european federation for freshwater sciences

FRESHWATER BIOLOGICAL ASSOCIATION

# SEFS 13

SYMPOSIUM FOR EUROPEAN FRESHWATER SCIENCES

## 13th Symposium for European Freshwater Sciences

# Abstract Book

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# Contents

# A catchment wide study to capture multiple ecological benefits associated with natural flood management interventions.

Dr Laura Weldon[1], Mr Matthew Taylor[1], Ms Anne Harrison[1], Dr Hannah Robson[1], Dr Geoff Hilton[1]
[1]The Wildfowl and Wetland Trust, Gloucestershire, United Kingdom
1B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I joined the Wildfowl and Wetland Trust in 2020 as a postdoctoral researcher, in the Conservation Evidence Wetland Science team. My background is largely laboratory based with extensive experience in molecular and microbiology. I am a an advocate for the practical application of novel research tools for monitoring and surveillance, particularly eDNA methods. I manage the Wetland Science laboratory and project manage our catchment wide monitoring to capture the additional biodiversity benefits associated with natural flood management interventions in Somerset and the Cotswolds.*

Catchment wide natural flood management (NFM) interventions result in widespread alteration of overland water flow after intense or prolonged rainfall events. NFM primarily slows down surface water flow by increasing infiltration, diverting water and holding water for longer upstream. NFM changes water velocity and patterns of movement bringing subtle changes to the freshwater environment and ecology. Data from a two year catchment wide study are presented where sites with NFM interventions were compared with control sites without interventions. Abundance and community composition of instream aquatic insects and flying insects were measured and riparian consumer activity evaluated using passive acoustic recordings. To compare effects between and within years a two-way generalised least squares model was used with a BACI methodology (Before After Control Impact). Insect abundance and community composition increased at sites down stream of NFM interventions. In addition bat activity, indicated by total bat passes and signs of feeding activity were greater at the sites associated with NFM. There was a change in flying insect composition between years at sites downstream of NFM interventions and those without that suggest a change to the aquatic - terrestrial subsidy and the surrounding insectivore activity. This work is amongst some of the early catchment wide evidence to find positive ecological benefits where NFM measures are implemented. Given the interest in NFM for improved flood management in rural areas as intense rainfall effects increase, the data provides positive ecological incentives for landowners who are active in installing and maintaining NFM.

# A comparison of machine learning and statistical species distribution models: quantifying overfitting supports model interpretation

Ms Emma Chollet Ramampiandra[1,2], Andreas Scheidegger[1], Jonas Wydler[1,3], Professor Nele Schuwirth[1]
[1]Eawag, Dübendorf, Switzerland, [2]ETHZ, Zürich, Switzerland, [3]University of Zürich, Zürich, Switzerland

4G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*After studying mathematics at the University of Neuchâtel, I started a PhD in ecological modelling at the Swiss Federal Institute of Aquatic Science and Technology (Eawag). My work consists of comparing different types of models with the aim to gain a better understanding of the processes that affect macroinvertebrates community assembly.*

Species distribution models are commonly used to predict how species respond to environmental conditions. A wide variety of models exist that vary in complexity, which affects their predictive performance and interpretability. To inform environmental management, it is important to use a model with a reasonable level of complexity that captures the true relationship between the response and explanatory variables as good as possible rather than fitting to the noise in the data. To investigate this, we applied eight models of varying complexity to predict the probability of occurrence of freshwater macroinvertebrate taxa based on 2729 Swiss monitoring samples, and compared them in terms of predictive performance, overfitting and learned response shapes, during cross-validation and for out-of-domain generalization. We found that, contrary to our expectations, all models predicted similarly well during cross-validation, while no model performed better than the null model during out-of-domain generalization. We also found that more complex models predicted slightly better than standard statistical models but were prone to overfitting, which impeded the interpretation of the learned response shapes. Thus, in this study, the minor gain in predictive performance from more complex models was outweighed by the overfitting. We therefore call for caution when using complex data-driven models to learn about species responses or to inform environmental management. In such cases, we recommend to compare a range of models regarding their predictive performance, overfitting and response shapes to better understand the robustness of inferred responses.

# A database of freshwater macroinvertebrate occurrence records across Cuba

Dr Yusdiel Torres Cambas[1,2], Dr Yoandri S. Megna[3], Juan Carlos Salazar-Salina[3], Dr Yander L. Diez[4,5], Alejandro Catalá[3], Dr Adrian D. Trapero-Quintana[6], Prof. Dr Boris Schröder[2], Dr Sami Domisch[1]
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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am a biologist interested in systematics, biodiversity informatics, global change biology, spatial ecology and conservation biology. During my PhD research, I have focused on the insect order Odonata (dragonflies and damselflies) as model organisms. At present, I am working on spatial conservation planning considering freshwater biodiversity and ecosystem services. In my research, I combine different approaches and tools that*

*include field and laboratory work, phylogenetic analysis, geocomputation, species distribution modelling and spatial conservation prioritization.*

In light of the ongoing freshwater biodiversity crisis, detailed knowledge regarding the spatial distribution of freshwater species is urgently required, especially in biodiversity hotspots. Here we present a database of georeferenced occurrence records of four freshwater invertebrate taxa groups across Cuba, namely flatworms (Platyhelminthes: Tricladida), insects (Ephemeroptera, Odonata, Hemiptera, Trichoptera, Coleoptera, Diptera), crabs and shrimps (Crustacea: Decapoda), and mollusks (Mollusca). We collated the geographic occurrence information from scientific literature, unpublished field records, museum collections and online databases. The database, comprising 6292 records of 457 species at 1075 unique localities, is organized in 32 fields that contain the information about the taxonomic classification of each recorded species, the sex and life stage of collected individuals; the geographic coordinates, location, author and date of the record and a reference to the original data source. With a geographic focus on the Cuban archipelago, we expect that the database is of interest to a broader scientific community focused on the distribution and conservation of freshwater biodiversity and macroinvertebrates in particular.

## A glimpse into a better future for the Danube's flagship species – the beluga sturgeon (Huso huso)

Dr Daniela Nicoleta Holostenco[1,2], Dr. Mitică Ciorpac[2,3], Dr. Marian Paraschiv[2], Dr. Ștefan Honț[2], Drd Marian Iani[2], Drd Katarina Tošić[2,4], MSc Elena Taflan[2], Dr Daniela Porea[2], Ms Petra Kersten[5], Dr. Eng. Radu Suciu[2], Dr. Jörn Gessner[5], Dr. Klaus Kohlmann[5], Prof. Dr. Geta Rîșnoveanu[1]
[1]University of Bucharest, Bucharest, Romania, [2] Danube Delta National Institute for Research and Development, Tulcea, Romania, [3]Grigore T. P University of Medicine and Pharmacy, Iasi, Romania, [4]University of Belgrade, Belgrade, Serbia, [5]Leibniz Institute for Freshwater Ecology and Inland Fisheries, Berlin, Germany

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Geta Risnoveanu is a Professor at the University of Bucharest, Department of Systems Ecology and Sustainability. She is a biologist having her Ph.D. in Ecology. Her research activities mainly addressed to structure, productivity and assessment of the ecological state of freshwaters; mechanisms of biological productivity and material and energetic fluxes; assessment of species' role in biogeochemical cycles; relationships between anthropogenic drivers, biodiversity and ecosystem functioning; aquatic-terrestrial interlinkages; monitoring of ecological systems; and conservation of biodiversity. Her research has been done in streams, lakes, riparian zones and wetlands in the Lower Danube River System.*

In the Black Sea basin, the last wild population of beluga sturgeon (Huso huso) survives and still spawns in the Danube River. During the 20th century, overexploitation and dam constructions reduced the population size to a critical level. Specific wildlife management interventions, such as fishing bans and stocking programmes, were implemented to recover the species in the region. Little is known about the efficiency of these management interventions in restoring a self-sustaining population. Here we investigate the genetic diversity and population structure of beluga sturgeon in the lower Danube River to provide the information needed to implement adequate management for the conservation and recovery of the species. Samples of 151 Huso huso were available for the study. Based on the analysis of mitochondrial and microsatellite DNA markers, 48 haplotypes and 119 alleles were identified. The phylogenetic relationships within haplotypes illustrate a complex population structure with multiple radiation events and a fine trace of annual sharing patterns. The wild stock of beluga sturgeon from the lower Danube has a specific cyclicity closely associated with the reproductive cycles of mature females. The genetic population structure indicates two genetic clusters with signs of admixture, thus indicating a strong tendency to homogenize the gene pool at the nuclear level. Both genetic markers reveal a slight demographic expansion for the beluga sturgeon population in the lower Danube River after a bottleneck event induced by overfishing and dam constructions. Several management concerns and urgent actions to recover this Critically Endangered species in the region are discussed.

## A metasystem approach to designing environmental flows

Mr Mathis Messager[1,2], Dr Julian D. Olden[3], Dr Jonathan D. Tonkin[4,5], Dr Rachel Stubbington[6], Dr Jane S. Rogosch[7], Dr Michelle H. Busch[8], Dr Chelsea J. Little[9], Dr Annika Walters[10], Dr Margaret Shanafield[11,12], Dr Songyan Yu[13,14], Dr Kate Boersma[15], Dr David Lytle[16], Dr Richard H. Walker[17], Dr Ryan M Burrows[18], Dr Thibault Datry[1]
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9B_RS12_Advances in environmental flow science and practice, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*

*Mathis Loïc Messager (He/Him) is a doctoral student in the Department of Geography at McGill University (Montréal, Canada) and the RiverLY research unit of the French National Research Institute for Agriculture, Food, and Environment (INRAE). His research seeks to inform the management and conservation of freshwater ecosystems and, in turn, support human cultures and livelihoods that depend on these ecosystems. His work is multidisciplinary, leveraging ecology and geosciences, together with advances in statistics and computing, to promote freshwater sustainability.*

*Mathis likes to talk about hiking, climbing, skiing, science and politics, even with people he doesn't know, so come chat.*

Accelerating the design and implementation of environmental flows (e-flows) is essential to curb the rapid, ongoing loss of freshwater biodiversity and the benefits it provides to people. E-flow assessments have historically relied on ensuring minimum instream flows for individual rivers below dams, but recent decades have witnessed a shift to e-flow standards encompassing multiple aspects of the flow regime and developed at the regional scale

rather than on a river-by-river basis. Nonetheless, regional e-flow planning remains focused on species' responses to the local flow regime. This singular focus overlooks recent advances in metasystem ecology which demonstrate that biodiversity and ecosystem functioning in river networks result from the interplay of local (abiotic conditions and biotic interactions) and regional (dispersal) processes. E-flow prescriptions may thus be less effective, for example, when the population and community dynamics within a river are strongly driven by species dispersal. No guidelines currently exist to account for these processes in designing e-flows. We address this gap by first illustrating how metasystem processes mediate ecological responses to flow. We then provide a step-by-step operational framework of how e-flows can be designed to conserve or restore metasystem dynamics, from defining the ecological targets of the e-flows program to designing, implementing, and monitoring e-flows. Our recommendations are relevant to diverse regulatory contexts and can improve e-flow outcomes even in basins with limited in-situ data.

# A reliable modular heating solution for experimental flow-through systems

Mr Philipp M. Rehsen[1], Mrs. Iris Madge Pimentel[1], Dr. Arne J. Beermann[1,2], Prof. Dr. Florian Leese[1,2], Dr. Jeremy J. Piggott[3], Dr. Sebastian Schmuck[4]
[1]Aquatic Ecosystem Research, Faculty of Biology, University of Duisburg-Essen, Essen, Germany, [2]Centre for Water and Environmental Research, University of Duisburg-Essen, Essen, Germany, [3]Zoology and Trinity Centre for the Environment, School of Natural Sciences, Trinity College Dublin, Dublin 2, Ireland, [4]Multiscale Process Engineering, Department of Urban Water and Resource Management, Institute for Sanitary Engineering, Water Quality and Solid Waste Management, University of Stuttgart, Stuttgart-Büsnau, Germany

1C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Philipp M. Rehsen is a PhD student in the Aquatic Ecosystem Research working group (LeeseLab) at the University of Duisburg-Essen. His current project focuses on the impact of multiple stressors on macroinvertebrate communities, with a focus on applying new image-based and DNA-based assessment methods.*

Water temperature is one of the main drivers of biotic community composition change in streams and strongly determines species distributions for macroinvertebrates, fish and periphyton. Changes in water temperature affect stream organisms in multiple ways including physiological effects, changes in life history and behavior, as well as indirect effects through altered biological interactions. Today, stream water temperature can be increased by both climate change and direct anthropogenic action (e.g., power plant cooling water, removal of riparian vegetation).
Whereas numerous mesocosm experiments have tested the effects of warming in lakes, only a few have been conducted in lotic systems. While some recirculating indoor systems simulate in-stream fluctuations (e.g., by including temperature and light cycles), flow-through systems are needed to include realistic variations in other environmental variables such as salinity or nutrient concentrations. As a major advancement for ecological experiments, we outline a heating module for differential temperature regulation in a flow-through system by automatic control of warm water supply.
We validated its functionality for maintaining a uniformly distributed target temperature increase in indoor trials, as well as outside using an “ExStream” experimental mesocosm system. Furthermore, we tested implications of different water temperatures for the survival of invertebrates drifting through the heating module to determine the maximum usable warming. No evidence for increased mortality relative to a control group was found when 43.6 °C warm water was mixed with ambient stream water. Key components are flexible and scalable and offer various possible applications allowing others to upgrade existing experimental flow-through setups.

# A tale of sister species: Ecological niches of the genus Luciobarbus in the western Iberian Peninsula

Dr Ana Filipa Filipe[1], Janine da Silva[2], Pedro Pacheco[1], Dr Paulo Branco[1], Dr Rafael Miranda[3], Dr Teresa Ferreira[1], Dr Virgilio Hermoso[4]
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1F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*My research focuses on freshwater ecology, with particular emphasis on patterns and processes of freshwater biota at various geographical (watershed scale, Iberian Peninsula, Europe) and temporal scales (past, present, future). I am focused on the impacts of climate change and biotic invasions on freshwater fish, particularly those affecting distribution, life-history, and evolution. I have been developing conservation planning and metabarcoding approaches to address freshwater biodiversity and conservation.*

Knowing about ecological niche properties has a great utility for examining the mechanisms which differentiate species across space and time. Range restricted species such as freshwater fishes from southwestern Europe may be particularly important for evaluating the ability of species to cope with global changes. Here we examined Luciobarbus bocagei, L. comizo and L. microcephalus, barbels which occur in the western region of the Iberian Peninsula. L. bocagei and L. comizo are partially sympatric in the Tagus basin, while L. microcephalus distribution is nested within the southern distributional range of L. comizo. We built Species Distribution Models to predict species current and future distributions. Forecasts were projected to the current distributional ranges, as well as beyond them. We further evaluate niche properties, including niche as breath and overlap. Overall, models performed excellently regarding predictive accuracy and discriminatory ability. Ecological niche properties revealed that the three Luciobarbus species have relatively broad niche breadth and high overlap. Finally we discuss the species ability to adapt to future environments, the accuracy of using such species as biotic indicators, and the risks translocating such species into new areas.

# A tale of two ponds: understanding the community ecology of macrophytes across the urban-to-rural gradient

Mr Sebastian Stroud[1]
[1]University of Leeds, Leeds, United Kingdom
5A_SS08_Freshwater ecosystems and urbanization – is the sustainable development of cities really possible?, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I am a PGR based in School of Biology at the University of Leeds working with Dr Hassall, investigating ecosystem services and urban plant communities.*

*My research covers a broad spectrum of topics from urban ecology to the pedagogy of botany. I am particularly interested in human plant interactions, the uses of plants for the mitigation of the impacts of urbanisation, and the development of sustainable and equitable cities.*

Urbanization is a global process threatening habitats through destruction and fragmentation. Urban areas are complex structural mosaics that develop and shift over temporal scales. Many studies have focused on the biological response of terrestrial taxa and habitats to urbanization but few have focused on aquatic species, with fewer still on aquatic plants. Pond communities, given that they present a range of environmental conditions and habitat niches. Consequently, the pond as a research site allows us to understand the impacts of urbanization at varying spatial scales within an understudied system.

We examine and present an analysis of aquatic macrophyte diversity and variation in community composition between urban and nonurban ponds across the United Kingdom. Gaining a more detailed understanding of community composition across the rural-to-urban aquatic landscape will provide enhanced opportunities for managers and environmental regulators to conserve and enhance freshwater biodiversity in urbanized landscapes whilst also facilitating key ecosystem services.

# A trophic trait database for rapid construction of food web models across North America

Miss Medha Gollapudi[1], Ms. Morgan Bucher[1], Ms. Madison Peters[2], Ms. Roxanne MacKinnon[3], Ms. Kaley Cave[1], Dr. Zacchaeus Compson[1]
[1]Department of Biological Sciences, Advanced Environmental Research Institute, University of North Texas, Denton, United States, [2]Department of Environmental Sciences, Western Washington University, Bellingham, United States, [3]Faculty of Forestry and Environmental Management, University of New Brunswick, Fredericton, Canada

7A_RS15_Science dissemination/communication & education, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Medha Gollapudi is a senior in high school at the Texas Academy of Mathematics and Science studying materials science and engineering. She has a strong passion for ecology and has been researching food webs at the University of North Texas since 2021. Medha plans to major in mechanical engineering while continuing to pursue her interest in environmental conservation. Her goal is to use her engineering education to develop technology that can lead to solutions to environmental problems.*

Food webs are important tools for visualizing biodiversity information and predicting the overall health and stability of aquatic ecosystems. There has been limited research focused on studying food webs with empirical data as opposed to theoretically based approaches. The creation of food webs requires specific and detailed data on body size, feeding habits, and trophic interactions, and gathering this information is laborious. The National Science Foundation’s National Ecological Observatory Network (NEON) provides large quantities of ecological data for the United States and Puerto Rico. However, we need more information than the basic diversity and community patterns given by this data to estimate food webs and predict trophic interactions. We gathered existing information from trait databases (e.g., Global Biotic Interactions and Encyclopedia of Life) for all of the fish and macroinvertebrates documented in the NEON wadeable streams. We then conducted a systematic search of published literature to discover trophic information and body size data missing from these public databases with the goal of creating a large trait database from which we can rapidly generate heuristic food web models using a previously published pipeline. The result of our systematic search and trait mining efforts for NEON taxa was combined with an existing food web database and is now a large trait database of trophic information that includes 904 taxa and over 50,000 pairwise interactions. This database is currently being used to characterize NEON food webs and will be made publicly available, enabling further food web research across North America.

# A workflow linking wetland conservation, management, restoration and climate policy to assess the role of wetland ecosystems on climate change mitigation

Prof. Antonio Camacho[1], Dr. Daniel Morant[1], Dr. Carlos Rochera[1], Dr. Antonio Picazo[1], Ms Alba Camacho-Santamans[2], Mr Javier Miralles-Lorenzo[1], Dr. Rafael Carballeira[1]
[1]Cavanilles Institute for Biodiversity and Evolutionary Biology - University of Valencia, Paterna, Valencia, Spain, [2]Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals. Universitat de Barcelona., Barcelona, Spain

4F_RS13_Climate change and freshwaters: challenges and solutions, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Antonio Camacho is a PhD in Biology, Director of the Limnology Research Group of the Cavanilles Institute of Biodiversity and Evolutionary Biology, and Professor of Ecology at the University of Valencia, in Spain. His main research and university teaching is related to basic and applied aspects of aquatic ecology and its interaction with climate change and ecosystem services. He is co-author of nearly 200 research papers. He is currently the Chairperson of the European Federation for Freshwater Sciences, and a member of the Scientific Committee of the Division of Earth and Environmental Sciences of the European Academy of Sciences.*

Ecosystems can be allies to confront anthropogenic climate change created by the huge amount of Greenhouse Gases (GHG) emissions by human activities. The biogeochemical cycles of Earth's ecosystems are modified by climate change but also by other anthropogenic impacts, such as land use changes. Here we present a multiscale workflow aiming to fix the relative importance of ecological processes and that of anthropogenic pressures and impacts, and the interconnections among scales at the proper level. This approach starts from measuring (and collecting from other available data sources) the rates of significant biogeochemical processes mediating GHG exchanges between different wetland's types representative sites and the atmosphere under different conditions, then assayed under experimentally controlled conditions. These data serve to calibrate C-cycle and GHG-exchange models to see how driving factors (e.g. temperature, hydrological patterns, meteorology, salinity, land use changes, etc.) can affect C and GHG fluxes. Multilevel models integrate C-cycle, hydrology and climate, allowing to forecast how human actions and future climate can influence C and GHG fluxes under different management/restoration/policy/climate-change scenarios. These models can be extrapolated when applying the conditions generated by climate change models, but also be related with the conservation/ecological status obtained from land uses and their changes (LULUC) applying novel methods, such as the LUPLES2 method: Land Uses – Pressure Level – Ecological Status – Ecosystem services. This work was supported by projects CLIMAWET-CONS (PID2019-104742RB-I00), funded by AEI (Spanish Government), and Wetlands4Climate (LIFE19 CCM/ES/001235), funded by the EU-LIFE programme, and has inspired the new EU Horizon project Restore4Cs.

# ADAPT - Upcoming project on the role of evolutionary adaptation in altering the response to multiple stressors in a rapidly changing environment

Dr Kamil Hupało[1], Daniel Grabner[2,3], Martina Weiss[1,3], Florian Leese[1,3]
[1]Aquatic Ecosystem Research, University of Duisburg-Essen, Essen, Germany, [2]Department of Aquatic Ecology, University of Duisburg-Essen, Essen, Germany, [3]Centre for Water and Environmental Research, University of Duisburg-Essen, Essen, Germany

1C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Kamil Hupało is a postdoctoral researcher at the University of Duisburg-Essen in Germany. Having background in molecular phylogeography, his current research interests revolve around studying freshwater biodiversity and ecology using a variety of DNA-based methods including DNA barcoding, genome-wide ddRAD-seq and (e)DNA metabarcoding. In his upcoming research project, he plans to investigate the role of eco-evolutionary adaptation on the multiple stress response. In his research, he uses freshwater gammarids (Amphipoda:Gammaridae) as eco-evolutionary model organisms.*

Rapid climate change and severe anthropogenic impact result in a multitude of environmental stressors that have a profound impact on global freshwater biodiversity. Those stressors often interact, sometimes in unexpected ways, making it difficult to accurately predict biodiversity responses. What likely contributes to the combined stress response, is the sensitivity of an organism to various stressors often resulting from eco-evolutionary adaptations. Prior exposure to stressors can affect organisms' stress response and thereby challenge our understanding of the effects of adding novel as well as reducing established stressors in an ecosystem. Thus, the aim of this upcoming project is to evaluate the role of eco-evolutionary adaptation on multiple stress responses of freshwater amphipods, aquatic keystone species. Here, we plan to investigate multiple stress responses of Gammarus pulex populations adapted to the neonicotinoid pesticide clothianidin. We plan to perform a series of indoor experiments using combinations of a stressor they are adapted to (pesticide) and additional environmental stressors related to heatwaves and droughts: temperature and salinity, all applied in a full factorial design. We aim to evaluate the sensitivity of the pesticide-adapted G. pulex populations towards a gradient of stressors by investigating a set of functional (leaf consumption), behavioural (activity patterns) and physiological (gene expression) endpoints. With that, the aim of this project is to provide a novel insight into our understanding of ecological responses to multiple environmental stressors in the light of organisms' eco-evolutionary adaptations, performance trade-offs as well as stressors' modes of action.

# Adaptive management of a complex floodplain system: Linking close range remote sensing (UAV and TLS), hydrodynamic modelling and immersive audio-visual virtual reality (VR)

Prof. Michael Doering[1], Dr.  Manuel Antonetti[1], Dr. Diego Tonolla[1], Dr. Ulrike Wissen-Hayek[2], Mr. Fabian Gutscher[2]
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1B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*M. Doering is head of the Ecohydrology Research Group at ZHAW. His research is centered on the ecology, restoration, and conservation of streams and floodplains, and the spatial*

*analysis of ecosystems at the landscape scale.*

*His work links science and application by utilizing sound scientific approaches and stakeholder involvement in order to develop applied practices in management and monitoring. He has expertise in investigating, modelling and simulating structural and functional parameters in relation to disturbance and the usage of ecosystem services in particular hydropower and restoration.*

The alteration of natural flow and sediment regimes for hydropower production is a major factor driving floodplain structure and function. Artificial floods are becoming more common as operational measures to restore hydrological and ecomorphological dynamics in floodplains downstream of dams. For the planning and application of these expensive and complex restoration measures, we use an adaptive management concept; i.e., continuous adaptation and optimization of measures based on the prediction and analysis of individual artificial floods. However, this requires the efficient cooperation among stakeholders from science, governmental organizations, and hydropower with different backgrounds and interests. Here, we combine 2D hydrodynamic modelling, UAV and TLS remote sensing to predict, plan and visualize the ecomorphological effects of artificial floods in a residual flow section of a complex floodplain. Input data for the hydrodynamic model were digital elevation models (DEM) obtained by UAV and TLS, and hydromorphological parameters. For highest possible information dissemination that supports collaboration among stakeholders, we implemented results into a 3D landscape visualization using an immersive audio-visual virtual reality (VR) application. Immersive VR application allows a realistic and highly detailed representation of landscapes as well as intensive interactions with human senses. The complexity of the floodplain, as well as impacts of restoration measures such as artificial flooding, can be conveyed in different ways to appeal to diverse perceptions of stakeholders. This method supports adaptive management decisions of rivers and floodplains.

# Advancing our understanding of freshwater biodiversity in remote and understudied regions with DNA-based methods: insights into regional and local biodiversity patterns on Sicily

Dr Kamil Hupało[1], Martina Weiss[1,2], Florian Leese[1,2]
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7C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Kamil Hupało is a postdoctoral researcher at the University of Duisburg-Essen in Germany. Having background in molecular phylogeography, his current research interests revolve around studying freshwater biodiversity and ecology using a variety of DNA-based methods including DNA barcoding, genome-wide ddRAD-seq and (e)DNA metabarcoding. In his upcoming research project, he plans to investigate the role of eco-evolutionary adaptation on the multiple stress response. In his research, he uses freshwater gammarids (Amphipoda:Gammaridae) as eco-evolutionary model organisms.*

Even though the Mediterranean region is among the top biodiversity hotspots, its freshwater biodiversity still remains understudied. Due to increasing anthropogenic pressure and ongoing climate change, Mediterranean freshwaters are among the most threatened ecosystems worldwide. Given the scarcity of knowledge about insular freshwater ecosystems, the current situation calls for novel ways to study regional and local freshwater biodiversity. DNA-based methods, such as environmental DNA (eDNA) metabarcoding, provide an opportunity for rapid large-scale species assessments in aquatic ecosystems. Furthermore, the growing evidence, based on mitochondrial data, for the presence of overlooked cryptic diversity on the islands point towards using genomic profiling methods that allow to zoom further into species diversity by assessing species status of highly diverse taxa. First, we present results of the first eDNA metabarcoding study from Sicily revealing interesting regional biodiversity patterns using an exact-sequence variant (ESV) based approach and indicating presence of new taxa for Sicily. Secondly, results from genomic data (ddRAD-seq) revealed the complexity of observed species diversity on example of Echinogammarus sicilianus, a freshwater amphipod, exhibiting extraordinary levels of intraspecific diversity revealed with mitochondrial data. Although DNA barcoding indicated presence of multiple cryptic species in the studied river system, genome-wide data revealed that most of mitochondrial diversity can be ascribed to single species, highlighting the importance of using genome-wide data for species validation in highly diverse species complexes. By providing insights into regional as well as local biodiversity patterns, our findings indicate that DNA approaches provide a promising solution for studying remote and understudied regions.

# Advocacy on freshwater pond and lake management for resilience trajectory in the context of built environment and land conversion scenarios of South Asian deltas: GBM, Mekong, and Red River Delta

Dr Indrajit Pal[1], Dr. Anirban Mukhopadhyay[1], Ms Neshma Tuladhar[1], Prof. Manas Sanyal[2], Mr. Jyoti Prakash Hati[3]
[1]Asian Institute Of Technology, Bangkok, Thailand, [2]Indian Institute of Engineering Science and Technology (IIEST), Kolkata, India, [3]Science for Sustainability, Kolkata, India

6A_SS17_Delta Ecosystems in transition, June 20, 2023, 4:15 PM - 5:30 PM

***Biography:***
*Indrajit Pal is an Associate Professor and the chair in the Disaster Preparedness, Mitigation and Management (DPMM) and Deputy Director of the Research Center "South- and South East Asia Multi-disciplinary Applied Research Network on Transforming Societies of Global South (SMARTS)" at AIT. Research thrust area for Dr. Pal includes disaster risk governance, hazard and risk assessment, community-based disaster risk management, public health risk, disaster resilience, and DRR Education. Dr. Pal has published 15 books and over 100 academic papers and book chapters.*

The research and advocacy in Asian mega deltas disproportionately focused on river channels, drainage networks and larger lakes than fresh water ponds and smaller lakes. Despite the integral role of freshwater ponds and smaller lakes across delta socio-ecological system, human wellbeing, resilience trajectory economics, natural, and cultural entities in delta daily life are heavily influenced by buit environment and land conversions. The economic value, multi-functionality, and high reliance on ponds in delta socio-ecological systems reveal the necessity of extensive study on why ponds are vanishing over time owing to anthropogenic interference for livelihood purposes like aquaculture or other land use purposes. The study uses long-term satellite images to identify and analyze the pond dynamics using Gray Level Co-occurrence Matrix in combination with the water index. The study assesses how freshwater ponds changed over time, becoming ‘hotspots’ traded off for built environment in three major mega deltas, Ganga Brahmaputra Meghna (India and Bangladesh), Mekong and Red River (Vietnam). Studies have stated how built-up areas are encroaching the freshwater ponds at an increasing rate in rural and urban settings. The conversion and loss of Freshwater sources, directly and indirectly, impact the lives and livelihoods depending on the sources and invite issues like water logging, even flooding during heavy precipitation, and other hazards. This clearly defines the urgency of advocacy about the vanishing Freshwater ponds in the delta region, which will contribute to necessary actions for the intervention and sustainable solutions that support the socio-ecological systems in the mega deltas.

# An eDNA approach to assess biodiversity effects of beaver activity – a case study from the Scottish Highlands

Dr Bernd Hänfling[1], Dr Nathan Griffiths[1], Mr James Macarthur[1], Dr Victoria Pritchard[1], Dr Barbara Morrisey[1], Ms Dasha Svoboda[1], Dr Angus Tree[2], Dr Martin Gaywood[1,2]
[1]University of Highlands and Islands, Inverness, United Kingdom, [2]Nature Scot, Inverness, United Kingdom

7C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Bernd has a broad interest in ecology and evolution. His primary expertise is the development and application of molecular tools for biodiversity and ecological research, and he has over 20 years' experience as an expert in the field. Most recently he pioneered the development of environmental DNA (eDNA) approaches for the monitoring of fish communities.*

The increased habitat heterogeneity associated with beaver activity can have multiple positive effects on biodiversity. A limited number of case studies have so far looked at biodiversity effects of beavers in Scottish freshwaters. In order to gain a more holistic understanding of beaver effects at a catchment level, effective biodiversity monitoring strategies are required which can be upscaled accordingly. Here we used an eDNA metabarcoding approach to characterise vertebrate and macroinvertebrate communities across a semi-natural beaver enclosure. We tested the usefulness of the eDNA approach to identify differences in community composition among sites which were previously studied using conventional approaches. Vertebrate eDNA metabarcoding showed a distinct change of community structure between sites modified by beaver dams and control sites. There was broad consistency with a previous study on the impact of beavers on brown trout populations at the same site, but eDNA approaches can't provide information on total abundance and age structure. Invertebrate metabarcoding showed an increased species richness in sites modified by beavers compared to control sites, and a significant difference in community structure between the groups. This was consistent with a previous survey based on morphological methods indicating that the eDNA approach is potentially suitable for large-scale monitoring of the effects on freshwater biodiversity. There was pronounced seasonal variation in both vertebrate and invertebrate communities as described through eDNA metabarcoding. Therefore, it is crucial that eDNA-based monitoring programmes carefully investigate this variation further and use appropriate sampling design to allow conclusions about long-term biodiversity change to be drawn.

# An eventful history of ecosystem recovery and destabilisation: impacts of biological invasions, climate change and other stressors on a temperate river

Dr Susanne Worischka[1,2], Dr Franz Schoell[2], Dr Carola Winkelmann[1], Dr Thomas Petzoldt[3]
[1]University of Koblenz, Institute for Integrated Natural Sciences, Koblenz, Germany, [2]Federal Institute of Hydrology, Department U4 Animal Ecology, Koblenz, Germany, [3]Dresden University of Technology, Institute of Hydrobiology, Dresden, Germany
3F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 4:15 PM - 6:00 PM

***Biography:***
*1990-1992 Undergraduate studies in biology, University of Rostock, Germany*

*1992-1997 Specialisation (graduate) studies in hydrobiology at TU Dresden (Dresden University of Technology), Germany*

*2007-2011 PhD studies, TU Dresden, stream food web ecology*

*2012-2016 Research associate, University of Koblenz-Landau, Germany, river ecology/ invasive species*

*2015 Doctorate at TU Dresden, Thesis: „Selective predators in complex communities – mechanisms and consequences of benthic fish predation in small temperate streams"*

*2016-2020 Postdoctoral researcher, TU Dresden, river restoration, invasive species*

*2021-2023 Postdoctoral researcher, University of Koblenz, river restoration ecology*

*2023 Postdoctoral researcher, Federal Institute of Hydrology, estuary ecology*

Multiple anthropogenic stressors affect the composition and functionality of benthic river communities. Identifying dominant stressors and detecting potentially alarming trends depends on the availability of long-term monitoring data sets. We conducted a causal analysis on a 28-year dataset for the benthic macroinvertebrate community of the upper Elbe river in Germany to detect the dominant stressors and hypothesised that multiple stressors, such as climate change and multiple biological invasions, reduce biodiversity and thus endanger ecosystem stability. We evaluated the effects of alien species, temperature, discharge, and other variables on the taxonomic and functional composition of the benthic community and analysed the temporal behaviour of biodiversity metrics. We observed fundamental taxonomic and functional changes in the community, with a shift from collectors/gatherers to filter feeders and feeding opportunists preferring warm temperatures. A partial dbRDA revealed significant effects of alien species' abundance and

richness and of temperature. The occurrence of distinct phases in the development of community metrics suggests a temporally varying impact of different stressors, with taxonomic and functional richness responding more sensitively than diversity and redundancy metrics. Especially the last 10-year phase showed a decline in richness metrics and an unsaturated, linear relationship between taxonomic and functional richness indicating reduced functional redundancy. We conclude that the varying anthropogenic stressors over three decades, mainly biological invasions and climate change, affected the community severely enough to increase its vulnerability to future stressors. Our study highlights the importance of long-term monitoring data and emphasises a careful use of biodiversity metrics, preferably including community composition.

# An unexpected effect of climate warming on denitrification and nitrate removal in a large river (Po, northern Italy)

Miss Maria Pia Gervasio[1], Dr. Elisa Soana[1], Mr. Fabio Vincenzi[1], Prof. Giuseppe Castaldelli[1]
[1]University Of Ferrara, Ferrara, Italy

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*

*Miss Maria Pia Gervasio performs her PhD research in aquatic ecosystems focusing on climate change and its effect on freshwater systems and the consequently eutrophication process.*

*Dr. Elisa Soana carries out her research in the field of biogeochemistry and aquatic ecology with a particular focus on the impacts of anthropogenic pressures on aquatic ecosystem metabolism and functioning.*

*Mrs. Fabio Vincenzi performs his work in Laboratory of Acquatic Ecology at the University of Ferrara in the research group of Prof. Giuseppe Castaldelli.*

*The research of Prof. Castaldelli interests ecology of freshwaters and transitional waters, nitrogen cycling and denitrification, eutrophication, fish ecology.*

In a climate change scenario, increasing water temperature is a key factor affecting river biogeochemical processes, such as denitrification. To the best of our knowledge, there is no scientific evidence of a causal relationship between climate change and microbial nitrate removal via denitrification.
The aim of the present study was to assess the temperature response of benthic nitrogen dynamics and denitrification in the sediments of the lower Po River (northern Italy), a nitrate pollution hotspot causing severe eutrophication in the transitional environments of its delta area and along the north-western Adriatic coast. Sediment–water fluxes of oxygen and dissolved inorganic nitrogen forms and denitrification rates were measured by dark laboratory incubations of intact sediment cores. Different water temperature treatments were applied in each season, based on historical data series and future predictions. Results showed that denitrification was stimulated by increasing water temperature. The correspondence between nitrate consumption and nitrogen gas production rates demonstrated that reactive nitrogen removal was quantitatively due to denitrification, mainly supported by nitrate diffusing from the water column into the sediments. Higher water temperatures also enhanced sediment oxygen demand and most likely the extent of hypoxic/anoxic horizons in surface sediments, further favouring anaerobic metabolism. In conclusion, the measured and predicted increase of water temperature in the Po River induced a significant increase of denitrification rates and a consequent decrease of nitrate loads exported to the coastal zone, i.e. a negative feedback of climate warming on eutrophication.

# Analysis of distribution of microcrustacean communities in groundwaters and groundwater-dependent ecosystems of Slovenia - comparing biogeographical regions and identifying knowledge gaps

Dr Nataša Mori[1], Dr Žiga Ogorelec[1], Dr Maja Zagmajster[2], Dr Cene Fišer[2], Dr Anton Brancelj[1,3]
[1]National institute of biology, Ljubljana, Slovenija, [2]University of Ljubljana, Biotechnical Faculty, Department of biology, Ljubljana, Slovenija, [3]University of Nova Gorica, Nova Gorica, Slovenija

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*My research work encompasses ecosystem studies of freshwaters, both groundwater and surface. I am primarily interested in biodiversity patterns and functioning and role of transitional areas between different ecosystems (groundwater-river, floodplains, springs) and the impact of disturbances on the structure and ecosystem processes. Concurrently, I am working on taxonomy, ecology and biogeography of Ostracoda (Crustacea) and biodiversity conservation and ecosystem services issues.*

Groundwaters and groundwater-dependent ecosystems (e.g., spring, hyporheic zones, etc.,) are inhabited by diverse biological communities, including ecologically and evolutionary highly diversified microcrustaceans (i.e, Copepoda, Cladocera, Ostracoda). Many species among them are rare and highly specialized. Due to their abundance, species richness and diversified evolutionary and ecological traits, they have high potential as bioindicators, to indicate for example groundwater hydrological flow paths, groundwater contamination or even assess groundwater ecological status. In comparison to surface waters, sampling of groundwater and groundwater-dependent habitats is demanding, taxonomic identification of microcrustaceans is requiring highly skilled experts and is time consuming. The summary of existing data is useful for guiding further research as well as point to already recognized rich areas. Data assembled over past few decades finally enables more exact spatial analyses for Slovenia, including comparison of different habitat types (e.g., springs, saturated and unsaturated karstic and saturated and unsaturated alluvial habitat) and different biogeographical regions (e.g., Alpine, Dinaric, subMediterranean, subPannonian). We analyzed for the species richness patterns and typical communities related to habitat types and regions. Furthermore, an attempt was made to define species affinities toward biogeographical region, habitat type, temperature regimes, water quality, etc. Mapping the patterns is useful to reveal knowledge gaps in species distributions and to help direct further studies.

## Aquatic biodiversity and ecosystem services: from biophysical survey to citizen´s perception

Prof. Cláudia Pascoal[1], Dr Cláudia Carvalho-Santos[1], Dr Janeide Padilha[1], Dr Giorgio Pace[1], Mr José Pedro Ramião[1], Dr Luís Machado[1], Professor Fernanda Cássio[1]
[1]CBMA & IBS / University Of Minho, Braga, Portugal

5B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Cláudia Pascoal is Associate Professor with Habilitation at the Department of Biology in the University of Minho, Portugal.*

*Her research interests focus on assessing, predicting and mitigating the impacts of global change on biodiversity and the functioning of aquatic ecosystems.*

*She has supervised 12 PhD ; 25 MSc, 31 BSc students*

*She published > 120 articles in journals indexed to Scopus plus 10 book chapters; h index=34.*

Aquatic biodiversity has a high social, economic, cultural and aesthetic value and is crucial for maintaining multiple ecosystem services. Assessing the status and trends of aquatic biodiversity and ecosystem services is key for the development of strategies for a sustainable use of natural resources and to implement measures to deal with major threats. We present results from the River2Ocean project that aims to develop strategies to promote biodiversity and aquatic ecosystem services in the Minho region, NW Portugal, using an integrative approach from the river basins to the coast. We conducted a comprehensive survey of freshwater biodiversity and ecosystem services in three watersheds (Cávado, Minho and Lima River basins). This allowed us to map biodiversity along the study area, with the identification of vulnerable species and habitats and the diagnosis of environmental factors shaping current species distribution. In parallel, we assessed representative ecosystem services, namely water provision, carbon sequestration, nutrient delivery, habitat quality, and sediment retention. Results were compared with data from participative workshops with stakeholders from the three watersheds that allowed us to collect opinions on biodiversity and ecosystem services status. Local stakeholders recognized the importance of biodiversity conservation and emphasized the need to increase protected areas. Regarding ecosystem services provision, stakeholders highlighted the importance of promoting regulation services. The impacts of scenarios of land use and land cover and climate change will be discussed. Our findings show that assessing the status and trends of aquatic biodiversity and ecosystem services is critical for developing strategies for adequate watershed management.

## Are ponds providing freshwater habitat for European Eels (Anguilla anguilla), an eDNA assessment of farm ponds in the Severn Vale, UK.

Miss Abigail Mackay[1], Miss Lucy Smith[1], Dr Laura Weldon[1], Dr Hannah Robson[1]
[1]WWT, Slimbridge, United Kingdom

1D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I have been a researcher in WWT's Wetland Science Team for just over two years. My role involves carrying eDNA surveys for European Eels and supporting on various monitoring projects in the Severn Vale. I am also studying for a Masters of Research at the University of the West of England where I designed eDNA surveys for rare and invasive freshwater fish.*

The European eel A. anguilla, is a critically endangered fish that migrates from marine spawning sites to spend its juvenile years in European freshwater and brackish waters. Loss of good quality habitat is thought to be one of the main drivers that underpins the populations decline. In the UK, the River Severn is the major migratory route for A. anguilla into the West of England and traditionally freshwater habitat in the Severn Vale supported a healthy eel population. Farm ponds can be biodiversity hot spots with capacity to support a wide range of species and anecdotal evidence suggests A. anguilla may use farm ponds as freshwater habitat. During the summer of 2022, more than one hundred ponds were surveyed across the Severn Vale. Habitat surveys were completed, two water samples were collected, one filtered to isolate eDNA and the other used to measure water chemistry. In addition, the pH, temperature, conductivity and dissolved oxygen levels of the water were measured. Using single species eDNA analysis A. anguilla DNA was amplified from 37% of the surveyed ponds. These findings were used to map the presence and distribution of A. anguilla in Severn Vale farm ponds and attributes of ponds that may influence A. anguilla presence in ponds were also identified. This research represents an assessment of farm ponds in the Severn Vale and provides direction for future research into the importance of freshwater farm ponds for A. anguilla.

# Are the aquatic alien species harmful for the biodiversity of the Doñana temporary ponds?

Mr Pablo Soto-García[1], Ms Carmen Díaz-Paniagua[2], Ms Margarita Florencio[1,3]
[1]Departamento de Ecología, Universidad Autónoma De Madrid (UAM), Madrid, Spain,
[2]Departamento de Ecología Evolutiva, Estación Biológica de Doñana, CSIC., Sevilla, Spain,
[3]Centro de Investigación en Biodiversidad y Cambio Global (CIBC-UAM), Universidad Autónoma de Madrid., Madrid, Spain.

7D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Graduated in Biology in 2022 by the Universidad Autónoma de Madrid and laboratory technician in pathological anatomy in 2016 by the Hopital Puerta de Hierro. Hired as a research support technician since september 2021 in the project ClimaRiskinPond, where I have done work related to aquatic ecology, in the field and in the laboratory by sampling ponds, macroinvertebrate recognition, analysis of physicochemical characteristics and chlorophyll.*

Mediterranean temporary ponds are priority habitats for conservation under the EU Habitats Directive. However, these ponds are under important threats such as biological invasions. In the Doñana pond network, which includes more than 3000 of temporary ponds, the aquatic alien species Trichochorixa verticalis, Stenopelmus rufinasus, Physella acuta, Procambarus clarkii and Gambusia holbrooki have been detected. We aimed 1) if these alien species have impacted the taxonomical and functional diversity of the macroinvertebrate assemblages of the Doñana temporary ponds; and 2) how these species persistence have changed in the last 14 years. To do that, we analysed the macroinvertebrate assemblages of 88 ponds sampled in spring of 2007, constructing a database of taxonomical and functional traits. G. holbrooki had significant impact at taxonomical and functional level, P. clarkii and S. rufinasus only at taxonomical level, P. acuta only at functional level and T. verticalis had no significant effect. Moreover, the same ponds were sampled in spring of 2021, which was particularly dry, in order to evaluate the persistence of these species. Despite we detected lower connectivity of the pond network in 2021, the alien species appeared in a similar proportion in the two study years (40 % of ponds), being only G. holbrooki severely reduced in 2021 (5% of ponds). The persistence of most alien species in a protected area such as Doñana is alarming. However, the drastic reduction of G. Holbrooki occurrence suggests that dry periods with low connectivity may have straight implications on eradication of alien species.

# Are we ready to implement the river connectivity targets under the new EU Nature Restoration Law?

Miss Mayra Darre[1], Petros Constantinides[1], Sami Domisch[2], Virgilio Hermoso[3], Michael Ørsted[1], Simone Daniela Langhans[4]
[1]Department of Chemistry and Bioscience, Aalborg University, Aalborg, Denmark, [2]Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany, [3]Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Sevilla, Spain, [4]Norwegian Institute for Water Research (NIVA), Oslo, Norway
9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*Mayra E. Darre has been working on conserving natural resources for almost 7 years. She is now a Ph.D. candidate at Aalborg University working on river connectivity, ecosystem services, and optimization. With a bachelor's from Argentina and an Erasmus Mundus Master from Ugent and Aarhus University; Mayra is passionate about traveling, learning, and being in contact with nature.*

As a critical element of the EU Biodiversity Strategy 2030, the new Nature Restoration Law calls for recovering at least 25,000 km of “free-flowing rivers” among other restoration goals. The new legislation emphasizes that protection alone would not be sufficient to stop multiple environmental impacts such as biodiversity loss and water quality. To restore the natural longitudinal and lateral connectivity of rivers and floodplains by 2030, Member States must develop a prioritized list of obsolete barriers and other pressures that need to be removed. The question is: do we have the data, methods, and tools ready to implement the river connectivity targets the new Nature Restoration Law asked for? Based on a structured literature review, we identified issues at the pan-European and regional levels that need to be addressed before river connectivity targets can be implemented. We found a lack of information on the spatial distribution of small and medium barriers, as well as on barrier occurrence in small streams, knowledge gaps related to opportunity cost, and limited information on different species and the inclusion of future climate change scenarios. Together, these gaps constrain our capacity to achieve the goals presented in the EU strategy. The quality of the data available, especially regarding the number and characteristics of obstacles, is crucial for predicting and optimizing the benefits and costs of barrier removal. Addressing these gaps and discrepancies in technology and knowledge between member states will be critical to implement this new legislation in a way that leads to satisfactory outcomes.

# Artificial substrata to assess ecological and ecotoxicological responses in river biofilms: use and recommendations.

Javier Ortiz-Rivero[1,2], Anna Freixa[1,2], Sergi Sabater[1,3]
[1]Catalan Institute for Water Research (ICRA-CERCA), Girona, Carrer Emili Grahit 101, 17003 Girona, Spain, , , [2]University of Girona, Catalonia, Spain, , , [3]Institute of Aquatic Ecology, University of Girona, Campus de Montilivi, 17071 Girona, Catalonia, Spain, ,

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*My name is Javier, I studied biology and I am a PhD student at Catalan Institute for Water Research (ICRA). My research focuses on the impact of multiple stressors that affect microbial communities of river biofilms (mainly algae and bacteria). Specifically, I study the effect of multiple stressors of different nature (i.e., pesticides, nutrients, hydric stress, temperature increase...), intensity, frequency and temporal occurrence at both a structural (diversity and composition) and functional level (primary production, respiration, mineralization of organic matter…) on the response of biofilm communities.*

River biofilms are biological consortia of autotrophs and heterotrophs colonizing most solid surfaces in rivers. Biofilm composition and biomass differ according to the environmental conditions, having different characteristics between systems and even between river habitats. Artificial substrata (AS) are an alternative for in situ or laboratory experiments to handle the natural variability of biofilms. However, specific research goals may require decisions on colonization time or type of substrata. Substrata properties (i.e., texture, roughness, hydrophobicity) and the colonization period and site are selective factors of biofilm characteristics. Here we describe the uses of artificial substrata in the assessment of ecological and ecotoxicological responses and propose a decision tree for the best use of artificial substrata in river biofilm studies. We propose departing from the purpose of the study to define the necessity of obtaining a realistic biofilm community, from which it may be defined the colonization time, the colonization site, and the type of artificial substratum. Having a simple or mature biofilm community should guide our decisions on the colonization time and type of substrata to be selected for the best use of AS in biofilm studies. Tests involving contaminants should avoid adsorbing materials while those ecologically oriented may use any AS mimicking those substrata occurring in the streambed.

# Assessing ecological status of selected Scottish freshwater lochs using phytoplankton

Dr Jan Krokowski[1], Ms Elisabeth Mullen[1], Dr Cathy Bennett[1]
[1]SEPA, Glasgow, United Kingdom

1E_RS10_Biomonitoring, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Jan Krokowski is a Senior Specialist Scientist working for the Scottish Environment Protection Agency working on monitoring algae in freshwaters - benthic diatoms, phytoplankton, and issues surrounding cyanobacteria.*

Phytoplankton have been used as a biological quality element to assess ecological status of freshwater lochs in Scotland according to the Water Framework Directive since the mid 2010s. The taxonomic composition metric, with abundance of phytoplankton as chlorophyll a shows a relationship to eutrophication pressure and other environmental variables. Data so far has highlighted information on primary impacts of eutrophication and also provided insights into potential secondary impacts, as well as potential effects of climate change. The majority of freshwater lochs highlight 'High' ecological status, as shown by the UK phytoplankton metric, PLUTO (Phytoplankton classification with uncertainty tool). A number of lochs are dominated by cyanobacteria with ecological status lower than 'Good', with some lochs showing high biomass of other algal phyla not necessarily highlighting anthropogenic nutrient pressure. Predicted effects of climate change highlight increasing nutrient pressure and increasing frequency and biomass of cyanobacteria.

# Assessing Ecosystem Services Supply in Mekong Delta: Integrating Biophysical Models, Social Values, and Geospatial Analysis

Dr Tarun Bisht[1], Prof Andy Large[1], Ms. Oanh Truong Thi Kim[2], Prof Thuy Tuong Vu[2], Dr Phong Nguyen Thanh[3], Mr Vu Nguyen[4]
[1]Newcastle University, Newcastle upon Tyne, United Kingdom, [2]Curtin University, Malaysia, , , [3]IUCN, , Vietnam, [4]HCMC Space Technology Application Center (STAC), Ho Chi Minh City, Vietnam

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*A PDRA at the Living Deltas Research Hub, studying the Ganga-Brahmaputra-Meghna (India-Bangladesh), Mekong, and Red River (Vietnam) deltas. Research involves analyzing ecosystem services by ground-truthing remotely sensed data and engaging with delta communities and policy makers through participatory-GIS. I help produce land-use classifications and develop a Living Delta Index to aid decision making on delta health. As a river scientist, I am passionate about exploring river channel morphology, dynamics, ecosystem functioning, and services. I earned my Ph.D. from the joint doctorate program under the Erasmus Mundus SMART Program from Free University Berlin, Germany, and the University of Trento, Italy.*

The coastal provinces of the Mekong delta face multiple pressures, including land conversion, subsidence, saline intrusion, and freshwater scarcity, that can affect local livelihoods and ecosystem services (ES). Understanding the supply of ES requires considering the complex interactions between nature and humans, which cannot be fully grasped by a simple biophysical understanding. Therefore, we use an integrated approach that combines biophysical and socio-ecological values to comprehensively understand the spatial characteristics of ES supply. To this end, we conducted a study in Ben Tre, a province in the Mekong delta, Vietnam. Our goal was to identify biophysical and socio-ecological hotspots and coldspots for supply of 9 ES, that are relevant to this coastal landscape. We used secondary data and biophysical models to obtain the spatial distribution characteristics ES supply indicators. For the same ES, we also conducted face-to-face surveys to gather information on perceived ES supply, importance, and vulnerability by different users. By comparing the results from both biophysical and socio-ecological data, we can identify overlaps and mismatches in hotspots and coldspots of ES supply. We also examine the interaction between synergistic and antagonistic ES using importance and vulnerability scores. This study aims to provide insights into sustainable management practices for natural resources and land use common in Ben Tre and other similar coastal provinces of the Mekong delta, which heavily rely on these resources as these remain predominantly rural.

# Assessing freshwater restoration options on a pan-European perspective to support the targets of the EU nature legislation

Dr Florian Borgwardt[1], Goncalo Duarte[2], Paulo Branco[2], Tamara Leite[2], Angeliki Peponi[2], Teresa Ferreira[2], Sebastian Birk[3], Jochem Kail[3], Annette Baattrup-Pedersen[4], Andrea Funk[1]
[1]University of Natural Resources and Life Sciences, Vienna, Vienna, Austria, [2]Forest Research Centre, Associate Laboratory Terra, School Of Agriculture, University Of Lisbon , Lisbon, Portugal, [3]Faculty of Biology, Aquatic Ecology, University of Duisburg-Essen , Essen, Germany, [4]Department of Bioscience, Aarhus University , Aarhus, Denmark

1B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*DI Dr. Florian Borgwardt is an expert in freshwater ecology with a focus on riverine landscapes and the environmental processes shaping the biological communities therein. His work addresses human impacts as well as climate change effects on aquatic biodiversity to inform management and to develop robust restoration and conservation strategies to halt biodiversity loss. Florian is experienced in using GIS systems and various statistical methods (e.g. multivariate techniques, species distribution modelling) to analyse the drivers and pressures on aquatic ecosystems. He has been involved in several national and international projects also serving as principal investigator and task leader.*

Europe’s freshwater ecosystems are largely degraded and their biodiversity is threatened in manifold ways, e.g., by pollution, habitat degradation, climate change. The EU nature legislation relevant to freshwater ecosystems, i.e., especially the Water Framework Directive and the Habitats Directive, set ambitious targets that are still largely failed. Although restoration measures are taken, current restoration practice is too often small-scale and piecemeal, and thus insufficient to substantially respond to the ecological crisis. Here we perform a Europe-wide screening on the landscape scale, which areas are suitable for different types of restoration measures to develop a pan-European framework for restoration options. Based on a spatial explicit framework, the so-called river restoration units, relevant stressors (such as dams, nitrogen input, hydromorphological changes) are identified that are relevant for not meeting EU legally binding nature targets. Then the stressors are linked in a Bayesian Belief Networks analyses to restoration needs as well as ecosystem services within the river restoration units. Subsequently, the restoration effects are mapped by the river restoration units across Europe to identify areas that are best suited for different types of restoration measures. Thus, landscapes with high potential and priority for transformative restoration are identified. The outcomes show how ecosystem restoration through nature-based solutions can help to support the needed transformative change in Europe.

# Assessing spatial and temporal patterns of carbon greenhouse gas fluxes in Mediterranean wetlands

Dr Carlos Rochera[1], Mr Antonio Picazo[1], Mr Daniel Morant[1], Mr Javier Miralles-Lorenzo[1], Mr Ernesto Aguirre, Mr David Miguélez[2], Ms Sonia Monferrer[2], Mr Javier Ruiz[2], Mr Antonio Guillem[2], Ms Vanessa Sanchez-Ortega[2], Mr Antonio Camacho[1]
[1]Cavanilles Institute for Biodiversity and Evolutionary Biology, University of Valencia, Paterna, Valencia , Spain, [2]Fundación Global Nature, Las Rozas, Madrid (Spain), Spain

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*

*Carlos Rochera holds a PhD in Biology. He is a research member of the group of Limnology of the Cavanilles Institute of Biodiversity and Evolutionary Biology (University of Valencia). He is accomplising investigations on the functional aspects of microbial populations from polar and temperate regions, as well as the sensitivity and vulnerability of ecological processes in aquatic ecosystems to climate change.*

The hydrological patterns of Mediterranean wetlands are variable and fluxes of greenhouse gases (GHGs) may vary accordingly. This poses the question of identifying appropriate methodologies and compartments to assess these fluxes. CO2 and CH4 fluxes were measured at different phases of the hydroperiod in representative Mediterranean wetlands and shallow lakes from the Iberian Peninsula. The survey comprised both coastal and inland sites, either saline or freshwater. Comparison among sites showed organic matter content in sediments as a main factor explaining GHGs production. Concomitantly, temperature and salinity showed an opposite effect, particularly for CH4, being this direct or inverse respectively. Strong differences were observed along the flooding gradients within wetlands, with a higher carbon outflow in shallower zones compared to the deepest ones, still CH4 emissions were usually highest at the intermediate depths, which are frequently flooded but still very shallow. We complementary performed ex-situ medium-term and in-situ short-term incubations using sediment cores and closed chambers, respectively. Because the longer incubation time, sediment cores integrated better the CH4 diffusion and ebullition processes, although the closed chambers also allowed to monitor them. These findings highlight the key role of hydrological dynamics explaining GHG fluxes and can serve to inform monitoring design for estimating carbon budgets, focusing on the ways that it can be either underestimated or overestimated. This work is supported by projects CLIMAWET-CONS (PID2019-104742RB-I00), funded by Agencia Estatal de Investigación and the Ministerio de Ciencia e Innovación (Gobierno de España), and Wetlands4Climate (LIFE19 CCM/ES/001235), funded by the EU-LIFE programme.

# Assessing the Impacts of Salinization of Freshwater Lakes using Field Survey & Synchronised Gradient Design Mesocosm Experiment

Prof. Meryem Beklioglu[1]

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8F_SS10_Freshwater salinization: causes, consequences and management, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

*Professor Meryem Beklioğlu is an export on shallow lakes' ecosystem structure and functions and how they are affected by global changes. The impact of hydrological changes, global warming and land use change and lately salinization are among her interest using mesocosms experiment, field surveys, monitoring as well as modeling. In her research, the focus on all trophic interaction and vertical community structures including microbial loop (bacteria, HNF, ciliate), phytoplankton, zooplankton, aquatic plants and fish biomass and diversity of these various groups.*

The widespread salinization of freshwater ecosystems poses a major threat to ecosystem structure, function and services that they provide. Central Anatolian Türkiye, located from Mediterranean to semiarid and arid climatic conditions is coupled with excessive water use for irrigation of water-thirsty crops, which leads to a substantial reduction of the surface and groundwater levels, a decrease of surface area of lakes, followed by an increase in salinisation, and even complete loss of several lakes. To understand the effects of salinization on shallow lakes, we performed synchronized long-term gradient design mesocosm experiments between September 2021 to May 2022 with 16 different salinities (0-50 g/L), in two places with different climate conditions in Türkiye (Ankara, mean temperature: 12.6°C; and Mersin, mean temperature: 20.1°C). The experiments were divided into three periods: increasing (30 days), stable (six months), and decreasing (40 days) salinity. In both places, the concentrations of nutrients, especially phosphorus, chlorophyll-a, turbidity and suspended solids increased, which was more pronounced after 20 g/l of salinity. Overall, the increase was much higher in the warmer Mersin mesocosms. Increasing salinity led to a linear decrease in water clarity in Ankara while it did not cause a change in Mersin mesocosms during the increasing salinity period. At stable levels, intermediate salinities showed higher water transparency in both places. Increased salinity shifted phytoplankton community to Cyanobacteria and diatoms dominated state. Zooplankton richness and density decreased largely with increasing salinity. Changes in ecosystem and community structure through increasing salinity will be discussed thoroughly

# Assessing the role of wetland restoration for climate change mitigation in Europe in the RESTORE4Cs project – State of the art based on a literature review

Benjamin Misteli[1], Daniel Morant[2], Antonio Camacho[2], Danja Abdul Malak[3], Antonio Sanchéz[3], João Pedro Coelho[5], Camille Minaudo[6], Biel Obrador[6], Daniel von Schiller[6], Anis Guelmami[7], Katrin Attermeyer[1,4]
[1]WasserCluster Lunz – Biologische Station, Lunz am See, Austria, [2]University of Valencia, Cavanilles Institute of Biodiversity and Evolutionary Biology , Paterna, Spain, [3]European Topic Centre on Spatial Analysis and Synthesis (ETC-UMA), Malaga, Spain, [4]University of Vienna, Department of Functional and Evolutionary Ecology, Vienna, Spain, [5]University of Aveiro, Department of Biology, ECOMARE-Laboratory for Innovation and Sustainability of Marine Biological Resources, CESAM-Centre for Environmental and Marine Studies, Gafanha da Nazaré, Portugal, [6]University of Barcelona, Department of Evolutionary Biology, Ecology and Environmental Sciences, Barcelona, Spain, [7]Tour du Valat, Arles, France

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*PostDoc in the RESTORE4Cs project modelling Restoration of Wetlands for Carbon Pathways, Climate Change Mitigation and Adaptation, Ecosystem Services, and Biodiversity, Co-benefits. Former University of Rennes (PhD) and ETH Zürich (MSc).*

Wetlands are valuable ecosystems providing many ecosystem services. Among others, they provide a high potential for carbon storage, as anaerobic conditions reduce the decomposition of organic matter, resulting in high carbon stocks. Wetlands worldwide are expected to store 20-30% of the estimated global soil carbon while only covering 5-8% of the world's land surface. Healthy wetlands are, therefore, an excellent carbon sink, tackling ongoing climate change, and supporting the EU`s goal of achieving climate neutrality by 2050. Furthermore, healthy wetlands ensure improving the status of critical biodiversity linked to these ecosystems, being a co-benefit that wetlands provide that would contribute to the EU Biodiversity Strategy for 2030 and to the EU proposed Law on ecosystem restoration. In the framework of the RESTORE4Cs project (Modelling RESTORation of wEtlands for Carbon pathways, Climate Change mitigation and adaptation, ecosystem services, and biodiversity, Co-benefits), we are working with partners across Europe to study the role of European wetlands in the carbon cycle and to assess the impacts of different ecosystem alterations and restoration measures in terms of climate change mitigation. With our poster, we want to introduce the RESTORE4Cs project, including our aims and partners. We also present the results of a literature review about wetlands' carbon sequestration capacity unveiling main gaps in our understanding of the carbon sequestration capacity of wetlands and their potential enhancement through restoration actions. The results from the RESTORE4Cs project and the literature review will thus support research, wetland management, and policy, identifying prioritization of sites for wetland restoration.

# Assessing zooplankton foraging depths using Bayesian fatty acid-specific stable isotope mixing model

Samuel-Karl Kämmer[1], Matthias Pilecky[1,2], Katharina Winter[1], Radka Ptacnikova[1], Len Wassenaar[1], Patrick Fink[3], Martin Kainz[1,2]
[1]WasserCluster Lunz - Biologische Station GmbH, Lunz/See, Austria, [2]Donau-Universität Krems, Krems, Austria, [3]Helmholtz Centre for Environmental Research – UFZ, Department Aquatic Ecosystem Analysis and Management, Magdeburg, Germany

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Samuel Kämmer is technical assistant at the WasserCluster Lunz and specialized in laboratory analysis of fatty acids from various environmental and biological samples.*

Aquatic consumers require dietary energy and essential dietary micronutrients, which they cannot synthesize de novo, to survive, grow and reproduce. Fatty acids (FA) supply both, dietary energy along food chains and essential omega-3 and omega-6 polyunsaturated FA (PUFA) for various physiological processes of consumers. Tracing PUFA sources is thus important for understanding which diet conveys required nutrients to consumers. We used compound-specific stable hydrogen and carbon isotope analysis (CSIA) to investigate the trophic transfer of linoleic acid (LIN, 18:2n-6) and alpha-linoleic acid (ALA, 18:3n-3) in a controlled laboratory study. This analytical approach was applied to assess specific feeding depths of Bosmina, Daphnia, cyclopoid and calanoid copepods in Lake Lunz during a 6-weeks summer field study. The isotope fractionation coefficients were larger for 2H (ALA: -12.4 ± 3.8 ‰ and LIN: -22.2 ± 5.8 ‰) than for 13C (ALA: -0.05 ‰ ± 1.32 and LIN: -1.55 ‰ ± 1.2). The CSIA values of epi-, meta- and hypolimnetic seston were clearly different at any sampling time, in contrast to bulk stable isotope values, which could not be used to distinguish between diet sources. Based on our models, Daphnia were mainly retaining epilimnetic diet sources, while calanoid copeponds were mainly feeding on hypolimnetic resources. Dual-isotope CSIA of FA are a promising tool to provide long-term information on specific feeding habitats of aquatic ecosystems and appear to be robust to time-dependent environmental fluctuations.

# Assessment of “Carbopeaking” in a hydropeaking-impacted river in the Italian Alpine area

Dr Maria Cristina Bruno[1], Dr Giulio Dolcetti[1], Dr Stefano Larsen[1], Dr. Elisa Calamita[1], Prof Sebastiano Piccolroaz[1], Prof Guido Zolezzi[1], Prof Annunziato Siviglia[1]
[1]Fondazione E. Mach - Reseach and Innovation Center, San Michele all'Adige, Italy
Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Dr. Bruno is an aquatic ecologist with a particular interest in animal biodiversity and ecosystem processes. In the last 15 years, she has been concentrating her activity on alpine and mountain streams and rivers, analysing the ecological effects of hydromorphological, physico-chemical and environmental alterations, due to anthropic uses and climate change. In her activity, she applies an experimental ecohydrological approaches to field and mesocosms studies, and to habitat suitability simulations to study the biotic component of stream ecosystems, integrating also biomolecular approaches to the assessment of biodiversity.*

Hydropeaking (i.e., rapid and frequent artificial flow fluctuations caused by reservoir-operated hydropower production) is a much-investigated river stressor, and has been associated, among others, to sudden changes in temperature (“thermopeaking”), underwater soundscape (“soundpeaking”), total dissolved gas saturation (“saturopeaking”). We have recently started investigating the “carbopeaking”, i.e., variations of greenhouse gas (mainly CO2) concentrations and evasion fluxes through the water-air interface associated with hydropeaks. Here we report on the methodology and preliminary results from a field-measurement campaign conducted in a single-thread Alpine river (River Noce, Italy) during multiple hydropeaking events. The analysis of water samples collected in the upstream reservoir showed CO2 oversaturation in the hypolimnion, around the depth of the hydropower intake system. In the Noce reach upstream of the hydropower plant outlet (i.e., in a residual flow stretch), the CO2 concentrations displayed diel fluctuations around the atmospheric equilibrium concentration, likely driven by diurnal primary production. Conversely, water released at the hydropower outlet during hydropeaking were consistently oversaturated in CO2 relative to the atmosphere, in agreement with the concentrations in the reservoir’s hypolimnetic water. As a result, hydropeaking events were associated with an alteration of the sub-daily patterns of CO2 concentration downstream of the hydropower outlet which, combined with higher gas exchange velocities occurring during higher flow rates, can cause periods of enhanced CO2 emissions. The results highlight the potential impact of hydropeaking on greenhouse gas emissions, demonstrating the need to account for sub-daily variations of flow and gas concentration to accurately quantify carbon balances in rivers impacted by hydropower.

# Back to the future: modelling the historical distribution of diadromous fish for better understanding the current impact of anthropogenic disturbances.

Dr Laura Plichard[1], Karl Kreutzenberger[2], Nicolas Hette-Tronquart[3], Jérôme Belliard[1]
[1]INRAE, UR HYCAR, HEF, Antony, France, [2]OFB, DG DSUED / DRAS, Service Eau et Milieux Aquatiques (SEMA) / Pôle R&D pour la Gestion des Migrateurs Amphihalins dans leur Environnement (MIAME : OFB – INRAE – Institut Agro – UPPA), Rennes, France, [3]OFB, DG DRAS, Service Anthropisation et Fonctionnement des Ecosystèmes Terrestres (SAFET), Vincennes, France

4D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*

*PhD in ecological modelling since 2019, specialized in habitat selection and preference models of freshwater fish, I focus my postdoctoral research on past Species Distribution Modelling of diadromous fish and beavers. My main research interest aims to better understand the anthropogenic influences on species – habitat relationships at different spatial and temporal scales.*

Diadromous fish remains threatened by human activities despite numerous restoration actions conducted these recent decades to mitigate their decline in rivers. Among the major factors influencing this decline, the increase of flow barriers limited their access to crucial habitats as spawning grounds for anadromous fish. Using a historical database built with 2586 occurrences of 12 species recorded in historical documents throughout France from 1790 to 1981, we aimed to evaluate the influence of river management and development projects over time, as dam or weir constructions, on diadromous fish distributions. Following an ensemble forecasting approach combining Random Forest, Generalized Linear Mixed Models (random effects on decades and watershed) and Artificial Neural Networks, based on seven environmental predictors (i.e., mean annual temperature, river slope, distance from the sea, coastline, watershed surface, aquifer type and soil permeability), we modelled diadromous past distributions in France by decades from 1870 to 1981. Model predictions were then projected regarding the evolution by decades of flow barrier variables (i.e., number of downstream flow barriers, cumulative heights of downstream barriers, maximum heights of downstream barriers) and anthrome variable (i.e., anthropogenic biomes: a combination of human population density and land use) to assess how changes in development and anthropogenic pressures may have affected species distributions. Combined with restoration program scenarii defined by stakeholders, the application of this work aims to help identifying which projects could support diadromous fish migrations in French rivers up to their original distributions.

# Bacteria dominate finest particles along the particulate organic matter continuum in streams

Leonie Haferkemper[1,2], Gertraud Steniczka[1], Samuel-Karl Kämmer[1], Martin J. Kainz[1,3], Dr Katrin Attermeyer[1,2]
[1]Wassercluster Lunz - Biological Station, Lunz am See, Austria, [2]University of Vienna, Vienna, Austria, [3]Danube University Krems, Krems, Austria

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*I am a freshwater biogeochemist and microbial ecologist. I have received my PhD in Germany, studying microbial carbon turnover in shallow lakes. As a postdoc, I studied greenhouse gas emissions from ponds and investigated particulate carbon in boreal freshwater ecosystems in Sweden. Currently, I am a senior scientist at the WasserCluster Lunz and University of Vienna in Austria where I unravel the mysteries of the smallest organisms involved in the turnover of carbon in freshwaters from source to sea.*

The majority of particulate organic matter (POM) transported through river networks is <1 mm in diameter and represents approximately 40% of its total mass flux. However, fluvial research to date has mostly focused on the processing of leaf litter and dissolved organic matter whereas processing of suspended fine POM is poorly understood in river networks. Therefore, we conducted field samplings to examine biochemical composition and microbial decomposition among different size classes along the fine POM size continuum and between mountainous and agricultural streams. We collected water samples from five streams dominated by agricultural land use and five streams dominated by mountainous areas, and separated the fine particles into five size classes (500-100, 100-50, 50-15, 15-2.7, and 2.7-0.7 µm). In each size class, we measured bacterial production, C:N ratios, and fatty acid composition of the collected particles. Our results show that particles <15 µm have highest bacterial production rates whereas particles between 15 to 500 µm had ~3000 times lower rates per volume. In addition, bacterial production rates on fine particles from agricultural streams showed higher activities compared to mountainous streams in all size classes. The fatty acid (FA) composition did not differ between mountainous and agricultural streams but among the size classes. Particles <15 µm were colonized by bacterial FA whereas larger particles mostly contained algal FA. Hence, fine particles <15 µm are hot spots of carbon turnover in streams and understanding their turnover and drivers is necessary to better understand the fluvial carbon cycle.

## Benefits and limits of geomorphic complexity for instream vegetation processes across a gradient of altered catchment hydrology

Mr Scott McKendrick[1], Mr Matthew Burns[1], Moss Imberger[1], Mr Joe Greet[1]
[1]University of Melbourne, Melbourne, Australia

1B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a PhD candidate and research assistant at The University of Melbourne in Australia. My research focuses on the processes and drivers of instream vegetation in lotic ecosystems, in particular, the interactions between geomorphic complexity, hydrology, extant instream vegetation and the instream propagule bank. I am particularly interested in the ecosystem engineering role of instream plants and the potential for this function to aid in stream restoration. I'm also interested in riparian plant processes and ecology more generally. I have worked on many projects related to freshwater ecosystems and their surroundings including a multi-year propagule bank trial.*

Restoration of degraded streams by enhancing geomorphic complexity has not always improved stream biota with catchment scale hydrology often more influential. These outcomes for instream vegetation, however, remain less understood. Using field and nursery-based investigations, we asked: How does instream vegetation respond to (1) geomorphic complexity; (2) different flow regime components; and (3) what is the relationship between geomorphic complexity and flow in driving instream vegetation responses? We surveyed instream vegetation and geomorphology along 23 lowland stream reaches. We tested for associations between six geomorphic complexity, and five flow metrics, and instream vegetation responses. Furthermore, we sampled sediment from different stream locations related to propagule retentiveness across five streams and conducted an emergence trial to determine propagule abundance and species richness. Simplified channels were negatively associated with amphibious vegetation and propagule abundance. More variation in depth and width was positively associated with aquatic vegetation, however, few aquatic plant propagules were detected. Flow flashiness was a key predictor of the vegetation and negatively associated with both amphibious and aquatic species, but only when sites were more geomorphically complex. Propagule abundance was highest within extant instream vegetation patches. We identified channel complexity and flow flashiness as key geomorphic and flow drivers of instream vegetation. More complexity resulted in better vegetation responses likely, in part, due to increased propagule retention. Importantly, however, our results suggest that instream vegetation benefits from improving geomorphic complexity are likely to be limited without also addressing catchment scale hydrology.

# Best practice in Citizen Science - Learnings from the Evenlode Catchment Partnership.

Dr Heather Moorhouse[1], Ann Berkeley, Caroline Pilat, Prof Steven Loiselle, Vaughan Lewis
[1]Earthwatch Europe, Oxford, United Kingdom

1G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Dr Heather Moorhouse is a researcher in water quality, citizen science and using biological indicators to reconstruct environmental change. Her work on Earthwatch Europe's FreshWater Watch programme is involved with bringing together citizen science and stakeholders of water management, advising on best practice in monitoring strategies, engagement and developing data frameworks. Currently focussed on UK freshwaters, Heather has also worked on tropical deltas and lakes.*

The Evenlode Catchment Partnership water quality subgroup aims to work with water companies, environmental regulators and local communities to improve the water quality status of the River Evenlode and its tributaries. It is currently in poor status with much focus on the 19 Sewage Treatment Works (STWs) that operate in this rural catchment. Citizen science water quality monitoring in the catchment has doubled each year from 2020, with nearly five times as many nitrate and phosphate measurements collected from surface waters in 2022 compared to the Environment Agency. This data coupled with automated sensors deployed upstream and downstream of 2 STWs in the catchment is showing the significant influence of point sources in this catchment, and the role of more diffuse wastewater and agricultural inputs. Despite this there exists multiple challenges of partnership working including the lack of a clear regulatory framework for incorporating and validating citizen science data. Citizen scientists want to see results for their efforts and regular engagement through knowledge-exchange events points to their concern of inaction by polluters and regulators. In this presentation, we will share lessons learnt from citizen science water quality monitoring in partnership working, and outline next steps to ensure citizen science remains a valuable asset to water quality management.

# Big Windermere Survey: Investigating water and bacterial quality in England's largest lake

Dr Louise Lavictoire[1], Dr Ben Surridge[2], Trine Bregstein[1], Ms Trine Bregstein[1]
[1]Freshwater Biological Association, Ambleside, Cumbria, United Kingdom, [2]Lancaster University, Lancaster, United Kingdom

1G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*See other bio*

Set within the UNESCO Lake District World Heritage Site, Windermere is England's largest lake and is one of the most visited tourist destinations in the country. Home to vulnerable species such as the Arctic charr, Windermere is ecologically important but is under pressure from high tourist numbers, and is an increasingly popular venue for water sports such as wild swimming, kayaking and sailing. Like many other water bodies set within developed landscapes, Windermere is facing challenges caused by pressures such as nutrient enrichment, invasive non-native species, habitat loss/modification and climate change. Whilst long-term, continuous water quality data are available for mainly offshore sites on Windermere, these data don't tell us much about shoreline areas where most people interact with the lake.

In 2022, a partnership between the Freshwater Biological Association and Lancaster University set out to collect data on key water quality and bacterial parameters, harnessing the power of citizen scientists. The project has so far engaged and trained more than 250 individuals to collect water samples quarterly (once each season) at specific times to better understand spatial and temporal variation of these parameters. These data are contributing to the scientific understanding of water quality in Windermere and supporting the development of future initiatives to improve the condition of the lake. Here we report key findings after one year of data collection, and highlight the importance of this project in better understanding the multiple pressures facing this iconic lake.

## Biodiversity conservation and fish production in ponds: a contradiction?

Mr Léo Girard[1], Dr Joël Robin[1], Dr Soraya Rouifed[1], Mr Mathieu Guerin[1], Prof Alexander Wezel[1], Dr Pieter Lemmens[2]
[1]Isara, Agroecology and Environment Unit, University of Lyon, Lyon, France, [2]Laboratory of Aquatic Ecology, Evolution and Conservation, KU Leuven, Leuven, Belgium

1D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a PhD student in agroecology at Isara, in the Agroecology and Environment unit. I also have an engineering background in agronomy. I work on fishponds in the framework of the European project Ponderful. My research focuses on the links between fish farming management practices and the maintenance of biodiversity and ecosystem services provided by these environments, but also on the challenges of climate change.*

The Dombes region is an important French “pondscape”, and a major landscape with extensive fish farming ponds in Western Europe. These ponds are originally man-made, established by monastic communities in the Middle Ages, and used to extensive fish production for centuries. Although this anthropogenic origin, they are also highly recognised for their strong contribution to regional biodiversity. A profound understanding of how management affect biodiversity patterns is crucial for effective long-term conservation. We have analysed the effects of fish farming management practices on the species richness and cover of aquatic plants. We focussed on two practices: drying out ponds during a complete year after four years of fish production, and fish stocking with different densities. We used data collected in Dombes fishponds over the last 15 years. We monitored physico-chemical parameters of water and sediments, and abundance and richness of algae and aquatic plants. We also collected information on fish stocking levels and time since the last drying out. Our results show that the dry out year allowed a recolonization of aquatic plants during the first year with water, with levels of diversity and cover at their highest while the phytoplankton concentration is at its minimum. They are decreasing during the following wet years, in parallel with an increase in algae. Intermediate fish density levels also allowed the maintenance of numerous aquatic plant species, not found in more intensive systems. These two historical practices probably create intermediate levels of disturbances that contribute to maintain stable ecosystems, fish productivity and biodiversity.

# Biological interactions are key to understand diatom metacommunities in temporary rivers

Mr Guillermo Quevedo-Ortiz[1,2], David Cunillera-Montcusí[1,3,4], Nuria Cid[1,6], Pau Fortuño[1,2], Raul Acosta[1,2,5], Dolors Vinyoles[1,2], María Soria[1,2,7], José Fernández-Calero[1,2], Miguel Cañedo-Argüelles[2,5], Núria Bonada[1,2], Joan Gomà[1,2]
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7A_RS15_Science dissemination/communication & education, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*I'm a Ph.D. student at the University of Barcelona. I am part of FEHM-Lab group (Freshwater Ecology, Hydrology and Management). My research focuses on studying diatom communities in temporary rivers. For this, we carry out different approaches through the analysis of metacommunities, ecological traits, molecular methods and biomonitoring.*

The influence of abiotic variables, such as water permanence and chemistry, on the aquatic meta-communities of temporary rivers has been relatively well studied, whereas the role of biotic interactions has received little attention. This is especially true for diatoms, a group of unicellular algae that have been widely used as bioindicators due to their sensibility to pollution. We studied diatom metacommunities along a gradient of broad hydrological conditions in order to understand the importance of biotic interactions among different diatom groups, macroinvertebrates and fish. We sampled seven temporary rivers of the Natural Park Sant Llorenç del Munt i l'Obac (Catalonia, Spain) during four seasons, with sites ranging from perennial to highly ephemeral conditions. We performed a PCA using physicochemical, hydrology and IHF data, and found a strong differentiation of samples between stations. We also identified and grouped the 222 diatom species found according to their raphe and ecological traits. We performed RDA using community data and found that the amount of variation explained by the environment strongly varied across seasons. When considering biological interactions together with environment and regional intermittency in mixed graphical models, we detected a strong variation in biotic interactions between seasons, with diatoms as a very significant group. Overall, environment and flow intermittency failed to explain much of the variation in diatom abundance, that was mostly explained by biotic interactions. In alignment with other

studies, our results show that biotic interaction can play a key role in assembling aquatic metacommunities.

