along the shorelines could affect the aquatic community interactions in these alien-dominated, and presumably disturbance-resilient systems. This is also true in tropical Singapore, where reservoirs were built in areas with varying degrees of human development. To this end, our study aimed to determine the relationship between different types of anthropogenic disturbances and aquatic

food webs in Singapore's reservoirs. Anthropogenic disturbances, including natural habitat fragmentation (lack of connectivity) and human accessibility, were quantified using Geographic Information Systems (GIS). Community interactions, defined here as trophic relationships between aquatic reservoir species/taxa, were elucidated from food web metrics (such as maximum trophic length) empirically derived from stable isotope and fish gut content analyses within each reservoir. Findings will shed light on how anthropogenic activities can influence the communities of these novel yet increasingly prevalent freshwater habitats.

S1T5 – Show me who your friends are, and I'll tell you how you are! Building sensitive networks

Eric Puche[1], Maria A. Rodrigo[1], Carmen Rojo[1]

1: Cavanilles Institute of Biodiversity and Evolutionary Biology

The potential of studies with ecological interaction networks lies in the ability to capture complex relationships between the elements that shape a community. Since these networks are representations of reality, the criteria used in their construction will play a key role in their success as models that respond to the environment. We are interested in selecting which elements constitute the most sensitive networks to biotic and abiotic changes. We used as a model an experimental community with three connected assemblages and we considered both trophic and non-trophic interactions. We built three versions of this network depending on node definition, ranging from a coarse-grained grouping (taxonomic groups) to a more fine-grained grouping (functional groups) and to a network without grouping (all species). We assessed these networks from the global structure (connectance, modularity, nestedness) to the nodes (peripheral or connector roles). Finally, to test their different sensibility, we simulate the effect of nodes' removal on the network

structure. As expected, the more we simplify a network (large taxonomic groups) the more connected and the less modular it is, thus, this type of network was the most sensitive and praise it as a good candidate to track disturbances in the community they represent. However, it is difficult to imagine an environmental change that exterminates a whole taxonomic group, therefore, this simple network will be, on one hand, very common between different environments and, on the other, inefficient because its nodes will remain despite the changes. This is the dilemma we must solve.

S2T1 – Microbial metacommunities under shifting environmental conditions

Máté Vass[1], Anna J. Székely[1], Eva S. Lindström[1], Silke Langenheder[1]

1: Uppsala University

Temporal variations in microbial metacommunity structure and assembly processes in response to shifts in environmental conditions are poorly understood. Hence, we conducted a temporal field study at the Baltic Sea coast in Sweden by sampling rock pools in four-day intervals during a 5-week period when there were strong changes in key environmental conditions due to a storm event. We characterised bacterial and microeukaryote communities by 16S and 18S rRNA gene sequencing, respectively, and used a suite of null-model approaches to assess dynamics in community assembly. We found that bacterial and microeukaryote communities were to a similar extent assembled by dispersal-related processes but by different selection processes. The dominance of dispersal-related processes was most likely due to historical contingencies (i.e. priority effects), particularly in bacteria, rather than dispersal limitation per se. Altogether, we can conclude that environmental change triggered different

responses in planktonic bacterial and microeukaryotic metacommunities wherein historical contingencies may have an effect on communities depending on the microbial group of interest.

S2T2 – Temporal and geographical patterns of cyanobacteria communities in the Danube Delta

Maria Iasmina Moza[1], Ana Maria Benedek[2], Mirela Moldoveanu[3], Carmen Postolache[1]

1: Faculty of Biology, University of Bucharest, Bucharest, Romania, 2: Faculty of Science, "Lucian Blaga" University of Sibiu, Sibiu, Romania, 3: Institute of Biology Bucharest,Romanian Academy, Bucharest, Romania

Freshwater cyanobacteria (CB) genera such as Microcystis, Anabaena, Lyngbya, Oscillatoria or Aphanizomenon are frequently encountered in the shallow eutrophic lakes of the Danube Delta (DD) and potential toxic blooms may occur. We aimed to expose the spatial and temporal distribution of CB in 19 lakes studied between 2013-2014, to find a potential spatial-temporal pattern of the CB composition and abundance (mainly those with toxic potential), and to relate it to the connectivity between the lakes and lake complexes. We consider that the difference in the community composition, concentrated mostly in Roșu-Puiu LC is partly explained by the different degree of connectivity of the lakes with the main branch, which is characteristic to the DD. Although each lake had different CB genus composition, the diversity and abundance (cell/l) had a clear geographical pattern,

decreasing from SE towards NW, due to the fact that CB where washed out in this direction. The CB genus richness was consistently highest in summer and lowest in spring, and 12.6% higher in 2013 compared to 2014. More than 70% of the CB identified in this study present toxic potential and the higher occurrence was in the maritime delta.

S2T3 – The role of historical events in the assembly process of benthic communities in the Orinoco basin

Juan David González-Trujillo[1], Jhon Ch. Donato-Rondon[2]

1: Catalan Institute for Water Research (ICRA), 2: National University of Colombia

The assembly of communities is viewed as a process where the successful colonization and coexistence of species at local scale is determined by the dispersal of species from a regional pool and the filtering by the abiotic and biotic environment. For decades, one of the major goals of ecologists has been to disentangle the mechanisms underlying this process. However, how past historical events have shaped the regional pool still remain as a gap to be addressed in the Neotropics. Here, we aim to fill this gap by assessing diversity patterns of benthic communities throughout the Orinoco basin. Among this basin, geological and climatic events, such as Andean uplifts and the expansions and retreats of glaciers, have shaped unique combinations of river forms and riparian ecosystems at regional-scale. Each ecoregion emerged then as a current "footprint" of the historical events. In light of this, we sampled freshwater diatom and

invertebrate communities - and measured physical and chemical variables - in 25 streams from six of the most representative ecoregions in the basin. Overall, we found that beta diversity was higher among than within ecoregions, pointing out that streams from the same ecoregion share a similar pool of diatoms and invertebrates notwithstanding their spatial closure. Statistical models also showed that community structure is better explained by ecoregion type rather than by the environmental conditions or spatial structure. Collectively, our results provided some insigths of the role of the historical events in the assembly process of Neotropical aquatic communities.

S2T4 – Community ecology of crustaceans in Indian rock pools

Mihir Kulkarni[1], Sameer Padhye[2], Kalpana Pai[1]

1: Savitribai Phule Pune University, Pune, India, 2: Wildlife Information Liaison Development society, Coimbatore, India.

Most studies on crustacean meta-community ecology do not consider constituent higher-level taxa separately despite ecological differences among them. This coupled with the fact that observed patterns can vary in different regions, prompted us to conduct this study in the megadiverse, yet understudied Western Ghats region in India. Temporary pools on a lateritic outcrop were studied to identify factors influencing species richness, meta-community structure and spatial patterns of constituent crustacean groups. We used Spearman's correlation, ordination based methods, partial Mantel tests, distance-decay patterns and β-diversity partitioning to analyse influence of spatial and ecological factors on distribution of taxa and community composition. Overall crustacean species richness was strongly influenced by hydroperiod; some influence of other parameters such as maximum surface area, depth on species richness of individual taxa was also observed. Hydroperiod had the highest influence on the community composition, and community dissimilarity increased with

environmental and inter-pool distance. Higher turnover among the communities, and significant influence of environmental factors of individual pools indicated a higher contribution of species-sorting processes to be structuring the structuring of the crustacean meta-community. The communities of copepods and cladocerans showed higher nestedness, while those of ostracods and large branchiopods showed higher turnover. The meta-community structure observed at a small spatial scale is discussed in the light of ecology of constituent crustacean groups, habitat and landscape features.

S2T5 – Freshwater mollusc metacommunity structuring in lowland lentic habitats

Erika Lorencová[1], Eliška Maršálková[2], Michal Horsák[1]

1: Masaryk University, Department of Botany and Zoology, 2: Institute of Botany, Czech Academy of Science

The highest freshwater mollusc diversity was repeatedly found in lowland standing waters. Despite the increasing degradation of these habitats and spreading of non-native species, still only little is known about the main drivers of mollusc diversity among individual stagnant water bodies at a regional scale. Besides environmental filters, freshwater mollusc distribution depends on the occurrence of active vectors and interconnection among individual sites due to passive dispersion mode of molluscs. Further, the distance between sites and the presence of stepping stones governs the success of mollusc migration to new habitats, being also link with their long-term survival in a dynamic environment. The presence of rare mollusc species can thus indicate low anthropogenic pressure and the quality of site. We quantitatively sampled mollusc assemblages at 56 stagnant water bodies within 5,000 ha region in the Dyje River floodplain (south-east Czechia). In total, 33 species were found, with the maximum number of 15 species (5 on average per

site). By measuring an extensive set of environmental predictors, we were able to describe the main variation in species composition of local assemblages. This allows comparing the effect of environmental based processes and distance-based processes on metacommunity structuring of mollusc assemblages in standing waters of a lowland agricultural region.

S2T6 – Space use of overwintering waterbirds in artificial wetlands outside Doñana National Park

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Doñana National Park is considered one of the most important freshwater wetlands in Europe, and is a central hub in the Afro-Eurasian waterbird flyway. The impacts of climate change and extensive groundwater abstraction in the vicinity of the park have strong effects on local hydrology, and are increasing the importance of artificial wetland habitats for many waterbirds as within-park hydrological condition declines. We investigated the space use of the Lesser Black-backed Gull (*Larus fuscus*), in the unprotected, agricultural wetland systems outside of the park to ascertain the role such wetlands play for waterbirds in a landscape context. Specifically, we analyzed >100,000 GPS locations of these gulls across more than 10 years of ongoing tracking efforts for individual, inter- and intraseasonal, and ecological patterns in space and resource use of waterbirds in the rice field landscape. Here, we present the preliminary findings of this study and their

implications for wetland ecology and conservation in Southern Spain.