# Bloomin' Algae! How citizen science delivers widespread surveillance and rapid action on cyanobacterial blooms

Prof Laurence Carvalho[1], Anne Dobel[2], Sigrid Haande[1], Camilla H.C. Hagman[1], Bryan Kennedy[3], Jan Krokowski[4], Miquel Lurling[5], Gemma Nash[2], Philip Taylor[2], Jeroen Van Wichelen[6]

[1]Norwegian Institute for Water Research (NIVA), Oslo, Norway, [2]UK Centre for Ecology & Hydrology, UK, , United Kingdom, [3]Environmental Protection Agency, Ireland, , Ireland, [4]Scottish Environment Protection Agency, UK, , Scotland, [5]Wageningen University, Netherlands, , Netherlands, [6]Research Institute for Nature and Forest (INBO), Belgium, , Belgium

1G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Laurence leads the Freshwater Ecology section at the Norwegian Institute for Water Research (NIVA). He has expertise in biological responses to environmental change in lakes and reservoirs, particularly phytoplankton, macrophytes and harmful algal blooms of cyanobacteria. He has carried out this research analysing national, European or global-scale datasets from regulatory monitoring, satellite earth observation and citizen science. He led development of the Bloomin' Algae citizen science app. Many of his recent projects examine the restoration of freshwater biodiversity and the management of freshwater habitats to ensure sustainable delivery of freshwater services.*

Harmful blooms of cyanobacteria are widespread in freshwaters and appear to be increasing in response to climate warming. Cyanobacteria can produce potent toxins and are high risk when populations form surface scums that accumulate in high densities along shores. Shoreline accumulations are unpredictable where or when they occur. National regulatory monitoring in a few lakes at monthly frequency is insufficient to provide rapid and widescale monitoring to safeguard public and animal health. Citizen monitoring, by definition, targets waterbodies visited by the public and has the potential to provide high coverage along the most accessible shorelines. The Bloomin' Algae smartphone app was developed for the public to record the location and date of suspected blooms, and upload a photo for algal experts to verify. Rapid feedback is provided to the recorder and public health and environment agencies get notified if confirmed correct, to activate public warnings of health risks. We present app data from five European countries, with a focus on Scotland, and evaluate the effectiveness of citizen science for providing large-scale, high frequency monitoring of blooms to form the basis of a rapid surveillance service at national scale. Data surprisingly reveals bloom events can occur any month of the year, with the greatest risks, as expected, from June to September. The most frequently recorded sites were from large lakes with high visitor numbers, highlighting the value of citizen science for delivering an early warning surveillance service directly to the public and agencies for reducing risks to public and animal health.

# Blooming blanket weed: investigating the occurrence and environmental drivers of nuisance algal blooms in shallow lakes

Miss Hannah Kemp[1], Alexandra Zieritz[1], Stephen Dugdale[1], Stephen Maberly[3], Martyn Kelly[1,4], Stewart Clarke[5], Carl Hawke[5], Suzanne McGowan[1,2]
[1]University Of Nottingham, Nottingham, United Kingdom, [2]Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, The Netherlands, [3]UK Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster, UK, [4]Bowburn Consultancy, Durham, UK, [5]National Trust, , UK

1F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am PhD student based in the School of Geography at the University of Nottingham and work in partnership with the National Trust. My research interests have developed around freshwater bodies, exploring the physical characteristics of lakes and rivers, how they change overtime and the advantages and disadvantages of implementing different restoration and management techniques. My PhD aims to understand the extent, main drivers, and impacts of nuisance macroalgae blooms on shallow freshwater bodies in the UK with the aim of informing sustainable management techniques. I love a day of fieldwork out on the boat - rain or shine!*

Shallow freshwater ecosystems are experiencing increasingly frequent blooms of macroalgae (blanket weed) which can cause surface proliferations that can negatively impact aquatic ecosystem functions and aesthetics. The current extent, cause and consequences of these prolific blooms are largely unknown. Understanding what triggers these blooms is therefore critical for the future management of fresh waters. Routine limnological monitoring over an 18-month period was carried out at Clumber Lake, a shallow water body within the National Trust property of Clumber Park, Nottinghamshire, UK, that has had nuisance macroalgal blooms over recent decades. We found that Clumber Lake receives highly nutrient-rich waters from the River Poulter; bioassay experiments confirmed that the vast biomass of macroalgae growing in the lake was unlikely to be nutrient limited at any point of the year. Using mesocosm experiments we investigated the effects of light intensity, photoperiod and water temperature on the growth and surface bloom formation of macroalgal blooms. Longer daylengths with higher light intensities triggered bloom formation and increased algal growth rates. We also identified a thermal optimum between 16-22 °C for algae to form surface blooms, whilst the highest growth rate of algae on the sediment occurred at 14°C. With the increasing impact of climate change on freshwater ecosystems, data from these projects will help predict the occurrence of surface blooms of macroalgae and assess which waterbodies could be under threat of blanket weed blooms in the future, with the aim of informing effective management responses.

# Bourne to be wild: Enhancing the aquatic–terrestrial biodiversity of temporary chalk streams

Mr Robert Collier[1], Professor Rachel Stubbington[1], Mr Tim Sykes[2]
[1]Nottingham Trent University, Nottingham, United Kingdom, [2]Environment Agency , Bristol, United Kingdom

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am a first-year PhD researcher studying the biodiversity in winterbourne chalk streams and springs in south England.*

*In particular, I am interested in how the composition of freshwater macroinvertebrates and plant communities change as winterbourne transition between flowing, ponded and dry states. As such, I need to develop practical skills in microscopy and identification in both these biotic groups.*

*My research interests also encompass the habitat requirements of nationally rare and scarce winterbourne specialist insects, which will require species-level identification to distinguish specialists from morphologically similar generalists in the same genus*

Temporary streams, including England's groundwater-fed 'winterbourne' streams and springs, experience natural transitions between wet and dry conditions, creating high habitat diversity and thus supporting high biodiversity. Some winterbourne headwater springs and streams are relatively unaltered by human activity—but most have been affected by anthropogenic impacts including abstraction, pollution and physical habitat modification, threatening their natural form and function and their biodiverse communities. As a result, tailored restoration actions are needed to improve the ecological health of winterbournes. A core aim of our research is to assess the biological and physical diversity of headwater winterbourne springs. We will determine how environmental characteristics influence their individual and collective biodiversity, and we will identify the physical habitat features that support high biodiversity and particular species of interest—not least Nationally Rare winterbourne specialist insects. A second aim is to evaluate how specific restoration measures alter the physical habitat diversity and biodiversity of winterbourne streams, using a before-after-control-impact (BACI) approach. Specifically, we will compare the effects of restoration on the aquatic and terrestrial communities that inhabit winterbournes during their wet and dry phases, respectively. To address these aims, 'MoRPh' (Modular River Physical) surveys will be used to assess physical habitats, and aquatic and terrestrial communities including invertebrates will be sampled during wet and dry phases, respectively. The findings of our research will inform the design of future restoration projects and management actions designed to protect biodiversity in drying rivers as they adapt to global environmental change.

# Breeding amphibian assemblages in temporary ponds of a fragmented landscape in central Spain

Ms María García-Camargo[1], Mr Christian Arnanz[1], Ms Marina Tomás-Martín[1], Mr Pablo Soto-García[1], Ms Paloma Alcorlo[1], Mr Carlos Caballero-Díaz[2,3], Ms Laura Serrano[4], Ms Rocío Fernández-Zamudio[5], Ms Margarita Florencio[1]
[1]Departamento de Ecología, Universidad Autónoma de Madrid, Madrid, Spain, [2]Departamento de Biología, Universidad Autónoma de Madrid, Madrid, Spain, [3]Asociaciación Herpetológica Española, Madrid, Spain, [4]Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Sevilla, Spain, [5]ICTS-RBD. Estación Biológica de Doñana, CSIC, Sevilla, Spain

1D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am currently working as a research assistant in the Ecology Department, specifically in the Terrestrial Ecology Team, at the Autonomous University of Madrid (Spain).However, I developed my master thesis, which includes part of this abstract, in the Inland-Water Ecosystems Team in the framework of the project ClimaRiskinPond, evaluating the effect that different environmental variables have on the structure of the pond-breeding amphibian communities of mediterranean temporary ponds.*

During the last decades amphibians have experienced one of the worst diversity declines due to habitat loss and fragmentation. Mediterranean temporary ponds, which also face multiple threats, are key habitats for many amphibian species that use them as breeding sites. This work evaluates the effect of different environmental variables shaping the pond-breeding amphibian assemblage of 35 temporary ponds widely distributed in central Spain. We characterized the specific composition of these temporary ponds, analyzed the role that physico-chemical, biotic, landscape and spatial variables play in the pond-breeding amphibian assemblage, and constructed a connectivity matrix between ponds. Neither land-use cover, nor road density were significant predictors of the assemblage of the pond-breeding amphibian community, but a negative tendency between mining and amphibian richness was observed, while rural road density showed a positive one. Variables structuring the pond-breeding amphibian composition were, in order of explained variance: maximum pond depth (25%), intermediate-long distances between ponds (11%) and macroinvertebrate predator richness (6%). Triturus pygmaeus preferred deeper ponds. The presence of Pleurodeles waltl was positively related with maximum pond depth and was conditioned by intermediate-long distances between ponds. Epidalea calamita showed preference for shallow ponds with low macroinvertebrate predator richness. Finally, two isolated pond clusters were found, revealing a possible threat to the studied amphibian populations. We highlight the importance of preserving the diversity of temporary pond habitats and of maintaining an excellent connectivity between them for the proper conservation of these amphibian breeding sites.

## Bridging across knowledge systems for environmental flows

Dr Wendy Monk[1], Dr Rebecca Tharme[2,3], Robyn Laubman[4], Lisa Hettrich[4], Dr Jennifer Lento[5], Dr Colin Curry[6], Dr Daniel Peters[7]
[1]Environment and Climate Change Canada @ Canadian Rivers Institute, University of New Brunswick, Fredericton, NB, Canada, [2]Riverfutures, Cressbrook, UK, [3]Australian Rivers Institute, Brisbane, Australia, [4]Splatsin te Secwepemc, Enderby, BC, Canada, [5]Canadian Rivers Institute, University of New Brunswick, Fredericton, NB, Canada, [6]Wolastoqey Nation in New Brunswick, Fredericton, NB, Canada, [7]Environment and Climate Change Canada @ University of Victoria, Victoria, BC, Canada

9B_RS12_Advances in environmental flow science and practice, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*

*Dr Monk is a Research Scientist with Environment and Climate Change Canada, Visiting Research Professor with the Faculty of Forestry and Environmental Management at the University of New Brunswick, and Fellow of the Canadian Rivers Institute. She is based in Fredericton, New Brunswick, Canada on the banks of the beautiful Wolastoq.*

Environmental flows methods and implementation have continued to actively evolve through researchers and practitioners alike in the direction of whole systems thinking and trans-disciplinarity. In particular, the gradual meaningful inclusion of social, cultural, and spiritual considerations to the extent that the current internationally accepted definition of environmental flows now makes explicit reference to such factors and their critical links to the sustainability and health of freshwater ecosystems. This is also reflected in the increasing research emphasis within the field on social and cultural connections and interdependencies from different perspectives and worldviews. Viewing space and connections across different knowledge systems can build a stronger foundation through exchanging stories, perspectives and ideas and can lead to connections with communities and strengthen our understanding of a system. Despite this trend towards working with broader perspectives across different knowledge systems, there is still a strong Western science focus, practice and thinking, both methodologically and in terms of implementation. Braiding and weaving of knowledge systems are increasingly used as ways to bridge different our understanding while maintaining the integrity of each respective knowledge system and enabling the reciprocal exchange of understanding for mutual learning. Here we explore a potential pathway for change through ongoing dialogue with examples of environmental flows studies from across Canada.

# Bridging the gap in diatom molecular databases for the assessment and management of river ecosystems beyond biogeographic borders in Southern Europe

Dr Rafael Carballeira[1], Dr Juan Antonio Villaescusa[2], Dr María José Villena[2], Dr Elisa Puchades[2], Dr Antonio Picazo[1], Dr Carmen Ferriol[1], Dr Panayiota Pissaridou[3], Dr Eleni Christoforou[3], Dr Gregoris Notaridis[3], Dr Marlen Vasquez[3], Dr Athina Papatheodoulou[4], Dr Pedro Raposeiro[5], Dr Vitor Gonçalves[5], Dr Marco Cantonati[6], Mr Javier Pérez-Burillo[7], Dr Rosa Trobajo[7], Dr David Mann[7], Dr Beatriz Vallejo[2], Dr Antonio Camacho[1]
[1]Cavanilles Institute for Biodiversity and Evolutionary Biology (ICBiBE), University of Valencia, Paterna, València, Spain, València, Spain, [2]Laboratorios Tecnológicos de Levante. Paterna, València, Spain, València, Spain, [3]Cyprus University of Technology, Cyprus, Limasol, Cyprus, [4]I.A.CO Environmental & Water Consultants, Cyprus, Nicosia, Cyprus, [5]CIBIO - Universidade dos Açores, Portugal, Ponta Delgada, Portugal, [6]University of Bologna, Bologna, Italy, Bologna, Italy, [7]Institut de Recerca I Tecnologia Agraria, Sant Carles de la Ràpita, Catalonia, Spain, Sant Carles de la Rápita, Spain

8C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

*Dr Rafael Carballeira, postdoctoral position `Juan de la Cierva in the Department of Microbiology and Ecology at the University of Valencia. He defended the PhD thesis at the Earth Sciences of the University of A Coruña (2021), during that period, he has developed his research and teaching activities related to fundamental and applied fields of the botany and ecology of microalgae (diatoms) in aquatic ecosystems. His work focuses on understanding how the biology and ecology of microalgae is linked to essential biogeochemical processes in aquatic ecosystems and subaerial environments, with relevant contributions to the taxonomy, biodiversity and ecology of diatoms.*

Diatoms are microorganism highly diverse and abundant in all aquatic ecosystems, and the diatom species ecological affinities are particularly relevant since this has also allowed the use of diatoms as ecological indicators in the environmental monitoring for several decades already. Benthic diatoms are routinely used as an effective tool to assess the ecological status of river ecosystems, however there are important limitations to develop diatom indices applicable at the macro-scale level, because the spatial biogeographical areas in southern Europe impose barriers that condition the distribution of diatom species and the structure of diatom communities in river ecosystems. Also, the occurrence of cryptic species, the high level of specialization and the high cost in time required for the identification of diatom taxa request intercalibration criteria to establish comparisons with certainty between the results of diatom indices between different geographical areas. Molecular methods are an alternative approach for establish robust and reproducible identifications using a diatom DNA metabarcoding database. Within the WATDIMON EU Eureka project, we have compiled diatom samples and environmental parameters in river basins of four biogeographical regions throughout southern Europe: Macaronesian, Alpine, Atlantic and (Wet and Dry) Mediterranean basins. A first taxonomic morphological analysis of diatoms has allowed us to determine the key diatom taxa linked to the diatom indices obtention, and sequencing part of those lacking barcode genetic information after isolation and culture, aiming to improve the Southern European benthic diatoms annotated collection of barcode reference databases based on rbcL gene, widely used in diatom taxonomy and phylogeny.

# Bringing back the burbot (Lota lota) to English rivers via hydrological rewilding: a novel classification approach to instream and lateral habitat suitability.

Miss Reagan Pearce[1,2], Professor Carl Sayer[1], Dr Michael Chadwick[2], Professor Helene Burningham[1], Dr Gemma Harvey[3]
[1]University College London, London, United Kingdom, [2]King's College London, London, United Kingdom, [3]Queen Mary University of London, London, United Kingdom

1B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*PhD researcher in the Department of Geography at University College London. My background is interdisciplinary, with research interests in low-cost environmental monitoring solutions, such as Arduino low-cost tech, and freshwater ecology. My PhD has a broad scope and touches on hydrology, water chemistry, and river ecology, utilising both fieldwork and desk-based studies applying GIS for spatial analyses and hydraulic modelling.*

Despite over 30 years of river restoration practice in the UK, freshwater biodiversity has continued to decline. Targeted species reintroductions, however, can take an ecologically-focused approach to this pressing environmental problem. Burbot (Lota lota) were extirpated from the UK in the 1970s purportedly due to habitat modification. This fish has specific habitat requirements for every life stage requiring river habitats that are both longitudinally and laterally connected. Before future reintroduction, candidate sites must be assessed for suitability based on the burbot's requirements. This study aimed to evaluate the feasibility of reintroducing burbot to the River Wissey, Norfolk, UK. Using habitat surveys coupled with a remote sensing habitat classification and a low-cost environmental sensor network, we focused on instream and lateral habitat suitability, temperature conditions, and hydrological connectivity between the floodplains and the main river channel during the winter spawning period. Our results show some suitable instream habitat for every life stage (i.e., instream spawning, juvenile, and adult habitat) were present, but additional restoration, focused on lateral reconnection, would be required to improve the chance for a successful reintroduction. Overall, this project is providing the needed quantitative evidence to ensure future burbot reintroductions are successful.

# Building a community: invertebrate and plant colonisation of a braided chalk stream

Miss Hannah King[1], Dr. Andrew Vowles[1], Prof. Paul Kemp[1]
[1]University Of Southampton, Southampton, United Kingdom

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*PhD researcher at International Centre for Ecohydraulics Research in the University of Southampton. Part of the Sustainable Infrastructure for Cities Centre for Doctoral Training. Studying community ecology in a chalk stream restoration context.*

Since the late Bronze Age, humans have been drastically modifying English chalk streams. The subsequent decline in populations of plants and invertebrates has severely impacted the functioning of the rare and biodiverse river systems. Whilst interest in restoration projects is increasing, the lack of adequate monitoring programmes limits the effectiveness of future restoration work. The Lower Anton (Hampshire, UK) restoration project involves the connection of a newly created braided channel within a historically dredged and drained water meadow. We characterise the floodplain system by conducting in-stream and water meadow plant surveys, kick sampling invertebrates, and mapping the physical environment. Then, we compare our findings to an unrestored control to test the relationship between habitat heterogeneity and biodiversity. We propose that channel creation and connection can be framed as a controlled disturbance and so will continue monitoring the communities over three years to study processes such as colonisation, turnover, and stabilisation. To establish the role of drift in community assembly, we compare the braided channel to sections directly upstream and downstream. Our study contributes to a growing body of literature about chalk stream recovery potential to inform future restoration work.

# Calibration of an advection-dispersion model to an urban river stretch (River The Cut, UK) to reveal the in-stream phosphorous transformations

Ms Mihaela Borota[1], Prof. Vasile Mircea Cristea[1], Dr. Elisabeta Cristina Timis[1], Dr. Michael George Hutchins[2]
[1]Babes-Bolyai University, Cluj-Napoca, Romania, [2]UK Centre for Ecology and Hydrology Wallingford UK, Wallingford, UK

4G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Mihaela Borota is a first-year Ph.D. student at Babes-Bolyai University where she works in rivers water quality modeling at the Computer Aided Process Engineering Research Centre. She is interested in mathematical modelling, nature-based solutions for nutrient pollution, eutrophication, and the effects of climate change on surface waters water quality. Being awarded a Deutsche Bundesstiftung Umwelt fellowship, she is now conducting her research in Dresden at the Institute of Hydrobiology of the Technical University of Dresden.*

Nutrient enrichment in surface waters represents one of the main causes of water bodies' degradation which is further aggravated by the complex effects of climate change, urbanization, and agricultural practices. Consequently, there is an urgent need for deepening the understanding of the relations between these drivers and the in-stream nutrient dynamics. In this context, the objectives of the present research are (1) to study with the help of a mechanistic model the effects of urban expansion and climate change on the phosphorus (P) transformation fluxes along a small urban river stretch (The Cut, UK) and (2) to describe the models' calibration methodology as well as the challenges, advantages, and disadvantages of such approach. The calibrated model, ADModel–P, relies on the analytical solution of the advection-dispersion equation and describes the transport and transformation of P species along the rivers. With the capacity to predict the P transformation fluxes at an hourly resolution, the calibrated model gives new and original insights regarding the in-stream transformations along the studied river stretch investigated in different climate change (e.g. extreme or prolonged draughts, heavy rainfalls), and urban expansion scenarios (e.g. increasing urban run-off). These findings can be used as a valuable support in water resources management, whereas the models' calibration methodology highlights the robustness, simplicity, and relative availability of the input data required for the ADModel-P transfer to other similar case studies.

# Can cormorant predation reduce ecological quality of rivers?

Dr Carola Winkelmann[1], Dr Daniela Mewes[1], Manfred Fetthauer[2], Roman Fricke[3], Michael Götten[1], Theresa Graf[3], Dr Madlen Gerke[4], Dr. Dirk Hübner[3]
[1]University Koblenz, Koblenz, Germany, [2]ARGE Nister/Obere Wied e.V., Stein-Wingert, Germany, [3]Bürogemeinschaft für fisch- und gewässerökologische Studien, Marburg, Germany, [4]Wasserwirtschaftsamt Ingolstadt, Ingostadt, Germany

5B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***

*Leader of the stream ecology lab at University Koblenz, working about anthropogenic impacts on stream and river ecosystems, mostly experimental and whenever possible on large scales. I'm working mostly on species interactions and how the affect ecosystem responses to stressor.*

*I studied biology in Dresden, did my PhD there and than went to Koblenz with my own project on invasive amphipods. There I built my group, thereby diversified my research and started teaching the subjects limnology.*

Eutrophication caused by nutrient input from agriculture and waste water treatment plants is one of the main reasons for the undesirable ecological quality in European rivers. It leads to excessive algal growth, clogging of the hyporheic zone and a reduced aquatic biodiversity. A large scale field experiment proved that eutrophication effects can be significantly reduced by high stocks of herbivorous nase (Chondrostoma nasus) and omnivorous chub (Squalius cephalus). Although the fish stock in this experiment was similar to historic fish stocks in that river, nowadays fish stocks are much lower in the whole region. Cormorants (Phalacrocorax carbo sinensis) started to use the area in winter 1998/99 and fish stocks declined ever since. Therefore, we quantified bird winter predation on fish stock in a small oxbow (fish wintering habitat) at the experimental river (0.04 ha) using camera traps. At the observation site, cormorants are hunted to protect the wintering habitat, thus the observed predation pressure represented a best-case scenario. Four piscivorous bird species occurred regularly: cormorant, grey heron (Ardea cinerea), great egret (Ardea alba) and goosander (Mergus merganser). For winter 2021/22, we estimated the fish withdrawal by birds as up to 450 kg (Approx. 25 % of the fish stock in the wintering habitat), with cormorant taking 180-275 kg alone. We conclude that piscivorous birds can pose an intense predation pressure for river fish, resulting in drastically reduced fish stock and in consequence indirectly in a lower ecological quality of affected river stretches.

# Can warming lead to internal eutrophication of headwater streams?

Associate Prof Gabriele Weigelhofer[1]
[1]WasserCluster Lunz, Lunz, Austria, [2]University of Natural Resources and Life Sciences Vienna, Vienna, Austria

1F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am employed at the University of Natural Resources and Life Science Vienna and scientific manager and working group leader of WasserCluster Lunz. My research focuses on aquatic biogeochemistry and microbiology in lotic ecosystems. In specific, I am interested in the interaction of autotrophic and heterotrophic biofilms in headwater streams and their resistance and resilience to climate change and land use.*

Droughts are significant hydrological and environmental hazards that threaten the ecological status and functioning of streams. Low flow together with increased water temperature leads to a cascade of hydrochemical processes that can impair water quality and threaten a wide range of ecosystem services including clean water supply, nutrient retention, and biodiversity. In the face of the current climate crisis, nutrient release from river sediments may become the dominant factor controlling the biogeochemistry and water quality of lotic ecosystems. Our study aims at analysing the mechanisms and drivers of nutrient remobilisation from stream sediments via a combination of laboratory experiments and event-based water quality monitoring. We further aim at estimating the significance of this remobilisation potential for water management under different low flow and environmental conditions. First results from temperature simulation experiments in the lab show a clear relationship between increased PO4-P release from the sediments and warming, albeit in dependence of the phosphorus loading of the sediments. In contrast, sediment respiration declined with increasing temperature. The patterns were less clear for organic carbon and the different species of dissolved inorganic nitrogen. Further experiments will look into the role of dissolved oxygen, heterotrophic and autotrophic microbial activities, and sediment composition on the nutrient remobilisation potential under warming.

# Can you create an old pond?

Professor Carl Sayer[1], Juliet Hawkins[2], Neema Binu[1], Dr Mathew Hill[3], Helen Greaves[1], Eleanor Baker[1]
[1]Pond Restoration Research Group, Department of Geography, University College London, , United Kingdom, [2]Suffolk Ponds Group, , United Kingdom, [3]Bournemouth University, , United Kingdom
3D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 4:15 PM - 6:00 PM

***Biography:***
*Carl Sayer leads the Pond Restoration Research Group at University College London. His research focuses on the restoration ecology of lakes, rivers, ponds and wet grasslands. Carl is a co-founder of the River Glaven Conservation Group and of the Norfolk Ponds Project in Norfolk, eastern England, UK. Through his active conservation work Carl makes major efforts to transfer scientific findings into practical aquatic restoration action. He is especially keen on landscape-scale conservation and rewilding-style approaches that put into place natural recovery processes.*

Many areas of farmed lowland Europe support high densities of human-dug ponds. These ponds, which were constructed for a myriad of reasons, can be many centuries old, but are often in a poor state due to terrestrialisation (especially involving wetland trees) and/or pollution. The key importance of farm ponds to the maintenance of European freshwater biodiversity is increasingly being recognised. Although there are regional exceptions, conservation activities have tended to focus more on the creation of new ponds, as opposed to the restoration of existing old ponds. But a key question looms - can you create new ponds that sufficiently replicate high quality old and ancient ones? Transfer this notion to other habitats such as woodland and grassland and we know that old species configurations and habitat structures cannot easily and quickly be achieved. In this paper we address this question through a comparison of recently created and restored farm ponds in East Anglia, eastern England. Focusing on wetland plant communities, we examine how successional patterns and timescales vary between these two pond conservation strategies, as well as investigating their relative contributions to species diversity and rare species conservation. What will the answer be? By prioritising pond creation are we missing out on opportunities to bring rare plants back into the landscape from long-lived seed banks? This is something to ponder on and the answer will have important implications for pond conservation strategies in Europe.

# Carbon emissions from temporary ponds in function of the dry-wet hydrological cycle

Miss Romane Darul[1], Mr Alexandre Pryet[1], Mrs Sabine Schmidt[1], Mrs Cristina Ribaudo[1]
[1]UMR 5805 EPOC, 33600 Pessac, France

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*Romane Darul is a PhD student at UMR 5805 EPOC, University of Bordeaux at Biogeochemistry and Environment Department. Her thesis work focuses on aquatic environments restoration on natural and artificial wetlands and rivers.*

In freshwater temporary systems, wet conditions are known to enhance both carbon burial and methane ($CH_4$) emissions. On the opposite, carbon dioxide ($CO_2$) emissions are expected to be enhanced during the phase of exposition to the air (dry period), thanks to aerobic conditions in the sediment. The balance between the two processes is fundamental to grasp the ultimate carbon budget of inland waters. This is especially true for groundwater-fed ecosystems whose water level depends on the fluctuation of the aquifers, such as temporary ponds.
We here present the preliminary results of an ongoing study performed on natural temporary ponds of the Landes de Gascogne (South-West of France). Here, about two thousand oligotrophic ponds develop on a sandy substrate within a landscape impacted by intensive crop farming and forestry. Global warming is expected to lengthen and intensify the drying up of these environments, and to diminish the capacity of carbon storage in sediments. With the aim of obtaining a multiseasonal carbon budget in function of the hydrological cycle, $CO_2$ and $CH_4$ fluxes are measured on a monthly basis on a set of temporary ponds. Floating and benthic chambers are deployed on submerged surfaces as well as on sediments exposed to the air. Concomitantly, a fine-scale bathymetry is realised and coupled to high-frequency measurements of the water level through automatic probes, in order to reconstruct the exact water level oscillation throughout the year. Also, the carbon storage in the sediments is assessed by sediment cores and stable isotope analysis.

# CaSTCo: Developing a national citizen science framework for monitoring rivers and catchments

Dr Bill Brierley, Mrs. Michelle Walker[1]
[1]The Rivers Trust, Plymouth, United Kingdom
1G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Michelle Walker is Technical Director at The Rivers Trust, leading a team which develops innovative ways of using data and evidence to help understand river environments and deliver river improvements. Michelle champions citizen science approaches for engaging communities in protecting and restoring their rivers.*

Citizen science has huge potential to fill growing knowledge gaps by increasing the spatial and temporal density of the evidence base which underpins river and catchment management decision-making.  However, numerous barriers exist which limit the impact of citizen science, including a fragmented landscape of monitoring methods, tools and databases, lack of quality assurance standards and inadequate long-term funding.
The Catchment Systems Thinking Cooperative (CastCo) project is seeking to address these barriers through collaborative co-design of a national citizen science framework, which will involve communities in monitoring and managing the health of their rivers. CastCo is bringing together NGOs, citizen scientists, academics, government and the water industry in England and Wales to agree a suite of standardised citizen science methods, which can provide information on river and catchment health, help target investment and monitor the effectiveness of interventions.  The partners in the project will develop robust quality assurance protocols, training hundreds of citizen scientists in eight demonstrator catchments and developing data management platforms and visualisation and analysis tools. The project is starting to engage partners in Scotland and Ireland to grow the approach in to a sustainable long-term transformational change.
By combining citizen science data with monitoring undertaken by government and businesses, academia and NGOs, the project aims to engage communities in understanding, valuing and advocating for their rivers, as well as driving investment in nature based solutions to pollution, flooding, drought and biodiversity loss.

# Catchment-scale strategies for limiting the secondary dispersal of freshwater invasive species while minimising impacts on native fishes.

Mr Jack Daniels[1], Dr James Kerr[1], Ms Ursula Juta[2], Professor Paul Kemp[1]
[1]University Of Southampton, Southampton, United Kingdom, [2]Norfolk Rivers Trust, , United Kingdom

1B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Jack Daniels is a final year PhD student at the University of Southampton, UK. His research utilises a combination of spatial modelling, fieldwork and laboratory experiments to evaluate the ability of river infrastructure (e.g., dams, weirs, and culverts) to limit the spread of freshwater invasive species. He has also contributed to a number of interdisciplinary freshwater projects, including the assessment of barotrauma in neotropical fishes, and quantifying the effects of metal nanoparticles on benthic algae. He has presented at numerous national and international conferences, and is a postgraduate representative for the British Ecological Society's Invasion Science Group.*

Invasive species are a major threat to freshwater biodiversity, and the prevention of secondary spread (i.e., containment) is vital to minimise the impacts on recipient ecosystems. Increasingly, in-stream infrastructure (e.g., dams, weirs and culverts) is being installed, maintained or modified for this purpose, but spatio-temporal limitations of current evidence, alongside minimal consideration of economic and ecological implications, have limited understanding of the catchment-scale, long-term effectiveness of this strategy. This study combined a spatially explicit individual-based model (IBM) with multi-criteria decision analysis (MCDA) to identify a combination of barrier modifications that effectively limited the spread of American signal crayfish (Pacifastacus leniusculus) in the River Glaven (Norfolk, UK), while minimising the impacts on native fishes and adhering to budgetary constraints. The IBM was calibrated based on historical records, and then used to predict the spatial extent of the invasion over a 20-year period. Subsequently, the effects of modifying numerous combinations of barriers by adding stainless steel plating (a common modification used to limit upstream movements by crayfish) was assessed over the same 20-year period. Additionally, the economic cost of each combination of modifications was assessed, alongside the impact on accessibility-weighted habitat availability for native fishes. An MCDA approach was developed with local river managers, and then used to identify the optimal combination of barrier modifications in the catchment. This presentation will describe the effectiveness of barrier modification as a management technique for invasive species, and explore the wider applicability of this framework for river managers aiming to balance conflicting conservation goals.

# Challenges in defining seasonal dynamics of rare taxa, an example from long-term research on the emergence of biting midges (Diptera: Ceratopogonidae)

Mr Mario Rumišek[1], Mrs Valentina Dorić[1], Dr. sc. Ivana Pozojević[1], Prof Ryszard Szadziewski[2], Prof Marija Ivković[1]
[1]Faculty Of Science, Zagreb, Zagreb, Croatia, [2]Faculty of Biology, Gdansk, Gdansk, Poland
7G_RS20_Aquatic terrestrial linkages, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*27 years old, married, live in Zagreb, Capital city of beautifull country Croatia, 1st year PhD student, my field of interest are Diptera specially family Ceratopogonidae*

In ecological research, rare taxa usually represent "white noise" or even a nuisance in statistical processing of biological data. Since these taxa are by definition few in numbers, adequate monitoring of their dynamics is only possible through long-term research. Precisely this type of research was conducted in the Plitvice Lakes National Park with the aim of continuous monitoring (from 2007 to the present) of the emergence of aquatic biting midges at three locations and on another seven locations from 2007-2009. Emergence traps were sampled once a month throughout the entire period. Out of 4800 samples from ten localities (6 traps per locality), biting midges were recorded only 90 times (in only about 0.02% of samples). In total, 440 individuals were recorded in this research, represented by 46 different species within 12 genera. Using the rarefaction curve based on the Jacknife estimation method, it was determined that even after almost 15 years of research, the asymptote - the theoretically finite number of biting midges taxa in this area has not yet been found. The disjunct nature of ceratopogonid distribution and occurrence is emphasized once more with the finding of Dasyhelea gothlandica Strandberg & Johanson 2015, recorded previously only from Sweden (more than 2000 kilometers away), which is fascinating given the relatively modest flight capabilities of ceratopogonids. This finding sheds light on the vast gaps in knowledge on the ecology of this fascinating insect group.

# Changes in macroinvertebrate biodiversity in major Czech rivers after the year 2000

Ms Selma de Donnová[1], Ms Alžbeta Devánová[1], Dr. Jindřiška Bojková[1]
[1]Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic
4D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a PhD student of Hydrobiology at Masaryk University in Brno, Czech Republic. My main interests include macroinvertebrate responses to anthropogenic disturbance in freshwaters and applied topics like stream restoration.*

We studied environmental and biological changes in nine major Czech lowland rivers over the 21st century, emphasising temporal changes in macroinvertebrate biodiversity. Both compositional and functional aspects were evaluated. Using previously unpublished data, we analysed temporal trends utilising linear mixed-effect models. Seventeen sites were divided into two groups based on hydromorphological degradation degree and assessed separately to reveal contrasting patterns. Changes in environmental variables were not related to hydromorphological degradation degree, i.e., they were comparable in both site groups. Substantial improvement of water quality as decreased organic pollution and decreased nutrient concentration over the last 25 years was recorded. Moreover, we brought evidence of novel threats like salinisation, alkalisation, and climate change affecting Czech lowland rivers. Some biological changes like increased overall abundance and abundance of non-native taxa, Annelida and Chironomidae, as well as increased species richness of Mollusca and non-native taxa, were found in both site groups. Similarly, few functional changes like decreased proportion of predators and xylophagous taxa, taxa with plastron respiration and taxa preferring coarse inorganic substrate were found across all sites, independent of the degradation degree. However, in most aspects, biological changes varied among sites with lower and higher degradation degree. Sites with lower degradation degree tended to experience more favourable biological changes, compared to sites with higher degradation degree, and their assemblages tended to be more resilient. Despite comparable trends in water chemistry and hydroclimatic variables, sites with different degradation degrees experienced distinct biodiversity changes.

# Changes in macroinvertebrate community structure and function following invasion of Ponto-Caspian amphipods in a freshwater reservoir

Dr Kate Mathers[1], Kelly Clinton[2], Drew Constable[3], Chris Gerrard[4], Charlie Patel[1], Prof Paul Wood[1]

[1]Loughborough University, , UK, [2]Northern Ireland Environment Agency , , UK, [3]Environment Agency, , UK, [4]Anglian Water Services Limited , , UK

7D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Kate Mathers is currently a UKRI fellow at Loughborough University, UK. She is freshwater scientist whose research is located at the interface of aquatic ecology, hydrology and fluvial geomorphology. Her research focuses on macroinvertebrate communities and aims to advance our understanding of how disturbances (anthropogenic and natural) affect aquatic ecosystems in addition to promoting the conservation and sustainable management of freshwater systems.*

Much of the research on the interaction of multiple invasive non-native species (INNS) is conducted within laboratory settings with field studies remaining rare or being conducted on a single occasion. There is therefore a deficit of knowledge pertaining to the natural population trajectories of multiple INNS and the wider ecological implications for the structure and function of the recipient communities. Here we present multiple years of data collected from a reservoir in the UK which has undergone invasion by three congener non-native amphipods. We observed the co-existence of Dikerogammarus haemobaphes with Crangonyx pseudogracilis under habitat segregation in the reservoir. However, complete displacement of C. pseudogracilis and reduced abundances of D. haemobaphes were observed once the more competitive Dikerogammarus villosus had established itself within the reservoir. The establishment of large numbers of D. villosus led to significant changes to the structure and function of the wider macroinvertebrate community, unlike its counterpart D. haemobaphes. These changes to the wider community may have modified the carrying capacity of the ecosystem which we believe led to subsequent population collapses.

# Changes of crustacean assemblages at the invasion front of Dikerogammarus villosus in the Drava River (Croatia)

Mr Tomislav Kralj[1], Damir Valić[1], Krešimir Žganec[2]
[1]Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička cesta 54, 10000 Zagreb, Croatia, [2]Department of Teacher Education Studies in Gospić, University of Zadar, dr. Ante Starčevića 12, 53000 Gospić, Croatia

7D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Tomislav Kralj works at the Ruđer Bošković Institute. He researches the impact of invasive amphipods on native species and macroinvertebrate communities and how their invasion can alter ecological processes in freshwater ecosystems. He also researches the relationship between invasive species and pollution and the impact of invasive species on biological monitoring.*

Crustaceans are successful group of invaders in European freshwaters, especially the amphipod Dikerogammarus villosus, which contributed greatly to density reduction and disappearance of native species. The aims of this study were to determine the impact of the invasive D. villosus at its invasion front on density, microdistribution and fecundity of four native peracarid crustacean species. Sampling was conducted twice, in 2019 and 2020, at two sites in the old course of the Drava River in Croatia below Donja Dubrava Reservoir. At each site, 20 samples were collected with a hand net (mesh size 500 µm) in two different microhabitats (macrophytes and stony substrate). Native species had much higher densities than D. villosus at the upstream site. In 2020 density of D. villosus increased significantly in the stony substrate at downstream site, with decrease of densities of all four native species, especially Gammarus fossarum. Slight increase of D. villosus at upstream site had no significant effect on native species. Native species at the downstream site preferred macrophytes in which D. villosus was present in low densities. Spearman correlation between densities of each native species and D. villosus was negative, highest for Asellus aquaticus. Fecundities of native species, G. fossarum and G. roeselii, were higher at the downstream site, statistically significant (M-W test, p=0.000) for G. roeselii. Thus, relatively slow, invasion of D. villosus at studied sites has changed densities, microdistribution and fecundity of native species, with the greatest negative impacts on G. fossarum and A. aquaticus on stony substrate.

# Changes of diversity-productivity relationship in rivers in response to the alteration of natural flow: A multi-taxa approach

Dr Alejandra Goldenberg Vilar[1], Miss Minh B. Hoang[1], Dr. Francisco J. Peñas[1], Prof Jose Barquín[1]
[1]IH Cantabria - Instituto de Hidráulica Ambiental de la Universidad De Cantabria, Santander, Spain

9B_RS12_Advances in environmental flow science and practice, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*I am an aquatic ecologist with a strong background in the ecology of primary producers, specifically macrophytes and diatoms, in freshwater ecosystems. As a postdoctoral researcher, my current focus is on using DNA metabarcoding to characterize freshwater biodiversity and identify potential indicators of anthropogenic impacts, such as hydrological alterations and global change, on ecosystem functioning.*

Human activities have had unprecedented effects on diversity, productivity, and their relationships in rivers over the past decades. While numerous studies have examined the alteration of diversity and productivity independently, less is known about the extent and direction of change in the diversity-productivity relationships and the key drivers that influence them. One of the unique study on this issue suggests that this relationship highly depends on the disturbance regime of the ecosystem. Therefore, considering the homogenization of seasonal and inter-annual streamflow caused by dams, we hypothesize that dams will disrupt the diversity-productivity relationship downstream by causing significant changes in the composition of freshwater communities. In this study, we used a control-impact design that covered 19 sites in northern Spain to test our hypothesis.
The results showed consistent patterns of change in the composition of all taxonomic groups, from prokaryotes and primary producers to secondary producers. Primary productivity exhibited a direct and positive relationship with the diversity of primary producers in control sites, which were characterized by high variability and unpredictable streamflow. In contrast, this relationship was non-existent or negative in altered reaches, which were characterized by homogenized and more stable flow conditions. This pattern observed for primary producers was consistent in different biological groups throughout the food web, as an increase in primary productivity also increased the diversity of the other eukaryotic groups. Our study also revealed that inter-annual variability (hydrological year or precipitation related events) has substantial impacts on stream ecosystem metabolism rates.

# Characterising freshwater biodiversity in the Okavango Delta (Botswana) using taxonomical and molecular techniques

Mr Luis Moliner Cachazo[1], Mr Kaelo Makati[3], Dr Michael Chadwick[1], Dr Benjamin Price[2], Dr Jane Catford[1], Dr Michael Murray-Hudson[3], Emeritus Professor Anson Mackay[4]
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7F_RS21_Wetland ecology and management, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*I am a PhD student in the London NERC DTP, looking at how to characterise freshwater diversity in the Okavango Delta using taxonomical and molecular techniques, with a focus on Diptera: Chironomidae (non-biting midges). I have a Master's Degree in Environmental Restoration and Management (University of Barcelona) and a Licenciate Degree in Biology (University of Vigo, Spain).*

The Okavango Delta, in Botswana, is one of the biggest inland deltas in the world, being fed by the annual flood pulse and local rainfall. Freshwater organisms in the Delta and connected Lake Ngami provide direct and indirect benefits to people and the economy of the region, such as fisheries and water purification. However, their existence could be threatened by human activities (upstream water abstraction and planned hydropower structures) coupled with climate change. For their protection, and in the current context of global freshwater biodiversity decline, it is essential to know their distribution, ecology, and status of the ecosystems that they inhabit. However, to date, studies on certain taxa from the Delta at species level, particularly within the macroinvertebrates (e.g. Chironomidae, Ostracoda, Ephemeroptera, Trichoptera) are scarce. The majority have not identified them beyond family level or morphospecies, due to their taxonomical difficulty and the lack of expertise. Here, we present preliminary data from eDNA and kick net sampling during low flow. DNA metabarcoding confirms some results from taxonomical identifications and the presence of new national records for Botswana: 5 genera of Chironomidae (Ablabesmyia, Cladotanytarsus, Microchironomus, Procladius, Tanytarsus), one family of Oligochaeta (Naididae) and 2 genera of Diptera (Calliphora and Culicoides). The combination of taxonomical and molecular techniques can be used in tropical wetlands to complete the inventories, improving not only the knowledge of freshwater diversity at species level, but also the rates of biodiversity loss with more certainty.

# Citizeen, a smart solution that promotes biodiversity mapping in blue and green urban areas for an active and healthy ageing

Dr Sónia RQ Serra[1], Elisabete Pitarma[2], Pedro Resende[3], Dr Maria João Feio[1]
[1]MARE Marine and Environmental Sciences Centre/ ARNET Aquatic Research Network, University of Coimbra, Dep Life Sciences, Coimbra, Portugal, [2]Cáritas Diocesana de Coimbra, Innovation Department, Coimbra, Portugal, [3]OWL – OUR WATCH LEADS, Coimbra, Portugal

5A_SS08_Freshwater ecosystems and urbanization – is the sustainable development of cities really possible?, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*SRQSerra is a researcher at MARE&ARNET, University of Coimbra, with experience in assessing the ecological integrity of streams and rivers using benthic macroinvertebrates. Author of a national guide for macroinvertebrates identification, also have been using macroinvertebrates traits (including Chironomidae; after developing a database for Chironomidae traits) to indirectly assess the functional integrity of stream systems. She has been working on urban streams, assessing ecosystem services and the importance of these blue and green urban areas for healthy and active ageing. Focusing recently on the use of technological solutions to reconnect citizens with natural environments, creating smarter and healthier cities.*

The world is ageing and concentrating on cities. Despite greater amenities and services, urban environments are often highly modified, disconnecting people from nature. Yet, citizens' regular contact with natural environments is beneficial, enhancing physical, mental health and social well-being. Well preserved Urban Blue and Green Areas (UBGAs), as stream and river ecosystems, function as ecological corridors between fragmented urban natural areas, potentially operating as preventive and restorative environments. Faced with an ageing world, great hopes are placed on the emergence of innovative technological strategies. Several technological solutions were identified responding to the needs of OAs in the indoor but not for the outdoor environment. One of the aims of Pharaon project, Pilots for Healthy and Active Aging (Horizon 2020 | DT-TDS-01-2019 | 857188), is to reconnect OAs with the natural outdoor urban environments, through "Together City and Nature" and "City Audit Tours" actions. Gathering requirements for users over 65 following a user-centric approach, Citizeen was born, responding to ageing specific needs and aiming for a smarter city. Citizeen is a smartphone app that uses satellite navigation, satellite Earth observation and AI, to locate the user and map the surrounding UBGAs. It promotes active mobility in urban natural areas, allowing users to access and co-create contents about biodiversity but also thermal comfort or vegetation density. It is a ludic, intuitive, rich application that tutors active citizens of all ages, collects citizen science data, and amazes passive users, favoring citizens' concern for the preservation and management of these natural urban areas.

# Citizen Science = Citizen Crane Update: Further evidence of the importance of long term research by a local community.

Prof. Paul Leonard[1]
[1]Brunel University, Uxbridge, London, United Kingdom, [2]FORCE, Twickenahm, UK, [3]The Zoological Society of London, London, UK

1G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***

*Paul Leonard FLS., headed the Marine & Freshwater Science Unit in a UK Government Department for 12 years that included extensive research on science - based evidence to meet policy needs with Citizen Scientists.*

*He is a long-term supporter of SEFS & an Independent Members of the Thames RFCC that promotes practical measures to reduce flooding & the use of Natural Flood Management.*

*https://www.gov.uk/government/groups/thames-regional-flood-and-coastal-committee*

Since SEFS6, the importance of Citizen Scientists has been highlighted. In October 2022, the Crane Valley Partnership identified 60 catchment-based community organisations with approximately 1000 volunteers. The work they cover is in partnership with the Environment Agency, Thames Water and Councils, all of whom may have a legislative role to control discharges and monitor their impacts. The Citizen Scientists are trained to add evidence and promote better environmental practice. Thus, outcomes include raising public awareness, access and participation, providing evidence to inform river management with the aim to improve water quality, habitats and biodiversity. The River Crane is an important tributary of the River Thames on the west side of London, with the Citizen Crane initiative & training commencing in 2014. In 2023, the 8th Year Report was able to provide details of progress on water quality and ecosystem health. Monitoring along the length of the river involves dedicated trained scientists and the success of the work is a tribute to their commitment. The upper catchment continues to pose pollution problems, due to misconnections and blockages, thus, regulators are encouraged to investigate. The middle catchment suffers from its geomorphology, while the lower catchment has the best environmental health as shown by a range of indicators. Approaches to improving the River Crane and wider implications for the Crane Valley Partnership are discussed.

# Citizen Science and the art of synoptic sampling: experiences from the iWharfe project

Prof. Rick Battarbee[1,2], Mr Malcolm Secrett[2], Dr Gina Henderson[1]
[1]University College London , London, United Kingdom, [2]Addingham Environment Group, Addingham, United Kingdom

1G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Emeritus Professor and former Director of the Environmental Change Research Centre at University College London with research interests in the ecology and palaeoecology of lakes with respect especially to acidification, eutrophication and climate change. In retirement I chair our village Environment Group and lead a citizen science project on the ecology of the River Wharfe working closely with the Yorkshire Dales Rivers Trust.*

The River Wharfe in Ilkley is the first running water site in the UK to be designated as a Bathing Water. I will describe the role played by citizen scientists in assembling data on faecal bacteria which helped to secure the designation. I will also describe our "iWharfe" project in which 60 samples for faecal bacteria and nutrient chemistry were collected by citizen scientists from the full 125 km length of the river in a single morning. By minimising the impact of flow variability along the river the data provided a remarkably coherent snapshot of river health from its headwaters in the Yorkshire Dales to its junction with the River Ouse near York. Epilithic diatom samples were collected during low flow conditions at each nutrient chemistry sampling site over the following few weeks. All samples were analysed by accredited labs. The combined data clearly identify the principal sources of faecal bacteria contamination and nutrient pollution along the river, with the Ilkley Sewage Treatment Works situated close to the designated bathing water site being the main culprit. The project illustrates the value of synoptic sampling in river systems and the central role of trained volunteers collecting samples. But it also illustrates the need for citizen science led projects either to be collaborative with professional freshwater ecologists or to have access to accredited laboratories for the analysis of critical determinands such as orthophosphate and taxonomically awkward biological groups such as diatoms.

# Classifying the metabolic regimes of Iberian rivers: A practical approach to synthesize river functioning

Dr Francisco J Peñas[1], Dr. Amaia Angulo[1], Prof. Jose Barquín[1]
[1]IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria, Santander, España

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*Francisco holds a PhD in Science and technology for the environmental management of hydrological systems (Universidad de Cantabria). Dr. Peñas was granted a two-year postdoctoral fellowship funded by the Chilean Government (2017-2019). Currently Dr. Peñas is a senior researcher at the IHCantabria.*

*His research focuses on key disciplines within the fields of freshwater ecology, water resources and ecosystem management aiming to improve our understanding on the dynamics of river ecosystems under natural and human-impacted conditions. He has publisehd 26 SCI papers and has participated in 18 competitive R&D projects and 18 non-competitive contracts with public and private entities.*

River Ecosystem Metabolism (REM) represents a cornerstone for river ecology and freshwater management as it includes the total interrelated fluxes that fix and mineralize organic carbon in an ecosystem and integrates the response to a broad range of natural and human factors. The proliferation of reliable sensors, and easy-to-use software for the calculation of Gross Primary Production (GPP) and Ecosystem Respiration (ER) represents an excellent opportunity to gain understanding of the river ecosystem energetics. However, to date very few studies have focused on analysing multiannual regimes of REM and their environmental drivers from a large-scale perspective. Moreover, the application of classification approaches to develop functional typologies can be very valuable to synthesized and understand the complex REM patterns at these spatio-temporal scales. In this study we estimated the GPP, ER and REM regimes of 49 Iberian rivers and developed a data-driven classification, based on a set of indices accounting for the mean and extreme values of GPP and ER. We found 3 and 4 GPP and ER types, respectively, distinguished by their monthly magnitude and seasonality. Our results suggested a clear presence of characteristic functional typologies in the Iberian rivers driven by a consistent set of natural gradients, and human related drivers (i.e. flow alteration and land cover and land use). This work has important implications since functional typologies could be linked to certain river ecosystem services rates, and they could aid to understand global carbon dynamics and predict the consequences of large-scale disturbances such as climatic change.

## Climate change feedbacks: Is lake warming impacting internal nutrient cycling?

Dr Eleanor Mackay, G. McShane, G. Rhodes, B. Dodd, G. Rankin, H. Feuchtmayr, S. J. Thackeray

4F_RS13_Climate change and freshwaters: challenges and solutions, June 20, 2023, 10:30 AM - 12:00 PM

There is widespread evidence for the warming of lake surface waters across the globe and the impacts of increased thermal stratification on deep water oxygen decline during the summer. These changes in the oxygen regimes of lakes have potentially severe consequences for nutrient cycling in enriched systems, with the positive feedback effects of increased internal nutrient cycling exacerbating water quality problems and delaying ecological recovery. Here we present long term data analysis from the temperate English Lake District collected as part of the UK-SCAPE Cumbrian Lakes Monitoring Platform. Long-term increases in surface temperature and stratification metrics are positively correlated with measures of oxygen decline and the duration of anoxia in a productive lake. Changes in anoxia are subsequently associated with an increase in late summer phosphorus and reduced nitrogen concentrations. These changes are indicative of increased internal nutrient supply from lake bed sediments and consequent impacts on phytoplankton biomass. These climate induced changes pose critical challenges to our ability to effectively manage lake water quality in a warmer world.

# Climate change impacts on standing waters – the need for urgent action

Dr Linda May[1], Mr Philip Taylor[1], Mr Iain Gunn[1], Dr Stephen Thackeray[1], Professor Laurence Carvalho[2], Miss Mairéad Corr[1], Miss Anne Dobel[1], Miss Alanna Grant[1], Miss Gemma Nash[1], Dr Emma Robinson[1], Professor Bryan Spears[1]
[1]UK Centre For Ecology & Hydrology, Edinburgh, United Kingdom, [2]Norwegian Institute for Water Research, Oslo, Norway

1F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Dr Linda May leads the UKCEH Freshwater Restoration and Sustainability Group at UKCEH Edinburgh and has 46 years' experience as a freshwater ecologist. Her main research areas are the causes, effects and remediation of water pollution problems. This includes catchment wide studies of point and diffuse sources of pollution, their impacts on water quality and the development of remediation strategies. A particular interest is the impact of climate change and extreme events on nutrient transport and ecological responses.*

Like the rest of the world, the UK is facing an unprecedented climate change crisis. This is likely to affect the quality of its standing waters. Here, we present some of the evidence required to evaluate climate-related risks to our standing waters and to inform adaptation strategies that will safeguard their integrity, biodiversity and sustainable use. Focusing on Scotland's standing waters, we have combined information from the literature, expert opinion and monitoring data, and used statistical analyses and visualisation (mainly mapping), to explore potential changes in climate change stressors to 2080. We have found that the water temperature of 97% of Scottish lochs increased between 2015 and 2019, and that most (88%) had warmed by 0.25°C to 1.0°C per year over that period. A small number (9%) of lochs had increased by 1.1°C to 1.3°C per year over that period. Using newly available climate change projections, we found that average April to September water temperatures in Scottish standing waters would probably rise by about 3°C by 2080, and that extreme drought events were likely to become more common. Our results suggest that by 2080, algal blooms are likely to become more prevalent in response to warming, lower flushing rates, and mismatches in the seasonal timing of algal communities and their zooplankton grazers. We provide evidence that climate change risk assessments are needed, urgently, for all standing waters to inform an evidence based, whole system approach to the sustainable management of lakes and reservoirs before it is too late.

# Climate change threats to biodiversity of alpine ponds: effects of temperature, hydroperiod and connectivity in 500 ponds in the French Alps and Pyrenees.

Mrs Marie Lamouille-Hébert[1,2,7], Mr Florent Arthaud[3,7], Mr Aurélien Besnard[4], Mrs Rosalie Bruel[5,7], Mrs Nathalie Reynaud[6,7], Mr Thierry Tormos[5,7], Mr Thibault Datry[1]
[1]INRAE, Riverly, Lyon, France, [2]France Nature Environnement Haute-Savoie, Pringy, France, [3]Université Savoie Mont Blanc, INRAE, CARRTEL, Thonon-les-Bains, France, [4]Centre d'Ecologie Fonctionnelle et Evolutive, UMR5175, Montpellier, France, [5]Office français de la Biodiversité, Service ECOAQUA, DRAS, Aix-en-Provence, France, [6]INRAE, Aix Marseille Université, UMR RECOVER, Aix-en-Provence, France, [7]Pôle R&D ECLA, Aix-en-Provence, France

5E_RS05_Small water bodies, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I work in a NGO, France Nature Environnement Haute-Savoie and I am conducting a PhD (2021-2024). I do research in alpine freshwater ecology and biodiversity conservation.*

The unprecedented rate of climate change is leading to a global erosion of biodiversity. Many species are becoming extinct or experiencing drastic shifts of their geographical distribution: contraction, enlargement or displacement. Alpine ponds are local biodiversity hot spots and act as sentinels of these changes due to the thermal preferences of their constituent species. In addition to thermal and trophic stresses, their high elevation and isolation within landscape induced slow population dynamics. In this context, the CIMaE project (Climatic Impact on Mountain aquatic Ecosystems) aims to better understand alpine ponds biodiversity distribution mechanisms for defining efficient management strategies to mitigate the effects of climate change. For that purpose, the current and future distribution (2025, 2050, 2100) of three biological groups (dragonflies, aquatic plants and frogs/newts) are studied in the French Alps and Pyrenees in more than 500 ponds. These groups exhibit contrasted life history traits (including their capacity to disperse) and different strategies to cope with increased temperature, drying and decreased connectivity. Their distributions are analyzed along different gradients of water temperature, hydroperiod and connectivity. We will present the first results and their implications for the next phases of the CIMaE project.

# Climatic effects on the synchrony and stability of temperate headwater invertebrates over four decades

Dr Stefano Larsen[1], Dr Fiona Joyce[2], Dr Ian Vaughan[2], Dr Isabelle Durance[2], Dr Jonathan Walter[3], Prof Steve Ormerod[2]
[1]Edmund Mach Foundation, San Michele all'Adige, Italy, [2]Cardiff University, Cardiff, UK, [3]University of Virginia, Charlottesville, USA
1F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***
*MS in Biological Sciences at Roma3 university (IT).*

*PhD in Ecology at Cardiff University (UK).*

*Marie-Curie Fellow at University of Trento (IT).*

*Permanent research scientist at Edmund Mach Foundation (IT).*

*Quantitative community ecologist with special interest in stream and riparian ecosystems*

Understanding the ecological effects of climate change on freshwater ecosystem dynamics requires assessment of the influence of other large-scale processes. However, few studies allow such assessments over decadal timescales. Here, we examined how variation in annual weather patterns associated with the North Atlantic Oscillation (NAO) over four decades affected synchrony and stability in a metacommunity of stream invertebrates across contrasting headwater streams in central Wales (UK). Prolonged warmer and wetter conditions during positive NAO winters synchronised variations in population and community composition among and within streams thereby reducing stability across levels of organisation. This climatically-mediated synchronisation occurred in all streams irrespective of acid-base status and land use, but was weaker where invertebrate communities were more functionally diverse. Wavelet modelling indicated that variation in the NAO explained up to 50% of overall synchrony in species abundances at a timescale of 6-8 years. However, the synchronising effect of the NAO varied across species groups, with cold-adapted species showing high sensitivity to climate variation. The NAO had no effects on spatial synchrony in hydrochemistry, instead appearing to affect ecological dynamics through local variations in temperature, precipitation and discharge.
Our findings illustrate how large-scale climatic fluctuations generated over the North Atlantic can affect population persistence and dynamics in continental freshwater ecosystems in ways that transcend local catchment character. The analyses also suggest that protecting and restoring functional diversity in stream communities can increase their stability in the face of warmer, wetter conditions that are analogues of ongoing climate change.

# Closing the gap: conservation and threats of temporary ponds in peninsular Spain

Dr Margarita P. Florencio Diaz[1], Mr. Christian Arnanz[1], Mr. Pablo Soto[1], Ms. Marina Tomás-Martín[1], Dr. Miguel Ángel Rodríguez[2], Dr. Jorge M. Lobo[3], Mr. David Aragonés[4], Dr. Rocío Fernández-Zamudio[5], Ms. Carmen Ramirez Soto[6], Dr. Santos M. Cirujano Bracamonte[7], Dr. Laura Serrano[8], Dr. Paloma Alcorlo[1], Dr. Salvador Mollá[1], Dr. Eugenio Rico[1], Dr. Ángel Baltanás[1], Dr. Ana Isabel Lopez-Archilla[1], Dr. María Anton-Pardo[9], Dr. Bruno R. Ribeiro[10], Dr. Geizianne Tessarolo[11], Dr. Luis M. Bini[10], Dr. Rafael Loyola[12], Dr. Ignacio Morales-Castilla[2], Dr. Juan Carlos Moreno Sáiz[1], Dr. Carlos Melián[13], Dr. Carmen Díaz-Paniagua[6]
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1D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am an experienced limnologist with a large background in aquatic ecology, particularly in the conservation of temporary ponds. During twelve years of postdoctoral research, almost six in two international institutions, more than five in tree national institutions, I have tried to understand the biodiversity patterns of temporary ponds using community ecology, and how these assemblages can face biological invasions and other anthropogenic perturbations at local and regional scales. The use of community ecology has also allowed me to determine biodiversity patterns of terrestrial and aquatic arthropods of the Azorean oceanic islands facing land-use changes and alien species*

Temporary ponds are characteristic habitats of the Mediterranean region, being a priority for conservation under the European Union Habitats Directive (code: 3170). However, these ponds are under serious threat, and many have been degraded or destroyed in recent decades, leading to significant consequences for their singular biodiversity. In peninsular Spain, temporary ponds occupy 52% of Natura 2000 sites, making up the largest proportion of this conservation network containing temporary ponds in Europe. Nevertheless, there is no comprehensive database of georeferenced and catalogued temporary ponds for this region. In this study, we mapped more than 3,700 temporary ponds in peninsular Spain,

using information from national catalogues, literature, and expert collaborators. We aim to assess the main threats to these ponds by (1) analysing how the macro- and micro-invertebrate assemblages of temporary ponds have responded to 14 years of species invasions and desiccation in the Doñana National Park, and (2) modelling the invasion risk of temporary ponds under various plausible scenarios of spatial connectivity, climate change, and landscape disturbance in peninsular Spain. Ponds will be classified as high-conservation priorities based on biodiversity data and as data deficient. To address the difficulty of detecting small, cryptic temporary ponds, we have created a webpage for citizen science (https://www.climariskinpond.com/) to help identify and protect these ponds for conservation purposes.

# Collateral Benefits: Using Long-Term Bioassessment Programs to Evaluate the Effects of Climate Change on Stream Ecosystems

Dr Robert Bailey[1], Dr. Trefor Reynoldson
[1]Ontario Tech University, Oshawa, Ontario, Canada
1F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Over the last 30 years as an academic researcher, Bob has worked with Trefor Reynoldson and the late Richard Norris to develop and refine the Reference Condition Approach (RCA) to bioassessment of freshwater ecosystems. With colleagues and students, he has applied RCA in assessing the effects of human activity on streams in Canada from placer gold mining in the Yukon to former coal mining areas in Cape Breton.He is currently a Professor in the Faculty of Science at Ontario Tech University, focused on new ways to model biological change in freshwater ecosystems with big data from remote sensing and GIS.*

Climate change has been shown to affect the physical and chemical component of stream ecosystems both directly (e.g. via changes in flow regime) and indirectly (e.g. via changes in frequency and intensity of catchment forest fires). Effects on stream biota are less well known, but long-term sampling in bioassessment programs (e.g. RIVPACS in the UK) may reveal climate-change driven changes in the benthic community. In Canada, the Canadian Aquatic Bioassessment Network (CABIN) program has gathered data on the monitoring of 100s of reference (i.e. low exposure to local human activity) streams in British Columbia for 25 years, with several sites sampled more than three times over periods of more than six years. We measured temporal change in the composition of the benthic community at these sites by looking at changes over time in the sites as a whole and the trajectory of individual, repeatedly sampled sites. This was compared to the 10x10km resolution climate change projection model created from archival temperature and precipitation data by Environment & Climate Change Canada. At some sites, there is evidence of systematic community change over time that is related to climate change. At others, variability through time does not track changes in the climate. We will look at some of the factors that may help explain these different answers to the question of if and how much climate change affects stream ecosystems.

# Combining palaeo- and contemporary ecology to assess biodiversity in aquatic environments

Tahir Khanzada[1,2], Meg Materne[1], Molly Colgate[1], Helen Bennion[1], Geraldene Wharton[2], Carl Sayer[1]
[1]Department of Geography, University College London, London, UK, [2]School of Geography, Queen Mary University of London, London, UK

5F_RS08_The past is the key to the future: the role of palaeoecology in understanding and managing fresh waters, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Tahir Khanzada is a PhD student on the London NERC DTP based at UCL Geography and Queen Mary Geography. He is supervised by Helen Bennion (UCL), Geraldene Wharton (Queen Mary), and Carl Sayer (UCL). His project focuses on analysing biodiversity changes in a freshwater landscape (the River Glaven, North Norfolk, UK) using both contemporary and palaeoecological techniques, supported by historic and contemporary mapping of waterbodies in the area. He previously completed an undergraduate degree in Geography and a master's degree in Climate Change, both at UCL Geography.*

Biodiversity changes over the last 200 years in lowland agricultural settings are primarily influenced by human activities, particularly farming practices involving fertilisers and land use changes. These changes occur on both long (decades-centuries) and short (years) timescales, and the intensity of these changes due to stressors varies temporally and spatially. The River Glaven catchment, north Norfolk, UK, offers an opportunity to examine biodiversity changes in the freshwater landscape using both palaeo- and contemporary ecological techniques. At two lakes in the catchment, Selbrigg and Bayfield, palaeolimnological studies, principally macrofossils and diatoms, have been carried out on radiometrically-dated sediment cores. Additionally, both sites have been fully and casually surveyed for aquatic macrophytes for the last 20 years. Selbrigg is situated near the headwaters of the river system and is therefore likely to be a comparatively clean site with less overall nutrient input, whereas Bayfield is an onstream site near the mouth of the river and as such can be considered a good catchment integrator, broadly representing change from the entire catchment. Combining palaeoecological data with detailed, consistent contemporary surveys and casual observations allows for analysis of both long-term and more rapid changes in biodiversity and can be used to answer questions such as how, when, and where biodiversity changes occur in a catchment in response to stressors.

# Comparative transcriptomics reveals molecular mechanisms of European fish salinity adaptation under multiple stressors

Mr Camilo Escobar-Sierra[1], Dr. Miguel Cañedo-Argüelles[2], Dr. Dolors Vinyoles[3], PD Dr. Kathrin Lampert[1]
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8F_SS10_Freshwater salinization: causes, consequences and management, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Camilo Escobar-Sierra is a PhD candidate in the Lampert's fish ecology lab at the University of Cologne. He earned a Bachelor's degree in Biology and a Master's degree in Aquaculture, Environment, and Society (ACES). Camilo's research interests are focused on aquatic ecology and exploring the interactions between humans and aquatic ecosystems. His expertise includes community ecology, and molecular ecology using tools such as transcriptomics, metabolomics, and isotopic analyses. Currently, his research investigates the impact of anthropogenic stress on fish populations across various European catchments, studying their response at both the population and molecular levels.*

European freshwater ecosystems face multiple stressors (MS), which can significantly impact their fish fauna. Freshwater salinization (FS) is an emergent stressor that poses a significant risk to freshwater-adapted species. However, the underlying molecular mechanisms of this adaptation are not well understood, and it can be challenging to discern the specific effects of a single stressor, such as FS, in an MS scenario. To address this research gap, we conducted three studies using comparative transcriptomics to examine the effects of FS on fish with different levels of salinity adaptation. Our research involved Gasterosteus aculeatus, Phoxinus septimaniae x P. dragarum, Cottus gobio, and Cottus rhenanus specimens collected from different rivers in Germany and Spain, covering a gradient of salinity and MS. We employed high-throughput mRNA sequencing and differential gene expression analysis to study the molecular pathways and over-expressed biomarker genes under these conditions in the different fish species. Our results revealed that increased salinity led to an enrichment of pathways and biomarker genes related to osmoregulation and physiological stress in G. aculeatus. Ongoing analysis is expected to show similar responses in P. septimaniae x P. dragarum and an increased enrichment of pathways related to physiological and immune stress in Cottus spp., which have a lower adaptation to salinity. Our study provides insight into the molecular mechanisms involved in fish salinity adaptation in both stenohaline and euryhaline species in natural habitats facing MSs. These findings have the potential to inform management strategies aimed at mitigating FS in species with different salinity sensitivity.

# Comparing microbial diversity patterns and community assembly in natural and constructed wetland systems

Dr Carlos Rochera[1], Mr Antonio Picazo[1], Ms Maria Peña[2], Mr Daniel Morant[1], Mr Javier Miralles-Lorenzo[1], Ms Nuria Oliver[2], Ms Tatiana Montoya[2], Mr Antonio Camacho[1]
[1]Cavanilles Institute for Biodiversity and Evolutionary Biology, University of Valencia, Paterna, Valencia, Spain, [2]Group Global Omnium, Valencia, Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Carlos Rochera holds a PhD in Biology. He is a research member of the group of Limnology of the Cavanilles Institute of Biodiversity and Evolutionary Biology (University of Valencia). He is accomplising investigations on the functional aspects of microbial populations from polar and temperate regions, as well as the sensitivity and vulnerability of ecological processes in aquatic ecosystems to climate change.*

Microbial communities participate in essential ecological functions in natural wetland ecosystems, and constructed wetlands aim to replicate such functions for the water treatment. Treatment effectiveness can be assessed by comparing the analogies of microbial parameters between both types of wetlands. In this study, we compared the microbial communities of constructed wetlands with a different structural complexity with those of natural coastal wetlands from the same geographical region (East Spain). Bacterial and archaeal community composition was determined using high-throughput 16S rRNA gene amplicon sequencing. Functional predictions of the microbial community were performed based on these data. The interactions and complexity of the resulting communities was assessed by a co-occurrence network analysis. The results demonstrated that topological properties of these networks were mainly associated with the complexity of the constructed wetland. Parameters such as the number of nodes, number of sub-networks, or the path length between nodes increased as the heterogeneity of the system did. Accordingly, the constructed wetlands with higher structural complexity, which combined both surface and subsurface flow, showed a network topology closer to that observed in natural wetlands. These advanced analytical tools can be used to support the management of these type of artificial wetlands to increase its performance in water quality improvement. This work is supported by the IVACE (Instituto Valenciano de Competitividad Empresarial, Generalitat Valenciana) through the PIDCOP-CV programme, and by the project CLIMAWET-CONS (PID2019-104742RB-I00), funded by Agencia Estatal de Investigación and the Ministerio de Ciencia e Innovación (Gobierno de España).

# Comparison of gap-filling methods for freshwater satellite data: a case study on spatial-temporal surface water temperature of Lake Titicaca

Ms Dieu Anh Dinh[1], Prof. Eleanor Jennings[1], Dr. Valerie McCarthy[1], Dr. R. Iestyn Woolway[2]
[1]Centre for Freshwater and Environmental Studies, Dundalk Institute Of Technology, Dundalk, Ireland, [2]School of Ocean Sciences, Bangor University, Menai Bridge, Anglesey, UK

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Dieu Anh is a PhD researcher at the Centre for Freshwater and Environmental Studies, Dundalk Institute of Technology, Ireland. Her research interests are climate change impacts, remote sensing and freshwater resources.*

Satellite Earth Observation can be used to provide time series data for lakes at a global scale, and thus are critical for understanding their responses to climate change. However, these satellite data also have their limitations, including the presence of gaps (e.g., due to clouds). Gaps in satellite data can be filled using linear interpolation, but this can introduce unknown and unquantified errors. In turn, novel techniques need to be developed and explored. In this study, we investigate numerous gap-filling methods to reconstruct missing lake surface water temperature data (LSWT) in Lake Titicaca, a lake of critical importance in Peru and Bolivia. Specifically, in this study, we explore several basic gap-filling methods, from relatively simple nearest neighbours and linear/stine interpolation to more complex EOF-based techniques, including DINEOF (Data Interpolating Empirical Orthogonal Functions) and a machine learning algorithm (e.g., Boosted Regression Trees). For this research, we used 7671 daily LSWT images for Lake Titicaca between 2000 and 2020 from the European Space Agency Lakes_ Climate Change Initiative dataset. The satellite data was derived from multiple sensors with a high spatial resolution of 1/120 degrees. The primary results show that DINEOF performed better in filling gap values compared to the other methods. The root mean square of error (RMSE) between the original LSWT and reconstructed LSWT using DINEOF resulted in the lowest value (RMSE= 0.29). The research contributes to climate change's impact on lake studies and resolves the challenge of cloud cover in freshwater remote sensing.

# Complexity calls for collaboration - a plea for an open modelling culture

Dr Thomas Petzoldt[1], M.Sc. Johannes Feldbauer[1], Dr. David Kneis[1], Prof.Dr. Karline Soetaert[2]
[1]Technische Universität Dresden, Institute of Hydrobiology, Dresden, Germany, [2]Royal Netherlands Institute for Sea Research, Department Estuarine and Delta Systems, Yerseke, Netherlands

4G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Diploma in biology at Rostock University and TU Dresden, Germany; scientific assistant and PhD about model-based short-term predictability of phytoplankton blooms (statistical, neural networks, fuzzy logic, differential equations). Since then member of scientific staff: teaching, computer infrastructure, research projects in the field of limnology and ecological modelling.*

During the last decade, ecological models have become too large, complex and diverse to be handled by a single person or a small group of modellers. Additional challenges arise to ensure software sustainability and increase life expectancy of models under a rapidly evolving technological basis. It is thus crucial to efficiently share experience between collaborators and transfer knowledge to students.  Open source software can facilitate this process since packages, examples, documentation, and building blocks can be shared easily. The use of common scripting languages like R or Python further supports exchangeability and interoperability. We will present a set of open source software components, that appeared as a technical byproduct of our research and teaching activities. Making those freely available has given us feedback and options for collaboration. Examples include contributions to package "deSolve" that became R's main differential equation solver package, to "marelac" with physical constants and equations for marine and freshwater applications, "growthrates" for fitting growth experiments, "rodeo", that generates computationally efficient code from tabular representations of complex models, and "rodeoFABM" for linking such models to hydrophysical drivers like GOTM. Even more important than our own contributions was the benefit we received from others. Without this toolbox, our recent contributions to water quality management and climate impact research would not have been possible. We regard it as our duty to share our technological experience with students and the community, in form of publicly available code and documentation, as didactic material, and easily accessible web applications.

# Connecting communities through citizen science

Ms Rebecca Lewis[1]
[1]Buglife, Scotland, United Kingdom

2G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Ecologist and Conservation Officer for Buglife - The Invertebrate Conservation Trust. Scottish Freshwater Group Advocacy Officer and Riverfly Partnership Trainer. Project lead for Guardians of our Rivers for Buglife Scotland and coordinator for Riverfly on the Esk.*

Citizen Science is a mostly understood area. Community citizen science may be another deviation from this that connects our modern-day ideals of 'Place' where we focus project development on our doorstep, connecting ourselves more with the immediate surroundings and how we sustain communities within these. The main difference being that they are community driven with the only agency being a collective agenda for change. Therefore, the drivers of citizen science might be more important to distinguish when it comes to sustainability; when its community grown its more malleable, allowing adjustments which incorporate societal and environmental change. Using a case study on the Lothian Esk, we have been exploring a project that has grown to catchment scale monitoring using community citizen science. Building and reconnecting the community to its river through a rather unlikely facilitator, the freshwater invertebrate. I will discuss this from the bottom up, the effort involved to grow and sustain this project. The communication and success of one group creating a 'Buzz' that attracted a wider audience across Scotland and a launch pad for a country wide roll out.

# Connecting inland wetlands to artificial embanked lakes to improve lake ecosystem functioning

Dr Ralf Verdonschot[1], Jeroen Veraart[1]
[1]Wageningen Environmental Research, Wageningen, Netherlands

2B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*My research focusses on the ecological functioning of aquatic ecosystems and its communities, with a focus on streams and wetlands and macroinvertebrates. Research topics include the mechanisms generating biodiversity in freshwaters, ecological restoration techniques and nature-based solutions, and the monitoring and assessment of ecological quality. Translating scientific findings into practical applications for water managers and policy makers is an important part of my work.*

The lakes IJssel and Marken in the Netherlands are large artificial water bodies with steep embanked shores, a controlled water level and no significant shoreline marshes. They could be described as novel ecosystems. Inflow consists of a mixture of river water and controlled water inlet from inland polders. Pumping stations are used to bridge inland-lake water level differences. In addition, lake water levels are kept high in summer to guarantee freshwater supply for agriculture, which complicates wetland development. Recent major food web changes, resulting in a decrease in fish and bird densities, has triggered a debate on how to improve the lakes ecological functioning. An important restoration target is stimulating inland wetland to lake organic matter exchange. The rationale behind this is that by providing riparian dissolved and particulate organic matter to the lakes the food web is strengthened through stimulating microbial and zoobenthos production. Inland wetland organic matter sources are currently disconnected from the lakes, as the pumping stations act as a barrier for the exchange of organic material. Furthermore, the material has to be transported through inland waterways over considerable distances, resulting in losses by removal and transformation. To determine the pathways and the contribution of different inland wetland habitats and its associated organic matter sources we recorded the spatial patterns in dissolved organic matter along the transport routes from inland waters to the lakes. This provided further insight into the restoration concept of ‘inland shores’, which aims at establishing a better connection between inland wetlands and lakes.

# Consequences of the neonicotinoid ban on ecological risk in streams

Mr Jonas Gröning[1], Prof. Matthias Liess[1]
[1]Department of System-Ecotoxicology, Helmholtz Centre for Environmental Research (UFZ), Leipzig, Germany

7E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Jonas Gröning is a second-year PhD student in the Department of System-Ecotoxicology at Helmholtz Centre for Environmental Research (UFZ). He received a bachelor's degree in geography and a master's degree in environmental research from Freie Universität Berlin, Germany. His current work focuses on the dynamics of pesticide exposure in aquatic environments and their ecological effects. He is particularly interested in the impact of regulations on exposure and the aquatic risk posed by legacy and emerging pesticides.*

Pesticide inputs to surface waters widely affect aquatic organisms and degrade ecological status. Despite extensive regulations, it has not yet been achieved to reduce the risk from pesticides to an acceptable level. Given the aims of the zero pollution vision and the European Green Deal to reduce the risk of pesticides by 50% until 2030, a better understanding of the consequences of current pesticide regulation on the resulting ecological risk in aquatic environments is needed. Taking the consequences of the ban of (most) neonicotinoids as an example, we investigated (1) to what extent the risk from this substance group remains due to long-term losses from soil pools, (2) whether an increased use of and risk from substitutes (especially pyrethroids) is apparent, and (3) how these alterations in single-substance exposure affect macroinvertebrate communities. Our study is based on time series of pesticide concentrations from grab and event-based water samples and data on macroinvertebrate communities in 20 agricultural streams in Germany between 2018 and 2021. The results show that although exposure and risk from neonicotinoids is decreasing, the slow rate of decrease and the simultaneous emergence of equally or even more toxic substitutes are counteracting the achievement of a better ecological status. To achieve substantial improvements, the identification and re-evaluation of already approved risk-driving pesticides needs to be accelerated. For new authorized substances, inclusion in regular monitoring should be ensured.

# Conservation and outdoor recreation in freshwater ecosystems

Dr Vicenç Acuña[1], Dr Anna Freixa, Ms Lorena Cojoc, Prof Mira Petrovic, Dr Josep Pueyo
[1]Catalan Institute For Water Research, Girona, Spain, [2]University of Girona, Girona, Spain

4E_RS05_Small water bodies, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Research scientist at the Catalan Institute for Water Research, with a background on stream ecology of temporary streams, although currently mainly working on water quality modeling, nature-based solutions, and ecosystem services.*

Freshwater biodiversity is under threat by multiple pressures and is decreasing faster than terrestrial or marine ecosystems. Outdoor recreation in freshwater ecosystems such as angling, canyoning or bathing at natural swimming holes has been considered a cultural ecosystem service, but it is nowadays also considered as a pressure on freshwaters. Thus, the rapidly rising number of recreationist in freshwater ecosystems, and the increasing clustering of these recreationist in fewer locations poses a serious threat to freshwater biodiversity. The situation of Climate emergency is not precisely helping, as the number of permanently flowing river sections is alarmingly decreasing, thus reducing the number of refugia for biodiversity. However, the consequences of outdoor recreation are still poorly understood, leaving environmental managers and conservationist with almost no scientific evidence to design policies such as carrying capacities or environmental fees. Given the COP15 target of reducing to near zero the loss of areas of high biodiversity importance and high ecological integrity, it is urgent to face the threat posed by outdoor recreation, assessing their impacts and co-designing evidence-based environmental policies. In this article, we review the existing literature on the topic, focusing on the following aspects: the drivers of recreational activities, the impact of these activities on freshwater biodiversity, and the environmental policies implemented to constraint their impact. Today, we are going to focus on the case of bathing in natural swimming holes, as a case study of a much broader issue.

# Conservation priorities under dynamic conditions in temporary river systems: where and when should we focus?

José María Fernández-Calero[1,2], David Cunillera-Montcusí[1,6,7], Virgilio Hermoso[9], Núria Cid[1,5], Dolors Vinyoles[1,2], Guillermo Quevedo-Ortiz[1,2], Pau Fortuño[1,2], Albert Ruhi[8], Miguel Cañedo-Argüelles[1,3,4], Núria Bonada[1,2]
[1]Freshwater Ecology, Hydrology and Management (FEHM), Departament de Biologia Evolutiva, Ecologia i Cienciès Ambientals. Universitat de Barcelona (UB), Barcelona, Spain, [2]Institut de Recerca de la Biodiversitat (IRBio). Universitat de Barcelona (UB), Barcelona, Spain, [3]Institut de Recerca de l'Aigua (IdRA). Universitat de Barcelona (UB), Barcelona, Spain, [4]Institut de Diagnòstic Ambiental i Estudis de l'Aigua (IDAEA) – CSIC, Barcelona, Spain, [5]Institut de Recerca i Tecnologia Agroalimentàries (IRTA), La Ràpita, Spain, [6]Departamento de Ecología y Gestión Ambiental, Centro Universitario Regional del Este (CURE). Universidad de la República, Maldonado, Uruguay, [7]GRECO, Institute of Aquatic Ecology, Universitat de Girona, Girona, Spain, [8]Department of Environmental Science, Policy, and Management. University of California, Berkeley, Berkeley, USA, [9]Departamento de Biología Vegetal y Ecología. Universidad de Sevilla, Sevilla, Spain

1A_SS14_Drying rivers in a time of global change, June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***

*I am a PhD student at the University of Barcelona. My research is focused on the community ecology of macroinvertebrates and the main factors that shape these communities in temporary rivers, typical of the Mediterranean region. I am passionate about aquatic insect biology and taxonomy, especially the groups of flies and stoneflies, although all of the groups fascinate me.*

*Temporary rivers (TRs) are highly dynamic ecosystems that alternate between flowing, drying (isolated pools), and dry phases. This dynamism results in significant community change over space and time, which makes biodiversity monitoring and conservation planning challenging. Here, we sought to assess the importance of flow intermittence on freshwater biodiversity conservation, and identify priority sites to protect this biodiversity at the regional scale. We hypothesized that priority sites for conservation would be those hosting unique species, with site prioritization being different for diatoms and macroinvertebrates due to their different dispersal abilities and strategies to cope with drying. We measured water chemistry and habitat variables seasonally. To measure flow intermittency and network connectivity, we deployed data-loggers along 513 days providing us a spatiotemporal connectivity index for each site. We collected diatom and macroinvertebrates seasonally from seven pristine streams from a Natural Park in the northeast of Spain. We then identified key sites and moments for conservation by using two complementary methods: Local Contribution to Beta Diversity (LCBD), and site selection frequency obtained from the Marxan software. Our results show high seasonal variability in the prioritization of sites using either LCBD or Marxan´s selection frequency, and we confirmed that this variability depends on the organism studied. Current work will allow us to explore the main factors driving those changes. Our approach could help inform management guidelines to ensure the protection of different facets of stream biodiversity over the seasons.*

## Consistent higher emissions of greenhouse gases at daytime in reservoirs

Dr Elizabeth León-Palmero

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

Greenhouse gas (GHG) emissions from reservoirs are quantitatively relevant for atmospheric climatic forcing. These emissions have a large temporal variability, with daily changes accounting for a significant part of the total variability. However, most estimations for GHG fluxes are based on the upscaling of discrete measurements performed at daytime, and, in general, they did not account for the nighttime emissions. Here, we explored the daily patterns of $CO_2$, $N_2O$, and diffusive and ebullitive $CH_4$ fluxes in two eutrophic reservoirs with contrasted morphometries in two different years. We found daily patterns for $CO_2$, $N_2O$, and diffusive $CH_4$ fluxes with consistent higher emissions at daytime than at the nighttime irrespectively of reservoir morphometry. These three diffusive fluxes showed evident daily synchrony suggesting a common driver. The emissions were coupled with the daily solar cycle, wind speed, and water temperature. The daily emissions of the $CO_2$, $N_2O$, and $CH_4$ were also positive and significantly related to oxygen saturation. In contrast, we did not find a consistent daily pattern for the ebullitive $CH_4$ fluxes, although they represented a significant fraction of the total $CH_4$ emitted in these reservoirs. Our study suggests that the daily variability in GHG emissions may be as relevant as the variability at spatial or inter-system variability and solar radiation increases emissions. Therefore, daily ranges should be considered in future GHG budgets to improve global estimates of GHG emissions from reservoirs.

# Coping with nanoplastics and parasites: a brave new world for Daphnia?

Pedro Costa[1,2], Bruno Castro[1,2], Lúcia Guilhermino[3,4]
[1]CBMA, Centre of Molecular and Environmental Biology / ARNET - Aquatic Research Network, University of Minho, Braga, Portugal, [2]IB-S, Institute of Science and Innovation for Bio-Sustainability, University of Minho, Braga, Portugal, [3]ICBAS, Laboratory of Ecotoxicology and Ecology (ECOTOX), Department of Population Studies, School of Medicine and Biomedical Sciences of Abel Salazar, University of Porto, Porto, Portugal, [4]CIIMAR, Research Team of Ecotoxicology, Stress Ecology, and Environmental Health (ECOTOX), Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Matosinhos, Portugal

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Pedro Costa is a grant holder at CBMA (Centre of Molecular and Environmental Biology), University of Minho, Portugal, where he works under the scope of project EnantioTox (Enantioselective ecotoxicity and bioaccumulation studies of psychoactive substances). He has graduated (B.Sc.) in Applied Biology (University of Minho), and later progressed to a post-graduation (M.Sc.) in Toxicology and Environmental Contamination (Instituto de Ciências Biomédicas Abel Salazar, University of Porto), having spent 6 months at the Institute of Environmental Sciences of the Jagiellonian University (Poland), under the Erasmus program. His research interests include ecotoxicology of emergent pollutants and their interaction with other stressors.*

Microplastic pollution has been a major cause of environmental concern due to its ubiquity, the known consequences for the polluted ecosystems, and the still overwhelming lack of knowledge regarding its interference with other stressors (natural and anthropogenic). There is special concern regarding plastic particles at the nanometer scale (NPs). In this study, the potential impacts of NPs in a host × parasite relationship between <i>Daphnia magna</i> and <i>Metschnikowia bicuspidata</i> were investigated. <i>Daphnia</i> is especially suited for studying micro- and nano-plastic pollution, given its intermediate position in aquatic food webs and suspensivore habits, which make it a relevant ecological receptor of micro- and nanoplastics and a potential vector for their trophic biomagnification. Hosts (<i>D. magna</i> specimens) were individually exposed to polystyrene nanospheres (50 nm in diameter; concentrations: 0, 0.1, 0.3 or 0.9 mg/L) in the presence or absence of the parasite <i>M. bicuspidata</i>, in a laboratory experiment. The presence of NPs had no significant impact on parasite infectivity nor on <i>D. magna</i> reproduction. Parasite spore production was significantly reduced in combined treatments containing 0.3 and 0.9 mg/L of NPs. These results suggest that NPs pollution may have an impact on disease transmission and <i>M. bicuspidata</i> epidemics in natural <i>Daphnia</i> populations. Hence, these results demonstrate that there is more than the eye can see regarding the potential interference of nanoplastics on aquatic food webs.

# COSAR – a 2022 Biodiversa Call project to identify contextual conditions beneficial to the ecological and social outcomes of rivers restoration

Dr Jérémy Piffady[1], Dr Mathieu Floury[2], Dr Aliénor Jeliazkov[2], Dr Nina Kaiser[3], Dr Celine Le Pichon[2], Dr Martin Palt[3], Prof Stefan Stoll[3], Ms. Evelyne Tales[2], Dr Ralf Verdonschot[4], Dr Christine Weber[5]
[1]INRAE - Riverly, Lyon, France, [2]INRAE - HYCAR, Antony, France, [3]University of Applied Sciences Trier - Environmental Campus Birkenfeld (UCB), Birkenfeld, Germany, [4]Wageningen Environmental Research (WUR), Wageningen, the Netherlands, [5]Eawag - Swiss Federal Institute of Aquatic Sciences and Technology, Kastanienbaum, Switzerland

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Jérémy Piffady is a researcher at the National Research Institute for Agriculture, Food and the Environment (France). He uses Bayesian statistical modeling and analysis to characterize both freshwater communities responses to multiple human stressors, and the related pressure contexts with a focus on hierarchical relationships and scales.*

*He has been involved in different projects related to hydromorphological alterations, pesticides contaminations, riparian woody buffers role, global trends in invertebrates communities under climate change,... He currently coordinates the Biodivers project COSAR.*

Many river restoration projects have been implemented worldwide, aiming at improving the ecological status of rivers by restoring or recreating local natural hydromorphological structures and habitats. However, ecological outcomes strongly depend on multiple drivers, processes and human stressors at various spatial scales, and are also potentially affected by past condition legacies. Considering spatio-temporal landscape context is crucial in restoration planning and implementation. Nonetheless, quantitative effects of the various context variables, the role of legacy effects, the issue of spatial scales as well as the functioning of metacommunities are still poorly understood and considered in restoration practice. Furthermore, societal needs and benefits from restoration, and the achievement of societal goals are rarely reviewed, although this is crucial for a complete and sustainable success of restoration projects. Based on existing monitoring data from about 200 European restoration projects, representing a large diversity of implemented hydromorphological measures, COSAR aims to provide an analysis framework of past restoration projects outcomes, assessed in terms of both ecological and societal (based on social network interactions analysis) metrics, along with their trade-offs. We will show results on these metrics and potential trade-offs related to different contextual variables. With a transdisciplinary approach, COSAR involves 8 different stakeholder groups throughout the project, with the aim to improve acceptance, communication and design of restoration programs. Therefore COSAR will provide feedback from stakeholder involvement and on the importance of assessing in an early phase whether the achievement of specific ecological and societal goals is realistic given the respective contexts

# Could global warming enhance the toxic effect of Bisphenol A on phytoplankton at the base of aquatic food webs?

Miss Veronica Moreno-Ayala, Dr Juan Manuel González-Olalla[1,2], Miss María Vila Duplá[1], Miss Irene González-Egea[1], Prof Gema Parra[3], Dr. Presentación Carrillo[1]
[1]Institute of Water Research, University of Granada, Granada, Spain, [2]Department of Watershed Sciences, Utah State University,, Utah, United States, [3]Department of Animal Biology, Plant Biology and Ecology, University of Jaén, Jaén, Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Verónica is a first-year PhD student at the Institute of Water Research, University of Granada (Spain). She has a background in Advances and Research in Microbiology. Currently, her research focuses on the interaction of global change and plastic degradation products on aquatic ecosystems in the Mediterranean region. Specifically, she is studying the effects of temperature and emerging contaminants on food webs in the lagoons of Andalusia, Spain.*

Both the temperature increase associated with climate change and the plastic waste production over the last few decades are two important stressors on aquatic ecosystems. In this study, the combined effects of Bisphenol A (BPA) and temperature increase on the growth and metabolism of the ubiquitous phytoplanktonic species Cryptomonas pyrenoidifera were investigated. The importance of phytoplankton in aquatic food webs and global primary production makes this study particularly relevant. Our hypothesis was that both stressors would have a negative effect on the growth and metabolism of C. pyrenoidifera, decreasing photosynthetic efficiency primary production, respiration, and cell abundance. We predicted that the BPA × T interaction would exacerbate the effects of both stressors. Six treatments were established, with two temperature levels (19ºC and 24ºC) and three levels of the chemical factor (control, addition of dimethylsulfoxide-DMSO solvent, and addition of DMSO and 5 mg/L of BPA). Our results showed that BPA had a negative effect on, photosynthetic efficiency, metabolic variables, and the abundance of C. pyrenoidifera.  The toxic effect of BPA together with the greater sensitivity to high temperature exhibited by this species led to a negative synergistic interaction between both factors. As a result, high temperature accelerated the negative effects of BPA, with the lowest photosynthetic efficiency and abundance values of all treatments. Our results show that the temperature increase may enhance the toxic effects of BPA on the first trophic levels of food webs, potentially affecting the metabolic balance and biogeochemical cycles of aquatic ecosystems.

# Coupling a probabilistic approach of sediment transport in migrating bed forms with biological processes of associated microbial communities

Anna Oprei[1], Aaron Hornschild[2], José Schreckinger[3], Michael Mutz[1], Ute Risse-Buhl[3,4]
[1]BTU Cottbus-Senftenberg, Department of Freshwater Conservation, Bad Saarow, Germany, [2]GFZ German Research Centre for Geosciences, Section 1.3: Earth System Modelling, Potsdam, Germany, [3]RPTU Kaiserslautern-Landau, Institute of Environmental Sciences, Landau, Germany, [4]RPTU Kaiserslautern-Landau, Ecology Department, Faculty of Biology, Kaiserslautern, Germany

4G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*PhD student at the Department of Aquatic Ecology at BTU Cottbus-Senftenberg, Germany.*

*BSc and MSc degree in Environmental Engineering.*

*Reserach interests: Biogeochemistry of benthic biofilms in lotic ecosystems, stress-recovery responses of microbial communities*

Sediments of sand-dominated streams are transported as migrating ripples already at low flow. Parallel to the transport direction, these ripples resemble asymmetrical triangles with a flat slope facing upstream and a steeper downstream slope. Single sand grains undergo recurring moving-resting cycles as the ripples migrate downstream. While moving, grains erode at the ripple stoss side and deposit on the lee side. Here they are buried under subsequent grains and remain resting until the next erosion cycle. Biofilms associated with sand grains are functionally and structurally compromised by frequent scour and abrasion during transport, and light limitation during resting. Ecological processes such as microbial growth, primary production and community respiration are constrained by transport frequency and resting duration of sediment grains. Thus, knowledge about the average resting duration of single sand grains in the ripple is essential. Standard models fail to adequately connect time scales of sediment transport with biological and biogeochemical processes. Based on empirical data on celerity and dimensions of migrating ripples, we present a probabilistic approach to estimate resting times and turnover frequencies of sand grains and relate these to basic microbial processes. Our approach allows coupling the time scales of moving-resting cycles of grains with microbial processes in streams and rivers, which is fundamental to understanding the environment and regulation of benthic organisms in moving bed sediments.

# Cross-ecosystem transfer of polyunsaturated fatty acids via emergent aquatic insects: a case study in a midsize, mesotrophic lake

Prof Dominik Martin-Creuzburg[1], Cornelia W. Twining[2], Jeremy Ryan Shipley[2], Margaux Mathieu-Resuge[3], Martin J Kainz[4], Tarn Preet Parmar[1]
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7G_RS20_Aquatic terrestrial linkages, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Dominik Martin-Creuzburg*

*BTU Cottbus-Senftenberg*

*Department of Aquatic Ecology*

*Researchstation Bad Saarow*

*Research interests: Aquatic food webs, essential nutrients*

Cross-ecosystem nutrient fluxes can crucially influence the productivity of adjacent habitats. Emerging aquatic insects represent one important pathway through which freshwater-derived organic matter can enter terrestrial food webs. Aquatic insects may be of superior food quality for terrestrial consumers, such as spiders, birds or bats, because they contain high amounts of essential polyunsaturated fatty acids (PUFA). We quantified the export of PUFA via emerging insects from a midsize, mesotrophic lake. Insects were collected using emergence traps installed above different water depths and subjected to fatty acid analyses. In addition, we deployed Malaise/window hybrid traps at different distances from the shore to estimate the penetration of aquatic insects and thus PUFA into adjacent terrestrial habitats. While chironomids contributed most to insect biomass and total PUFA export, Chaoborus flavicans contributed most to the export of long-chain PUFA. The export of total insect biomass declined with depth and the timing at which 50 % of total insect biomass emerged was correlated with the water depths over which the traps were installed, suggesting that insect-mediated PUFA fluxes are strongly affected by lake morphometry. Aquatic insect biomass decreased with distance from shore and the majority of aquatic insects did not penetrate further than 10 m into the adjacent terrestrial habitat. We show here that insect-mediated PUFA fluxes from lakes can be substantial. However, our data also suggest that aquatic PUFA exported via emergent insects are available only to riparian predators foraging in near-shore habitats.

## Cultural Invaders - arguing the case against against the invasive species socio-ecological trap and the Neoliberal agenda

Dr Josie South[1,2]
[1]University Of Leeds, Leeds, United Kingdom, [2]South African Institute for Aquatic Biodiversity , Makhanda, South Africa
7D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Josie South is an aquatic ecologist with a keen interest in biological invasions and their intersectionality with other disciplines. Josie works in freshwater ecosystems in the UK, southern Africa, Brazil and Indonesia and particularly likes anything to do with catfish, frogs and swamps. Unfortunately this presentation has nothing to do with any of those.*

A common diatribe in invasion ecology revolves around whether an introduced species should be utilised via a novel market in order to manage or control the population. The major perception is that commodification in this manner is a socio-ecological trap where association of value with a species ought to promote maladaptive behaviour and socioeconomic responses from communities which result in the propagation and spread of the invader to ensure continued economic benefit. I argue that this is not a clear-cut socio-ecological trap as this prevailing assertion reduces cultural and complex socioecological relationships to Neoliberal economics and the irrationality of late stage capitalism without considering the dialectical materialism of novel species, and therein individual agency and desire. My argument is rooted in the fact that invasive species are not only phylogenetically new in the ecological realm but also in the cultural and social realm. Using a series of case studies including African crayfish invasions, lionfish in the Caribbean and Canadian inland fisheries I will illustrate the complexities around human – novel species interactions and suggest a decolonialised management approach to this polarising issue.

# Current and past genetic assessment of native brown trout populations in an Alpine River ecosystem: implication for future conservation and management

Dr Caterina Maria Antognazza[1], Dr Anja Palandaćić[2], Dr Giovanni B. Delmastro[3], Dr Serena Zaccara[1]
[1]Università Degli Studi Dell'insubria, Varese, Italy, [2]Natural History Museum, Zoological Department, Fischsammlung, Vienna, Austria, [3]Laboratorio di Ittiologia e Biologia Acque, Museo Civico di Storia Naturale, Carmagnola, Italy
4D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a biologist, holding a PhD in conservation genetics. My research work and studies performed since 2013 focused on molecular ecology.*

*My experience involved research in conservation genetics of species protected by legislation or in a vulnerable status. The main purpose was the production of information for stakeholders, able to provide useful knowledge for prioritizing conservation actions and guidelines in conservation management.*

Freshwater ecosystems are among the ecosystems most altered by human activities, mostly favoured by anthropic introductions. Investigating the biological and historical memory retained in museums using molecular tool can help detect recent environmental changes (within the last 150 years). The brown trout is a complex of developing species distributed around the Palearctic region. The reconstruction of its recent evolutionary history is essential to propose careful management and, where possible, a requalification of ecosystems, hence it is important to examine and recognize the species that populated the basins before 1900, when the major hydro-morphological alteration and introduction activities began to carry out. The purpose of this study is to investigate the conservation of an Alpine River ecosystem through the protection of the brown trout, as it is the main salmonid at the top of the food chain of mountain alpine riverine ecosystems. This species has been extensively manipulated throughout Europe and in the specific case in the Po basin. This study proposes a comparison between the natural reality before 1900 and the current genetic structure of trout populations in the main Alpine basins, to understand and quantify the genetic fingerprint implemented by biological manipulation. Evolutionary history was inferred using the mitochondrial control region marker, whilst the current level of introgression using the nuclear gene LDH-C1. Outputs revealed strong signs of introgression with the allochthonous Atlantic strain. Nevertheless, the mitochondrial lineages linked to the native Adriatic strain in both current samples and in the museum samples, suggesting its historical presence.

# Current biotic indices do not respond to anthropogenic gradients in disconnected pools of temporary rivers

Dr Zeynep Ersoy[1,2], Nieves López-Rodríguez[1,2], Raúl Acosta[1,2,3], Joan Gomà[1,2], Francesc Gallart[3], Cesc Múrria[2], Jérôme Latron[3], Pilar Llorens[3], Pau Fortuño[1,2], Guillermo Quevedo-Ortiz[1,2], Maria Soria[1,2], Núria Cid[1,4], Narcís Prat[1,5], Miguel Cañedo-Argüelles[3], Núria Bonada[1,2]
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1A_SS14_Drying rivers in a time of global change, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Zeynep Ersoy is a Postdoctoral Researcher at Universitat de Barcelona. Her research centres on understanding the response of aquatic food webs to the global climate crisis and other anthropogenic perturbations (e.g., eutrophication, salinization, microplastics), using approaches ranging from mesocosm experiments to biodiversity monitoring to investigate trophic interactions, energy transfer, ecological status and ecosystem functioning.*

Disconnected pools are often found in temporary rivers once the flow ceases and the connection between the stream reaches disappears. Despite their great value for maintaining biodiversity and ecosystem functioning, disconnected pools have been largely neglected in biomonitoring programmes adopted under the European Water Framework Directive (WFD). This is mainly due to several challenges such as their hydrological variability, the difficulty of establishing reference conditions and their small size. Here, we assess whether the current biological indices and functional metrics based on diatoms and benthic macroinvertebrate communities reflect the biological quality of disconnected pools. We sampled 56 disconnected pools in Catalonia, NE Spain, covering broad environmental and anthropogenic gradients (e.g., physico-chemical parameters, water chemistry, human influence index, land cover) and quantified the time since disconnection using stable water isotopes and data loggers. We showed that most of the current biotic indices and functional metrics respond poorly to either anthropogenic or hydrological stressors (i.e., time since disconnection). Out of 34 indices and metrics tested, only IBMWP, IPS and TDI which are widely used indices showed a significant response to the stressors. However, the models explained less than 20% of the total variation, likely due to the combination of colonisation/extinction events, density-dependent trophic interactions, and stochasticity that may govern the communities of the disconnected pools. Therefore, we call for the development of novel tools to infer the ecological status of disconnected pools, as these habitats will become more abundant and widespread in the future.

# Dammed Fish - Impact of structural and functional river network connectivity losses on fish biodiversity – Optimizing management solutions

Dr Paulo Branco[1], Dr. Florian Borgwardt[2], Dr. Jesse O'Hanley[3], Dr. Rui Figueira[4,5,6], Dr. Gonçalo Duarte[1], Dr, José Maria Santos[1], Dr. Pedro Segurado[1], Tamara Leite[1], Dr. Maria Teresa Ferreira[1]

[1]Forest Research Centre, Associate Laboratory TERRA, School of Agriculture, University of Lisbon, Lisbon, Portugal, [2]University of Natural Resources and Life Sciences, Vienna; Institute of Hydrobiology and Aquatic Ecosystem Management , Vienna, Austria, [3]Kent Business School, University of Kent, , UK, [4]Linking Landscape, Environment, Agriculture and Food (LEAF), School of Agriculture, University of Lisbon, Lisbon, Portugal, [5]Research Centre in Biodiversity and Genetic Resources (CIBIO/InBIO), School of Agriculture, University of Lisbon, Lisbon, Portugal, [6]Research Centre in Biodiversity and Genetic Resources (CIBIO/InBIO), University of Porto, Oporto, Portugal

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Biologist with special interest in Ecology. His researcher focuses on freshwater fish, river network connectivity and macroecological approaches to freshwater studies. Paulo leads a research line of river connectivity, developing new conceptual and practical tools. He is the CEO of the Associate Laboratory TERRA (Laboratory for the Sustainability of Land Use and Ecosystem Services) that integrates 5 research centers with more than 400 PhD researchers.*

The Dammed Fish project aims at assessing and proposing solutions and tools to inform the management of river network connectivity in order to improve fish biodiversity and enhance biotic quality in European rivers. To achieve this objective, the management of river network connectivity requires guidance to select the most appropriate options within the context of ongoing human activities. Dammed Fish adopts a European-wide basin scale approach to connectivity management for three different time periods, namely past, present, and future. The project is structured around five interconnected tasks, which include: (1) setting the scene by managing river network data and tools; (2) quantifying river network connectivity and disconnection; (3) assessing the impact of dams on freshwater fish distribution and biotic quality; (4) developing the RivOpt barrier connectivity enhancement management tool; and (5) promoting outreach and scientific literacy. These tasks are designed to evaluate how dams, both individually and in conjunction with other pressures, affect river network connectivity, biodiversity loss, species range contraction, and species turnover in riverine fish. We also assess how the impairment of connectivity due to barriers can interfere with environmental practices aimed at achieving the goals set forth in policies such as the Water Framework Directive. The results of this research will contribute to further studies and improved management of river network connectivity by developing three free tools: RivFish - which links fish data and river networks; RivConnect - which calculates basin-wide network connectivity; and RivOpt - which optimizes basin-wide connectivity management solutions while considering conflicting management goals.

# DAMOLAKE project preliminary results: stable isotopic signature (15N and 13C) in the food web of three lakes of different trophic state in Central Spain.

Dr JAVIER ARMENGOL DIAZ[1], Dr ERIC PUCHE[1,2], Dr. CARMEN ROJO[1], Dr MANUEL E MUÑOZ[1], Ms BELÉN ROGER[1], Mr PABLO GARCÍA[1], Dr SALVADOR SÁNCHEZ[2], Dr MARÍA A RODRIGO[1]
[1]University of Valencia, Valencia, Spain, [2]Museo Nacional de ciencias Naturales (CSIC), Madrid, Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Dr. Javier Armengol is a professor of ecology and his main line of research is freshwater zooplankton (rotifers, branchiopods and copepods). He currently belongs to the Limnology group of the Institute Cavanilles of Biodiversity and Evolutionary Biology (ICBiBE) of the University of Valencia, where he co-directs the Laboratory of Biogeography and Ecology of Aquatic Systems.*

DAMOLAKE project aims to addres the anaerobic oxidation of methane, coupled with denitrification, in lakes from two differentiated but complementary disciplines: one related with the functional approach of lakes, focused on biogeochemical processes and the other based on the effects on lake structure, centered on the responses of the food web. As a part of this second approach -food web characterization-; in winter and summer 2022, we studied the main constituents of the food web and their isotopic signature (15N and 13C) of three lakes, with a different trophic level (oligotrophic, mesotrophic and eutrophic), in the karstic system of “Lagunas de Ruidera Natural Park” (Castilla - La Mancha, Central Spain). In winter, the isotopic signature of 15N, ranged between 6.8 and 14.8 ‰, and, in summer, between 4.3 and 15.5 ‰. Averaged values for the different studied compartments were ordered as follows: Phytoplankton < Zooplankton < Sediment < Macrophytes < Macroinvertebrates < Fish. The isotopic signature of 13C ranged, between -40.9 and -5.8 ‰ in winter, and, in summer, between -39.5 and -11.2 ‰. Averaged values for the different studied compartments were ordered as follows: Sediment < Macrophytes < Phytoplankton < Fish < Zooplankton < Macroinvertebrates. The pattern of 13C in relation to the trophic level is not very clear; however, in general terms, 15N values were lower in the oligotrophic lake than in the meso and eutrophic ones.

# Defining river units for European-wide freshwater restoration targets

Gonçalo Duarte[1], Angeliki Peponi[1], Diogo Moreno[1], Tamara Leite[1], Florian Borgwardt[2], Sebastian Birk[3], Annette Baattrup-Pedersen[4], Pedro Segurado[1], Maria Teresa Ferreira[1], Paulo Branco[1]
[1]Forest Research Centre, Associate Laboratory Terra, School Of Agriculture, University Of Lisbon, Lisbon, Portugal, [2]Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria, [3]Faculty of Biology, Aquatic Ecology, University of Duisburg-Essen, Essen, Germany, [4]Department of Bioscience, Aarhus University, Silkeborg, Denmark

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Biologist with advanced studies in GIS, an MSc in Conservation Biology and a PhD in Freshwater restoration.*

*My research focus river restoration, freshwater fish ecology, spatial ecology and historical ecology concerning large-scale environmental processes and using ecological modelling.*

In Europe, rivers and wetlands are heavily impacted, thus it is critical to work towards restoration. The MERLIN project aims to “identify landscapes with high potential and priority for transformative restoration, particularly focusing on essential ecosystem services, biodiversity targets, and climate change mitigation”. To support this, river units were established for all European basins taking into consideration river network features (dendriticity, hierarchy, directionality). The goal was to aggregate river segments and their drainage area into units without upstream dependencies (small river units), connected by units associated with the main stem river segments and respective drainage areas of a basin (large river units). These units were created using the River Network Toolkit, taking advantage of well-known features of river networks such as Hack and Strahler values, upstream drainage area and upstream river length. Considering the EU Member States, in over 2 300 basins considered relevant at European-scale (Strahler value ≥ 3), more than 12 000 river units were established with an average size of around 400 km2 and river length close to 150 km. By aggregating river segments into these two types of riverscape units with considerable homogeneity that abide by freshwater ecosystem functioning, it will be possible to support the development of European-wide guidelines towards river restoration and management.

# Developing a field-based, rapid assessment of macroalgae for use by citizen scientists to describe eutrophication risk in rivers.

Miss Katrina Woodfield[1]

[1]Lancaster University, Lancaster, United Kingdom

2G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Final year Undergraduate student studying Environmental Science at Lancaster University. Collaborated with the Freshwater Biological Association and Ribble Rivers Trust on a dissertation project about water quality, freshwater macroalgae and citizen science.*

The involvement of citizen scientists in issues of water quality is acknowledged as an opportunity to increase both public engagement and spatiotemporal resolution of monitoring data. The Rapid Assessment of PeriPhyton Ecology in Rivers (RAPPER) is a method for evaluating the risk of eutrophication in wadable rivers, recognised for having potential application in citizen science. However, the use of a microscope is a barrier to adoption of the method by citizen scientists. A simplified, field-based version of RAPPER was developed with the aim of producing comparable results to the original method. The original and simplified RAPPER methods were trialled simultaneously at 19 sites across two sub-catchments of the river Ribble. Furthermore, Anglers' Riverfly Monitoring Initiative (ARMI) surveys were undertaken to investigate the potential for incorporating RAPPER with other rapid ecological assessments. The simplified and original RAPPER methods were highly comparable, attaining matching results at 95% of sites. By not using a microscope, the risk of false positive results was potentially increased, although further study is required to assess the uncertainty surrounding simplified RAPPER, especially in waters with very low alkalinity. No significant differences between ARMI score and the RAPPER eutrophication risk classification were observed, potentially due to the influence of longitudinal changes in river productivity. The RAPPER results were also compared with different Water Framework Directive classifications, but no significant associations were observed. Despite the poor relationships between RAPPER and other measures of water quality, the benefits of using rapid monitoring to supplement other datasets was recognised.

# Developing a new practical high quality pond creation programme for the Great Crested Newt (Triturus cristatus) in England: the NatureSpace District Licensing scheme

Dr Pascale Nicolet[1,4], Prof Jeremy Biggs[1,4], Dr Tony Gent[2,4], Prof Richard Griffiths[3,4], Dr Tom Tew[5], Ms Sarah Garret[5]
[1]Freshwater Habitats Trust, , United Kingdom, [2]Amphibian and Reptile Conservation, , , [3]University of Kent, , , [4]Newt Conservation Partnership, , , [5]NatureSpace, ,

4E_RS05_Small water bodies, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Pascale Nicolet is a Technical Director at Freshwater Habitats Trust and CEO of the Newt Conservation Partnership. She has over 20 years experience of the ecology and conservation of ponds and other freshwater habitats, with a special expertise in the ecology of temporary ponds and the creation of new ponds. She is a steering group member of the European Pond Conservation Network.*

In England the great crested newt (Triturus cristatus) is a strictly protected and widely distributed pond-breeding amphibian thought to be in long-term decline. Frequently impacted by built environment development (new housing, road building), site-based measures to mitigate development impacts on the species were demonstrated in the 2010s to be failing. As a result of this, new planning policies were introduced to encourage off-site pond and terrestrial habitat creation to address development impacts on great crested newt populations. In 2018 a private sector, local authority and NGO consortium comprising NatureSpace, English local planning authorities and NGOs Freshwater Habitats Trust and Amphibian and Reptile Conservation, established the great crested newt District Licensing scheme to run a pond and terrestrial habitat creation programme for great crested newts supported by compensation funds from developers. This programme has rapidly expanded to cover 20% of England, establishing a new pond creation mechanism for great crested newt conservation. The key features of the programme, now covering 70 local authorities, including: a landscape rather than site-based approach to compensation incorporating species distribution models to identify pond creation locations, application of extensive research experience of new pond design, payments to landowners to manage new ponds over 25 years and comprehensive post-construction pond monitoring. Since 2018, 252 new high quality ponds have been created of which 42% were colonized by newts in the first 4 years post-construction. Monitoring indicates that created pond occupancy rates are higher than regional and national occupancy levels over the same time period.

# Developing the evidence base for effective biosecurity of aquatic invaders within raw water transfers

Miss Zoe Cole[1], Professor Martin Tillotson[2], Miss Polina Nikova[1], Mr Alexander Donovan[1], Professor Alison Dunn[1]
[1]School of Biology, University Of Leeds, United Kingdom, [2]School of Civil Engineering, University of Leeds, United Kingdom
7D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Zoe Cole is a PhD student researching biosecurity of raw water transfers focusing on physical and chemical treatments which can apply to large scale raw water transfers alongside her case partner Yorkshire Water. Previously research during her masters focused on how temperature impacted upon the embryonic development of an invasive amphipod Dikerogammarus villosus and its native counterpart Gammarus pulex. Her interests include biosecurity, aquatic invaders and prevention of invasive alien species.*

The introduction and secondary spread of invasive alien species (IAS) negatively impact the environment, the economy and human health. The spread of aquatic IAS is primarily due to human facilitated pathways, including transport, trade, recreation. A further key pathway that has been identified is that ofraw (untreated) water transfers (RWT). RWT refers to movement of large volumes (1-5 Mega litres) of water from between different water sources (reservoir, lake or river), or from a source to a Water Treatment Works. RWT are essential to ensure that water companies can provide a consistent supply of water to domestic and industry customers. In the UK, The National Infrastructure Commission (NIC) has identified the need for a national transfer network in response to climate change which will lead to an increase of investment into new RWT networks. However, RWT pose a high risk of spreading IAS as water may be moved between different sources (e.g. reservoir chains) spanning different catchments, with RWT often peaking during summer drought periods. In the UK, The Environment Agency (EA) are working with UK water companies to prevent spread of IAS within both current and new RWT. Water companies have clear evidence based biosecurity protocols in place to prevent IAS spread via contamination of equipment and PPE. However, there is a need for research into biosecurity protocols that can be incorporated into RWT. We present evidence for the effectiveness of physical (hydrocyclone and screens) and chemical biosecurity protocols for RWT in reduction the risk of IAS spread.

# Dietary fatty acid transfer in pelagic food webs across a nutrient gradient of lakes in China

Mr Yinzhe Zhang[1,2], Prof. Jiashou Liu[1], Prof. Martin J. Kainz[2]
[1]Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, China, [2]WasserCluster Lunz – Biologische Station GmbH, Lunz am See, Austria

8C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

*Yinzhe Zhang, a PhD student from the Institute of Hydrobiology, Chinese Academy of Sciences, is currently on exchange as a guest researcher at WasserCluster Lunz, Austria. My area of research interest is nutrient flow in pelagic food webs in Chinese lakes, using fatty acids as dietary markers to explore the effects of temporal, spatial and environmental factors on dietary nutrient acquisition and retention in fish.*

Non-traditional biological manipulation is now widely used in China to mitigate the adverse effects of eutrophication, including stocking of filter-feeding fish, especially silver carp (Hypophthalmichthys molitrix) and bighead carp (Aristichthys nobilis). However, the acquisition and retention of dietary nutrients of filter-feeding fish across oligo- to hypereutrophic lakes remains unclear. In this field study, we investigated the pelagic food web and silver and bighead carps of four large lakes in China, which varied widely in geographic location and trophic gradients, and used fatty acids (FA) as diet markers from plankton to fish. Results reveal that macrozooplankton (>500 µm body size) retained less polyunsaturated FA (PUFA) than smaller zooplankton during summer in a hypereutrophic lake (Hulun Lake). Each size zooplankton of Hulun Lake had higher PUFA retention than in the oligo/meso- (Qiandao Lake), meso- (Bosten Lake), and eutrophic lakes (Liangzi Lake). Silver and bighead carp retained more long-chain PUFA (including arachidonic acid, eicosapentaenoic acid, and docosahexaenoic acid) from zooplankton in Hulun Lake, suggesting that higher trophic lake status results in higher retention of long-chain PUFA in these fishes. In the oligo/mesotrophic Qiandao Lake, bighead and silver carp had higher PUFA content than carps from more nutrient-rich lakes. Bighead carp had generally 1.5-3 times higher PUFA levels than silver carp, suggesting taxa-specific PUFA retention across this lake nutrient gradient. In conclusion, PUFA retention in zooplankton decreases with body size in these eutrophic systems and filter-feeding carp exhibited higher long-chain PUFA retention in highly eutrophic lakes.

## Different responses of biological structures and functions to hydromorphological restoration in streams

Miss Julia Pasqualini[1], Miss Christine Anlanger[1,2], PD Dr. Patrick Fink[1], Prof. Dr. Markus Weitere[1], Prof. Dr. Andreas Lorke[2], PD Dr. Mario Brauns[1]
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1C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Julia Pasqualini works at the Helmholtz Centre for Environmental Science in Magdeburg, where she investigates structural and functional responses of macro and microorganism to multiple stressors.*

Human activities have been altering the natural hydromorphology of streams causing a decrease in biodiversity and changes in ecosystem functioning. Stream restoration initiatives have been implemented worldwide, but it is unclear whether they are effective in restoring both biodiversity and functioning.
Here, we analyzed whether community structure and functional parameters respond similarly to stream restoration and weather both recover to their reference conditions. To do so, we measured structural attributes (e.g. macroinvertebrate and bacterial abundance, chlorophyll-a content, macroinvertebrate diversity) and ecological functions (e.g. nitrate and DOC uptake and food web structure) in a reference, an impacted, and a restored reach of a stream in Central Germany.
Our results show that the overall response of functionality to restoration was positive, though spatially heterogeneous, leading to a lack of significant differences between the impacted and restored sites. Contrary, structural attributes of macroinvertebrates (abundance and diversity) remain unaffected by restoration. Whilst restoration slightly increased chlorophyll-a content and lowered bacterial abundances compared to the impacted site.
When assessing whether functional and structural parameters recover to their reference state, we found an overall positive but not significant response of the structural parameters. While from a functional point of view, DOC uptake was significantly lower in the restored and impacted sites than in the reference one, suggesting that restoration efforts were not successful in restoring this function to its original levels. This study highlights that there are differences between the structural and functional responses to restoration and that restoration efforts should aim to restore both aspects.

# Disentangling molecular-based methods for river benthic diatom biomonitoring. Southern European rivers case study: WAT-DIMON project

Dr Juan Antonio Villaescusa Vinader, Dr Maria Jose Villena[1], Dr Antonio Picazo[2], Ms Athina Papatheodoulou[3], Dr Panayiota Pissaridou[4], Dr Marlen Vasquez[4], Dr Rosa Trobajo[5], Dr David Mann[5], Dr Vítor Gonçalves[6], Dr Antonio Camacho[2]
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1E_RS10_Biomonitoring, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*phD in aquatic microbial ecology in University of Valencia.*

*Specialist in genomics at Laboratorios Tecnológicos de Levante S.L. Spain*

The use of molecular techniques for river biomonitoring has become a reliable and cheaper alternative to traditional morpho-taxonomy methods. Thus, the use of river benthic diatom has shown promising results in different European regions, mainly due to their excellent ecological properties: high sensitivity, small and easy to process, availability of barcode database, etc.. The applicability of these molecular techniques on rivers of different biogeographic regions, from Mediterranean, Alpine, Atlantic and Macaronesian has been tested on the European WATDIMON project, showing here some of its conclusions. The obtained results are promising, showing a good correlation with the traditional approach. However, some discrepancies appeared between methods for some samples.  This problem can be related to incompleteness of barcode reference databases for southern European rivers; taxonomic discrepancies on cryptic species; heterogeneous number of gene copies between species, etc… In the case of databases, different responses have been taken (isolation and culture of missing diatoms, intercomparison between expert taxonomist to avoid wrong identifications, etc…). However, to obtain a more realistic relative abundance, a correction factor based on biovolume (CF) was applied. So, despite the differences obtained by both methods, the IPS correlation improved after the application of the CF, bringing the molecular data in line with the expected inventory values. In conclusion, although molecular methods provide an alternative approach to traditional methods, some improvements are needed: enrichment of DNA barcodes and the establishment of molecular reference values which could give a more taxonomy-free approach, like has been already tested in other regions.

# Disentangling the ecological complexity of "Mediterranean temporary ponds" for need-oriented restoration, conservation, and management practices.

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6B_SS18_Driving forward the network on the interpretation, conservation and management of temporary ponds, June 20, 2023, 4:15 PM - 5:30 PM

***Biography:***

*Biologist with ten years of professional experience in the conservation and management of Mediterranean ecosystems. PhD in Landscape Ecology (topic: EU Urban Green Infrastructure) from the University of Padova and Master in EU Policy Consultancy & Project Management from the Institute of European Studies of the University of Louvain. Manager of several EU-funded projects on restoration ecology, biodiversity conservation and governance of protected areas (LIFE17NAT/GR/000511 LIFE PRIMED, LIFE20PRE/IT/000007 NewLife4Drylands, LIFE20 NAT/IT/001468 LIFE SEEDFORCE, NaturAL IPA 2013 EuropeAid/135803/L/ACT/AL).*

Wetlands are considered among the most diverse and fragile ecosystems on the planet. Mediterranean temporary ponds are of particular significance as featured by a peculiar alternation of desiccation and submergence phases. In Europe, they are among the most degraded and threatened habitats, with an "unfavourable" conservation status according to Art. 17 of the EU Habitats Directive (92/43/EEC). In addition to direct and indirect human-related pressures such as climate change, eutrophication, trampling, and inappropriate water and landscape management, mistakes in habitat interpretation represent another conservation problem. In the framework of an EU-funded project, LIFE PRIMED (LIFE17NAT/GR/000511), an interdisciplinary and multi-scale study was carried out in the Lazio region (Italy) to improve the ecological understanding of a cluster of Mediterranean temporary ponds located in the Natura 2000 sites of Bosco di Palo Laziale and Bosco di Foglino (Rome). Field surveys, laboratory analysis and data processing were implemented to determine the patterns, processes and interdependencies of both the biotic and abiotic domains. Factors considered were the vegetation structure and composition, chemical and physical properties of soil, micro-topographic characteristics and climate proxies. Such an integrated approach allowed for a finer clusterisation of surveyed coenoses and made possible the identification of the most significant environmental drivers influencing the configuration of the habitat, ultimately determining its ecological niche. Results confirm how in ecology, the bio-physical-chemical components are intimately associated with each other and remind us that the ecosystem-based approach is the best way we have to face the restoration, conservation and management of critically endangered nature.

# Distribution and abundance of microplastics along rivers are determined by land uses and riverbed characteristics.

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7E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*I'm a Ph.D student at the University of Barcelona. My research focuses in the effect of environmental and anthropogenic drivers on diatom communities in high mountain mires by using taxonomy and metabarcoding techniques to identify species changes. We use fundamental approaches to determine species diversity, community dissimilarity, and biogeography patterns in conservation areas in high mountain mires in the Iberian Peninsula. I also have experience working on microplastics contamination in rivers in Catalonia.*

Microplastics in freshwater ecosystems have gained attention for their potential harm to biodiversity. Rivers are highly complex and dynamic ecosystems and act as conveyor belts that transport particles and organic matter from the headwaters through the watershed. Few studies consider the relevance of rivers on the transport and accumulation of microplastics downstream. Urban land uses and WWTPs increase plastic contamination risk because they can concentrate microplastics in their effluents. In turn, hydromorphological characteristics can play an important role in microplastics' transport. The goal of this study is to determine land uses and river hydromorphology relationship with the abundance and spatial distribution of microplastics using a recent and simple detection technique by Nile red staining. We studied two watersheds with contrasting land uses and anthropic pressure (Besòs and Tordera, Central-East Catalonia). Microplastic particles were detected in all sampling sites, in both water (4.40 ± 3.90 particles/L Besòs; 2.61 ± 1.78 particles/L Tordera) and sediments (58.04±52.64 particles/g Besòs; 55.78 ± 21.29 particles/g Tordera). Microplastics in sediments have a positive relationship with the size range 1.0-0.5 mm of granulometry (R2=0.14, p=0.050), and microplastic in water increased significantly with the percentage of urban land use (R2=0.18, p=0.030). The WWTPs show significant relation with the abundance of microplastics. In conclusion, there are contrasting behaviors for suspended and sedimented microplastics particles: those flowing with water are related to land uses, whereas those stranded in sediments are related to riverbed granulometry. All our results suggest that multiple factors are controlling microplastics distribution along the rivers.

# Distribution and vulnerability to climate change of aquatic macroinvertebrates in the Canary Islands: the BIOACUANA project.

José María Fernández-Calero[1,2], Raúl Acosta[1,3,4], Jérôme Latron[4], Mariella Olcese-Rojas[10], Brent Emerson[7], Francesc Gallart[4], Marcos González[6], Maria Soria[1,2,9], Núria Bonada[1,2], Núria Cid[1,5], Pau Fortuño[1,2], Paula Arribas[7], Pilar Llorens[4], Virgilio Hermoso[8], Miguel Cañedo-Argüelles[1,3,4]

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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am a PhD student at the University of Barcelona. My research is focused on the community ecology of macroinvertebrates and the main factors that shape these communities in temporary rivers, typical of the Mediterranean region. I am passionate about aquatic insect biology and taxonomy especially the groups of flies and stoneflies, although all of the groups fascinate me.*

Freshwater biodiversity is disappearing at an accelerated rate as a result of human pressures. This situation is especially relevant in oceanic islands, where native communities are characterized by high levels of endemicity but also high vulnerability to human impacts. Besides, the knowledge we have on freshwater biodiversity in islands is much lower than in continental areas. Taking all of this into account, it is possible many undescribed freshwater species might have been already lost. The BIOACUANA project focuses on the aquatic macroinvertebrates of three of the Canary Islands (Tenerife, La Palma and La Gomera) that are characterized by severe water scarcity associated to with climate change and a strong human water demand (e.g. banana plantations). The main goals of this project are: 1) to hydrologically characterize the presence/absence of water in the sampled streams of the islands; 2) to produce basic information on the taxonomic and genetic diversity of aquatic macroinvertebrates; 3) to determine the vulnerability of the species to global change; and 4) to identify priority areas for the conservation of aquatic macroinvertebrates insect biodiversity using systematic planning tools. Thus, this project will help improve basic knowledge on the aquatic macroinvertebrate fauna of the Canary Islands, which includes a large number of endemic and vulnerable species. In addition, this project will promote conservation strategies in the face of global change. In this communication, we will provide an overview of the project and show some preliminary results from 17 sampling reaches in the first sampling campaign conducted in November 2022.

# Diurnal Variations in GHG Fluxes from Peatland Pools

Mr John King[1], Dr Peter Gilbert[1], Dr Roxane Andersen[1], Dr Amy Pickard[2], Dr Daniel Mayor[3]
[1]Environmental Research Institute, University of the Highlands and Islands, Thurso, United Kingdom, [2]Centre for Ecology & Hydrology, Edinburgh, United Kingdom, [3]University of Exeter, Exeter, United Kingdom

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*

*John is a final year PhD researcher at the University of the Highlands and Islands Environmental Research Institute, based within the institute's Carbon, Water and Climate research theme. His research seeks to quantify GHG fluxes from freshwater pools in the blanket bogs of the Flow Country in Northern Scotland, and identify the dominant processes controlling these fluxes. Particular aims of the project are to study diurnal and seasonal variability of fluxes and and assess the impact of the climate gradient across the region. This work will improve understanding and modelling of a critical component of carbon cycling in wetlands.*

Freshwater pools are a characteristic feature of northern peatlands, often forming complex systems, with widely differing pool morphologies. These pools receive large inputs of dissolved organic carbon (DOC) from the surrounding terrestrial environment and, as a result of biogeochemical processing within the pools, have been found to be net emitters of greenhouse gases (GHGs). The GHG fluxes from peatland pools are known to vary diurnally, however the magnitude of these variations and the drivers behind them remain poorly understood. Previous studies have mainly involved daytime only measurements in the summer season, primarily driven by logistical necessity. This study examined diurnal variations in $CO_2$ and $CH_4$ fluxes from a selection of peatland pools in the blanket bog of the Flow Country, Europe's largest blanket bog, with sampling conducted across different seasons and including different pool size categories. The results suggest that there is notable variability in the fluxes from peatland pools across daily cycles. In general, daytime only measurements underestimated actual $CO_2$ fluxes (daytime measurements were up to 10 times lower and in some cases showed $CO_2$ uptake, while the daily average was an emission), while overestimating $CH_4$ fluxes (by up to 2.1 times). Further variability was found seasonally and there were clear differences found between different pool sizes. Monthly spot measurements at similar pools in the Flow Country were used to investigate the implications of these findings for calculating annual flux values from peatland pools, further highlighting the importance of including temporal variability when modelling the carbon balance of peatlands.

# Diversity of bacterial communities associated with Spongilla lacustris (Linnaeus, 1759) specimens inhabiting the Pasvik river and Kevo Lake

Dr Carmen Rizzo[1,2], Dr Gabriella Caruso[2], Giovanna Maimone[2], Marco Bertolino[3], Maria Papale[2], Alessandro Ciro Rappazzo[2,4], Rosamaria Soldano[2,5], Stefania Giannarelli[6], Paul Eric Aspholm[7], Maurizio Azzaro[2], Angelina Lo Giudice[2]
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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I'm Researcher at Stazione Zoologica Anton Dohrn, Messina. My main research activities are focused on microbial ecology and marine biotechnology. I'm interested in studying prokaryotic populations in aquatic temperate and extreme environments, their structure and distribution related to environmental conditions and pollution, and their biotechnological potential in bioremediation, medical, pharmaceutical fields.*

The associations between microbial populations and porifera are the topic of several studies, driven by the interest of a better understanding of dynamics in these relationships. It has been proven that sponges tend to actively select the microbial components for a closer relationship, and that microbial communities play pivotal roles in the wellbeing of their hosts. Freshwater sponge microbiomes have been scantly explored, especially in the Arctic areas. Within the INTERACT projects BIP and CIRCE (Grant Agreement EU2020 no. 730938) sponge specimens of Spongilla lacustris (Linnaeus, 1759) were collected from the Pasvik River (Norway) and the Kevo Lake (Finland), both in the Northern Fennoscandia. Physical-chemical parameters were measured at sampling the time. Here we aim at comparing the microbial communities associated with the two sponges species, with the intention of highlighting the differences between the microbial populations and relating them to the different environmental conditions. Microbial community diversity was investigated by next generation sequencing (NGS) after DNA extraction and amplification with standard universal primers. Analysis of biomass, live/dead cells, microbial enzymatic activities (leucine aminopeptidase, LAP, beta-glucosidase, GLU, alkaline phosphatase, AP) was additionally carried out. Proteobacteria (Alpha- and Gammaproteobacteria) predominated in both the sponge-associated microbial communities, but some differences at phylum and genus level were observed in the samples, probably related to the different origin of the sponges. The occurrence of high percentage of chloroplast was observed in both S. lacustris bacterial sequences. Dataset of diversity, enzymatic values, cellular abundance and morphological properties is discussed in relation to the physical-chemical parameters.

# Diving into the thermo-mineral springs: meta-community dynamics in extreme ecosystems

Pierre Gosseaume[1,2], Aude Beauger[2], Olivier Voldoire[2], Elisabeth Allain[2], Carlos Wetzel[3], Dr Aurélien Jamoneau[1]

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4E_RS05_Small water bodies, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Aurélien Jamoneau is a researcher at INRAE institute in France and is studying aquatic plant community ecology from local to global scales. He is particularly interested in understanding processes governing species assemblages in space and time, including both influence of abiotic and biotic factors.*

Thermo-mineral springs are specific ecosystems with extreme physicochemical conditions. Scattered throughout the landscape, these springs offer interesting models to study meta-community processes for small organisms living in these particular habitats. In this study, we used benthic diatoms communities to assess the importance of habitat size, habitat isolation, spatial configuration, physico-chemical and climatic conditions in structuring their assemblages. We sampled 54 thermo-mineral springs located in the Massif Central in France, where we measured 42 morphological, chemical and climatic parameters. We tested the species-area relationship for all springs and for several group of springs classified according to their environmental and hydrochemical composition. We also tested the distance-decay hypothesis and examined the relationships between environmental variables and local diversity (species richness, Shannon and Piélou indices). We finally evaluated the relative importance of spring morphology, water chemistry, climate and space on species composition. We failed to find any significant species-area or as well as any significant distance decay relationships, suggesting that ecological processes related to regional effects are of minor importance for benthic communities of thermo-mineral springs. However, environmental variables strongly explained species diversity and composition, emphasizing the well-known dependence of benthic diatoms to local environmental conditions. Yet, we found that some spatial structure may explain part of the species composition and still needs to be further investigate. Finally, this study provides new insights into the functioning of diatoms communities in thermo-mineral springs and should contribute to the conservation of these ecosystems at the regional scale.

# DNA metabarcoding enhances detection of change from streams to landscapes

Dr Alex Bush[1], Dr Wendy Monk, Dr Zacchaeus Compson, Dr Nellie Gagne, Dr Royce Steeves, Prof. Mehrdad Hajbabaei, Dr Teresita M. Porter, Prof. Donald Baird
[1]Lancaster University, Lancaster, United Kingdom
1E_RS10_Biomonitoring, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a community ecologist interested in the scaling of biodiversity monitoring to support strategic decision making at landscape scales. I specialise in the integration of molecular methods, autmated image processing, acoustics and remote sensing.*

DNA metabarcoding has the capacity to improve the quality and utility of ecological data by changing the statistical properties of the communities we are describing. By standardising identification, improving taxonomic resolution and increasing species detectability per sample we are better able to describe the dynamics of communities, or even metacommunities at different scales. Here we provide an overview of three studies demonstrating the utility of metabarcoding for freshwater biomonitoring across Atlantic Canada. At the largest scale, we compare the performance of reference condition models using traditional and DNA-based sampling to identify sites that are potentially degraded. Although DNA metabarcoding data is conservatively interpreted as evidence of presence/absence only, enhanced detection and improved taxonomic resolution mean DNA-based models could explain more turnover among reference communities, and hence better predict when sites were likely to be impaired. While abundance data may not be necessary for bioassessment, there are applications where responses within species ranges are of interest. We therefore demonstrate how changes in abundance across a whole community can be studied simultaneously using DNA metabarcoding , first in a single stream, and then across the catchment. In the former we detected changes in abundances due to seasonal phenology and predator exclusion and then in response to water temperature and elevation in the spatial study. Although uncertainties in species specific abundances are high, cross-community estimates of sensitivity such as these could be used to develop more refined interpretation of the regional bioassessment model in the future.

# DNA-based river biomonitoring, biodiversity mapping and citizen science networks: lessons from Canada's STREAM project.

Dr Donald J Baird[1], Ms Tamanna Kohi[2], Ms Carley Maitland[2], Ms Raegan Mallinson[3], Dr Katie M McGee[2], Dr Wendy A Monk[1], Dr Teresita M Porter[2], Mr Michael T G Wright[2], Dr Mehrdad Hajibabaei[2]
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2G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Donald Baird is a Senior Research Scientist with Environment and Climate Change Canada's Water Science and Technology Directorate. He is also a Visiting Research Professor at the Canadian Rivers Institute, University of New Brunswick. His research focuses on river and wetland biomonitoring, with a strong focus on biodiversity modelling and ecological risk assessment. He has pioneered the use of environmental DNA in freshwater biomonitoring, and, most recently, to the challenge of rewilding damaged watersheds.*

Given its large land area and significant remoteness, Canada represents a major challenge for river monitoring. One solution has been the development of partner-based monitoring networks such as the Canadian Aquatic Biomonitoring Network (CABIN) which can deliver national training for sample collection, with community-based monitoring groups playing an increasingly prominent role. The Sequencing the Rivers for Environmental Assessment and Monitoring (STREAM) project is expanding this approach by employing environmental DNA to support a better understanding of the health of river systems across Canada. This project links citizen scientists, including Indigenous Groups, and NGOs with university and government scientists. The project includes components on outreach and recruitment, training and dissemination of results obtained from sequence data, and allows the rapid dissemination of watershed biodiversity reports with a target turnaround time of ~ 2 months. This Biomonitoring 2.0 approach eliminates the scientific data bottleneck for consistent identification of freshwater benthic macroinvertebrates. Freshwater macroinvertebrates, due to their trophic position and feeding habits, are natural environmental samplers, and thus multi-marker metabarcoding can support detection of diatoms and vertebrates from the same kick-net samples --allowing simultaneous monitoring across taxon groups, delivering novel data products such as trait and trophic network analyses. Here we discuss how STREAM can provide a model for river monitoring on a global scale. Our approach is a gateway to monitoring that moves beyond bioindicators, integrating 'omics methods to extract functional insights, assess interactions, and supports predictive modelling.

# Do agri-environment schemes deliver for pond biodiversity?

Mr David Morris[1], Miss Penny Williams[1], Mr Peter Scarlett[2], Dr Cedric Laize[2], Dr Ruth Hall[3]
[1]Freshwater Habitats Trust, , United Kingdom, [2]UK Centre for Ecology and Hydrology, , United Kingdom, [3]Natural England, , United Kingdom

2B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***

*David Morris is a plant ecologist with a particular interest in freshwater and wetland plants, and wetland eco-hydrology and vegetation. He has a special interest in the ecology and conservation of alkaline fens, but is widely involved in other kinds of freshwater ecosystems. At Freshwater Habitats Trust, David carries out research into freshwaters, such as surveys of ponds and wetlands, and he coordinates a range of conservation projects in England and Wales. David is also very much involved in citizen science aspects of plant and habitat conservation, both in the freshwater and terrestrial realms, professionally and voluntarily.*

For decades UK governments have invested in schemes to improve farmland biodiversity, including measures aimed at ponds. In this talk we present the results of the first survey of ponds in agri-environment schemes in England, carried out in 2021 by Freshwater Habitats Trust, Centre for Ecology and Hydrology, and Natural England. We surveyed 120 randomly selected ponds included in an Environmental Stewardship Scheme, recording plants and a range of environmental variables. Pond quality was assessed using the Predictive System for Multimetrics (PSYM), which compares against a predicted 'reference' state. Comparison with other survey data showed that agri-environment ponds were four times less likely to be degraded than other ponds in the countryside. Despite this only a third of ponds were of the highest quality. On average, ponds had ~75% of the number of submerged and emergent plant species and 50% of the number of uncommon plants that would be expected. There was widespread evidence of eutrophication, and invasive non-native plants were found in just over 20% of ponds. The most important factors explaining variation in quality were location in a protected area; geographical location, with quality declining northwards and westwards; water source, with quality greater when fed by groundwater; shade from trees, heavy shade being associated with poorer quality; and, surrounding land use, with quality greater where there was a greater cover of e.g. wetlands and poorer where a higher proportion of arable/urban land. Our results have implications for how future schemes could be significantly improved to benefit pond biodiversity.

# Do benthic algal mats act as a buffer for periphyton species during stressful abiotic conditions?

Mr Daniel Zamorano[1], Dr Travis Ingram[1], Prof Christoph D Matthaei[1]
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9E_RS03_Microbial ecology in freshwaters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*

*Daniel Zamorano was born in Chile in 1990. He grew up in a small house in Chile's capital, Santiago, sharing the house with his large family, including parents, two siblings, grandparents, and his aunt. After getting a government scholarship, Daniel was able to enter the university, where he showed an early interest in environmental science and ecology. After 8 years of science work in Chile, he was accepted as a PhD student in the Zoology Department at the University of Otago in 2020 and moved to Dunedin with his wife.*

In freshwater ecosystems, certain periphyton species can modify their microhabitats by generating a three-dimensional “algal mat”. Thick algal mats can change periphyton community composition, increase nutrient fixation, and reduce risk of detachment. Despite this evidence, the role of benthic algal mats has not been evaluated in the context of metacommunity frameworks. Further, most studies on algal mats focused on the invasive diatom Didymosphenia geminata, and “normal” periphyton mats remain understudied. To help address these knowledge gaps, we investigated to which extent algal mats can act as a buffer for species during stressful abiotic conditions. First, we exposed three sets of ceramic tiles in a moderately polluted source river for 4 days, 2 weeks or 4 weeks. We then re-located these tiles to 12 receiving rivers in three pollution categories (low, moderate, high). After 4 weeks, we collected all tiles and evaluated mat volume and the full periphyton community on each tile. After translocation, tiles pre-colonized for 2 weeks and 4 weeks showed significantly higher ash-free dry mass than tiles pre-colonized for 4 days or non-precolonized tiles exposed for 30 days in the receiving rivers. These results suggest that, despite the change in their environment, communities with pre-existing thicker algal mats were able to retain these, due to being more resilient to the new conditions. Taxon-specific responses will be analysed to evaluate the community-composition patterns driving this biomass pattern. Our initial findings suggest that species interactions within algal mats can affect metacommunity processes, by allowing survival under new environmental conditions.

# Do different sediment preparation approaches impact zooplankton communities in mesocosm studies?

Mrs Katarzyna Brzozowska-Wojoczek[1], Mrs Anna Arendarczyk[1], Mrs Ewa Nierzędska[1], Mrs Inga Mrzyk[1]
[1]Łukasiewicz Research Network – Institute Of Industrial Organic Chemistry, Pszczyna, Poland
Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Katarzyna Brzozowska-Wojoczek is a part of Ecotoxicology Research Group at Łukasiewicz Research Network – Institute Of Industrial Organic Chemistry. Deputy Head of the Laboratory of Aquatic Organisms Toxicology.*

The outdoor mesocosm system is a useful risk assessment tool that, studies the natural environment under controlled conditions. It allows understanding and predicting what may occur in the natural environment after pollution or climate change. However, a big challenge is how to design a sufficient environment, as close as possible to imitate the natural conditions. Creating the right sediment structure is crucial for making a suitable habitat for animals and plant growth. The aim of the study was to compare the zooplankton community composition present in two types of mesocosm tanks. For this purpose, two approaches to tank preparation were tested. The first were tanks with natural sediment originating from a pond. The second were tanks with artificial soil (a composition of mixed sand, peat, and agricultural soil) with a small layer of natural aquatic sediment. The study was carried out in 6 artificial water tanks, made of acid-resistant stainless steel with a total volume of 1700 L. The tanks were settled in the ground, in an open space area without shade, and remained uncovered throughout the test period. The test was carried out in a natural daily lighting cycle and temperature period. For qualitative analysis, the recorded planktonic animals were identified to the level of species or genus (Rotifers, Copepods, and Cladocerans). For the identification and counting of zooplankton species, samples were microscopically analyzed in the Kolkwitz chamber.

# Do the biology recover in Europe's rivers and lakes?

Dr Anne Lyche Solheim[1], Dr Jan-Erik Thrane[1], Dr Jannicke Moe[1]
[1]Norsk institutt for vannforskning (NIVA), Oslo, Norway

5B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Anne Lyche Solheim works as a chief scientist at the Norwegian Institute for Water Research in Oslo Norway. Her main expertise is on impacts of nutrient enrichment and climate change on harmful algal blooms in lakes. She has worked for many years with European assessments related to the EU Water Framework Directive, focusing on ecological status in lakes and rivers. An important part of her work is to develop freshwater biological indicators for EEA within the European Topic Centre for Biodiversity and Ecosystems. These indicators can also be used as essential biodiversity variables as they capture floristic and faunistic changes.*

The objective of the EU Water Framework Directive to achieve good ecological status in rivers and lakes by 2015 has not yet been achieved. More than half of Europe's rivers and lakes are still in moderate or worse ecological status. Trends are not easy to find if looking only at changes in status class. However, analyzing ecological quality ratios (EQR), trends may be detected even within a status class using EQR-data for single biological quality elements reported annually to the European Environment Agency (EEA) from many countries in Europe. A trend analysis of these data show significant increase of EQR-values during the period 2015-2020 for the majority of rivers and lakes that were in poor or bad ecological status in 2015. Increasing EQR-values were found for all the four biological quality elements with sufficient data for trend analysis: phytobenthos and benthic invertebrates in rivers and phytoplankton and macrophytes in lakes. For water bodies in high, good or moderate status in 2015 little change in EQR-values was found in most of the water bodies, and almost the same number of water bodies showed increasing or decreasing trends. These results indicate that the biology is slowly recovering in the most deteriorated water bodies.

# Does niche overlap predict stressor interactions on community composition?

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1C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Bertrand Laloux is an ecotoxicologist and product stewardship specialist employed by Albemarle Corporation, a global chemical company headquarted in Charlotte, NC, USA. In addition to his professional activities, he is a scientific collaborator at the Research Unit in Environmental and Evolutionary Biology (URBE), University of Namur.*

Environmental protection commonly consists of extrapolating effects of single stressors on single populations to the whole community. Whether or not there are integrative community-level variables that predict stressors interactions on community composition is therefore an important question. Here, we propose niche overlap as a measure of competition intensity. We simulated the exposure to multiple chemical stressors in communities competing for resources. We defined synergy among stressors in the event when a given species goes extinct when exposed to a multiple-stressor treatment but survives in its corresponding single-stressor conditions, and conversely for antagonism. Our results suggest that: (1) the probability of interactive effects decreases with the number of stressors; (2) the probability of synergistic effects tend to increase with increasing niche overlap at low stress levels, while this trend reverses at higher stress levels; (3) the most sensitive species are more prone to face synergistic interactions.

# Does the biodiversity of urban freshwaters matter?

Dr Maria João Feio[1], Dr Sónia RQ Serra[1], Prof Salomé FP Almeida[2], Prof Jaime Ramos[1], Prof Paulo Silveira[3], Dr Carlos Alexandre[4], Dr Sílvia Pedro[4], Carolina Campos[2], Jorge Santos[1], Dr Zara Teixeira[1], Dr Ana R Calapez[1]
[1]University of Coimbra, FCTUC/DCV, MARE, ARNET, Coimbra, Portugal, [2]Department of Biology, GeoBioTec, University of Aveiro, Aveiro, Portugal, [3]Department of Biology, CESAM, University of Aveiro, Aveiro, Portugal, [4]MARE, ARNET, University of Évora, Évora, Portugal

5A_SS08_Freshwater ecosystems and urbanization – is the sustainable development of cities really possible?, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Maria João Feio is Principal Researcher at University of Coimbra and MARE, Portugal with a PhD in Biology, specialization in Ecology (2005). Her research is focused on the ecological assessment of rivers through functional and structural approaches, environmental policy on freshwaters, ecology and conservation of urban ecosystems and their ecosystem services, and the link between ecosystems health and human health. She coordinates the Horizon Europe project OneAquaHealth - Protecting urban aquatic ecosystems to promote One Health (2023-2026) and is responsible for the UC team in the H2020 project PHArA-ON - Pilots for Active and Health Ageing (2019-2024).*

The rehabilitation of urban freshwaters is presently recognized as interesting for cities in developed countries. Yet, actions are mainly aimed at developing riverside parks and promoting the aesthetics of urban neighborhoods, rather than protecting the health of the ecosystem. This is aggravated by the widely held view that urban ecosystems lack a relevant biodiversity. Here we aimed to understand how urbanization affects the biodiversity of urban stream ecosystems, from aquatic to terrestrial components, and what value these ecosystems have for the conservation of global biodiversity. We used the urban catchments of the city of Coimbra, Portugal, as a case study, and assessed nine urban streams, covering an urbanization gradient. The urban catchments held many taxa (ca. 600 species so far), including endemic species of mollusks and plants and sensitive invertebrates of Plecoptera and Trichoptera orders. Yet, Beta diversity was high (ca. 40%) with over 150 species being found at only one site, and a high number of non-native and invasive species. Also, many atypical species from the riparian vegetation or river ecosystems of the region were found (reaching 80% of the taxa of a site) leading to what can be considered novel ecosystems. Species diversity was correlated with urbanization level. Urban parks had also a low biodiversity while less managed streams had the highest diversity. Our results highlight the need of defining better strategies for the management and conservation of urban aquatic ecosystems.

# Drivers of amphibian richness in European ponds

Dr Alejandro Lopez[1], Dr. Lluis Benejam[1], Dr. Dani Boix[2], MSc. Lars Briggs[3], Dr. Maria Cuenca-Cambronero[1], Dr. Thomas Alexander Davidson[4], Dr. Luc De Meester[5,6,7], MSc. Julie Fahy[8], Dr. Pieter Lemmens[5,6], Dr. Beatriz Martin[9], Dr. Thomas Mehner[6], Dr. Beat Oertli[8], Dr. Marzenna Rasmussen[4], Dr. Carl Sayer[10], Dr. Sandra Brucet[1,11]
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4E_RS05_Small water bodies, June 20, 2023, 10:30 AM - 12:00 PM

***Biography:***
*PhD in Ecology by the University of Girona. I am interested in freshwater ecology, conservation and herpetology.*

The declining populations of native amphibian species in Europe, with nearly a quarter of them at risk of extinction, highlight the urgent need for effective conservation and management actions. Small standing waterbodies, such as ponds, play a critical role in the survival of amphibians as they offer a variety of habitats that are essential for amphibian breeding, feeding, and shelter. However, ponds remain largely neglected in current water, nature, and conservation policies. The present study aims to identify key drivers for variation in amphibian richness at the spatial scale of Europe. For this purpose, we conducted a comprehensive ecological characterization of over 180 ponds in six European countries along gradients of land use intensity, and simultaneously assessed the amphibian community characteristics in all investigated ponds utilising environmental DNA. By using general linear models, we found that latitude, anthropogenic impacts (e.g. eutrophication), and local pond characteristics are the primary factors explaining amphibian richness. Our results suggest that protected ponds subject to appropriate management practices are more likely to have a higher amphibian richness, whereas more eutrophic and deeper ponds, which often harbor fish, were less likely to have a rich amphibian community. Our results highlight the importance of conservation efforts focusing on reducing anthropogenic stressors, such as pollution and habitat destruction, to prevent the extinction of vulnerable amphibian species.

# Drivers of size distribution and diversity of the invasive fish Gambusia holbrooki in coastal Mediterranean wetlands (Valencia, Spain)

Ms CLAUDIA M RODRÍGUIEZ-SIERRA[1,2], Dr. MARÍA ANTÓN-PARDO[1], Ms. CRISTINA RIVERA[1], Dr JAVIER ARMENGOL DIAZ[1]

[1]University of Valencia, Valencia, Spain, [2]Universidad Surcolombiana, Neiva, Colombia

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*

*Dr. Javier Armengol is a professor of ecology and his main line of research is freshwater zooplankton (rotifers, branchiopods and copepods). He currently belongs to the Limnology group of the Institute Cavanilles of Biodiversity and Evolutionary Biology (ICBiBE) of the University of Valencia, where he co-directs the Laboratory of Biogeography and Ecology of Aquatic Systems.*

Body size is a key trait in organisms, since it can reflect ecosystem processes or limitations in growth, and at the same time, it can determine the functional role of the organism in the ecosystem. In populations of the same species, size distribution and diversity could be influenced by environmental factors, such as availability of resources or environmental stressors that constraint the growth. Gambusia holbrooki is an invasive fish species that has a wide distribution in european wetlands, where it has displaced autochtonous species. It presents a high tolerance to a great range of environmental conditions (trophic level, salinity). The objective of this work is to study the size distribution and diversity of G. holbrooki, and analyze the main drivers of these variations in size. With that aim, different stations were seasonally sampled in 6 coastal Mediterranean wetlands (Eastern Spain) along a year. These wetlands, where G. holbrooki, was the dominant fish (99 % of the catches) in handnet caughts presented variations in salinity, trophic level or anthropogenic impact. Number of caught individuals, at the different wetlands, ranged from 51 to 235; and individual standard length was between 0.6 to 4.5 cm. Size diversity, an adaptation of Shannon-Weiner diversity index for a continuous variable, had a minimum value of -0.5, and a maximum of 2.5.

# Drought refuges, refugia and flow-regime change in southwestern Australian streams: the ghost of future present.

Dr Nicole Carey, Dr Edwin Chester, Prof. Belinda Robson[1]
[1]Murdoch University, Perth, Australia
1A_SS14_Drying rivers in a time of global change, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Belinda Robson has been a freshwater ecologist in Australia for longer than she'd like to admit. Her interests these days focus on climate change impacts and adaptation for freshwater invertebrates at population and community levels and she supervises Honours and PhD students in these areas. Belinda is also Editor in Chief of Freshwater Biology (the top ranked freshwater ecology journal globally). She is an academic who teaches freshwater ecology & management and climate change adaptation at Murdoch University in Western Australia. She was the 2021 recipient of the Hilary Jolly Award from the Australian Freshwater Sciences Society.*

In drying landscapes, drought refuges and evolutionary refugia are expected to become critical for conserving freshwater biodiversity. Southwestern Australia (SWA) has already experienced widespread loss of perennial streams due to climatic drying. We characterised drought refuges in formerly-perennial streams in a forested headwater catchment impacted by severe drying, where most streams are now intermittent, to determine their contribution to species persistence in the landscape and community recovery. Refuges sampled included small spring-fed pools, perched receding pools and subterranean refuges associated with granite inselbergs; no hyporheos was present. Dry sediments were collected for rehydration. Refuge types had very different invertebrate assemblages: spring-fed refuges supported several locally-endemic species, but perched pools were dominated by opportunistic colonists. Taxa found aestivating in dry sediments included adult Coleoptera and larval Chironomidae. Inselberg springs supported small populations of endemic Trichoptera and Ephemeroptera and are a potential subterranean evolutionary refugium for an endemic amphipod. Despite the diversity of species found, dry season refuges did not contribute significantly to community recovery. Instead, aerial recolonisation from perennial streams was the primary source of recovery. The existence of both perennial streams and drought refuges is under threat from intensifying climatic drying. Continued losses will result in landscape wide reductions in diversity as colonisation sources are lost, because there are no known evolutionary refugia present in this landscape. Identification and protection of potential evolutionary refugia is therefore urgent for regions facing drier climates, because they will become critical reservoirs of freshwater biodiversity as global warming progresses.

# Drugging the environment: enantioselective toxicity of amphetamine (AMP) in Daphnia magna

Gonçalo Duarte[1,2], Ana Rita Pimentão[1,2], Pedro Costa[1,2], Cláudia Ribeiro[3,4], Bruno Castro[1,2]
[1]CBMA - Centre of Molecular and Environmental Biology / ARNET - Aquatic Research Network, University of Minho, Braga, Portugal, [2]IB-S - Institute of Science and Innovation for Bio-Sustainability, University of Minho, Braga, Portugal, [3]TOXRUN-Toxicology Research Unit, University Institute of Health Sciences, IUCS-CESPU, CRL, Gandra, Portugal, [4]Interdisciplinary Center of Marine and Environmental Research (CIIMAR), University of Porto, Matosinhos, Portugal

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Rita Pimentão is a PhD student, funded by FCT, at the University of Minho. Completed a Masters in Ecology and a Degree in Biology, at the University of Minho. Currently her interests are focused on ecotoxicology, host-parasite interactions, leaf litter decomposition process and fungicide contamination. During the initial training, acquired experience in the maintenance of freshwater aquatic organisms (invertebrates, zooplankton, microalgae), as well as in the evaluation of the effects of stressors through toxicity tests involving these organisms. During her international internship, she acquired experience participating in fieldwork involving aquatic ecosystems, collecting and processing samples of water, sediment and organisms.*

Amphetamine (AMP) is a chiral psychoactive substance used as a recreational drug and in the treatment of various disorders, and it exhibits enantioselective pharmacological activity. AMP has been detected in wastewaters and surface waters and can occur as enantiomeric mixtures, but little is known about its environmental risk and potential enantio-dependent toxicity to aquatic organisms. The goal of this study was to evaluate AMP toxicity and its potential enantioselectivity on an important freshwater model, the crustacean <i>Daphnia magna</i>. To do so, we evaluated effects of the racemate, (<i>R,S</i>)-AMP, and its enantiomeric forms, (<i>S</i>)-AMP and (<i>R</i>)-AMP, on the growth, reproduction and population rate of increase of <i>D. magna</i>, using a standard 21-day reproduction assay. Daphnids were exposed under controlled laboratorial conditions to seven sublethal concentrations (0, 0.10, 0.18, 0.32, 0.56, 1.0, and 1.8 µg/L) of each form. The effects of AMP were subtle, but (<i>S</i>)-AMP reduced <i>Daphnia</i> reproductive output and caused mortality (up to 20 %) from 1.0 µg/L upwards, unlike (<i>R</i>)-AMP or the racemate. This concurs with observations that the (<i>S</i>)-enantiomer is more potent than its counterpart and their mixture in causing biological effects. Although reproduction was only affected at the higher concentrations by (<i>S</i>)-AMP, previous data show that lower concentrations of AMP – either as (<i>R</i>)-, (<i>S</i>), or (<i>R,S</i>)-AMP – can affect relevant morphophysiological and behavioral endpoints. Thus, more attention should be paid to the ecotoxicological potential of AMP (and AMP-like substances). Screening for enantioselective effects of drugs is important for accurate risk assessment of chiral pollutants.

# Drying effects on ecological functions in river networks: an overview and a meta-analysis

Dr Margot Sepp[1], Rafael Marcé[1], Sergi Sabater[1]
[1]Catalan Institute For Water Research (ICRA), Girona, Spain
1A_SS14_Drying rivers in a time of global change, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Margot Sepp is a Postdoctoral Researcher Advanced at the Catalan Institute for Water Research (ICRA). She is currently investigating how global climate change is altering carbon cycling related ecosystem functions and ecosystem services provision in drying river networks. Margot Sepp has a PhD in Applied Biology and her previous research focused on dissolved organic matter and nitrogen cycling in lakes.*

More than half of the world's rivers, measured by length, experience occasional, seasonal, or even permanent drying. Waterways, which cease flow or dry completely at some point, are called intermittent rivers and ephemeral streams (IRES) and they are found across all climate zones, biogeographical ecoregions, and continents. The number and length of IRES will increase and periods of drying will become more prolonged in many regions around the world due to global climate change. Drying alters most biogeochemical processes and ecosystem functions in IRES. Contracting phases during non-flow periods may maintain some active biogeochemical processes. Further, dry riverbeds may perform as highly active biogeochemical reactors. We here provide an extensive overview on the expected impacts of the different phases of flow intermittency on the ecosystem functions related to carbon cycling (i.e., primary production, respiration, organic matter decomposition, greenhouse gas emissions) in rivers and streams. We examined the published literature and the information concerning the different hydrological phases and biogeographical ecoregions. Using the collected data, we have performed a meta-analysis, in order to assess the magnitude and direction of alterations caused by drying for some ecosystem functions. While several studies have shown that drying enhances river metabolism, effects are larger on ecosystem respiration than on primary production, promoting heterotrophy and, in turn, greenhouse gas emissions from IRES. Identifying overall trends and patterns on ecosystem functions is crucial for predicting and mitigating the effects of global change on river and stream ecosystems.

# Drying from the bottom up: intersection of water resources development and climate variability in a large dryland river, Australia

Prof Fran Sheldon[1]
[1]Australian Rivers Institute, Griffith University, , Australia
3A_SS14_Drying rivers in a time of global change, June 19, 2023, 4:15 PM - 6:00 PM

The Barwon-Darling River, Murray-Darling Basin, Australia, is one of Australia's most hydrological variable dryland river systems, with periods of low flow and small flow pulses, or freshes, punctuated by large overbank flows that fuel large scale riverine productivity. The Barwon-Darling and its tributaries are also highly developed river systems with more than 50% of the in-channel flows extracted for agriculture. An intense period of low rainfall in the tributaries between 2017 and 2020 saw the system begin drying from the bottom where long-term data suggests the unmodified system would not have dried. This drying resulted in mass fish kills in remaining restricted waterholes and mass deaths of freshwater mussels left stranded in dry channels. The future of the Barwon-Darling looks bleak, the continued pressure from water resource development combined with an increasingly variable climate suggest this large river may be going the way of other large dryland rivers, such as the Colorado, where flows no longer make it to the lower reaches.