S3T1 – Effects of seasonal acclimatization on the thermal performance curves of aquatic ectotherms

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Thermal performance curves (TPCs), which describe the effects of temperature on fitness-related processes such as growth, metabolism and feeding, have become a key tool to predict the response of ectotherms to climate change. Phenotypic plasticity has the capacity to modulate the shape, breadth and position of the TPCs for acute exposures (e.g. after lab acclimation), but these impacts can be hidden when rate processes are measured after chronic exposure (e.g. by seasonal acclimatization). We assessed the effects of seasonal acclimatization on the TPCs of feeding and metabolic rates in an aquatic predator, *Chaoborus obscuripes* (Diptera). The microcosm feeding trials were performed at 10 test temperatures (6-36°C) in two seasons (spring and autumn) by using *Daphnia magna* (Cladocera) as prey. Water temperature was measured in the natural habitat of C. obscuripes throughout the year to gain information about the seasonal acclimatization before

the experiments. We found significant differences in the shape of the feeding performance with higher thermal optimum in autumn than in spring. However, the breadth and the position of the TPCs did not differ. Furthermore, we found significantly lower metabolic rates in autumn. These changes in the TPCs correspond to the previous chronic exposure to seasonally varying temperatures. Our results highlight the need to consider the role of previous chronic temperature exposure in TPCs before using them for predicting organismal responses to climate change.

S3T2 – Are populations of *Gammarus fossarum* able to reflect stream drying?

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Stream intermittency is one of the typical consequences of climate change with long-term effects on aquatic biota. Dry episodes are becoming more frequent in the Czech Republic. Especially during supra-seasonal drought, they can completely change a population structure of permanent fauna. *Gammarus fossarum* is key taxa (ecosystem engineer), strongly affected by stream intermittency. Mostly because it inhabits small, often drying streams across the whole Czech Republic and lacks any drought-resistant stages. We compared its population structure (sex ratio and size distribution) on 12 pairs of intermittent and perennial streams during 2012-2016. Populations from intermittent streams after the dry period had a higher proportion of larger males and a lower proportion of juveniles in comparison to populations of neighboring perennial streams. This result supports a hypothesis, suggesting a higher male recolonization ability resulting from their larger body size which enables higher mobility in comparison to smaller females and

juveniles. Fecundity analyses of the same species in residual pools persisting in otherwise dry riverbed of intermittent streams showed a lower proportion of breeding females in residual pools than in comparable nearby perennial streams. This difference can be explained by an increase in predation of overcrowded refuge pools or overall stress in this highly unstable habitat, leading to possible egg loss, indicating a limited possibility of rapid population recovery from residual pools after flow resumption. Our study confirms that alterations in the population structure of *Gammarus fossarum* could indicate an impact of previous dry episodes on small streams of Central Europe.

S3T3 – Drivers of flight activity patterns in aquatic and terrestrial chironomids (Diptera: Chironomidae)

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The ability to move between sites and habitats is crucial for long-term survival of species in highly dynamic environment such as small standing waters. Chironomidae, a most widespread macroinvertebrate taxon in many standing freshwaters, rely on adult flight to reach suitable sites, however, the flight patterns of adults are not completely understood. In particular, little is known about the impact of weather conditions on their flight activity. To fill this gap, we investigated seasonal flight activity patterns of aquatic and terrestrial chironomids in a sandpit area and analysed how weather conditions and seasonality influenced their total abundance and species composition. Weather conditions significantly affected total flight activity of both groups, but not in the same way. We identified an intermediate temperature and humidity optimum for the flight activity of terrestrial chironomids, which contrasted with weaker, timescale-dependent

relationships in aquatic species. Observed flight activity of both groups further declined with wind speed, increased with air pressure and varied in time on both daily and seasonal scale. Surprisingly, aquatic and terrestrial chironomids used partly alternating time windows for dispersal during the season. This may be driven by different seasonal trends of key environmental variables in larval habitats and hence implies that species phenologies and conditions experienced by chironomid larvae influence adult flight patterns more than weather conditions. Our results provide detailed insights into the drivers of chironomid flight activity and highlight the methodological challenges arising from the inherent collinearity of weather characteristics and their diurnal and seasonal cycles.

S3T4 – The role of Mediterranean wetlands in a climate change framework through their carbon balance study

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Mediterranean wetlands are relevant systems because of their climate regulation capacity, as they may act like natural carbon sinks. However, climate change effects could alter their carbon storage capacity, as well as their balances of Greenhouse Gases (GHG) emissions. The aim of this study was to estimate the carbon balance in Mediterranean wetlands with quite different conservation status, as well as their response to climate change scenarios, in order to evaluate the role of these ecosystems in their mitigating ecosystem service. For that purpose, carbon cycle was assessed within the field data and estimating experimentally carbon processes. Response of all these factors was experimentally determined according to the temperature, salinity and dehydration fluctuations. Then, a model was built by taking into account every carbon process and their relation with the environmental features. Finally, model was applied to different climate change

scenarios, from which the role of these ecosystems in the climatic ecosystem service could be evaluated. Preliminary results showed differences in the carbon balance between the sites differently conserved. Those altered sites showed higher carbon exchange rates, in both carbon retention and carbon emission. Methane emissions were especially higher regarding the rates obtained on the well conserved sites, and therefore, drove their Global Warming Potential balance to the greenhouse effect enhancement. Future predictions showed two different responses. Models forecasted increases of the sink effect, but also an increment of the GHG emissions, especially methane gas, in the different climatic scenarios. Work supported by the CLIMAWET project.

S4T1 – Effects of artificially induced water turnover on microbial food web dynamics in Lake Zurich

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Thermal stratification patterns of Lake Zurich undergo drastic changes owing to climate warming. The consequent stronger stratification reduces the depth of water turnover and impedes the transport of orthophosphate from deep (hypo-) to upper water strata (epilimnion) which seems to strikingly limit phytoplankton spring blooms. Consequently, Lake Zurich experiences a sudden and severe oligotrophication due to lake warming. In order to understand if reduced water turnover indeed hinders adequate phytoplankton blooms, we artificially simulated complete water turnovers (holomixis) by (i) mixing epi- with hypolimnetic water or (ii) amendment of surface waters with phosphorous. These experiments were conducted at different time-points of the year to study seasonal effects. We could induce striking phytoplankton blooms throughout all seasons with either of the above mentioned treatments. Increased primary

production was followed by rising bacterial numbers and changes in assemblage composition known from in situ observations during times when natural holomixis still occurred. Microbial food web dynamics were also documented by mass sequencing which reflected the striking changes due to experimental manipulations. We confirmed that Lake Zurich would still have the internal phosphorus capacity to promote distinct phytoplankton blooms given just intensive water (natural or artificial) turnovers again. However, in contrast to algae and bacteria, consumers (hetero- and mixotrophic protists) responded to artificially increased primary production in a much less predictable way in terms of abundances and community composition. Therefore, possible intentions to artificially mix or fertilize lakes should be seen very critical by policy makers with respect to sustainable lake management.

S4T2 – Importance of stochastic processes in shaping bacterial community structure and functionning

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After decades of debates, ecologists agree that both, deterministic and stochastic processes play a role in shaping the structure of microbial communities. However, the relative importance of both processes and their implication for community functioning are still unknown. In microbial communities, the link between community structure and functioning remains elusive due to the high metabolic plasticity of bacteria. This project aims to investigate whether similar abiotic conditions can lead to communities with different structure and functioning due to stochastic community assembly. Bacteria from the epilimnion of lake Zurich were cultivated at 3 different seasons in 20 replicated microcosms of 200 mL under identical abiotic conditions. Each microcosm contained bacteria from the same inoculum and 2 carbon sources: glucose (10 µM) and cellobiose (100 µM). Community functioning was assessed via substrate consumption and growth parameters. Community structure at the end of the experiments was elucidated by

16s rDNA amplicon sequencing. The emerging communities showed a diverse genotypic structure and a high variability in functional parameters. Mantel test revealed that the community functioning was related to the community structure. About 1/3 of the identified genotypes were exclusive to a single microcosm. Overall evenness was low, with 3 OTUs accounting for more than 50% of total sequence reads. Stochastic assembly processes, likely associated with biotic interactions, had a fundamental role in shaping the structure of the experimental communities. Moreover, the observed variability in functional aspects may have severe implications for our ability to predict ecosystem functioning and response to climate change.

S4T3 – Once Upon a time… *Chaoborus* and top-predator cues: a failure tale

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For a potential prey, detecting predator presence and reacting accordingly is literally a matter of life or death. In freshwater environments, the detection of the chemical cues released by a predator can effectively support or replace visual detection. Some species of dipteran larvae *Chaoborus* are known to react to these cues (mainly from fish), inducing specific behavioral responses. We investigated the influence of the chemical cues of Aeshna larvae (a predator of *Chaoborus*) on the feeding behavior and the microhabitat choice of *Chaoborus obscuripes*. Seeking for a positive result, three different experiments took place – a functional response experiment, a feeding experiment with multiple chemical-cues combination and a Y-maze choice behavioral experiment-, with systematical negative results, suggesting *Chaoborus* cannot detect these cues; or can it? With this presentation, we want to illustrate the failure of a hypothesis, the difficulty to deal with negative results and the reasons why you should not give up on them.

S4T4 – Effects of chronic hypoxia on multiple fitness components in overwintering mayfly larvae

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Hypoxic conditions can appear in freshwater water bodies during winter due to ice and snow cover on the surface that prevents oxygen and light penetration into water. Such a scenario can last up to several months depending on local conditions. However, responses of aquatic invertebrates to hypoxic conditions during winter remain poorly understood. Using larvae of the mayfly *Cloeon dipterum* as a model species, we experimentally investigated the chronic effects of hypoxic conditions differing in duration (1 week and 1 month) under simulated winter conditions (4 °C) in the lab. We focused on four key components that underpin individual fitness: survival, body size, metabolic rate and energy reserves. We found that (1) mass-corrected metabolic rates decreased under hypoxic conditions, (2) survival significantly decreased in hypoxia, and (3) dry weight and relative protein and lipid content of the larvae

declined under hypoxic conditions. Our results show that chronic hypoxia strongly affects multiple fitness components and should thus be considered as an important factor that can drive adaptive physiological responses of aquatic invertebrates to severe winter conditions.

S4T5 – Influence of drying and organic pollution on macroinvertebrate community composition

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Stream drying is nowadays a highlighted research topic because more and more streams becoming intermittent globally. Despite it, there is still lack of information about co-influence of drying with other stressors such as organic pollution on instream biota. Benthic invertebrates can reveal different responses (e.g. different resistance to drying and pollution) to these effects depending on their combined or isolated impacts. We tested in laboratory benthic invertebrates from dry riverbed samples from streams with two different combinations of following factors – i) unpolluted intermittent streams (3 sites) and ii) organic polluted intermittent streams (3 sites). Samples of benthic invertebrates were taken during the drying episode and rehydrated for 2 months under laboratory conditions (controlled temperature and aeration). In each stream we taken 10 plots from 10 representative mesohabitats according their proportional representation within reach. We also analysed substrate composition and

sediment moisture in each mesohabitat as important factors affecting invertebrate resistance. This experiment can help to understand differences in seedbank composition in unpolluted and organic polluted intermittent streams and differences in species resistance under combination of both stressors.

S5T1 – Resolving host-phage dynamics at ecosystem scales

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The persistent inertia in the ability to culture environmentally abundant microbial representatives from aquatic habitats remains an Achilles heel towards disentangling the complex web of interactions spun by a most diverse assortment of participants (pro- and eukaryotes and their viruses). The relative paucity of manipulative abilities within classical frameworks that allowed linkages of phenotypes to genotypes e.g. in model organisms, spurred development of culture-free approaches like metagenomics, that now allow increasingly magnified genomic perspectives of entire microbial communities. Even so, in aquatic microbial communities (freshwater or marine), the numerically most abundant actors, the viruses, still remain the most elusive, largely owing to their small size and enormous sequence diversity. While the marine habitats have been increasingly explored in wide-ranging surveys, viruses from freshwater remain relatively unknown and their ecology remains in its infancy. Here, using ultra-deep metagenomic

sequencing from multiple freshwater habitats we recover complete genomes of >2000 phages, paving the way towards genome-centric viral ecology studies. We show that the most abundant, small, streamlined microbes in freshwater also have abundant phages with small genomes. Temporal analyses of phage genome abundances reveal evanescence as the primary dynamic in upper water layers and persistence in the deeper ones. Moreover, temporal phage genome abundance patterns mimic not only their host abundances but also stratification and mixis, paving the way towards genome-based ecology.

S5T2 – The impact of OTU sequence similarity threshold on diatom-based bioassessment

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Extensive studies on the taxonomic resolution required for bioassessment purposes have determined that resolution above species level is sufficient for their use as environmental indicators. High-throughput sequencing (HTS) and meta-barcoding methods now used for bioassessment employ an arbitrary sequence similarity threshold (SST) around 95% or 97% to cluster sequences into operational taxonomic units (OTUs), which is considered descriptive of species-level resolution. We analyzed the effect of the SST on the resulting diatom-based ecological quality index, which is based on OTU abundance distribution along an environmental gradient, ideally avoiding taxonomic assignments that could result in high rates of unclassified OTUs and biased final values. A total of 90 biofilm samples were collected in 2014 and 2015 from 51 stream sites on Mayotte Island in parallel

with measures environmental parameters. HTS sequencing was performed on the biofilms using the rbcL region as genetic marker and diatom-specific primers. Hierarchical clustering was used to group sequences into OTUs using 20 experimental SST levels (80%–99%). An OTU-based quality index (Idx_OTU) was developed based on a weighted average equation using the abundance profiles of the OTUs. The index revealed significant correlations between the Idx_OTU values and the reference gradient, which reached maximal performance using an SST of 90% (well above species level delimitation). We observed an important trade-off with the power to discriminate between sampling sites and index stability that will greatly inform future applications of the index.

S5T3 – Universal light inhibition of photosynthesis gene expression in freshwater AAP bacterial community

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The aerobic anoxygenic phototrophic bacteria (AAPB) are a phylogenetically diverse group, sharing functional ability of anoxygenic phototrophy under fully aerobic conditions using Bacteriochlorophyll a (BChl-a) as the light capturing pigment. Previous experiments and observations established that BChl-a is synthesised only in the dark. It creates a light-dark oscillation pattern in BChl-a concentrations, which in case of natural communities has a diurnal manner. While currently this is an established feature, data on light regulation at the level of gene expression are scarce and results are not consistent. Here we conducted two independent diurnal sampling campaigns of two freshwater lakes in Czech Republic. We followed BChl-a concentration changes with HPLC and community-wide pufM gene expression in RT-qPCR in samples collected every 2 hours to cover at least one day-night cycle. We also surveyed the AAP community composition and its active fraction based on deep

amplicon sequencing of the commonly used pufM marker gene. Our results showed that the expression of the pufM gene undergoes strong diurnal pattern and is completely inhibited by light. As the composition of the active AAP community is entirely different in the two sampled lakes, we can conclude that light inhibition of photosynthesis gene expression is their universal feature, observable both in natural and artificial conditions. To our knowledge, this is the first study that combines the diel BChl-a changes, observed commonly in fresh- and marine waters, with the expression of a photosynthetic gene in a natural AAP bacterial community.

S5T4 – Dynamic Transfer of Dissolved Organic Carbon and Bacteria from Soils to Small Streams

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Small headwater streams are well connected to the surrounding landscape, interlinking terrestrial biogeochemical cycles to the river network and constitute an important reservoir of microbial life. The bacterial communities in streams are highly influenced by the input of soil organic matter as well as bacteria, potentially driving community composition and diversity. Headwater streams are dynamic systems, variation in dissolved organic carbon (DOC) concentrations and microbial abundances can be observed throughout the year. However, the drivers of these variations and their dynamics are not yet well understood. To address this knowledge gap, we monitored six first-order streams and three soil transects with two depths located in the pre-alpine Oberer Seebach catchment in Austria for a duration of 18 months. Our study shows that soils contribute to DOC and microbial life inputs of small headwater streams and that these contributions are determined by flow conditions. We also observed an

increasing influence of soil along the stream's flow length. Additionally, DOC concentration and bacterial abundance were strongly correlated across all streams and seasons. Our results demonstrate the importance of soil inputs in small headwater streams in terms of carbon content and microbial diversity and will open the way to more in-depth studies, especially on the impact of these influxes on streams microbial communities and biofilms.

S6T1 – Impact of a constructed floodplain on river sediment conditions

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Small, reconstructed floodplains provide a sound solution to mitigate flood peaks by increasing the retention capacity of the river, imitating the functioning of natural floodplains. In fact, local hydrodynamic conditions are modified similarly to natural systems: flooding occurs when water level is high, fluctuations in water level are smoothed, shear stresses are dampened and more stable conditions are created with respect to channelized sections. However, reconstructed and natural floodplains may show a different lateral and longitudinal connectivity with the main channel due to morphological differences. Both these aspects may lead to changes in channel sediment conditions. The research focused on the effects of a small, reconstructed and managed floodplain on the sediment conditions of an agricultural stream exposed to high fine sediment loads from the terrestrial catchment. We analysed sediment samples in upstream channelized sections and in downstream

reaches bordered by either the reconstructed floodplain or a natural floodplain for ecologically relevant parameters, namely: grain size distributions, benthic respiration, nutrients and phosphorus adsorption capacity. Samples were taken after high and low flood events and during baseflow. First results show that while the sediment physical structure and the nutrient content remain stable with sites and hydrological conditions, the variability in phosphorous adsorption capacity and benthic respiration rate between different hydrological conditions is reduced at different extents by both the artificial and the natural floodplain.

S6T2 – The effects of different DOM-sources on microbial activity in riverine sediments

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Agriculture is the dominant land use form in Lower Austria, covering more than 41 % of the total area. Agriculture delivers significant amounts of dissolved organic matter (DOM) to streams, changing basic processes at the water-sediment interface and affecting the ecological state of the stream ecosystem. The aim of the project was to investigate the influence of agricultural land use on the quantity and quality of DOM inputs to streams and to examine the effects of these DOM inputs on the aquatic carbon cycling in stream ecosystems. Via in-door flume experiments, we investigated the short-term effects of different DOM sources (extracts from manure, soil from pasture and unfertilized soil) on the growth of benthic microorganisms, the benthic respiration and the activity of extracellular enzymes. The DOM sources were characterised as to their concentrations of dissolved inorganic nutrients as well as to their fluorescence (Excitation-Emission-

Matrices) and absorbance characteristics (e.g. SUVA254). As expected, leachates from manure had the highest ammonium and phosphorus contents, but not the greatest effect on bacterial activities. DOC from unfertilized soil was degraded fastest. Bacterial abundances were constantly low throughout the experiments. Notable enzymatic activities were only measured in unfertilized soil leachate samples. From the results it could be provisionally concluded that substrates of a more natural, heterogenic composition are better accepted by microorganisms than anthropogenically altered enriched substrates. The results also hint to a possible lack of bioavailable carbon.

S6T3 – Effects of viticulture on fungal communities and their associated leaf decomposition in streams

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Agricultural pesticides are well-known stressors to freshwater ecosystems. In the highly specialised cultivation form of viticulture, fungicides are the mostly used pesticide group. Fungicides are known to affect non-target groups of in-stream fungi, the hyphomycetes, which play a key role in the decomposition of allochthonous leaf material. Previous studies were able to show that hyphomycete communities, as well as their decomposition ability, are altered by fungicide exposure. In this study, we investigated hyphomycete communities as well as their decomposition in terms of decomposed ash-free dry mass in streams in South-West Germany, a region well-known for its viticulture. We deployed leaf bags filled with Alnus glutinosa at four different time points during the period of vine cultivation from March until September. At each time point, we analysed three different treatments of ten streams. The first treatment represented an undisturbed

control. Leafs were deployed in the forested upstream area. The second treatment represented a viticulture treatment and leaves were deployed in vinicultural streams. The third treatment represented a transplantation treatment where the leaves were colonised in undisturbed upstream areas and moved to the viticulture area of the same stream. The treatments were compared regarding potential effects of fungicide exposure on fungal communities. Preliminary results suggest that hyphomycete communities adapted to the conditions in vinicultural sites showed a reduced decomposition capacity compared to transplanted communities.