# Drying resistance and resilience traits from rivers in Europe

Mr Luka Polovic[1,4], Dr Petr Pařil[1], Prof Nuria Bonada[2], Prof Thibault Datry[3], Prof Marko Miliša[4]
[1]Department of Botany and Zoology, Masaryk University, Brno, Czech Republic, [2]Faculty of Biology, University of Barcelona, Barcelona, Spain, [3]Riverly, French National Institute for Agriculture, Food, and Environment (INRAE), Lyon, France, [4]Biology Department, Faculty of science, University of Zagreb, Zagreb, Croatia

3A_SS14_Drying rivers in a time of global change, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I am an undergraduate of environmental sciences and a graduate of freshwater ecology. My current interest and topic of research is dryng resistance and resilience traits of freshwater biota.*

Drying River Networks (DRNs) are one of the most vulnerable ecosystems to climate change which is causing increasingly pervasive environmental stressors. DRNs represent more than half of Earth's waterways and because of their fluctuating hydrology have unique physical, chemical, and biological characteristics which is reflected by freshwater metacommunities inhabiting them. One of the most important characteristic of freshwater organisms populating such habitats is their ability to survive and recover from drying events. Understanding the unique traits of freshwater organisms that inhabit DRNS is essential for the management and conservation of these ecosystems. To concentrate efforts to understand and mitigate the effects of climate change on DRNs, the DRYvER project was initiated (www.dryver.eu). Important part of the DRYvER project is to develop a comprehensive meta-system framework that will improve our understanding of the effects of drying and changes in the dry periods on river network biodiversity and ecological integrity. In this effort, a database  is compiled from the existing as well as newly gathered data and it will contain taxonomic information on a suitable level with attributed traits. It includes traits of bacteria, fungi, diatoms, macroinvertebrates and fish across Europe, and trait sourcing is unique to each group. Gathered knowledge will be used to create predictive models which can improve and accelerate the development of effective conservation strategies to maintain and restore the ecological integrity of DRNs. Additionally, understanding the biological responses of DRNs to environmental change can help predict the impacts of climate change on freshwater ecosystems worldwide.

# Dry-up, light-up: the effect of multiple interacting stressors on freshwater invertebrates

Dr Gemma Burgazzi[1], Dr Noël Juvigny-Khenafou[1], Dr Jeremy Piggott[2], Dr Eric Harvey[3], Dr Akira Terui[4], Dr Florian Leese[5], Dr Ralf Schäfer[1]
[1]Institute for Environmental Sciences, RPTU Kaiserslautern-Landau, Landau, Germany,
[2]Zoology Department, School of Natural Sciences, Trinity College Dublin, Dublin, Ireland,
[3]Département de Sciences Biologiques, Université de Montréal, Montréal, Canada,
[4]Department of Biology, University of North Carolina at Greensboro, Greensboro, USA,
[5]Aquatic Ecosystem Research, Faculty of Biology, University of Duisburg-Essen, Essen, Germany

4C_SS01_Mechanisms underlying responses to multiple stressors, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a postdoc researcher at RPTU Kaiserslautern-Landau, Germany. My current research focuses on multiple stressors experiments with mesocosms, investigating the effects of flow intermittency, light pollution, and invasive species on aquatic communities, mainly biofilm and invertebrates. Formerly, I was a PhD student at the University of Parma (Italy), studying the effects of climate change and water abstractions on the distribution of aquatic invertebrates. My research is framed in the context of community and metacommunity ecology, with a strong interest in the spatial distributions and main drivers of organisms at different spatial scales.*

Human activities are increasing the diversity and spread of stressors that affect freshwater ecosystems. When stressors co-occur in space and time, their local effect may trigger unpredictable cascading effects to downstream sections via changes in the fluxes of material and organisms. However, few studies tested how the spatial configuration of stressors influences both local and downstream dynamics. Here, we evaluated the single and combined effects of flow intermittency and light pollution on freshwater invertebrates (both for drifting and benthic communities), using mesocosm experimental units organised in a simplified river network. The mesocosm system was designed with 18 flumes, each composed of two separated upstream sections that merged into a single downstream section.  Stressors were applied upstream in a full factorial design, weekly measuring changes in the downstream drift over 24 hours. Benthos was sampled in both upstream and downstream sections at the end of the experiment, after 3 weeks of treatment. Preliminary results show changes in drift rates and composition, with flow intermittency reducing the drift of most taxa (except for good dispersers) and light pollution increasing drift through stressor avoidance mechanisms. Benthos composition was also affected, with changes both in upstream and downstream sections. Responses of drifting and benthic organisms were different between the treatments with co-occurring and spatially separated stressors, but with a stronger effect of flow intermittency. Finally, unimpacted reaches (both upstream and downstream) seemed to act as in-stream refuge areas. These outcomes provide valuable information for understanding the spatial dimension of multiple stressors and their mitigation.

# Ecological responses of the UK chalk rivers to climate change in a context of multiple pressures

Dr Romain Sarremejane[1], Judy England, Rachel Stubbington
[1]Nottingham Trent University, , Royaume-Uni
1C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Romain is a Research Fellow at Nottingham Trent University. His research focusses on the responses of aquatic invertebrates to interacting climate change and anthropogenic pressures in rivers.*

Groundwater-dominated freshwaters including chalk rivers are relatively buffered from hydrological and thermal variability. However, intensifying climate change and associated extreme events such as droughts and floods, and other pressures including land use change, water abstraction and pollution, threaten their biological stability. Collectively, these pressures—and in particular, stressor combinations that interact to cause synergistic responses—could push already stressed communities beyond critical thresholds at which their taxonomic and functional resilience is permanently compromised. We aim to examine aquatic invertebrate community responses to climate change and other pressures in chalk rivers, to identify the pressure combinations that may reduce ecological resilience—an early sign of an ecosystem approaching a critical threshold. We will use invertebrate community time series (> 20 years) from >200 sites coupled with hydroclimatic (e.g. water temperature and discharge) and anthropogenic alteration (e.g. water quality and physical habitat modification) information, to identify the factors influencing community resilience. Preliminary results indicate that community recovery may take on average 3 years, following extreme low flows and drying events, in chalk rivers. Our new analyses will identify the drivers of resilience across the UK and where critical threshold may be most likely to occur as pressures intensify. Understanding long-term ecological responses to climate change and other interacting stressors will enable prediction of future changes to biodiversity and ecosystem function, thus enabling the timely interventions that support the resilience of vulnerable chalk streams.

# Ecology meets toxicology: Investigating changes in benthic invertebrate communities along toxicity gradients

Mr Sebastian Heß[1,2], Ms Delia Hof[3], Dr. Matthias Oetken[3], Dr. Andrea Sundermann[1,2]
[1]Senckenberg Research Institute and Natural History Museum Frankfurt, Department of River Ecology and Conservation, Gelnhausen, Germany, [2]Goethe University Frankfurt, Faculty of Biology, Institute of Ecology, Evolution and Diversity, Frankfurt am Main, Germany, [3]Goethe University Frankfurt, Faculty of Biology, Department of Aquatic Ecotoxicology, Frankfurt am Main, Germany

6F_SS11_Understanding ecological complexity of freshwaters under a chemical stress context, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Sebastian Heß is currently a PhD student in the working group for River Ecosystem Management of the Senckenberg Research Institute and Natural History Museum Frankfurt, Germany. His PhD deals with the importance of chemical pollution for benthic invertebrates and the development of alternative, ecotoxicological monitoring tools of chemical pollution. He did his Master thesis in the department of Aquatic Ecotoxicology at the Goethe University Frankfurt, Germany. He was investigating the effects of weathered plastics on freshwater shrimps.*

One of the main stressors for freshwater ecosystems is water pollution with a significant input of nutrients and micropollutants, such as pesticides or pharmaceuticals. However, the identification of major sources of pollution and their contribution to the deficient status of water bodies is complex. For technical and economic reasons, current standard chemical monitoring methods are limited, resulting in the inability to analyze, detect and quantify the majority of the pollutants and mixtures of substances present in the aquatic environment. The DECIDE project aims to overcome these limitations by developing an ecotoxicological assessment system for rivers and streams. At 30 sites in Central Germany, a comprehensive range of in-vivo and in-vitro methods were tested for their informative value and practicality. In addition, these ecotoxicological investigations were complemented by an assessment of the benthic invertebrates, local river habitat structure and supporting physicochemical quality components. In this contribution, we linked ecotoxicological, morphological, chemical and biological data to investigate changes in the benthic invertebrate community along toxicity gradients.

We like to thank the German Federal Environmental Foundation (Deutsche Bundesstiftung Umwelt (DBU)) for funding the DECIDE project (AZ 35663/01).

# Ecotoxicity of a cupric fungicide on non-target aquatic fungi under different salinization scenarios

Prof. Manuela Abelho[1], Andreia  Oliveira[2], Matilde Moreira-Santos[3]
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8F_SS10_Freshwater salinization: causes, consequences and management, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Manuela Abelho is a freshwater ecologist most interested in organic matter processing in streams, the effects of human activities and global warming on ecosystem integrity.*

Aquatic hyphomycetes are the main decomposers in streams, where allochthonous organic matter constitutes the major energy source for aquatic food webs. Streams are exposed to a multitude of stressors which may negatively affect aquatic communities and ecosystem processes. Among these, fungicides pose a risk for non-target aquatic fungi. However, effects on these organisms are not considered in the risk assessment of this specific pesticide group. Furthermore, the predicted increased salinization of freshwaters in low-lying coastal areas due to seawater intrusion may worsen the effect of copper-based inorganic fungicides since salinity influences copper bioavailability at the biological action site and affects metal biodistribution and bioaccumulation in the organisms. We determined the effective 20 and 50% inhibition growth concentrations of Bordeaux mixture (EC20 and EC50) for two aquatic hyphomycete species (Neonectria lugdunensis, Tricladium splendens) growing under increasing salinization scenarios (3.3 to 25 mS/cm). In the absence of salinity, EC20 and EC50 were 43±17 mg/L and 171±37 mg/L for N. lugdunensis and 851±224 mg/L and 1228±134 mg/L for T. splendens. In the case of N. lugdunensis, EC20 and EC50 decreased with increasing salinity, reaching 179±15 mg/L and 294±17 mg/L at 25 mS/cm. For T. splendens, there was an activation of growth at intermediate salinities, but lowest EC20 and EC50 were also attained at the highest salinity: 22±10 mg/L and 69±32 mg/L. These results highlight the need to incorporate aquatic fungi into environmental risk assessments to safeguard the integrity of aquatic ecosystems.

# Effect of climate change on biological water quality assessment

Dr Imran Khaliq[1], Dr. Emma Chollet Ramampiandra[2], Prof. Christoph Vorburger[1], Dr. Anita Narwani[1], Prof. Nele Schuwirth[2]
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2F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I am an ecologist and broadly interested in biodiversity. I work on species' distributions both in spatial and temporal dimensions. In my work, I integrate species distributional, morphological, physiological, ecological and phylogenetic data to understand species responses to climate change. For the past few years, my focus has been on understanding the role of species and communities responses to rising temperatures.*

Anthropogenic climate change is leading to changes in the composition of local communities across biomes. This has implications for ecological assessment methods that rely on macroinvertebrates as bioindicators of water quality. To investigate the influence of changing temperature on these assessment methods, we analysed macroinvertebrates time-series data collected by the Swiss Biodiversity Monitoring and the National Surface Water Quality Monitoring Program. We used species distribution model to simulate temperature change effects on macroinvertebrate communities and estimated the resulting changes on three indices used in Switzerland (EPT species richness, IBCH, and SPEARpesticides). Our model results suggest that a general temperature increase of +2°C would have a net positive influence (however, not accounting for other hydrological changes), increasing the probability of occurrence for 75% of the taxa and resulting in higher index values at most sites. However, the sensitivity to temperature as captured in our model varies among these biological indices: on average across all sites a +2°C increase in temperature resulted in 7% increase in EPT species richness, 4% increase in IBCH and 12% increase in SPEARpesticides. Our study underscores the need to consider temperature as a factor when assessing water quality using these biological indices. Despite some limitations of statistical species distribution models (e.g. not accounting for dispersal limitation, predictive performance varying by taxon), the study provides valuable insight into the complex relationships between environmental factors and macroinvertebrate communities, and the potential impacts of future temperature change. These findings can inform conservation and management efforts for these important ecological systems.

# Effect of eutrophication on the leaf litter decomposition in ponds with different trophic levels

Dr Vladimíra Dekanová[1], Ms Emília Židišinová[1], Ms Marcela Sedlačková Přidalová[1], Dr Milan Novikmec[1], Dr Marek Svitok[1,2]
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5E_RS05_Small water bodies, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I received a Ph.D. in Ecology and Biodiversity Protection from the Technical University in Zvolen (TUZVO), Slovakia in 2020 and I am currently working at the Technical University in Zvolen, Slovakia as a Junior Researcher. My research focuses on aquatic insect and their length-mass relationships, live cycles and biomass; plant litter decomposition by macroinvertebrate community and human impact on this process (plant invasion and eutrophication). For many years I have been involved in freshwater ecosystems research using aquatic insect larvae as model system.*

Leaf litter decomposition is a critical ecosystem-level process in many freshwater habitats and although ponds are likely to derive a large proportion of their energy from the riparian vegetation, decomposition in these water bodies received little attention. Ponds are heavily affected by many anthropic activities which may substantially change the process of organic matter decomposition. Among those, eutrophication is known to increase litter decomposition rates by stimulating microbial activity and enhancing interactions among decomposers and detritivores. We performed litter bag experiments using black alder (Alnus glutinosa) litter in 37 ponds in Slovakia and assessed the effect of nutrient addition and pond trophic level (amount of phosphorus) on the rate of leaf litter decomposition. The decomposition rates ranged from -k = 0.00005 to 0.003 degree-days-1 and generally decreased along the trophic gradient. Nutrient addition enhanced decomposition in oligo-, meso- and eutrophic ponds but did not change the rate of decomposition in hypertrophic systems. The results indicate that the process of organic matter decomposition is threatened by eutrophication in low to medium nutrient conditions while hypertrophic systems showed low decomposition rates that are unaffected by further nutrient additions. The negative relationship between the rate of litter decomposition and the trophic gradient is likely connected with the decline of detritivore activity and anoxic conditions in hypertrophic ponds. The study was supported by the Slovak Research and Development Agency under contract No. APVV-16-0236 and No. APVV-19-0134.

# Effect of management strategies and substrate composition on functional and taxonomic macroinvertebrate communities in lowland ditches.

Dr Francesca Vallefuoco[1], Laura Bellentani[2], Magdalena Vanek[1], Dr Alberto Scotti[3], Dr Roberta Bottarin[1]
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6G_RS23_Ditching misconceptions: the ecological diversity of artificial waterbodies, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Francesca Vallefuoco is a Post-Doc Researcher working within the limnological team at the Institute for Alpine Environment at Eurac Research (Italy). With a doctorate in ecohydrology at the University of Trento and Edmund Mach Foundation, she is working on flow-ecology relations, aquatic biomonitoring projects and macroinvertebrate biodiversity in Alpine rivers.*

Lowland ditches/canals could represent a tool for biodiversity enhancement and preservation in agricultural environments. A previous study within the aquatic biomonitoring program Biodiversity Monitoring South Tyrol, found different benthic assemblages in these semi-natural habitats compared to surrounding mountain streams, with more than 30 exclusive taxa. This work investigates the relationship between the taxonomic and functional biodiversity of macroinvertebrates and management strategies operated in situ by the Consortia (i.e., within an area of none, low and medium intensity of canal maintenance). In 10 ditches located in the Adige Valley (North-East Italy), a total of 12 samplings were collected during the last two years, including macroinvertebrate and environmental factors describing water quality, in-stream hydrology, substrate composition and geomorphology. The functional structure of the benthic communities was described using 6 biological traits related to microhabitat/substrate preference, temperature preference, saprobity, trophic status, feeding habits and locomotion types. According to our results these lowland canals were characterized mostly by plant substrates such as hydrophytes, algae and halophytes and by high concentrations of water nutrients, temperature, and conductivity. We observed significant differences in taxa richness between management strategies, with higher number of taxa in low intensity disturbance conditions rather than none or medium intensities. Moreover, significant differences between substrates were found applying the Shannon evenness diversity and the EPT%, which was higher than 10% only in big mineral sediments, gravel and mobile blocks substrates. Consequently, a sustainable management plan is crucial for ditch functioning, to assure and improve both agricultural purposes and its biodiversity conservation potential.

# Effect of the invasive signal crayfish and artificial light at night on emerging aquatic insects – a mesocosm study

Dr Marina Arias[1,2], Dr. Alessandro Manfrin[1], Dr. Gemma Burgazzi[1], Dr. Verena Schreiner[1], MSc. Collins Ogbeide[1], Bsc. Nazmus Sadat[1], Dipl. Florian Burgis[1], MSc. Rajdeep Roy[1], PD Dr. Jens Schirmel[1,3], Dr. Anne Schrimpf[1], Dr. Lorenzo Rovelli[1], Dipl. Thomas Schmidt[1,3], Dr. Anja Knäbel[1], Prof. Dr. Ralf Schulz[1,3], Jr. Prof. Dr. Mirco Bundschuh[1,4]
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1C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I'm Biologist from Universidad Nacional de La Plata, Argentina. I did my Ph.D. at ILPLA focusing on the impact of food production on streams and macroinvertebrate communities. Then, I started a postdoc assessing runoff from food production plots under conventional and agroecological modalities. I'm currently doing a postdoc at iES Landau, Germany in the SystemLink project, studying the impact of multiple stressors on the aquatic-terrestrial linkage. I will return to Argentina as an Assistant Researcher at ILPLA to study the role of riparian ecosystems in the relationship between streams and agroecosystems.*

Aquatic and terrestrial ecosystems are functionally linked, for example, via fluxes of emerging aquatic insects as prey for terrestrial consumers. For this reason, stressors in freshwaters may cascade to adjacent terrestrial ecosystems through changes in biomass and quality of the emerging insect community. Artificial light at night (ALAN), one of the most widespread human-induced alterations can affect, among others, the dispersal of aquatic organisms. Additionally, the North American signal crayfish Pacifastacus leniusculus has invaded many freshwater ecosystems in Europe, potentially becoming an important threat to their biodiversity. To assess the effect of these stressors on emerging aquatic insects, we carried out an experiment in the Riparian Stream Mesocosm Facility (RSM), where we exposed artificial streams (16 in total, 15 m long, 80 cm wide) to ALAN, to the introduction of signal crayfish, and to both stressors combined (n=4). Emerging insects were collected from three emergence traps (1 m²) for seven weeks starting in late spring 2022, and identified to family level, counted, and weighted. Preliminary results show that streams inhabited by signal crayfish showed reduced emerging insect abundance and biomass. In streams exposed to ALAN, we observed a similar effect but only after long-term exposure. The interaction of these stressors was not significant, suggesting a dominant effect of the signal crayfish over ALAN. Changes in the community structure will be discussed during the presentation. Present results shed light on the understanding of individual and combined effects of two important anthropogenic stressors on the secondary productivity of freshwater ecosystems.

# Effects of emergent chemical contaminants on detrital food-webs and across generations

Prof. Fernanda Cássio[1], Dr Arunava Pradhan[1], Dr Daniela Batista[1], Mr Nuno Martins[1], Ms José Trabulo[1], Prof Cláudia Pascoal[1]

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7E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Fernanda Cássio is a Full Professor at the Department of Biology of the University of Minho, Braga, Portugal.*

*Her research focuses on the study of the effects of pollutants on freshwater ecosystems by eutrophication, metals and emerging contaminants (nanoparticles, drugs and microplastics), using biomarkers and omics, with the aim of contributing to more sustainable ecosystems.*

*She has published over 100 scopus-indexed articles (index h 33) and several book chapters. She supervised 17 (10 completed) doctoral, 26 MSc and more than 50 BSc students. She has participated in 25 competitively funded national and international projects, 12 of which as Principal Investigator.*

Effects of emerging chemical contaminants on detrital based food-webs and across generations

F. Cássio, A. Pradhan, D. Batista, N. Martins, J. Trabulo, C. Pascoal

Freshwater ecosystems represent an important receptor of emerging chemical contaminants that have the potential to cause adverse ecological and/or human health effects. Here, we present results on the effects of emerging chemical contaminants, namely nanomaterials, pharmaceuticals and microplastics, alone and in combination, on the diversity and functions of microbial decomposers and invertebrate detritivores in freshwater ecosystems. Also, we will show multigenerational effects on population of the freshwater rotifer Brachionus calyciflorus, which have been used as a model system to reveal effects across generations. Our results showed that emerging chemical contaminants have negative effects on microbial diversity, invertebrate population and the functions ensured by microbes and invertebrates, mainly by reducing fungal reproduction output, microbial biomass production, and invertebrate population growth rate and feeding activity. This has implications for organic matter turnover and detrital based food-webs in freshwaters. Moreover, effects might be propagated along generations, although they can differ with the type of the emerging chemical contaminants. Overall, we concluded that emerging chemical contaminants can pose at risk freshwater ecosystems, and effects can last over time. Results should be taken into consideration in monitoring programs when assessing the ecological status of freshwaters.

# Effects of hydropeaking-induced flow variations on fish microhabitat use downstream from small hydropower plants

Dr José Maria Santos[Forest Research Centre, School Of Agriculture, University Of Lisboa], Mr Renan Leite[1,2], Dr Maria João Costa[2], Dr Francisco Godinho[3], Professor Maria Manuela Portela[2], Professor António  Pinheiro[2], Dr Isabel Boavida[2]
[1]Forest Research Centre, School Of Agriculture, University Of Lisboa, Lisbon, Portugal, [2]Civil Engineering Research and Innovation for Sustainability (CERIS), Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal, [3]Conselho Nacional da Água, Lisbon, Lisbon, Portugal

2B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*José Maria Santos is an Assistant Professor at the School of Agriculture, University of Lisbon, Portugal. He has been doing research in mainly in Ecohydraulics, Water Resources, Environmental Hydraulics and River Restoration and Modelling.*

Hydropower stands out as one of global emerging threats for freshwater biodiversity and particular to fish and their habitats, which are seriously affected by induced flow variations on the river segments downstream. However, effects are still poorly understood, particularly at the microhabitat use scale, when hydropeaking is sourced from small hydropower plants (SHP).  This study aimed to determine the effects of hydropeaking-induced flow variations on native fish microhabitat use downstream from small hydropower plants, partitioned by season and size-class. Fish sampling was performed by a modified point electrofishing procedure, and a multivariate approach was used to analyse microhabitat use and availability data from sites located upstream (reference) and downstream (disturbed by induced peak-operations) from two SHP in NE Portugal. Instream cover and depth were the most important variables in microhabitat use for all species at the reference and disturbed sites. Leuciscid fish evidenced similar patterns of non-random microhabitat use between the reference and the disturbed sites. Overall, seasonal and size-related patterns in species microhabitat use were similar between the reference and disturbed sites, with most of species displaying seasonal patterns in microhabitats use from spring to summer. This study showed that the effects of hydropeaking by SHP on fish microhabitat use downstream were negligible when compared to reference sites upstream, and that cover might have played a key role in tempering the effects of artificial induced fluctuating flows.

# Effects of inland freshwater navigation on biodiversity: impacts and opportunities for waterway management

Dr Alienor Jeliazkov[1], Dr Aaron Sexton[2], Dr Jean-Nicolas Beisel[3]
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3B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Dr. Alienor Jeliazkov (researcher at INRAE, France) is a community and landscape ecologist interested in metacommunity dynamics, species coexistence and distribution, connectivity issues, taxonomic and functional diversity, scaling issues in biodiversity modelling across space and time, and synthesis research, with expertise on terrestrial and freshwater ecosystems.*

Facing global change, inland navigation transport is a promising sustainable transport alternative to help reduce greenhouse gas emissions. However, the development of infrastructures to promote this transport modifies eco-morphological characteristics of rivers with serious risk of disturbance of their biodiversity.
The NAVIDIV project gathers 10 European research institutes and investigates the effects of inland freshwater navigation and infrastructures on biodiversity across contexts and scales in order to produce adapted recommendations for waterwayscape management. We will present the results of two major studies.
(i) A global systematic review of the literature allowed us to show that navigation itself most often had negative effects on non-exotic species/communities (57%), closely followed by the combination of multiple navigation factors (52%), waterway management (40%), and infrastructures (35%). We identified remaining knowledge gaps and future research directions to better understand the mechanisms driving navigation-biodiversity relationships.
(ii) The analysis of a unique compilation of observational data from multiple sources at the European scale which allowed us to quantify the effects of shipping and infrastructure density on taxonomic and functional diversity of fish and aquatic macroinvertebrates. We showed that navigation intensity decreased diversity and increased the prevalence of invasive taxa. Importantly, these effects were strongly context-dependent, with adverse effects being amplified in natural areas compared to anthropized areas. Furthermore, navigation most negatively affected benthic and non-migratory taxa.
NAVIDIV provides useful synthetic knowledge and guidelines to prioritize management and restoration actions considering the various human uses of waterwayscapes and the need for transboundary waterway management.

# Effects of multiple stressors on organic matter decomposition in permanent Mediterranean rivers

Mr Manuel Pinilla Rosa[1], Ms Aida Viza[1], Ms Itxaso Martinez-Sanz[1], Mr Francesc Oliva[1], Ms Isabel Muñoz[1], Ms Margarita Menéndez[1]
[1]Department of Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona, Barcelona, Spain

3C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*We are a research group with wide experience in the study of freshwater ecosystems ecology, including their different communities and the ecosystem functions they develop. This abstract is a part of the PhD of the young member of the group and is included in a new proyect we are conducting to understand the effects of multiple stressors in rivers.*

Rivers receive multiple human stressors such as drastic changes in their hydrology, channel form or water quality, which can act in combination with consequences for biological communities, ecosystem functioning and human wellbeing. However, these effects can vary depending on the intensity, frequency and order (legacy effects) of stressors. Organic matter decomposition is a key function in rivers that transforms original leaf and wood to elemental products that fuel detrital-based food webs. We conducted a field experiment to assess the effects of drying (flow interruption simulation) and urban pollution on organic matter decomposition in two 3rd order permanent Mediterranean rivers. First, we placed leaf litter bags for microbial colonization. After that, we simulated two intensities of drying stress (pulse: short and repeated; press: long and continuous) moving bags in/out the streambed. Finally, we transferred the bags downstream to the effluent of an urban wastewater treatment plant. We have analyzed both the individual and the joint effects of these stressors on the leaf decomposition rate, ergosterol content as a proxy of fungal biomass and C/N ratio as a proxy of food quality for detritivores. Preliminary results show that drying significantly decreases leaf litter decomposition while wastewater has no effect. One of the studied streams shows legacy effects of drying (both intensities) after wastewater exposure, reducing decomposition rate in contrast to control treatment. All this suggested that flow interruption in permanent rivers could cause legacy effects on leaf decomposition when faced to other stressors.

# Effects of salinization on lake ecosystems: results from an internationally coordinated experiment

Dr Miguel Cañedo-Argüelles[1], Dr Zeynep Ersoy[2], Dr William Hintz[3], Dr Pablo Urrutia-Cordero[4], Dr Gesa Weyhenmeyer[5], Dr Rick Relyea[6], Dr Lorenzo Proia[7], Dr Matthew Schuler[8], Dr Jonathan Shurin[10], Dr Chirstopher Steiner[9], Andrea Kirkwood[11], Dr. Hjalmar Laudon[12], Dr. James Rusak[13,14], Dr. Catherine Searle[15], Dr. Celia Symons[16], Dr. Stephanie Melles[17], Dr. Amy Downing[18], Dr. Marie-Pier Hébert[19], Andrea Kirkwood[11], Emily Hassal[11], Dr. Alison Derry[12], Dr. Beatrix Beisner[12], Dr. Lida Vendrell[7], Dr. Carmen Espinosa[7], Dr. Vincent Fugère[20], Dr. Shelly Arnott[13]

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8F_SS10_Freshwater salinization: causes, consequences and management, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

*I am an ecologists working to assess the impact of human activities on aquatic biodiversity and ecosystem functioning using a wide variety of methods (e.g. biomarkers, ecological modelling, geographical information systems, ecological traits) and combining laboratory/mesocosm experiments with field studies. My research includes multiple levels of organization. For example, I have studied how anthropogenic stressors and natural disturbances affect populations and communities of aquatic organisms and how this is translated into changes in ecosystem functioning. Also, I have addressed spatiotemporal dynamics by studying how organisms' dispersal and the landscape configuration determine the exchange of species among communities.*

Worldwide, lakes are getting saltier due to freshwater salinization (FS) caused by factors such as agriculture or road deicing operations. Studies have shown that FS can impact aquatic biodiversity and ecosystem functioning. However, there are some differences between studies that might be attributable to biogeographical, evolutionary or environmental factors. To address this variability we conducted a set of coordinated experiments in Europe and North America using lake mesocosms following a common protocol for the experimental design. We applied 20–30 chloride (Cl-) treatments using a regression design where nominal concentrations ranged from ambient to 1500 mg Cl- L-1. Our results show that FS led to a reduction in cladoceran abundance, leading in turn to an increase in algal biomass. We found some differences between regions that were not explained by environmental factors but by differences in community composition – populations of a given species responded more similarly to FS when embedded in similar communities. Also, we found that current water quality guidelines in Canada, Europe and the US fail to protect lake ecosystems from FS, since Cl- additions below the recommended thresholds triggered a 50% decline in zooplankton abundance in many of our experiments. Overall, our results show that relatively low Cl- concentrations can have strong effects on planktonic communities. Thus, we call on managers and policy makers to take action to better protect lake ecosystems from the global environmental issue of FS.

# Effects of the plastisphere on metabolic traits of the Lower Mekong River Basin

Dr Veronica Nava[1], Dr. Barbara Leoni[1], Arienzo M. Monica[2], Emily M. Carlson[3], Zeb S. Hogan[3], Chea Seila[4], Valentina Orlandi[1], Savoeurn Soum[5], Sudeep Chandra[3]
[1]University of Milano-Bicocca, Department of Earth and Environmental Sciences, Milano, Italy, [2]Desert Research Institute, Reno, Nevada, [3]Global Water Center and Biology Department, University of Nevada, Reno, Nevada, [4]Institute of Technology of Cambodia, Phnom Penh, Cambodia, [5]Royal University of Phnom Penh, Phnom Penh, Cambodia

8E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

*Veronica Nava is a postdoctoral researcher at the University of Milano-Bicocca (Italy) and a visiting postdoc at the Global Water Center, University of Nevada-Reno (USA). Her research focuses on the study of the impacts of anthropogenic stressors on lentic and lotic systems, through the analysis of long-term trends. She studies microplastics and plastic pollution in freshwater ecosystems, specifically focusing on the effect of these pollutants on the wider ecological context through the study of the interaction of plastic debris with microalgae and the subsequent effects on metabolic traits (i.e., productivity).*

Plastic pollution of freshwater ecosystems is increasingly recognized as a widespread and growing issue, however less information is known about their influence on ecological processes. Plastics can have potentially negative effects on aquatic organisms and food-webs, but they can also serve as a surface for biofilm growth, known as the "plastisphere". We investigated the microalgal and bacterial community growing on plastic debris from three rivers in the Lower Mekong River Basin (Cambodia). Different plastic polymers were incubated for 30 days and the plastisphere community was then characterised by combining DNA analyses (16S and 18S rRNA) and microscope investigations. We evaluated effects on ecosystem production (gross, respiration, and net) through measurements of oxygen dynamics in light-dark bottle incubations, together with changes in the chemical species of nitrogen, phosphorus and organic carbon. Our findings indicate the dominance of a heterotrophic activity that reduces dissolved oxygen across sites. This suggests that plastic debris can have far-reaching effects and may alter metabolic traits within aquatic ecosystems.

# Effects of woody riparian vegetation on aquatic invertebrates are scale- and context-specific

Dr Martin Palt[1,2], Prof. Dr. Daniel Hering[2], Dr. Jochem Kail[2]
[1]Umwelt-Campus Birkenfeld, Birkenfeld, Germany, [2]University of Duisburg-Essen, Essen, Germany

3C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 4:15 PM - 6:00 PM

***Biography:***
*Apr 2022 - today: Research Associate, Interdisciplinary Conservation Research, Umwelt-Campus Birkenfeld, Trier University of Applied Sciences*
*Aug 2017 - Feb 2023: PhD studies in biology, Aquatic Ecology Department, University of Duisburg-Essen*
*Aug 2017 - Mar 2022: Research Associate, Aquatic Ecology Department, University of Duisburg-Essen*
*Sep 2013 - Nov 2016: Master studies in Applied Limnology, Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences, Vienna*
*Sep 2010 - Nov 2013: Bachelor studies in Environmental Sciences, Faculty of Environment and Natural Resources, University of Freiburg*

Woody riparian vegetation (WRV) benefits well-being of aquatic ecosystems in running waters. However, only some functions provided by WRV occur irrespective of surrounding and catchment landuse while others are context-specific. In recent large-scale studies, effects of WRV on benthic macroinvertebrates were therefore small compared to catchment landuse questioning the relevance of WRV for restoration.
Through model-based recursive partitioning, the context-dependency of effects of WRV on the macroinvertebrate community was investigated in small (catchment area 10 – 100 km²) lowland (n = 361) and mountain (n = 748) streams: WRV cover was quantified from orthophotos along the near and far upstream river network while agricultural, urban and woodland cover at the local and catchment scales along with hydromorphology were considered as partitioning variables.
In agricultural landscapes, the effect of WRV on macroinvertebrates was large, as near-upstream WRV can improve the ecological status by two of the five status classes. This indicates that smaller-scale functions provided by WRV, such as temperature regulation, outweigh larger-scale functions such as nutrient or sediment retention.
In urban landscapes, effects of far-upstream WRV were also large if moderate levels agricultural landuse exist at the catchment scale and effects WRV were only limited in purely urban catchments or in a multiple-stressor context.
While WRV can even improve the ecological status in urban settings, it is especially relevant for river management in rural agricultural catchments, where developing WRV potentially are effective measures to achieve good ecological status.

# Environmental and anthropogenic effects on diatom communities in high mountain mires

Mrs Fernanda Gonzalez Saldias[1,2], Mr Aaron Pérez Haase[1], Mr Joan Gomà[1,2]
[1]Department of Evolutionary Biology, Ecology, and Environmental, University of Barcelona, Barcelona, Spain, [2]Freshwater Ecology, Hydrology, and Management (FEHM), Barcelona, Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*I'm a Ph.D student at the University of Barcelona. My research focuses in the effect of environmental and anthropogenic drivers on diatom communities in high mountain mires by using taxonomy and metabarcoding techniques to identify species changes. We use fundamental approaches to determine species diversity, community dissimilarity, and biogeography patterns in conservation areas in high mountain mires in the Iberian Peninsula. I also have experience working on microplastics contamination in rivers in Catalonia.*

The impact of anthropogenic activity on freshwater ecosystems has increased in recent years, resulting in land use changes and habitat fragmentation. These can be observed in the high mountain mires (bogs and fens), these changes affect the structure of aquatic communities and their functioning, for instance, primary production locally and even globally. For this purpose, we chose the Pyrenees as a region of study because it has been affected by land use changes in recent decades. Diatoms are a good indicator of environmental changes because they have a high dispersal capacity and their distribution is shaped by environmental drivers. However, little is known about the effects of overgrazing and trampling on mires. To estimate the effect of livestock pressure on the composition of diatom communities, an experiment was carried out in which cattle exclusion fences were installed in high-mountain mires in the Pyrenees for four years. We measured pH, conductivity, altitude, environmental heterogeneity, the area of the mires, and the distance between sampling sites. Our results showed no effect of livestock grazing and trampling on diatom communities. However, pH, altitude, and mire area were the most important variables shaping compositional changes, but only pH had a positive relationship with species richness. These results demonstrated the importance of pH as an environmental factor at the local scale potentially affecting the availability of silicic acid to diatoms due to its importance for frustule formation, lipid structure, and carbohydrate production. Concerning livestock impact, diatom communities proved to be resilient to grazing activities.

# Environmental changes in lakes of the middle Yangtze floodplain during the last two centuries

Dr Xu Chen[1], Prof Suzanne McGowan[2], Linghan Zeng[1,3], Yanmin Cao[4], Jing Ji[1], Jia Liang[1]
[1]Department of Geography, China University of Geosciences, Wuhan, China, [2]Department of Aquatic Ecology, Netherlands Institute of Ecology,, Wageningen, Netherlands, [3]. School of Geography, University of Nottingham, Nottingham, United Kingdom, [4]South-Central Minzu University , Wuhan, China

6A_SS17_Delta Ecosystems in transition, June 20, 2023, 4:15 PM - 5:30 PM

The lake group in the middle reaches of the Yangtze River is the largest group of freshwater lakes in China. During recent decades, most lakes have faced environmental deterioration with rapid growth of human population and economy. However, spatiotemporal patterns of lake environmental changes and the underlying mechanisms are still unclear. In this study, eight typical lakes in the middle Yangtze reaches, including Dongting, Honghu, Futou, Luhu, Shahu, Yanxi, Wanghu and Poyang Lakes were selected for paleolimological investigation. Chronologies of sediment cores were established based on 210Pb, 137Cs and the spheroidal carbonaceous particle using the model of constant rate of supply. Geochemical analyses showed that K/Al ratios in sediment cores decreased rapidly after the damming, indicating that the input of riverine suspended particulates from the Yangtze River decreased. Dam construction has impounded nutrients such as nitrogen, phosphorus and silicon from the upstream. The depletion of Si (without artificial supply) relative to nitrogen and phosphorus probably caused the decoupling between nitrogen, phosphorus and silicon in these lakes. The blooms of eutrophic Cyclotella and small-sized Achnanthes in most lakes from the 1960s indicated rapid shifts in the structure and function of lake ecosystems. Our results can improve our understanding on human-environment interaction in densely-populated regions, and provide baseline information for the protection of these ecologically-important lakes.

Key words: the middle Yangtze reaches; Diatoms; Ecological stoichiometry; Paleoecology

# Environmental DNA (eDNA) based decision-making – A framework to assign confidence in absence (CIADM)

Dr Nathan Griffiths[1,2], Dr Bernd Hänfling[1], Dr Marco Cattaneo[3], Dr Rosalind Wright[4], Mr James Macarthur[1], Miss Sara Peixoto[2], Dr Jonathan Bolland[2]
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4D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Dr. Nathan Griffiths is a molecular biologist with a particular interest in applied ecology and emerging technologies. He attained his PhD in 2022 at the University of Hull and has spent the last 5 years working on the optimisation and application of eDNA based approaches to environmental management.*

Policy based decision-making is an important aspect of environmental management globally, regularly driven by the presence of priority species. Due to the recent declining trends in freshwater biodiversity, up to date knowledge surrounding the distribution of rare and elusive priority species is often lacking. In addition to this, traditional methods of monitoring freshwater fish can be invasive, field intensive, and vary in efficiency between species. While emerging molecular based monitoring methods have only been extensively validated in certain environments. This makes informed decision-making a challenge, particularly in understudied environments.

This case study employs eDNA based monitoring to assess present-day eel status upstream of 44 water pumping stations. Here, we present a framework to determine confidence in absence for decision-making (CIADM) based on single visit water sampling. Through high levels of biological (sample) and technical (PCR) replication, we applied CIADM to assign 'confidence in absence' and propose optimal future sampling strategies. We found that 17/44 pumping stations were eel positive and were able to retrospectively assign a >99% confidence that the remaining 27 sites were negative for eel DNA at the time of sampling. We observed that increasing biological (sample) and technical (PCR) replication both increased 'confidence in absence' values. Eel positive sites had significantly higher species richness, and fish communities differed between eel positive and negative sites. This study highlights that multiple within-site sample replicates are essential to achieve high confidence in absence, while increased PCR replication can allow for fewer replicate samples to attain this.

# Environmental DNA time series analysis of a temperate stream site reveals distinct community and functional shifts depending on sampling time but not sampling spot

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7C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Mandy Sander is a PhD student at LeeseLab with a focus on (e)DNA metabarcoding and primer design. She is interested in uncovering the underlying processes influencing eDNA detection in streams and in developing and validating different eDNA-based approaches for the detection of macroinvertebrates. She is funded by the DBU (Deutsche Bundesstiftung Umwelt) which supports projects with a focus on environmental research and nature conservation.*

Environmental DNA (eDNA) extracted from water is routinely applied in river biodiversity research. Especially, eDNA metabarcoding can provide comprehensive taxa lists with little effort and cost. However, several studies have shown that eDNA-based species detection in streams and rivers is influenced by sampling time and spot, but also other key factors such as water temperature and discharge. Research linking these factors and also providing information on the potential of eDNA metabarcoding to detect shifts in ecological signatures, such as species phenology and functional feeding groups (FFG) across seasons is missing. To address this gap, we took water samples at three different spots, surface, riverbed and riverbank, in a stream section at a long-term ecological research (LTER) site biweekly for 15 months. We analyzed macrozoobenthic species and Molecular Operational Taxonomic Unit (OTU) richness and community turnover across seasons and sampling spots based on COI metabarcoding data. Using Generalized Additive Models, we found a significant influence of sampling time but not sampling spot on community composition. Community turnover followed a cyclical pattern, reflecting the continuous change of the macrozoobenthic community through the year. While water temperature had no influence on inferred community composition, discharge had a small negative effect on species richness for Annelida and Ephemeroptera. Most macroinvertebrate taxa showed highest detection rates in spring, in particular merolimnic species with univoltine life cycles. For the temperate stream studied here, our results highlight the added value of eDNA metabarcoding to assess and trace biodiversity and functional change in stream ecosystems through time.

# Establishing supporting element thresholds for the aquatic environment. A revised approach

Dr Gary Free[1], Dr Sandra Poikane[1], Prof Geoffrey Phillips[2], Dr prof Martyn Kelly[3,4], Dr Prof Agnieszka Kolada[5], Dr Anne Lyche Solheim[6], Dr Fuensanta Salas Herrero[1], Dr Heliana Teixeira[7], Dr Gabor Varbiro[8]
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7B_SS15_Who knows what is "good"? Defining aquatic ecosystem health targets for the United Nations Sustainable Development Goals, national and international policies, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am an aquatic ecologist, currently employed at Sustainable Resources, Joint Research Centre of European Commission in Ispra, Italy. My research covers several aspects of applied ecology, focusing on aquatic bioassessment and the definition of biological integrity and ecosystem health. Currently, I am leading a pan-European intercalibration work, which has resulted in harmonization of ecological assessment of lakes, rivers and coastal waters. I am involved in a project focusing on nutrient thresholds associated with good ecological quality in lakes and rivers of Europe. I have authored 50 papers on these topics in peer-reviewed journals.*

Setting appropriate parameter boundaries that support ecological status is a vital step in the protection and restoration of aquatic ecosystems. It enables programmes of measures to be tailored to maintain or restore waterbodies. However, there is still uncertainty within and among countries about where critical thresholds for nutrients and other supporting elements should lie.
Previous work made significant improvements in harmonising the approach to nutrient boundary setting in the EU, introducing several methods and producing values for Member States. However, some limitations were also present in the methods and data used, with some estimated boundary values not corresponding to Member States experts` estimations. We present a new protocol and the results of its application to calculate nutrient boundaries. It is intended to extend the method, where appropriate, to other parameters. The key development of the method is that the new approach to boundary setting is based on logistic models that incorporates an assessment of the distribution of misclassifications. Where data are well balanced, the method used is less important but real improvements are seen where the variation of biological quality is not even along the pressure gradient – often forming a so-called wedge shaped response which is common.

## Estimation of form resistance (Φ) for sinking microalgae using size independent shape measures

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9E_RS03_Microbial ecology in freshwaters, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*Gábor Borics is a phytoplankton ecologist in the Centre of Ecological Research (Hungary). He has been dealing with monitoring of freshwaters for thirty years. He has been involved in the development of phytoplankton-based ecological status assessment methods for Hungarian and other European lakes and rivers (working closely with the JRC). He manages the Functional Algology Research Group, where they study the microalgal diversity of ponds lakes and rivers. His current research interest include the morphology of microalgae, focusing on how morphology can be quantified and used as a quantitative trait both in theoretical and applied research.*

As most microalgae are denser than water they live in, they continuously sink. This downward movement enables them to have an access to nutrients or avoid intense light, but it also results in the sinking loss of phytoplankton. Sinking velocity (SV) of spherical particles in a viscous medium can be described by the Stokes formula, which states that SV of a spherical particle depends on the gravitational force, viscosity of fluid, the density differences between the particle and the fluid, and on the size of the particle. Algae however are not spherical and any distortion of the cells from the sphere affects SV. To express how much slower or faster a particle of any form sinks in a fluid than a sphere of equivalent volume, a dimensionless number, the so-called form resistance (Φ) has been proposed. In this study we investigated how the Φ relates to size independent shape measures of the objects, i.e.: length/width ratio; relative elongation; relative surface area extension, compactness; Cs/Cv ratio and fractal dimension. We created the shape realistic 3D models of those forms for which Φ values were available in the literature, and calculated their shape measures. Relative surface area extension, compactness and Cs/Cv were those measures that showed strong relationships with Φ. For the subset of similar shapes this relationship is so strong that it can be used to predict Φ for the vast majority of species.

# European river typologies fail to capture the distribution of diatoms, fishes and macrophytes

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2B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Jonathan Jupke is a PhD Student at the RPTU, where he studies the biogeography of freshwater taxa, its connection with environmental risk assessment, as well as the application of modern statistical tools in ecology.*

Typology systems are a common tool in ecology and relevant for environmental monitoring, conservation, and biogeographical studies. They organize real-world ecosystems into mutually exclusive categories based on biotic and/or abiotic variables, thus assuming that ecosystems of the same type are more alike than ecosystems of different types. We evaluated whether the Broad River Types (BRTs), a recently proposed pan-European river typology system, which is based exclusively on environmental variables, meets this assumption when used to group biological communities. With pan-European data sets of diatoms, fishes, and macrophytes from least disturbed sites, we compared the performance of BRTs to that of four other typology systems (Illies Freshwater Ecoregions, Biogeographic Regions, Freshwater Ecoregions of the World, and Environmental Zones) and spatial autocorrelation (SA) models using Analysis of similarities, classification strength, indicators species analysis, and zeta diversity decline curves.
All typology systems received low scores from all evaluation methods, relative to predefined thresholds and the SA models. BRTs were often scored lowest. The biological communities of site groups defined by the five typology systems showed considerable overlap within each typology system. The communities delineated by the typologies tended to be more distinct for fishes than for diatoms or macrophytes, with Illies Freshwater Ecoregions often defining the most distinct communities.
In conclusion , we found that existing large scale river typology systems fail to delineate sites groups with distinct and compositionally homogeneous communities. A way to improve the fit between typology systems and communities might be to combine reach-based and regional typology system.

# Evaluation of macroinvertebrate and water quality indices in the Titicaca Lake catchment

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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*

*A PhD student on Muséum national d'Histoire naturelle. From undergraduate studies focused on the investigation of anthropogenic contamination in freshwater ecosystems in Ecuadorian Amazon basins. Through the integration of different approaches, such as macroinvertebrates, physical-chemical parameters and metals. Now developing research on freshwater ecosystems in high Andean basins threatened through biomonitoring tools.*

The High Andean Basins (HAB), characterized by high altitude and glacier influence, are increasingly impacted by anthropogenic pressures, putting the integrity of the ecosystem at risk. Appropriate evaluation method that recognizes the particularities of HAB aquatic ecosystems is thus crucial to quantify the effect of anthropogenic pressures on their ecological state. This study aimed to evaluate existing macroinvertebrate and water quality indices for HAB. Benthic macroinvertebrates and water samples were taken from 25 stream sites within the Titicaca Lake catchment (Achacachi, Sehuenca, and Katari basins) during the wet and dry seasons in 2021. We used the Biological Monitoring Working Party adapted for Bolivia (BMWP/Bol) for macroinvertebrates and the Water Quality Index adapted to HAB (WQI-HA). BMWP/Bol shows a degradation of water quality at 44% of the study sites, where the families sensitives to contamination such as Gripoterygidae, Leptophlebidae, and Leptoceridae were absent. On the other hand, we found good water quality in 76% of the sample sites in both seasons, with low concentrations of biological oxygen demand (BOD), nitrates, and nitrites enhancing the index. Katari basin was the most affected in both seasons. Overall, the study has shown that the quality of the aquatic ecosystem was different depending on the approach used, although both should be adapted to HAB conditions. We recommended that we integrate biologic and physical-chemical parameters into an index to better understand this aquatic ecosystem.

# Examining spatial variation in the soundscapes of urban and rural ponds

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8B_SS04_Soundscape studies in ponds and lakes, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Rob Briers is Professor of Ecology & Biodiversity in the Centre for Conservation & Restoration Science and School of Applied Sciences, Edinburgh Napier University. His research focuses on how and why biodiversity and environments vary across space, from local to global scales, working mainly in aquatic ecosystems and with a particular interest in ponds.*

There is significant interest in the potential for measures of freshwater soundscapes to act as a proxy for biodiversity in the same way as has been developed for terrestrial ecosystems. Spatial variability in sound within freshwaters could have a significant influence on the outcome of any assessment and is a key consideration when considering sampling methods. Here we compare the characteristics of, and spatial variation in, pond soundscapes as determined through the application of different sampling methods, ranging from single static recordings to a custom-built hydrophone array. We also examine the variation in acoustic characteristics of ponds along an urban-rural gradient and the implications of this for acoustic-based biodiversity assessment.

# Expansion predictability and niche dynamics in a long-term global invasion

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7D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*SG. Freshwater Ecologist at Doñana Biological Station (EBD - CSIC, Seville - Spain) and Visiting Fellow in River Science at Loughborough University (UK).*

Freshwater ecosystems are invaded by a non-random selection of taxa, among which crustaceans, and particularly crayfish, stand out with successful examples worldwide. Species Distribution Models (SDMs) have been used to detect suitable areas for invasive species and predict their potential distributions. However, these prediction exercises assume the temporal stability of realised environmental niches, which is uncertain in invasion processes.
Focussing on the invasion history of the red swamp crayfish Procambarus clarkii (Girard, 1852), we assessed its geographic expansion and niche dynamics over time. To achieve this, an updated dataset of red swamp crayfish occurrences, both in its native and invaded ranges, was used. We then constructed multiple sequential SDMs over 25-year intervals, based on a set of temporally-explicit bioclimatic variables, and asked how well the SDMs of any given interval predicted crayfish expansion in the following periods.
Overall, SDM maps based on past species records showed concordance with the current crayfish occurrences. Had anyone collected red swamp crayfish records in 1975 and disposed of a climatic scenario for 2022, an accurate projection of present-day range would have been obtained. This seems related to the remarkable stability of the species niche, which, in spite of having expanded along the invasion process, changed little in terms of position (i.e. centroids).
Our approach can be easily transferable to other well-documented taxa and represents a relevant support for exploring biodiversity inventories and validating the use of SDMs in a highly dynamic world where biogeographical barriers are often bypassed.

# Experimental adaptation: a key to understanding the impact of climate change on aquatic ecosystems

Dr Bogdan Druga[1], Elisabeth Ramm[2], Dr Charlotte Briddon[1], Maria Nicoară[1], Dr Cecilia Chiriac[3], Dr Mihai Miclăuş[1,4], Dr Adriana Hegedüs[1], Dr Maria Stockenreiter[5]
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2F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Bogdan Druga is an aquatic microbiologist, having studied phytoplankton and bacteria as a postdoc at Eawag (Switzerland) and TU Darmstadt (Germany). His main research interest is to understand the way climate change might impact on key phytoplankton species and how that might affect aquatic communities and ultimately the human society. His research focuses on both freshwater and marine microorganisms, and includes doing long-term adaptation experiments of phytoplankton to future predicted conditions, followed by in situ community experiments, using mesocosms. He is analyzing community composition both through traditional and modern methods, including genome and metagenome sequencing.*

Global warming has been widely predicted to impact on phytoplankton fitness, and this impact will most likely vary among different groups of microalgae. Considering the paramount importance of phytoplankton as primary producers in freshwaters, it is vital to understand the magnitude of the impact that future conditions might have on these organisms. Cyanobacteria, and the harmful blooms they produce, are thought to be positively impacted by global warming, but long-term studies targeting their adaptive potential to higher temperature have not been carried until recently.
We examined the effect of acclimating 3 Microcystis aeruginosa strains to ambient (22°C) and high (26°C) temperature, for 6 months. The competitive ability of the strains after heat acclimation was also evaluated, by analyzing their impact on plankton community composition (in mesocosm experiments, with natural lake water). In parallel, all M. aeruginosa genomes were sequenced and the expression of several thermal-relevant genes was also measured, for a better understanding of the mechanisms of heat adaptation.
After the inoculation into natural plankton communities, cyanobacterial abundance significantly increased in the cultures inoculated with one heat-acclimated strain of M. aeruginosa as compared to the ambient-acclimated version. The structure of prokaryotic and eukaryotic communities was significantly impacted by both inoculated cyanobacteria and temperature during the experiments. We found that heat-adapted M. aeruginosa displayed a stronger expression of genes associated with thermal tolerance due to adaptation to elevated temperature. In conclusion, genome plasticity of heat shock and thermal tolerance genes allow cyanobacteria to adapt rapidly and to be resilient to warming.

# Exploring network connectivity as driver of river-floodplain functioning – a graph theoretic approach.

Andrea Funk[1,2], Damiano Baldan[3], Elisabeth Bondar-Kunze[1,2], Johannes Kowal[1,2], Thomas Hein[1,2]
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9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*Andrea Funk is an expert in the field of wetland ecology with a special focus on organismic biodiversity as well as restoration and conservation of river-floodplain systems. Presently her research focuses on meta-community dynamics in floodplain networks, meta-ecosystem theory and modelling with a special emphasis on floodplain restoration.*

Connectivity has long been recognized as a key property of river-floodplain systems that drives transport of matter, energy and biota, and thus ecosystem functions, services and biodiversity. It is therefore surprising that floodplains have rarely been explored as connectivity networks. We developed a graph-based approach analysing main transport pathways in a floodplain system: a flow-directed and undirected transport in the waterbodies' network as well as euclidean distances to account for flows independent from the network (seepage exchange or overbank flow). Using predictors accounting for centrality of waterbodies and its temporal variability due to hydrological conditions, we model basic indicators of exchange processes and water body functioning including sediment composition, chemical conditions as well as macrophyte coverage.
We test the model approach in a floodplain section of the river Danube characterised by different levels of fragmentation due to engineering structures and therefore varying in their hydrological processes and functioning. Our results indicate that accumulation of inorganic fine sediments is driving terrestrialisation processes in side channels that are not critical for directional transport, whereas accumulation of organic sediments is dominating in waterbodies with overall low network connectivity. In contrast exchange of water and nutrients is dominated by transport independent from the network such as seepage exchange. Macrophytes are dominating in water bodies which are not impacted by directed transport. Overall, the graph theoretical approach can be used to classify the floodplain water bodies related to their basic function and importance in the network and is a promising tool for management and restoration.

# Exploring the current status of European Freshwater Ecosystems

Gonçalo Duarte[1], Angeliki Peponi[1], Diogo Moreno[1], Tamara Leite[1], António Faro[1], Florian Borgwardt[2], Sebastian Birk[3], Annette Baattrup-Pedersen[4], Pedro Segurado[1], Maria Teresa Ferreira[1], Paulo Branco[1]
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4D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Biologist with advanced studies in GIS, an MSc in Conservation Biology and a PhD in Freshwater restoration.*

*My research focus river restoration, freshwater fish ecology, spatial ecology and historical ecology concerning large-scale environmental processes and using ecological modelling.*

Globally, freshwater habitats are home to 9.5% of all animal species, being disproportionally relevant when considering the earth's surface occupied. These ecosystems have also been crucial for human societal development since prehistoric times, which translates into being impacted by a multitude of anthropogenic pressures and effects throughout time. The work aims to map for freshwater ecosystems the areas where European Union legally binding targets, sensu Habitats Directive (HD) and Water Framework Directive (WFD), have not been achieved. Areas not abiding by the targets established by these directives are considered to require restoration. Overall, the conservation status (CS) of freshwater-related protected habitats from the HD are found to be unfavourable in most of Europe, with higher severity for coastal central Europe and British islands. The CS of freshwater-related species discloses a West-East European separation with the former falling into unfavourable (except the British Islands) and the latter into favourable. On the WFD Good-ecological status target, in general only mountainous and/or remote areas are predicted to currently meet the target. Integrating these three outputs reveals a European continent where only small and specific areas (e.g., Scandinavia and western Greece) can meet the HD and WFD legal goals. This work has not only identified river restoration areas but also which of the targets is not being achieved and what species and habitat groups are most affected in each freshwater unit. These results are of utmost relevance to shape governance and public policies (e.g., restoration law) towards biodiversity conservation and ecosystems' functional resilience.

# Factors influencing organic matter transport, storage, and processing in a non-perennial Mediterranean river

Ms Oriana Lucia Llanos Paez[1,2], Dr. Junyu Qi[3], Nils Gutierrez[1,2], Dr Miriam Colls[4], Dr Sergi Sabater[1,5], Dr Vicenç Acuña[1,2]
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2A_SS14_Drying rivers in a time of global change, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Oriana Llanos is a Biologist and PhD student at the Catalan Institute for Water Research, University of Girona. With a Master's degree in Soil and Water Management from the University of Lleida, Spain, Oriana possesses a general understanding of the interrelationships between ecological systems and the environment. Her current research focuses on the study of Intermittent rivers, employing modelling techniques to investigate their hydrological patterns and the organic matter dynamics that impact ecosystem services. Oriana is deeply committed to the dissemination of her findings and is actively involved in sharing her knowledge and expertise in her field.*

Freshwater ecosystems are significant contributors to the global carbon cycle. Non-perennial rivers and streams may alter their organic carbon dynamics through the hydrological changes in lateral and longitudinal connectivity. Organic matter accumulates, and it is transported and decomposed in a series of pulses during cycles of wet and dry phases. Therefore, the study of organic carbon in non-perennial systems has garnered increased attention from the scientific community. We here examine the spatial and temporal patterns of organic carbon dynamics (storage, transport, and processing) in the non-perennial Algars basin (NE Spain) and identify its driving factors. We conducted seasonal sampling in 16 sites across the river basin, with samples collected for (i) storage, assessed as benthic organic matter measurements, (ii) transport, assessed as dissolved and particulate organic matter measurements, and (iii) processing, assessed as aerobic respiration (Raz-Rru method). We observed consistent seasonal patterns in organic carbon transport across the river network, but irregular longitudinal behaviour in storage, mainly related to upstream terrestrial land use and flow intermittency. Processing exhibited longitudinal and lateral seasonal patterns, with lower activity in winter and higher processing in summer, particularly in the wet section of the channel. We identified hydrological connectivity (both lateral and longitudinal), flow intermittency, upstream terrestrial land use, and geomorphological characteristics of the channel as key drivers of organic matter storage, transport, and processing. Understanding organic carbon dynamics in non-perennial systems can help estimate the impact of hydrological irregularities associated to global change with the ecological functioning of stream ecosystems.

# Factors influencing representation in metabarcoding of freshwater macroinvertebrate communities

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7C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*'m an aquatic ecologist, with a particular passion for river and stream ecosystems, and the invertebrates that make these places their home. I've been involved in a diverse range of invertebrate ecology research projects, with the common goal of disentangling the response of freshwater species and assemblages to natural environmental heterogeneity and anthropogenic pressures, particularly from agriculture and industry.*

Steady advancements have been made in the use of DNA-based methods for detection of species in a wide range of ecosystems. However, the routine application of DNA-based methods to monitor whole communities (typically metabarcoding) to assess the status of ecosystems continues to be limited. The DNAqua-Net consortium undertook a structured experiment to assess the factors influencing the precision and accuracy of molecular methods for freshwater macroinvertebrate community assessment. Standard kick samples were collected from nine sites in England for which long-term data (c. 10 yrs) on community composition were available. The macroinvertebrates present in the samples were identified and counted using standard morphometric protocols then reconstituted. The samples were homogenised, and aliquots of the homogenate and a DNA extract of each sample were distributed among seven laboratories across Europe. Each laboratory sequenced the homogenate and the DNA extract in triplicate. Data were summarized using the mixed taxonomic level used by UK environmental agencies. The factors influencing the returned community were explored. Furthermore, comparison with the morphological analysis enabled the benchmarking of molecular to traditional processing approaches.

# Fall of giants: simulating European waterscape degradation and its consequences for diversity patterns

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5C_SS05_Freshwater Macroecology research and perspectives, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*

*These team of researchers has joint their efforts within the Ponderful project where they try to understand pond relevance from a landscape scale. However they are also interested in the entire waterscape and the interaction between freshwater habitats from a regional point of view. Now, they present another work were they go an step further and present sensitivity to fragmentation from European waterscapes.*

Landscape degradation is always listed as a main driver of the diversity crisis even though its consequences for diversity patterns are difficult to identify. However, most of the studies have focused on terrestrial systems due to the clear link with human land use impacts. Freshwater studies focused on lotic systems also considering the impact of dams but seldom considering lentic systems. Furthermore, when referring to aquatic landscapes we must acknowledge the interconnection among them and their shared diversity. In this work, we explore the potential trends in diversity in response to freshwater degradation across Europe. Satellite information was used for estimating European waterscapes. Based on this initial layout, we simulated diversity patterns with a coalescent model that considered main European ecoregions as working units and nine dispersal abilities representing different organisms' interaction with waterscape. Then, we generated a gradient of waterscape degradation scenarios systematically removing a percentage of habitats and recalculating their corresponding diversities. Overall, for each ecoregion, dispersal ability and degradation scenario we obtained theoretical gamma diversity values. Using this information, we analysed degradation patterns by calculating the diversity loss rate and the acceleration rate, which described the simulated diversity decay pattern. We mapped these two parameters across ecoregions and related them with continental scale predictors. Large differences were observed between ecoregions with some of them rapidly collapsing and others being more resistant to waterscape degradation. Such information will contribute to management of freshwater biodiversity at broad scales, improving adaptation and resilience to human-derived changes.

# Fate, transport and ecological consequences of microplastics in non-perennial streams

Mr Nans Barthélémy[1], Dr Florian Mermillod-Blondin[1], Dr Thibault Datry[2], Dr Stefan Krause[3], Dr Laurent Simon[1]
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1A_SS14_Drying rivers in a time of global change, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I'm Nans Barthélémy a PhD student based at the Claude Bernard University Lyon 1 (France). My PhD concerns the fate, transport and ecological consequences of microplastics in non-perennial streams.*

Microplastics (MPs) are plastic particles <5 mm that raise global concern due to their ubiquitous presence in ecosystems and the threat they pose to organisms and ecosystem functions. Rivers have, for long, been considered as pipes transporting MPs towards the ocean, but recent studies have shown that MPs can accumulate for long times in rivers and negatively affect freshwater communities. However, the effects of drying on the transport, accumulation and fragmentation of MPs remains unknown, despite the majority of streams and rivers experiencing natural flow intermittence. Here, we explore through both field and laboratory experiments whether river intermittency has significant influences on plastic fate and bear consequences for ecosystems functioning. First, we assess the plastic fragmentation under controlled conditions, simulating a gradient of drying intensity. In mesocosms, alternances of aquatic and terrestrial phases were generated to evaluate their effects on plastic fragmentation (i.e. formation of smaller plastics particles). We then study the impact of different sizes and concentrations of MPs on G. fossarum, a common amphipod in temperate European rivers. The effects of MPs exposure on its underlying functional role as a shredder organism will be quantified after several weeks of MPs exposure in mesocosms. Finally, we perform sediment coring in the riverbed of multiples reaches experiencing contrasted drying intensity to evaluate the effects of drying on the stocks and the vertical distribution of MPs accumulated in the riverbed. In this presentation, preliminary results will be discussed as well as their implications.

## Fatty acids in periphyton and invertebrates of alpine glacial streams.

Maria Chiara Vulcano[1], Prof. Martin J. Kainz[2,3], Prof. Leopold Füreder[1], Dr Georg H. Niedrist[1]
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7A_RS15_Science dissemination/communication & education, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Maria Chiara Vulcano is a PhD student at the University of Innsbruck in the group River and Conservation Ecology. Her research focuses on the production of fatty acids in alpine streams and their role in the local food webs, especially considering the compartments of benthic algal producers and invertebrate consumers.*

Fatty acids (FA) are physiologically important compounds for stream invertebrates. They constitute a source of dietary energy, are structural components of cell membranes, and especially some omega-3 (n-3) and n-6 polyunsaturated fatty acids (PUFA) serve as precursors of hormones and signaling molecules conducive for somatic growth and reproduction of invertebrates. In freshwater ecosystems, n-3 and n-6 PUFA are almost exclusively synthetized by algae, while animals generally depend on dietary PUFA acquisition as they cannot biosynthesize them de novo. The dietary availability of PUFA from the base of stream food webs is related to periphyton and ultimately controlled by abiotic conditions that determine community diversity and also affect the biochemical composition within taxa. The progressive deglaciation of mountain areas is producing changes in the physico-chemical habitat conditions of glacial streams, with potential effects on periphyton biomass, community composition, and FA content, and on consumers of local food webs. In this study we assessed the FA composition of periphyton and invertebrates of 7 glacial streams along a decreasing gradient of glaciation and 2 non-glacial streams in the Austrian Alps. We found that the FA content of periphyton varied among different stream types, and within glacial rivers with different degrees of glacial influence. This variability was not reflected in the consumer lipid profiles, suggesting that glacial invertebrates retain physiologically important FA and control their lipid composition endogenously rather than via environmental conditions or dietary FA composition.

# Fine sediment pollution: a targeted approach to source identification and mitigation

Dr Jessica Durkota[1], Dr  Simon Pulley[2], Professor Adie Collins[2]
[1]Environment Agency, London, United Kingdom, [2]Rothamsted Research, Devon, United Kingdom

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Jessica Durkota is a researcher and practitioner at the Environment Agency (England). Her research considers ecological community response to changes in water quality and quanity. She is currently focused on using this research to support policy development and implementation in agriculture.*

The erosion, transportation and deposition of sediment are natural catchment processes, important in shaping habitat diversity and supporting ecosystem function; however, excess fine sediment can impact aquatic ecosystems adversely, impair water quality and increase flood risk. Elevated sediment loss is often associated with agricultural land management, but varies by catchment and can include other sources of sediment pollution, such as urban runoff and forestry. Sediment fingerprinting, an approach which compares the properties of sediment retrieved from the water environment with those of its potential sources, can be used to understand the provenance of sediment pollution and target interventions, but conventional sediment fingerprinting is often costly, thereby limiting its uptake. This study reviews the use of a novel low cost rapid-assessment sediment fingerprinting method across three catchments in England to assess its potential to inform the provision of advice for mitigation measures through an agri-environment programme. The results suggest that this method is effective at identifying and discriminating between the most important sources of sediment across the studied catchments, and that it can be used to target and tailor the delivery of advice for mitigation measures to the most critical areas in these catchments. This approach can greatly enhance the catchment-specific understanding of sediment pollution sources and help to target efforts to mitigate the loss of sediment to the water environment more effectively.

# Floating ferns for wetland restoration? Lessons learnt from four years of Azolla cultivation on former agricultural soils

Renske Vroom[1], Bas Van de Riet[1,2], Alfons Smolders[1,2], Leon Lamers[1], Sabine Hilt[3], Sarian Kosten[1]
[1]Radboud University, Nijmegen, Netherlands, [2]B-WARE Research Centre, Nijmegen, Netherlands, [3]Leibniz Institute for Freshwater Ecology and Inland Fisheries (IGB), Berlin, Germany

7F_RS21_Wetland ecology and management, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Renske Vroom researches how human land use change impacts freshwater ecosystems. Her research focuses on nutrient dynamics and greenhouse gas emissions in peatlands, (former) agricultural soils and aquaculture ponds.*

The restoration and novel creation of wetlands is crucial as they provide myriad ecosystem services including carbon sequestration. Degraded wetlands have often known agricultural use, resulting in a substantial nutrient legacy, especially of phosphorus (P). Subsequent rewetting of these former agricultural soils typically leads to water quality issues, low biodiversity and high methane emissions. To overcome these challenges in a novel, cost-effective way, Azolla filiculoides (water fern) could be cultivated to simultaneously extract P, sequester carbon, and provide a commercial product. Azolla is excellent at accumulating P due to its nitrogen fixating capacity and high growth rate. To test this approach, we cultivated Azolla on former agricultural peat and mineral soils in several field and mesocosm trials. We measured soil, water, and plant nutrient dynamics, and methane emissions. We found that Azolla cultivation is only feasible on soils with a high P mobilisation potential under oxic conditions, as Azolla cover did not reduce surface water oxygen concentrations as anticipated. Only after prolonged (>1 year) cultivation, oxygen levels dropped, presumably due to organic matter accumulation and subsequent decomposition. On suitable soils, P extraction rates up to 123 kg/ha/yr were measured, while surface water P concentrations remained low. Methane emissions (diffusion and ebullition) were highly dependent on time frame, season, and development of other macrophytes and algae. We conclude that cultivating Azolla shows potential in the transition from agriculture to nature, while recovering P from former agricultural soils. Remaining challenges include pest control, product development, and technologies for large-scale implementation.

# Flood-related aquatic-terrestrial pesticide transfer in riparian plants

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[1]RPTU Kaiserslautern-Landau, Landau, Germany

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am a Ph.D. student studying aquatic-terrestrial ecosystem linkages within the DFG Research Training Group GRK 2360 "SystemLink" at the RPTU Kaiserslautern-Landau. As an ecotoxicologist, I am particularly interested in studying the aquatic-terrestrial pollutant transfer via flooding events and the relative contribution of the flood-related contamination pathway with potential bottom-up effects in the terrestrial environment.*

Climate change will strongly alter and impact many ecosystems. This applies also to riparian aquatic-terrestrial transition zones and their communities, which will be impacted even more in the future by recurring floods and droughts. Flooding can have an impact on riparian communities in both positive and negative ways, including through the input of particle- and nutrient-rich water. These floods, however, can also be carriers of pollutants dissolved in water or associated with sediment particles. The goal of this study was to determine the extent to which riparian herbaceous vegetation may receive contamination through this pathway.

This study investigated six stream sites in the Upper Rhine Plain, an area dominated by viticulture, fruit orchards, and vegetable crops. The micropollutant load was investigated in five different plant species and their respective rhizospheric soil within a recently flooded floodplain and a nearby higher, non-flooded section of the riverbank at each site. The quantitative and qualitative differences in micropollutant load between soil and plants, divided into root, shoot, and leaf, from the floodplain and non-floodplain, were investigated by applying sensitive LC–MS/MS analysis.

Our study illustrates flood-mediated micropollutant contamination of the riparian plant species to support the hypothesis of an aquatic-terrestrial contaminant link. As plants are part of the terrestrial food web, the risk for possible bottom-up effects in the riparian zone will be addressed.

# Flow intermittence alters community resilience in a naturally drying river network

Dr Amélie Truchy[1,2], Dr Romain Sarremejane[1], Dr Thibault Datry[1]
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2A_SS14_Drying rivers in a time of global change, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Amélie Truchy received her graduate education at Uppsala University (Sweden) and Université Claude Bernard Lyon 1 (France). She holds a PhD degree from the Swedish University of Agricultural Science, at which she is currently a researcher. Her work focuses on understanding the impacts of - anthropogenic or natural - environmental change on the structures and the functions of freshwater ecosystem services.*

The likelihood of an ecosystem to undergo flow regime shifts increases under global change. To understand how drying in river networks can affect ecosystem resilience, i.e. the ability of an ecosystem to maintain its structure and processes when facing a disturbance, we sampled communities along a gradient of flow intermittence comprising 20 sites distributed across a naturally-drying river network. Based on the discontinuity hypothesis, species with similar body sizes operate at specific spatial and temporal scales, mirroring resource availability to support their subsistence and ecological functions. After measuring fish, aquatic and terrestrial invertebrates found in leaf litter packs, we inferred community resilience based on a set of indicators (cross-scale structure, within-scale structure, aggregation length, gap size, functional redundancy and cross-scale functional redundancy). Headwaters and mainstem differed in their resilience components, with mainstem characterized by greater overall resilience. Flow intermittence had a negative effect on both cross-scale and within-scale resilience, with the lowest amount of resilience found in headwaters subjected to drying. Although within-scale functional richness remain stable, cross-scale functional redundancies of most functional feeding groups were negatively affected by flow intermittence, impairing the associated ecological functions, such as leaf litter decomposition. This study shows the profound effects of flow intermittence on community resilience, with intermittent ecosystem potentially being more sensitive to disturbances, implying that mitigating the effects of drying on river network ecosystems could be challenging in the future.

# Food webs of agricultural streams are less complex but not less efficient

Dr Mario Brauns, Romy Wild[2]
[1]Helmholtz Centre for Environmental Research - UFZ, Magdeburg, Germany, [2]Technical University of Munich, Munich, Germany

7A_RS15_Science dissemination/communication & education, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Mario is a researcher at the Helmholtz Centre for Environmental Research - UFZ since 2010. He is interested in quantifying relationships between physical heterogeneity, biodiversity and ecosystem functioning in freshwater ecosystems.*

The expansion and intensification of agricultural land use and the associated deforestation, eutrophication and modification of habitat heterogeneity remain the most important stressors to stream ecosystems worldwide. Their effects on biodiversity and community composition are well described, but we lack comparative knowledge about the effects of agriculture on the topology of and energy fluxes in food webs. We combined stable isotope-derived dietary proportions with quantifications of ecosystem production to calculate food chain length, complexity and trophic transfer efficiency (TTE) of the green (biofilm) and brown (terrestrial POM) food chain in two forested and two agricultural streams. Food web complexity was lower, and food chains were shorter in agricultural than in forested streams. There was a shift in basal resources from tPOM to biofilm in agricultural streams, and TTE of the brown and green pathway decreased with increasing trophic positions in agricultural streams. However, the remarkably high TTE of primary consumers in agricultural streams compensated for the loss of green and brown fluxes to higher trophic levels. We attribute the observed food web effects to the release of primary consumers from top-down pressure, as predator production was lower in agricultural than in forested streams. We discuss if the inverse relationship between food chain length and TTE is a peculiarity of highly modified freshwater ecosystems.

# For how long is time relevant? Assessing spatiotemporal time windows relevance on macroinvertebrates diversity from temporary streams.

Dr David Cunillera-montcusi[1,2,3], Dr. Miguel Cañedo-Argüelles[1,7], Mr. José María Fernández-Calero[1,4], Dr. Núria Cid[1,6], Mr. Pau Fortuño[1,4], Dr. Maria Soria[1,4], Dr. Dolors Vinyoles[1,4], Dr. Núria Bonada[1,4]
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2A_SS14_Drying rivers in a time of global change, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*The current authors belong to the FEHM-Lab at university of Barcelona have deboted several years to the study of temporary streams. In this presentation they are going to present the results of the MECODISPER project, financed by the spanish government.*

River networks have a distinct spatial structure defined by their dendritic nature. However, the influence of landscape structure on the assembly of local communities (meta-community dynamics) depends on the dispersal abilities of the species. In networks containing temporary streams, biotic community assembly mechanisms vary widely in space (not all stream sections dry up) and time (along a year). Thus, there is a growing interest in addressing spatiotemporal variability of biotic communities, which has been fostered by the availability of high frequency flow measurements. Recently, new frameworks have been proposed to quantify how hydrological connectivity patterns change through space and time (STcon). In this study, we aim to better understand how communities respond to drying by analysing spatiotemporal connectivity considering different number of days before the sampling (time-windows). We used a dataset of flow state (flowing vs. dry) spanning a 513-day period. This dataset corresponded to seven temporary streams sampled during four seasons. Later, we compared how macroinvertebrate alpha and beta diversity related to STcon values along all time-windows, spanning from 10 days to all the monitored time before the samplings. The amount of variance in diversity explained by spatiotemporal connectivity peaked at short time-windows (30 days). The current exercise allowed us to calibrate the STcon framework and, specially, to quantify the approximate time-window at which drying may impact temporary streams biotic communities. This will help to better disentangle biodiversity patterns in temporary streams and improve management practices of these ecosystems.

# Freshwater biodiversity of temporary streams from the Canary Islands: status, trends, and new initiatives for conservation

Dr Núria Cid[1,2], Dr Raúl Acosta[1,3], José María Fernández-Calero[1], Dr Jérôme Latron[1,3], Dr Pilar Llorens[1,3], Dr.Prof Francesc Gallart[1,3], Dr Carles Alcaraz[1,3], Dr Rosa Trobajo[1,3], Dr David Mann[1,3,9], Dr Xavier Benito[1,3], Dr Brent Emerson[4], Dr Paula Arribas[4], Dr Maria Soria[3,5], Dr Núria Bonada[3,5], Pau Fortuño[3,5], Dr Marcos González[6], Dr Belinda Gallardo[7], Dr Virgilio Hermoso[8], Dr Miguel Cañedo-Argüelles[2,3]

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2A_SS14_Drying rivers in a time of global change, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Núria Cid is a researcher in freshwater ecosystems working on community ecology of intermittent rivers, with a focus on adapting ecosystem assessments to climate change. She dedicated most of her research to study the implications of global change for the bioassessment and conservation of rivers. She participated in several projects dedicated to improve the management of Mediterranean intermittent rivers and streams.*

Most streams from the Canary Islands (Macaronesian region) are temporary, i.e., they may stop flowing or dry out during some periods. The permeability of the volcanic terrain, the high pressure on water resources, and the general decrease in precipitation are increasing the severity and duration of the dry period in these systems. These streams can host many species of aquatic insects and diatoms, most of them endemic with restricted distributions and limited dispersal, making them prone to extreme risk of extinction. Some of the species can be part of the hidden biodiversity and may even become extinct without having been described. Within this context, actions to halt island biodiversity loss, especially in small islands such as the Canary archipelago, are urgently needed. Two recently funded projects, CONACAN and BIOACUANA, aim to contribute to inform the protection of freshwater biodiversity of the Macaronesian Region by collecting data from non-perennial streams in Tenerife, la Palma and la Gomera islands. These projects aim to generate information on: (i) hydrology, (ii) taxonomic, and genetic diversity of aquatic insects and diatoms, (iii) the distribution of aquatic invasive species within national parks, (iv) the vulnerability of aquatic insects and diatoms to climate change, and (v) priority areas for the conservation of biodiversity to design a long-term aquatic monitoring network. Here we present an overview of the trends and status of freshwater biodiversity from the Canary Islands, with special attention to aquatic insects and diatoms, together with the preliminary results of the first sampling campaigns.

# Freshwater ostracod assemblages associated to environmental variables (Lake Vegoritis, Western Macedonia, Greece)

Miss Valentini Navrozidou[1,2], Miss Olga Koukousioura[2], Mr Peter Frenzel[3], Mrs Maria Triantaphyllou[4], Mr Pavlos Avramidis[5], Mrs Elina Aidona[2], Mr George Syrides[2]
[1]Greek Biotope/Wetland Centre, The Goulandris Natural History Museum, Thermi, Greece, [2]School of Geology, Aristotle University of Thessaloniki, Thessaloniki, Greece, [3]Institute of Earth Sciences, Friedrich-Schiller-Universität Jena, Jena, Germany, [4]Faculty of Geology and Geoenvironment, National and Kapodistrian University of Athens, Athens, Greece, [5]Department of Geology, University of Patras, Patras, Greece

1E_RS10_Biomonitoring, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a Geologist, MSc in "Ecological Quality and Water Management" and a PhD candidate in Geology, focusing on Environmental Micropalaeontology. I have been working at the Greek Biotope/Wetland Centre of the Goulandris Natural History Museum since 2013, as a phytoplankton specialist in the national monitoring program of Greek lakes. I am also involved in projects related to the Natura 2000 Network and the Implementation of the Nature Directives, such as the preparation of the national reports on the implementation of Directives 92/43/EEC and 2009/147/EC in Greece and the preparation of the Special Environmental Studies.*

Ostracods are small bivalved crustaceans sensitive to changes in water quality, displaying various response and tolerance to distinctive environmental variables, thus considered valuable environmental tracers in freshwater ecosystems. However, ostracods are not taken into account for the water quality assessment. Studies on their biogeography, biology, ecology, and shell geochemistry provide useful insights during both paleoenvironmental investigations and evaluations regarding the impact of human activities on aquatic ecosystems. Lake Vegoritis is a karstic lake and one of the largest lakes in Greece. Over the past few decades, has started exhibiting eutrophication phenomena, due to various anthropogenic land use activities in its catchment area. The lake has been very limited studied concerning ostracods. Our preliminary results provide a detailed documentation of the lake's ostracod fauna accompanied by a complete dataset of physicochemical, sedimentological and geochemical measurements, in order to test their ability to serve as environmental proxies in freshwater ecosystems. Almost 1650 ostracod valves were counted belonging to six taxa. Most dominant was Candona spp. (most likely C. neglecta) mostly juveniles, while the second most abundant was the species Limnocythere inopinata. Some stations lacked of ostracod fauna while the southern stations were most abundant and diversified. In general, the ostracod abundance and diversity displayed a gradual decrease with increasing depths, resulting in total absence in stations with depths exceeding 40 m (northern part of the lake). The same trend was observed with increasing TOC and nutrient content. Further investigation will enable us to evaluate ostracod assemblage's response to the various environmental variables.