S6T4 – Age and diet-specific trace element accumulation patterns in different tissues of chub (*S. cephalus*)

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Chub (*Squalius cephalus* L. 1758) specimens of three age groups with different types of diet were collected in November 2013 in the River Szamos/Someş, Hungary. The Ca, K, Mg, Na, Cd, Cr, Cu, Fe, Mn, Pb, Sr and Zn concentrations were analyzed in the muscle, gills and liver samples of chub by microwave assisted plasma-atomic emission spectrometry (MP-AES). The Kruskal–Wallis test revealed significant differences among different age groups based on the trace element concentrations in the liver, muscle and gills. The trace element concentration pattern in muscle and liver of different age groups differed, may be according to the different diet types of the groups. Meanwhile no differentiation among the age groups based on the trace element concentration in the gills was observed, probably because the pattern of trace elements in the gills is related to the habitat preference, which does not differ during

the life-span of chub. In contrast to expectations, trace element concentrations in juveniles were the highest in most cases, certainly because of their specific diet, relatively fast metabolic rate and inadequately developed detoxification system. Only the copper concentrations in liver increased with fish age. Considerable concentrations of trace elements in the tissues of juveniles were observed in the case of elements whose concentrations in the River Szamos were higher in 2013 than in previous years. According to this phenomenon, trace element patterns in the tissues of juveniles may be good indicators of recent pollution of watercourses.

S6T5 – Microplastics and their potentially adsorbed pollutants in Hungarian surface waters

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Microplastics (plastic particles <5mm) have been detected globally in a wide range of environmental elements, but the focus on freshwater areas is moderate. In 2017 our research team started the first samplings in the Carpathian basin: Danube and Tisza watershed, such as aquaculture fish ponds are also affected with the pollution. The methods of sampling, sample preparation and analysis are not harmonised yet. The efficiency of the extraction processes is barely monitored. To improve the knowledge on sample preparation efficiency, we developed a standard addition method, where recovery rates can be analysed fast and precisely. The prototype with the associated standard operating procedure has been also validated using field samples: recovery rates have been detected over 90%. The toxicological risks of microplastics are not only physical (e.g. inflammation of the digestive tract), but

chemicals can also leach from, and adsorb on the surface of the plastics. The adsorption of some pesticides has already been investigated, but there is no information on the water catchment specific pesticides. The first step to assess the sorption capacities of these substances was to set up a general pesticide load profile of the Hungarian surface waters based on the analysis of more than 400 components in hundreds of samples. Supported by project no. KFI_16-1-2017-0477, that has been implemented with the support provided by the National Research, Development and Innovation Fund of Hungary, financed under the "Vállalati KFI_16" funding scheme.

P01 – Testing various artificial spawning nests of pikeperch (*Sander lucioperca* L.) in Lake Balaton

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Water management and regulations induced habitat degradation is common phenomenon worldwide. The long-term effects of these processes are wide-scaled: the loss of biodiverstity, the alteration of assemblage composition may seriously affect the fisheries as well. Lake Balaton is the biggest shallow lake in Central Europe. Large-scale water level and shoreline regulations were carried out between 1860 and 1950, which resulted in the large scale decrease of natural spawning habitats of most of the fish species, especially in case of the most economic valuable predatory fish, pikeperch. This study is aimed to develop and test artificial spawning nests for pikeperch. Testing of eight prototype of artifical nests, characterized with different size, shape and spawning substrate was carried out in the 2017-2018 season. Nest occupancny was registered and the mean number of eggs on a given substrate area was calculated and compared in case of

different types. The mean occupancy was high (above 50%) in case of all localities, however no differences has been found between the occupancy of different nest types. The lowest mean egg numbers were found on the small, round shaped, garland covered nests (106.000±11.100 eggs). The large, round shaped, artificial grass covered nests proved to be the most effective (392.000±35.000db). These artificial nests can be the first step towards a self-sustaining pikeperch population of Lake Balaton. This study was supported by the GINOP2.3.2-15-00004 project. ÁF and ÁS were supported by the Bolyai Fellowship of the HAS, as well as the ÚNKP Bolyai+ fellowship.

P02 – Water quality assessment for a heavily human-impacted stream based on chironomid assemblages

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Recently, the loss of biodiversity due to habitat degradation is one of the most important problems of freshwater ecosystems. It is especially true in the case of small watercourses, which are influenced by wide range of human activities. Chironomids, a major insect group in freshwater, are good indicators of habitat quality. However, our knowledge on the chironomid assemblages in human-impacted streams is still limited. The Pécsi-víz is one of the main watercourses in South Hungary. It suffers from strong human impacts, because it is running through inhabited and agricultural areas in its whole length. The main aim of our study was to measure the quality of aquatic habitats based on diversity and functional groups of chironomid assemblages. In 2017 chironomid samples were taken at three section of Pécsi-víz, three times in the year, according to Chironomid Pupal Exuviae Technique. Altogether 63 species were identified from 3479 collected exuviae. All parameters (i.e. an average taxonomic distinctness,

functional feeding groups, longitudinal distribution, saprobity, rate of intolerant taxa and background variables: land use, water chemistry) showed high degradation degree of the habitats. However, the chironomid assemblages were surprisingly more diverse than it was expected. Moreover, the composition and functional characteristics of the chironomid assemblages remarkably differed at different sections with similar water quality. Although it was not possible to find direct relationships, our results suggest that chironomid assemblages might be influenced by multiple environmental effects differing site by site.

P03 – Adaptative evolution to climate change in freshwater cyanobacteria

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Climate change (including increase in water temperature and acidification – due to increased CO_2) impacts the quality of the waters and the fundamental biology of our planet. This project aims to understand the evolutionary responses to warming and acidification in three key cyanobacterial genera: *Microcystis*, *Anabaena* and *Planktothrix*. Cyanobacteria are a globally distributed group of phytoplankton, producing a large part of the oxygen that we breathe, with some species generating massive accumulations of biomass (blooms), which are often toxic. Knowing the response of cyanobacteria to climate change is crucial for understanding the long-term stability of aquatic ecosystems and occurrence of toxic blooms, and these aspects are still largely unknown. The predictions made by modelling techniques are mainly based on short-term experiments, but these experiments do not offer information on the evolutionary potential of these organisms. The specific aims of this project are: 1) to assess the adaptive

potential of the tested cyanobacteria to high temperature/acidification; 2) to investigate to what extent pre-adaptation of multiple clones affects their evolutionary potential; 3) to check whether adaptation to increased temperature/acidification comes with any change in toxin production; 4) to understand to what extent the competitive ability of cyanobacteria is affected by/affects the natural communities of microorganisms. For this, during a long-term experiment, we will measure how the response of different strains to warming and acidification evolves. Then, we will check how pre-adaptation affects their responses when they are inoculated in natural communities.

P04 – How current velocity affects the zooplankton assemblages in streams?

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Slow current velocity in streams create distinct environmental conditions that are suitable for the development of zooplankton populations. This study aimed to answer the question: what current velocity value leads to abundant zooplankton in small streams? In slowly flowing streams with a water current lower than 0.1 m s-1, there was a greater abundance of zooplankton than in the majority of streams. This level of abundance was equivalent to the densities of zooplankton in lakes or dammed reservoirs. The presence of zooplankton in these streams may be of great significance for the establishment of food webs.

P05 – Microecology meets macroecology: Nitrogen cycling in soda lakes

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Soda lakes have high sodium (hydrogen) carbonate content, which results in alkaline pH. Such aquatic habitats are common in the Pannonian lowland steppe. Due to the extreme environmental conditions present in these shallow soda pans (high turbidity, seasonally changing salt concentration, polyhumic and hypertrophic character), they have a unique ecosystem. The soda lakes are also important from bird conservation perspective as they serve as resting and feeding sites for birds. However, bird visitation of the lakes varies both in time (due to migration) and across the pans. These leads to varying nitrogen load, which according to preliminary data might have an effect on the whole soda pan ecosystem. Therefore, our aim was to assess the role of birds in the nitrogen budget and in the microbial nitrogen cycling processes of the pans. To achieve this a biweekly sampling campaign of three soda pans located at the Kiskunság NP

was conducted from April to November in 2017. Physicochemical properties of the lakes were determined. The bacterial community composition was identified by sequencing of the 16S rRNA gene. The ratio of Bacteria and Archaea and the quantity of selected functional genes were evaluated using qPCR. Our results showed that bacteria were presented in high numbers continuously in the studied soda pans. The concentration of nitrogen forms and the ratio of functional genes varied temporally and spatially which could be explained with the effect of aquatic birds.

P06 – Investigating the impact of a dairy processing plant on a river catchment

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1: University of Plymouth

Through the processing of milk there is potential to create nutrient rich waste products. Liquid waste is treated to reduce its nutrient loading before release into a local watercourse, below discharge permit levels. Solid wastes can be co-mingled with other waste streams and incorporated into local land as nutrient rich soil conditioner, thereby recycling the phosphorus from the milk waste. Communities of invertebrates and diatoms live within the receiving waters for the discharge. This study, taking place at the Dairy Crest Davidstow facility in Cornwall, SW England, will look at the effectiveness of current treatment in terms of phosphorus reduction tertiary wastewater treatment processes including iron dosing and how invertebrate and diatom communities are affected upstream and downstream of the discharge point.

P07 – Prey selectivity of freshwater mixotrophic and heterotrophic flagellates

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Traditionally, protists were split into autotrophic algae and heterotrophic protozoa, while mixotrophy was regarded as an exotic phenomenon. Today, we know that mixotrophy is common among a variety of protists. Moreover, mixotrophs can play a pivotal role as picoplankton grazers, especially in surface waters of oligotrophic systems. Despite their obvious importance as bacterivores in such systems, less is known about their potential structuring effect on microbial communities. Based on stoichiometric considerations, heterotrophic bacteria with their low C:P ratio could be a more attractive prey for mixotrophic bacterivores, which have an alternative energy source, while heterotrophic flagellates should prefer more C-rich picophytoplankton such as cyanobacteria. We conducted a series of short term feeding experiments, under light and dark conditions, to test for prey preferences of different freshwater mixotrophic and

heterotrophic flagellates. The artificial food web consisted of one heterotrophic bacterial strain, one picocyanobacterial strain, together with a mixotrophic or heterotrophic flagellate strain. In order to reveal feeding strategies for different functional groups, several mixotrophic taxa ranging from more phototrophic to more heterotrophic lifestyles were tested in separate experiments. First results indicate strong taxon-specific responses to the different prey types.

P08 – Development of a fish-based ecologocal assessment of Hungarian ponds: a research plan

Vera Juhász[1], Bence Sziráki[1], Ádám Staszny[1], András Weiperth[1], Árpád Ferincz[1]

1: Szent István University

Anthropogenic originated ponds represent a siginifcant proportion of the total freshwater on the Earth. Moreover, these waterbodies may maintain complex aquatic communities and can be charaterized as local biodiversity hotspots. The ecological state of these ponds is variable, according their age, management and locality, however there is a few existing index for assessing it, especially regarding the Central- European lowland and submontane areas. The aims of our project are to (1.) review the existing literature of „pond ecology" in order to identify the key factors/metrices of their ecological state assessment, (2) carry out a robust sampling campaing on variously utilized Hungarian ponds to collect information regarding the identified metrices, and (3) develop a validated, multimetric ecological quality index, which is suitable for Water Quality Framework integration. On our poster we want to identify the main steps, risks and pitfalls of this project, in order to collect all valuable inputs and new viewpoints, which

can considered for further methodological development.

P09 – Water usage may play more important role in maintenance of diatom diversity than nature conservation

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Kisköre Reservoir (Lake Tisza, Hungary) is the second largest standing water of the Carpathian Basin. Beside its nature conservation value, this artificial shallow lake is also considered as an important recreation centre. It is divided into four differently managed basins characterised by different protection level. Here, we studied the structure and the diversity of epiphytic diatom assemblages and the diatom based ecological status in the four basins in early and late summer during a five-year period from 2014 to 2018. We hypothesised that (i) spatial heterogeneity will be more pronounced, hence the different water usage of basins will have significant influence on taxonomical composition of diatom assemblages. (ii)

The diversity of diatom assemblages will be markedly different in differently managed basins: the lowest diversity is expected in the basin with low protection. (iii) Diatom based water quality will differ significantly in the basins: the highest quality will be characteristic for the highly protected basin, while the lowest quality will be expected in the least protected basin. The results partially proved our assumptions. No spatial separation was found, but composition of diatoms significantly differed in the four basins in time. There were strong diversity – recreation activity relation in early summer, but no differences in diversity of basins were found in late summer. Furthermore, an inverse proportionality was found between ecological status and protection status of basins. These results highlighted that development of an effective management and protection strategy in reservoirs is taxonomical group dependent.

P10 – Influence of nano-copper in the form of Cu and CuO compared to $CuSO_4$ on *Lemna minor* L.

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1: Wrocław University of Environmental and Life Sciences

The aquatic environment is the most vulnerable to pollution. The nanotechnology industry has developed very rapidly in recent years. It is to be expected that with its development, contamination of the aquatic environment with various nano-sized products should be expected. For this reason, it would be good to determine the harmfulness of nano-compounds. It depends on the species, the size of the nano-elements and their shapes, which gives great prospects for researchers. The effect of two types of nanoparticles comparte to $CuSO_4$ on *Lamna minor L.* was examinated. As a result of the studies, the toxicity of nano-forms was found to be less than that of $CuSO_4$.

P11 – Changes in the abundance of *Aphelocheiru aestivalis* (Insecta: Heteroptera) in the Drawa River.

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Aphelocheirus aestivalis (as the only known representative of the family Aphelocheiridae wildly spread in Europe) in some countries is rare species, considered as endangered by categorization of IUCN. The A. aestivalis tolerance for some environmental changes is relatively well known but this species is still threatened by anthropogenic pollution (mainly changes in the river morphology).Therefore, the insight into dynamics of change in numbers of A. aestivalis in Drawa river would help to species conservation. The samples were taken every month from twelve sections on Drawa River in NW Poland, from 2011 to 2014. Samples were taken by scraping the bottom with a sampling net on the surface about 0,25 m^2. A. aestivalis was found in nine from twelve sites, and their highest number was observed in the short section of river in Rzepowo village, where the morphology of the river is similar to the mountain river and to stretch in Drawieñski National Park, where the

antropopressure is not observed. On the sections, where the river bed was strongly altered by human, A. aestivalis was not observed. The highest number of A. aestivalis was observed in late spring (May, June) and early autumn (September), what was correlated with species phenology. The most serious threat to the examined species are the progressive drainage works and, straightening riverbed. Hence, change in the bottom substrate from sandy-gravel to sandy-muddy is observed.

P12 – Effects of environmental changes on microbial communities and diversity in alpine lakes

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Microbial communities in aquatic mountain ecosystems are shaped by a strong heterogeneity in abiotic conditions and microclimates across small regions. These conditions, including extreme weather, exposure to UV light, and a shortened growth season at higher altitude shape mountain ecosystems, which are highly adapted and vulnerable to global change. Human-driven environmental changes, like e.g. fish stocking, pollution and disturbance, will affect mountain freshwater ecosystems in a pronounced and complex manner with consequences for key biota. Such impacts may then facilitate the invasion of wildlife pathogens, such as ranavirus and chytrid fungi which cause mortality and morbidity of amphibian populations worldwide. Within the project P^3 (https://p3mountains.org/), we examine the consequences of anthropogenic impacts on the structure, composition and

co-occurrence networks of microbial communities in mountain lakes. We sampled 29 Pyrenean lakes with 3 seasonal sampling campaigns in 2016 to 2018 for more than 700 freshwater samples. The DNA of these samples was extracted, amplified and highly variable regions of the 16S rRNA (bacteria) and 18S rRNA (micro-eukaryotes) encoding genes are sequenced using next generation sequencing technologies (Illumina MiSeq). Biogeochemical data and hydrogeological characteristics are obtained to disentangle the environmental factors shaping the microbial community and biodiversity. We will use our data to compare microbiomes of pristine and lakes where human-introduced fish as top-predators or the invasion of wildlife pathogens may have affected the local microbiome. We obtained first evidence, that the bacterial community composition shifted in the presence of the amphibian pathogen *Batrachochytrium dentrobatitis*.

P13 – Recovery of aquatic macroinvertebrate community in a small brook after poisoning by insecticides

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This case study documents the evolution of macrozoobenthos community in the small brook Doubravka (Czech Republic) contaminated by Nurelle D insecticide (chlorpyrifos: 44–49%; cypermethrin: 4–5.5%), from drainage of a local agricultural enterprise in March 2014. The measured concentration of chlorpyrifos in sediments under the confluence with the tributary was 13 000 µg×kg^{-1} several days after this accident but it quickly declined to 1% after approx. 2.5 months. The concentration decreased to 6.5 µg×kg^{-1} in 2018. Sediment analyses for cypermethrin have been conducted since 2016 and it also declined from 21 µg×kg-1 in 2016 to 10 µg×kg^{-1} in 2018. The macrozoobenthos sampling was conducted before that accident (in 2009) and continued after that from 2014 to 2017 at three sites along the brook profile. The upper part of the brook was not contaminated thus a fast recolonization process of species resistant to pesticides was expected. Overall,

almost 150 taxa of aquatic macroinvertebrates was found and determined throughout the whole sampling campaign. Although no surviving invertebrate individual was detected in impacted sites immediately after this accident, overall 23 taxa (Insecta: Diptera: 8 Chironomidae taxa and 1 Simulidae taxon, 5 Trichoptera taxa, 2 Ephemeroptera taxa; 1 Nematomorpha taxon; Mollusca: 2 Pulmonata taxa; and Annelida: 4 Oligochaeta taxa, resp.) were detected in these two contaminated localities after approx. 2.5 months from the accident. Finally, it must be mentioned that severe droughts which have occurred during hot summer periods since 2015 probably play an important role in the diversity of species.

P14 – Effects of Macrophytes on nutrient cycling and metabolism in lowland rivers of lower Austria

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Macrophytes in streams cause changes to water quality and modify the aquatic environment through their physical resistance against flow. Some of the changes are consequences of direct effects, such as assimilation and leaching. Whereas further potential routes of nutrient retention may be accredited to indirect effects, involving sedimentation, adsorption, burial and processes of nitrogen transformation. We investigated seven river-reaches in different varying landscapes of Lower Austria and subsequently defined an upstream-downstream approach to determine nutrient retention. To gather knowledge and to describe our different reaches we additional took samples of macrophytes, sediment and measured discharge and metabolism. We hypothesized (1) that macrophytes will be the primary driver of stream metabolism due to their rapid growth rates and prolific biomass, (2) and that the impact of macropyhtes on nutrient retention will clearly correlate with high standing stocks and therefore a high biota-

water contact time and there will be a higher effect in nutrient-rich streams because nutrient uptake is not only limited by root uptake. Preliminary results demonstrated limnochemical similarities within the investigated reaches, which enabled us to categorize them in to three river groups: oligotrophic/groundwaterfed -, oligotrophic/siliceous- and eutrophic rivers in agricultural landscape. Metabolism measurements for all river groups indicated that macrophyte biomass drives ecosystem metabolism. Nevertheless, no clear relationship between nutrient retention and macropyhtes biomass over a season was found. Macrophyte can be either a sink or source of nutrients for the system.

P15 – The effect of glyphosate on a filamentous green algae (*Zygnema* sp.)

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This study wants to assess the effect of the herbicide glyphosate and its metabolite AMPA on the filamentous green algae *Zygnema* sp. Many studies testet concentrations in mg range, often manyfold higher than concentrations that can be detected in nature. Therefore this study uses a concentration range, which can be found in surface waters. Algae are especially suspectible to the effects of glyphosate because they share similar physiological traits, such as the shikimate pathway, the target metabolic pathway of glyphosate. Furthermore, the adverse effects on the primary producers can be cascaded to higher trophic levels and impact the function of the entire ecosystem may be impacted. The experiment was carried out in 20 400ml flasks used for algae cultivation. There were two runs of the experiment, one with glyphosate addition and a second run with AMPA addition. 3 different concentrations (50µg/L-1; 300 µg/L-1; 600 µg/L-1) of glyphosate and AMPA were used, with 5 replicates each and one control without

glyphosate/AMPA addition. After an algae colonization phase (14 days), glyphosate/AMPA was added for 7 days, followed by an recovery phase of 14 days. In order to asses algal biomass and pigments, Chl-a analysis and HPLC were carried out. PAM fluorescence was measured to assess photosynthetic activity and stress tolerance. SOD activity (Superoxid dismutase) and protein concentrations will be measured to implore oxidative stress situations, such as the influence of herbicides. Shikimate acid and glyphosate/AMPA concentration in the algae cell will be measured as well as protein composition and metabolomics.