# Freshwater Pearl Mussel, Margaritifera margaritifera, Recovery Project

Mr Ben King[1], Yasmin AliEskandari[1], Dr Louise Lavictoire[1]
[1]Freshwater Biological Association, , United Kingdom

5D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***

*Ben King is the FBA's Pearl Mussel Officer, based at the Species Recovery Centre in the Lake District, Cumbria. Ben's job purpose is to manage the rearing systems in order to ensure the success of pearl mussel, Margaritifera margaritifera, breeding and the wider Freshwater Pearl Mussel Ark Project.*

The freshwater pearl mussel (Margaritifera margaritifera) is a critically endangered species in the UK, listed as Endangered on the IUCN Red List of Endangered Species, and declining throughout the whole of its range. Many of the existing UK populations are ageing, with the youngest mussels in rivers being over 70 years old due to juveniles being most affected by poor habitat conditions. The future status of M. margaritifera is heavily dependent on increasing their overall population size through captive breeding. Established in 2007, the Freshwater Pearl Mussel Recovery project is an ongoing partnership project led by the Freshwater Biological Association (FBA). A national holding facility has been established at the FBA in Windermere, Cumbria, to maintain and breed threatened populations of M. margaritifera from rivers across England and Wales, which supports the national plan of captive breeding and release to suitable rivers. The project has already achieved notable success with juvenile production and retention. In recent years, the FBA has successfully trialed releases into the wild of juveniles reared at their facility. These mussels were tagged with both numbered and electronic tags so that they can be monitored to determine the success of these releases over time. This oral presentation will give an update on the success of the project and the expansion of the release programme.

# Freshwater soundscapes and the acoustic ecology of tadpoles in urban ponds

Prof. Kirsten Parris[1]
[1]The University Of Melbourne, , Australia

8B_SS04_Soundscape studies in ponds and lakes, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Kirsten Parris is a Professor of Urban Ecology at the University of Melbourne. She led the multidisciplinary National Environmental Science Program's Research Hub for Clean Air and Urban Landscapes (CAUL) from 2018-2021, facilitating practical research and engagement across air quality, urban planning, liveability, urban greening and biodiversity. She has a deep affinity with frogs, and her current research focuses on the impacts of noise, light and chemical pollution on urban wildlife.*

Urban areas provide crucial habitat for native biodiversity, including > 400 federally listed threatened species in Australia, such as the growling grass frog (Litoria raniformis) in Melbourne. Native wildlife also faces a range of novel stressors in cities. One such stressor is anthropogenic noise from transport, industry and construction. In adult frogs, transport noise impairs hearing and acoustic communication, while prolonged exposure to road-traffic noise is known to increase physiological stress and impair immune function. A recent analysis demonstrated that while on land, adult growling grass frogs experience significant acoustic interference from transport noise at half their remaining breeding sites in Melbourne. However, little is known about the effects of anthropogenic noise on freshwater soundscapes in cities, or its impacts on the acoustic ecology of larval frogs (tadpoles) in urban ponds and streams. I will present the first results of a study to quantify the contribution of transport noise to freshwater soundscapes in urban ponds in Melbourne, and to assess its impacts on audition in tadpoles.

# From DNA to diagnostics: the potential of macroinvertebrate metabarcoding to diagnose stressors and assess the effectiveness of restoration measures

Dr Gea Van Der Lee[1], Dr Marcel Polling[1], Ms Iris van der Laan[2], Dr Ralf Verdonschot[1]
[1]Wageningen Environmental Research, Wageningen, Netherlands, [2]Waterschap de Dommel, Boxtel, Netherlands

7C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Gea van der Lee is a researcher in aquatic ecology at Wageningen Environmental Research. She obtained her doctor degree in 2020 on functional indicators of anthropogenic stress in aquatic ecosystems. Currently, she works together with the water authorities on improving the monitoring and diagnosis of streams and ditches.*

Freshwater ecosystems are under pressure due to multiple stressors. Restoration measures should halt further degradation these ecosystems and improve their ecological status. However, diagnosis of the relevant stressors to determine the proper restoration measures, and assessment of the effectiveness of the implemented measures is often insufficient in terms of spatial and temporal coverage because of logistic and financial constraints. DNA metabarcoding has been proposed as an cost-effective method to scale up sample processing, although its diagnostic application is still limited. The aim of our study was to assess if DNA metabarcoding of macroinvertebrates could be used for diagnostic purposes at the watershed scale. To this purpose, we collected macroinvertebrate samples and extracted eDNA from the water at 28 sites in the upstream, restored and downstream section of a recently restored lowland stream in The Netherlands. The specimens in the samples were first identified morphologically, after which DNA was extracted from the bulk sample. The results showed that eDNA only detected a limited part of the macroinvertebrates present, whilst the DNA of the bulk samples was representative for the community in the stream. Therewith, the ecological traits of the species in the DNA bulk samples could successfully be used to both diagnose the stressors at the different sites in the stream, and to assess the effectiveness of the restoration measures, showing the added value of the approach for water managers.

# From minimum flow to ecological flow in a lowland Italian river: Considerations on ecological targets

Dr Silvia Quadroni[1], Dr Caterina Maria Antognazza[1], Prof Giuseppe Crosa[1], Dr Serena Zaccara[1], Dr Livia Servanzi[2], Dr Paolo Espa[2]
[1]Department of Theoretical and Applied Sciences, University of Insubria, Varese, Italy,
[2]Department of Science and High Technology, University of Insubria, Varese, Italy

9B_RS12_Advances in environmental flow science and practice, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*I am postdoc in river ecology and ecohydraulics at University of Insubria. I am expert in river biocenosis and in the use of benthic macroinvertebrates as bioindicators to assess the impacts of hydro-morphological alterations due to water diversions and flushing of sediments from hydropower reservoirs. My current research project focuses on the collection of the information needed to improve water resource management from an ecological viewpoint.*

In the European Union, river managers and authorities are facing the challenge of the transition from minimum flows to ecological flows, i.e., from flows sufficient to maintain aquatic species during crucial low-flow periods to flows consistent with the achievement of the good ecological status sensu Water Framework Directive. In order to evaluate the suitability of the current management practices and protection measures, we investigated a river reach of the lowland Ticino River, the second Italian river in terms of average flow. The study reach is located downstream of an intake structure, capable of maximum diversion of approximately 60% of the river mean annual discharge, for agriculture and hydropower. We first monitored benthic macroinvertebrate community during low-flow periods and quantified the ecological status based on this biological quality element. Then, we applied eco-hydraulic modelling to assess habitat availability for different aquatic organisms at the currently adopted ecological flows. We selected two fish species, marble trout (Salmo marmoratus), the only salmonid species of this river even if locally extinct in recent years, and Padanian barbel (Barbus plebejus), a cyprinid species sensitive to environmental pressures and currently threatened also by the invasion by the congeneric European barbel (Barbus barbus). Moreover, we set-up habitat suitability curves for benthic macroinvertebrate taxa representative of the Ticino community, and used them for modelling their habitat. The results of the two approaches support a thorough assessment of the efficacy of ecological flows for the protection of freshwater ecosystems in regulated rivers.

# Functional non-equivalence in ecosystem engineers: Freshwater mussel species identity alters associations with macroinvertebrate communities in a subtropical lake

Isobel Ollard[1], Professor Gawsia Chowdhury[1,2], Professor David Aldridge[1]
[1]University Of Cambridge, Cambridge, United Kingdom, [2]University of Dhaka, Dhaka, Bangladesh

7A_RS15_Science dissemination/communication & education, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Isobel Ollard is a PhD student in the Aquatic Ecology Group at the University of Cambridge. I study the ecology and conservation of freshwater mussels, focusing on tracking population changes over time, and the interactions between mussels and other benthic invertebrates.*

Freshwater mussels (Bivalvia: Unionidae) are often described as ecosystem engineers, with the capacity to alter abiotic habitats; this can facilitate certain macroinvertebrate taxa, increasing biodiversity and potentially altering community composition. Mussel species are often implicitly considered approximately ecologically equivalent, with similar impacts on abiotic environments and benthic communities. This assumption of redundancy is important in conservation approaches which aim to preserve ecosystem functioning, rather than species identity. We tested this assumption of equivalence in two species of subtropical freshwater mussels, <i>Lamellidens marginalis</i> and <i>Parreysia caerulea</i>, studying their associations with macroinvertebrate communities in a heavily polluted urban lake in Dhaka, Bangladesh. We investigated the associations of mussel density on different macroinvertebrate families, which we further classified into functional feeding groups (predators, scrapers, collectors and shredders). We found that densities of the two mussel species were strongly negatively correlated. Sites containing higher densities of <i>Lamellidens</i> contained similar macroinvertebrate communities, while there was no similarity between <i>Parreysia</i> sites. These similarities were driven by associations between mussels (mainly <i>Lamellidens</i>) and certain macroinvertebrate families and functional feeding groups, particularly predators and scrapers. This provides support for the role of mussels in structuring freshwater invertebrate communities and emphasises the importance of species identity, with one possible keystone species (<i>Lamellidens</i>) largely driving associations. We conclude that the two mussel species do not show ecological equivalence. These results highlight the importance of species identity in supporting ecosystem functioning and community composition, particularly for ecosystem engineer species, and the need to test assumptions of ecological redundancy.

# Genetic and taxonomic diversity of Aquitaine coast lakes isoetid communities

Mrs Estelle-Marie Blanquart[1,2], Mr Aurélien Jamoneau[1], Mr Olivier Lepais[2]
[1]INRAE EABX, Cestas, France, [2]INRAE BIOGECO, Cestas, France

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Estelle-Marie Blanquart is a PhD student at INRAE in Bordeaux, France.*

*With a master degree in evolutionary biology from Lille University, she is working on conservation genetics, population dynamics and plant biology.*

Southwestern freshwater lakes of the Aquitaine coast host a unique aquatic plant diversity, which maintain vital ecosystem functions. However, anthropogenic activities and global changes pose significant threats to these communities, leading to local extinctions.
In this project, we first aim to investigate the genetic diversity of nine macrophytes species composing isoetids communities from five lakes. To this end, we will study the genetic variation with sequence-based nuclear microsatellites genotyping across 4000 sampled individuals. The distribution of genetic diversity within and between lakes will help understanding population-level processes as well as identifying ancient and contemporary factors structuring populations and communities assemblages. These results will provide insights into the adaptation capacity, demographic history, dispersal abilities and structure of macrophytes populations.
In addition, we aimed to deepen our understanding of ecological processes to a larger biological scale in examining the correlation between genetic and taxonomic diversity using the SGDC (species-gene diversity correlation) framework. This approach aims to determine if the same ecological processes occur at different biological scales as well as to establish if taxonomic diversity can be a good proxy for genetic diversity.
In essence, this project should provide valuable information for conservation management plans in the Aquitaine region and contribute to our understanding of how freshwater plant communities are structured and how they respond to anthropogenic threats. The ultimate goal of this project is to work with the stakeholders to ensure the conservation of these sensitive but fundamental populations.

# Geographical range and spatial patterns in the population structure of aquatic beetles of supralittoral rockpools

Mr Antonio José García-Meseguer[1], Mrs Juana María Mirón-Gatón[1], Dr. Andrés Millán[1], Dr. Josefa Velasco[1], Dr. Adrián Villastrigo[2], Dr. Irene Muñoz[3]
[1]Ecology and Hydrology Department, University of Murcia, Murcia, Spain, [2]Division of Entomology, SNSB-Zoologische Staatssammlung München, Munich, Germany, [3]Biodiversity, Ecology and Evolution Department, Complutense University of Madrid, Madrid, Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Predoctoral researcher (FPI-MCIU fellowship) at Department of Ecology & Hidrology, University of Murcia, Spain.*
*M.Sc. in Protected Areas, Natural Resources and Biodiversity, 2017. University of Murcia.*
*B.Sc. in Biology, 2014. University of Murcia.*
*Research lines:*
*Taxonomy, ecology, biogeography and evolution of macroinvertebrates.*
*Conservation and climate change vulnerability of macroinvertebrates.*
*Tolerance to multiple stressors in aquatic and subterranean macroinvertebrates.*
*Career history:*
*- 2023-present: Visiting PhD student. Zoologische Staatssammlung München. Munich (Germany).*
*- 2019-present: Predoctoral researcher (FPI-MCIU fellowship). Aquatic Ecology Research Group. Department of Ecology and Hydrology, UMU.*
*- 2017-2019: Predoctoral researcher. Mediterranean Ecosystem Research Group. Department of Ecology and Hydrology, UMU.*

Knowledge of population structure, genetic diversity and distribution patterns help us to identify insect populations representing genetic lineages and determine the geographic distribution of genetic variability, which are of crucial concern for understanding insects' ability to disperse and colonize different areas. This is important for the conservation of biodiversity since populations with low genetic variability and dispersal capacity are more susceptible to extinction. At the ecotone of the marine and terrestrial environments, supralittoral rockpools are among the most dynamic and extreme habitats. In these adverse conditions, only a few and singular species have been able to adapt and survive, like Ochthebius quadricollis, O. lejolisii and O. subinteger (Coleoptera: Hydraenidae), with cryptic lineages. To know the distribution ranges and population limits of these species, 21 localities were samples along the Mediterranean coast of the Iberian Peninsula and the Balearic Islands, where they co-occur. At each locality, ten specimens of each species were analyzed using 10 microsatellites to understand its population structure as well as connectivity between populations. Overall, we detected a significant population structure matching with the previous cryptic lineages identified for the studied species using CO1 and wingless molecular markers. Northern and southern populations genetically differ, while the southeastern populations located between dispersal barriers, exhibit a higher diversity of lineages. Our results provide novel information on the genetic flow and dispersal ability of aquatic beetles of the genus Ochthebius.

# Geomorphological effects of fish in mountain streams

dr Aneta Bylak[1]
[1]University of Rzeszów, Rzeszów, Poland

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Freshwater ecologist at the University of Rzeszów (Poland). Dr. Aneta Bylak's research interests are broad, but her research focuses on the life history of freshwater fish, in particular the role of ecological barriers in determining fish distribution and influencing the structure and functioning of fish communities.*

Elucidating the impact of faunal activity on stream channels is an emerging field wherein ecologists, geomorphologists, and engineers collaborate to research and manage fluvial ecosystems. Fish inhabiting mountain streams impact on bottom substrate during their reproductive cycles, e.g. female brown trout (Salmo trutta fario) build gravel redds. At high densities of fish building redds, large areas of the bottom substrate are mixed, which promotes better oxygenation or removal of fine-grained sediments. Foraging fish also substantially affect the bottom structure. Small fish alter the grain arrangement, and large fish can move stones and large amounts of finer bottom materials. They can dig hollows, and mix and push sediments. Fish that forage the bottom substrate include species with inferior mouths and barbels, e.g. barbel (Barbus barbus), gudgeon (Gobio gobio), and stone loach (Barbatula barbatula). The barbel affects the substrate structure, bed load transport, and substrate coarseness. Fish such as nase (Chondrostoma nasus) that feed on periphyton can shift relatively large stones. Foraging of large fish may disturb bottom imbrication, destabilising the gravel and pebbles and increasing the risk of bed-load movement in response to flowing water. Smaller fish affect the physical structure of the channel only at the microhabitat scale. Foraging of fish may disturb bottom imbrication, destabilising the gravel and pebbles and increasing the risk of bed-load movement in response to flowing water.  Fish burrowing in the bottom substrate also mix fine sediments and affect their deposition and transport downstream. Their cumulative impacts on mountain stream channel may be very large.

# Getting the message right on water quality and wild swimming

Prof Suzanne McGowan[1,2], Svenja Adolphs[2], Carol Adlam[3], Laurence Carvalho[4], Fiona Moffatt[2]
[1]Netherlands Institute of Ecology (NIOO-KNAW), , The Netherlands, [2]University of Nottingham, , United Kingdom, [3]https://caroladlam.co.uk/ , , United Kingdom, [4]Norwegian Institute for Water Research, , Norway

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Aquatic ecologist and palaeolimnologist who investigates how and why aquatic ecosystems respond to environmental changes over a variety of timescales. Interested in how people interact with water. Works with algae and their pigments as bioindicators. Head of Deaprtment of Aquatic Ecology at the NIOO-KNAW and fellow of the Freshwater Biological Association.*

Wild swimming (swimming outdoors in natural blue spaces) has surged in popularity as the physical and mental health benefits are increasingly recognized. Concurrently, publicity surrounding poor water quality in UK inland and coastal waters is escalating, with swimmers often leading environmental campaigns for water quality improvements. Balancing the potential health benefits versus the environmental risks of wild swimming is essential to help (potential) swimmers make informed decisions. In this interdisciplinary Arts and Humanities Research Council project, we conducted a survey of over 2000 low income households in the UK and found that water quality was the top barrier to engagement with outdoor swimming, above other water safety concerns. We identified gaps in information provision to UK swimmers and found that, in contrast to coastal waters, most inland waters (lakes, ponds, rivers) lacked basic water quality information because only a handful are “designated” swim sites which must legally be monitored. Swimmers were often reliant on swim groups and personal knowledge to help assess water safety. The Bloomin’ algae app can help to educate swimmers, but there are no user-friendly methods or kits suitable for rapid detection of the most prevalent water quality risks including cyanobacterial toxins and bacterial coliforms. Therefore, we developed artwork and messaging on environmental and safety risks that can be used to empower swimmers to make realistic risk assessments for deciding when and where to swim.

# Glacier retreat reorganises river habitats leaving poorly-protected refugia for Alpine invertebrate biodiversity

Prof. Lee Brown[1], Dr Martin Wilkes, Prof Jonathan Carrivick, Dr Emmanuel Castella, Dr Christiana Ilg, Dr Sophie Cauvy-Fraunie, Dr Sarah Fell, Dr Leo Fureder, Prof Matthias Huss, Dr Will James, Dr Valeria Lencioni, Dr Chris Robinson
[1]University Of Leeds, Leeds, United Kingdom
2F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I am Professor of Aquatic Science within the River Basin Processes and Management research group at Leeds, where I lead research on river ecosystems and aquatic ecology. Through my research I aim to increase understanding of how aquatic ecosystem biodiversity and functional processes respond to environmental change.*

*My work crosses several research fields (population and community ecology, hydrology and geomorphology). I am particularly interested in river ecosystems in cold regions (alpine, arctic), the effects of catchment management (e.g. land-use change, environmental-flows) on rivers, and aquatic food webs.*

Alpine river biodiversity around the world is under threat from glacier retreat driven by rapid warming, yet our ability to predict the future distributions of specialist cold-water species is currently limited. Here, we link future glacier projections, hydrological routing methods and species distribution models to quantify the changing influence of glaciers on population distributions of 15 alpine river invertebrate species across the entire European Alps, from 2020 to 2100. Glacial influence on rivers is projected to decrease steadily, with river networks expanding into higher elevations at a rate of 1% per decade. Species are projected to undergo upstream distribution shifts where glaciers persist but become functionally extinct where glaciers disappear completely. Several alpine catchments are predicted to offer climate refugia for cold-water specialists. However, present-day protected area networks provide relatively poor coverage of these future refugia, suggesting that alpine conservation strategies must change to accommodate the future effects of global warming.

# Global datasets of aggregated environmental variables at the sub-cachment scale for freshwater biodiversity modeling

Jaime Garcia Marquez[1], Sami Domisch[1], Vanessa Bremerich[1], Afroditi Grigoropoulou[1], Maria Magdalena Üblacker[1], Yusdiel Torres[1]
[1]Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany

4G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Ecologist with emphasis on biodiversity and landscape modeling. My work as a researcher but also in the private and NGO sector range from analysis of land cover patterns and changes over time, analysis of forest fragmentation and landscape connectivity strategies, land planning and scenario development, design of biodiversity offsets and quantification and mapping of ecosystem services and the study of wildlife spatial distribution and definition of high-value conservation areas.*

The current loss of freshwater habitats and biodiversity calls for immediate improvements and applications of existing modeling frameworks in research. The availability and quality of the data available for modeling is therefore crucial towards informed decision making in conservation. A common approach to model freshwater habitats and biodiversity at large scales is to use subcatchments as the unit of analysis. A recently published dataset, Hydrography90m, delimited 726 million subcatchments globally. Our aim was to aggregate a set of environmental layers for each sub-catchment and provide tools for easy access to the new derived datasets. We calculated summary statistics (i.e, mean, standard deviation, minimum, maximum and range) for each sub-catchment using as reference a total of 106 environmental variables, including 47 variables related to topography and hydrography, 19 climate variables (current and future), 22 land cover categories, 16 soil variables and 2 variables related to nitrogen deposition. The calculations were also done for each year if time-series were available. We used open-source geoprocessing tools (e.g. GDAL/OGR, GRASS-GIS) within a High Performance Computer cluster. Functions within the R-package hydrographr and a Shiny application have been developed for public access and easy retrieval of the newly-aggregated datasets. This new and large database opens a range of opportunities for research and application in biogeographical analysis and conservation of freshwater systems.

# Good times ahead? How the Holocene sediment geochemical record can help with scenario testing and target setting for lake water total phosphorus

Dr Madeleine Moyle[1], Dr John Boyle[1], Prof Richard Chiverrell[1]
[1]University of Liverpool, , UK

7B_SS15_Who knows what is “good”? Defining aquatic ecosystem health targets for the United Nations Sustainable Development Goals, national and international policies, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a palaeolimnologist, with a background in archaeology, interested in how humans have impacted their environments through time. I primarily use lake sediment geochemical records to reconstruct changes in landscape phosphorus supply and lake water nutrient concentrations through the Holocene. I use this long-term perspective to give context to today’s freshwater systems and to consider how we might better manage these environments for people and nature.*

Successful lake nutrient management relies on total phosphorus (TP) targets that are both achievable and meaningful. Here we present a critical evaluation of TP targets from Crose Mere, a small eutrophic UK lake, using a novel sediment geochemical approach to provide a Holocene-scale perspective on lake nutrient status. Combined with land cover modelling (REVEALS), the sediment-inferred TP (SI-TP) record shows firm evidence of human impact on lake water TP concentrations from at least ca. 6600 BP. Eutrophic conditions are reached during the Iron Age, with TP concentrations comparable to the present day, following a significant shift in vegetation cover, the introduction of cattle, and increased erosion in the catchment. This highlights the need for a millennial scale perspective truly capture pre-disturbance lake conditions. Comprehensive hydrochemical monitoring shows that the present-day P budget balances, suggesting that the major catchment P sources been identified. Together with the sediment evidence this forms an empirical basis for quantifying the P budget under a range of land use scenarios, using a validated export coefficient model to test management options for achieving ‘good status’. We find it may not be possible for lake water TP to return to true pre-disturbance levels. However, ‘good status’ can be achieved at Crose Mere if the direct contribution from cattle and the human contribution via septic systems are removed. Here we show that lake sediment geochemical records enable testing and validation of management options, by providing the long-term, empirical evidence needed to fully contextualise present day lake status.

# Greenhouse gas dynamics: High-resolution measurement of $CH_4$ and $CO_2$ in temperate urban ponds.

Mr Ben Archer[1], Prof. Mark Gessner[1]
[1]Igb-berlin, Berlin, Germany

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*Having undertaken a research masters at the University of Essex investing GHG dynamics and drivers in hypereutrophic reservoirs, I continued to investigate freshwater GHG dynamics in my doctoral work at IGB-Berlin. My main focus has been the development and application of openSource automatic floating chambers in urban freshwater environments, inorder to get the high temporal and spatial resolution data.*

Urban freshwaters favour high rates of microbial $CO_2$ and $CH_4$ production. As urbanisation increases globally, a rapidly growing number of freshwater bodies are subject to these conditions. Despite this, no studies have investigated $CO_2$ and $CH_4$ emissions at a sufficient temporal resolution to accurately characterise the dynamics of the system. To start bridging this gap, we connected automatically ventilating floating chambers (AFCs) with a high-resolution Cavity Ring-Down Spectroscopy (CRDS) analyser and deployed them in seven urban ponds for 24-hour periods . The unprecedented temporal resolution of the measurements revealed a clear diel influence on emissions rates, with average day-time $CH_4$ fluxes 1.8 times higher than night-time fluxes, and large variability over 24 hours. Deployment of the AFCs in four seasons between autumn 2021 and summer 2022 also showed seasonal variation in flux rate, with $CH_4$ efflux and $CO_2$ influx increasing from winter to spring, then peaking in summer, and the prevailing pathway varying from near complete diffusion in the winter to strong ebullition dominance in the summer. High spatial variation both among and within ponds was driven by ebullition events. Collectively, these results underline the importance of high-resolution flux measurements and, most notably, that urban ponds are disproportionately large sources of $CH_4$. and This calls for increasing efforts to capture diel and seasonal $CH_4$ dynamics in urban freshwaters, particularly in light of ongoing global warming and urbanization trends.

# Greenhouse gas flux dynamics in a river network fragmented by drying

Ms Teresa Silverthorn[1], Dr. Naiara López-Rojo[2], Dr. Romain Sarrenejane[1], Dr. Arnaud Foulquier[2], Mr. Abdelkader Azougui[1], Dr. Vincent Chanudet[3], Dr. Thibault Datry[1]
[1]National Institute for Agriculture, Food, and Environment (INRAE), RiverLy Research Unit, Villeurbanne, France, [2]Univ. Grenoble-Alpes, Univ. Savoie Mont Blanc, CNRS, LECA, Grenoble, France, [3]Électricité de France (EDF), Hydro Engineering Centre, Department ES, La Motte Servolex, France

2A_SS14_Drying rivers in a time of global change, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Teresa is a PhD candidate in aquatic ecology, based in Lyon, France.*

The drying of surface water is occurring with increasing frequency in the Anthropocene. Drying fragments river networks, influencing important ecosystem functions such as the processing of carbon and nitrogen, and associated fluxes of greenhouse gases (GHGs). Drying creates different habitat patches varying in space and time: dry river beds, isolated pools, and flowing waters. These habitats, and the transitions between them (i.e. rewetting and drying), create unique conditions that may promote the production of GHGs. We hypothesized that riverine GHG fluxes should be governed by the frequency of drying and that responses may differ depending on location along the river network. We used the chamber method with automated analyzers, to measure $CO_2$, $CH_4$, and $N_2O$, along with a suite of environmental variables, over 8 months at 20 reaches across an intermittent river network, the Albarine, in France. We found that $CO_2$ and $N_2O$ flux rates from flowing waters were higher on average than fluxes from dry river beds. Furthermore, fragmentation by drying had a legacy effect on flowing GHG fluxes. Perennial reaches had on average higher $CO_2$ and $N_2O$ fluxes, but lower $CH_4$ fluxes than the intermittent flowing reaches, and the drivers of flowing GHG fluxes differed between the perennial and intermittent reaches. $CO_2$ emission rates at perennial reaches increased with a higher frequency of drying upstream, and intermittent reaches with more frequent drying had lower $CO_2$ fluxes. This research advances our understanding of biogeochemical cycling in intermittent river networks and can inform upscaling for global riverine GHG emission estimates.

# Habitat distribution modelling in alpine glacial streams threatened by climate change.

Oskar Schröder[1], Bina R. G. Perl[1], Nieves Rodríguez Lopez, Julio Schneider[1], Ernesto Razuri Gonzales[1], Sami Domisch[3], Steffen[1]
[1]1Department of Terrestrial Zoology, Entomology III, Senckenberg Research Institute and Natural History Museum, Frankfurt, Germany, [2]2Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia, Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona (UB), Barcelona, Spain, [3]3Department II, Community and Ecosystem Ecology, Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany

4G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Dr. Oskar Schröder is a postdoctoral researcher at Section Entomology III of Senckenberg Research Institute, working on biodiversity, biogeography and taxonomy of aquatic insects. He is especially interested in phylogeographic patterns in mountainous caddisflies, stoneflies, chironomids and blepharicerids.*

While global climate change is affecting all limnic environments, the effects are especially pronounced in high-altitude mountain streams. Disappearance of alpine glaciers and shifting of ecosystems to higher altitudes is projected to disturb and fragment benthic invertebrate communities in this vulnerable environment. GloBios is an international project aiming to assess taxonomy and functional biodiversity of trichopterans, plecopterans and chironomids of high-altitude streams of South American, Central American and European mountain ranges. Using barcoding, metabarcoding and species distribution modelling approaches, we identified species that are especially vulnerable to climate change due to low genetic diversity, habitat specificity and small distribution ranges. Additionally we predict changes in distribution based on future climate scenarios, to identify areas of high conservation value to minimize loss of genetic and taxonomic diversity.

# Habitat type strongly influences the structural benthic invertebrate community composition in small water bodies in an agricultural landscape in the northeastern German lowlands

Fee Nanett Trau[1], Dr. Stefan Lorenz[1]
[1]Julius Kühn-Institut, Berlin, Deutschland

1D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Fee Nanett Trau is a PhD student at the Julius Kühn Institute in Berlin, Germany. Her research focuses on characterizing community composition and trophic interactions of benthic macroinvertebrates in small water bodies of agricultural landscapes in Germany.*

Small water bodies (SWBs, < 1ha) are heterogeneous habitats, characterized besides others by differences in water regime, physicochemical parameters, habitat types and the influences of the surrounding land use, e.g. nutrient and pesticide inputs. Due to their diverse features, they are biodiversity hotspots for various aquatic and terrestrial organisms as shown for example in the northeastern German lowlands for rotifer communities (Onandia et al. 2021) and amphibians (Savić et al. 2021). However, knowledge on how benthic invertebrate communities are structured is scarce. Based on a comprehensive data set of 111 samples from 100 SWBs, we showed that the factor best explaining benthic community structures was the habitat type. Pesticide and nutrient concentrations only played a minor role in the structuring of benthic invertebrate community compositions, which could be caused by the long-term and ubiquitous occurrence of those stressors in the examined landscapes. However, it is yet unclear if possible indirect effects of agricultural stressors may affect the functional diversity of the benthic invertebrate communities. Therefore, this contribution will also focus on agricultural effects on food web structure in selected small water bodies.

Onandia, Gabriela; Maassen, Sebastian; Musseau, Camille L.; Berger, Stella A.; Olmo, Carla; Jeschke, Jonathan M.; Lischeid, Gunnar (2021): Key drivers structuring rotifer communities in ponds: insights into an agricultural landscape. Journal of plankton research 43 (3), 10.1093/plankt/fbab033.

Savić, Biljana; Evgrafova, Alevtina; Donmez, Cenk; Vasić, Filip; Glemnitz, Michael; Paul, Carsten (2021): Assessing the Role of Kettle Holes for Providing and Connecting Amphibian Habitats in Agricultural Landscapes.Land 10 (7), 10.3390/land10070692.

# Hidden in plain sight? – The biodiversity and conservation value of silt traps

Mr Charlie Patel, Prof Adrian Collins, Dr Jessica Durkota, Prof Paul Wood, Dr Kate Mathers
[1]Loughborough University, Loughborough, United Kingdom

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Paul is an ecohydrologist with research interests the response of instream organisms to hydrological variability and disturbances (including drought, sedimentation, pollution and invasive species) over a range of spatial and temporal scales.*

Agriculture is one of the biggest drivers of biodiversity losses globally, impacting both terrestrial and aquatic ecosystems. In England, agriculture covers more than 70 % of land which has led to the loss and homogenisation of aquatic habitats at a local and regional scale. This is most evident for ponds and small lentic waterbodies, with more than 30 % of ponds have been lost over recent decades in the UK. Despite pond losses, pond ecosystems are widely acknowledged as being one of the most abundant and biodiverse habitats of all aquatic habitats at the regional scale and have the greatest rarity value, with 80 UK Biodiversity Action Plan species recorded. Aquatic flora and fauna benefit from creation and restoration of ponds, including silt traps, which has been encouraged through Agri-environment schemes. Silt traps are artificially dug shallow basins designed to store excess sediment and nutrients from soil erosion that would otherwise be transported and subsequently deposited into riverine ecosystems. However, whilst silt traps have been shown to be effective in the use of retaining sediment, to date limited ecological data has been collected in relation to their biodiversity and conservation value. To address this knowledge gap, a range of silt traps located in both lowland and upland areas will be sampled in this project across the landscape and their local macroinvertebrate diversity and conservation value compared to other pond types in agricultural settings. This study will aim to inform future environmental legislation by understanding the hidden ecological benefits of ponds.

# How do agricultural types differ in their effect on river biota? A large-scale analysis

Mr Christian Schürings[1], Dr. Jochem Kail[1], Dr. Willem Kaijser[1], Prof. Dr. Daniel Hering[1,2]
[1]Department of Aquatic Ecology, Faculty of Biology, University of Duisburg-Essen, Essen, Germany, [2]Centre of Water and Environmental Research, University of Duisburg-Essen, Essen, Germany

5C_SS05_Freshwater Macroecology research and perspectives, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***

*Christian Schürings is a PhD student in Freshwater Ecology at the University of Duisburg-Essen, holding a stipend from the German Federal Environmental Foundation (DBU).*

*His research focuses on the effect of agriculture on freshwater biodiversity.*

*Education:*

*B.Sc Environmental Science from University of Koblenz-Landau, 2017*

*M.Sc Environmental Toxicology from University of Duisburg-Essen, 2019*

*Publications:*

*Effects of agricultural land use on river biota: a meta-analysis*

*https://doi.org/10.1186/s12302-022-00706-z*

Agriculture is often identified as the most relevant stressor for river biota. Consequently, transition of intensive to extensive agriculture gains rapidly importance in legislation. For freshwater protection a better understanding of the agricultural impact is needed as the effects can differ between crops and organism groups. This study assesses the effect of different crop types compared to urban areas and forests. A German wide dataset of 7748 sampling sites with multimetric indices for macroinvertebrates, macrophytes and diatoms was related to the adjacent land use by fitting generalized linear mixed models to estimate the effect of the different land use types. We found an effect of agriculture strongly differing between crop types exceeding urban effects in magnitude. Strongest negative effects were found for pesticide intensive crops for macroinvertebrates and macrophytes and nutrient intensive crops for diatoms. The results highlight the need to account for crop types when implementing freshwater protection.

# How do epiphytic algae and grazing snails modify the stable states between free-floating and submerged plants?

Prof Sandor Szabo[1], Mr Edwin Peeters[2], Mr Gábor Várbíró[3], Mr Gábor Borics[3], Mr Sebastian Birk[4], Mr Gergő Koleszár[1,3]
[1]University of Nyiregyhaza Institute of Environmental Sciences, Nyiregyhaza, Hungary, [2]Aquatic Ecology and Water Quality Management Group, Wageningen University and Research, Wageningen, The Netherland, [3]Department of Tisza Research, Centre for Ecological Research, Debrecen, Hungary, [4]University Duisburg-Essen, Faculty of Biology, Aquatic Ecology, Essen, Germany

8A_RS15_Science dissemination/communication & education, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Sandor Szabo is an experimental aquatic ecologist, investiagtes the interactions among aquatic plants, algae; the stable states between vegetation types. He also study the key traits in aquatic plant invasion and biofilltration potential of waterplants.*

In lentic water bodies, both submerged and floating vegetation can sustain their stable dominance. The competition between these two vegetation types can be strongly influenced by epiphytic algae, that are controlled by snails. However, how these relations between snails and epiphyton shape the competition between floating and submerged rootless vegetation remains rather unknown. The aim was to investigate this interaction. In laboratory experiment we co-cultured free-floating (Lemna gibba) and submerged plants (Ceratophyllum demersum) with the absence and presence of pond snail Radix labiata. Snails strongly reduced biomass and nutrient uptake of algae. Furthermore, Ceratophyllum-epiphyton complex without snails reduced N and P concentration of the water faster and had higher pH values than with the presence of snails. Overall, epiphytic algae significantly reduced the growth of free-floating plants resulting unfavourable conditions for them. Snails indirectly increased the growth, tissue N concentration and N uptake for both Lemna and Ceratophyllum. Experimental results together with structural equations modelling showed that snails seem to weaken the harmful influence of macrophyte-epiphyton complex on Lemna. Large-scale field observations showed that the abundance of L. gibba negatively correlated with Ceratophyllum cover. Abundance of C. demersum and L. gibba negatively correlated with algal biomass; however, correlated positively with the group of larger sized grazing snails. Results strengthen the hypothesis that under a certain nutrient range, epiphytic algae stabilize the dominance of submerged plants preventing colonization of small water bodies by free-floating plants.

# How do we prepare the freshwater scientists of the future?

Dr Gill Notman[1]
[1]University of Cumbria, Lake District Campus, Ambleside,, United Kingdom
6D_RS17_Science dissemination/communication & education, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Gill has been teaching in the UK higher education sector since 2011 and running the BSc Hons degree in Marine & Freshwater Conservation at the University of Cumbria since 2015. She is an experienced aquatic ecologist and passionate about science communication and education.*

It is essential that levels of education around environmental issues increase across society as a whole. Not only do we need to understand the numerous environmental challenges we face, but we also need to develop knowledge and strategies to improve matters for the future. Citizen science and community action may offer part of the answer, many excellent examples of freshwater monitoring projects spring to mind, including a number coordinated by our hosts and other organisations across the world. But is it enough?
How can we raise awareness of careers in the environmental sector more widely? In particular, how can we encourage young people, many of whom are committed to address the environmental challenges of our time, to consider a career in freshwater science?
Analysis of the UK higher education sector, specifically undergraduate (UG) provision in 'Ecology and Environmental Biology' shows some promising trends. UK applications are up 27% despite the pandemic from 2019 to 2021. Over 2000 students were registered on such courses in 2021, representing around 0.1% of the total number of UG students at UK Universities. But what needs to be done to raise promote freshwater science as a career and attract more students to courses where freshwater receives the focus it deserves?
I would welcome the opportunity to debate these ideas with the SEFS community to help identify barriers and explore opportunities around the exciting career prospects the sector provides.

# How far do adults of stream insects travel in terrestrial environments? Tracing different life stages using stable isotopes and DNA barcoding.

Dr Maria Alp[1], Mr. Emmanuel Jaulin[1], Dr. Thibault Datry[1], Ms. Uma Disdier[2], Prof. Sylvain Dolédec[2], Mr. Maxence Forcellini[1], Mr. Bertrand Launay[1], Dr. Laurent Simon[2], Dr. Mathieu Floury[1]
[1]INRAE, Villeurbanne, France, [2]Claude Bernard University Lyon 1 , Lyon, France
7G_RS20_Aquatic terrestrial linkages, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*I'm a freshwater ecologist specialised in the assessment of anthropogenic impacts on freshwater animals. After a PhD at Eawag (Switzerland) focusing on terrestrial stages of aquatic insects, I worked in several labs in Germany and France acquiring tools in population genetics, functional and spatial ecology and studying different model organisms (invertebrates, fish, crayfish). Two major axes of my current research today are 1) connectivity of river networks (in its different dimensions) for freshwater animals; and 2) socio-ecological effects of river management and restoration.*

Even though often short-living, adult life stages play a significant role in the population dynamics of stream insects. The stay in the terrestrial environments is crucial for completing their life cycle : it is in this period that they mate, disperse and then return to water to oviposit and recruit the next generation. Dispersal distances of adult aquatic insects in terrestrial environments are difficult to assess in the field and yet poorly known. Mark-recapture experiments using stable isotope enrichment of stream water (and thus of larval stages of insects) offer a way to trace adult insects from the site of their emergence. However, recapturing adults during their flight only reflects a snapshot of their dispersal, especially for females, whose « effective » dispersal corresponds to the distance between the emergence and the oviposition site. In the framework of an isotopic enrichment experiment we test the potential of using egg masses fixed by females to stream substrates for estimation of adult dispersal distances. Our results for two mayfly species demonstrate for the first time, that isotopic enrichment of larvae persists up to the egg stage allowing to use this life stage for estimating dispersal distances of females. We compare dispersal distances estimated based on marked egg masses to those based on marked adults and find a general trend for an upstream dispersal. Our empirical study provides rare empirical estimates of insect dispersal distances, crucial for making realistic assumptions on connectivity among populations when designing conservation and management strategies in stream networks.

# How resource supply (leaf litter) and leaf preconditioning influence leaf litter processing in streams

Ms Mourine Yegon[1,2], Ms. Pratiksha Acharya[2,3], Dr. Katrin Attermeyer[2,3], Assoc. prof. Dr. Wolfram Graf[1], Dr. Simon Vitecek[1,2]
[1]Institute of Hydrobiology, University of Natural Resources and Life Sciences, Vienna, Austria, [2]WasserCluster Lunz – Biological Station, Lunz am See, Austria, [3]Department of Functional and Evolutionary Ecology, University of Vienna, Vienna, Austria
7G_RS20_Aquatic terrestrial linkages, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am currently a Ph.D. student at WasserCluster Lunz Biological station affiliated with the University of Natural Resources and Life Science, Vienna (BOKU). My research focuses on Exploring the Biodiversity-Ecosystem Functioning Relationships of Leaf litter Decomposition in streams.*

In the wake of the sixth mass extinction, key ecosystem processes are declining, including leaf litter fragmentation in streams. Leaf litter fragmentation is critical in stream ecosystem functioning as it subsidizes detritus-based food webs and influences nutrient cycles. Loss of riparian tree biodiversity affects the leaf diversity, and thus the nutritional quality of litter introduced into streams. Leaf preconditioning facilitates the establishment of microbial assemblages on leaf surfaces that further modulate leaf palatability and selection by macroinvertebrate shredders. In this work, we used a single invertebrate taxon (a Sericostoma caddisfly) to examine whether leaf diversity and preconditioning affected litter fragmentation rates. We hypothesized that nutritional quality of leaves drives preferential feeding and thus, high-quality leaves will be decomposed at higher rates compared to low-quality leaves and produce greater amounts of fine particulate organic matter (FPOM). We addressed this by performing microcosm experiments to explore how litter diversity and preconditioning influence the feeding preferences and growth of Sericostoma, as well as the amount and composition of decomposition products. We used three leaf species (alder, maple, beech) pre-conditioned in either oxic or anoxic conditions as food resources and analyzed biomasses and elemental composition of the leaves, shredders, and FPOM. Litter fragmentation was variable and generally higher on the oxic-preconditioned litter, but not significantly so. The production and composition of the FPOM was related to leaf quality. Our results indicate that the loss of riparian biodiversity may have implications for in-stream consumer-resource interactions, especially in headwaters, where leaf litter is a major resource.

## How stresses affect freshwater fish?

Dr Paulo Branco[1], Tamara Leite[1], Dr. Pedro Segurado[1], Daniel Mameri[1], Dr. Maria Teresa Ferreira[1], Dr. José Maria Santos[1]
[1]Forest Research Centre, Associate Laboratory Terra, School of Agriculture, University of Lisbon, Lisbon, Portugal

6C_SS03_Fish Ecology and Conservation, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Biologist with special interest in Ecology. His researcher focuses on freshwater fish, river network connectivity and macroecological approaches to freshwater studies. Paulo leads a research line of river connectivity, developing new conceptual and practical tools. He is the CEO of the Associate Laboratory TERRA (Laboratory for the Sustainability of Land Use and Ecosystem Services) that integrates 5 research centers with more than 400 PhD researchers.*

Rivers are affected by a multitude of stressors that may impact fish in different ways. Some stressors act isolated, others in combination, some are only felt in the presence of others, while there are some that have their impact disappear when co-occurring with additional stressors. While fully understanding what is happening in situ, is difficult, due to the complexity of interactions, we can always isolate stressors in experimental setups to mechanistically determine how stressor levels affect animal behaviour, and then extrapolate to wider ecosystem level consequences. In this work we join several controlled mesocosms experiments conducted with freshwater fish species in presence of several anthropogenic driven stressors, such as: 1) secondary salinization, 2) forest fire ashes lixiviates, 3) oxygen depletion, 4) longitudinal fragmentation, 5) pesticides and 6) heat waves, and analyse their impact on a variety of behavioural metrics, such as: a) cerebral lateralization, b) boldness, c) activity, d) acceleration, e) shoal cohesion and f) movements. This work clearly demonstrates how different stressors have different effects in fish and how species may react differently to the same stressor. By doing this, we are able to derive conservation and management actions for maintaining freshwater fish communities healthy.

# How to manage temporary ponds and wetlands to strengthen their climate mitigation capacity? A biogeochemical study of their carbon balance under different management and restoration scenarios

Dr Daniel Morant[1], Dr Carlos Rochera[1], Dr Antonio Picazo[1], Mr Javier Miralles-Lorenzo[1], Mr Ernesto Aguirre[2], Dr David Miguélez[2], Ms Sonia Monferrer[2], Mr Javier Ruiz[2], Mr Antonio Guillem[2], Ms Maria Rosa López[2], Ms Vanessa Sánchez[2], Dr Antonio Camacho[1]
[1]University of Valencia, València, Spain, [2]Fundación Global Nature, Madrid, Spain

6B_SS18_Driving forward the network on the interpretation, conservation and management of temporary ponds, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Researcher focused on the biogeochemical study of the carbon balance in Mediterranean wetlands, the implications of management and restoration, and their applicability to the European Water Framework and Nature Directives.*

The carbon sequestration and climate mitigation capacity displayed by temporary ponds and wetlands can be diminished, and even reversed towards a higher release of greenhouse gases and turn them as contributing to warming  when they are altered and/or mismanagement. However, specific management and restoration actions could be key to strengthen the carbon sink capacity and reduce greenhouse gas emissions, recovering or maintaining at the same time a healthy structure and function. Funded by the Life Wetlands4Climate project (LIFE19 CCM/ES/001235), field experiments were carried out, evaluating the rates of carbon biogeochemical processes both using an ecosystem metabolic approach as well as directly measuring fluxes of greenhouse gases (CO2 and CH4) under different conditions. Specifically, actions related to water flooding gradients, direct actions on vegetation, such as mowing and grazing, as well as acting on soils, specifically mud mixing or stripping, were evaluated. The results revealed how the mowing of helophytes (reeds, rushes), with proper management of the obtained biomass such as its use for agricultural purposes, favoured carbon sequestration. Soil management actions (mud mixing and stripping), and flooding-drying levels also modulated greenhouse gas emissions and the rates of primary production and respiration in plankton and benthos. The assessment of each of these actions was carried out in parallel to the maintenance of their natural characteristics, in order to establish actions to strengthen the carbon sequestration capacity without compromising their natural status.

# hydrographr: a new R-package for scalable hydrographic data processing in R

Dr Sami Domisch[1], Maria M. Üblacker[1], Afroditi Grigoropoulou[1], Vanessa Bremerich[1], Christoph Schürz[2], Giuseppe Amatulli[3], Yusdiel Torres-Cambas[1], Thomas Tomiczek[1], Jaime R. Garcia Marquez[1]
[1]Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Germany, [2]Helmholtz Centre for Environmental Research GmbH - UFZ, Leipzig, Germany, [3]Yale University, New Haven, USA

4G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Sami is leading the research group focusing on global freshwater biodiversity, biogeography and conservation at the IGB, Berlin. Beside spatial freshwater biodiversity science, his group is developing novel datasets and tools to be used in high-resolution spatial biodiversity analyses.*

Freshwater ecosystems are characterized by the unique feature of the longitudinal connectivity among water bodies. Yet, this connectivity is largely neglected in large-scale biodiversity analyses given the complex geospatial processing steps. In addition, the sheer amount of geospatial data is considered a challenge, since such data can’t be easily managed in a standard GIS environment. We have developed the R-package hydrographr that offers easy-to-use hydrographic processing tools. The package provides (i) basic functions in terms of downloading and processing the recently published Hydrography90m dataset, (ii) point processing tools for e.g. delineating catchments and annotating sampling locations with freshwater-specific data, and (iii) analysis tools which support stream network analyses regarding distance and neighourhood calculations. The package offers scalability as it uses the open-source GDAL/OGR and GRASS-GIS tools in the background, without having to load all data into the R environment. We will demonstrate the R-package, available at https://github.com/glowabio/hydrographr, and also show how to interact with a new online platform to retrieve environmental attributes across the stream network globally. The hydrographr package addresses an important gap in spatial freshwater biodiversity analyses by bringing the advanced and scalable command-line geospatial processing tools into a common user environment.

# Hydromorphological pressures alter the structure and distribution of fish communities in high-altitude rivers in Carpathians

Mr Stelian Valentin Stanescu[1,2], Prof. Dr. Geta Risnoveanu[1]
[1]University of Bucharest, Doctoral School in Ecology, Faculty of Biology, University of Bucharest, Bucharest, Romania, [2]National Institute of Hydrology and Water Management, Bucharest, România

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Stanescu Stelian Valentin, currently ecologist at the National Institute of Hydrology and Water Management in Romania.  He studied Ecology and environmental protection between 2008 and 2013 and is currently undergoing PhD studies at University of Bucharest. During the last 10 years, he practiced in environmental consultancy and in water management, manifesting interest for water resource management and ecohydrology in order to support the implementation of Water Framework Directive (WFD) in Romania, biodiversity, freshwater ecosystems, environmental flows calculus, water body impact assessment and reviewing the hydromorphological assessment methodology for rivers.*

Water is vital for human development, and various water uses generate multiple pressures on rivers. Hydromorphological pressures can alter aquatic habitat quality and rivers' longitudinal and lateral connectivity. Alteration of the aquatic habitat (e.g., water velocity and substrate) lead to unfavorable spawning and feeding conditions for some species and changes the structure of the fish fauna in rivers. This paper assesses the influence of hydromorphological alterations on the structure and distribution of fish communities in 124 high-altitude rivers, tributary of several major rivers in the Romanian Carpathians. The sites were classified as reference (47 sites), slightly (40 sites) and heavily impacted (37) sites based on three types of hydromorphological pressures (transversal structures, embankments and channelization). Overall, 24 native species of fish were confirmed. Some are protected at the European and national level, two are classified as Near Threatened by IUCN, and four are non-native species. Fish abundance decreases as the impact increases. Overall-tolerant species, species with a generalist feeding behavior, limnophillic and phytophilic spawn species have higher densities in heavily impacted sites. Feeding specialists, such as periphyton feeders, recorded the highest densities in slightly impacted sites. Lithophilic spawners, invertivorous and rheophilic species, recorded smaller densities as impact increased. Long-migrant and piscivorous species are present only at very low densities in reference sites. The paper discusses the effect size of the impact on different species and traits and identifies the tolerant and the most sensitive species to the hydromorphological changes.

## Hyperspectral Imagery and Artificial Intelligence feasibility to boost the Early Warning of Cyanobacterial Blooms

Ms Claudia Fournier[1], Prof Antonio Quesada[1], Dr Samuel Cires[1], Dr Mohammadmehdi Saberioon[2]
[1]Universidad Autónoma De Madrid, Madrid, Spain, [2]Helmholtz Centre Potsdam – GFZ German Research Centre for Geosciences, Potsdam, Germany

1E_RS10_Biomonitoring, June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Claudia Fournier is a PhD student at Universidad Autónoma de Madrid. Her background is in Biology (BSc) with a following specialization in Inland Water Quality Assessment (MSc).*

*In parallel, she has been learning and working as Data Scientist on different projects related to aquatic ecosystems. Nowadays, her research focuses on developing advanced tools for the early warning of Cyanobacterial Harmful Algal Blooms from a multi-scale perspective.*

*This perspective combines ecological, taxonomical, and toxicological approaches typical of biological sciences with machine-learning techniques, hyperspectral imagery,*

Cyanobacterial Harmful Algal Blooms (CyanoHABs) represent a major risk for freshwater and marine ecosystems, having significant impacts on socioeconomic systems and human health. The early warning of these events is of special interest to water managers worldwide. In this context, this multidisciplinary work aims to assess the feasibility of artificial intelligence techniques and hyperspectral imagery to boost the early warning of CyanoHABs. To be able of discriminating the spectral characteristics of the main potential toxicogenic cyanobacterial genera, a hyperspectral imagery (HI) collection of diverse cyanobacterial cultures was collected under controlled conditions with the hyperspectral camera Specimen FX10 (which records the complete spectral reflectance in the wavelength range of 400–1000 nm region with 224 bands). This collection includes mainly HI from a factorial experiment where five cultures representative of widespread toxic bloom-forming genera (Microcystis, Planktothrix, Aphanizomenon, Dolichospermum, and Chrysosporum) were exposed to different environmental conditions (e.g., light and nutrients). For the analysis, (1) first, correcting methods were applied considering the dark and white references, outliers were removed, and regions of interest were selected, (2) then, different spectral pre-processing methods were used and (3) finally, machine learning methods were implemented to classify the different spectral responses of cyanobacteria, whose results were evaluated with diverse classification metrics. The results from this new objective method to enable the classification of cyanobacteria through hyperspectral and image-based features will be discussed in relation to their foreseen applicability for the advanced monitoring of waterbodies.

# If done right, ecosystem metabolism is a reliable and integrative tool to evaluate river restoration efforts: a new framework

Mr Hugo Enrique Reyes Aldana[1,2], Dr. Daniel Graeber[2], Dr. Matthew Cohen[3], Prof. Dr. Markus Weitere[1], PD. Dr. Ute Risse-Buhl[4]
[1]Department of River Ecology, Helmholtz Centre For Environmental Research - UFZ, Magdeburg, Germany, [2]Department of Aquatic Ecosystem Analysis, Helmholtz Centre For Environmental Research - UFZ, Magdeburg, Germany, [3]School of Forest Sciences, Fisheries and Geomatic Sciences, University of Florida, Gainesville, United State of America, [4]Institute for Environmental Sciences, University of Kaiserslautern, Landau, Germany

2B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*My name is Hugo and I'm a PhD student at the Helmholtz Centre UFZ in Magdeburg, Germany. I focus on developing a better understanding of ecosystem functions and its relevance for the provision ecosystem services and development of restoration strategies. With a biology and evolutionary ecology background, I try to bring those perspectives into the fields of applied ecology and environmental sciences, as I consider them essential to have a deep understanding of how Earth's ecosystems works. I'm also profoundly interested in science communication and the science-policy interface in topics such as biodiversity, restoration and management.*

Rivers provide multiple ecosystem functions and services, which are compromised by anthropogenic exploitation. Guaranteeing the provision and sustainability of such services thus requires restoration efforts. Such efforts are almost exclusively evaluated according to structural properties of the communities. But a more comprehensive evaluation of restoration success is needed and might benefit by considering functional properties, such as ecosystem metabolism. We synthesized the literature on ecosystem metabolism as a metric of river restoration, to reveal if its promising role as an integrative metric is able to reflect the improvement of freshwater ecosystem health after restoration. We hypothesize that impacts of restoration practices will be evident in ecosystem metabolism. Restoration practices such as (re-)establishing riparian vegetation, adding channel woody debris, and engineering river meanders should be expected to modify ecosystem metabolism by altering gross primary production or ecosystem respiration through its drivers. We found that different restoration strategies affect environmental variables that, in turn, control river ecosystem metabolism. Nutrients, carbon, light, morphology, and flow resulted the most dominant drivers of metabolism after restoration, surprisingly biodiversity also appeared to influence metabolism at certain level which is a novel finding. We identified clear patterns that helped ecosystem metabolism to succeed as a restoration metric, such as the evaluation of the adequate temporal and spatial scales, clear functional references and goals, and the understanding of its drivers. Then, we developed a working framework to ecosystem metabolism as metric for river restoration expecting to advance the science and practice of river restoration.

# Impact of artificial light at night on the activity behaviour and physiology of brown trout (Salmo trutta)

Mr Matthew Hatfield[1], Dr Andrew Vowles[1], Prof Paul Kemp[1]
[1]International Centre For Ecohydraulics Research (ICER), University of Southampton, Southampton, United Kingdom

6C_SS03_Fish Ecology and Conservation, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Matt Hatfield graduated from the University of Plymouth (2018) with a BSc (Hons) degree in Marine Biology. Following that, he graduated from the University of Southampton (2019) with an MSc degree in Oceanography. After a successful MSc thesis project investigating the impact of artificial light at night (ALAN) on intertidal benthic invertebrates, he has pursued his interest in the effects of ALAN on aquatic environments through his PhD in Environmental Engineering at the University of Southampton. His current research is focused on freshwater fish behaviour and physiology, and his interests span a vast range of aquatic biology and behavioural ecology.*

The world has experienced unprecedented urbanisation and population growth over the last century, with urban areas predicted to house up to 68% of the global population by 2050. Artificial light at night (ALAN) provides society with the means to be active during night-time, but has become a fast-growing, serious, and ongoing pollution event. Considering the dependence of numerous biological phenomena on natural light regimes, it is unsurprising that ALAN constitutes substantial anthropogenic pressure on natural biological systems. Despite still being in its early stages, fish-related research has identified a range of impacts of ALAN on fish reproduction, movement, behaviour, and physiology. However, the field is still understudied in comparison to terrestrial research. Therefore, this talk will focus on the direct impacts of ALAN on brown trout activity during a 21-day ALAN exposure period, followed by the impacts of ALAN on a wider range of behaviours post-exposure, whilst under flume conditions. Initial results indicate impacts of ALAN on population-level activity, with daytime activity following exposure to ALAN approximately 50% lower compared to those in the control tank. Although behavioural impacts were observed, effects on fish physiology appear less obvious. This talk will present these results and discuss their implications within the context of experimental studies aimed at identifying ecological impacts of ALAN and the need to better understand and mitigate this major form of environmental change.

# Impact of fish ponds on freshwater pearl mussel streams

Ms Rebecca Hoess[1], Prof. Dr. Juergen Geist[1]
[1]Technical University of Munich - Aquatic Systems Biology Unit, Freising, Germany
2D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*June 2018 - present: PhD position at the Aquatic Systems Biology, Technical University of Munich*

*April 2015 - June 2018 Master-Program Biology, Technical Universitiy of Munich*

*October 2011 - April 2015 Bachelor-Program Biology, Technical Universitiy of Munich*

Fish ponds are integral parts of river catchments in Northern Bavaria, affecting water retention, sediment and nutrient dynamics, as well as the thermal regimes of the stream systems they are connected to. We quantified these effects over more than two years within two catchments containing both > 500 ponds and the largest remaining populations of the endangered freshwater pearl mussel (Margaritifera margaritifera), which is particularly sensitive to fine sediments and changes of hydrology and temperature. Nearby ponds increased summer stream temperature by up to 5.5 °C in receiving streams, with the spatial extent of the temperature increase also strongly depending on the riparian land use and groundwater contribution via the hyporheic zone. Nutrient and fine sediment inputs from ponds over most of the time and across various discharges were typically small compared to other sources such as land use. In contrast, pond drainage - in particular during the fish harvest - released large quantities of fines to the receiving streams, especially in situations when no mitigation measures were applied. These inputs resulted in decreased habitat quality and increased mortality of juvenile mussels. Mitigation measures such as physical settling structures and adjusted harvesting methods significantly reduced the fine sediment deposition rates in the receiving streams. In the context of freshwater pearl mussel conservation, these impact of ponds need to be accounted for to maximize benefits and minimize negative impacts of fish ponds on the habitat quality for mussels and their host fish.

# Impact of sediment generation related to forestry on stream fish communities

dr Aneta Bylak[1], prof. Krzysztof Kukuła[1]
[1]University of Rzeszów, Rzeszów, Poland

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Freshwater ecologist at the University of Rzeszów (Poland). Dr. Aneta Bylak's research interests are broad, but her research focuses on the life history of freshwater fish, in particular the role of ecological barriers in determining fish distribution and influencing the structure and functioning of fish communities.*

Our current understanding and assessment of the impacts of forest exploitation on catchments and fluvial ecosystems are limited. After agriculture and mining, forest exploitation is a major source of mineral suspensions. Forestry activities require the use of appropriate equipment for tree felling and timber transport. Tree clearing disturbs soil cover and aggravates erosion. Cleared trees are transported on logging trails that support mineral suspension transport. The loose, thin soil layers characteristic of mountains are easily washed out. Fine sediments that enter stream may directly or indirectly affect particular stages of fish development. The accumulation of fine sediments may reduce fish spawning effectiveness, inhibit migration, and interfere with feeding. Streams degraded by the influx of anthropogenic sediments, however, may be recolonised. The objectives of the study were to i.) investigate and assess the effects of forest exploitation on the physicochemical parameters and substrate properties of stream habitats as they affect the requirements of fish species, ii.) investigate the response of these fish species and their various developmental stages to forest exploitation in the stream catchment. Our analysis revealed that channel silting reduced brown trout (Salmo trutta) and Siberian sculpin (Cottus poecilopus) abundance. The Water Framework Directive has indicated that measures must be taken to remediate the ecological condition of flowing waters in the region. We propose that the management of forest catchments and the ecological health of montane streams may be improved by constructing sedimentation tanks and fences that cut off the flow of eroded soil to streams.

# Impacts of climate change and anthropogenic pollution on socio-ecologicaly important ponds in The Red River Delta, Northern Vietnam.

Dr James Fielding, Jodie Brown[1], Nga Do Thu[2], Suzanne McGowan[3], Dr Virginia Panizzo[1], Adrian Bass[4], Jack Lacey[5], Andrew Smith[5], Gina Henderson[6], Andrew Henderson[6], Andrew Large[6]

[1]School of Geography, University of Nottingham, Nottingham, United Kingdom, [2]Electric Power University, Hanoi, Viet Nam, [3]Netherlands Institute of Ecology, Wageningen, Netherlands, [4]Geographic and Earth Sciences, Glasgow, United Kingdom, [5]National Environmental Isotope Facility, British Geological Survey, Nottingham, United Kingdom, [6]School of Geography, Politics & Sociology, Newcastle University, Newcastle, United Kingdom

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

The Red?? River Delta in northern Vietnam comprises the country's most densely populated region, as well as substantial agriculture, contributing ~20% of the nation's food production, and internationally important protected natural habitats. To date research into the impacts of climate change and anthropogenic pollution on waterbodies in the region has been focused on the major river channels. However, a large part of the open fresh and saltwater landscape is made up of ponds and lakes, which are subject to a traditional multi-use model (potable water, food and farm waste disposal, sanitation, bathing, washing, aquaculture, and agricultural irrigation) and play an important role in the regions natural and cultural heritage. Despite their important socio-ecological role many ponds in the region are impacted by industrial, domestic and agricultural pollution, and climate change. To assess these impacts pond physio-chemical (Alkalinity, salinity, DO, turbidity, TP, SS, Oxygen and Nitrogen stable isotopes, DIC, DOC, DON, Sediment elemental geochemistry), and biological (Diatoms, eDNA, Chl a, phytoplankton) parameters were analysed, as well as living experiences of the pond users and stakeholders recorded for 36 sites across the Red River Delta. Early results indicate some water bodies are highly impacted by recent extreme eutrophication, leading to fish kills. Pond users have also indicated that lower river levels caused by prolonged dry seasons have led to concentrating of pollutants in irrigation canals leading to further pollution of ponds fed by these sources. This work hopes to highlight the importance of and threats to these traditional aquatic systems in the wider context of the globally important Red River Delta.

# Implications for managing the climate crises in rivers: aspects of shading, residual flows and cold-water pools in the thermal regime of a pre-alpine river

Dr Florian Borgwardt[1], MSc Stephanie Popp[1], Dr. Kurt Pinter[1]
[1]University of Natural Resources and Life Sciences, Vienna, Vienna, Austria
2F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*DI Dr. Florian Borgwardt is an expert in freshwater ecology with a focus on riverine landscapes and the environmental processes shaping the biological communities therein. His work addresses human impacts as well as climate change effects on aquatic biodiversity to inform management and conservation on robust strategies to halt biodiversity loss. Florian is experienced in using GIS systems and various statistical methods (e.g. multivariate techniques, species distribution modelling) to analyse the drivers and pressures on aquatic ecosystems. He has been involved in several national and international projects also serving as principal investigator and task leader.*

Water temperature is one of the basal factors in the physico-chemical environment of rivers. Driven by several environmental factors, climate and in more detail atmospheric conditions are amongst the most important drivers of the thermal regime. Thus, climate change also affects the thermal regimes with important implications for their conservation and management. Fish are significantly influenced by their ambient temperature. Both the spatial (longitudinal) and temporal (daily and seasonal) component of the thermal regime is relevant to them and their life stages. In this study, we detailly disassemble the thermal regime of a pre-alpine river to identify cold-water pools relevant as refugia for flagship species such as Hucho hucho during heat periods as well as to investigate the role of shading and residual flow in the evolvement of stream temperatures along the longitudinal gradient. The thermal regime is analysed along the longitudinal gradient with a detailed investigation of two residual flow sections. Underpinned by fish-sampling data we further analyse critical temperatures and periods for fish species and link the findings to management implications. The findings will help to better realize management and/or restoration actions to obtain conditions in the thermal regime suitable for fishes.

# Improved sediment detection in old gravel pit lakes as a basis for future monitoring and measures

Dr Stephan Hilgert[1], Dr. Klajdi Sotiri[1], PD Dr. Ing. Stephan Fuchs[1]
[1]Karlsruhe Institute of Technology, Karlsruhe, Germany

2B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Apr 19 Foundation limknow GmbH & Co. KG, environmental office*

*May 2017 - today Visiting professor at the State University of Paraná, Curitiba, Brazil.*

*Jan 2017 - present Working group leader: applied ecology and water quality.*

*Feb. 2015 Double PhD at KIT and the State University of Paraná, Brazil*

*Oct. 2009 - today Research associate at the Karlsruhe Institute of Technology (KIT); Institute of Urban Water Management, Water and Watercourse Development*

*May 2009- Diploma, graduation in geoecology at the University of Karlsruhe*

Gravel pits have become important parts of our cultural landscape and aquatic ecosystems in recent decades. In particular, abandoned gravel pit lakes are often of high importance for local recreation but also as ecological stepstones. Accumulation of organic material and nutrients from the surrounding area leads to eutrophication and siltation of the lakes. Especially during the increasingly longer and warmer summers, many water bodies show signs of eutrophication (algae blooms) and/or oxygen deficits, which limit their ecological function. Improvement measures may become necessary. Since large portions of the nutrients are bound in the sediment, this is the focus of desludging or conditioning measures. For a targeted and cost-efficient planning and implementation it is important to know the distribution and nature of the sediments in the lake. This study compares two acoustic and one rheological method with respect to a detailed areal determination of sediment thickness and discusses the strengths and weaknesses of the approaches. The obtained results allow for the improved assessment of sediment volumes and types, which serve as a basis for e.g. the calculation of P-release or sediment oxygen uptake. We also present recommendations for an improved lake monitoring.

## Improving biodiversity conservation by predicting where are unknown aquatic insects in Europe

Miss Carlota Sánchez-Campaña[1,2], Cesc Múrria[2], Virgilio Hermoso[3], David Sánchez-Fernández[4], J.Manuel Tierno de Figueroa[5], Marcos González[6], Andrés Millán[4], Joel Moubayed[7], Marija Ivković[8], Dávid Murányi[9], Wolfram Graf[10], Tomáš Derka[11], Wolfram Mey[12], Füsun Sipahiler[13], Petr Pařil[14], Vendula Polášková[14], Núria Bonada[1,2]
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3B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*

*Carlota Sánchez-Campaña is a PhD student at the University of Barcelona. Her thesis focuses on analysing the state of knowledge and conservation of aquatic insects in the Iberian Peninsula, identifying areas that may harbour unknown diversity, as well as identifying species that are more vulnerable to global change and proposing priority areas for their conservation. Her interests include biogeography, freshwater ecology, biodiversity management and restoration.*

Current biodiversity crisis requires a better understanding of global species patterns since it is difficult to protect what it is not known. The large proportion of species that still remain to be described makes setting conservation practices difficult, especially for insects, one of the most diverse taxonomic groups. In this study, we explore the distribution of recently described species of aquatic insects in Europe (including western Russia, Cyprus and Turkey) to determine (1) the potential location of unknown biodiversity hotspots, and (2) the variables that can anticipate the distribution of unknown biodiversity. We compiled georeferenced data of species descriptions of aquatic insects between 2000 and 2020 and translated into the HydroBASIN sub-catchments. The richness of described species was

modelled using a Zero-inflated Poisson regression approach. During the last two decades, a total of 966 species were described, which mostly belonged to Diptera (398 sp.), Trichoptera (362 sp.) and Coleoptera (105 sp.). Roughly 74% of all species were described in the Mediterranean Basin, mostly of them outside of protected areas. Results showed the richness of described species per spatial unit was highest at mid-elevation areas (400-1000 m), mid-latitudes, and in areas with yearly average precipitation levels of 500-1000 mm, a medium intensity of sampling effort and low population density. Results highlight the urgent need to put sampling and conservation efforts in these areas in the Mediterranean Basin in order to increase the understanding of freshwater biodiversity and to promote ecosystem conservation in the context of climate change.

# Improving forecasts of algal blooms in freshwater systems using satellite imaging and the process-based model GLM-AED

Miss Maud Siebers[1], Peter Hunter[1], Dr Ian Jones[1], Dr Tom Shatwell[2]
[1]University Of Stirling, Stirling, United Kingdom, [2]UFZ, Magdeburg, Germany

5G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*A second-year PhD student at the University of Stirling, Scotland. My PhD project is part of 'inventWater' which is a Marie Sklodowska Curie Action European Training Networks (ETN) project. I have a background in water quality and aquatic ecology as well as ecological modelling.*

The ability to forecast and observe algal blooms in freshwater systems could improve water management by aiding mitigation and prevention strategies. The case study of Esthwaite Water in the UK Lake District has been used in this work to implement a process-based model to simulate algal blooms. Process-based models are based on biological and physical processes instead of historical data trends creating opportunities for more informed predictions and simulations. These models are data-hungry which makes it difficult to implement them in poorly monitored lakes and reservoirs. To account for the lack of in situ data, Earth Observation (EO) data can be used to fill data gaps as well as to improve the forecast by enabling validation with the most recent data available. The improvement in satellites and EO techniques in recent years, and future improvements, will make data collection in even smaller lakes and reservoirs possible, creating more opportunities for the use of EO in modelling freshwater systems. EO data such as chlorophyll-a and surface temperature could greatly increase the ability to model and forecast chlorophyll-a concentrations of lakes and reservoirs worldwide. This talk will present initial modelling results from Esthwaite Water and an analysis of model sensitivities.

# Incorporating the interaction of flow into invertebrate response to fine sediment

Dr Morwenna Mckenzie[1], Professor Paul Wood[1], Dr Kate Mathers[1]
[1]Loughborough University, , United Kingdom

1E_RS10_Biomonitoring, June 19, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Morwenna is a Postdoctoral Research Assistant on a UKRI Future Leaders Fellowship project led by Dr Kate Mathers. The objective of the project is to identify, examine and quantify the primary abiotic and biotic controls influencing the ecosystem effects of instream sedimentation. Morwenna's research interests are inherently applied with a focus on the impact of anthropogenic stressors, ecological resilience, and the development of effective biomonitoring practices in aquatic ecology. Prior to working in research, Morwenna has cross-sector sector experience working on a range of environmental issues.*

The delivery of excessive fine sediment (particles < 2 mm in diameter) to rivers can cause serious deleterious effects to aquatic ecosystems and is widely acknowledged to be one of the leading contributors to the degradation of rivers globally. Flow is intrinsically linked with fine sediment dynamics in rivers. However, prevailing flow conditions also shape the invertebrate community through direct effects on many physicochemical variables and physical characteristics of the stream bed. With aquatic invertebrates' preferences and tolerances to sediment and flow being closely linked, understanding the interactions between these environmental variables on invertebrate communities presents a challenge in aquatic ecology. Using paired biological and hydrological data from UK rivers, we investigated the influence of flow regime, fine sediment cover (as visual estimates %) and their interaction on a number of taxonomic, functional and biomonitoring invertebrate response metrics. Hydrological metrics were calculated from daily flow discharge data to describe either the hydrological regime or antecedent flow at each site prior to each sampling occasion. Results indicate that antecedent flows were the dominant factor influencing invertebrate responses. In a number of instances, invertebrate communities demonstrated responses to the interaction of fine sediment and flow conditions demonstrating the complexity of the interlinked nature of flow with sediment.

# Indigenous engagement to support river management resilience: an Australian case study

Prof. Ross Thompson[1], Associate Professor Bradley Moggridge[1,2]
[1]University Of Canberra, Canberra, Australia, [2]A descendant of the Kamilaroi Nation, Canberra, Australia

9B_RS12_Advances in environmental flow science and practice, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*

*Ross Thompson is a Teaching and Research Professor and Foundation Director of the Centre for Applied Water Science at the University of Canberra (UC). Ross' research interests are biodiversity and restoration of landscapes, mainly in freshwaters. His fundamental research is in food-web ecology; seeking the rules that determine how natural communities assemble and persist. Ross' applied research addresses the ways in which food webs can be influenced by anthropogenic factors including river management, land-use change, pollution and invasion.*

While there is an increasing recognition of the need to engage Indigenous perspectives to generate sustainable and resilient management and policy decisions, there remains a substantive gap between intent and implementation. There is an urgent need in Australia for robust approaches to engaging Indigenous knowledge to inform water management. Including Indigenous perspectives and actively engaging Indigenous people in water management is critical to generating resilient models of management and governance that provide sufficient certainty to manage agricultural and natural landscapes. Over the past two decades Indigenous people have sought greater access to water entitlements and a shift to co-design of research, informed by Indigenous research methodologies and led by Indigenous scientists. The research presented here develops and applies a methodology derived from Indigenous (Kamilaroi) ways of knowing and being to engage with Kamilaroi people to inform water management.  A framework is proposed for engaging effectively with Kamilaroi specifically but is also likely to provide insights which are more generally applicable for Indigenous engagement in Australia and internationally. This methodology provides a way forward in resilient water management and planning which incorporates Indigenous knowledge, values and perspectives.

# Inferring Past Occurrences of Diadromous Fish – iPODfish

Pedro Segurado[1], Paulo Branco[2], Gertrud Haidvogl[3], Didier Pont[4], Maria Teresa Ferreira[5], Gonçalo Duarte[6]
[1]Forest Research Centre, Associate Laboratory Terra, School of Agricuture, University of Lisbon., Lisbon, Portugal, [2]Forest Research Centre, Associate Laboratory Terra, School of Agricuture, University of Lisbon., Lisbon, Portugal, [3]Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences Vienna (BOKU), Vienna, Austria, [4]Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences Vienna (BOKU), Vienna, Austria, [5]Forest Research Centre, Associate Laboratory Terra, School of Agricuture, University of Lisbon., Lisbon, Portugal, [6]Forest Research Centre, Associate Laboratory Terra, School of Agricuture, University of Lisbon., Lisbon, Portugal

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Pedro Segurado is an Assistant Professor at the School of Agriculture, University of Lisbon and a Researcher at the Forest Research Centre. His work is mainly focused in freshwater ecology, macroecology, ecological modelling and multiple stressors in freshwater ecosystems, with a especial emphasis on connectivity.*

Historical records have proven their value for ecological studies. Although historical records on diadromous fish species are more common when compared with the available information for many other fish species, this data is still often country truncated, spatially incomplete and recorded at a wide range of spatial resolutions. The iPODfish method aims at using multiple sources of historical data and, despite their limitations and caveats, infer a comprehensive representation of the historical occurrence of diadromous fish species accross their geographical distribution range. This method uses a set of rules, assumptions and thresholds stemming from the interchange between known historical occurrences, diadromous fish species ecology and freshwater network features. It is a five-step method with two sequential application moments, expressed by a tree-like representation that allows establishing species presence, pseudo-presence, and pseudo-absence, while also having the possibility of an “unknown” outcome. The method has been validated alongside common statistical approaches and proved its reliability by being conservative and avoiding relevant ecological caveats that other methods fail to elude. Moreover, this method can be applied in any river network across the globe and considering any diadromous fish species where relevant historical data is available. The outputs obtained can be useful for large-scale studies using historical data where the goal is to provide insight and/or guidelines towards diadromous fish species management and conservation.

# Influence of Reduced Flow Regime on the Aquatic Food-Base of the Colorado River Undergoing Extreme Drought

Dr John Wehr[1], Ms. Madelaine C. Wrey[1], Dr. Lawrence E. Stevens[2]
[1]Fordham University, Armonk, United States, [2]Springs Stewardship Institute, Flagstaff, United States

9B_RS12_Advances in environmental flow science and practice, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*I am a Professor of Biological Sciences at Fordham University, working out of the Louis Calder Center – Biological Station, in Armonk, NY, USA. I specialize in the ecology and biodiversity of freshwater algae. People in my laboratory study the ecological stoichiometry of riverine food-webs, ecological bioassessments, fatty acid and elemental composition of benthic algae, biology and phylogeny of freshwater brown algae, and causes and consequences of harmful algal blooms.*

We conducted a 2-year study (2020-2021) on the aquatic foodweb in the Glen Canyon reach of the Colorado River, the sixth-longest US river with a drainage area of 673,000 km2. One of the nation's largest hydroelectric dams is situated in Glen Canyon and until recently was run as a hydropeaking facility, creating turbulent flow similar to mountain rivers in the region. In 2014, flow was reduced to produce power while protecting the Grand Canyon downstream, creating a relatively stable flow in tailwaters. The macrophyte assemblage during turbulent flow (1970s-1990s) was dominated by the green alga Cladophora glomerata colonizing cobbles and boulders, with epiphytic diatoms as the primary foodbase for invertebrate consumers and fish. Under present flow conditions, we document major biotic shifts on sand and rock substrata: a dense aquatic meadow of Fontinalis hypnoides, Chara vulgaris, Potamogeton spp., Zanichellia palustris, and Cladophora. Significantly different physical conditions may also have led a change in the epiphytic diatom flora. Of 218 subgeneric taxa identified in 2020, approximately 53% had not previously been recorded during turbulent-flow conditions, including extensive mucilage-producing species Cymbella mexicana and Didymosphenia geminata. Benthic algal production in 2021 peaked early in spring and declined sharply by summer, corresponding with algal nutrient stoichiometry (C:P ratios) shifting rapidly from phosphorus-sufficient (120 +/- 15) in May to P-limited (630 to 680) ratios in June-July. Algal production may also have been limited by a summer peak of New Zealand mudsnails (Potamopyrgus antipodarum). Efforts are underway to examine invertebrate gut contents to assess grazing impacts.

# Influence of single and multiple stressors on predator cues and predator-avoidance behavior.

Miss Anna-Maria Vermiert[1], Miss Iris Madge Pimentel[2], Mr. Philipp Magua Rehsen[2], Dr. Arne J. Beermann[2], Prof. Dr. Ralph Tollrian[1]
[1]Ruhr University Bochum, Bochum, Germany, [2]University of Duisburg-Essen, Essen, Germany
4C_SS01_Mechanisms underlying responses to multiple stressors, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Anna-Maria Vermiert is a PhD candidate at the Ruhr University Bochum. She is part of CRC Resist 1439, in which several interconnected projects are investigating the multilevel response to stressor increase and release in river ecosystems. Her research focuses on the influence of anthropogenic stressors on predator-prey interactions and the resulting ecosystem consequences.*

The relationship between predator and prey greatly influences many ecological and evolutionary processes, whether on land or in water. These interactions are often modulated via chemical signals called kairomones, but can also be acoustic and visual in nature. Accurate detection and appropriate response to the cues determine the survival of the prey. However, anthropogenic stressors in aquatic ecosystems are suspected to hinder predator recognition. One of the suspected causes is the impairment of the prey physiology or sensory system, resulting in the inability to perceive and respond appropriately to predator signals. However, there is little data on the impacts so far. Therefore, we studied the influence of multiple stressors on predator-prey interactions in a stream macroinvertebrate community within an outdoor mesocsosm system (ExStream system). Using a full factorial design, the stressors warming (+4 °C) and salinisation (+250 mg/L chloride) were applied in combination with or without predation pressure via kairomones and direct predation. Exposure only to chemical signals or direct predation had similar effects: The drift propensity of several macroinvertebrate taxa increased, revealing a clear predator avoidance behaviour; this phenomenon no longer occurred when abiotic stressors such as warming or salinisation were added. This suggests that either both predation pressure and stressor are perceived and the combined stress leads to a change in drift behaviour, or that the added stressor hinders predator recognition, thereby negating the predator avoidance behaviour.

## Inside the Red River

Dr John Wedgwood Clarke[1], Dr Rob Mackay[2]
[1]University of Exeter, , United Kingdom, [2]Newcastle University, , United Kingdom
8B_SS04_Soundscape studies in ponds and lakes, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***
*Dr John Wedgwood Clarke is Senior Lecturer in Creative Writing at the University of Exeter. He has published two collections of poetry, Ghost Pot (2013), and Landfill (2017), which explores the poetics of rubbish and marine ecology. John regularly collaborates with scientists, educationalists, and other artists on cross-disciplinary projects with a strong participatory element, working with both schools and groups outside formal education.*

*Rob Mackay is an award-winning composer, sound artist and performer. Rob is Senior Lecturer in Composition at Newcastle University. Recent projects have moved towards a cross-disciplinary approach, including geology, soundscape ecology, theatre, audiovisual installation, and human-computer interaction.*

Inside the Red River is a poetry and soundscape installation developed for the AHRC funded project Red River: Listening to a Polluted River. Led by Dr John Wedgwood Clarke of the University of Exeter, it explores how creative writing can transform our relationship to a polluted, post-industrial river through listening to the human and non-human voices that have shaped, and continue to shape, its course.