P16 – Functional approaches in phytobenthon colonisation (two case studies)

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Colonisation studies focusing on benthic algal traits contribute to interpret functional-level relations of assemblages in a continuously changing environment. However, functional approach in phytobenthon research is a relatively new field. Here, we studied the development of benthic algal assemblages in a Hungarian small lowland stream. As a starting point, we reported that single diatom traits such as guilds or biovolume classes were not appropriate to reveal fine scale, assemblages-level changes. Thus, we created combined eco-morphological functional groups (CEMFGs). The explanatory power of CEMFGs in ecological processes was higher than the

taxonomical based analyses. But the exclusion of soft algae on analyses can lead to an information gap. To get a more holistic picture on the functioning of phytobenthon during colonisation, we also studied functional-level changes in the whole algal assemblages. The results indicated again that changes in assemblages can be interpreted better by using combined groups than single traits.

P17 – Effect of zooplankton grazing pressure on actinobacterial dominance in soda pans

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Actinobacteria is one of the most studied bacterial phylum. It contains Gram-positive organisms with usually high G+C content and in some cases a special light-utilizing molecule, the actinorhodopsin. This group of prokaryotes occurs with high density in soil, and it was assumed in the past that this habitat is their primary environment. It has recently been revealed that planktonic actinobacteria can also be dominant in saline temporary waters, soda pans. These planktonic actinobacteria have small coccoid cells and belonging mostly to ultramicrobacteria. Our research aim was to determine the effect of zooplankton grazing pressure on the microbial community composition. All sampling sites are located in the Pannonian Plain (Hungary). Samples were collected from five Hungarian soda pans (Böddi-szék, Kelemen-szék, Sós-ér, Zab-szék and Vörös-Boros-kopó) biweekly from April to November in 2017. The composition and abundance of

microcrustaceans were determinded by microscopy, while the ratio and taxonomic composition of actinobacteria in the bacterioplankton was revelaed with next-generation DNA sequencing. The bacterial community composition shifted to the dominance of actinobacteria when zooplankton grazers had higher density in the soda pans. Within phylum Actinobacteria, clade acIII-A1, acIV-unc. and Luna1-A had the highest ratio, while microcrustacean communities were dominated by typical species of soda pans (*Arctodiaptomus spinosus, Daphnia magna, Moina brachiata*, etc). It is suspected that small cell size and Gram-positive cell wall structure are advantageous to decrease zooplankton pressure upon freshwater actinobacteria population.

P18 – Efficiency of protected area for fish in a freshwater reservoir.

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Protected areas (PAs) have been shown to provide benefits that include greater productivity of fish stocks due to increased densities, average sizes, and reproductive output. Lipno reservoir is the biggest waterbody in the Czech Republic and its PA was created to increase the population size of target species by recreational anglers the reservoir. The aim of this study is to test if the fish assemblages in Lipno's PAs have higher biomass, abundance and species diversity than non-PAs. For testing the efficiency of the PA for the fish community, standard gillnets were deployed in the 2016 and 2017 inside and outside the PA (three Control areas - CAs). Altogether 41610 fishes were collected, and the abundance was higher in CAs. However, *Perca fluviatilis* was up to 2.3 times more abundant inside of the PA, while *Alburnus alburnus* was up to 2.8 times more at CAs. Fish biomass showed

no significant difference between PA and CAs, but again target species had up to 3 times higher biomass inside the PA (Esox lucius, *Sander lucioperca* and *Perca fluviatilis*), while the Alburnus alburnus biomass was twice higher at CAs. The fish community was more diverse and more evenly distributed inside PA. Our results indicate that the PA in Lipno lake is benefiting especially the target species by anglers, and thus being effective in their purpose. Additionally, the protection of these areas helps to increase the diversity of fishes in the lake, and the recruitment of small fishes in the lake community.

P19 – Analysis of metagenome assembled genomes (MAGs) of freshwater Gemmatimonadetes

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Gemmatimonadetes is a novel, cosmopolitan bacterial phylum with members distributed in many natural habitats (waters, sediments and soils) but is still an understudied group with only 5 cultured species. So far, most of the research concerning Gemmatimonadetes has been focused on soil environments where they represent one of the top 10 bacterial phyla and there is no information about their distribution and species diversity in fresh waters. The only photoheterotrophic species of the phylum (*Gemmatimonas phototrophica*) was isolated from a freshwater lake and it seems that other photoheterotrophic Gemmatimonadetes may be present in freshwater environments. To learn more about the uncultured freshwater Gemmatimonadetes we analyzed 35 metagenome assembled genomes (MAGs) from three different sampling sites- mesotrophic (Øimov reservoir) and humic

lake (Jiøicka Lake) in the Czech Republic and a pre-alpine oligotrophic lake- Lake Zürich in Switzerland, and covered both epilimnion and hypolimnion. The analyzed MAGs were clustered into 13 groups. Seven of this groups contained phototrophic genes and were present both in epilimnion and hypolimnion. The identified groups probably represent new species. Results also showed that both heterotrophic and photoheterotrophic Gemmatimonadetes persist in the water column and can be found in different seasons.

P20 – Interactions between stressors can change in magnitude and direction over time due to evolution

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Multiple stressor research has become a key focus of global change biology over the past twenty years. However, key knowledge gaps have been identified in recent literature reviews. For example, most experimental work on multiple stressors is carried out over relatively short periods of time and does not take into account how adaptation may modify the interaction between stressors. Here, we explore this by analysing a dataset generated from a long-term experiment on rotifers in multiple stressor conditions. Over 70 days (~40 generations) rotifers were grown in eight different environments: a fully factorial design of increased salt, increased copper and reduced temperature. Population densities were calculated every four days during the experiment. At the end of the experiment growth rates for the eight evolved lines of rotifers in each of the eight stressor environments (64 combinations) were calculated. Rotifers evolved tolerance to the stressors and therefore the effect of the stressors on rotifer fitness was reduced

over time. Importantly, the interactions between stressors changed in direction over time, with a general trend from less than expected (antagonistic) to more than expected (synergistic) cumulative effects. These results have important implications for ecosystem management and ecotoxicology. Developing a mechanistic understanding of how and why the interactions between stressors can be modified over time due to evolution will be an important research topic within multiple stressor research in the coming years.

P21 – Fishponds – artificial ecosystems with considerable contribution to people

Péter Palásti[1], Éva Kerepeczki[1]

1: NAIK-HAKI

Sustainable use of resources is one of the main challenge humanity must accomplish today, facing the effects of climate change, land overuse and degradation. To answer these concerns, researchers in the past few decades have been created hundreds of studies to assess the ecosystem services (ES) –or „nature's contriputions to people (NCP)"- of diverse habitats from multiple perspectives. The main goal was to create appropriate background knowledge for sustainable developments. Despite their hard work although we still can find ecosystem types that somehow remained out of the focus. To fill this gap we collected and assessed the NCPs of a Hungarian fishpond system called the „Biharugra Fishponds" which is one of the biggest (~2000 ha) artificial fishpond system in the country. In our study we are performing an integrated assessment where the biophysical, socio-cultural and monetary values of the given fishponds were accounted together: interviews with diverse stakeholders revealed 14 provided NCPs which was then ranked by the people of Biharugra

-the most fishpond-related village in the area- using a survey, based on a new ranking method. In the results, „fish production", „recreation", „aesthetics" and „high biodiversity" proved to be the four most known and used services. The potential and actual use of the 14 services were assessed and mapped in the ponds' sub-habitats, during a biophysical valuation, with the help of indicators and a matrix-based approach which allowed us to build in ecological knowledge. In the meantime, we are implementing a monetary valuation as well.

P22 – Spatial distribution and environmental preferences of the freshwater gastropod *Theodoxus anatolicus*

Athina Papatheodoulou[1], Panayiotis Klonis[1], Phoebe Vayianou[1], Ayis Iacovides[1]

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The distribution, population and environmental preferences of the freshwater snail *Theodoxus anatolicus* will be presented. The species is the only representative of the Family Neritidae in Cyprus and has been characterised as Near Threatened by the International Union for the Conservation of Nature (IUCN). Threats and conservation management action will be presented.

P23 – Aggregation of a preliminary food web reveals problems and promises

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In the era of big data and bioinformatics, the possibility of synthesizing data has become common practice. For food web research, which aims to synthesize data from varying field methods, and research projects of various scope and ecological organization levels, this persists to be of central issue. For example, aggregation of data and incomplete sampling are two notorious problems of food web research. We suggest to look at them in parallel since their effects are interdependent. Different aggregation methods are not equally sensitive to missing data and they lead to different biases in describing food web structure. Through an example of constructing a preliminary food web for Lake Balaton, we aggregate the data in several ways (taxonomic vs topological), compare the different versions of the food web by network analysis, and discuss how the results can help guide future field work and collective research priorities. We identify groups where resolution should be increased to improve the quality of the food web.

P24 – Food web research in mesocosms: a literature survey

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Studying food webs offers great opportunities to better understand the processes of community organization. The main problem is that the spatio-temporal scales and the complexity of multispecies systems make it frequently almost impossible to test models and theory. Therefore, food web research needs good experimental support. Fortunately, mesocosms made it recently possible to study complex relationships: these systems enable well-controlled experiments mimicking the dynamics of natural systems. Within this experimental framework, scientists are able to test theories, validate models and design controlled experiments that can synergestically help each other. Here, we present a survey based on literature mining, showing the key properties of both the experimental facilities and the experimental designs implemented. The ultimate question is how to improve mesocosm research for the needs of food web research.

P25 – Trophic links in astatic soda pans

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Aquatic ecosystems are facing ongoing habitat loss, which represents a serious threat for their biodiversity. Besides the conservation of the remaining habitats, restoring degraded and constructing new habitats represent important conservation measures for aquatic biodiversity. A current challenge in restoration ecology is how to evaluate the success of habitat reconstructions. Trophic ecology might provide successful tools for this, although it has relatively rarely been used so far. Our study focuses on trophic links between aquatic organisms in temporary saline waters, soda pans, in the Seewinkel region in eastern Austria and western Hungary. Our aim was 1) to investigate whether the trophic position of the most frequent species and food chain length of individual habitats depend on their naturalness (measured as conservation index) or other environmental parameters, 2) to investigate the diet of two selected waterbird species. We selected four natural and two reconstructed soda pans,

covering a wide gradient in human-induced habitat degradation. Trophic position, food chain length and prey composition were estimated by using nitrogen and carbon stable isotopes.

P26 – The importance of the spatial heterogeneity for the structuring of macroinvertebrates in spring fens

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During the past decades, ecologists conceptualized several well-known theories assuming different effect of local environment and species dispersal ability on the structuring composition of metacommunities (i.e. patch-dynamic model, neutral model, species sorting, and mass-effect). However, the role of dispersal and environmental processes vary among metacommunities as well as among spatial scales. For instance, the stream ecologists suppose generally the weaker effect of dispersal on the stream biota than on lentic one, and strong environmental filtering in headwater biotopes. The special headwater biotopes are spring fens occurring in the Western Carpathians. These unique systems host specific macroinvertebrate assemblages (i.e. spring specialists) coexisting at a single site within a relatively small area. High alpha-diversity of the spring fens is probably caused by a spatial distribution

of the species across patches with variable environmental characteristics within sites, but the role of the spatial heterogeneity for the structuring spring fen macroinvertebrates on the small-scale was not studied so far. Similar to natural spring fens, the high species richness was found at post-mining calcareous seepages that can provide surrogate habitats for specific biota of vulnerable spring fens. However, these systems are relatively young and dynamic, probably with higher role of environmental filtering then spatial heterogeneity for the structuring benthic assemblages. We aimed to explore the role of the spatial heterogeneity and environmental filtering for the coexistence of benthic invertebrate assemblages on the small scale in natural calcareous spring fens and post-mining seepage. This research was supported by the Czech Science Foundation (project no. P505/16-03881S).

P27 – Development and establishment of eDNA monitoring methods for waterbodies in the alpine region

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With the adoption of new methodologies and approaches, the Eco-AlpsWater project sets very ambitious objectives, anticipating the route in the development of the new generation water monitoring systems in Europe. Ecosystem services provided by lakes and rivers are facing serious threats under the pressure of anthropogenic impacts, climate change, loss of biodiversity and invasion of exotic species. The evaluation of these changes is still evaluated by traditional criteria, which

include expensive and time-consuming approaches (for example based exclusively on the classical identification of aquatic species with microscopy techniques). The main objective of Eco-AlpsWater is to integrate the traditional monitoring approaches used in the Alpine region and at the European level with advanced and innovative approaches, providing solid and qualified knowledge to further support water resources management plans. The new approach will use Next Generation Sequencing technologies to analyze environmental DNA extracted from water samples collected in lakes and rivers. These new techniques, based on the amplification and analysis of millions of DNA sequences and on the use of smart technologies, allow a rapid and low cost identification of aquatic organisms, from bacteria to fish. Together with the implementation of new monitoring techniques in European regions, the new technologies will provide the census of lake and river biodiversity in the Alpine region at an unprecedented level. The data will in particular identify the areas most at risk due to the presence of toxic cyanobacteria, pathogenic bacteria, and invasive or potentially invasive organisms.

P28 – Arsenic uptake and accumulation in vegetables, cultivated on different soil types, using ICP-MS

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Arsenic and its compounds being very mobile are present in the soil, water and air. In many countries, including Hungary, the ground water arsenic level exceeds the internationally set standard of 10 µg L-1. As accumulation in plants, not only causes damage to the plant but also to the humans consuming them. The main chemical forms of As available for plant uptake are As (V) and As (III). Presence of clay, organic matter and P in the soil influences As uptake. In this experiment, the uptake of arsenic by the different plant parts was studied. The vegetables cultivated were bean (*Phaseolus vulgaris*), tomato (*Solanum lycopersicum*), potato (*Solanum tuberosum*) and cabbage (*Brassica oleracea var. capitata*).The plants were cultivated in three different types of soil (Sand, Loamy sand and Sandy loam). Arsenic was added in the form of sodium arsenate at concentrations of

0.10, 0.25 and 0.50 mg L-1 to the irrigation water. The dried samples were homogenized and subjected to microwave assisted acidic digestion and the arsenic concentrations were measured by ICP-MS. The arsenic content of the plant parts was found to increase with the increase in arsenic concentration applied. The highest arsenic concentration was found in the roots, while the lowest was in the edible parts. Although the edible portion contained the least amount of arsenic but, it could lead to adverse health effects in the consumer.

P29 – CROSSLINK - Cross-habitat linkages between streams and riparian habitats in the Lake Mälaren basin, Sweden

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The CROSSLINK project is a pan-European research project with a multidisciplinary research team from five countries. The project focuses on the role of cross-habitat linkages between stream (aquatic) and adjacent riparian (terrestrial) habitats in modified landscapes. Multiple human pressures can affect longitudinal and lateral connectivity in river networks, driving habitat and diversity losses, threatening ecosystem services, and causing stakeholder conflicts. Using existing data and extensive field surveys, CROSSLINK aims to evaluate where, when, and how forested riparian buffers affect biodiversity, ecosystem functions and services provided by coupled aquatic-terrestrial ecosystems. In the Swedish case study, field sampling has focused on

agricultural and forested sub-catchments in the Lake Mälaren basin. Specifically, we have used 30 stream reaches, of which 20 paired sites comprised of upstream, impacted (agriculture) and downstream, buffered (forested) reaches to quantify land-use impacts on the biodiversity and functioning of coupled aquatic-terrestrial ecosystems. Our extensive sampling included habitat characterization, water chemistry, biodiversity, and functional indicators (e.g., litter decomposition). Preliminary results revealed two major environmental gradients driven by agricultural and forestry land uses, as well as differences in community composition and functioning between forested and agricultural sites. Ongoing analyses are addressing ecological connectivity between stream insects and riparian consumers using novel biomarker analyses. Ultimately, the knowledge gained through this project will contribute to better catchment management through the targeted use of riparian forest buffers to mitigate human activities.

P30 – Effect of a simulated extreme weather event on the summer phytoplankton assemblage of Lake Stechlin

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As a consequence of global climate change, increasing frequencies of extreme weather events are predicted. These events can initiate dramatic changes on lake ecosystems as was observed in 2011 in the deep, mezo-oligotrophic Lake Stechlin, Germany. A summer storm altered the stable summer stratification of the lake, which resulted in dispersal of the metalimnetic cyanobacterial layer into the epilimnion and initiated a cyanobacterial bloom with massive calcite precipitation. In summer 2014, such a storm event was experimentally simulated in 4 of 8 mesocosms (9 m diameter, 20 m depth), with the other four mesocosms serving as controls. In the short term, mixing caused an immediate decrease in epilimnetic water temperature and total phytoplankton biomass, and an increase in nitrate and soluble reactive phosphorus concentrations. After that, the epilimnetic phytoplankton biomass increased in the

mixed mesocosms with a first peak of *Cryptomonas* and a second peak of *Dolichospermum* species, but remained low in the epilimnion of control the mesocosms. Highest phytoplankton biomasses were observed two weeks after the experimental summer storm, which declined below the initial level after. The dominant phytoplankton functional groups were H1, Y and X2. Extreme weather events such as summer storms can cause strong shifts in phytoplankton community dynamics that are likely to transfer to higher trophic levels and to impact sedimentation rates and thus the biogeochemical cycles in lakes.

P31 – Trophic state and lake depth determine occurrence of glacial relict *Eurytemora lacustris* in Poland

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The depth of lakes have a profound effect on freshwater ecosystems because this strongly affects the availability of nutrients, light and oxygen. Deep lakes are more resistant to pollution and eutrophication than shallow lakes. High trophic state is the main cause of biodiversity decline. Crustaceans communities are also affected by eutrophication, therefore are used as an indicator of changing ecological status. One of the indicator of good ecological status is glacial relict *Eurytemora lacustris*. The aim of this study was to determine gradients of trophic state and depth of lakes that meet the habitat requirements of *Eurytemora lacustris*. Zooplankton sampling was conducted one time during the daylight for each lake, in the summer from 15 July to 15 August between 2011 and 2018. A total of eighty-five zooplankton samples from the same number of lakes (NW Poland) were collected. In five out of eighty-five lakes, individuals of Eurytemora lacustris were found. This species was reported only in

dimictic and mesotrophic lakes. This allows to suppose that rapid eutrophication and shallowing of lakes may lead to extinction of Eurytemora lacustris in lakes of north-west Poland.
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P32 – Spatial vs environmental drivers of benthic diatom assemblages in Greek rivers

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Benthic diatoms in rivers are being widely studied due to their importance in primary production of these ecosystems and their use for ecological monitoring studies. As diatoms are unicellular algae, they have been mainly considered ubiquitous, and their presence and abundance are driven by local environmental factors. However, in recent years, the importance of dispersal limitation (i.e. space) and historical factors are recognized as possible drivers of diatom assembly rules. Herein, we study the effects of environment and space in shaping benthic diatom assemblages in Greek rivers. Data were collected from 212 sites in 95 streams and rivers during the Greek National Water Monitoring Program. Beta diversity accounting for species turnover and nestedness was calculated, using the Sorensen index. Moran's Eigenvector Maps (MEMs) were used to account for differentiation of assemblages due to space, whereas environmental variables such as nutrient concentration, dissolved oxygen, pH, conductivity and land use where applied to

account for differentiation due to local environmental conditions. Diatom assemblages presented high beta diversity among sites; whereas both spatial and environmental variables were found to be significant. The results of the current study will disentangle the role of niche-based and neutrality-based processes in driving the structure of benthic diatom assemblages in Greek rivers.

P33 – The effects of different DOM sources on stream bacterial activity

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Dissolved Organic Matter (DOM) influences streams functions in a variety of biological, chemical, and physical processes. Agricultural land use has shown to shift both DOM quantity and quality in streams, thereby affecting microbial activity, an environmental issue that still demands in-depth analysis. The current study focuses on the effects of DOM composition from three sources (leaves, maize and manure) on benthic microbial processes within a laboratory flume experiment. Specifically, we tested whether benthic algae have a positive effect on bacterial DOM degradation. The experiment consists of 22 laboratory flumes, 11 of which are exposed to a 14/10 hours dark/light cycle, and 11 are kept under dark conditions. The flumes were filled with pre-cleaned sand and glass slides as substrates for biofilm growth, and fed with nutrient-enriched groundwater in circulating flow mode. After 4 weeks colonization, DOM leachates were added in a single pulse (6

replicates each and 4 controls). Samples were taken before and after additions in increasing intervals over 7 days. Preliminary results display DOC degradation being always higher in the autotrophic flumes than in the heterotrophic flumes. Maize leachate was degraded fastest (26-35% during the first 20 hours in dark - light flumes), followed by leaves (19-24%) and manure (10-11%). Leachate addition led to an SRP increase by 17-38 µg/L in the dark flumes after 4 h, which remained stable during the experiment. In contrast, in the light flumes, no SRP was detectable 4 h after the additions.