Although only 7.5miles in length, the Red River passes through a remarkably diverse physical and cultural landscape. Given its centrality to the Industrial Revolution in Cornwall, and the development of hard-rock mining around the world—it flows through part of a UNESCO World Heritage mining site—the Red River's sediments are rich in stories and ecology that reveal the human and non-human legacies of heavy industry. It even contains a unique sub-species of trout that has evolved to live in its polluted water, a life form that may be considered as much an artefact of tin-mining as the Cornish engine-houses on the slopes around its banks: mining is in its genes.

The sound installation draws on a continued collaboration between Wedgewood Clarke and Mackay as they have developed numerous place-related works over the past decade which situate the disembodied voice within soundscapes. Their practice requires both artists to experience the same site at the same time during field trips, and then explore the sites through their own artistic lenses.

This work has been presented at Tate St Ives (April 2022) and CAST (Oct 2021).

Website: https://redriverpoetry.com/

# Insights from groundwater dominated streams in a changing climate

Dr Judy England[1], Dr Matt Charlton, Mr Michael Finney, Prof David Hannah, Mr Kieran J. Gething, Dr Kieran Khamis, Dr Romain Sarremejane, Dr Rachel Stubbington, Dr Glenn Watts
[1]Environment Agency, Exeter, United Kingdom
2F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Judy is a national research scientist for the Environment Agency. As an applied researcher Judy works with many academics to address real-world issues and to distil research into application. Recently this has included a focus on understanding the effects of climate change and the interaction with other anthropogenic pressures. Working in collaboration with hydrologists, geomorphologists and climate change scientists data sets are being used to explore long-term patterns across spatial scales to improve our knowledge on how to increase the resistance and resilience of our aquatic systems.*

Chalk streams are groundwater-fed rivers renowned for their biodiversity and intermittently flowing 'winterbourne' reaches, with almost the entire global chalk stream network occurring in England. Despite their value, chalk streams are exposed to interacting climate change and anthropogenic pressures that impact their biodiversity and functioning. We are working to better understand and estimate the impacts of these pressures on chalk stream ecosystems. First, we have developed water temperature projections, finding that under a high emissions scenario the average temperature of the warmest month is projected to rise by about 0.6°C per decade and could be up to 4.6 °C warmer than present by the 2070s. Those around London could experience the greatest increases and those in the north the least. Second, we are using multi-decadal time-series comprising seasonal macroinvertebrate community samples, coupled with hydrological, temperature and anthropogenic stressor information to characterize the concurrent, interacting responses to specific stressors in five major pressure categories: temperature, hydrological extremes (i.e. drying, low flows and floods), land use, physical habitat modification and water pollution. We will use the characterized responses to estimate the effects of future environmental change on communities, under different climate change scenarios. Preliminary observations include evidence of profound change in community composition during the concurrent drought and heatwave events which affected chalk streams in summer 2022. By identifying the times and places at which ecosystems could cross tipping points to alternative, depauperate states, our results will inform targeted management actions that facilitate climate change adaptation in chalk streams.

# Insights from two decades of pond construction for amphibians

Dr Helen Moor[1,2], Dr. Ariel Bergamini[2], Prof. Dr. Christoph Vorburger[2,3], Prof. Dr. Rolf Holderegger[2,3], Christoph Bühler[4], Simon Egger[5], Dr. Benedikt R. Schmidt[6,7]
[1]Eawag - Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, Switzerland, [2]WSL - Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf, Switzerland, [3]ETH Zurich, Zurich, Switzerland, [4]Hintermann and Weber, Reinach, Switzerland, [5]Canton of Aargau, Aarau, Switzerland, [6]info fauna karch, Neuchâtel, Switzerland, [7]University of Zurich, Zurich, Switzerland

2D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Helen Moor is a researcher at Eawag and WSL, with main interests in the application of ecological modelling to conservation and environmental management problems.*

Success stories are rare in conservation science, hindered also by the research-implementation gap: scientific insights rarely inform practice and practical implementation is rarely evaluated scientifically. Amphibian population declines, driven by multiple stressors, are emblematic of the freshwater biodiversity crisis. Pond construction is a straightforward conservation action that has been shown to locally benefit amphibians, as well as other taxa, but does it benefit entire amphibian communities at large spatial scales? We evaluated a landscape-scale pond-construction program by fitting dynamic occupancy models to 20 years of monitoring data for 12 pond-breeding amphibian species in five regions of a densely populated area of the Swiss lowlands. We showed that this large-scale conservation action countered population declines and lead to landscape-scale stabilization or increases in the numbers of occupied ponds for all but one species. While there were regional and species-specific differences in the use of constructed ponds, all species colonized new ponds, compensating or even overcompensating for disappearances from old ponds. Testing for effects of local and landscape-scale variables on colonization probability enabled us to make species-specific recommendations to improve pond creation, regarding pond (surface area, water table fluctuations) and landscape characteristics. Importantly, we found positive effects of very simple connectivity metrics, i.e., the distance to the nearest neighboring pond and density of occupied ponds, which can support management decisions that consolidate functional pond networks. Simple, but massive conservation action leads to population recovery of threatened amphibian species, and easily implementable rules of thumb can help maximize conservation efficacy.

# Insights on zooplankton dynamics and regulation of water transparency in oligo-mesotrophic reservoirs

Rafael Machado[1,2], Sara C Antunes[3,4], Bruno B Castro[1,2]
[1]CBMA, Centre of Molecular and Environmental Biology / ARNET - Aquatic Research Network, University of Minho, Braga, Portugal, [2]IB-S, Institute of Science and Innovation for Bio-Sustainability, University of Minho, Braga, Portugal, [3]Department of Biology, Faculty of Sciences, University of Porto, Porto, Portugal, [4]CIMAR/CIIMAR, Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Matosinhos, Portugal

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*

*I am currently a professor and researcher at University of Minho (Portugal) working on the frontier between aquatic ecology, ecophysiology and ecotoxicology. I am mostly interested in understanding how freshwater organisms, particularly invertebrates, cope with stress on multiple dimensions, considering their ecological and evolutionary context, as well as their potential bioindicator role. I am motivated by the belief that we need solid scientific underpinnings to approach the current threats that freshwater ecosystems are facing and tackle the consequences of man-induced disturbance.*

*Centre of Molecular and Environmental Biology (CBMA) ::: http://cbma.uminho.pt/*

*Researcher profile @ ORCID  ::: https://orcid.org/0000-0002-7130-6061*

Zooplankton is crucial in transferring energy from lower to higher trophic levels, regulating phytoplankton growth, and shaping pelagic ecosystems. In northwestern Portugal, numerous reservoirs supply drinking water and energy, but their ecological dynamics is less well-known; indeed, zooplanktonic communities therein face innumerable pressures, including extensive hydrological fluctuations due to human usage, as well as low levels of nutrients (that constrain productivity) and hardness (that limit large herbivorous crustaceans). The main aim of this study was (i) to identify seasonal and spatial (within and between reservoirs) patterns of zooplankton communities and (ii) to assess which processes regulate water transparency, namely bottom-up (nutrient limitation) and top-down (herbivory) mechanisms. To achieve this, zooplankton communities and several physicochemical parameters were collected regularly between April and November 2021 in four reservoirs: Andorinhas, Caniçada, Touvedo, and Venda Nova. Results showed differences between reservoirs, some seasonal variation (with distinct patterns between reservoirs), and reduced within-reservoir variation regarding environmental parameters, primary productivity, and composition of zooplankton communities. Crustacean zooplankton had low diversity, and the seasonal succession of taxa differed between reservoirs. The determinant variable of the differences between reservoirs was depth, which was associated with transparency and productivity. Zooplankton did not show significant control over water transparency phases and phytoplankton biomass, suggesting an important role of other factors in primary and secondary productivity. Distinct pressures across reservoirs were observed, with varying levels of influence over planktonic populations, water transparency, and system productivity, which raises different challenges in the management of these heavily modified waterbodies.

# Integrating tolerance data into an aquatic food web model to simulate multiple stressor effects

Annabel Kuppels[1], Helena Bayat[2], Prof. Dr. Ralf B. Schäfer[2], Prof. Dr. Matthijs Vos[1]
[1]Ruhr-University Bochum, Bochum, Germany, [2]RPTU Kaiserslautern-Landau, Landau, Germany

4C_SS01_Mechanisms underlying responses to multiple stressors, June 20, 2023, 10:30 AM - 12:00 PM

***Biography:***
*The presenting author is a PhD candidate working on food web models within the collaborative research centre multilevel response to stressor increase and release in stream ecosystems (CRC RESIST).*

*Previously Annabel Kuppels completed a B.Sc. and M.Sc. in biology at the Ruhr-University of Bochum.*

Freshwater ecosystems are subject to degradation by multiple stressors, including warming, salinity, toxic chemicals and hydromorphological change. These stressors affect ecological communities not only through direct effects on organisms, but also through subsequent changes in biotic interactions. Organisms and functional groups are differentially sensitive to stressors, with the most sensitive typically most affected initially. This may change population densities and alter food web interactions, possibly leading to local primary and secondary extinctions. Even stressor-tolerant species can be indirectly affected via biotic interactions. We ask how these changes combine to affect ecosystem functions such as internal nutrient cycling and the breakdown of terrestrial allochtonous input. To extrapolate stressor effects from the species to the community scale, we connect stressor effects on individual functional groups to food web interactions, integrating existing tolerance data into a mathematical aquatic food web model that includes green and brown food web compartments. To simulate stressors, the death rate of individual functional groups and population density of each group are altered based on relative sensitivity thereof. Relative sensitivity is determined using single-stressor, single-species test data of stressors, queried from existing literature. Sequences of single stressor and multiple stressor events (with additive, synergistic or antagonistic effects) are tested in various scenarios, at high and low levels. Our approach allows in silico testing of a variety of stressors in different combinations to evaluate food web dynamics and ecosystem function before, during and after stressor impact. Our work aims to inform decisions regarding ecosystem repair.

# Inter- and transdisciplinary research to tackle freshwater salinisation in southern Morocco

Dr Elisabeth Berger[1]
[1]RPTU Kaiserslautern-landau, Landau, Germany

8F_SS10_Freshwater salinization: causes, consequences and management, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***

*BSc: Marine Biology*

*MSc: Environmental Science*

*PhD: Freshwater Ecology: Large scale analysis of chemical and biological monitoring data*

*2019 Juniorresearch group Leader: Rivers as social-ecological systems*

Limnology or hydrobiology is a study that by nature is very connected to the human sphere. River and lakes exist in human landscapes. They are deeply intertwined with society. Nevertheless, limnologists generally see and define themselves as natural scientists where the scope and extent of questions allowed to ask finishes at the shoreline. For example the question “What is the impact of agriculture on aquatic ecosystems?” appears within the scope, whereas: “How could human food provision systems be designed in order minimize impact on aquatic ecosystems?” could easily be considered outside the scope. Humans are typically conceptualised as an external force acting on the ecosystem. Despite this understanding many researchers work and engage with many stakeholders out of an intrinsic interest in the conservation of the rivers and nature they so love. In practice they often have a lot of knowledge beyond their field of “living stuff in water” and are familiar with institutional arrangements, policies and contributions of aquatic ecosystems to people. In this talk I will call for a braver and broader understanding of limnology that could easily position itself as a part of the large field of sustainability science by strenghening interdisciplinar collaboration. I will illustrate such an attempt by presenting the conceptual framework of the ongoing project “SaliDraaJuj – Salt in the system” where natural and social scientists work together with practitioners to better understand freshwater salinization as a complex social-ecological problem and also present challenges we face as an inter- and transdisciplinary team.

# Intermittent streams around the Mediterranean Sea – pressures and its potential assessment by diatoms and benthic invertebrates

Dr Armin Lorenz[1], Dr. Andrea Burfeid-Castellanos[2]
[1]University of Duisburg-Essen, Faculty for Biology, Department of Aquatic Ecology, Essen, Germany, [2]University of Duisburg-Essen, Faculty for Biology, Department of Phycology, Essen, Germany

3A_SS14_Drying rivers in a time of global change, June 19, 2023, 4:15 PM - 6:00 PM

***Biography:***

*My primary research focus is the ecology of streams and river. I am active in ecological issues involving stream assessment,  river restoration, and floodplain ecology. Along the way, community ecology of benthic invertebrates, fish, and macrophytes built the foundation of my experience.*

*I have been involved with taxonomic issues of benthic invertebrates for more than 15 years and have extensive experience in data analysis and storage. Field work is my spring and summer pleasure where benthic invertebrates and macrophytes are in the focus.*

Intermittent streams around the Mediterranean Sea suffer from severe and diverse anthropogenic pressures. On the one hand water abstract for irrigation and increased water shortage by climate change foster accumulation of nutrients and toxic substances like pesticides or pharmaceuticals and on the other hand point sources from urban areas and from waste water treatment plants change the amount of water and its components. The EU-PRIMA-funded project INWAT tries to explore these different pressures and its effects on diatoms and benthic invertebrates. Intermittent streams were investigated in Spain, France, Italy, Jordan and Tunisia. The results show that the communities differ depending on the gross climatic regions, but become more similar with increasing anthropogenic stress. Benthic invertebrates reacted mainly to organic pollution which reduced diversity and resembled the communities. In diatoms the organic pollution reduced diversity, too, but increased abundance. Furthermore, high conductivity and salinity in individual sites reduced diatom richness and diversity. This talk will give an overview of the main problems intermittent streams face in individual countries around the Mediterranean Sea and will make suggestions on potential metrics which could be used to assess the pressures these streams face.

# Invasive Crayfish moving Northwards: management challenges and policy implications at the local scale

Dr Maria Cristina Bruno[1], Ms Sonia Endrizzi[1], Dr. Paolo Pedrini[1], Mr. Michele Bortoli[1], Mr Giancarlo Orsingher[1]
[1]Fondazione E. Mach - Reseach and Innovation Center, San Michele all'Adige, Italy

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Dr. Bruno is an aquatic ecologist with a particular interest in animal biodiversity and ecosystem processes. One of her current research interests is the conservation of endangered species, and she has prepared the management plant for the endangered crayfish Austropotamobius pallipes in Trentino, and is supervising all the implementation activities described in the Plan: monitoring, control of alien invasive species, active conservation measures.*

Freshwater ecosystems in Italy, as in most European countries, have been severely impacted by the invasion of alien crayfish. The two most widespread species in Trentino (NE Italy) are Procambarus clarkii and Faxionus limosus; for both species, the high elevation and cold climate of most of the Trentino territory represent a climatic barrier to their northwards spread. Procambarus clarkii is present in one small lake at 950 m asl, and Faxionus limosus in a group of 5 lakes at 450 m asl, over an area of about 80 km2. The introduction of both species is associated with fish restocking, and leads to the extinction of existing populations of the native stone crayfish Austropotamobius pallipes. The Management Plan of Austropotamobius pallipes in Trentino listed the eradication/containment of these IAS populations among the conservation priorities for the native populations. The eradication campaigns of P. clarkii started in 2018 with a release/recapture campaign aimed at assessing the abundance of the population and continued in 2020-2022. As a result, the capture efficiency decreased, suggesting a population reduction trend. The containment of Faxionus limosus is more difficult, given its presence in a higher number of lakes, three of which are hydrologically connected. A first containment campaign to prevent its spread in the river network is planned for summer 2023. The financial support for these activities has been granted by the local Nature 2000 networks and by the local administrations, which have also promoted communication with citizens and stakeholders to raise consensus and collaboration.

## Investigating and modelling lake mixing regimes in southern Finland

Miss Leeza Pickering[1], Dr Emma Hocking[1], Dr Paul Mann[1], Dr Leanne Wake[1], Dr Saija Saarni[2], Professor Timo Saarinen[2], Dr Maarten van Hardenbroek[3]
[1]Northumbria University, Newcastle Upon Tyne, United Kingdom, [2]University of Turku, Turku, Finland, [3]Newcastle University, Newcastle Upon Tyne, United Kingdon

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*My interest of reconstructing paleoenvironments began during my undergraduate degree whereby I successfully identified the Storegga tsunami at Budle Bay in Northumberland and I am currently in the process of publishing this work. Concerning my PhD, my project will investigate and model paleoenvironmental change within lakes in southern Finland and project future changes in the mixing regimes of lakes in this area as recent studies suggest that more lakes in these areas are expected to become permanently stratified by the end of the century.*

By 2100AD, it is predicted that approximately 16% of lakes worldwide will experience less frequent mixing and become permanently stratified (meromictic) as a result of climate change. Within the Arctic and subarctic, it is anticipated that increases in global air temperature will be magnified leading to strong feedback effects on the climate system, drastic changes in ecologically sensitive aquatic systems and increasing carbon emissions from lakes. Within Finland, there is a dense network of lakes of differing mixing regimes including meromictic lakes that contain high resolution biogeophysical and biogeochemical data, enabling the opportunity to understand their response to warming temperatures in the Northern Hemisphere. Hydroclimatic reconstructions have been undertaken across various lakes within Finland, however they have not been focused on mixing regime changes and they have not been combined with modelling efforts to fully visualise changes in mixing both during the past and in the present, nor have future predictions of mixing regimes been investigated. Here, we present preliminary results from reconstructions of lake mixing regimes from sediment cores and initial modelling results from some of the study lakes within southern Finland.

# Investigating suitability of potential donor populations of juvenile freshwater pearl mussels (Margaritifera margaritifera) for restoring the river Kent SAC, Cumbria.

Ms Yasmin Alieskandari[1], Mr Ben King[1], Dr Louise Lavictoire[1], Mr Ian Emerson[2], Ms Suzanne Southern[3], Ms Emma Wright[4]
[1]Freshwater Biological Association, Ulverston, United Kingdom, [2]Natural England, Kendal, United Kingdom, [3]Environment Agency, Warrington, United Kingdom, [4]South Cumbria Rivers Trust, Ulverston, United Kingdom

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Yasmin Alieskandari graduated from the university of Cumbria with a BSc (Hons) in Conservation Biology in 2022 and is the LIFE R4ever Kent project officer at The Freshwater Biological Association, as well as a committee member for the development of a new British standard for sustainable cities and communities. After investigating a novel non-invasive and non-lethal DNA extraction technique on a rare, endangered butterfly during her degree, Yasmin has gone on to begin genetic and metabolomic research focusing on freshwater pearl mussel populations and their interactions with salmonid fish hosts.*

LIFE R4Ever Kent is an EU LIFE funded multi-partner project lead by Natural England working with the Environment Agency, South Cumbria Rivers Trust and the Freshwater Biological Association to restore and revitalise to ensure a more resilient river Kent and its species. The project includes practical river restoration and monitoring work, catchment sensitive farming actions, increasing community awareness of the SAC and its protected species as well as research in to host-parasite interactions to better understand how to restore the freshwater pearl mussel population in the river Kent. Freshwater pearl mussel glochidia are specialised parasites which require population-specific host salmonids for successful development and population recruitment. Our proposed research will focus on host-parasite interactions to make evidence-based decisions on potential donor populations. The results of this research will help to inform donor population selection within the project, as well as providing new information on mechanisms of encystment. This information is important to inform the selection of a resilient freshwater pearl mussel population capable of future natural recruitment, as well as for the streamlining of captive breeding processes on a wider scale.

# Is it relevant the order of occurrence of stressors for the maintenance of river biofilm functions? Results for short-term experiments.

Javier Ortiz-Rivero[1,2], Lourdes Gultemirian[3], Anna Freixa[1,2], Sergi Sabater[1,4]
[1]Catalan Institute for Water Research (ICRA-CERCA), Girona, Carrer Emili Grahit 101, 17003 Girona, Spain, , , [2]University of Girona, Catalonia, Spain, , , [3]Institute of Neotropical Biodiversity, National Council for Scientific and Technical Research (CONICET), Yerba Buena, Tucumán, Argentina., , , [4]Institute of Aquatic Ecology, University of Girona, Campus de Montilivi, 17071 Girona, Catalonia, Spain, ,

4C_SS01_Mechanisms underlying responses to multiple stressors, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*

*My name is Javier, I studied biology and I am a PhD student at Catalan Institute for Water Research (ICRA). My research focuses on the impact of multiple stressors that affect microbial communities of river biofilms (mainly algae and bacteria). Specifically, I study the effect of multiple stressors of different nature (i.e., pesticides, nutrients, hydric stress, temperature increase...), intensity, frequency and temporal occurrence at both a structural (diversity and composition) and functional level (primary production, respiration, mineralization of organic matter…) on the response of biofilm communities.*

Freshwater ecosystems are exposed to multiple stressors from anthropogenic activities such as agriculture, livestock, or industry that affect aquatic organisms to multiple stressors, and the occurrence of these differs in their order of occurrence as well as in their intensity. We investigated whether the order of occurrence, contrasting their simultaneous and sequential appearance and intensity affected on the response of epilithic biofilms, which respond rapidly to disturbances and play an essential role in several relevant processes in river ecosystems. For this purpose, we conducted a 2 separate 96-hour experiments using glass microcosms to respectively evaluate the effect of a mixture of pesticides (stressor 1) and hydric stress (stressor 2), and of a mixture of pesticides (stressor 1) and increase of temperature (stressor 2). Pesticides had negative effect on biofilm functions and the combination with other stressors can result in a synergistic or antagonistic effects, the order of co-occurrence of each stressor remains poorly studied. We studied the response of biofilm communities in basal fluorescence, photosynthetic efficiency, phosphorus uptake and extracellular enzyme activities, as well as on chlorophyll-a, 18S rRNA, and 16S rRNA. Our results showed how the order of stressors has a direct impact on microbial communities, where a differential effect was observed depending on whether the pesticide mixture was incorporated the first or in the last 48 hours of the experiment. Similarly, we determined that the impact of most harmful stressor (pesticides) will be compensated by the less stressful stressor, producing an antagonistic effect in the same functions.

# It all becomes clearer: the filter feeding effect of Corbicula fluminea on turbidity levels

Ms Sarah Evans, Prof Paul Wood[1], Dr Jonathan Millett, Dr Kate Mathers
[1]Loughborough University, Loughborough, United Kingdom
4F_RS13_Climate change and freshwaters: challenges and solutions, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Paul is an ecohydrologist with research interests the response of instream organisms to hydrological variability and disturbances (including drought, sedimentation, pollution and invasive species) over a range of spatial and temporal scales.*

Many waterbodies are characterised by high turbidity levels due to the presence of algae or suspended fine inorganic sediment in the water column. In many locations, large populations of bivalves have been observed to act as ecosystem engineers, actively filtering the water they inhabit by extracting fine organic and inorganic particles from the water column. As such, when population densities are high, bivalves may have a significant influence on turbidity levels potentially resulting in major changes to the water clarity of the aquatic systems they inhabit. With water temperatures predicted to increase in the future due to climate change, filter feeding effects may be enhanced as metabolic activity increases. This paper examines the filtering activity of small and large Asian clams, Corbicula fluminea, on turbidity levels at different temperatures (10-25°C) in a series of controlled experiments. Filter-feeding activity of C. fluminea reduced turbidity levels significantly compared to control treatments (no C. fluminea) with the fine sediments bound together within their pseudo-faeces. This binding of fine sediment may lead to a reduction in the subsequent resuspension of fine sediments. There was a strong association between the size of the individual clam and the reduction in turbidity over time. The results also clearly indicated that as water temperature increased, turbidity levels were reduced more rapidly than at lower temperatures. The wider implications of the filter-feeding activity of C. fluminea populations will be considered in relation to wider habitat characteristics and how this may change under future warmer conditions.

# Key traits in invasion success of an alien submerged plant Cabomba caroliniana

Mr Gergo Koleszar[1,2], Dr. Péter Tamás Nagy[3], Dr. Sándor Szabó[2], Dr. Balázs András Lukács[1]
[1]Wetland Ecology Research Group, Centre for Ecological Research, Debrecen, Hungary, [2]Department of Biology, University of Nyiregyhaza, Nyíregyháza, Hungary, [3]Institute of Water and Environmental Management, University of Debrecen, Debrecen, Hungary
3F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I am a member of the Wetlands Funcitonal Ecology Research Group and work with auqatic plants. I did many microcosm and mesocosm experiments where I investigated the competitive conditions between floating and submerged aquatic plants. In the last few years, I have been working in experiments where I examined the response of alien and native aquatic plants to global climate change.*

The response of submerged plants to climate change and eutrophication is a key factor that determines the outcome of biological invasion. In microcosm experiments, different environmental factors (temperature, light, nutrients) related to eutrophication and climate change were investigated on the trait responses of a native (Myriophyllum spicatum) and an alien (Cabomba caroliniana) submerged species. The two species were cultivated under low and high nutrient concentrations, at four light intensities under two temperature levels (intermediate and warm) using full factorial design. Invasion related functional traits were measured (relative growth rate, specific leaf area, leaf dry matter content, nitrogen to carbon ratio) in order to examine the environmental response of species. Furthermore, plasticity indexes were calculated to express the trait differences between species. Plants were also incubated in co-cultures in a long term (75 days) mesocosm experiment with various biomass ratio (10:40, 40:10, 25:25 g) under intermediate light intensity and nutrient level. Relative growth rate, specific leaf area of Cabomba was significantly higher than that of Myriophyllum especially under low light intensity. The daily nitrogen uptake of Cabomba was more than three times faster than that of Myriophyllum. In mesocosm co-cultures, Cabomba showed higher growth, the shoots performed 60% higher branching degree and lateral spread regardless of biomass ratio of the plants. Results indicated that greater invasion success of Cabomba is related to its higher shade tolerance together with more intensive lateral spread.

# Known but not called by name: recreational fishers' ecological knowledge of freshwater plants in Hungary

Dr Viktor Loki, Dr Jenő Nagy[2], Mr András Nagy[3], Dr Dániel Babai[4], Dr Zsolt Molnár[5], Dr Balázs A. Lukács[1], Mr  Gergő Koleszár[1]
[1]Centre For Ecological Reseach, Debrecen, Hungary, [2]ELKH-DE Conservation Biology Research Group, Debrecen, Hungary, [3]Pál Juhász-Nagy Doctoral School of Biology and Environmental Sciences, University of Debrecen, Debrecen, Hungary, [4]Lendület Ethnoecology Research Group, Institute of Ethnology, Research Centre for the Humanities, Budapest, Hungary, [5]Traditional Ecological Knowledge Research Group, Institute of Ecology and Botany, Centre for Ecological Research, Vácrátót, Hungary

6C_SS03_Fish Ecology and Conservation, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Viktor Loki is a research fellow at Centre for Ecological Research in Hungary. He defended his Ph.D. titled 'The role of cemeteries in biodiversity conservation' in 2019. He is now mainly interested in botanical evaluation and conservational assessment of Hungarian wetlands and learning more about recreational fishers' ecological knowledge in the country.*

Documenting local ecological knowledge (LEK) has recently become a topic of considerable interest. It has been recently revealed that recreational fishers' ecological knowledge (FEK) can also provide valuable information about different organisms and habitats, while recreational fishers' ecological knowledge is understudied in many aspects and regions of the world. To start a conversation on the topic, we aimed to record Hungarian recreational FEK on plant species related to freshwater habitats. Our research was conducted in three regularly fished, but different water bodies in Hungary, where a total of 72 interviews were conducted with recreational anglers on the field. During interviews, 24 plant species occurring in freshwater habitats with common or sporadic distribution were shown to anglers as single species or in congeneric pairs. Anglers identified a total of 16 plant species, while they used 45 botanical or folk names. An angler knew the name of 4.6 plants and recognized 7.4 other species without naming them, therefore, was familiar with half of the species shown on average. According to our detailed analysis, anglers were able to name or at least recognize those plant species which are somehow related to fishing activities, are salient, and/or common. We found that recreational FEK exists even in the case of freshwater plants which are not the main focus of anglers. Based on the present study, we believe that recreational fishers would be able to provide reliable ecologically related data for scientific research, including future citizen science projects of nature conservation.

# Lake phosphorus internal loading from a palaeolimnological perspective: investigating recovery rate following high nutrient inputs at Lake Søbygaard

Dr John Boyle[1], Dr Madeleine Moyle[1], Dr Martin Søndergaard[1], Dr Erik Jeppesen[1]
[1]University Of Liverpool, , United Kingdom, [2]Aarhus University, Aarhus, Denmark

5F_RS08_The past is the key to the future: the role of palaeoecology in understanding and managing fresh waters, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Having originally studied geology and geochemistry, I developed my interest in lake sediments working on acid rain in Norway. Since then, at the University of Liverpool, I have specialised in applying lake sediments and landscape models to understand long term terrestrial and aquatic phosphorus dynamics*

Lake phosphorus internal loading, a phenomenon widely reported in lakes that are recovering from historical nutrient pollution of their catchments, leads to delayed response to mitigation measures and may dominate the total lake water P dynamics for decades. Uncertainty over how far and how quickly a lake will respond to reduced external loading remains an obstacle to lake restoration, discouraging application of expensive mitigation measures. A novel approach to this problem is offered by sediment geochemical records of lake P dynamics. Here we report on lessons learned from the sediment record at Lake Søbygaard (Denmark). Analysis of the long-term P dynamics at Lake Søbygaard make it clear that evaluation of internal loads depends on the temporal scales under consideration. For a short-term lake P budget, it is meaningful to treat internal and external P loads as separate phenomena that can be independently quantified. However, on decadal time scales internal loading is better viewed as a delayed external load, with magnitude and timing as a function of the external load history. At still longer timescales (>> decadal) internal loads can be treated simply as reduced P retention efficiency by the lake. We evaluate a simple dynamic model that can be used to predict the magnitude and temporal development of internal loading, and we report preliminary testing of the model against published records of internal loads. This long-term perspective, arising from lake sediment records, is crucial for understanding and predicting lake recovery following management interventions.

# Large-scale variation in phytoplankton community composition of >1,000 lakes across the U.S.A.

Dr Jolanda Verspagen, Dr Xing Ji, Prof Dr Quan-Xing Liu, Prof Dr Jef Huisman
[1]Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Amsterdam, Netherlands
9E_RS03_Microbial ecology in freshwaters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*I am a phytoplankton ecologist, currently working as an assistant professor in the department of Freshwater and Marine Ecology at the University of Amsterdam. In my research I combine experimental data and/or field data with mathematical models. My scientific fascination regarding phytoplankton focuses on two topics. 1) How physiology influences the ecological distribution of and the ecological interactions between different phytoplankton species. 2) The role that phytoplankton communities play in ecosystems functioning, particularly in carbon cycles.*

How biodiversity and species composition of lake phytoplankton communities respond to environmental variation across large spatial scales has received little attention. We performed a comprehensive analysis to assess how phytoplankton community composition varies among >1000 lakes across the conterminous USA. Our results show that lake-to-lake similarity in species composition was low even at the local scale, and slightly decreased with geographical distance. Analysis of the compositional data revealed that geographical variation in phytoplankton community composition was best explained by total phosphorus (TP), water temperature, pH, and lake size. High TP concentrations were associated with high relative abundances of cyanobacteria and euglenophytes at the expense of other phytoplankton groups. High temperatures stimulated cyanobacteria, dinoflagellates, desmids and euglenophytes, whereas cryptophytes, golden algae and diatoms were relatively more abundant in colder lakes. Low pH correlated with high dissolved CO2 concentrations, which may explain why it benefitted phytoplankton with inefficient carbon concentrating mechanisms such as golden algae and euglenophytes. Conversely, the relative abundance of cyanobacteria increased strongly with lake pH. Large lakes showed higher relative abundances of cyanobacteria and diatoms, whereas small lakes showed higher relative abundances of chlorophytes, desmids and euglenophytes. Biodiversity increased with lake temperature, but decreased at high TP concentrations and pH. The key environmental variables (high phosphorus loads, warm temperature, low pH) are associated with anthropogenic pressures such as eutrophication, global warming and rising atmospheric CO2 concentration. Hence, our results provide an illustration of the major impact of these pressures on the biodiversity and taxonomic composition of lake phytoplankton communities.

# Launching the new EU LIFE Nature & Biodiversity Project LIFE PREDATOR - PREvent, Detect, combAT the spread of SiluRus glanis in south European lakes to protect biodiversity

Dr Vanessa De Santis[1], Dr Ester Eckert[1], Dr Diego Fontaneto[1], Dr Filipe Ribeiro[2], Dr Filomena Magalhães[3], Dr Joana Martelo[2,3], Dr Martin Čech[4], Dr Lukáš  Vejřík[4], Dr Pietro Volta[1]
[1]Water Research Institute - National Research Council Of Italy, Verbania, Italy, [2]MARE – Marine and Environmental Sciences Centre / ARNET - Aquatic Research Network, Faculty of Sciences, University of Lisbon, Lisbon, Portugal, [3]cE3c—Centre for Ecology, Evolution and Environmental Change, Faculty of Sciences, University of Lisbon, Lisbon, Portugal, [4]Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Vanessa De Santis is a second-year post doc in the ichthyology group of the Water Research Institute-Italian National Research Council. She conducted her PhD on the ecological and biological impacts of an invasive freshwater fish, and she is now carrying out research activities on the diversity and ecology of freshwater fishes and the influence exerted by human activities, investigated through a multidisciplinary approach that combines genetics, stable isotopes, and morphometric analyses. She is also a member of the European Fresh and Young Researchers (EFYR), the representative group of early career researchers of the European Federation of Freshwater Sciences (EFFS)*

The European catfish Silurus glanis L. is one of the most emblematic and controversial European freshwater fish being considered a problematic invasive species in western and southern Europe while it is subject to extensive and lucrative trophy fishing mostly by central European anglers. Information on invasive lacustrine populations where the species is thriving is scarce, limiting the efficacy of management measures in these systems. Started in September 2022 with a budget of € 2.85 million and a consortium of six partners from three countries, LIFE PREDATOR aims at developing a multidisciplinary and transnational approach to control already established populations of S. glanis and preventing further spread and future introductions in southern European lakes and reservoirs. The project is going to develop and test on 50 lakes an early warning system based on eDNA and citizen science. Furthermore, it is going to test on 10 selected lakes the most effective capture techniques actively involving anglers, to reduce the abundance of catfish in Natura 2000 sites. Massive raising awareness campaigns are planned specifically targeting anglers but also the general public, whilst protocols and best practices are going to be transferred to at least 15 management authorities. For the long-term sustainability of the project, a South European Management Group is created. Additionally, where the catfish invasion is more advanced (i.e., large lakes in northern Italy), the creation of a local circular economy is proposed, experimenting with the best processing methods to increase the fishing pressure on catfish by encouraging its consumption as food.

# Leading the path towards sustainable freshwater management: reconciling challenges and opportunities in historical, hybrid and novel ecosystem types

Associate Prof Simone Daniela Langhans[1,2], Dr. Tibor Erös[3], Dr. Virgilio Hermoso[4]
[1]Norwegian Institute for Water Research (NIVA), Oslo, Norway, [2]Aalborg University, Department of Chemistry and Bioscience, Aalborg, Denmark, [3]Balaton Limnological Research Institute, Tihany, Hungary, [4]Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Sevilla, Spain

3B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*

*Simone has recently left her position as tenured associate professor at Aalborg University and joined the Norwegian Institute for Water Research (NIVA) to lead the section on Nature-based Solutions and Aquatic Ecology. Simone has 15plus years of experience in river ecology, freshwater restoration, decision support theory, and collaborative, spatial management planning. She has led projects in Switzerland, Germany, Australia, New Zealand, Spain and Denmark, often in multi-disciplinary teams and with government representatives and communities, to investigate alternative ways of solving complex environmental decision problems with a focus on the concurrent protection of freshwater biodiversity and sustainable use of ecosystem services.*

Due to their importance for human development and wellbeing, freshwater ecosystems are among the most threatened and modified in the world; a situation that is expected to intensify in the future. Freshwaters convey a mix of novel, historical, and hybrid systems, each with different values for biodiversity conservation and ecosystem services provision. We argue that securing future access to freshwater services, while halting aquatic biodiversity loss, requires an evaluation of the opportunities offered and challenges imposed by each of these types of systems. Such an inventory can then build the basis to systematically plan restoration, conservation and management actions with the goal of harmonizing the multiplicity of co-occurring freshwater-related interests. Developing river basin management plans that integrate these multiple, often conflicting interests poses complex challenges, including 1) the current ecosystem condition that defines to a large extent what type of objectives can realistically be aimed at, 2) socio-economic needs that limit our capacity to modify current conditions, e.g. drinking water and energy provided by large dams, and 3) governance constraints related to managing large, often transboundary, river basins. Multi-objective management planning rooted in systematic conservation planning can help overcome these challenges. Consequently, we argue that adequate planning must play a key role when designing river basin management plans to make the most of the opportunities associated with local freshwater ecosystem types. We call for governments to embrace and promote a systematic approach to river basin management planning to create the urgently needed pan-global shift towards a sustainable freshwater future.

# Leaf litter retention and decomposition as early indicators of restoration success in urban streams

Ms Ulrike Haase[1], Luisa Kauert[1], Prof T U Berendonk[1], Dr Mario Brauns[2]
[1]TU Dresden, Dresden, Germany, [2]Helmholtz Centre for Environmental Research, Magdeburg, Germany

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Ulrike Haase holds a Diploma degree in Geography and Hydrobiology from TU Dresden, Germany. She is a research assistant and PhD student at the Institute of Hydrobiology, TU Dresden. Her research is about the interrelationship of macroinvertebrate communities, functional diversity and ecosystem functioning with a focusing on urban streams, restoration and monitoring.*

Retention of leaf litter and its decomposition are fundamental ecosystem functions depicting both, the morphological and functional aspect of ecosystem integrity.
We investigated these ecosystem functions at urban stream sites before and two years after restoration and compared them to a reference site. To complement, we measured instream morphological characteristics and quantified species and functional trait diversity of the shredder communities.
Areas of retention, instream characteristics and retentive structures differed between restored and reference sites. However, sufficient leaf litter was held back at the restored sites and thus provided valuable habitats and food resources for shredders. The successional shredder communities of the restored site led to a significant increase in leaf litter decomposition rates compared to before restoration. Significantly higher decomposition rates observed at the reference site can be mainly attributed to dominance of Gammarus fossarum. At the restored sites, taxonomic and functional attributes of the shredder community differed from those at the reference site and showed higher species and functional diversity. Fine sediment covers at restored sites might have impeded leaf litter decomposition.
Monitoring of functional attributes and ecosystem functioning two years after restoration provided information regarding suitability of restored habitats for shredders and on how to improve restoration measures, i.e. increase stream velocity to avoid fine sediment deposition. Further, bank vegetation served as complementary food resource for shredders, but may lead to a community establishment, which is not stream type specific.
Nevertheless, successional communities maintaining ecosystem functioning in urban stream sites are a valuable contribution to species diversity.

# Life history traits of the steno-endemic fairy shrimp Chirocephalus sibyllae Cottarelli and Mura, 1975 living in a small high-elevation pond (Central Italy)

Dr Antonella Carosi[1], Dr Alessandro Rossetti[2], Dr Federico Morandi[2], Dr Francesca Lorenzoni[1], Mr Aymeric Joubert[1], Dr Giovanni Tagliaferri[1], Prof Massimo Lorenzoni[1]
[1]Department of Chemistry, Biologies and Biotechnologies University of Perugia, Perugia, Italy, [2]Monti Sibillini National Park, Visso, Italy

5E_RS05_Small water bodies, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I work as researcher at Univerity of Perugia. My research interests are mainly focused on the distribution, ecology and biology of freshwater fish populations, and the impacts of anthropogenic stressors on inland waters biodiversity, with special reference to biological invasions and climate change effects.Outputs of my work have included the management of invasive fish and crayfish populations to support native biodiversity conservation.*

Chirocephalus sibyllae is a fairy shrimp represented by one population living in Central Italy, in a high elevation temporary pond, whose existence is strongly linked to climatic conditions. The main objectives of the study were to: (i) evaluate the climate-related effects on C. sibyllae habitat; (ii) expand the documentation on the life cycle of the species. The C. sibyllae population was monitored fortnightly, during the filling phases of the pond, from April 2019 to May 2022. Biological data were collected using an 80 µm mesh net, within transects of known length. Meteorological data collected over twenty years were used. The progressive increase in air temperature and decrease in snowfall, seem to play a key role in the recent shortening of the filling phase of the pond, and in its increasingly rapid drying up. In 2020, the short duration of the pond did not allow the species to complete its life cycle. The bet hedging reproductive strategy of the species, with delayed hatching, reflects the adaptation of the species to the extreme environmental uncertainty. The species exhibits a marked r-strategy, with high reproductive effort and a high number of cysts per broodpouch. The main threat to the survival of C. sibyllae seems to derive above all from the rapid changes that its habitat may experience, as a future response to climatic variations. Detailed studies on dynamics and functioning of the cyst bank are essential to shed light on the future prospects of the species in relation to global warming effects.

# Llegim el riu: a participatory project to assess and improve urban rivers through citizen science

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6D_RS17_Science dissemination/communication & education, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*My scientific contributions have been mainly focused on macroinvertebrate community responses to anthropogenic impacts in naturally disturbed ecosystems using temporary rivers as a model system. I am and have been involved in several projects on aquatic biodiversity conservation and biomonitoring. I have worked on developing tools to improve the detection of anthropogenic impacts on aquatic ecosystems for a sound implementation of the Water Framework Directive, and on adapting participatory processes to enhance the inclusion of temporary rivers. In terms of scientific dissemination, I am involved in the RiuNet citizen science app and its related projects (e.g. Llegim el Riu).*

Recently, participatory processes have been incorporated into water–related policies so that citizens can freely and equally take part in the management of these resources. To do so, the most commonly participatory engagement mechanisms are surveys, interviews, workshops and scientific dissemination, while few initiatives include environmental education activities and citizen science projects. In this sense, "Llegim el riu" project is a participatory process that aims to promote the assessment and management of rivers near the municipalities of Barcelona, incorporating both environmental education activities and citizen science projects.

The following elements have been considered to engage stakeholders in this process: (1) establishing a collaborative leadership between the regional council of Barcelona, researchers from the University of Barcelona and the NGO called Associació Hàbitats, (2) using multiple participatory engagement mechanisms, (3) involving stakeholders in the diagnosis before the co-creation process of measures, and (4) evaluating the outcomes of the process. Regarding stakeholders from each municipality, the so-called 'tandem' formed by a librarian and an environmental technician, researchers, individual citizens and NGOs have participated.

This project started fall 2021 and, so far, 23 municipalities from the Llobregat basin have participated. Participants conducted a diagnosis using the RiuNet App and, after that, each site was analysed including already existing data from water agencies and research projects of citizen science and universities. Finally, measures to improve these ecosystems have been and will be implemented in most of these 23 municipalities, either by using fundings from each municipality or those from other public administrations.

# Local knowledge: An overlooked source of information for river monitoring design

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[1]UCL, London, United Kingdom

2G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*I use science to help improve the state of the world's freshwater resources. Working at the interface between ecology and geography, I explore complex interactions between environmental and social systems. I'm particularly interested in combining data from different sources and understanding how the findings can be applied in practice to help reverse global and local declines in freshwater biodiversity. Citizen science and community involvement in freshwater conservation are important themes within my work.*

The idea that citizen science can fill 'gaps' in data collected by regulators is often quoted as a justification for the widespread adoption of volunteer monitoring. The many papers that support this focus on how quantitative data produced by volunteers can complement professionally-gathered data, e.g. from water resource authorities. In this study, we move beyond the data to explore how local knowledge (held by volunteers) can complement institutional knowledge (held and formally documented by the regulator). We present the results of a community mapping exercise focussed on the Lower Lea – an urban tributary of the River Thames in East London. A series of focus groups and interviews were held with local communities over the summer of 2022. These gathered qualitative and geolocated information about a) the ways people interact with the river, and b) people's concerns about the river environment. A total of 27 socio-environmental activities linked to potential deterioration of ecological health were identified and located along a 19km stretch of river, compared to 16 formally documented by the regulator. Furthermore, we identified that the current regulatory monitoring regime does not collect data at a high enough spatial or temporal resolution to formally identify these issues nor to understand their impacts on river condition. Our results invite greater consideration of citizen-generated data and knowledge in the design of targeted or 'agile' river monitoring schemes.

# Long-term trends in the abundance of fish and invertebrate species

Prof. Iwan Jones[1], Dr John Murphy, Dr Nick Isaac
[1]QMUL, London, United Kingdom
5D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Iwan Jones is a freshwater ecologist whose work includes the collection and analysis of large-scale and long-term data, to determine the effect of human activities on fresh waters. He is a fellow of the FBA.*

Serious concerns have been raised regarding the condition of UK rivers and the associated apparent declines in the abundance of riverflies. Such concerns feed into the development of government policy aiming to halt the decline in biodiversity. To date, indicators of trends in biodiversity have largely excluded aquatic taxa, in favour of more iconic terrestrial taxa. Working towards establishing legally binding biodiversity targets that include aquatic habitats, we have assessed trends in the abundance of widespread aquatic species, including both invertebrates and fish. Using data collected in England by the Environment Agency from sites where there were long and consistent records, we selected taxa for which there were sufficient data to assess the average trend in their abundance at a national scale. The temporal span of the data varied with taxonomic resolution. For macroinvertebrates, out of 237 taxa comprising 61 genera, 12 species groups and 164 species, more taxa have increased in abundance over the period 2013-19 than have declined. A similar pattern is apparent for macroinvertebrate families at the GB scale over the period 1980-2020, indicating that these positive trends are robust. Average trends in the abundance of fish species over the period 2000 – 2020 also show that more species are increasing than declining. These positive trends in more recent years may indicate that populations are recovering from some past nadir. Whilst some species are of obvious concern, this indicator of biodiversity (the abundance of widespread species) suggests that the general trend in English rivers is positive.

# Long-term, fine-scale biomonitoring of stream benthic macroinvertebrates in an Italian glacier-fed stream

Ms Magdalena Vanek[1], Dr Francesca Vallefuoco[1], Dr Roberta Bottarin[1], Dr Alberto Scotti[2]
[1]Eurac Research, Bozen, Italy, [2]AQEM Ltd., Stockport, United Kingdom

2E_RS10_Biomonitoring, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***

*In 2021 Magdalena Vanek conducted her master thesis on "Assessing variation of stream benthic macroinvertebrates after the implementation of a run-of-river hydropower plant" at the University of Vienna and Eurac Research. In 2022 she started working as a Junior Researcher at the Institute of Alpine Environment at Eurac Research in Bozen, where she is currently organising and conducting the aquatic monitoring program within the Biodiversity Monitoring project of South Tyrol. Besides she is also involved in the EUROPONDS project, a joint call of the European Federation of Freshwater Sciences (EFFS) board and the EFFS Societies.*

Human impacts and disruptive factors such as hydrological regime alterations or river fragmentation on freshwater ecosystems are pervasive. However, often short and discontinuous datasets limit the ability to understand deeply how to effectively manage freshwater resources. Within a Long Term Social-Ecological Research Network site (LTSER) located in the Italian Central-Eastern Alps, a thorough dataset of benthic macroinvertebrates and environmental parameters has been established over the last 8 years (from 2015 to 2022) in the glacier-fed Saldur stream. Additionally, studies on the impact of the small hydropower plant, which has been implemented in 2015, have been conducted. Here, we focus on the results of a high temporal resolution analysis with monthly sampling events of macroinvertebrate assemblages during 2015 and 2020. From April to September, we analyzed the structural and taxonomic assemblages of the benthic macroinvertebrate community at 6 sampling sites during the glacial melting season. Contrary to expectations, the adjacent sites of the small run-of-river power plant did not exhibit distinct habitats compared to downstream habitats in the depleted stretch. The macroinvertebrate communities showed no significant temporal differences between the two surveys, 2015 and 2020. Our results showed how, even performing a very high resolute analysis in time, predominantly seasonal glacier and snow melting processes govern dynamics of the benthic community in the glacier-fed Saldur stream, even after the implementation of a small run-of-river hydropower plant.

# Lost connection: impacts of river network fragmentation

Miss Tamara Leite[1], Dr. Gonçalo Duarte[1], Dr. Pedro Segurado[1], Dr. Maria Teresa Ferreira[1], Dr. Paulo Branco[1]

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9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*

*I am a biologist, attending the doctoral program FLUVIO–River Restoration and Management, and working on freshwater ecology focusing on fish species. My research is based on river network connectivity, and connectivity loss, the impacts of river network fragmentation on freshwater fish species, fish movements, and freshwater fish biology.*

Humans greatly modify riverscapes by altering watersheds, climate, and channels. As a consequence of damming and channelization, longitudinal and lateral connectivity of rivers have been severely compromised, and most large rivers are disconnected from their floodplains. Longitudinal connectivity is the most relevant dimension for fish species, nonetheless, lateral disconnection is recognized as a significant impact on ecological function in the river landscape, negatively affecting the development of side-channel habitats, floodplain evolution, riparian ecosystem processes, and biodiversity. The ubiquity of dams and their dramatic effects on water, sediment transport and fish movements have made them a more common subject of fluvial research. However, roads and railroads, are even more abundant features in riverscapes than dams. Additionally, navigation in heavily developed waterways may impact diversity of fish assemblages, contributing to the effects of migration barriers, pollution, expansion of invasive species, and habitat destruction. To characterize anthropogenic disturbance on lateral connectivity of European rivers, we mapped these ecological barriers, by identifying the river network segments affected by dams and their reservoirs, roads, and railroads, and waterways. Furthermore, we calculated density and other metrics of these infrastructures and impoundments at the sub-basin scale and used them as a proxy to measure the potential impact on river systems of the European continent. Aggregation of these metrics allowed the classification of the sub-basins regarding the overall effect on lateral connectivity. Assessing the extent of these disturbances is relevant in the context of attaining goals placed by environmental policies like the Water Framework Directive.

# Machine learning for short-term forecasting of algal blooms: a case study using historical data from a small, eutrophic lake to demonstrate key challenges and nuances when evaluating performance

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[1]University Of Stirling, Stirling, United Kingdom

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Daniel Atton Beckmann is a Hydro Nation scholar and PhD candidate at the University of Stirling. Daniel's research focuses on finding practical and innovative ways to monitor and forecast cyanobacterial blooms in inland waters using satellite images, meteorological data, and automated in-situ sensors. He has an MEng from Durham University and is interested in exploring how machine learning approaches, and data from new satellite missions may be used to make short-term predictions.*

The ability to forecast harmful algal blooms is desirable to provide warning to managers of drinking water supplies and recreational water users, and furthers our understanding of aquatic ecosystem modelling. Using historical data from Blelham Tarn, a small, eutrophic lake in the English lake district, this work focuses on highlighting some key challenges associated with evaluating the performance of machine learning-based freshwater algal bloom forecasting models. For all forecasting tasks, it is important to compare more advanced forecast models with a 'naive' benchmark forecast. However, in much of the data-driven freshwater algal bloom forecasting literature this comparison is omitted, with comparisons only being made between different machine learning models. In this study, we first demonstrate how omission of a naive benchmark forecast may lead to misleading results. It is then shown that evaluating performance metrics over different parts of the time series can lead to significantly different conclusions, and that therefore care must be taken to evaluate performance in a way that is aligned with the aims of the forecasting task. For example, when considering a model intended to predict the onset of summer cyanobacterial blooms, it is useful to look at the model's performance over the entire year, but particular attention should be given to performance at the key transition points. Furthermore, it is important to understand the conditions and drivers which may lead to a model failing to predict an algal bloom – here we demonstrate how machine learning feature importance tools can be used for this.

# Macroinvertebrate assemblages of temporary ponds in a fragmented landscape: the case of large branchiopods in central Spain.

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2D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Graduate in Biology and master in Ecology at Universidad Autónoma de Madrid. In my degree's thesis I studied the seasonal drivers determining the macroinvertebrate assemblages in a temporary pond complex throughout the hydroperiod. In my master's thesis I have contributed to the ClimaRiskinPond project through the study of temporary ponds in Madrid. My doctoral thesis is associated with the European project ResPond: Restoring and Managing Biodiversity and Ecosystem Services of Temporary Pond Landscapes. I'm also member of the European project EUROPONDS assessing the contribution of ponds to the adjacent terrestrial ecosystem through the nutritional value of emerging insects.*

Temporary ponds are priority habitats for conservation under the Habitats Directive, harbouring singular fauna and flora. Some of these emblematic species are large branchiopods, being some rare and relict species considered as ‘’sentinels’’ in temporary ponds, i.e., reflecting good conservation status. In recent decades, the biodiversity of temporary ponds has been seriously threatened. From a conservation perspective, we aimed to analyse the environmental drivers of the macroinvertebrate assemblages of 35 temporary ponds distributed across Madrid (central Spain). This territory constitutes a fragmented landscape within a matrix of natural conditions, including ponds under anthropogenic alterations.  In this pond network, we detected 125 macroinvertebrate taxa, and large branchiopods were found in 10 ponds. Macroinvertebrate assemblages structure of temporary ponds harbouring large branchiopods differed from the rest showing lower aquatic vegetation cover and macroinvertebrate richness. Hence, distance-based linear models indicated that aquatic vegetation, pH, conductivity, nitrate concentration and areas of naturalised vegetation were the main drivers of overall macroinvertebrate assemblages structure and composition, revealing a possible anthropogenic gradient. Increased nutrient loading directly affects water quality, which in turn alters the structure of aquatic vegetation, decreasing resource availability and altering the rest of the community. Notably, the 70% of the sampled ponds were in managed environments. However, the distinct macroinvertebrate assemblages that presented large branchiopods were only conditioned by turbidity and the distance to the nearest water point. The high macroinvertebrate richness found in the studied temporary ponds highlights the urgency of managing these vulnerable ecosystems against the detected threats for their conservation.

# Macroinvertebrates survival to flow intermittency: when mesohabitat matters

Dr Gemma Burgazzi[1], Dr Verena Schreiner[1], Mr Rajdeep Roy[1], Dr Ralf Schulz[1,2], Dr Alessandro Manfrin[1]
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[2]Eusserthal Ecosystem Research Station, RPTU Kaiserslautern-Landau, Eusserthal, Germany

3A_SS14_Drying rivers in a time of global change, June 19, 2023, 4:15 PM - 6:00 PM

***Biography:***
*I am a postdoc researcher at RPTU Kaiserslautern-Landau, Germany. My current research focuses on multiple stressors experiments with mesocosms, investigating the effects of flow intermittency, light pollution, and invasive species on aquatic communities, mainly biofilm and invertebrates. Previously, I did a PhD at the University of Parma (Italy), studying the effects of climate change and water abstractions on the distribution of aquatic invertebrates. My research is framed in the context of community and metacommunity ecology, with a strong interest in the spatial distributions and key drivers of organisms at different spatial scales.*

Flow intermittency is a growing phenomenon in stream ecosystems, and its frequency and severity are predicted to increase in the future. Despite its impacts on aquatic biota being widely recognized, the local effects of flow intermittency might be variable. Indeed, streams are one of the most dynamic and diverse environments, with local conditions (and associated communities) highly variable in space and time. Here, we aimed to evaluate the short- and long-term effects of different degrees of intermittency (normal flow, intermittent drought, and permanent drought) on macroinvertebrate communities from different mesohabitats: riffles and pools. The study was performed in summer 2021 in the Riparian Stream Mesocosm facility (RSM) in 16 flumes (15 m long, 1 m wide). To assess both habitat-specific and short- and long-term responses to intermittent and permanent drought, we sampled macroinvertebrates in riffle and pool mesohabitats of the flumes, before (June), during (August, after 9 weeks of treatment), and after (October, 4 weeks after the rewetting) the application of the treatments. We will analyze taxonomical and functional changes in the macroinvertebrate communities. We hypothesize a greater tolerance from macroinvertebrates inhabiting pools, as we expect those communities to better functionally cope with water drying. Conversely, we expect stronger effects on riffle communities, for the presence of rheophilic taxa. We also expect the most severe impacts in permanent drought treatments for the lack of the buffer effect of the rewetting episodes. Lastly, we predict a better recovery in riffles, for the presence of active disperser organisms.

# Making the most of vertical slot fishways: achieving the best design

Dr Paulo Branco[1], Dr Gonçalo Duarte[1], Ms. Ana Mascartenhas[1], Dr Filipe  Romão[2], Dr Susana Amaral[1], Professor Teresa  Ferreira[1], Professor António Pinheiro[2], Dr José Maria Santos[1]
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9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*José Maria Santos is an Assistant Professor from the School of Agriculture, University of Lisboa. He has been developing research mainly in Ecohydraulics, Water Resources, Environmental Hydraulics and River Restoration and Modelling.*

Fragmentation by rivers barriers stands out as one of the most important pressures that impacts rivers and associated biota, particularly fish, which are hindered from reaching critical habitats and fulfil their life cycle needs. To mitigate these undesirable effects, fishways have been used to aid fish passage past the barriers. The most common ones are the pool-type fishways, particularly the vertical slot fishways (VSF), these ones considered one of the most effective technical designs, as they remain operational even with fluctuating water discharges and allow fish to negotiate each cross-wall at their desired depth, catering to species with different ecological requirements. This work aimed to conduct a meta-analysis of published data on several VDF designs for cyprinids native to Mediterranean rivers, in a tentative to outline the best one. For this, Bayesian Generalized Mixed Models were used, as they enable the construction of models while accounting for random effects of non-controlled factors that may influence the model outcome, a valuable advantage when aiming to perform joint analyses of datasets with inherent data dependencies. Fish size, irrespective of species, was a strong predictor of fishway negotiation success. Overall, multiple slot fishways with one orifice proved to be the best solution, regardless of fish species, and for all fish sizes. To make these devices more holistic, future experimental studies should be focused on smaller fish and small-sized species. Design guidelines for holistic fishways will benefit from this integrative approach, allowing for more effective connectivity solutions.

# Map analysis: sinuosity of Estonian rivers and streams and the impact of straightening

Mr Jürgen Karvak
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3B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 4:15 PM - 6:00 PM

Rivers and streams are facing several anthropogenic pressures that change fluvial and riparian habitats and functioning of the natural processes. Due to the human induced pressures there has been extensive decline in aquatic and riparian species. One of the pressures is straightening of the rivers and streams that simplifies the habitats, hinders the lateral connection and changes water regime.
In the map analysis QGIS was used to estimate how much of more than 1200 Estonian watercourses are changed. Rivers and streams with different lengths were made into 100 m, 500 m or 1000 m segments and sinuosity of each segment was calculated. River or stream segments with sinuosity index larger than 1.05 were considered as unchanged and segments with values 1.05 or below were considered as straightened segments.
Results of the analysis showed that in 61% of rivers and streams natural meandering was unchanged and 39% were straightened. 2/3 of rivers and streams longer than 10 km were straightened. According to the random checking, the analysis is underestimation.
Yearly national hydrobiology monitoring results show that about 40% of Estonian flowing waters are not in good ecological condition and one of the reasons might be straightening of the waterbodies. Most affected are streams, smaller rivers and upstream stretches of larger rivers, which often belong to the drainage system. There are also other additional pressures like damming, diffuse pollution and drainage ditches. Some questions arise around the straightening of rivers: (1) how is straightening impacting the habitats downstream from the changed channel (e.g. in protected areas); (2) could the drainage system transport water too fast away from the landscape in the future because of climate change and (3) what management decisions could be made to restore the functioning of these rivers and streams?

# Maximising the detection of freshwater invasive non-native species through environment DNA capture – new and improved sampling methodology

Ms Ava Waine[1,2]

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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*PhD researcher at Newcastle University/Northumbrian Water - my research aims to increase our understanding of the key pathways of spread of all freshwater invasive species taxa and develop novel methods of surveillance and spread prevention.*

Invasive non-native species (INNS) are a major threat to freshwater ecosystems and a significant driver of freshwater biodiversity loss worldwide. Key stakeholders of the freshwater environment such as water companies are increasingly required to carry out invasive species surveillance, to monitor the expansion of established populations and rapidly identify novel introductions. Environmental DNA (eDNA) has the potential to provide valuable insight into the presence of invasive species in freshwater environments, and stakeholders are increasingly relying on the analysis of eDNA captured by water filtration for this purpose. Water filtration is a relatively easy sampling method and can be carried out quickly. However, there are issues associated with this method: detection of species with exoskeletons can be limited, detection reliability can vary according to water quality, filter clogging can impair eDNA collection and make using equipment more difficult, and single filters can only yield a limited volume of DNA. Given the large number of waterbodies within water company remit, and the ever-expanding list of INNS, surveillance and monitoring must be both cost efficient and effective. This study aimed to determine which method of DNA sampling – filtered water samples using commercially available kits or the collection of suspended sediment using fine-mesh nets - offers the most effective method of INNS detection. This work helps to maximize the potential for efficient INNS surveillance across large scales and contribute to practical INNS management. The proposed poster will explore the methods referred to and the results obtained.

## Mechanisms determining effects and adaptation to multiple stressors.

Prof. Matthias Liess

2C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 2:15 PM - 3:45 PM

The exposure of biological systems to various stress factors is widespread under natural conditions. So is adaptation of individuals, populations, and communities to natural and anthropogenic stressors. The basic processes of effect and adaptation are known; however, the quantification of the stress-effect relationships is only possible to a very limited extent because the biological effect is determined by the combination of stressors and the adaptation by the duration of exposure to the stressors and the dynamics of the environmental conditions. In the case of incomplete adaptation, a trade-off is observed that leads to a reduction in performance, especially under multiple stress conditions. The lecture will provide examples for the processes listed here and furthermore shows possibilities of quantifying these processes.

# Mediterranean temporary ponds (habitat type 3170*) in the South Aegean Archipelago islands (Greece): filling the gaps

Dr Elpida Karadimou[1], Mrs Dimitra Kemitzoglou[1], Mrs Vasiliki Tsiaoussi[1]
[1]The Goulandris Natural History Museum/Greek Biotope-Wetland Centre, Thermi, Greece

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Mrs Dimitra Kemitzoglou is a biologist, MSc. She has been working at The Goulandris Natural History Museum – Greek Biotope / Wetland Centre since 2006, where currently she is Technical Manager of the Water Quality Laboratory. Since 2012, she has been working on the implementation of the national monitoring network for lakes, in accordance with WFD. She has supported the Ministry of Environment in water quality issues (contribution to assessment methods, reports, representation in working groups etc). She has undertaken the implementation of various projects related to conservation and management of natural resources, some of which received European recognition.*

Mediterranean temporary ponds (3170*, Directive 92/43/EEC) are scattered in the South Aegean islands (Greece). Their importance for biodiversity is great; they host plant and animal species depending exclusively or to a large extent on water, and form special habitats which act as "life refuges". At the same time, they support the agricultural activities of the local residents and provide multiple benefits. In this study, we focus on the identification, delineation and mapping of the Mediterranean temporary ponds, the description of the composition of their vegetation, their structure and functions, assessment of their conservation degree and recognition of the pressures they face. The 3170* habitat type was identified, recorded and studied in 42 locations, on 10 islands. Our results indicate that, in the South Aegean, despite the adverse climatic conditions, several small temporary ponds are preserved. They have a high degree of diversity in terms of their ecological, morphological and physico-chemical features. These are often natural wetlands with a high diversity of plant species, but in several cases, humans have artificially modified their abiotic, and hence biotic, characteristics. Most temporary ponds are altered under the pressure of long-term use of water, mainly in cultivations and grazing. Excavation, embankment and road openings bring about further degradation. In places undergoing tourist development, these risks increase. Strengthening their protection efforts, especially under the pressure of change in the climatic conditions, is essential for the conservation of Mediterranean temporary ponds.

# Meiofaunal ecology in harsh environments, a case study in a deglaciating Alpine area

Dr Maria Cristina Bruno[1], dr Stefano Brighenti[1], Dr. Monica Tolotti[1]
[1]Fondazione E. Mach - Reseach and Innovation Center, San Michele all'Adige, Italy
3F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I am an aquatic ecologist with a particular interest in animal biodiversity and ecosystem processes. I have been investigating for more than 30 years groundwater and surface water ecosystems in Italy and abroad, focussing my activity on the ecology, zoology and biogeography of invertebrate communities from different habitats: karstic, hyporheic and benthic in streams, interstitial in lacustrine and marine habitats*

Climate change and progressive glacier loss are leading to rapid ecological shifts in alpine aquatic systems. Rock glaciers and paraglacial features such as proglacial lakes, moraines, and taluses can alter the gradients of glacial influence along alpine river networks. Particularly relevant is the effect of rock glacial streams on invertebrates, although the hydrology and ecology of such high-elevation stream types is still scarcely known. We investigated the main meiofaunal component of benthic communities of different stream types in a deglaciating area of the Italian Alps, i.e., Crustacea Copepoda. We used an index of habitat mildness based on water temperature, channel stability, turbidity, and organic detritus, to measure the difference in community metrics over a gradient of habitat amelioration, driven by the mixing of distinct stream types (glacial, rock-glacial, snowmelt, mixed) and their interactions with paraglacial features. The composition of copepod communities of rock-glacial sites differed from the one of the other stream types, particularly it was very different from the kryal sites, and more similar to the rhithral and krenal ones. Under progressive deglaciation, rock glaciers and paraglacial features will increasingly influence the meiofaunal communities of alpine river networks. As they host a higher number of taxa and individuals than non-glacial locations, rock glacial streams may act as stepping stones facilitating colonization following glacier retreat. After glacier loss, rock glacial streams may represent climate refugia for cold-adapted taxa and/or kryal specialists, because the slow thawing of their ice might sustain cold water conditions for a longer period of time.

# Mesocosm experiments highlight the decisive role of dust and temperature as global change drivers in Mediterranean high mountain lakes

Miss MARIA VILA DUPLA[1], Juan Manuel González Olalla, Manuel Villar-Argaiz, Juan Manuel Medina-Sánchez, Alejandra Fernández Zambrano, Guillermo Garrido Cañate, Presentación Carrillo
[1]University Of Granada, Granada, Spain
4C_SS01_Mechanisms underlying responses to multiple stressors, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Maria is a third-year PhD student at the Institute of Water Research, University of Granada (Spain). With a background in Marine Science and Science Communication, she currently studies the effect of multiple global change drivers on high mountain lakes. For her thesis, she is focusing on the combined effects of dust and temperature in a sentinel lake in the Spanish Sierra Nevada and their ecosystem-wide implications. She is also looking to identify tipping points of high mountain lakes in order to predict future change.*

Mediterranean high-mountain lake dynamics have been altered by a steady increase in the frequency of dust deposition events in the past few decades. The net effect of Saharan aerosols is still unclear, as they provide macro- and micronutrients while reducing water transparency. To assess the overall impact of dust deposition and temperature in a global change scenario, field mesocosms and paired laboratory experiments were conducted in La Caldera, an oligotrophic lake in the Spanish Sierra Nevada. In-situ mesocosms covered a dust concentration gradient of 0-320 mg/L in two-fold increases, with sampling taking place every week for two months (July 22-September 23, 2021). Additionally, 10-day paired laboratory experiments tested for the combined effects of dust and temperature on weeks 2, 5 and 10 of the experiment. Physicochemical and biological factors such as light attenuation, nutrients, chlorophyll, phytoplankton and bacterial abundances, and primary and bacterial productions were measured. Overall, there was a direct correlation between Saharan dust concentration, inorganic nutrients, chlorophyll a, and bacterial abundance, the two latter peaking two weeks after dust addition and reaching five-fold higher values in the highest level of dust treatment. Temperature effects on bacteria and phytoplankton were time-dependent. The ratio of light attenuation to total phosphorus (Kd/TP) was highest in the intermediate dust level (80mg/L) throughout the experiment, with differences among treatments accentuated five weeks after dust addition. These results suggest that strength of dust deposition events paired with temperature regimes shape the magnitude and timing of community responses in high-mountain lakes.

# Metabarcoding reveals age-related differences in diet, prey selectivity and consumption of invertebrates of aquatic origin, in a wetland-associated songbird

Dr Sarah Davies[1,2], Dr Ian Vaughan[2], Dr Rob Thomas[2], Dr Lorna Drake[2], Ms Angela Marchbank[2], Professor William Symondson[2]
[1]Wildfowl and Wetlands Trust, Slimbridge, United Kingdom, [2]Cardiff University, Cardiff, United Kingdom

7C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Dr Sarah Davies is a researcher at the Wildfowl and Wetlands Trust, currently working within the Wetland Science Team. A prominent part of her work involves investigating the value of emerging insects from wetlands as a food resource for terrestrial wildlife. Prior to this role she completed a PhD at Cardiff University using molecular tools to study diet and competition in wetland songbirds. She undertook her master's degree in Conservation at University College London in 2014 where her dissertation focused on the use of farmland ponds by birds.*

Aquatic insects that emerge as winged adults in wetland habitats can form an important food subsidy for terrestrial insectivores such as songbirds. Songbird diets can be flexible however, changing over time to incorporate different prey items, both in response to short-term food fluctuations and over longer time scales as an individual ages and meets different challenges over its lifetime. We present the results of our metabarcoding study revealing the diet of different life stages of a migratory songbird, the Eurasian reed warbler (Acrocephalus scirpaceus) over the 2017 summer breeding season in Somerset, United Kingdom. The feces of adult, juvenile, and nestling warblers were collected during bird ringing activities and screened for invertebrate DNA, enabling the identification of prey species from both aquatic and terrestrial origins. Key invertebrate taxa were monitored in the field over the same period, to determine prey availability. We compared available prey with consumed prey using a prey choice simulation and examined dietary selectivity among warbler age classes. Our results demonstrate the utility of metabarcoding data for enhancing ecological studies of insectivores in dynamic environments. We also highlight the vital role of wetland habitats in providing food subsidies that help to support terrestrial wildlife.

# Metabolic drivers of growth and survival in salmonids.

Mr Peter Betts[1], Dr Anna Sturrock[1], Dr Thomas Cameron[1], Dr Rasmus Laurisden[2], Dr Colin Bull[3], Dr Eoin O'Gorman[1]
[1]University Of Essex, Colchester, United Kingdom, [2]Game and Wildlife Conservation Trust, Fordingbridge, United Kingdom, [3]Missing Salmon Alliance, Fordingbridge, United Kingdom
Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am a first-year marine biology PhD at the University of Essex, my primary interests include metabolic rate and how this interacts with external factors such as temperature to influence fish biology and ecology. I am also fascinated by stable isotope analysis and how natural tracers can be used to retrospectively infer an organism's ecology.*

Atlantic salmon and brown trout are two species with great cultural, economic, and ecological value, despite this, salmonids have been in decline since the 1980s. Recently much effort has been directed towards stock rebuilding, however salmon around Europe continue to fall with only one river in the UK classed as not at risk. Smolt size and riverine growth are primary drivers of marine survival and the time spent feeding at sea can influence reproductive success. However, despite its importance the key drivers behind the decision of when and if to migrate to sea are unclear and represent a crucial knowledge gap to improving management of these species. This project will address this gap by assessing how metabolic rate (a key determinant of performance and ecological decisions) affects the growth, survival, timing, and length of migration in salmonids across a latitudinal transect of rivers from Spain to Iceland. Our approaches include measuring metabolic rate in situ alongside growth rate, stomach contents, and subsequent tagging and tracking. Preliminary results show a positive relationship between metabolism and growth rates and suggest that the thermal variability of a river can influence metabolism, outlining the utility of this approach. The results of this project should broaden understanding of the key drivers behind migration choices in salmonids and how rising temperatures may impact these choices and the overall fitness of these species .

# Metabolic rates plasticity of supralittoral rockpools beetle populations with contrasting climatic conditions

Mrs Juana María Mirón-gatón[1], Dr. Susana Pallarés[2], Dr. Josefa Velasco[1], Dr. Andrés Millán[1], Dr. David T. Bilton[3]
[1]University Of Murcia, Murcia, Spain, [2]University of Sevilla, Sevilla, Spain, [3]3Marine Biology and Ecology Research Centre, School of Marine Science and Engineering, University of Plymouth, Plymouth, UK

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Predoctoral researcher (FPU-MCIU fellowship)*

*Dept. Ecology & Hidrology, University of Murcia*

*Research lines:*

*Ecology and ecophysiology of aquatic insects*

*Tolerance to multiple stressors in aquatic and subterranean macroinvertebrates*

Climate change is altering the environmental conditions of aquatic ecosystems globally, particularly temperature; one of the main variables that impacts the physiology of ectotherms. Thermal acclimation can alter metabolic rates and their thermal sensitivity and the metabolism of a species can vary across latitudes as a result of local adaption to different climatic conditions. In this study, closed respirometry was used to measure routine metabolic rate at five temperatures (10, 15, 20, 25, 30°C) in two populations of the aquatic beetle species Ochthebius lejolisii (Hydraenidae), a specialist of supralittoral marine rockpools. One population was located at a cooler latitude with more stable thermal environmental conditions in SW England (Northern Population, NP), and the other at a warmer latitude with wide thermal fluctuations in SE Spain (Southeren Population, SP). Both populations were acclimated at two temperature regimes that simulated the daily spring fluctuations of each site (NP = 10 – 14 ºC; SP = 20 – 28 ºC). Total metabolic rate increased with temperature in both populations ($F=23.896$, $P<0.001$), with NP exhibiting higher mean metabolic rates than SP across all tested temperatures, in agreement with the Metabolic Cold Adaptation hypothesis. Also, SP had a higher thermal sensitivity of metabolic rate (activation energy, Ea = 0.667 eV) than NP (Ea= 0.352 eV). Previous acclimation conditions did not affect metabolic rates in both populations, thus the lack of thermal plasticity in the metabolic response could be detrimental its performance to increased temperatures.

# Metal/metalloid bioaccumulation in the muscles of the northern pike (Esox lucius) from the historically contaminated Mrežnica River (Croatia): physiological and environmental considerations

Zrinka Dragun[1], Dušica Ivanković[1], Nataša Tepić[2], Vlatka Filipović Marijić[1], Sara Šariri[1], Tatjana Mijošek[1], Sara Drk[1], Fran Barac[1], Zoran Kiralj[1], Mr Tomislav Kralj[1], Damir Valić[1]
[1]Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička cesta 54, 10000 Zagreb, Croatia, [2]Koios Consulting Ltd, Kemp House, 152 City Road, London, United Kingdom

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Tomislav Kralj works at the Ruđer Bošković Institute. He researches the impact of invasive amphipods on native species and macroinvertebrate communities and how their invasion can alter ecological processes in freshwater ecosystems. He also researches the relationship between invasive species and pollution and the impact of invasive species on biological monitoring.*

Fish are important bioindicators for monitoring consequences of water contamination. The advantage of the northern pike, representative species in the Mrežnica River (Croatia), is its tendency to display limited migration. Until about 15 years ago, the Mrežnica River was exposed to cotton-industry wastes for more than hundred years. Northern pike was used to assess the differences in metal/metalloid bioaccumulation in fish muscles due to different exposure levels at two sites, upstream and downstream of the former textile factory, in April and September 2021. In addition, possible influence of fish age and sex on bioaccumulation was evaluated, as well as seasonal variability. Metal/metalloid concentrations were measured in HNO3/H2O2 digested muscle samples using HR ICP-MS. Significantly higher bioaccumulation at the upstream site was detected for Rb, Se, and Tl in both seasons, and for K and Mn in spring, possibly reflecting agricultural impact. Slightly higher bioaccumulation at the downstream site was detected for Bi and Cs (significant only in autumn), possibly indicating the exposure to the factory waste remainings. Between-site differences only partly coincided with the water/sediment contamination data. Although certain effects of age and/or sex were observed on Bi, K, Mn and Se bioaccumulation, the site-specific differences were still present even when these factors were considered. The majority of detected elements had somewhat higher concentrations in spring. The obtained results indicated that the river contamination, which remained after the factory ceased to operate, did not cause troublesome metal/metalloid bioaccumulation in fish muscles that could be potentially health-threatening to fish and/or humans.

# Microbial diversity and ecosystem function in river networks

Dr Rosetta Blackman[1,2], Prof Florian Altermatt[1,2]
[1]Department of Evolutionary Biology and Environmental Studies, University Of Zurich, , Zurich, Switzerland, [2]Eawag: Swiss Federal Institute of Aquatic Science and Technology, Department of Aquatic Ecology, Dübendorf, Switzerland

8C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*I am a freshwater ecologist, currently working at the interface of molecular and organismal ecology. I am interested in identifying how anthropogenic stressors are, and potentially will, affect biodiversity at the species distribution, community interaction and ecosystem function level. I utilise molecular approaches to assess biodiversity across trophic levels in order to gain further insight into how changes at individual levels may manifest themselves across subsequent trophic levels.*

Assessing biodiversity and the associated ecosystem function within a habitat is a crucial step towards sustainable management and identifying ecosystem degradation. Due to the vulnerability of freshwater ecosystems to anthropogenic pressures, such as climate change, pollution and invasive species, there has been a rapid increase in the decline of biodiversity and its associated function, it is therefore essential that we carry out further exploration of community changes and the implications this may have on ecosystem function. Riverine ecology often focuses on indicator groups with an emphasis on easily collected or recognisable groups, such as macroinvertebrates and fish. However, this focus lacks detail of ecosystem processes, such as energy flow and nutrient cycling which are fundamental to understand the state of an ecosystem. The rapid development of molecular tools, such as environmental DNA (eDNA), was hailed as a “game changer” in the way we can interpret changes in freshwater ecosystems, yet the application of these tools to delve further than the traditional taxonomic groups and into ecosystem dynamics remains unrealised. Here, we assessed the spatial and temporal changes in microbial diversity over a large river network. We explore microbial communities and the ecosystem function they provide as foundations of these ecosystems. Our data demonstrates the effect of anthropogenic pressures on microbial diversity and identifies key indicator taxa derived from eDNA samples to establish ways to assess the ecosystem function in these vulnerable ecosystems.

# Microorganisms inhabiting polar lakes and their biotechnological potential in the field of decontamination of cold areas

Dr. Maria Papale[1], Miss Alessia Marchetta[2], Mr Alessandro Ciro Rappazzo[1,3], Dr. Carmen Rizzo[1,4], Prof. Antonio Camacho[5], Dr. Carlos Rochera[5], Prof. Filomena De Leo[2], Dr. Maurizio Azzaro[1], Dr Angelina Lo Giudice[1]

[1]Institute of Polar Sciences (CNR-ISP), Messina, Italy, [2]University of Messina, Messina, Italy, [3]Ca' Foscari University of Venice, Venice, Italy, [4]SZN, Messina, Italy, [5]University of Valencia, Valencia, Spain

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Angelina Lo Giudice is Senior Researcher in Microbial Ecology at the Institute of Polar Sciences (CNR-ISP) in Messina, Italy. Her research activities are mainly addressed to the study of the prokaryotic communities in polar environments. Particular attention is paid to: Microbial ecology (diversity and function) of aquatic and terrestrial systems; Associations between prokaryotes and benthic filter-feeders; Response by bacterial communities to human impact; Biotechnological potential of cold-adapted bacteria; Relationships between chemical contamination and prokaryotic biodiversity. Angelina Lo Giudice has published more than 100 papers in highly ranked scientific journals (IF 29). She is Associate Editor of Polar Biology.*

Many studies have been conducted on the determination of pollutant levels in polar regions. Major contaminant transport routes to the Arctic and Antarctica include atmospheric and oceanic transport and accumulation on the snow and ice surface of pollutants deposited from the atmosphere. Lakes are widely reported as very sensitive ecosystems to environmental changes. Small variations in the dynamics and duration of their snow and ice covers or the deposition of xenobiotic substances can have a noticeable effect on the lake's ecological variables. Microbial communities (prokaryotes and eukaryotes) respond very quickly to environmental perturbations and the response can be researched in the expression of specific catabolic genes. Within the project PNRA18_00194 "Microbial response to human Pollutants in polAr lakeS" – MicroPolArS, this work was aimed at analysing the microbial communities in polar lakes, with particular attention to bacteria and fungi able to tolerate heavy metals and grow in the presence of biphenyl as a unique carbon source. Samples were collected from 13 coastal lakes at Svalbard Islands and Antarctic Peninsula. More than 100 strains tolerated high concentrations of heavy metals, while 121 strains were able to use biphenyl as a sole carbon source. All the obtained results highlight the importance of further studies in understanding the biogeochemistry of polar lakes, but in particular for the sound exploration of microorganisms inhabiting these environments for their possible use as biosensors or in the bioremediation of cold polluted areas.