P34 – Spatio-temporal variation in aquatic metabolism of littoral habitats in a shallow eutrophic lake

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The metabolic balance between gross primary production (GPP) and ecosystem respiration (R) is known to display large spatial and temporal variations within shallow lakes. Thus, although estimation of aquatic metabolism using free-water measurements of dissolved oxygen concentration has become increasingly more common, the explanation of the variance in the metabolic regime remains an extremely difficult task. In this study rates of gross primary production (GPP), respiration (R) and the metabolic balance (net ecosystem production, NEP) were estimated in four littoral habitats with different macrophyte growth forms (floating-leaved vs submerged) over a 28 month period in lake of Kastoria (Grecce), a shallow eutrophic lake. Our results showed that net heterotrophy prevailed over the studied period suggesting that allochthonous organics fuel respiration processes in the littoral. Temporal variation in the metabolic rates was driven mainly by the seasonal variation in

irradiance and water temperature, with the peak of metabolic activity occurring in summer and early autumn. Most importantly, significant spatial variation among the four habitats was observed and associated with the different macrophyte growth forms that occurred in the sites. The results highlight the importance of habitat specific characteristics for the assessment of metabolic balance and underline the potentially high contribution of littoral habitats to the whole lake metabolism

P35 – The impact of ion concentration on cyanobacteria scum formation

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Cyanobacterial scums at the surface of the lakes are potentially harmful phenomena with increasing occurrence in the last decades, and the causes that lead to their formation are still an unresolved issue. In order to better understand what triggers the scums, we investigated the effect of several Mg^{2+} and Ca^{2+} ion concentrations in promoting them in eight *Microcystis aeruginosa* strains. The possibility to prevent scum formation by using the ion chelator EDTA was also explored. We found that in some strains the cell aggregation takes place under lower ion source concentrations (20 mM $MgSO_4$ or $CaCl_2$), while in others this phenomenon does not occur even at 60 mM concentration. The scum formation correlated to the amount of extracellular polymeric substances (between 234 and 351 µg/cell). EDTA failed to prevent the scum formation in most strains, and in turn it caused cell lysis followed by the

release of cellular content into the culture medium. We emphasize the relevance of these results for cyanobacterial scum formation in the environment and we also suggest that controlling the salinity of the medium (by manipulating the ion concentration) is a potentially efficient method for biomass harvesting in large ponds/tanks.

P36 – Effects of aquaculture effluent on the seasonal Rotifera community in the Kákafok oxbow lake

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The Kákafok oxbow lake of the River Körös near the settlements Szarvas and Békésszentandrás (Hungary) is the largest oxbow lake of the Tisza water system, and also represents a high natural value. This oxbow lake receives effluent from the experimental pond system of the NAIK Research Institute for Fisheries and Aquaculture and an associated fish farm rearing African catfish (*Clarias gariepinus*). To assess the impact of the effluent, information on taxon diversity and abundance are indispensable, but analysing the functional and phylogenetic relationships of the community provides important additional information. We studied the seasonal biodiversity of the Rotifera community, by taking zooplankton samples nine times between April and October 2016 at five sites over a 4500 m section surrounding the effluent entry point. The biodiversity was characterized by Rényi diversity and Hill's expected number of species. To create

functional groups we used eight traits. The distances from the common ancestor were used to determine phylogenetic distances. Twenty-two species and two genera were identified. The effluent containing a large amount of organic matter had an adverse effect on the diversity of the Rotifera community in the different seasons of the year. The significant correlation between functional and phylogenetic distances indicate that species phylogenetically close to each other have similar life strategies. The combined functional-phylogenetic diversity index indicated a random community organization.

P37 – Aquatic ecosystems and their services: how to assess their condition at national level

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As an EU memberstate, Hungary is also obliged to assess and map its most important ecosystem services (ES). The national ecosystem service assessment in Hungary was initiated in 2016. Hydrological ES such as maintenance of the water regime, water retention (flood control), erosion control and water purification are among the highlighted major subjects for the four-year programme. Many of these services are related to aquatic or semi-aquatic ecosystems, which aspects we focus on in the presentation. First we defined two sets of relevant indicators of ecosystem

condition (EC) for each habitat type: 'general' indicators, for characterizing the general state of aquatic or semi-aquatic ecosystems (relating to conservation), and 'specific' indicators, which are more directly related to certain ecosystem functions, hence to hydrological ES. For the 'general' indicators, we worked out recommendations at a workshop together with national level experts, while a set of 'specific' indicators was elaborated by a special hydrologic working group based on literature review and expert opinion. Among the selected indicators for ecosystem condition is a naturalness index calculated from land cover ratios, a Wetness Probability index based on the Copernicus Water & Wetness layer, Water Framework Directive indices re-evaluated, and a lateral connectivity index for rivers. The indicators represent an optimum compromise between processing efficiency and ecological relevance. Including relevant EC into ES models is vital to reflect the effects of anthropogenic pressures and make them more easily communicable towards society.

P38 – Distribution of herbivorous fish is frozen by low temperature

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Herbivory of fish is a diet strategy that is dependent on temperature. Fish depend on the production of enzymes by symbiotic microorganisms living in their digestive tracts that are able to grow at ca. T>16°C. Thus climate change has marked impact on the fish herbivory. For instance, season of utilizing macropytes by omnivorous fish can prolong, and so the vegetation cover can change significantly. Secondly, distribution of herbivorous fish can move polewards, thus it can significantly affect species of macrophytes that evolved in colder water with absence of herbivores and are the most vulnerable.

P39 – Study of iodine and selenium uptake in bean plants cultivating in rhizobox systems

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Nowadays, iodine and selenium deficiency is a well known environmental health problem in several regions of the world. Vegetables and fruits have been proven to be an effective way to increase iodine and selenium intake in edible plant parts by using irrigation water having different essential elements. Our research work was carried out in the Danube Research Institute of Hungarian Academy of Sciences (project number: NVKP 16-1-2016-0044). In this project plant physiological processes in a bean (*Phaseolus vulgaris* L. convar. nanus.)/sandy soil system (rhizobox) were tested by adding iodine (as potassium iodide) and selenium (as sodium selenate) to the irrigation water in concentration of 0.10, 0.25 and 0.50 mg/L. During the experiments biomass production, iodine, selenium and essential element uptake by the root and its translocation to the stem, leaf and fruit parts of the bean plant was investigated. After homogenization of the dried samples microwave-assisted acidic

digestion was applied and the elemental concentrations were measured by inductively coupled plasma mass spectrometer. It can be concluded, that using 0.50-0.50 mg/L iodine and selenium concentrations in the irrigation water the biomass production of the crops were decreased by 43% and 58%, respectively. Iodine achieved its highest concentration in the roots (108 mg/kg) and the smallest in the fruits (1,8 mg/kg). In case of selenium addition target element concentration of the root, stem, leaf and fruit were similar (33-39 mg/kg). Results showed, that essential element concentrations of different plant parts were changed differently by adding iodine and selenium to the irrigation water.

P40 – Influence of environmental stability on microcrustacean assemblages in Western Carpathian spring-fen

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In this study we have evaluated the environmental stability, characterized as water and temperature regime, in 34 spring fens in the Western Carpathians, and its influence on microcrustacean assemblages (Ostracods, Harpacticoids). Altogether 20 ostracod and 19 harpacticoid taxa were found at the 34 spring fens during one shot sampling in June 2008, 2011 and 2012. The median number of species per site was 7 and the median total abundance was 236 individuals. Water temperature was recorded every 30 min for 24 months and water levels were measured manually six times (April 2016 to April 2018). The spring fens differed in thermal stability: stable sites were situated only in colder climatic areas, while fluctuating sites were scattered along the whole climatic gradient. Temperature and water regime (i.e., mean July water temperature, surface water depth) were the most

significant variables influencing microcrustacean assemblages. Their effects were only partly shared with other environmental variables (Ca+Mg content, nutrients and mean January air temperature). Two groups of species according to their specialization were identified: a) species with a relatively high affinity to spring habitat, which prevailed at the stable sites, and b) ubiquitous species, which were constricted almost only to the fluctuating sites, i.e. sites that warmed up in summer. We suggest that the "ubiquitous" species are weaker competitors in the stable environment.

P41 - The impacts of rehabilitating an urban waterway on freshwater fish and trophic ecology in Singapore

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A straight, 2.7 km stretch of concrete urban canal in Singapore was rehabilitated and converted into a meandering 3.2 km "naturalised" stream between 2009 and 2012. Now known as the Kallang River at Bishan-Ang Mo Kio Park (KRBAP); the biodiversity, community and trophic ecology of this novel fish community and its wider food web was studied and analysed. Quantitative fish surveys, fish dietary analyses, as well as food web studies (based on stable isotope analysis of basal resources, invertebrates and consumers) were conducted during the last quarter of 2016, 2017 and 2018. In total, >8,000 fish belonging to 23 non-native species from eight families were captured. The Cichlidae were the dominant family, with the Quetzal cichlid, *Vieja melanura*, being the most abundant species (> 60% relative abundance). Only one native species, the common snakehead, *Channa striata* (Channidae), was recorded. Stable

isotope analysis of various taxa and functional groups at KRBAP, indicated that macroinvertebrates supported a range of fish species at higher trophic levels, while primary production was mainly attributed to periphyton and phytoplankton. Gut content analysis of captured fish indicated diets of *Vieja melanura* consisted of aquatic macrophytes and insects, while the next numerically dominant taxon (*Oreochromis* spp.; Cichlidae) was shown to be primarily herbivorous. The dietary and trophic studies suggest that the dominant predators of KRBAP to be the peacock bass, *Cichla orinocensis* (Cichlidae), and the golden tank goby, *Glossogobius aureus* (Gobiidae). We demonstrate that the creation of this unique, rehabilitated habitat has a different fish community to natural forest streams within Singapore; the Kallang canal (adjacent and most similar to Bishan park prior to its rehabilitation); and the reservoir source of the Kallang river.

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