# Model-driven engineering for the management of cyanobacteria blooms

Mr José Luis Risco Martín[1], Eva Besada-Portas[1], Elvira Perona[2], Antonio Quesada[2], José A. López-Orozco[1]

[1]Universidad Complutense de Madrid, Madrid, Spain, [2]Universidad Autónoma de Madrid, Madrid, Spain

5G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***

*José L. Risco-Martín is Full Professor of the Computer Science Faculty at Universidad Complutense de Madrid, Spain. He received his M.Sc. and Ph.D. degrees in Physics from Universidad Complutense de Madrid, Spain in 1998 and 2004, respectively. His research interests focus on Computer Simulation and Optimization, with emphasis on Discrete Event Modeling and Simulation, Parallel and Distributed Simulation, Artificial Intelligence in Modeling and Optimization and Feature Engineering. In these fields, he has co-authored more than 150 publications in prestigious journals and conferences, several book chapters, and more than 25 research projects and contracts with industry.*

IA-GES-BLOOM-CM and SMART-BLOOMS are synergy projects for the ecological and digital transition that propose the design of a novel Early Warning System (EWS) based on the Internet of Things (IoT) paradigm and driven by Digital Twins (DTs) to enable the autonomous real-time monitoring and hazard prediction of Cyanobacteria Blooms (CBs) in inland lakes, reservoirs or rivers. Both projects bring together researchers from Biology, Economy, Automation, and Information & Communication Technologies to develop new tools for the early detection and prediction of CBs. Modeling and Simulation (M&S) is established as the central pillar of designing the EWS. Typically, numerical-based and data-driven machine learning models have been recursively used to simulate CBs, supporting the EWSs. Our M&S vision is, however, oriented to a system of systems architecture, a more holistic and integrative model-driven design that includes not only the use of the numerical models but also the whole infrastructure of the EWS. Following an IoT-based architecture and through the use of DTs, the EWS is conceived as a water body, which is monitored in the edge layer by a set of sensors, including those onboard Unmanned Surface Vehicles (USVs) that continuously send data to the server at the nearest Ground Control Station at the fog layer. There, domain experts can analyze the data, run models and tests, or plan the USVs trajectories. The proposal allows horizontal scalability, being able to add more water bodies with the support of a cloud layer, where authorities can compare reports and make high-level decisions.

# Modelling lake networks: how lake food-webs interact with flows to shape meta-ecosystems

Lilith Kramer[1,2,3], Tineke Troost[3], Annette Janssen[2], Robert Brederveld[4], Luuk van Gerven[5], Dianneke van Wijk[1,2], Wolf Mooij[1], Sven Teurlincx[1]
[1]Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, The Netherlands, [2]Wageningen University & Research, Wageningen, The Netherlands, [3]Deltares, Delft, The Netherlands, [4]Witteveen + Bos Consulting Engineers, Deventer, The Netherlands, [5]Waterboard Aa & Maas, 's Hertogenbosch, The Netherlands
5C_SS05_Freshwater Macroecology research and perspectives, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Lilith Kramer is a PhD candidate at the Netherlands Institute of Ecology (NIOO-KNAW). The topic of her PhD project is the social-ecological perspective of nutrient management in surface water networks. Before starting her PhD in 2019, she worked for four years as a researcher and consultant on freshwater ecology and water quality modelling at the independent knowledge institute Deltares.*

Freshwater networks come in all shapes and sizes. In river networks, water transport is a dominant factor, while in lake networks local biogeochemical dynamics play a major role. In either case, nutrients and organisms present in one freshwater ecosystem transfer to and influence neighboring freshwater ecosystems - thereby forming meta-ecosystems. Understanding how such meta-ecosystems function, and how individual system characteristics play a role in their dynamics, is key to macroecological water management. To untangle the complexity of lake functioning in a meta-ecosystem context, we developed the model PCLakeS+. We applied this model to two conceptual cases, which showed the importance of the spatial position of a lake in the waterscape and the importance of modeling food webs in their entirety. Currently, we are testing the model in a part of the Frisian Lakes, a network of shallow lakes located in the North of the Netherlands, in order to provide water managers with a new way to explore the management of lake networks.

# Modelling meets data science - new opportunities for collaboration

Dr Nele Schuwirth[1], Sami Domisch[2], Johannes Feldbauer[3], Thomas Petzoldt[3]
[1]Eawag, Dübendorf, Switzerland, [2]IGB, Berlin, Germany, [3]TU Dresden, Dresden, Germany

5G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Nele Schuwirth is head of the department Systems Analysis, Integrated Assessment and Modelling at Eawag, head of the Ecological Modelling group and lecturer at ETH Zurich. Her main research interests are:*

*1) the development of mechanistic and empirical models for aquatic ecosystems; use of these models for improving our understanding of ecosystem functioning and for the prediction of effects from measures or changing environmental influence factors; application of Bayesian techniques for model calibration and uncertainty analysis.*

*2) ecological assessment and multi-criteria decision support for environmental management to support decisions with multiple objectives and multiple stakeholder perspectives.*

In the past, mechanistic modelers, statistical modelers and data scientists working with machine learning tended to work in separated communities. Since these three approaches have different requirements regarding the availability of prior knowledge about the system and regarding the amount of data needed, there were limited opportunities to apply and compare all three approaches within a single case study.
In recent years, the availability of data, computational resources, and suitable inference algorithms increased, and the synthesis of knowledge from different disciplines improved. This opens new opportunities for collaborations and cross-fertilization among different modelling communities. For example, the consideration of mechanistic knowledge about a system may support variable selection for machine learning approaches and support the selection of suitable structures of statistical models. On the other hand, machine learning approaches that are flexible to include new sources of data can be used to infer responses that may lead to the discovery of processes that have been neglected in mechanistic models. Such collaborations could lead to an iterative cycle of data-driven and knowledge-driven approaches to test new hypotheses and improve predictions. In addition, new hybrid approaches, such as neural ODEs offer possibilities to integrate data-driven knowledge while profiting from mechanistic constraints. With this talk, we aim to inspire modelers and data scientists to jointly explore new avenues for collaboration. We see the high potential that this could help moving the field of ecological modelling towards a higher relevance for addressing the grand challenges of climate change and biodiversity loss.

# Modelling river fish distribution under connectivity constraints

Mr Swann Felin[1], Mr Jérôme Belliard[1], Mr Guillaume Thirel[1], Mr Gaël Grenouillet[2], Ms Céline Le Pichon[1], Mr Damiano Baldan[3], Ms Florentina Moatar[4], Mr Johannes Radinger[5], Ms Alienor Jeliazkov[1]
[1]Hydrosystèmes Continentaux Anthropisés – Ressources, Risques, Restauration (HYCAR), UR 1462, INRAE, Université Paris-Saclay, Antony, France, [2]Laboratoire Évolution et Diversité Biologique (EDB), UMR 5174, CNRS, Université Toulouse III Paul Sabatier, Toulouse, France, [3]Italian Institute for Environmental Protection and Research (ISPRA), Venice, Italy, [4]Unité de recherche et de développement pluridisciplinaires sur le fonctionnement des hydrosystèmes (RiverLy), UR 1469, INRAE, Villeurbanne, France, [5]Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Germany

9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*Swann Felin is a second-year PhD student at INRAE, working within the HYCAR research unit (close to Paris), which gathers researchers interested in river ecology, ecotoxicology and water management. He received a master's degree in environmental management from the AgroParisTech engineering school. His doctoral thesis started in October 2021 and aims at building a species distribution model susceptible to predicting river fish distribution, taking connectivity constraints into account, and using the said model to explore future fish distribution under co-constructed global change and management scenarios. He is interested in nature conservation, ecology and environmental management.*

Anthropogenic change and its effects on rivers cause fish to adapt through a shift in their distribution. However, the management of rivers leads to connectivity constraints (dams, sluices, etc.) which impede this dynamic. Our study sought to characterize connectivity's influence on fish distribution. To do so, we worked on the extended Seine River basin (France), a heterogeneous, 95,000-km² area that includes more than 14,000 artificial barriers. Our analyses relied on a unique dataset of fish species abundance for 52 species, covering 40 years and 2,700 stations. We first calculated connectivity metrics, often overlooked in this context, from species-specific leptokurtic dispersal kernels, using the R package {riverconn} to account for asymmetrical dispersal (upstream and downstream). Second, we built a set of species distribution models (SDM, including BIOMOD, and Joint SDMs) to explain current fish distribution in response to climatic and hydrological conditions, water physical chemistry, and land use. Third, to assess the importance of connectivity in fish species distribution, our innovative approach was to include connectivity metrics in the SDMs. We also investigated the relative impact of different barriers on connectivity. To do so, we calculated leave-one-out barrier prioritization indexes based on catchment-scale connectivity indices. We thus highlighted a selection of dams that constitute the best candidates for removal. Our results will contribute to a better understanding and quantification of the importance of connectivity in river fish distribution in anthropized environments. Furthermore, this work will allow predicting biodiversity under scenarios of global change and open doors for application to different catchments.

# Modular River Physical survey (MoRPh): A high resolution, physical habitat and geomorphological survey for Citizen Scientists

Dr Judy England[1], Mr Kieran J. Gething, Dr Chloe Hayes, Prof Angela Gurnell, Dr Lucy Shuker, Prof Rachel Stubbington, Prof Geraldene Wharton
[1]Environment Agency, , United Kingdom

2G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Judy is a national research scientist for the Environment Agency. As an applied researcher Judy works with many academics to address real-world issues and distil research into application. Recently this has included a focus on understanding the effects of climate change and the interaction with other anthropogenic pressures. Working in collaboration with hydrologists, geomorphologists and climate change scientists, datasets are being used to explore long-term patters across spatial scales to improve our knowledge on how to increase the resistance and resilience of our aquatic systems. Citizen Scientists bring and additional valuable element to this work.*

The Modular River Physical (MoRPh) survey was developed in 2015 to provide Citizen Scientists with a means to record and assess physical habitat and hydromorphological functioning in their local rivers and streams. It provided Citizen Scientists, who were implementing the Riverfly (macroinvertebrate) survey, with a tool to capture changing physical habitat conditions at their biological sampling sites. Since 2015 approximately 6000 surveys have been recorded across the United Kingdom and the Republic of Ireland to characterize physical habitats in rivers and streams; track the impacts of river restoration and natural flood management interventions; and provide habitat information to aid interpretation of biological survey data. We describe and illustrate the MoRPh survey and provide examples of how survey data and indices have been used to track changes induced by river restoration interventions on rivers. We provide two examples of how MoRPh habitat data has contributed to understanding river biological survey data through characterizing the responses of aquatic macroinvertebrates and terrestrial plants and invertebrates to environment variables in groundwater-fed rivers and predicting beetle richness in dry temporary streams. Although the MoRPh survey was developed for application to rivers, other complementary Citizen Science methods are becoming available including MoRPh Estuaries (for surveying tidal rivers and estuary margins) and MudSpotter (for recording the locations and types of sources delivering fine sediment to river systems during wet weather).

# Molecular approach to diatoms community in disconnected pools

Mr Guillermo Quevedo-Ortiz[1,2], Zeynep Ersoy[1,2], Nieves López-Rodríguez[1,2], Raul Acosta[5,6], Pau Fortuño[1,2], Rosa Trobajo[1,7], Núria Cid[1,7], Dolors Vinyoles[1,2], Martina Weiss[4], Dominik Buchner[4], Till Macher[4], Florian Leese[4,8], Cesc Múrria[2,10], María Soria[1,2,9], Narcis Prat[1,6], Miguel Cañedo-Arguelles[5,6], Joan Gomà[1,2], Núria Bonada[1,2]
[1]FEHM-Lab (Freshwater Ecology, Hydrology and Management), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia. Universitat de Barcelona, Barcelona, Spain, [2]Institut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona, Barcelona, Spain, [3]Eurofins-Cavendish, Granada, Spain, [4]Aquatic Ecosystem Research, University Duisburg-Essen, Essen, Germany, [5]EHM-Lab (Freshwater Ecology, Hydrology and Management), Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain, [6]Institut de Recerca de l'Aigua (IdRA), Universitat de Barcelona, Barcelona, Spain, [7]IRTA, Marine and Continental Waters Programme, Là Ràpita, Spain, [8]Center for Water and Environmental Research (ZWU), University Duisburg-Essen, Essen, Spain, [9]CERM, Center for the Study of Mediterranean Rivers, University of Vic – Central University of Catalonia, Manlleu, Spain, [10]ZooSysEvo (Zoological Systematics and Evolution), Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Facultat de Biologia. Universitat de Barcelona, Barcelona, Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I'm a Ph.D. student at the University of Barcelona. I am part of FEHM-Lab group (Freshwater Ecology, Hydrology and Management). My research focuses on studying diatom communities in temporary rivers. For this, we carry out different approaches through the analysis of metacommunities, ecological traits, molecular methods and biomonitoring.*

Temporary rivers are dynamic fluvial ecosystems that alternate between flowing moments with periods of disconnected pools and dry riverbeds over space and time. Although they are very common in the Mediterranean basin, temporary rivers are often not included in biomonitoring programs. This is even more relevant during the disconnected pools phase in summer, despite these pools being key refugia for many freshwater species. Diatoms are one of the biological quality elements considered in the Water Framework Directive and a group rich in species. Nevertheless, their identification to species level by traditional taxonomy is usually complex and incomplete in the case of molecular methods.  To improve the performance and operability of the use of diatoms to assess the biological quality of temporary rivers, we compared the use of morphology and metabarcoding methods in disconnected pools. We collected biofilm and sediment samples from 58 disconnected pools in Catalonia (Spain) and compared both substrates using metabarcoding by rbcl primers. We also identified the biofilm samples by classical taxonomy to compare with the molecular taxonomy. Our preliminary results suggested that sediments and biofilm provide complementary information on the state of the diatom communities in disconnected pools. We expect that sediment eDNA methods can identify additional taxa to those obtained with traditional methods and allow finding sparse taxa, which opens up new opportunities to develop new biological indices for disconnected pools.

# Molecular diversity of spring fen macrozoobenthos from two geomorphological regions

Miss Magdalena Gajdošová[1], Arne Beermann[2], Jindřiška Bojková[3], Vendula Polášková[3], Jana Schenková[3], Marie Zhai[3], Michal Horsák[3], Florian Leese[2], Adam Petrusek[1]
[1]Faculty Of Science, Charles University, Prague, Czech Republic, [2]Aquatic Ecosystem Research, University of Duisburg-Essen, Essen, Germany, [3]Faculty of Science, Masaryk University, Brno, Czech Republic

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*PhD student from Charles University in Prague using metabarcoding approach to study freshwater biodiversity. Also interested in evolutionary parasitology.*

Recent studies on diversity of stream amphipods indicated that the Western Carpathians may have served as an important glacial refugium of freshwater fauna. If this scenario is true, a considerably high molecular diversity can be expected in this biogeographic region also for other aquatic taxa. In our project, we aim to uncover and characterize molecular diversity of benthic macroinvertebrate fauna of calcareous spring fens (a well-studied and hence convenient model community) of the Western Carpathians. For a comparison we also sampled macroinvertebrates in comparable habitats of the Bohemian Massif, the adjacent region, but with different geomorphological history. Using a DNA metabarcoding approach, we sequenced a fragment of the COI gene of pooled spring fen invertebrate communities from 21 Carpathian and 8 Bohemian Massif localities. Here the up-to-date insights about the comparison of molecular diversity of the same habitats in these two geomorphological regions will be presented. We observed a considerable lack of reference sequences in public databases (Barcoding of Life Database, GenBank) for a large portion of the detected molecular operational taxonomic units (MOTUs), indicating that the studied regions are not yet sufficiently covered by barcoding efforts, and/or suggesting that there indeed may be a considerable unrecognized diversity of macrozoobenthos. We also found large amount of NUMTs in some taxa.
Furthermore we aim to compare the MOTU diversity with the morphological diversity, already well studied in most of the localities, and to detect the spatial variation associated with distinct molecular/morphological communities/phenotypes.

# Monitoring the Health Status of the Elsa River (Tuscany) Through a Holistic Approach: From Bioindicators to the Ecosystem as a Whole.

Dr Isabella Calattini[1,2], Prof. Claudio Leonzio[1], Dr Dario Giani[1], Dr Stefania Ancora[1], Dr Tiberio Fiaschi[3], Dr Pietro Centorrino[2], Prof. Letizia Marsili[1], Prof. Maria Cristina Fossi[1], Prof. Claudia Angiolini[3], Prof. Silvia Casini[1], Dr Tommaso Campani[1]
[1]Department of Physical, Earth and Environmental Sciences, University of Siena, via Pier Andrea Mattioli, 4, Siena, Italy, [2]Associazione LaGorà, Via Garibaldi 82/84, Colle di Val d'Elsa (SI), Italy, [3]Department of Life Sciences, University of Siena, Via Pier Andrea Mattioli, 4, Siena, Italy

7E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*Isabella Calattini is an ecotoxicologist and PhD student at the University of Siena. Her research is based on an interdisciplinary and holistic approach, integrating physicochemical, ecosystemic and biological indicators.*

*She's coordinator of the "Science on the Elsa" project in Tuscany, for the participatory monitoring of the Elsa river, where she collaborated with local associations and with local high schools for the realization.*

*She is passionate and interested in citizen science projects, she is part of the group of young researchers called Scienza Radicata, where she deals with issues concerning freshwater streams.*

Freshwater ecosystems are essential for the planet. The Elsa river is a tributary of the Arno river, in Tuscany (Italy) is stressed by many contamination inputs and the presence of some towns. To evaluate the health status of the river, we proposed an integrated methodology that takes into account chemical, ecological and ecotoxicological parameters. Chemical parameters of water were sampled with the citizen science project, inscribed to "FreshWater Watch". The EBI and the FFI ecological indices were evaluated. The Squalius squalus were used as bioindicators, for the chemical and ecotoxicological analyses. We evaluated the microplastics ingestion, heavy metals and OCs concentration and a battery of biomarkers. The results showed a negative trend going from upstream to downstream, mainly from the stretch through the town of Colle Val d'Elsa and Poggibonsi, with genotoxic effects, correlated to the presence of Hg, PCBs and B(a)P metabolites in bile. The contamination is probably due to agricultural and industrial activities, vehicular traffic, polluted tributaries and inappropriate disposal of waste. The greatest abundance of microplastics was found in chubs caught in Colle Val d'Elsa, due to the presence of the urban area, the regular release of waste along the river in the past, and the increase of tourism in the last years. This integrated approach permits us to define the health status of the river, identify the contamination and hypothesize the sources. This tool is useful to promote mitigation actions to block the sources of impact and bring the river to a good ecological state.

# Multiple stressor effects on the taxonomic and functional diversity of macroinvertebrates in Atlantic streams

Prof. Cláudia Pascoal[1], Mr José Lourenço[1], Prof Fernanda Cássio[1], Dr Francisco Carvalho[1], Dr Cayetano Gutiérrez-Cánovas[2], Dr Giorgio Pace[1]
[1]CBMA & IBS / University of Minho, Braga, Portugal, [2]Universidad Rey Juan Carlos, Madrid, Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Cláudia Pascoal is Associate Professor with Habilitation at the Department of Biology in the University of Minho, Portugal.*

*Her research interests focus on assessing, predicting and mitigating the impacts of global change on biodiversity and the functioning of aquatic ecosystems.*

*She has supervised 12 PhD ; 25 MSc, 31 BSc students*

*She published > 100 articles in journals indexed to Scopus plus 10 book chapters; h index=34.*

Freshwaters are considered among the most endangered ecosystems globally due to multiple stressors, which coincide in time and space. Despite recent advances, current knowledge on multiple stressor effects in real-world ecosystems is still limited. Using an extensive survey of 50 stream reaches across North Portugal, we evaluated taxonomic and functional macroinvertebrate responses to multiple stressors, including marked gradients of nutrient enrichment, flow reduction, riparian vegetation structure, thermal stress and dissolved oxygen depletion. We analyzed multiple stressor effects on two taxonomic (taxon richness, Shannon-diversity) and two trait-based diversity indices (functional richness, functional dispersion), as well as changes in trait composition. We found that multiple stressors had additive effects on all diversity metrics, with nutrient enrichment identified as the most important stressor in three out of four metrics, followed by dissolved oxygen depletion and thermal stress. Taxon richness, Shannon-diversity and functional richness responded similarly, whereas functional dispersion was driven by changes in flow velocity and thermal stress. Functional trait composition changed along a major stress gradient determined by nutrient enrichment and oxygen depletion. Overall, our results reinforce the need to consider complementary facets of biodiversity to better identify assembly processes in response to multiple stressors. By combining an extensive field survey with an integrative consideration of multiple biodiversity facets, our study provides new insights that can help to better assess and manage rivers in a global change context.

# Multiple stressors and chemical mixtures – same but different?

Dr Ralf B. Schäfer[1]
[1]RPTU Kaiserslautern-Landau, Landau, Germany
3C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Funny guy with long hair*

Ecosystems are strongly influenced by multiple anthropogenic stressors. These include a wide range of chemicals and their mixtures. So far, studies on the effects of multiple stressors have largely focussed on non-chemical stressors, whereas studies on chemical mixtures have largely ignored other stressors. However, both research areas face similar challenges and require similar tools and methods to predict the joint effects of chemicals or non-chemical stressors, and frameworks to integrate multiple chemical and non-chemical stressors are missing. We provide an overview of the research paradigms, tools and methods commonly used in multiple stressor and chemical mixture research and discuss potential domains of cross-fertilization and joint challenges. We compare the methods to identify interactions between chemicals or non-chemical stressors and highlight potential for integration. We identify that both research areas suffer from rather simplified experimental designs that focus on only a limited number of stressors, chemicals and treatments and discuss concepts that can guide more realistic designs. We also discuss the promises of process-based and data-driven models to tackle the challenge of prediction of effects of chemical mixtures and non-chemical stressors on (meta-)communities and (meta-)food webs. Here, the Asymmetric Response Concept can help to evaluate spatial and temporal stressor profiles. We propose a framework to integrate the effects assessment for multiple stressors and chemical mixtures and argue that the ARC can guide when to use process-based models.

# Multiple-stressor effects of climate-change and land-use drivers on stream macroinvertebrate communities.

Ms Ann-Marie Kelly[1], Dr. Jeremy Piggott[2], Dr. Marcin Penk[2], Prof. Mary Kelly-Quinn[1]
[1]School of Biology and Environmental Science, University College Dublin, Ireland, [2]Trinity Centre for the Environment & Dept. of Zoology, Trinity College Dublin, Ireland

2C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Ann-Marie is a current PhD student at the School of Biology and Environmental Science, University College Dublin, Ireland. Her primary interests lie in multiple stressor research and their effects on freshwater ecosystems.*

Predicted future climatic change stressors and land-use drivers pose a significant threat to freshwater ecosystems, aquatic communities as well as associated ecosystem services. Improved understanding of the complex interactive effects between climate and land-use stressors are necessary for freshwater management in order to inform mitigation of potential negative impacts. The aim of this study was to investigate the individual and combined effects of two climate stressors (increased variability of flow velocity, carbon dioxide enrichment) and a key land-use stressors (deposited fine-sediment) as well as shading on stream benthic macroinvertebrate communities. To address this aim, a full-factorial experiment of these four factors was carried out using the ExStream System (an experimental stream mesocosm system comprising of 128 circular stream channels) in Annamoe, Co. Wicklow, on the east coast of Ireland between May and July 2022. Stressors were either applied in pulses or continuously. Stressors applied in pulses included increased flow velocity variability (pulsed fast- and slow-flow periods vs. constant velocity) and deposited fine-sediment (two pulses vs. absent). While shading and carbon dioxide were applied continuously and were either present/enriched or absent/ambient, respectively. The results focus on the macroinvertebrates remaining in the mesocosms at the end of the experiment. The findings are expected to inform catchment management to mitigate negative impacts of climate change stressors and provide further empirical support for mechanistic frameworks of stressor interactions.

# Multiple-stressor effects on ecosystem functions in freshwaters: a systematic review and meta-analysis

Dr Fengzhi He[1,2,3], Ms. Graciela Medina Madariaga[1,2], Dr. Roshni Arora[4], Dr. India Mansour[5], Prof. Sonja C. Jähnig[1,2]
[1]Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany, [2]Geography Department, Humboldt-universität Zu Berlin, Berlin, Germany, [3]Center for Biodiversity Dynamics in a Changing World (BIOCHANGE), Department of Biology, Aarhus University, Aarhus C, Denmark, [4]India Program, The Nature Conservancy, New Delhi, India, [5]Institut für Biologie, Freie Universität Berlin, Berlin, Germany

3C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Fengzhi He was trained as a stream ecologist at the Institute of Hydrobiology, Chinese Academy of Sciences. Then he started his PhD at the Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB) and expanded his research on diversity and risk patterns of large freshwater animals (i.e. freshwater megafauna). Currently, he is a postdoctoral researcher at the Conservation Biogeography lab at Humboldt-Universität zu Berlin and the Center for Biodiversity Dynamics in a Changing World (BIOCHANGE), Aarhus University. His research seeks to understand patterns and drivers of riverine biodiversity at different scales.*

Freshwaters support enormous biodiversity and essential ecosystem functions worldwide, and contribute to human well-being. However, freshwater ecosystems have experienced a sharp biodiversity decline due to multiple stressors, including habitat fragmentation, altered flow and sediment regimes, warming, pollution, and species invasion. These stressors, alone or in concert with each other, may affect community structure and biotic interactions in freshwater ecosystems, with subsequent functional consequences. In recent decades, multiple-stressor research in freshwater ecosystems has received increasing attention. We conducted a systematic review of studies that have experimentally manipulated multiple stressors simultaneously in freshwaters and measured responses of multispecies assemblages and associated biotic interactions and ecosystem functions. Most identified studies have focused on community structure (e.g., alpha diversity, biomass, and abundance), while biotic interactions and ecosystem functions received less research attention. Using meta-analysis, we further investigated whether the inclusion of biotic interactions affects the measured response of ecosystem function - the exclusion/addition of macroinvertebrates has an impact on the magnitude and direction of the interaction effect size of multiple stressors in litter decomposition. In addition, we investigated the potential effects of moderator variables related to experimental settings, such as habitat type, experiment duration, and litter size. Our results highlight the importance of considering biotic interactions in multiple-stressor research, which can facilitate a deeper mechanistic understanding of how stressor interactions affect freshwater assemblages and associated ecosystem functions.

# National breakdown: controls on leaf litter decomposition and aquatic communities across the United States

Morgan Bucher[1], Lleysi Martinez[1], Kaley Cave[1], Oriana Silva Belisario[1], Haley Daniels[1], Joyradyn James-Rollins[1], Jane C. Marks[2], David J. Hoeinghaus[1], Zacchaeus G. Compson[1]
[1]Department of Biological Sciences, Advanced Environmental Research Institute, University of North Texas, Denton, TX, United States, [2]Department of Biological Sciences, Center for Ecosystem Science and Society, Northern Arizona University, Flagstaff, AZ, United States
8G_RS20_Aquatic terrestrial linkages, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Morgan is an MSc student at the University of North Texas, where she is working on a project under Dr. Zacchaeus Compson that utilizes isotopically labeled leaf litter to assess trophic linkages in streams across the National Ecological Observatory Network (NEON). She is interested in how food web models and DNA metabarcoding can be applied to make better informed resource management decisions, particularly in riparian areas and aquatic systems. Morgan's background includes plant and animal monitoring surveys with the U.S. Fish and Wildlife Service, GIS mapping of sage-grouse habitat, and fishing surveys with the Oregon Department of Fish and Wildlife.*

Leaf litter is a critical allochthonous food source for aquatic macroinvertebrates in headwater streams. Although leaf litter decomposition in aquatic systems is relatively well studied, few studies link litter decomposition rates to macroinvertebrate assemblages across large spatial scales. We assessed decomposition rates of two litter species: relatively fast-decomposing Fremont cottonwood (Populus fremontii) and relatively slow-decomposing Arizona sycamore (Platanus wrightii), using leaf pack assays. We placed litter packs in 12 wadeable streams of the US National Ecological Observatory Network (NEON) during Autumn 2021. Sites ranged from Massachusetts to California and from Washington to Puerto Rico, providing a wide range of streams varying in physical and chemical parameters. We identified, counted, and measured lengths of aquatic macroinvertebrates present in each litter pack to identify community structure and body size distributions. These data allowed us to test the hypothesis that litter decomposition is primarily driven by Mean Annual Temperature (MAT), and secondarily controlled by litter species and associated macroinvertebrate community dynamics (e.g., shredder diversity and biomass). We also hypothesized that macroinvertebrate communities are structured more by stream identity than leaf litter species. Testing these hypotheses in a controlled study using the same leaf types across a wide range of streams will allow us to assess observations made from recent meta-analyses, illuminating the controls on litter decomposition and macroinvertebrate community assembly.

# Natural Vs. Artificial River Network Fragmentation in Europe

Miss Tamara Leite[1], Dr. Gonçalo Duarte[1], Dr. Pedro Segurado[1], Dr. Maria Teresa Ferreira[1], Dr. Paulo Branco[1]
[1]Forest Research Centre, Associate Laboratory TERRA, School of Agriculture, University of Lisbon Lisboa, Portugal, Lisboa, Portugal

9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*I am a biologist, attending the doctoral program FLUVIO–River Restoration and Management, and working on freshwater ecology focusing on fish species. My research is based on river network connectivity, and connectivity loss, the impacts of river network fragmentation on freshwater fish species, fish movements, and freshwater fish biology.*

Longitudinal connectivity of freshwater systems can be disrupted by natural or artificial barriers. In addition to limiting fish migration, barriers can also affect habitat quality by creating changes in flow regime, sediment and nutrient transport, and water temperature. Most of the research on river network fragmentation lacks the distinction between the independent effects of natural pre-existing barriers, such as waterfalls, and the constructed artificial ones, such as dams. Additionally, studies on the impacts of dams have considered the dam as the principal or only barrier impairing longitudinal fish movements. But the upstream water reservoir itself represents a strong ecological barrier because it creates completely different hydrological and limnological conditions. Consequently, besides the limitations imposed by the dam, these impoundments represent a behavioural obstacle to migration of fish. To understand the impacts of riverine longitudinal connectivity loss, regarding potamodromous and diadromous fish species across Europe, the work aims at solving one question – Are we under or overestimating the effects of artificial river barriers on fish species? For this we compare the effects of natural and artificial barriers, including the reservoir as an ecological barrier, on river network connectivity. Natural fragmentation has to be considered in river network connectivity studies, not to overestimate the impact of barriers; and, the integration of the reservoirs as ecological barriers, demonstrates how we may have underestimated the impact of barriers by considering that these structures only affect the river segments where they are implanted.

# New ponds: an ecological tool to protect freshwater biodiversity

Prof. Jeremy Biggs[1], Ms Penny Williams[1], Dr Pascale Nicolet[1]
[1]Freshwater Habitats Trust, Oxford, United Kingdom

5D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Jeremy Biggs is a co-founder and Chief Executive Officer of Freshwater Habitats Trust. He has extensive experience of measures to promote the protection of freshwater biodiversity, with a special interest in ponds. He is also a Steering Group member of the European Pond Conservation Network and a Director of the Newt Conservation Partnership.*

Ponds are an ancient natural habitat type now often created by humans. This talk takes examples from three pond creation projects undertaken in the UK by Freshwater Habitats Trust and partners which show that new ponds can: bring sustained biodiversity benefits; enhance the potential for spread of uncommon species and reverse landscape-scale declines in freshwater species. (i) The pond complex at Pinkhill Meadow in Oxfordshire was created in the 1990s. Through a combination of knowledge-based design, good water quality and a fortuitous location, it rapidly developed a rich aquatic invertebrate and macrophyte assemblages and has maintained an exceptional conservation value for over 30 years. (ii) Aquatic macrophyte data from 25 new ponds originally created for Great Crested Newts between 2017 and 2020 showed that some new ponds were colonised by regionally rare plant species. At least one of these species, Baldellia ranunculoides, appears to have recovered from regional extinction and to be spreading into surrounding areas as a result of high-quality pond creation. (iii) Decade-long monitoring for the Water Friendly Farming initiative in Leicestershire has shown that, against a background of regional decline in freshwater plant species, simply doubling the number of high quality (clean water) ponds created exceptional benefits: increasing regional wetland plant gamma richness by 26% and the number of regionally rare wetland plants by 181%. Pond creation can be quick and inexpensive to undertake and, when done well, shows considerable potential to protect freshwater biodiversity in an era when urgent solutions to biodiversity loss are required.

# New special issue on biological invasions: insights, challenges, and methodological advancements in river ecosystems

Dr Simone Guareschi[1,2], Dr Zarah Pattison[3], Dr Kate Mathers[2]
[1]Donana Biological Station (EBD-CSIC), Seville, Spain, [2]Geography and Environment - Loughborough University, Loughborough , UK, [3]University of Stirling , Stirling, Scotland
Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Dr. Simone Guareschi is a freshwater ecologist at Doñana Biological Station (Spain - CSIC) annd Visiting fellow in River Science at  Loughborough University (UK - Geography and Environment). He is a researcher with international experience in both environmental consulting (Spain) and the academic sector (Italy, Spain, UK: Royal Society Newton International fellow).*

The spread and successful establishment of invasive non-native species (INNS) is a key driver of lotic ecosystem degradation globally within the Anthropocene era. Despite historic interest in biological invasions, tackling INNS remains a key challenge for managers of freshwater systems and a continued focus of international research.
Many of the concepts and hypotheses associated with biological invasions have traditionally been developed using terrestrial ecosystems thus far. However, the emblematic conditions of river systems, associated with their spatial connectivity in the landscape, the presence of cryptic / unknown biodiversity and multiple stressors, would benefit from context specific approaches specifically designed to consider them and the communities they support.
A recently published virtual special issue (2023) in "River Research and Applications" aimed to bring together some of the most important themes in invasion biology related to rivers and their associated freshwater systems. Spanning nine countries, four continents and four biogeographic regions the papers showcased the diversity of research being conducted globally and demonstrated the far-reaching and heterogenous implications of INNS within rivers, reservoirs, and riparian zone habitats affecting symbionts, plants, invertebrates, fish, and mammals. Overall three main themes (notwithstanding some inevitable overlap) emerged from this Special Issue: (i) insights to characterize the environmental and ecological drivers that facilitate INNS; (ii) monitoring techniques for INNS management, and; (iii) assessments of environmental and ecological implications of INNS establishment.

# Nitrospira viruses in biofilms of a unique mine water collection basin

Mr Joern Starke[1], Mr Tom L. Stach[1], Mrs Sarah P. Esser[1], Mrs Katharina Sures[1], Mrs Julia Plewka[1], Dr. Till L. V. Bornemann[1], Dr. André Soares[1], Prof. Dr. Alexander J. Probst[1,2]
[1]Environmental Metagenomics, Research Center One Health Ruhr of the University Alliance Ruhr, Faculty of Chemistry, University of Duisburg-Essen, Essen, Germany, [2]Centre of Water and Environmental Research (ZWU), University of Duisburg-Essen, Essen, Germany

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*I am a microbiologist/Bioinformatician at the University of Duisburg-Essen who studies the effects of anthropogenic stressors on the microbiome of freshwater streams. I studied Water Science at the University of Duisburg-Essen and currently do my PHD in the lab of Prof. Dr. Alexander Probst.*

Industrialization is a significant stress factor for global aquatic systems, causing pollution, temperature increases, and changes in salt and nutrient concentrations. The effects of these stressors on eukaryotic organisms are fairly well understood, yet little is known about the impact of combinations of stressors on microbial communities with key roles in biochemical cycling. Here, we genomically resolved aquatic biofilms naturally grown at an outlet discharging highly ferruginous mine effluent (Friedlicher Nachbar, Germany) with increased salt concentrations to investigate the bacterial, archaeal, and viral community thriving under these stressors. Biofilms were dominated by Nitrospira and iron oxidizing Gallionella, with five out of six recovered Nitrospira MAGS encoding for complete ammonia oxidation (COMAMMOX). We also identified CRISPR-Cas systems in all six Nitrospira genomes, whose spacers matched 22 previously taxonomically unrecognized viral particles, indicating either past and/or current viral infections of Nitrospira. These results demonstrate that biofilms in this ecosystem impacted by multiple stressors have likely adapted by living off ammonium and reduced iron contained in the mine effluent. Our bioinformatics approach also provided the first evidence for viral infection of Nitrospira populations, rendering this ecosystem a treasure trove for exploring Nitrospira virus-host relationships. We conclude that aquatic ecosystems impacted by multiple stressors can bear ecological information on key metabolisms like COMAMMOX controlling prevalent biogeochemical processes on Earth.

# No continent for Freshwater fish – Current status and threats of European freshwater fish species

Gonçalo Duarte[1], Pedro Segurado[1], Gertrud Haidvogl[2], Diogo Moreno[1], Angeliki Peponi[1], Tamara Leite[1], José Maria Santos[1], Didier Pont[2], Maria Teresa Ferreira[1], Paulo Branco[1]
[1]Forest Research Centre, Associate Laboratory Terra, School Of Agriculture, University Of Lisbon, Lisboa, Portugal, [2]Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria

5C_SS05_Freshwater Macroecology research and perspectives, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Biologist with advanced studies in GIS, an MSc in Conservation Biology and a PhD in Freshwater restoration.*

*My research focus river restoration, freshwater fish ecology, spatial ecology and historical ecology concerning large-scale environmental processes and using ecological modelling.*

Fish represent a quarter of all vertebrates and 40% of those are freshwater-related species, the second most threatened animal group. These species are, at least for a significant part of their life cycle, limited to occur in rivers, i.e., hierarchic and dendritic networks where flow imposes a directionality. Data collected from the International Union for Conservation of Nature Red List and the Habitats Directive facilitates characterising freshwater fish species ecology, distribution and associated threats. Moreover, complementing this with historical data from multiple sources (e.g., PHish, EuroDiad) enables developing a comprehensive evaluation of freshwater fish species' current conservation status. Using these datasets, this work aimed at establishing and comparing spatial patterns of threat incidence, species richness and conservation status taking into consideration species migratory phenology. Additionally, considering diadromous fish species and their use of river networks it was also possible to determine the structural and functional connectivity impairment throughout the 20th century. Data collected covers 434 species for which 837 threats were identified. Amidst the overall high level of imperilment throughout Europe, southern regions seem more problematic by having lower richness but high threat incidence and species threatedness. Overall, the most frequent threat typology was "Dams & water management/Use". Historically, considering simply large dams, it was only after WWII that longitudinal connectivity impairment increased severely, and in the early 21st century functional impairment existed for all diadromous species analysed. Particularly, erecting dams in the mainstem rivers of European basins seems to be related to the deterioration of multiple diadromous species occurrence.

# No Iberia for freshwater mussels: lessons from considering biotic interactions to predict the impacts of climate change

Janine P. da Silva[1], Ronaldo Sousa[1], Duarte Vasconcelos Gonçalves[2], Rafael Miranda[3], Joaquim Reis[4], Amílcar Teixeira[5], Simone Varandas[6,7], Manuel Lopes-Lima[7], Ana Filipa Filipe[8,9]
[1]Centre of Molecular And Environmental Biology - University of Minho, Braga, Portugal, [2]CIIMAR - Centro Interdisciplinar de Investigação Marinha e Ambiental, University of Porto, Porto, Portugal, [3]Instituto de Biodiversidad y Medioambiente (BIOMA), Universidad de Navarra, Navarra, Spain, [4]MARE - Marine and Environmental Sciences Centre//ARNET-Aquatic Research Network, Lisbon, Portugal, [5]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal, [6]CITAB-UTAD - Centre for Research and Technology of Agro-Environment and Biological Sciences, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal, [7]CIBIO/InBIO – Research Center in Biodiversity and Genetic Resources, University of Porto, Vairão, Portugal, [8]Forest Research Centre, School of Agriculture, University of Lisbon, Lisbon, Lisbon, Portugal, [9]TERRA Associate Laboratory, Lisbon, Portugal

5C_SS05_Freshwater Macroecology research and perspectives, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Janine P. da Silva is a PhD student at the University of Minho, Portugal. Her work seeks to understand and predict the distribution of freshwater organisms at different spatial and time scales using GIS, ecological niche-based species distribution models. She is particularly interested in applying biogeography to the conservation of freshwater mussels, fish and species interactions in a changing world.*

Climate change is becoming the leading driver of freshwater biodiversity loss. Unprecedented biodiversity declines have been recorded particularly in southwestern Europe. Within freshwater ecosystems, freshwater mussels contribute to essential ecosystem services but are among the most threatened faunal groups on Earth. Their poor conservation status is related to the dependence on fish hosts to complete the life cycle, which also makes them particularly vulnerable to climate change. This study investigated the potential impact of future climate on the distribution of freshwater mussel species while considering their obligatory interaction with fish hosts using Species Distribution models. Specifically, ensemble models were used to forecast the current and future distribution of six mussel species in the Iberian Peninsula, including environmental conditions and the distribution of fish hosts as predictors. We found that climate change is expected to severely impact the future distribution of Iberian mussels. Mussel species with narrow ranges were predicted to have their suitable habitats nearly lost and could potentially be facing regional or global extinctions. Widely distributed mussel species are expected to suffer distributional losses but may gain new suitable habitats if fish hosts are able disperse to these areas while carrying larvae. We also found that including the distribution of fish hosts in the mussels' models avoided the underprediction of habitat loss under climate change. This study warns of the imminent loss of mussel species and populations and the urgent need of management actions to reverse current trends and mitigate irreversible damage to species and ecosystems in Mediterranean regions.

# Novel insights from a national scale monitoring network for measuring aquatic GHG emissions

Dr Amy Pickard, Dr Carole Helfter[1], Karen Yeung[1], Dr Ellie Mackay[4], Nick Everard[3], Gwyn Rees[3], Michael Hutchins[3], Bryan Spears[1], Chris Barry[2], Professor Chris Evans[2]
[1]UKCEH, Edinburgh, United Kingdom, [2]UKCEH, Bangor, United Kingdom, [3]UKCEH, Wallingford, United Kingdom, [4]UKCEH, Lancaster, United Kingdom

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*Amy Pickard is a biogeochemist at UKCEH with more than ten years experience researching carbon, nutrient and greenhouse gas cycling in aquatic systems from source to sea.*

It is now recognised that freshwaters are active components of the global carbon cycle; rivers and lakes process the organic matter and nutrients they receive from their catchments, emit carbon dioxide and methane, sequester carbon dioxide through aquatic primary production, and bury carbon in their sediments. Human activities have greatly modified natural aquatic biogeochemical processes and in some inland waters, this has led to large greenhouse gas emissions to the atmosphere. However these emissions are highly variable in time and space, occur via a range of pathways, and are consequently exceptionally hard to measure on the scales required. In the GHG-Aqua project we are establishing an integrated, UK-wide system for measuring aquatic GHG emissions, combining a highly instrumented sentinel sites with a distributed, community-run network of low-cost sensors systems deployed across inland waters to measure emissions from rivers, lakes, ponds, canals and reservoirs across key environmental gradients. In this presentation, we will describe the network and highlight some of our early findings. Using data from the UK's first eddy covariance flux towers installed to quantify freshwater carbon dioxide and methane emissions, we show that overturning creates hot moments for methane emissions from lakes. High temporal resolution flux data from our sentinel sites also demonstrate seasonal variation in the source-sink potential of freshwaters. Insights from this globally unique, integrated measurement system will transform our capability to understand and quantify aquatic GHG emissions from inland waters.

# Nutrient removal by buffer zones; knowns and unknowns

Ms Annalieke Bakker[1,2], Mr Tom van der Meer[1,2], Dr. Michiel Kraak[2], Prof. Piet Verdonschot[1]
[1]Wageningen Environmental Research, Wageningen, Netherlands, [2]Institute of Biodiversity and Ecosystem Dynamics, Amsterdam, Netherlands

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*Annalieke Bakker is a PhD candidate at Wageningen Environmental Research and the University of Amsterdam. Her research focusses on the effects of macroinvertebrates regarding nutrient retention and removal in aquatic-terrestrial environments. Furthermore, the contribution of these effects to the efficiency of buffer zones is an important focus point.*

One of the main causes of the insufficient ecological water quality in the Northwestern European lowlands is the ongoing diffuse excess nutrient input from adjacent agricultural fields. Buffer zones, consisting of a vegetated strip between agricultural areas and surface waters, may filter this diffuse pollution at the source, preventing that nutrients leach into surface waters. The efficiency of buffer zones to retain and remove nutrients does, however, vary. Understanding the nutrient retention and removal processes is therefore vital to improve buffer zone design and efficiency. The biogeochemical processes in such aquatic-terrestrial transition zones are relatively well known, but the contribution of the interactions between the present vegetation and soil invertebrates to these processes remain overlooked and understudied. The aim of this study was therefore to assess the interactions between vegetation and soil invertebrates in nutrient retention and removal processes in periodically inundated buffer zones. Based on the available literature, we created an overview of the relevant processes of nutrient retention and removal and the interactions between vegetation and invertebrates. We concluded that although periodic flooding can enhance both nutrient retention and removal, also leaching of nutrients and structure and functioning of vegetation may contribute to nutrient retention efficiency. Furthermore, although macroinvertebrates have a profound effect on biogeochemical cycles in other systems, the effects of macroinvertebrates functioning in periodically inundated buffer zones is rarely studied and the contribution to nitrogen and phosphorus retention and removal remains unclear, which we therefore identified as a pressing research priority.

## On the frontier of eDNA: developing barcodes for rapid detection of endangered fishes in the Southern Plains (USA)

Ms Kaley Cave[1], Lindsey Davis[1], Andrew Frye[1], Damian Quiroz[1], Micheal Curtis[1], Chase Nimee[2], Carmen Montaña[2], Zacchaeus Compson[1]
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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Kaley is PhD student working under Dr. Zacchaeus Compson at the University of North Texas. For her dissertation, Kaley is using eDNA metabarcoding to assess and model the presence of endangered cyprinids in the upper Brazos River in Texas.*

Environmental DNA (eDNA) metabarcoding is a revolutionary bioassessment tool that can be employed as a long-term monitoring method for the management of endangered fishes. The Sharpnose shiner (Notropis oxyrhynchus) and Smalleye shiner (Notropis buccula) are federally endangered cyprinids endemic to the upper Brazos River, Texas, USA. DNA metabarcoding has never been applied to either species; in fact, 10 of the 22 commonly reported fish species in the upper Brazos have no publicly available DNA sequences in online databases. This information gap limits the utility of eDNA metabarcoding in this system. To employ eDNA metabarcoding in the Brazos River, we extracted DNA from vouchered specimens in the Texas A&M University Biodiversity Research and Teaching Collection, and used five primer sets to generate a suite of barcodes for 27 fish species documented in the upper Brazos and nearby watersheds. We performed a series of experiments using mock communities (containing DNA from all 27 target species) and tests in the wild (linked to visual detection from traditional approaches) to assess the effectiveness of each primer set at producing barcodes for resolving the fish assemblage in the upper Brazos to the species level. Based on these results, we will choose 2 primer pairs to use for a 3-year field study. DNA sequences will be uploaded to GenBank so that key amplicon sequences of the entire upper Brazos fish assemblage are publicly available, enhancing the utility of DNA metabarcoding for species in need of non-invasive, rapid detection for sustained management.

# One-year of aquatic Biodiversity Monitoring South Tyrol data: a multi-scale habitat approach to assess benthic macroinvertebrate assemblages drivers in mountain rivers.

Dr Francesca Vallefuoco[1], Magdalena Vanek[1], Dr Roberta Bottarin[1], Dr Alberto Scotti[2]
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2E_RS10_Biomonitoring, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Francesca Vallefuoco is a Post-Doc Researcher working at the Institute for Alpine Environment at Eurac Research (Italy) within the limnological team. With a doctorate in ecohydrology at the University of Trento and Edmund Mach Foundation, she is working on flow-ecology relations, aquatic biomonitoring projects and macroinvertebrate biodiversity in Alpine rivers.*

Mountain riverine ecosystems are hotspots of biodiversity but also face threats of ecological deterioration through changes in land use, climate conditions and progressive habitat loss due mostly to anthropogenic impacts. Here we present the results of the first sampling season of benthic macroinvertebrates within the long-term program Biodiversity Monitoring South Tyrol (BMS). Although the goal of BMS project is related to quantify the regional aquatic biodiversity and its' changes over time, we also investigated the variation in taxonomic richness and diversity of stream benthic community at multiple spatial scales. In 48 sites across the Autonomous Province of Bolzano/Bozen (Italy), benthic macroinvertebrates and a set of environmental factors describing water quality, stream/river hydrology and geomorphology and substrate composition were collected. First, we assessed which ecological factors were the main drivers of benthic macroinvertebrate assemblages and diversity in mountain environments. Second, we identified possible indicator taxa for each substrate and stream/river type. We observed differences in benthic composition and diversity among stream/river type rather than among substrates, with only exception for EPT%. We also found several indicator taxa for each stream/river type, but no indicators for any substrate. Our results suggest that ecological factors acting at reach and landscape scale such as temperature, streambed channel stability and elevation are the most important drivers in macroinvertebrate distribution patterns in mountain rivers. Those environmental features could be key aspects for assessing long-term biodiversity variations and should also be included in future monitoring programs in mountain regions.

# Past and future joint trends in river temperature and flow: implications for diadromous fish

Dr Anthony Maire[1], Dr Hanieh Seyedhashemi[2], Dr Elorri Arevalo[3], Dr Marion Legrand[4], Dr Florentina Moatar[2], DR Hilaire Drouineau[3]

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3F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*

*As a Research Engineer at EDF R&D, Anthony Maire is mainly working on the influence of water warming on aquatic ecosystems.*

Most key life-cycle events of organisms are synchronized by complex interactions of environmental cues to ensure optimal survival and growth of individuals and their offspring. However, this synchronicity is threatened by global change, which modifies the hydrological and thermal regimes of rivers worldwide. In particular, the asynchronous evolution of river temperature and flow can alter the duration and frequency of environmental windows suitable for the migration of diadromous fish. In this research project, we first developed the 'Choc' method to explore temporal CHanges in the OCcurrence of associations in bivariate time series. We applied this method to several case studies, which highlighted how global change has altered the conditions under which the endangered European eel and Atlantic salmon migrate, and how they have responded to these environmental changes. Recently, reconstructed (1963-2019) and projected (2020-2100) daily river temperature and flow data have been modelled over the entire hydrographic network of the Loire catchment (France). We combined this extensive dataset with daily fish passages available at fishways to assess the spatial and seasonal variability of trends in temperature-flow associations at a large scale. We then described how it has affected and will likely affect migration conditions of Atlantic salmon, allis shad and sea lamprey in the Loire catchment. Finally, we developed indicators to quantify past, present and future environmental suitability for their migration that allow comparison between rivers and tributaries, thereby providing operational results for the conservation of diadromous species and the prioritization of management actions in the context of global change.

## Patterns and drivers for benthic algal biomass in subarctic mountain ponds

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2D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 2:15 PM - 3:45 PM

The subarctic comprise many small and shallow waterbodies in which benthic algae are often the dominant producer group. This study investigated the spatial variation in total benthic algal biomass and within the three dominant benthic algal groups: cyanobacteria, green algae, and diatoms.
Additionally to the more widely used abiotic variables, we considered snowmelt and ice duration as their importance on algal communities have been poorly resolved. A total of 90 subarctic ponds were sampled in the Finnish Lapland.
Cyanobacteria was the most abundant benthic algal group contributing 62% towards total biomass.
Trace elements were the most significant explanatory variable group in explaining benthic algal biomasses. Total algal biomass was significantly explained by conductivity, Mn, and Cu, all showing a positive relationship. For cyanobacteria biomass, the most significant variables were green algae with a positive relationship and elevation with a negative relationship. Surprisingly, ice duration had a positive relationship towards cyanobacteria biomass. Diatom biomass was best explained by Se (positive relationship) while Mn best explained green algal biomass (positive relationship).
These results highlight the importance of conductivity and trace elements in shaping algal biomass in subarctic ponds. We suggest future research to focus on trace element concentrations to better understand the productivity of oligotrophic subarctic waters. Despite snowmelt was found insignificant, it may have an indirect effect on benthic algal biomasses by affecting the chemical composition of subarctic freshwaters. Studying benthic algal biomasses and the chemical composition of subarctic freshwaters provides important information on the aquatic primary production of the area.

# Patterns and drivers of greenhouse gases emissions in European drying river networks

Dr Naiara Lopez-Rojo[1], Rubén del Campo[3], Edurne Estévez[3], Francisco J. Peñas[4], Amaia A. Rodeles[4], Romain Sarremejane[5], Teresa Silverthorn[2], Gabriel Singer[3], Jose Barquín[4], Thibault Datry[2], Arnaud Foulquier[1]
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3A_SS14_Drying rivers in a time of global change, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I am a postdoctoral researcher within the DRYvER project (Securing biodiversity, functional integrity and ecosystem services in DRYing riVER networks). I am focused on greenhouse gas emission patterns and drivers and in the patterns of drying and it's effect of network scale fragmentation. I am also analysing the effect of drying on microbial communities (through environmental DNA) and the link to ecosystem functioning (respiration and methanogenic activity)*

Streams and rivers receive substantial inputs of terrestrial organic carbon from which a large fraction is released as carbone dioxide ($CO_2$) or methane ($CH_4$) to the atmosphere. However, although up to 50-60% of total global river length is intermittent, current global estimates of carbon emissions only include perennial rivers. Within the project DRYvER (Securing biodiversity, functional integrity and ecosystem services in DRYing riVER networks), we determined $CO_2$ and $CH_4$ emissions across six European drying river networks and three hydrological seasons (pre-drying, dry period, after-rewetting). Fluxes were measured in different habitats (flowing waters, dry-riverbeds, pools) using a GHG analyzer connected to a closed-loop chamber to determine: 1)patterns and drivers of GHG emissions from dry-riverbeds and 2)if drivers of GHG emissions during flowing conditions differed between perennial and intermittent reaches. Local and regional variables, together with metrics describing drying patterns and spatio-temporal fragmentation by drying, were tested as predictors. Emissions from intermittent reaches were comparable to those from perennials. Variables driving emissions from flowing waters were different between perennial and intermittent reaches: in perennials, $CO_2$ emissions were determined by in-stream variables while for intermittents, the most important predictors were related to climate and soils and sediments characteristics. In dry-riverbeds, $CO_2$ fluxes were affected by climate, while $CH_4$ fluxes were more related to sediment characteristics. Our results highlight the importance of including GHG emissions from all hydrological phases of intermittent reaches and considering independently perennial and intermittent reaches when flowing to fully assess the contribution of river networks to the global carbon cycle.

# Patterns and drivers of river ecosystem metabolism in intermittent streams

Dr Amaia A. Rodeles[1], Dr Francisco J. Peñas[1], Dr María Morán-Luis[1], Dr Naiara López-Rojo[2,3], Dr Rubén del Campo[4], Dr Edurne Estévez[4], Dr Romain Sarremejane[5], Dr Teresa Silverthorn[3], Dr Arnaud Foulquier[2], Dr Gabriel Singer[4], Dr Thibault Datry[3], Dr José Barquín[1]
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2A_SS14_Drying rivers in a time of global change, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I am a postdoctoral researcher at IHCantabria studying river ecology. My work is focused on river metabolism and river connectivity. Within the project DRYvER I have been analysing river metabolism in intermittent rivers and streams.*

River Ecosystem Metabolism (REM) integrates the biological activities related to carbon fixation (Gross Primary Production, GPP) and mineralization (Ecosystem Respiration, ER) contributing significantly to the global carbon cycle. However, REM has received less attention than metabolism of other terrestrial and aquatic ecosystems. This is especially true for intermittent streams, which account for up to 60% of all rivers and streams globally. Within the DRYvER project, we analyzed REM across 120 reaches distributed in six drying river networks (DRNs) covering a large bioclimatic gradient across Europe, and in three hydrological seasons (pre-dry, dry and post-rewetting). The two main objectives of the study were to: 1) characterize the spatio-temporal dynamic of daily REM in the six DRNs and three seasons and 2) uncover the main abiotic and biotic drivers controlling daily REM across the large environmental gradient considered. REM was generally low, with ER higher than GPP making almost all the sampling reaches heterotrophic. Moreover, there were no significant differences between the three hydrological seasons in perennial and intermittent streams. Although there were small differences in REM across DRNs, no latitudinal gradient was detected and REM varied mainly in response to river size and local factors. GPP was mainly controlled by upstream catchment area, light and discharge, while ER was mostly affected by upstream catchment area and GPP. Other variables related to both GPP and ER were water chemistry, chlorophyll-a and dissolved organic carbon. Our results suggest that REM rates in intermittent streams share similar patterns and drivers with perennial streams.

# Photosynthetic microbes inhabiting inland saline shallow lakes and its relationship with carbon fixation

Dr Rafael Carballeira[1], Dr Antonio Picazo[1], Mrs Carla Morales[1], Dr Javier Miralles-Lorenzo[1], Dr Daniel Morant[1], Dr Antonio Camacho[1]
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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Dr Rafael Carballeira, postdoctoral position `Juan de la Cierva in the Department of Microbiology and Ecology at the University of Valencia. He defended the PhD thesis at the Earth Sciences of the University of A Coruña (2021), during that period, he has developed his research and teaching activities related to fundamental and applied fields of the botany and ecology of microalgae (diatoms) in aquatic ecosystems. His work focuses on understanding how the biology and ecology of microalgae is linked to essential biogeochemical processes in aquatic ecosystems and subaerial environments, with relevant contributions to the taxonomy, biodiversity and ecology of diatoms.*

Photosynthetic microbes, both prokaryotes and protists, account for an important part of the primary productivity in aquatic ecosystems with key ecological and biogeochemical roles, but extreme environments such as saline and hypersaline waters impose serious physiological limits to life. The inland wetlands of the semi-arid  Central Iberian areas are a paradigm of natural saline ecosystems with shallow lakes ranging on a strong gradient from freshwater to hypersaline wetlands, also including soda lakes. The high representativeness and diversity of these saline wetlands offers a natural laboratory to understand the contribution of photosynthesis to life, even on the edge. We extracted DNA from waters and sediments of the Iberian inland wetlands within this salinity gradient. High-throughput sequencing of 16S rRNA genes was conducted to evaluate the composition and structure of the photosynthetic microbial assemblages, and the DNA metabarcoding data were taxonomically assigned using a customised reference database. The data on zero-radius Operational Taxonomic Units (zOTUs) of the photosynthetic microbes, the environmental parameters and in situ productivity measures were jointly analysed using multivariate statistic to disentangle the interrelationship between the interspecific composition and photosynthetic rates under this strong salinity gradient. In this paper, we show the patterns found there. This work was supported by the project CLIMAWET-CONS (PID2019-104742RB-I00), funded by Agencia Estatal de Investigación and the Ministerio de Ciencia e Innovación (Gobierno de España).

# Phytoplankton taxonomic groups in relation to physicochemical parameters. A case study from Greek lakes.

Miss Valentini Navrozidou[1,2], Mrs Iliana Nikolopoulou[1], Mrs Sotiria Katsavouni[1], Mr Miltiadis Seferlis[1], Mrs Vasiliki Tsiaoussi[1]
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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***
*I am a Geologist, MSc in "Ecological Quality and Water Management" and a PhD candidate in Geology, focusing on Environmental Micropalaeontology. I have been working at the Greek Biotope/Wetland Centre of the Goulandris Natural History Museum since 2013, as a phytoplankton specialist in the national monitoring program of Greek lakes. I am also involved in projects related to the Natura 2000 Network and the Implementation of the Nature Directives, such as the preparation of the national reports on the implementation of Directives 92/43/EEC and 2009/147/EC in Greece and the preparation of the Special Environmental Studies.*

The composition, abundance and biomass of phytoplankton are long considered as indicative of the eutrophication pressure in lakes. In addition, cyanobacteria-formed algal blooms are mostly linked to poor water quality. The objectives of the present study were a) to explore phytoplankton groups and physicochemical parameters of lakes in a Mediterranean setting and b) to investigate the response of phytoplankton taxonomic groups to phosphorus loading in those lakes. We analyzed data from the National Monitoring Network from 2019-2021 for 16 freshwater lakes in Greece. Water transparency, ionic composition and Total Phosphorus (TP) were correlated with major phytoplankton groups (chlorophytes, dinoflagellates, cryptophytes, bacillariophyceae and cyanobacteria). Based on both phytoplankton and physicochemical parameters, two groups of lakes were formed in cluster analysis, corresponding a) to deep warm monomictic and b) shallow and very shallow polymictic lakes. With regard to the impact from phosphorus loading, in both groups of lakes, a considerable increase of cyanobacteria biomass along a TP gradient was observed. Chlorophytes showed a statistically significant response in relation to TP in shallow and very shallow lakes. The results highlight the importance of phytoplankton in monitoring and evaluation of the status of aquatic ecosystems as phytoplankton biomass and community structure respond to changes in environmental parameters.

# Plant responses to different hydrological regimes in Mediterranean Temporary Ponds

Prof. Simonetta Bagella[1], PhD Maria Carmela Caria[1], Dr Giovanni Rivieccio[1]
[1]University of Sassari, , Italy

6B_SS18_Driving forward the network on the interpretation, conservation and management of temporary ponds, June 20, 2023, 4:15 PM - 5:30 PM

***Biography:***
*Simonetta Bagella is prof. of Botany at the University of Sassari and President of the Italian Society of Vegetation Science*

Plants living in Mediterranean Temporary Ponds (MTPs) show specific strategies which make them capable of tolerating different flooding conditions and can survive dry periods thanks to seed bank accumulating in the sediments. However, drastic changes in the hydroperiod length and water availability due to climate changes could result in adverse impacts. In this study, we evaluate the responses of vascular plants of MTPs to different hydrological regimes to identify those most sensitive to their variations. We performed field surveys in Sardianian (Italy) MTPs and indoor experiment. In the field, we analyzed the distribution of plant species along the three concentric belts typical of MTPs (central belt, intermediate belt and outer belt). In indoor experiments, we evaluated the effects of different hydrological regimes on the life cycle, using soil core collection from theee MTPs. Our results highlighted the relevance a clear pattern within the ponds related of the hydroperiod length. Some key species such as Isoetes histrix, Laurentia gasparrini, Exaculum pusillum and Cicendia filiformis revealed a clear distribution pattern along the three belts . On the other side, the indoor experiments showed that species, such as Crassula vailantii, can adapt the length of their life to the different hydrological conditions while others such as Helosciadium crassipes, Middendorfia borysthenica, Ranunculus ophioglossifolius fail to close the cycle with seed production if conditions are not favourable. Based on the results obtained, it will be possible to identify the species most sensitive to climate change to target the conservation efforts effectively.

# Plastic-associated bacterial communities in a freshwater pond of the High Arctic (Goose Pond, Ny-Ålesund, Svalbard Islands)

Dr Angelina Lo Giudice[1], Dr. Maria Papale[1], Mr Alessandro Ciro Rappazzo[1,2], Dr. Carmen Rizzo[1,3], Mr Alessio Lena[1,4], Prof. Edoardo Calizza[5], Mr Giulio Caseddu[5], Dr Maurizio Azzaro[1]
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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Angelina Lo Giudice is Senior Researcher in Microbial Ecology at the Institute of Polar Sciences (CNR-ISP) in Messina, Italy. Her research activities are mainly addressed to the study of the prokaryotic communities in polar environments. Particular attention is paid to: Microbial ecology (diversity and function) of aquatic and terrestrial systems; Associations between prokaryotes and benthic filter-feeders; Response by bacterial communities to human impact; Biotechnological potential of cold-adapted bacteria; Relationships between chemical contamination and prokaryotic biodiversity. Angelina Lo Giudice has published more than 100 papers in highly ranked scientific journals (IF 29). She is Associate Editor of Polar Biology.*

Plastic production has increased significantly in recent decades, thanks to its durability, wide use, and low cost. Despite its obvious benefits in our everyday lives, the environment has become increasingly polluted with plastic debris due to unsustainable use and poor waste management. As a result, concern about its damaging effects on the ecosystem is spreading throughout the world. Plastics might end up in freshwater habitats where they would build up and endure for years, becoming the substrate for the development of complex microbial biofilm, playing a pivotal role in organic matter utilization and energy supply to the food web. Unfortunately, plastics have reached also remote areas, such as the Ny-Ålesund Research Village in the High Arctic, causing alterations in the biological diversity. In the framework of two different research projects [i.e. MicroPolArS (PNRA18_00194) and EcoClimate (PRA2019-0019)], both aimed at exploring the microbial diversity of Arctic freshwater lakes, researchers in the field stumbled upon a clear macroplastic pollution in the Goose Pond. Twelve different typologies of macroplastics (from duct tape scraps to Styrofoam bits) were aseptically collected and preliminary analysed for the attached bacterial communities. The next-generation sequencing was applied to gain an overall picture of the bacterial diversity, while more than 150 bacterial isolates were tested for biofilm formation, production of enzymes involved in plastic degradation (e.g., esterases and lipase), antibiotic susceptibility, and then taxonomically identified. The differences encountered among the analysed plastic substrates are discussed. This work contributes to our knowledge about the yet underexplored plastisphere in Arctic freshwaters.

# Ponds and their aquatic-terrestrial linkages via emerging insects across Europe - the EUROPONDS FreshProject

Ms Lena Fehlinger[1,2,3], Biljana Rimcheska[4], Luca Bonacina[5], Tamás Bozóki[6,7], Maria Calderó Pascual[8], Alba Camacho-Santamans[9], Anna Camacho-Santamans[10], Dr Fernando Chaguaceda[11,12], Dr Teofana Chonova[13], Dr David Cunillera-Montcusi[14], Dawid Dąbrowski[15], Valentin Dinu[16], Emma Drohan[8], Constanze Englisch[17], Ana Balibrea Escobar[18], Stephen Esosa Osakpolor[19], Julie C. Fahy[20], Judit Fekete[7,21], Dr Encarnación Fenoy[22,23,24], Zeus Freixinos Campillo[25], Dr Jorge García-Girón[26], Dr Remi Gerber[27], Mercedes Guerrero Brotons[25], Aleksandra Haba[28], Dr Dariusz Halabowski[29,30], Dr Jorge Henriques[31], Ellinor Jakobsson[11], Dr Noel Juvigny-Khenafou[19], Dr Vojtěch Kolář[32,33], Katarzyna Kuczyńska[28], Dr Frederic Labat[27], Alfredo Llorente[34,35], Dr Pierre Marle[36], Dr Joana Martelo[37,38], Dr Margaux Mathieu-Resuge[2,39], Dr Benjamin Misteli[2,27], Dr Rhiannon Mondav[11,40], Dr Daniel Morant[10], Simone Moras[11], Dr Maria Iasmina Moza[41], Karla Münzner[11], Liam Nash[42], Dr Veronica Nava[5], Darmina Nita[41], Adriana Olenici[16], Dr Juan Rubio-Ríos[22,23], Martin Sarkezi[17], Dr Alberto Scotti[43], Pablo Soto García[44], Martin Souto Souto[18], Agnieszka Sowa[45], Olivera Stamenković[46], Ena Suarez[36], Dr Pablo Timoner[36], Dr Pietro Tirozzi[5], Marina Tomás Martín[44], Francesca Vallefuoco[43,47,48], Magdalena Vanek[43], Lucie Vebrová[32], Jose Manuel Zamora-Marín[49], Marta Zawadzka[15]

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2D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*Biljana Rimcheska and Lena Fehlinger were both PIs of the EUROPONDS FreshProject from 2020 to 2022 and would like to present the project and results at the SEFS13 Conference. Biljana is currently finishing her PhD at the Bulgarian Academy of Sciences in Sofia. She focuses on water conservation and water quality management with special interest in macroinvertebrates. Lena just started her PhD in the GEA group of the University of Vic. She will study high altitude ponds in the Pre-Pyrenees, focusing on macroinvertebrates and amphibians.*

Ponds have many important functions within our landscapes: from being biodiversity hotspots as ecologically unique systems, to providing ecosystem services to us humans such as water provision. In these aspects, natural but also artificial water bodies are relevant. For a long time, ponds were left out of protection measures and management was focused rather on the bigger water bodies However, this is beginning to change due to increasing knowledge regarding their importance. Ponds are linked with their environment also via the emergence of emerging insects, which contain valuable nutrients (such as essential fatty acids), a valuable food resource for terrestrial consumers. The FreshProject "EUROPONDS", a collaborative consortium of over 70 ECRs in freshwater sciences from all over Europe, had the aim to provide additional knowledge about the spatiotemporal variations in emergence of insects. To achieve this aim, we sampled a total of 55 ponds each season for a whole year using emergence traps. After taxonomical identification and fatty acids analysis (n=297), now, we would like to present results concerning quantified biomass and fatty acids differences looking into seasonality effects, the effect of latitude, and land-use categories. These insights into aquatic-terrestrial connections can provide decision-makers with the required information when developing pond protection plans or when creating new pond systems.

# Ponds as integral parts of agricultural landscapes – Ecosystem services in spatial and temporal within-field transition zones (SWBTrans project)

Dr Marlene Pätzig[1], Marina Gerling[1], Dr. Michael Glemnitz[1], Klarissa Kober[1], Konlavach Mengsuwan[1], Dr. Marina Müller[1], Dr. Carsten Paul[1], Maximilian Wulfheide[1]
[1]Leibniz Centre For Agricultural Landscape Research (ZALF), Müncheberg, Germany
2D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*2010 Diploma in Geography (TU Dresden),*
*2010 to 2015 PhD student at the Department of Freshwater Conservation (BTU Cottbus-Senftenberg),*
*2014 to 2018 scientist at the Centre for Agricultural Landscape Research (ZALF),*
*2017 Schwoerbel-Benndorf-Nachwuchspreis (Young Talent Award of the German Limnological Society),*
*2019 - 04.2021 Project coordinator SWBTrans project (ZALF),*
*since 04.2021 visiting scientist at ZALF,*
*since 2010 member of EPCN, currently treasurer,*
*Initiator of the German pond network (Kleingewässer-Netzwerk)*

Ponds are not isolated islands but integral parts of agricultural landscapes. Between the agricultural core matrix and the aquatic system there are many spill-over effects, which have received little attention so far. Smart use of agricultural landscapes must account for interactions between ponds (as semi natural landscape element) and cropping fields in order to combine high yields with resource use efficiency while optimizing the supply of ecosystem services. For this, a better understanding of ecosystem functions and of their effect on ecosystem services is needed. The SWBTrans project empirically investigated selected ecosystem functions and services related to kettle holes (natural ponds) in the AgroScapeLab Quillow (Northeast Germany). Hydrological and small-scale remote sensing studies of water and moisture dynamics, and of their transition zones were carried out. These were accompanied by microbiological investigations about the possible spread of phytopathogenic fungi from weeds (intermediate hosts) established on kettle hole edges into agricultural fields, as well as investigations about biodiversity-related ecosystem services (measured with "Rapid ecosystem function assessment methods (REFA)). The field surveys were complemented by an impact assessment, which synthesizes the results for different ecosystem services into a comprehensive assessment, discusses implications for agricultural management and highlights synergies and trade-offs. Our project generated knowledge relevant for locally adjusted agricultural management and thereby contributes to an agroecological transition.

# Porifera of the Pasvik River (Northern Fennoscandia): microbiological and chemical observations in two different sub-Arctic freshwater sponges

Dr Carmen Rizzo[1], Dr Gabriella Caruso[2], Dr Giovanna Maimone[2], Luisa Patrolecco[2], Marco Termine[3], Marco Bertolino[4], Stefania Giannarelli[3], Maria Papale[2], Tanita Pescatore[2], Alessandro Ciro Rappazzo[2,4], Jasmine Rauseo[2], Rosamaria Soldano[2,6], Francesca Spataro[2], Paul Eric Aspholm[7], Maurizio Azzaro[2], Angelina Lo Giudice[2]
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9E_RS03_Microbial ecology in freshwaters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*I'm Researcher at Stazione Zoologica Anton Dohrn, Messina. My main research activities are focused on microbial ecology and marine biotechnology. I'm interested in studying prokaryotic populations in aquatic temperate and extreme environments, their structure and distribution related to environmental conditions and pollution, and their biotechnological potential in bioremediation, medical, pharmaceutical fields.*

Porifera are generally considered optimal sentinels to detect the presence of contaminants in the environment, and the associated bacterial communities can be shaped by their occurrence. In this context, freshwater sponges are of increasing interest due to their capability to filter large volumes of water and sensitivity as bioindicators to assess the environmental health of aquatic habitats. This feature holds even greater importance in remote environments, such as Arctic areas and their freshwater habitats. Within the INTERACT project BIP (Grant Agreement N. 730938), specimens of the sponge species Spongilla lacustris (Linnaeus, 1759) and Ephydatia muelleri (Lieberkühn, 1856) were collected from the Pasvik River (Norway), together with sediment and water samples. Physical-chemical parameters were measured at sampling time. Samples were analysed for bacterial diversity by NGS, total prokaryotic counts by DAPI-staining, microbial enzymatic activities (leucine aminopeptidase, LAP, beta-glucosidase, GLU, alkaline phosphatase, AP), and concentration of emerging and legacy contaminants (e.g. pharmaceutical products-PPs, pesticides, polychlorobiphenyls, polycyclic aromatic hydrocarbons-PAHs). Among PPs investigated, only ciprofloxacin and diclofenac were detected in the sponge tissues, and their concentrations were lower than those measured in sediment. Sulfamethoxazole, trimethoprim, tetracycline and ibuprofen occurred only in water and sediment. Some PAHs and Dieldrin were more concentrated in the sponge than in abiotic samples, whereas comparable amounts of PCBs were determined in the sponge and sediment. Proteobacteria (Alpha- and Gammaproteobacteria) predominated in the sponge-associated bacterial communities, which differed from those observed for sediment and water. Results on site- and/or sponge species specificity of microbiological and chemical data are discussed.

# Positive population trends of non-native fishes in rivers of the Eastern Alps

Dr Georg H. Niedrist[1,2], Dr Andreas Hilpold[3], Dr Petra Kranebitter[2]
[1]Department of Ecology, University of Innsbruck, Innsbruck, Austria, [2]Museum of Nature South Tyrol, Bolzano, Italy, [3]Institute of Alpine Environment, Eurac Research, Bolzano, Italy
8D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*He is a mountain stream ecologist based at the University of Innsbruck, which is in the European Alps. Before, he had a position at the Museum of Nature in South Tyrol, in Italy, where he worked on region-wide fish survey data from the last 20 years. In this presentation he will present population trends of non-native fish species and different developments in low-land and mountainous rivers.*

Non-native fish threaten freshwater biodiversity worldwide, but their occurrence and spread in mountain regions and associated population trends are insufficiently known, which has hindered effective management of non-native species so far. This study analyzed over 1300 electrofishing surveys in 650 sites across a 7400 km² area in the Eastern Alps to quantify non-native species occurrences and to predict their foraging in distinct river types. Additionally, population sizes and biomass trends were estimated for sites that were fished multiple times between 2000 and 2020 (>150 sites). Among the 42 fish species in the study region, 11 are non-native. Two invasive species of union concern, Lepomis gibbosus and Pseudorasbora parva, increased their population sizes in the last decades by 8 and 9% per year, supposedly supported by increasing water temperatures. Among the non-native species relevant for recreational fishing, Oncorhynchus mykiss populations have significantly increased (+7 ±3% year-1), Salmo trutta populations have remained stable, while Salvelinus fontinalis populations have significantly decreased (-7.4 ±3% year-1). The variation in their population trends may be due to different stocking intensities, with S. fontinalis being stocked minimally compared to the others. Our study found that non-native and invasive fish species are a relevant part of fish communities in mountain rivers. Non-salmonid non-natives thrive in warm rivers at low elevations, while salmonid non-natives consolidate in steeper habitats. Since rising temperatures in mountain rivers will accelerate the spread and growth of these species, this first quantification of the current extent will improve fish management strategies in mountainous areas.

# Preliminary results on the evolution of proglacial ponds in the deglaciating Alps

Miss Maria Vittoria Tenci[1,2], Mr Marco Toffolon[1], Mr Walter Bertoldi[1], Mr Stefano Brighenti[3], Mrs Maria Cristina Bruno[2], Mr Leonardo Cerasino[2], Mr Massimo Pindo[2], Mrs Monica Tolotti[2]
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6E_RS05_Small water bodies, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Maria Vittoria Tenci is a PhD candidate at the Department of Civil, Environmental and Mechanical Engineering at the University of Trento and at the Research and Innovation Centre at the Edmund Mach Foundation (Italy). She graduated in Global Change Ecology at the University of Trieste (Italy). Her main research interests are hydrobiology and freshwater ecology. Currently, she is developing a multidisciplinary project addressing the origin, evolution and fate of proglacial lakes in the Ortles-Cevedale Mountain group (Italy), with a focus on microbial and algal communities and their relations with the environmental changes related to glacier retreat.*

Deglaciation is one of the most evident effects of the ongoing climatic changes on the Alpine environment. One of its common consequences is the formation of new water bodies in the proglacial area, where proglacial lakes and ponds are increasingly relevant ecosystems for the mountain landscape. The EVERLAKE project focuses on a recent system of proglacial ponds that originated from the retreat of the Zufall/Cevedale Glacier (Plima catchment, Central/Eastern Italian Alps). The aims of the project are to: (i) provide a first hydroecological characterisation of these pond ecosystems from a physical, chemical and biological point of view; (ii) understand their evolutionary trend during the process of deglaciation, with a space-for-time substitution approach. Here, we present data collected during the ice-free season 2022, showing the seasonal development occurring in three ponds located along a gradient of distance from the Cevedale Glacier terminus (i.e., at 2700-2900 m a.s.l.). We monitored water level, temperature and electrical conductivity and assessed the origin of water through analyses of stable isotopes (δ2H, δ18O). Bathymetric measurements were performed to estimate the residence time of each waterbody. We also analysed basic water chemistry, concentrations of trace elements, benthic and planktonic chlorophyll-a and organic content. The biological communities of these poorly known aquatic ecosystems were characterised by adopting an integrated approach combining morphological observations of microalgae and 16S and 18S rRNA metabarcoding of eDNA from both benthic and planktonic samples. The ponds showed different ecological conditions related to their distance from the glacier margins.

# Prioritization of barrier removal to mitigate the effects of climate change and habitat fragmentation on freshwater biodiversity in Switzerland

Dr Bernhard Wegscheider[1,2], Dr Conor Waldock[1,2], Dr Bárbara Calegari[1,2], Dr Dario Josi[1,2], Dr Ole Seehausen[1,2]
[1]University Bern- Institute of Ecology and Evolution, Bern, Switzerland, [2]Eawag- Swiss Federal Institute of Aquatic Science and Technology, Kastanienbaum, Switzerland

3B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I am a freshwater ecologist with research interests mostly related to modelling flow-habitat relationships of aquatic species to aid conservation and management of rivers. Currently, I am a researcher at the University of Bern and the Swiss Federal Institute of Aquatic Science and Technology. I did my undergraduate and MSc degree at the University of Innsbruck, Austria in 2015 and received my doctoral degree at the University of New Brunswick, Canada in 2020. My current research focuses on assessing potential impacts of altered flow regimes, habitat fragmentation, land-use and climate change on freshwater biodiversity in Switzerland.*

The effects of climate change on river ecosystems are substantial, causing alterations in water temperature, discharge regime and distribution and abundance of aquatic species. Furthermore, the fragmentation of habitat by barriers impede aquatic organisms from moving freely through the river network, hindering their ability to disperse and colonize new areas while current habitat is being lost to climate change. With temperatures in Switzerland rising at twice the rate of the global average and barrier density being among the highest in the world, this region presents an important case for urgent data-driven mitigation programs. Switzerland has set the goal to restore fish passage and sediment transport at large hydropower dams by 2030, however, small structures that form the vast majority of barriers on rivers are often overlooked. Many of these smaller barriers are aging and becoming obsolete, which calls for a strategy to prioritize removal of dams and restoration of fish passage. We combined national records of fishes and benthic macroinvertebrates with high resolution environmental data and predictions of future climate change to model changes in species` distributions. We used a prioritization analysis to determine which barriers most strongly impede species colonization of restored habitats and climate refugia, both now and in the future. Finally, we suggest that joint evaluation of river connectivity with other past, current, and future environmental factors is critical to inform national restoration plans and identify suitable locations for habitat restoration that allow the persistence of freshwater biodiversity and functioning of ecosystem processes.

# Profound changes in the chemical and physical characteristics of UK upland lakes and streams resulting from acid emission controls

Mr Don Monteith[1], Mr David Norris[2], Mr Ewan Shilland[3,4,5], Dr John Murphy[3], Professor Iwan Jones[3], Professor Rick Battarbee[5], Professor Chris Evans[2]
[1]UKCEH, Lancaster, United Kingdom, [2]UKCEH, Bangor, United Kingdom, [3]QMUL, London, United Kingdom, [4]Natural History Museum, London, United Kingdom, [5]UCL, London, United Kingdom

9D_RS02_Biogeochemical processes and greenhouse gas emissions in inland waters, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*Don Monteith is based at the UK Centre for Ecology & Hydrology. He leads the UK Upland Waters Monitoring Network - a consortium of organisations (UKCEH, QMUL, UCL and Marine Scotland), and supported by Defra, NERC, Welsh Government, Natural Resources Wales, NatureScot and Forest Research and considerable volunteer effort. He has a background in aquatic ecology and biogeochemistry and a particular research interest in how upland water ecosystems are influenced by regional changes in pollution and climate. He represents the UK on the International Cooperative Programme for assessment and monitoring of the effects of air pollution on rivers and lakes.*

Over the past two centuries, upland lake and stream ecosystems across the UK became acidified by air pollutants derived from fossil fuel-based emissions of sulphur, nitrogen and hydrogen chloride to the atmosphere. Since the 1980s, a series of international agreements aimed at protecting sensitive environments, led by the United Nations Economic Council for Europe, and the European Union, have resulted in a major reduction in emissions, and consequently acid deposition. The UK Acid Waters Monitoring Network, later to become the Upland Waters Monitoring Network (UWMN), was established to audit the efficacy of emission controls with regard to the health of upland freshwater ecosystems. In this presentation we summarise the results of a recent analysis of the first three decades of UWMN water chemistry data in relation to changes in acid deposition. We show that these environments have been undergoing profound chemical change as a direct consequence of the air policy measures, involving not only reductions in water acidity but also substantial increases in dissolved organic matter that have major potential consequences for aquatic primary productivity and the management of the UK's upland drinking water supplies. As the deposition of acid pollutants begins to level off, concerns remain over the capacity of historically heavily acidified catchment soils to enable full recovery of the receiving waters, the potential longer-term legacy of reactive nitrogen deposition, and the extent to which projected changes in regional air temperatures and precipitation patterns will further influence these systems into the future.

# Project Pit Stop: can citizen scientists successfully ground-truth pond distribution and quality in the English countryside to help inform strategic pond conservation and wider habitat network planning in the future?

Helen Greaves[1,2], Prof. Carl Sayer[1,2], Prof. Helene Burningham[1], Dr. Isabel Bishop[1]
[1]University College London, London, United Kingdom, [2]Norfolk Ponds Project, Norfolk, United Kingdom

2G_SS02_Monitoring, managing and protecting/restoring freshwaters – the role and power of citizen science, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Helen Greaves is a freshwater ecologist based in the department of Geography at UCL where she is currently focussing on the variability of greenhouse gas emissions from overgrown neglected ponds in comparison to restored ponds, for the EU-Horizon2020 'Ponderful' project. Helen is also Strategic Lead for the Norfolk Ponds Project where she develops and implements projects that aim to engage landowners and the public with pond conservation and restoration. Finally, Helen is Secretary of the European Ponds Conservation Network, a network of researchers, policy makers and practitioners promoting the conservation of ponds and their biodiversity in a changing European landscape.*

We are now at a pivotal moment in UK nature conservation. Fulfilling the ambition to think big, at least on paper, the UK Government's Nature Recovery Strategy (NRS) will, for the first time, provide a legislative driver to address the ambitions of the Lawton Review (2010), which emphasised a need for large-scale land-use change in the UK. A key component of the NRS is a proposed Nature Recovery Network (NRN), a national network of wildlife- rich places. Strategic mapping of habitats, that can provide connectivity within the wider landscape, outside of nature reserves, will provide the building blocks of the NRN. The ability to incorporate ponds and pond restoration into England's NRN will depend on knowledge both on pond locations present and past and on existing pond quality. Nevertheless, previous desk-based studies of ponds by the UCL Pond Restoration Research Group (Alderton, 2017) have highlighted often considerable differences between current Ordnance Survey (OS) mapping and actual pond presence/absence on the ground. Further, little is currently known on the state of UK ponds. To fill these key knowledge gaps, the Norfolk Ponds Project's UCL-led 'Project Pit Stop' has aimed to engage citizen scientists with pond mapping and habitat assessment in the pilot area of the Norfolk Coast AONB. Using a 'strawman' approach to development, the project tested the potential interest for citizen science based 'ground-truthing' of pond distribution and loss, as well as existing pond quality. Findings from the project and feedback provided from the pilot study group will be discussed.

## Promoting the resilience of streams and rivers to climate change

Dr Ana Filipa Filipe[1], Dr José Maria Santos[1], Dr Paulo Branco[1], Dr Rui Rivaes[1], Dr Susana Amaral[1], Pedro Pacheco[1], João Santos[1], Dr Teresa de Melo[2], Dr Rodrigo Proença de Oliveira[2], Thiago Nascimento[2], Susana Fernandes[3], Maria Helena Alves[3], Alice Fialho[3], Samuel Queijo Fernandes[3], José Mendes[3], André Matoso[3], Luisa Pinto[4], Noemi Santiago[4], Dr Teresa Ferreira[1]

[1]Forest Research Centre (CEF) and Associate Laboratory TERRA, School of Agriculture (ISA), University of Lisbon, Lisboa, Portugal, [2]Civil Engineering Research and Innovation for Sustainability (CERIS), Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal, [3]Agência Portuguesa do Ambiente, , Portugal, [4]EDIA Empresa de Desenvolvimento e Infraestruturas do Alqueva, , Portugal

3B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*

*My research focuses on freshwater ecology, with particular emphasis on patterns and processes of freshwater biota at various geographical (watershed scale, Iberian Peninsula, Europe) and temporal scales (past, present, future). I am focused on the impacts of climate change and biotic invasions on freshwater fish, particularly those affecting distribution, life-history, and evolution. I have been developing conservation planning and metabarcoding approaches to address freshwater biodiversity and conservation.*

Climate scenarios predict dramatic changes for Southern Europe. In Portugal the increase in air temperature might reach +5°C by 2100. Such predictions imply changes in thermal and hydrological patterns in the coming decades, and an increase in the frequency intensity and duration of extreme events such as droughts and floods. Consequently, the sustainable development of Portugal's inland region will inevitably depend on the ability to adapt to such climate-related changes. The project AQUADAPT aims to promote the resilience of river ecosystems to climate change, through risk assessment and the construction of adaptation tools. We are developing a high-resolution monitoring and warning system through modelling, forecasting, and planning techniques. We are also testing nature-based solutions in riverine restoration projects aiming to increase resilience to current and future changes. The gained knowledge of climate and hydrological changes, their impacts, and possible responses to promote resistance and resilience of ecosystems will allow the construction of scenarios and alternatives for an informed decision-making for the coming decades. By working with academic partners, public administration, and companies, we aim to build a framework aligned with the EU Biodiversity Strategy 2030 able to be transferred and replicated in other regions.

# Proposing biologically-based nutrient thresholds for Greek Lakes

Mrs Dimitra Kemitzoglou[1], Dr Elpida Karadimou[1], Mrs Sotiria Katsavouni[1], Mrs Valentini Navrozidou[1], Mrs Iliana Nikolopoulou[1], Dr Miltiadis Seferlis[1], Dr Ioanna Zerva[1], Mrs Vasiliki Tsiaoussi[1]

[1]The Goulandris Natural History Museum/Greek Biotope-Wetland Centre, Thermi, Greece

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Mrs Dimitra Kemitzoglou is a biologist, MSc. She has been working at The Goulandris Natural History Museum – Greek Biotope / Wetland Centre since 2006, where currently she is Technical Manager of the Water Quality Laboratory. Since 2012, she has been working on the implementation of the national monitoring network for lakes, in accordance with WFD. She has supported the Ministry of Environment in water quality issues (contribution to assessment methods, reports, representation in working groups etc). She has undertaken the implementation of various projects related to conservation and management of natural resources, some of which received European recognition.*

According to the Water Framework Directive, the composition and abundance of biological communities guide the assessment of lake ecological status; physicochemical parameters are supportive elements in this process. With regard to nutrients, the thresholds of Good-Moderate (GM) status for Total Phosphorus concentrations (TP) in two high alkalinity lake types in Greece have been proposed using a European toolkit. Our objective was to investigate the conformity of GM thresholds for TP with changes in biological communities of two types of lake ecosystems, shallow polymictic and warm monomictic. We examined pressure response relationships using data collated from the National Monitoring Network. We plotted parameters of phytoplankton, aquatic macrophytes and water transparency across TP concentrations in the two types of natural lakes. In TP threshold values of 20-40 µg/l, changes in biological communities and water transparency were observed in both lake types. These nutrient thresholds seem comparable with the ones proposed with the application of the standard toolkit. Changes in the composition and abundance of biological communities, as well as in water transparency, appear to be explained by TP concentrations in two types of natural lakes in Greece. Efforts should focus on minimizing phosphorus loading in lake waters.

# Protecting glaciers to preserve freshwaters

Dr Sophie Cauvy Fraunié[1], Dr Jean-Baptsite Bosson[2], Dr Mathias Huss[3,4,5], Dr Jean-Christophe Clément[6], Mst Guillaume Costes[2], Dr Mauro Fischer[7,8], Dr Jérôme Poulenard[9], Dr Florent Arthaud[6]
[1]INRAE, UR RIVERLY, Centre de Lyon-Villeurbanne, Villeurbanne, France, [2]Conservatory of Natural Areas of Haute-Savoie - Asters, Annecy, France, [3]Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zürich,, Zürich, Switzerland, [4]Department of Geosciences, University of Fribourg, Fribourg, Switzerland, [5]Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), , Birmensdorf, Switzerland, [6]Université Savoie Mont Blanc, INRAE, CARRTEL, Thonon-les-Bains, France, [7]Institute of Geography, University of Bern, Bern, Switzerland, [8]Oeschger Centre for Climate Change Research, University of Bern, Bern, Switzerland, [9]Université Savoie Mont Blanc/CNRS, Laboratory EDYTEM Environnement Dynamique et Territoire de la Montagne, Le Bourget-du-Lac, France
3F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Hydro-ecologist, specialist on alpine ecosystems*

Glacier retreat, icons of climate change, is having profound impact on freshwater ecosystems. First glaciers constitute considerable reservoirs, providing water to aquatic organisms, especially in dry periods. Second, glacial meltwaters present specific abiotic conditions, generating ecosystems with particular structures and functions. While, over the last decades, glacier retreat has been thoroughly studied, with a particular focus on the worldwide evolution of glacier volume, no global-scale analysis exists on the ecological counterpart. We used glacier modelling to explore the ecological trajectory until 2100 of the ~650000km2 currently covered by Earth's glaciers outside the Greenland and Antarctica ice sheets. We quantify the number, the surface, and the topographic characteristics of emerging postglacial ecosystems globally. Depending on climate change magnitude, glaciers could lose less than one quarter to half of their area by 2100. Mainly composed of terrestrial, then marine and freshwater areas, deglaciated areas could range from the equivalent surface of Nepal to Finland. In Europe, while 58 to 97% of 2020-glacier volume may disappear by 2100, between 410 to 860 new lakes should appear, through storing only 0.3 to 1% of glacial meltwater. Some new glacial lakes might produce catastrophic outburst floods, but most of them will act as sediment sinks that buffer upstream hazards and offer new habitats and refuges for the cold-adapted aquatic species threatened by the overall warming of water bodies. While climate change mitigation is a prerequisite to slow down glacier retreat, in-situ protection of current glacier areas will allow preserving future deglaciated areas, thereby emergent ecosystems.

# Protecting platypus and river blackfish from a drier future

Dr Ryan Burrows[1,2], Dr Rhys Coleman[2], Dr Yung En Chee[1], Dr Christopher Walsh[1], Dr Sharyn Rossrakesh[2], Dr Trish Grant[2]
[1]The University Of Melbourne, Melbourne, Australia, [2]Melbourne Water, Melbourne, Australia

3A_SS14_Drying rivers in a time of global change, June 19, 2023, 4:15 PM - 6:00 PM

***Biography:***
*I'm an ecologist with particular expertise in ecosystem ecology and environmental monitoring programs. My everyday work activities help ensure that we have clean and healthy catchments for both human and ecological needs. Much of my current work and science supports the 2018 Healthy Waterways Strategy for the Melbourne region, focusing on implementing the best strategies and interventions to improve and maintain habitat for vegetation, platypus, fish, and macroinvertebrates.*

Australian aquatic ecosystems are increasingly threatened, particularly by a reduction in streamflow due to climate change, drought, altered flow regimes and water extraction. A challenge for waterway managers is to maintain or improve waterways for many species and communities against a backdrop of climate-induced changes to streamflow and temperature in conjunction with population growth, increasing urbanisation, as well as community aspirations and expectations for healthy waterways. Meeting this challenge requires extensive datasets and tools to help us prioritise actions that are most appropriate for supporting waterways. One of the most important tools that we use at Melbourne Water are habitat suitability models. These spatially explicit quantitative ecological models are used to predict the likelihood of organisms being present across the region. Habitat suitability models allow us to predict how future climate change and urban development scenarios will potentially impact species' distribution. This includes being able to investigate how effective management interventions are for mitigating predicted declines in the absence of such interventions and under a changing climate. In this presentation, I will outline how we are already adapting to climate change to protect freshwater ecosystems in Melbourne, with a focus on platypus (Ornithorhynchus anatinus) and river blackfish (Gadopsis marmoratus) and the threat of drought, and the challenges we still face.

# Protecting Urban Aquatic Ecosystems to Promote One Health – get to know the Project OneAquaHealth

Dr Ana Raquel Calapez[1], Dr Maria João Feio[1], OneAquaHealth Consortium[2]
[1]MARE, ARNET & Department of Life Sciences, University of Coimbra, Portugal, , Portugal,
[2]https://oneaquahealth.eu/, , Portugal, France, Norway, Greece, Austria, Spain, Italy, Israel, Belgium, Switzerland

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Ana Raquel Calapez is a researcher at the Marine and Environmental Sciences Centre at the University of Coimbra. She is specialized in anthropogenic impacts and their interactions (multiple stressors) on stream biota, including macroinvertebrates and biofilms, and has collaborated in several R&D projects on the ecological quality assessment and monitoring of freshwater ecosystems. More recently her research has been focused on the study of these ecosystems in an urban context, including survey of their biodiversity (flora and fauna) and the potential services associated to the ecosystem as natural solutions for more sustainable cities.*

In urbanized areas, river ecosystems constitute ecological corridors between fragmented natural areas supporting a wide biodiversity and multiple ecosystem services, contributing to improve the sustainability of cities. Yet, these ecosystems are often degraded by cuts of riparian vegetation, artificialization of the channels, imperviousness of the margins, water and air pollution, noise, among others. This degradation can lead to several disservices to human populations and biodiversity losses, and increase the probability of pathogen emergence, lower disease resistance of wildlife and humans, increasing the likelihood of disease severity and epidemies, as well as diseases associated to permanence in stressful environments found in cities.
In view of this, arises the project OneAquaHealth (Horizon Europe, GA 101086521), involving the participation of 13 partners from 10 different countries, that aims to demonstrate that the health of freshwater ecosystems and human wellbeing in urban contexts are highly interconnected, as improving one results in the improvement of the other, re-establishing the balance between nature and humans. For this purpose, OneAquaHealth main objectives are to identify the level of integrity of urban aquatic ecosystems which allows for the maintenance of human health and wellbeing, animal and plant health; to determine adequate early warning indicators to assess ecosystem health and predict disease outbreak risks; to integrate live Earth observation data to monitor early warning indicators; and to engage stakeholders raising their awareness to the importance of urban streams, supporting them with a tool that allows the selection of measures to act upon early warnings ensuring environmental monitoring.

# Quantitative consequences of deglaciation for alpine river consumers and producers

Mr Christian Mitterrutzner[1], Ms Maria Chiara Vulcano[1], Prof Leopold Füreder[1], Dr Georg H. Niedrist[1]
[1]River and Conservation Research, Department of Ecology, University of Innsbruck, Innsbruck, Austria

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*He is a stream ecologist based in the European Alps at the University of Innsbruck and his research centers on the understanding of life in mountainous freshwater habitats, how species are adapted to these special habitats, and how rapid environmental changes affect entire biocenoses and the integrity of ecosystems. This presentation is part of his first large project as PI and illustrates quantitative effects of deglaciation on primary producers and invertebrates in mountain rivers, focusing on biomass, body mass and nutritional quality.*

Deglaciation in mountain catchments changes water source contributions and associated habitat conditions in usually cold and dynamic mountain rivers. Recent research has demonstrated the consequences of glacier retreat for aquatic biodiversity or for specific invertebrate or algal groups, but quantitative effects upon the aquatic food web structure remain poorly understood. In this study we assessed the abiotic habitat conditions and different compartments of river food webs (primary producers and invertebrates) in 7 catchments in the Central European Alps and demonstrate significant links to declining glacier cover. We found that deglaciation in the long term not only leads to decreasing sediment concentrations, but also to reduced runoff during summer, which in combination affects the stability of the benthic habitats. This parameter dominates the differences between sites along the consequences of glacial retreat in subsequent river habitats. ´We found that periphyton biomass in rivers currently fed by glaciers will increase with ongoing deglaciation and warming, whereby it is in particular diatoms and cyanobacteria that benefit from the milder conditions. At the trophic level of invertebrates, glacial influence was negatively linked with biodiversity and total biomass of all invertebrates, but body-sizes of glacier-bound species decreased with shrinking glaciation in the catchments. In this presentation, we illustrate clear links between decreasing glacier cover and the identity of aquatic producers and consumers in Alpine catchments, and provide evidence for shifting resource base in terms of biomass and nutritional quality.

# Recovery and conservation of endemic freshwater fish using molecular approaches: the case of the endangered Arno goby Padogobius nigricans in the Tiber River basin (central Italy).

Prof Massimo Lorenzoni[1], Dr Antonella Carosi[1], Dr Francesca Lorenzoni[1], Dr Michele Croce[2], Dr Simone Ricci[2], Dr Caterina Maria Antognazza[3], Dr Serena Zaccara[3]
[1]Department of Chemistry, Biology and Biotechnologies, University of Perugia, Perugia , Italy, [2]Forests, mountains, nature systems and wildlife-hunting Service, Umbria Region, Perugia, Italy, [3]Department of Theoretical and Applied Sciences, University of Insubria, Varese, Italy

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Prof. Massimo Lorenzoni is Associated Professor at the Department of Chemistry, Biology and Biotechnologies of the University of Perugia and his studies mainly deal with Italian freshwater fish ecology and biology. He has 30 years of professional experience in biodiversity conservation, with specific expertise in: • Ecology and Biology of fish populations; • Survey, analysis and management of freshwater habitats; • Management and impact assessments of freshwater exotic species.*

The Arno goby Padogobius nigricans is an endemic fish species of the Tuscany–Latium ichthyogeographic district (central Italy), which is strongly threatened by the presence of the alien Padanian goby Padogobius bonelli. For this reason, the Arno goby is listed in the Italian IUCN Red List as endangered (EN), with a progressively worsening population trend. Concrete conservation actions aimed at the recovery of the species are promoted as part of the IMAGINE European project (LIFE19 IPE/IT/000015). Since P. bonelli can outcompete P. nigricans mainly for spawning sites preventing its reproduction, the project foresees an experimental action to improve the recruitment success of the native species, using a molecular approach. In some invaded areas of the Tiber River basin where the two species coexist, goby nests will be collected and for each nest an egg sample will be genetically analysed to identify the species through barcoding marker (COI mtDNA). After this selection, P. bonelli eggs will be destroyed, while those of P. nigricans will be kept in captivity until the reintroduction in their original locations. This project is an attempt to support native populations and reduce the recruitment of the invasive species, also representing an example where the application of molecular methods could help the conservation and protection of biodiversity in freshwater ecosystems.

# Recovery of acidified surface waters in the United Kingdom: 33 years of biological monitoring (1988–2021)

Dr John Murphy[1], Mr Ewan Shilland[1,2,3], Prof Steve Juggins[4], Dr James Pretty[1], Mr Dave Cooling[1], Dr Katrin Layer-Dobra[1], Mr Iain Gunn[5], Mr Stuart Orton[1], Dr Julie Winterbottom[1], Dr Don Monteith[6], Prof. Iwan Jones[1]

[1]Queen Mary University Of London, London, United Kingdom, [2]University College London, London, United Kingdom, [3]Natural History Museum, London, United Kingdom, [4]Newcastle University, Newcastle upon Tyne, United Kingdom, [5]UK Centre for Ecology and Hydrology, Edinburgh, United Kingdom, [6]UK Centre for Ecology and Hydrology, Lancaster, United Kingdom

2E_RS10_Biomonitoring, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*

*I have over 25 years of experience of research into freshwater invertebrate and fish communities. Much of my research has involved large-scale and long-term studies. I have established a strong reputation in the development of biotic indicators using empirical data. I have developed and tested indices to diagnose the impacts of acidification (AWIC), excess fine sediment (CoFSI) and metal pollution (MetTol) on freshwater macroinvertebrate communities. These indices are being used by UK government agencies to assess water quality and to detect recovery in long-term data. Other stressors I have investigated include invasive species, organic pollution, radioactivity and climate change.*

Upland waters in the UK have been in receipt of atmospheric pollutants from the combustion of fossil fuels for over 200 years. As a result, waters in areas with low acid neutralising capacity became severely acidified. Concerted international efforts have dramatically reduced the emission of acidifying gases to the atmosphere. The Upland Waters Monitoring Network (UWMN) was established in 1988 to assess the chemical and biological response of acidified lakes and streams in the UK to these reductions. The Network consists of a 33-year time series of environmental data that documents the trajectory of hydrochemical and biological (macroinvertebrate, diatom and macrophyte, plus fish to 2015) recovery at 22 sites, the majority of which are acidified. Large reductions in acid deposition have driven major reductions in water acidity accompanied by increases in dissolved organic matter, and this provides a national-scale natural experiment to examine how these upland aquatic ecosystems are responding to reductions in this international pressure. There have been major changes in the biological communities of the majority of UWMN sites, driven mainly by a turnover of taxa rather than an increase in richness. There is strong agreement between the sites showing positive trends in biological indicators of water pH and the sites that are undergoing the clearest chemical recovery from acidification. The UK UWMN has proved, and is continuing to prove, a highly effective source of evidence for assessing the efficacy of emissions reduction policy in restoring damaged upland freshwater ecosystems.

# RECOVERY OF CLADOCERAN COMMUNITIES FROM EUTROPHICATION IN THREE BASINS OF LAKE CONSTANCE DIFFERING IN MORPHOLOGY

Mr Marjohn Baludo[1], Dr Simone Wengrat[1], Dr Dietmar Straile[1]
[1]Limnological Institute, University of Konstanz, , Germany

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Marjohn is currently doing his PhD in the University of Konstanz, Germany. He is studying the responses of small cladocerans with the presence of co-occurring invertebrate predators in Lake Constance. His field of interests include zooplankton ecology and physiology, limnology, and paleoecology.*

Cladocerans are known to respond strongly and rapidly to environmental changes such as eutrophication and climate variability. As cladoceran remains are furthermore well preserved in lake sediments, cladocerans are an ideal group to study the resilience of lake ecosystems. Here we investigate cladoceran dynamics during approximately the last 100 years in three basins of Lake Constance, which went a similar history of trophic changes and warming, but differ in morphology: the large Upper Lake Constance (zmax = 250m), and Zellersee (zmax = 22m) and Gnadensee (zmax = 19 m), the two basins in Lower Lake Constance. In all three basins, eutrophication resulted in phosphorus concentrations around 100 µg/L in the 1970s, with subsequent declines due to the establishment of sewage plants towards <10µg/L in Upper Lake Constance, and <20 µg/L in the other two basins. The cladoceran community in Upper Lake Constance was strongly dominated by pelagic cladocerans, whereas in the Lower Lake Constance basins, especially in Gnadensee, benthic species were also found in higher numbers such as Chydorus sphaericus, Alona quadrangularis, and Alonella nana. Community recovery from eutrophication was more complete in Upper Lake Constance compared to the other two basins. However, measurements of the size of Daphnia and Bosmina remains suggest that the three basins also differ in fish predation pressure.

## Recreational use of rivers: People don't care much about river naturalness as long as it's a nice landscape

Dr Jochem Kail[1], Oliver Becker[3], Prof. Robert Arlinghaus[2], Dr. Jürgen Meyerhoff[3]
[1]University Of Duisburg-Essen, Essen, Germany, [2]Leibniz Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany, [3]Hochschule für Wirtschaft und Recht Berlin (HWR), Berlin, Germany

3B_RS11_Restoration and conservation (incl. nature-based solutions), June 19, 2023, 4:15 PM - 6:00 PM

***Biography:***
*Dr. Jochem Kail has been working on the effect of multiple-stressors at multiple spatial scales and the effect of river restoration, especially of large wood and riparian buffers on river biota. Besided being a "riparian lover" sensu H. Piégay, his interest and research also covers other related topics like ecosystem services of rivers.*

Rivers and their floodplains provide a multitude of ecosystem services, including recreation as a cultural ecosystem service (CES). It is a common narrative that more natural or restored rivers provide improved CES, because such natural systems are believed to be more attractive for recreation. However, there is limited empirical evidence, especially based on actual behavioural decisions (revealed preferences). In this German-wide study, information from 1381 respondents on their last recreational visit was used to investigate the effect of river naturalness - objectively quantified using a physical habitat assessment method - on recreation as a CES. More specifically we tested if respondents' subjective rating of naturalness, suitability of the river section visited and overall satisfaction depends on river naturalness. Results indicated that respondents had difficulties to correctly assess river naturalness. Suitability for the recreational activity was rated highest by the respondents if the river segments visited were embedded in an extensively used, diverse and patchy cultural landscape, supporting the "savanna hypothesis". River naturalness did not relate to suitability in the full dataset. However, for small sub-datasets of recreational activities strongly related to water and respondents with a strong relation with nature, suitability indeed depended on river naturalness. Overall satisfaction with the trip depended on both, river naturalness and the surrounding landscape. In conclusion, most visitors seemed to only unconsciously perceive and value river naturalness and the surrounding landscape was of similar or even higher importance for recreation. Therefore, assuming a simple relationship between river naturalness and recreation as CES seems naïve.

# Relationships among ecosystem services, bioindicators' diversity and urbanization: an urban river ecosystem perspective.

Dr Ana Raquel Calapez[1], Dr Sónia RQ Serra[1], Dr Salomé FP Almeida[2], Dr Maria J Feio[1]
[1]MARE, ARNET & Department of Life Sciences, University of Coimbra, Coimbra, Portugal,
[2]GeoBioTec & Department of Biology, University of Aveiro, Aveiro, Portugal

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*Ana Raquel Calapez is a researcher at the Marine and Environmental Sciences Centre at the University of Coimbra. She is specialized in anthropogenic impacts and their interactions (multiple stressors) on stream biota, including macroinvertebrates and biofilms, and has collaborated in several R&D projects on the ecological quality assessment and monitoring of freshwater ecosystems. More recently her research has been focused on the study of these ecosystems in an urban context, including survey of their biodiversity (flora and fauna) and the potential services associated to the ecosystem as natural solutions for more sustainable cities.*

River ecosystems within cities can provide important Ecosystem Services (ES) to urban population along with the maintenance of biodiversity. Increasing urbanization with land use change can affect biodiversity, impacting ES provision, but the relationships between biota and ES are intricate and poorly understood. This study aims to explore relationships between aquatic biodiversity (communities' structure), urbanization and ES provided by urban streams. Nine streams were surveyed within a city area focusing on: a) biological indicators (i.e., macroinvertebrates and diatoms), b) their urbanization degree, according to the surrounding imperviousness area (IMD), and c) indicators of Provisioning (N=7), Regulation (N=14) and Cultural (N=23) services for this type of ecosystem. Pearson correlations showed trends of negative relationships between IMD and both Provisioning and Regulating services. Macroinvertebrate communities related specifically with Provisioning and Regulating indicators, while the diatom responded just to Regulating indicators (BIOENV analysis). Overall, this study showed that aquatic biodiversity is linkable with ES provided by urban streams, and such relationship depends on specific ES indicators mainly for Provisioning and Regulating services. Also, macroinvertebrate communities can be used as a suitable indicator for the potential of streams in supplying Provisioning and Regulating ecosystem services, showing that their indicator value goes beyond their known ability to assess ecological integrity of river ecosystems. These results also reinforce the need to protect the natural environment (flora and fauna) associated to running water ecosystems in urbanized areas, as they provide green and blue solutions for the sustainability of cities.

# Relevance of Electrofishing monitoring surveys to understand and address freshwater fish decline

Dr Raphael Santos[1], Dr. Nicolas Poulet[2], Dr. George Carrel[3], Dr. Nicolas Lamouroux[1], Dr. Jean-Michel Olivier[4], Dr. Aurélien Besnard[5]
[1]INRAE – UR Riverly, Lyon, France, [2]Pôle Ecohydraulique, Office Français de la Biodiversité; Institut des Mécaniques des Fluides, Toulouse, France, [3]INRAE, RECOVER, Aix Marseille Univ., Aix-en-Provence, France , [4]CNRS, UMR 5023 – LEHNA, Biodiversité des Ecosystèmes Lotiques, Univ. Lyon 1, Villeurbanne, France, [5]CEFE, Univ Montpellier, CNRS, EPHE-PSL University, IRD, Montpellier, France

5D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*The authors have dedicated their careers to freshwater biodiversity conservation and restoration. They developed scientific programs with academics, environmental managers, industrials and policy makers to investigate freshwater species population dynamics at different spatial scales and to develop ambitious restoration and monitoring programs. They lead and coordinate the RhôneEco program that aims at restoring key habitat variables such as minimum flow and transversal connectivity on multiple sites along the Rhône River. They developed standardised electrofishing programs and used electrofishing data to study freshwater fish ecology, the impacts of anthropogenic pressures on fish species and the benefits of restoration programs.*

Understanding the population dynamics of aquatic species and how inter-specific variation in demographic and life history traits influence population dynamics is crucial to address freshwater biodiversity loss. Focusing on 18 common European species representing 94% of fish captured between 1990 and 2011 across France through the National electrofishing program, we investigated common species trends in abundance and biomass. Among the 18 species, eleven of them have exhibited significant declines. Of the demographic and ecological traits investigated, life-history strategy and maximum length were significantly correlated with species' population growth rates in abundance and biomass, revealing that the decline mainly concerned large-bodied species with slow life-histories. To implement evidence-driven management and conservation decisions at a regional scale we further investigated spatial heterogeneity in common freshwater fish population dynamics in France with a focus on trends in River Basin Districts (RBDs), the management unit in the EU. Our results highlight areas where most of the common species exhibited declines. Freshwater electrofishing surveys provide the fundamental information about freshwater fish population dynamics, necessary to develop evidence-based environmental management measures and to update European environmental policies. The next steps to restore freshwater biodiversity are to identify the main drivers of freshwater biodiversity erosion and to assess the success of restoration projects such as the RhôneEco restoration program implemented along the Rhône River over two decades. Some results from the RhôneEco program will also be presented to the audience.

# Reproductive success of stream fish species in relation to high and low flow patterns: the role of life history strategies and species traits

Mr Lucas Mignien[1,2], Prof.Dr Stefan Stoll[1,2]
[1]Duisburg-Essen University, Essen, Germany, [2]Umwelt Campus Birkenfeld, Hoppstädten-Weiersbach, Germany

6C_SS03_Fish Ecology and Conservation, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*My Ph.D. focus on disentangling the effects of climate change and extreme hydrological events (such as floods and droughts) on fish communities. To do so, a large data-driven study was first conducted in North Rhineland Westphalia (Germany) to assess the impact of hydrological variability on fish population abundances and especially on young-of-the-year (YOY). Then, on a local scale, we implemented a network of PIT tag antennas in a low-mountain braided stream to detect small-scale movement patterns and microhabitat use of every fish.*

Hydrological variability is widely regarded as a key factor structuring the biotic and abiotic processes in freshwater ecosystems and is of particular importance for fish populations. We used 171 hydrological indexes to investigate the short-, intermediate-, and long-term effects of high and low flow patterns on young-of-the-year (YOY) fish abundances, indicating the reproductive success of the species. Our study comprised 13 fish species in headwater streams in the state of North Rhine-Westphalia, Germany. Generalized linear models on average explained 64 % of the variability in YOY abundances and long-term hydrologic indices performed better than indices based on shorter periods. Across all species, low flow indices hardly affected YOY abundances, while high flow events showed negative long-term impacts. High flow patterns differentially affected the reproductive success of fish species according to their life history strategies. Equilibrium strategists negatively responded to high frequency and magnitude as well as late timing of high flow events, while periodic and opportunistic species mostly thrived under these flow conditions. Four ecological traits mediated these differences between life history strategies. Species with low relative fecundity, large eggs and larvae and long incubation periods were negatively impacted by high frequency, high magnitude and late timing of high flows. Conversely, species displaying a high relative fecundity, short incubation periods and small eggs and larvae were fostered by strong, frequent, and late high flows. Our analyses help to identify species-specific risks related to changes in the hydrological regime, e.g. as an effect of climate change or direct human intervention.

# Resistance and resilience of under-ice bacterioplankton to seasonal changes in high mountain lakes

Dr Marisol Felip[1,2], Dr Aitziber Zufiaurre[2,3], Dr Jordi Catalan[2,4]
[1]University of Barcelona, Barcelona, Spain, [2]CREAF, Cerdanyola del Vallès, Spain, [3]Area de Biodiversidad GAN-NIK, Pamplona, Spain, [4]CSIC, Cerdanyola del Vallès, Spain
9E_RS03_Microbial ecology in freshwaters, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*Since 2007 Associate Professor of the Department of Evolutionary Biology, Ecology and Environmental Sciences, Univesity of Barcelona.*

*Member of the Biogeodynamics and Biodiversity Research Group (CREAF - CSIC, UB), GECA and of the node LTER-Aigüestortes.*

*Director of the High Mountain Research Center (UB).*

*Our research group has been studying the high mountain lakes of the Pyrenees for more than 30 years and has accumulated a long experience and knowledge of the ecology and biodiversity of their communities. Specialist in aquatic microbial ecology I study functional traits and diversity through the application of the latest single cell and molecular tools.*

Most of the world's high mountain lakes are covered with ice and snow for several months of the year, which determines contrasting conditions throughout the seasons. A phytocentric view of the lake ecosystem might consider the ice-free period as the most relevant for lake microbial communities. However, heterotrophic and chemoautotrophic prokaryotes may experience more favourable conditions under ice. We used 16S rRNA gene sequencing to monthly monitor the bacterioplankton community of a deep high mountain lake ice-covered for half a year. The lake shows a rich core bacterioplankton community consisting of three components: (i) an assemblage stable throughout the year, dominated by Actinobacteria, resistant to all depths and season conditions; (ii) an ice-on-resilient assemblage dominating during the ice-covered period, which is more diverse than the other components and includes a high abundance of Verrucomicrobia; the deep hypolimnion constitutes a refuge for many of the typical under-ice taxa, many of which recover quickly during autumn mixing; and (iii) an ice-off-resilient assemblage, which members peak in summer in epilimnetic waters when the rest decline, characterized by a dominance of Flavobacterium, and Limnohabitans. The bacterioplankton paradigm for long seasonally ice-covered lakes should consider the primary role of highly diverse resistant and resilient assemblages to seasonality

# Resource diversity drives the microbial processing of fine particulate organic matter during leaf breakdown in streams

Ms. Pratiksha Acharya[1,2], Ms Mourine Yegon[1,3], Ms Leonie Haferkemper[1,2], Prof. Christian Griebler[2], Dr. Simon Vitecek[1,3], Dr. Katrin Attermeyer[1,2]
[1]WasserCluster Lunz - Biological Station, Lunz am See, Austria, [2]University of Vienna, Vienna, Austria, [3]University of Natural Resources and Life Sciences, Vienna, Austria

8G_RS20_Aquatic terrestrial linkages, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***

*I am a Ph.D. student at WasserCluster Lunz affiliated with the University of Vienna. My research focuses on Exploring the Biodiversity-Ecosystem Functioning Relationships of Leaf litter Decomposition in streams. For my Ph.D., I am investigating the microbial decomposition and carbon flow of fine particles during leaf breakdown in streams. I have broad interests in exploring the role of microorganisms in carbon and nutrient cycling with the application of stable isotopes.*

Leaf litter decomposition (LLD) is an essential ecosystem function in headwater streams, which can be influenced by leaf diversity and the preconditioning of the leaves. However, how resource diversity affects LLD and the microbial decomposition of fine particulate organic matter (FPOM) produced during LLD is not well known. We hypothesized that leaf litter diversity influences the composition of the produced FPOM and associated microbial functional responses. In laboratory microcosms, we fed alder, beech, and maple leaves and their mixtures, preconditioned under anoxic and oxic conditions to caddisfly larvae (Sericostoma sp.) for 24 days. Every four days, we measured the production, composition, and microbial activities of the produced FPOM, i.e., manually shredded fine leaves and shredder egesta. The shredded leaf particles showed significantly different microbial activities with higher microbial respiration but lower bacterial production on shredded alder and maple leaves following oxic compared to anoxic preconditioning. Therefore, anoxic preconditioning increased microbial growth efficiencies on shredded leaf particles. Bacterial production on faecal pellets from shredders that fed on oxic preconditioned leaves was lower than on anoxic ones, similar to the shredded leaf particles, suggesting that the gut passage does not change the microbial growth efficiencies observed on the shredded leaf particles. However, this difference was only significant in the early experimental phase whereas no differences in bacterial production on faecal pellets were found after 24 days. Hence, these results emphasize that microbial decomposition of FPOM produced during LLD depends on leaf species and preconditioning, however, modulated by the duration of the decomposition.

## Response of a key ecosystem process to large-scale stream restoration

Dr Gwendoline M. David[1], Prof. Dr. Mark O. Gessner[1,2]
[1]Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Department of Plankton and Microbial Ecology, Neuglobsow Stechlin, Germany, [2]Berlin Institute of Technology (TU Berlin), Department of Ecology, Berlin, Germany

2C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Dr Gwendoline M. David is a Post-Doctoral researcher at the IGB. She received her PhD degree at the University Paris-Saclay (France) in 2020. During her PhD, she worked on microbial communities living in small freshwater ecosystems (ponds, streams). She investigated the spatiotemporal dynamics of those communities over 8 years, to better understand their role in the functioning of those understudied ecosystems. In her current project, she focuses on one specific group of microorganisms, the aquatic hyphomycetes. Her goal is to investigate the impact of multiple stressors on fungal communities in streams, and therefore the impact on the leaf-litter decomposition processes.*

The highly industrial metropolitan Ruhr area of Germany is one of the largest in Europe. For over a century, its streams have been exposed to massive pollution and degradation by industrial activities and domestic wastewater, with many of them transformed to concrete channels and used as open sewers. However, over the last three decades, the entire stream network has been gradually restored, spurred by investments exceeding €5 billion. The aim of the present study was to assess to what extent these improvements of stream hydromorphology and water quality have entailed changes in leaf-litter decomposition, a pivotal component of stream ecosystem functioning. We conducted a decomposition experiment at 20 stream sites differing in the time when restoration measures were completed. Freshly fallen leaves were collected in autumn, placed in mesh bags and submerged in the streams in late October 2022. Six pairs of fine-mesh and coarse-mesh bags per site were retrieved after 5 weeks to determine mass loss, microbial respiration, fungal sporulation, and the community composition and contribution to mass loss of leaf-shredding macroinvertebrates. In contrast to our hypothesis that decomposition is least efficient at recently restored sites, decomposition dynamics proved similar across all streams, with highly consistent microbial decomposition but important variability when macroinvertebrates could access leaves. All other response variables proved insensitive to restoration history. This suggests either extremely rapid recovery of ecosystem functioning, no effect of stream degradation prior to restoration, or, most likely, persisting functional impairment across the stream network, including at reference sites previously considered unimpacted.

# Restoring and exploring the Secret Life of Ponds: Utilising underwater sound recordings as a key tool for engaging the public in H2020 Ponderful research and UK pond restoration practices.

Helen Greaves[1,2], Tom Fisher[2]
[1]University College London, London, United Kingdom, [2]Norfolk Ponds Project, Norfolk, United Kingdom

8B_SS04_Soundscape studies in ponds and lakes, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***
*Helen Greaves is a freshwater ecologist based in the department of Geography at UCL where she is currently focussing on the variability of greenhouse gas emissions from overgrown neglected ponds in comparison to restored ponds, for the EU-Horizon2020 'Ponderful' project. Helen is also Strategic Lead for the Norfolk Ponds Project where she develops and implements projects that aim to engage landowners and the public with pond conservation and restoration. Finally, Helen is Secretary of the European Ponds Conservation Network, a network of researchers, policy makers and practitioners promoting the conservation of ponds and their biodiversity in a changing European landscape.*

Over the past 8 years the Norfolk Ponds Project and UCL Pond Restoration Research Group (PRRG) have been working with underwater sound artist Tom Fisher (Action Pyramid) who has recorded the sounds of both overgrown and restored ponds. These sound recordings have been used to engage the public with the concept of species richness in ponds in a number of novel ways including the through the 'In the Dark' radio event at the Grant Museum, London. 'Exploring and restoring the Secret Life of Ponds' is an Arts Council and Natural England funded project that has built on these engagement practices by incorporating underwater sound recordings with poetry inspired by pond restoration and research from the EU-funded Horizon 2020 Ponderful project. Over the course of four months, three musicians and three sound artists worked with UCL PRRG researchers to undertake their own pond restoration and discuss key messages from the research for public engagement. The project outputs were then presented in both urban London and rural Norfolk through two exhibitions, two performances and four workshops. Underwater sound recordings were found to be an inspiring way for the public to engage with the science behind ponds and pond restoration. The value of integrating science with the arts to help public understanding of science is discussed, as well as the important role it can play in expanding both artists and researchers ability to communicate with the wider public.

# Restoring river ecosystem functions: Mapping priority areas for watershed rewilding

Ms. Natalie Rideout[1], Dr. Bernhard Wegscheider[2,3], Dr. Michelle Gray[4], Dr. Wendy Monk[5], Dr. Donald Baird[1]

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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*PhD Candidate with the Canadian Rivers Institute at the University of New Brunswick, interested in examining how biodiversity and ecosystem function are linked in freshwater ecosystems impacted by anthropogenic disturbance*

Today, few watersheds remain untouched by global change process arising from climate warming, impoundments, channelization, water extraction, pollution and urbanisation. Concurrently, many countries, including Canada, have pledged to conserve large tracts of land according to Aichi targets, but often conservation areas are chosen for convenience (e.g., they are not suitable for other uses) rather than their intrinsic value for biodiversity and ecosystem functioning. The need for restoration has resulted in a myriad of interventions, generally performed at small scales, and which have limited measurable impact in restoring biodiversity and ecosystem functions. We propose bringing rewilding principles to rivers and their watersheds to allow freshwater ecosystems to heal themselves, focusing on restoration of ecosystem functions. We present an ongoing case study of the Wolastoq | Saint John River, one of the last semi-intact large river floodplain systems on the eastern coast of North America and a priority place due to its significant biodiversity, concentration of species at risk and opportunities to advance conservation efforts. Our study focuses on identifying priority areas for rewilding and nature-based restoration. Using open source data, we combine DNA metabarcoding-based species distribution models, watershed stressor indices and habitat suitability maps in a conservation prioritisation framework, aiming to stimulate a wider discussion on how we can heal our broken rivers.

# Re-visiting RIVPACS Reference Condition Sites

Dr Jennifer Dodd[1]
[1]Centre for Conservation & Restoration Science, Edinburgh Napier University, Edinburgh, Scotland

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Jennifer Dodd is a freshwater ecologist with a broad range of interests including, river restoration, non-native species and the role of sound in the environment. She is particularly interested in robust data collection to support evidence driven change to "bend the curve" of biodiversity loss.*

The reference condition approach evaluates the condition of a site of interest (observed) by comparing it with unimpacted sites (expected) with similar environmental conditions (i.e. a reference condition). Deviations between observed and expected community composition provides a fair and comparable measure of site condition – increasing deviations from unity indicating increasing levels of impact. This approach relies upon the reference condition sites being a realistic representation of the system, capturing natural spatial and temporal variation. The River Invertebrate Prediction and Classification System (RIVPACS) uses a suite of reference condition sites collected across Great Britain (GB) to make predictions about expected macroinvertebrate species presence at GB sites of interest. Of the 685 sites comprising the RIVPACS reference condition site database, 30% of the samples were collected in 1978 and 1979, 44% collected between 1980 and 1990 and the remaining reference condition samples collected by 2002. Since the late 1970s, changes to the GB environment has resulted in macroinvertebrate species distribution change. It is highly likely that large scale environmental changes have altered community composition at RIVPACS reference condition sites. If consistent patterns of change at reference condition sites are not accounted for in RIVPACS faunal predictions, the predictions of macroinvertebrate community composition may be generating unachievable benchmarks against which we currently measure river health. Macroinvertebrate community composition of samples from 16 reference condition sites collected in spring 2023 within two weeks (dd/mm) of their original sample date will presented.

## Rewilding-ready: Using environmental DNA (eDNA) metabarcoding to assess the impact of European beaver (Castor fiber) reintroductions

Dr Lynsey Harper[1], Ms Holly Broadhurst[2], Miss Elin Smith[2], Mr Jake Jackman[2], Miss Maria Loftus[3], Mr Richard Young[3], Prof Stefano Mariani[3], Dr Allan McDevitt[4], Dr Lucia Galvez-Bravo[3]
[1]Freshwater Biological Association, Newby Bridge, United Kingdom, [2]University of Salford, Salford, United Kingdom, [3]Liverpool John Moores University, Liverpool, United Kingdom, [4]Atlantic Technological University, Galway, Ireland

8C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***
*Lynsey is an aquatic ecologist with expertise in lentic systems, community ecology, and the development of new tools for biodiversity monitoring. Her research to date has ranged in focus from distribution and conservation assessments for single species, dietary profiling for threatened and invasive species, to factors influencing community dynamics using conventional and molecular monitoring tools. She has applied environmental DNA (eDNA) analysis to ecological questions in order to better inform biodiversity conservation, management and policy. She is currently applying existing and new tools for biodiversity monitoring to drive decision-making on the state and health of Windermere, Cumbria.*

The European beaver (Castor fiber) is a recognised ecosystem engineer that can benefit biodiversity through wetland modification. Beaver reintroductions via fenced enclosures are increasing throughout the UK, but the impact these reintroductions have on other vertebrates is understudied. Environmental DNA (eDNA) metabarcoding enables non-invasive, cost-effective, high-resolution vertebrate surveys, and is an ideal approach to monitor both short- and long-term beaver reintroduction effects on vertebrate communities. We used eDNA metabarcoding with seasonal sampling to examine vertebrate species richness and community composition pre- and post-fence construction as well as pre- and post-beaver reintroduction. Sampling included a distance gradient downstream from the beaver enclosure to assess the potential for beaver eDNA transport and/or wide-reaching effects on vertebrate diversity. A control system was established and sampled for comparison. Both systems were monitored for one year. Fencing did not appear to influence vertebrate diversity, and no major differences were found between the reintroduction and control systems for most vertebrate groups. However, new species were recorded after beaver reintroduction and changes in community composition were observed for some vertebrate groups. Beaver eDNA was consistently detected up to 500 m away from the beaver enclosure, but infrequently at greater distances (1-2.5 km). Overall, no obvious short-term effects of beaver reintroduction on vertebrate diversity were identified. Nonetheless, these results provide critical baseline data for longer-term assessment of the consequences of beaver reintroduction and the time required for assessing the potential ecological benefits of beaver rewilding.

# Riparian vegetation mitigates river warming: exploring its large scale effects on past and future thermal regimes

Dr Hanieh Seyedhashemi[1], Dr Florentina Moatar[1], Dr Jean-Philippe Vidal[1], Dr Anthony Maire[2]
[1]INRAE, UR RiverLy, centre de Lyon-Grenoble, Villeurbanne, France, [2]EDF R&D, LNHE - Laboratoire National d'Hydraulique et Environnement, Chatou, France
3F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*We assess the influence of climate change and anthropogenic activities on rivers and aquatic ecosystems. We also try to find and propose adaptation and mitigation strategies for the global warming.*

As air temperature increases worldwide due to climate change, stream temperature (Tw) is expected to follow a similar trajectory with even faster changes. In this study, we aimed at investigating and quantifying the extent to which riparian shading can help mitigate river warming at a large scale (100,000 km²). To do so, a physical process-based thermal model coupled with a semi-distributed hydrological model was used to reconstruct (1963-2019) and project (2005-2100) Tw for 52000 hydrographic reaches of the Loire basin (France). This high spatial resolution (1 km) model includes a novel routine to account for riparian shading dynamically across seasons. Results showed that past and future increases in Tw were greater in relatively large rivers (Strahler order≥5), which was attributed partly to the mitigation effect of riparian shading observed on smaller streams. Indeed, riparian vegetation shading mitigated spring and summer Tw increases by up to 0.16°C per decade in headwater streams (i.e. < 30 km from the source) over the past six decades. Moreover, riparian shading could mitigate the future increase in summer Tw in small streams by 3.75°C to 5.17°C by the end of the 21st century, depending on the climate model and scenario from sparsely shaded reaches to highly shaded reaches. We complemented these results by exploring the consequences of theoretical scenarios of large-scale riparian restoration or loss on Tw changes. Our results suggest that the restoration and maintenance of riparian forests holds great promise to help mitigate the effects of global warming on rivers and their biodiversity.

# RISK ASSESSMENT IN RIVERS FROM SPANISH NATIONAL PARKS: OCCURRENCE OF POTENTIALLY MULTI-TOXIN CYANOBACTERIAL MATS

Mr Albano Diez Chiappe[1], Mrs MA Muñoz-Martín[1], Mr Samuel Cirés[1], Mrs Paula Martín-González[1], Mrs Ana Justel[1], Mr Antonio Quesada[1], Mrs Elvira Perona[1]
[1]Universidad Autónoma De Madrid, Madrid, Spain

8C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Albano Díez Chiappe is a PhD student from the Microbiology program in the Universidad Autonoma de Madrid. Currently, he is conducting his research studying the proliferation of toxic cyanobacteria (benthic and planktonic) in different aquatic ecosystems (rivers, ponds and reservoirs) within Spanich National Parks.*

Benthic cyanotoxin-producing cyanobacteria have been confirmed in high proportion of Spanish rivers, some of them located within National Parks. This study focuses on the proliferation of benthic cyanobacterial communities in these protected areas, with the aim of minimizing the risks to visitors and fauna. Our results, obtained during 2021, confirmed mats presence in two rivers from Monfragüe National Park and two rivers from Guadarrama Mountains National Park, reaching a remarkable 40-50 % coverage of the riverbed in some areas. Metabarcoding analysis based on cyanobacterial-specific 16S rRNA and cyanotoxin-biosynthesis genes (anaF, mcyE and sxtA) revealed that mats were dominated mainly by Microcoleus autumnalis or Potamolinea aerugineo-caerulea and confirmed potential production of the neurotoxins anatoxins (95 % of the samples) and saxitoxins (35 % of the samples) and the hepatotoxins microcystins and/or nodularins in > 80 % of the samples. In addition, the genetic identity of the mcyE gene found and the level of production of the different cyanotoxins will be discussed. Due to the potential risk detected, mats presence was monitored in both parks during the summer of 2022 and continued periodically in those rivers where the highest risk was identified. Given that these protected areas are inhabited by livestock and vulnerable fauna, and are highly frequented by visitors with pets, there is a need for protocols to evaluate and manage the potential risk associated with benthic cyanobacteria.

# River Network connectivity – Taking a holistic approach

Dr Paulo Branco[1], Dr. Pedro Segurado[1], Dr. José Maria Santos[1], Dr. Susana Amaral[1], Ana Margarida Mascarenhas[1], Dr. Gonçalo Duarte[1], Dr. Filipe Romão[2], Tamara Leite[1], Dr. António Pinheiro[2], Dr. Maria Teresa Ferreira[1]
[1]Forest Research Centre, Associate Laboratory Terra, School of Agricuture, University of Lisbon, Lisbon, Portugal, [2]CERIS—Civil Engineering for Research and Innovation for Sustainability, Técnico, University of Lisbon, Lisbon, Portugal

9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***

*Biologist with special interest in Ecology. His researcher focuses on freshwater fish, river network connectivity and macroecological approaches to freshwater studies. Paulo leads a research line of river connectivity, developing new conceptual and practical tools. He is the CEO of the Associate Laboratory TERRA (Laboratory for the Sustainability of Land Use and Ecosystem Services) that integrates 5 research centers with more than 400 PhD researchers.*

Rivers have historically played a critical role in the development of human societies, but this relationship has resulted in a high degree of anthropogenic impacts on freshwater systems. Among these pressures, the fragmentation of river networks by artificial barriers is considered to be one of the most damaging, particularly for freshwater fish species that rely on longitudinal movements. This hinders the ability of river systems to maintain their fish biodiversity, thereby affecting population maintenance and promoting imbalances in meta-communities. To effectively address the problem of fragmentation in river systems, it is crucial not only to accurately quantify the structural and functional impairment of river networks, but also to develop cost-effective approaches to facilitate connectivity management and design effective solutions for enhancing connectivity suitable for different types of barriers serving different fish communities. In this work, we demonstrate how this comprehensive approach is the most effective way to tackle river network fragmentation. We present the key findings and contributions of 15 years of research centered on river network connectivity. These results are based on theoretical, laboratory-controlled, and field experiments, ranging from historical fish records to predictions of future fish occurrences and habitat suitability, and from fish passage research, small barrier negotiation, and fish behavior to management and planning techniques for enhancing connectivity at large spatial scales.

## Riverflies: the canaries of our rivers

Trine Bregstein, Mr Steve Brooks, Dr Louise Lavictoire
[1]The Riverfly Partnership, Freshwater Biological Association, ,

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Trine Bregstein joined the Freshwater Biological Association in 2022 as a coordinator of two citizen science projects, now her focus is solely on The Riverfly Partnership. Trine completed a BSc in Environmental Sciences at the University of Brighton and in this role she is growing her knowledge of freshwater invertebrates, ecosystems and the importance of citizen scientists in monitoring the health of our rivers.*

The Riverfly Partnership is dynamic network of organisations working together to protect the water quality of our rivers, further the understanding of riverfly populations and actively conserve riverfly habitats. Hosted and coordinated by the Freshwater Biological Association, we work with over 60 hubs around the UK who coordinate sampling across the 3030 sites registered on our database. Citizen scientists undertake monthly monitoring of river sites using standardised kick-sample monitoring methods and reporting suspected environmental issues to the statutory environmental bodies.
In this poster we report the fantastic work undertaken by Riverfly citizen scientists to monitor river sites. We currently have around 1000 active volunteers and total surveys on our database is currently 40,666. Data from the project have been used to successfully prosecute serial water polluters.
Riverflies are at the heart of the freshwater ecosystem and are a vital link in the aquatic food chain. Their common characteristics of limited mobility, relatively long life cycle, presence throughout the year and specific tolerances to changes in environmental conditions make them good biotic indicators of water quality and useful indicators of change in local environmental conditions such as pollution, siltation and low flows. Riverflies are often thought of as the canaries of our rivers.
Here we present a poster on the importance of this project, how it helps to engage people from a variety of backgrounds with their natural environment and blue spaces in their area, and we highlight the successes of this citizen science project.

# Role of disturbance and effectiveness of the Natura 2000 network for the conservation of riverine fish diversity in a Mediterranean region

Dr Anna Gavioli[1], Dr. Marco Milardi[2], Dr. Ana Filipa Filipe[3], Dr. Katalin Patonai[1], Prof. Giuseppe Castaldelli[1]
[1]University of Ferrara - Department of Environmental and Prevention Sciences, Ferrara, Italy, [2]Southern Indian Ocean Fisheries Agreement (SIOFA), Parc de la Providence, Saint-Denis, France, [3]Forest Research Centre (CEF) and Associate Laboratory TERRA, School of Agriculture, University of Lisbon, Lisbon, Portugal

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Since the Bachelor's degree, my overall research aim is to explaining the drivers of native species loss and among them the role of non-native species. To address this question, during my PhD in Ecology and Evolution at the University of Ferrara (Italy), I have collected and analyzed the largest dataset of abundance-based fish data in Italy. My main research interests include freshwater and fish ecology and I have a strong background in the study of the relationships between fish diversity and environmental features. A relevant topic for my research is also the impact of non-native freshwater species on native fish.*

Fish is one of the most vulnerable biodiversity components in freshwaters due to several anthropogenic pressures. Natura 2000 network of protected areas (PA) is one of the most relevant efforts taken for its conservation. Nonetheless, uncertainties remain about how pressures interact with each other and on how relevant are PAs to contrasting the dramatic, continuous loss of fish biodiversity.
To address these questions, we have studied the contribution of land use, spatial variables, and invasion degree by exotic fish species on native fish communities and we also investigated if PAs mitigate anthropic pressures promoting higher native fish diversity compared to unprotected river section in the same rivers.
Using linear mixed model, partition of R2, and Kruskal-Wallis test we evidenced that the invasion degree by exotic fish species was the most important variable, with a positive effect on both alpha and beta diversity. Furthermore, land use and related human impacts had a positive influence on alpha diversity, whereas it showed a negative effect on beta diversity. PAs did not guarantee less anthropogenic impacts and higher fish species richness than outside protected areas, indicating that presently protected areas are not playing an effective safeguard of fish diversity. The invasion degree plays a central role in shaping fish diversity and, on the base of this, additional caution should be paid in promoting dedicated management measures and in designing new PAs.

# Science education via Citizen Science: Examples from cooperations with high schools

Associate Prof Gabriele Weigelhofer[1], DI Eva Feldbacher[1]
[1]WasserCluster Lunz, , Austria
6D_RS17_Science dissemination/communication & education, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*I am working as assistent professor at the University of Natural Resources and Life Sciences Vienna and as scientific manager and group leader at WasserCluster Lunz. My research focus lies on aquatic biogeochemistry and microbiology of lotic ecosystems. Additionally, I am working on the interface between research and education and have long-term experience in science education and Citizen Science projects.*

Recent studies show that Austrian citizens have little interest and trust in science. This is closely linked with a lack of scientific literacy, i.e. a low knowledge about how different research disciplines work and how scientists generate scientifically sound data. Citizen Science projects at the interface of science and education provide an excellent opportunity to develop innovative ways of science communication, raise scientific literacy, and influence the attitude towards scientific findings positively.
We will present examples from several Citizen Science projects with high school students, demonstrating concepts for science education at different age levels, strategies to involve young people in scientific projects and generate publishable data with them. We will also present a network for science education currently developed in Austria that joins forces in science education, including scientists from different disciplines, partner schools, and the Austrian authorities for education.

# Searching for the wiggle signal – using reference condition predictions to inform river restoration expectations

Dr Jennifer Dodd[1]
[1]Centre for Conservation & Restoration Science, Edinburgh Napier University, Edinburgh, Scotland

4B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Jennifer Dodd is a freshwater ecologist with a broad range of interests including, river restoration, non-native species and the role of sound in the environment. She is particularly interested in robust data collection to support evidence driven change to "bend the curve" of biodiversity loss.*

Macroinvertebrates are a commonly used group to investigate the ecological response of a river to restoration intervention. Reviews of the literature summarising the response of macroinvertebrates to river restoration highlight variability in the strength and direction of the response. Disentangling whether this variability is a true reflection of the system or a lack of consistent and robust study design is difficult at best. The River Invertebrate Prediction and Classification System (RIVPACS) is a tool which uses information collected from a suite of reference condition sites (sites of perceived high ecological quality) to predict macroinvertebrate community composition, based on environmental conditions, expected to be found at a site in the absence of (human) stress. This tool presents an opportunity to investigate the 'response' of the macroinvertebrate community to common river restoration actions (e.g. changing the channel slope through increased sinuosity or changing the riverbed composition through substrate addition). By holding the simulated environment constant and adjusting the variable of interest (e.g. slope), predicted macroinvertebrate community composition can be compared across a gradient of variable change. The results of this simulation study shows patterns of change in community composition in response to changes in slope (a response of increasing channel sinuosity) and substrate change (changing riverbed roughness) across rivers of different size. Patterns are interpretated within a river restoration monitoring context.

# Seasonal and spatial variability of molecular biomarker responses in the digestive glands of freshwater mussel Unio crassus exposed to long-term pollution

Zoran Kiralj[1], Zrinka Dragun[1], Jasna Lajtner[2], Krešimira Trgovčić[3], Mr Tomislav Kralj[1], Damir Valić[1], Dušica Ivanković[1]
[1]Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička cesta 54, 10000 Zagreb, Croatia, [2]Faculty of Science, Department of Biology, University of Zagreb, Roosveltov trg 6, 10000 Zagreb, Croatia, [3]Vodovod i kanalizacija d.o.o. Karlovac, Gažanski trg 8, 47000 Karlovac, Croatia

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Tomislav Kralj works at the Ruđer Bošković Institute. He researches the impact of invasive amphipods on native species and macroinvertebrate communities and how their invasion can alter ecological processes in freshwater ecosystems. He also researches the relationship between invasive species and pollution and the impact of invasive species on biological monitoring.*

Molecular biomarkers can be used to determine the earliest disturbances of homeostasis that may have occurred in the organism due to exposure to contaminants. Bivalves accumulate large amounts of pollutants and are therefore considered good bioindicator organisms for assessing the pollution of aquatic ecosystems.
The aim of this study was to evaluate the seasonal and spatial differences in molecular biomarker responses in the digestive glands of freshwater mussel Unio crassus from two sites at the Mrežnica River with a high density of this species and different levels of contamination. Biomarkers were measured spectrophotometrically, and the following biomarkers were included: metallothioneins (MT) for metal exposure, malondialdehyde (MDA) for oxidative damage, and acetylcholinesterase (AChE) for monitoring the effects of organophosphate and carbamate pesticides exposure. Mussel samples were collected in two seasons, spring and autumn 2021.
The levels of all biomarkers were significantly higher in spring compared to autumn at both sites studied. Food availability, temperature, and reproductive cycle along with agricultural and industrial activities are some of the many factors that may influence higher biomarker activities/concentrations in spring. Higher MTs concentrations and lower AChE activity were observed at the site where agricultural practices were conducted. MDA levels were increased in mussels from the site near the industrial zone, indicating possible overproduction of reactive oxygen species and oxidative stress in these mussels.
The presented results suggest that molecular biomarkers provide valuable information on organism health status, but physiological and environmental factors should be considered together when evaluating the obtained data.

# Seasonal dynamics of macrozoobenthos and microplastics in sediment samples along an urban stream

Ms Dunja Jurina[1], Ms Laura Huljek[2], Dr Hana Fajković[2], Dr Mirela Sertić Perić[1]
[1]University Of Zagreb, Faculty Of Science, Department Of Biology, Zagreb, Croatia,
[2]University of Zagreb, Faculty of Science, Department of Geology, Zagreb, Croatia

7E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Research Assistant at the University of Zagreb, Faculty of Science, Department of Biology, Division of Botany. In September 2022 obtained a Master's degree in Environmental Science at the University of Zagreb, Faculty of Science. In 2019 completed undergraduate studies at the University of Zagreb, Faculty of Science and obtained a Bachelor's degree in Environmental Science. During studies, participated in two projects (Marbled and spiny-cheek cray-fish  as carriers of causative agent of crayfish plague in Croatia; Geoecological study of Maksimir Park and the significant landscape of Savica).*

In this study, we investigated differences in: (i) the taxonomic composition and abundance of macrozoobenthos and (ii) the content of microplastics in sediment samples collected in spring (April and May) and autumn (October, November and December) 2021 at two sites (V1, V2) along the urban Vrapčak stream (Zagreb, Croatia). Along the stream, there is an obvious anthropogenic influence in the form of visible pollution and walking paths for recreational purposes of citizens. The two sampling sites (V1 upstream and V2 downstream) are 1 km apart, both are channelized and partially paved as a result of urbanization. During the sampling months, sites were visited every two to three weeks, resulting in 24 spring and 18 autumn sediment samples. Significantly more individuals of Chironomidae, Ephemeroptera, Simuliidae, and Diptera (pupae) were found in the benthos in spring than in autumn, while Isopoda predominated in autumn. These trends likely reflect the seasonal dynamics of the life cycle of these organisms. A total of fifteen microplastic particles (MP) and two macroplastic particles were detected in sediment samples collected at the two sites. The number of MP did not differ significantly between seasons. The mass of MP was slightly higher in autumn (0.012 g (microplastics)/g (sediment)) than in spring (0.011 g (microplastics)/g (sediment)). The results of this study suggest that microplastics in the sediments of urban streams is quite stable and seasonally persistent, and that its accumulation may pose a threat to the composition and life cycles of organisms inhabiting the benthos of these streams.

# Seasonal variability of lotic macroinvertebrate community structure and function at the habitat scale informs the assessment of fine sediment pressures and riverine health

Dr Kate Mathers[1], Dr Patrick Armitage[2], Melanie Bickerton[3], Dr Matthew Hill[4], Dr Morwenna Mckenzie[1], Dr Isabel Pardo[5], Dr David Tickner[6], Prof Paul Wood[1]
[1]Loughborough University, , UK, [2]Freshwater Biological Association, , UK, [3]University of Birmingham, , UK, [4]University of Bournemouth, , UK, [5]University of Vigo, , Spain, [6]WWF, , UK
2E_RS10_Biomonitoring, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Kate Mathers is currently a UKRI fellow at Loughborough University, UK. She is freshwater scientist whose research is located at the interface of aquatic ecology, hydrology and fluvial geomorphology. Her research focuses on macroinvertebrate communities and aims to advance our understanding of how disturbances (anthropogenic and natural) affect aquatic ecosystems in addition to promoting the conservation and sustainable management of freshwater systems.*

Substrate composition has been widely recognised as a primary variable shaping riverine macroinvertebrate communities at the habitat unit level. However, fundamental understanding of how communities inhabiting different habitats are structured in terms of their function and diversity, and how this varies seasonally is lacking. We therefore sought to: 1) assess macroinvertebrate taxonomic and functional alpha and beta diversity at the habitat unit level (sand, silt, mixed gravel / sand, gravel and vegetation) and 2: evaluate whether this varied seasonally. Habitat differences in community composition were evident for taxonomic communities regardless of the season but were not seasonally consistent for functional communities, and notably season was found to explain a greater amount of variance in functional community composition than the habitat unit. Sand and silt communities were structured predominantly by nestedness, being species poor and a subset of other, more species rich habitats. However, silt habitats demonstrated strong seasonal differences in the biodiversity supported being functionally comparable to sand habitats in spring and to gravel habitats in autumn. Sand communities in contrast were impoverished regardless of the season. Our results suggest that discriminating between the size fractions of fine sediment habitats (sand or silt) and conducting seasonal assessments, is important to be able to fully elucidate the wider ecological importance of these habitats and the distinct biodiversity and functioning they support.

# Securing Biodiversity, Ecological Integrity and Ecosystem services in Drying River Networks (DRYvER)

Dr Thibault Datry[1], The DRYvER consortium
[1]Inrae, Lyon, France
4A_SS14_Drying rivers in a time of global change, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a freshwater scientist working on the eco-hydrology of rivers and hyporheic zones, with particular emphasis on drying river networks. I am developing international research programs at different scales to improve knowledge and management of intermittent rivers and ephemeral streams. I serve on editorial boards of different international journals, including Journal of Applied Ecology from the BES and coordinates IRBAS (Intermittent River Biodiversity Analysis and Synthesis), SMIRES (Science and Management of Intermittent Rivers and Ephemeral Streams) and the DRYvER Horizon 2020 european project on the effects of climate change on drying river networks.*

Freshwaters are biodiversity hotspots, but among the most threatened habitats on Earth. They provide habitat for threatened and endangered organisms, support crucial biogeochemical cycles and provide key ecosystem services to people. In the Anthropocene Era, river networks are increasingly drying due to climate change and human alterations to flow regimes. Currently, rivers and streams that naturally do not flow all year round represent the dominant type of flowing water on Earth, with 51–60% of the mapped global river network. After being overlooked for decades, the ecological effects of flow intermittence have been intensively studied in the past 15 years and we are now gradually gaining understanding of drying impacts at the river network scale, where fragmentation alters spatiotemporal patterns of flows of sediments, nutrients and both aquatic and terrestrial organisms. As an interdisciplinary group of 80+ scientists from Europe, North and South America and China, the European project DRYvER is modelling the current and future hydrological, ecological and socio-economical responses of river networks to drying. Here, we will present our preliminary results related to the effects of current drying on 9 river networks scattered across Europe and South America.

## SEPURE: New fish stocking solutions for ponds in France

Mr Léo Girard[1], Dr Joël Aubin[2], Dr Marielle Thomas[3], Dr Thomas Lecocq[3], Dr Joël Robin[1], Mr Aurélien Tocqueville[4], Ms Jésabel Laithier[4], Dr Alexandrine Pannard[5], Dr Julie Coudreuse[6], Mr Marc Roucaute[2], Dr Christophe Jaeger[2], Dr Aurélie Wilfart[2], Mr Quentin Latourre[2], Ms Marie Maillot[2], Dr Michael Corson[2], Mr Mathieu Guerin[1]

[1]Isara, Agroecology and Environment Unit, University of Lyon, Lyon, France, [2]UMR SAS, INRAE, Institut Agro, Rennes, France, [3]UR AFPA, Université de Lorraine, INRAE, Nancy, France, [4]ITAVI, Rouen, France, [5]Université de Rennes 1, UMR 6553 CNRS Ecobio, Rennes, France, [6]Institut-Agro, Agrocampus-Ouest, Rennes, France

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*I am a PhD student in agroecology at Isara, in the Agroecology and Environment unit. I also have an engineering background in agronomy. I work on fishponds in the framework of the European project Ponderful. My research focuses mainly on the links between fish farming management practices and the maintenance of biodiversity and ecosystem services provided by these environments, but also on the challenges of climate change.*

Freshwater fish ponds are agro-ecosystems that provide important ecosystem services (ES) to territories, notably by hosting a recognized biodiversity. In France, the low profitability of freshwater ponds for fish production runs the risk that they will be abandoned, and thus that the ES they provide will disappear. The FEAMP SEPURE project brings together scientists from different backgrounds (agronomy, ecology, biology, modelling, environmental sciences) to link farmers' practices, economic and environmental performances and pond responses by monitoring water quality, phytoplankton, zooplankton, benthic macroinvertebrates, aquatic macrophytes and fish communities. Based on the analysis of the contexts and expectations expressed in Dombes, Lorraine and Brenne-Sologne, eleven scenarios with different species assemblages were co-designed with fish farmers. They took into account many parameters, such as the complementarity of species according to their trophic and behavioral traits, water availability, water temperature in summer, the existence of local and national markets, the presence of submerged vegetation, the depth of the ponds, feeding and liming practices, and the use of the ponds for other activities (e.g. hunting). In 10 production sites, farmers applied these scenarios, and practices and ecosystems were monitored. The new data generated by the SEPURE project should help support decision making for the future development of the pond sector and help maintain this economic activity in the territories.

# Setting up of novel eDNA-based tools for supporting sturgeon repopulation monitoring plans

Dr Caterina Maria Antognazza[1], Fausto Ramazzotti[2], Antonella Bruno[2], Dr Andrea Galimberti[2], Dr Monica Di Francesco[3], Dr Serena Zaccara[1]
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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am a biologist, holding a PhD in conservation genetics. My research work and studies performed since 2013 focused on molecular ecology.*

*My experience involved research in conservation genetics of species protected by legislation or in a vulnerable status. The main purpose was the production of information for stakeholders, able to provide useful knowledge for prioritizing conservation actions and guidelines in conservation management.*

The southern European basin (Po River, Italy) is a complex freshwater ecosystem flowing into one of the most populated European regions (Po plan). The whole ecosystem is largely altered and impacted by human activities and recently also climatic stressors, like long and frequent drought periods, are threatening the associated freshwater habitats and their communities. In the last years, more attention has been spent on conservation management of local fauna, both promoting conservation strategies of target species and recovering habitat connectivity through projects of river defragmentation. In this context, the reintroduction of sturgeon species (Huso huso and Acipenser naccarii), extinct since '70s, represents one important goal of ecosystem restoration programs. In the last years reintroduction plans have been promoted in Ticino natural park (i.e. LIFE project), that is one of the main alpine Po River tributaries. In order to verify and assess the efficiency of repopulation programs, novel molecular approaches based on environmental DNA (eDNA) detection are going to constitute a gold standard to support monitoring actions. For this reason, two Taqman-based assays, specific for the two sturgeon's species have successfully been developed by using the mitochondrial cytochrome b region and quantitative polymerase chain reaction (qPCR) and validated through in silico (i.e. bioinformatics tools), in vivo (i.e. use of tissues as positive controls), and in situ (water sampling in aquaculture and natural contexts) trials. The application of this assay will enhance the monitoring efficiency of the next repopulation programs.

# Shredders’ diversity and identity play a role in mitigating multiple stressors’ impact. Insights from a microcosm experiment

Mr Valentin Dinu[1], Mrs Darmina Nita[1], Dr Cristina Popescu[1], Dr Ioana Enache[1], Prof Geta Risnoveanu[1]
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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*

*Bachelor in Ecology, Master in Ecology, currently PhD student at Doctoral School in Ecology. My research topic is focused on “The impact of multiple stressors on benthic shredder invertebrates’ communities from low-level streams”.*

*Main topics of interest: invasive plant species and leaf litter decomposition. I was involved in the implementation of CROSSLINK project – Research project aiming at improving understanding of aquatic-terrestrial linkages in stream networks – as a Research Assistant, involved in all practical aspects from data collection to analysis regarding litter decomposition and riparian vegetation, as well as other projects.*

Benthic freshwater detritivores play a significant role in the decomposition of leaf litter detritus. Leaf hardness, leaf nutrient content and secondary compounds in different types of leaves shape the shredders' communities in a stream. By feeding on leaf litter, invertebrates lead to a rapid fragmentation of leaves and incorporation of plant material into secondary production. Little is known about the simultaneous effects of fine silt accumulation caused by hydromorphological changes and food quality reduction caused by invasive plant species in riparian areas (such as Fallopia japonica). To distinguish between the impacts of the pressures outlined above on benthic shredder populations and the decomposition process, we developed a full factorial microcosm experiment. The experiment, lasted 10-12 days and mimicked the changes in sediment particle size and food quality. Here, we show that the native food (A. glutinosa) has a faster decomposition rate than the invasive food (F. japonica). We also found that the shredder’s diversity mitigates the impact of anthropogenic stressors in streams while the shredder’s identity modulates the effects of the individual and combined stressors. Our results might help managers of freshwater biodiversity adapt and use the best conservation measures.

# Silver linings: Challenges and opportunities in the restoration of lowland stream watersheds in the Netherlands

Dr Jip de Vries[1], Ralf C. M. Verdonschot[1]
[1]Wageningen Environmental Research, Wageningen, Netherlands

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Jip de Vries is interested to find ways to convey understanding of our dependence on and connection with functional ecosystems around us. During her PhD at University of Amsterdam, she studied the impact of multiple stressors on aquatic ecosystems from a biological point of view. Currently, she is working at Wageningen Environmental Research to continue the translation of and cooperation between aquatic ecological sciences and the practices of water management. She currently works on the restoration of stream ecosystems on catchment to reach scales. Furthermore, she likes to spend her free time outside, cycling, dancing, or making music.*

The extreme drought and flood events in recent years have aggravated the negative ecological consequences of the extensive hydrological and morphological degradation of lowland stream watersheds in the Netherlands. This has put populations of sensitive species with habitat requirements associated with stable hydrological regimes under severe pressure. The situation has led to calls to action by both freshwater researchers and water managers to restore watersheds on the catchment scale. The aim is to retain, store and delay the discharge of rainwater in the headwaters and to allow more space for the inundation in the stream valleys further downstream. However, despite ambitious goals being set, restoration of lowland steam watersheds in practice appears hard to implement. In a series of interviews with stakeholders the underlying causes were investigated, ranging from a limited insight in water system functioning to contradictory management or restoration goals. However, the expressed reasons also offered ways to improve the effectiveness of the current and future watershed restoration projects. A visual representation is given of the challenges and opportunities that Dutch water managers experience when they aim for catchment-scale restoration of lowland stream ecosystems. Furthermore, the poster presentation also aims at giving the floor to the audience, to reflect on their experiences with challenges and opportunities with restoration in practice and how these relate to the findings of the presented study.

# Sludge degradation, nutrient removal and reduction of greenhouse gas emission by a Chironomus-Azolla wastewater treatment cascade

Mr Tom van der Meer[1,2], Ms Lisanne Hendriks[3], Dr. Michiel Kraak[2], Prof. dr. Piet Verdonschot[1,2], Prof. dr. Fons Smolders[3,4], Prof. dr. Leon Lamers[3], Dr. Annelies Veraart[3]
[1]Wageningen Environmental Research, Wageningen, the Netherlands, [2]Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Amsterdam, the Netherlands, [3]Department of Aquatic Ecology and Environmental Biology, Radboud Institute for Biological Sciences, Radboud University, Nijmegen, the Netherlands, [4]B-WARE Research Centre, Nijmegen, the Netherlands

7E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Tom van der Meer is a PhD candidate studying the biogeochemical dynamics during macroinvertebrate mediated sludge degradation. Focus of this research is how the functional traits of (combinations of) different species of macroinvertebrates affect sludge degradation rates and distribtution of nutrients and contaminants. His research combines ecology and ecotoxicology and takes place at the Institute for Biodiversity and Ecosystem Dynamics (Amsterdam) and Wageningen Environmental Research.*

WWTPs remain a point source of organic and inorganic contaminants and nutrients, negatively impacting the discharge-receiving surface. Moreover, during the treatment process, greenhouse gases (GHGs) are emitted, contributing to climate change and large volumes of excess sludge are produced. Therefore, there is an urgent need for WWTP post-treatment techniques that further reduce the nutrient concentrations in the effluent, as well as the amount of produced sludge, while having a minimal GHG footprint. As macroinvertebrates and floating plants play an important role in the degradation of organic matter, nutrient dynamics, and GHG emissions in WWTP impacted systems, they could also be used for the treatment of WWTP sludge and effluent. To this end, we designed an experiment consisting of a recirculating cascaded setup with a wastewater treatment sludge compartment containing bioturbating Chironomus riparius larvae, and an effluent container containing the floating plant Azolla filiculoides. To calculate the N, P and C mass balance of this system, we measured nutrient concentrations, biomass production, and sludge degradation, as well as the N, P and C content of all compartments in the cascade during the 26-day experiment. We found additive effects of C. riparius and A. filiculoides, as the larvae enhanced sludge degradation and sludge oxygenation, limiting P and $NH_4$ fluxes from the sludge, but promoted C and N fluxes, while Azolla removed accumulated P, N and C in its biomass, increasing $CO_2$ uptake. Applying macroinvertebrate-plant cascades may therefore be a promising tool to tackle the present and future challenges of WWTPs.

# Space invaders: their effects, and methods for management in Madagascar

Mr Jonathan Greenslade[1]
[1]Wildfowl & Wetlands Trust, Slimbridge, England

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***
*Researcher with the Wildfowl and Wetlands Trust working to conserve wetlands for native species and people in the UK, Cambodia and Madagascar.*

*Previously gained a master's with distinction from Imperial College London and has varied experience including research in Spain, Fiji, Ascension Island, Mexico and Madeira as well as supervising a project in Botswana.*

Madagascar contains a unique repository of phylogenetic information for freshwater fish species. The north-west of the country is a particular hotspot for almost 100 native and endemic species, which are under one of the highest risks of extinction globally and are in urgent need of attention for conservation. Unfortunately, there is a current lack of data to help us understand the multitude of increasing threats facing remaining populations. Known threats include habitat loss, sedimentation, overfishing, and invasive fishes for which at least 24 species have been introduced since the 19th century including the blotched snakehead and at least 8 tilapiine species. The effects of such species on Madagascan freshwater ecosystems are not well understood, and even less so are the practical methods with which to sustainably manage or control them. This study seeks to fill these knowledge gaps by collating published evidence from studies in other countries with similar invasive species threats. We provide potential solutions for the management of these invasive fishes, whilst paying attention to how they can be implemented sustainably when working towards improving food security for people in the region. Finally, we provide recommendations for essential areas of future research and ground-truthing of these theories before any implementation is carried out. We aim for this research to provide the latest evidence and practical guidance in the fight to protect Madagascar's unique and threatened freshwater fish species from extinction.

# Spatial and temporal variations of benthic macroinvertebrate communities in Lake Kastoria, Greece

Mrs Athina Patsia[1], Mrs Dimitra Kemitzoglou[1], Mrs Efpraxia Mavromati[1], Mrs Vasiliki Tsiaoussi[1]
[1]The Goulandris Natural History Museum/Greek Biotope-Wetland Centre, Thermi, Greece

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Mrs Dimitra Kemitzoglou is a biologist, MSc. She has been working at The Goulandris Natural History Museum – Greek Biotope / Wetland Centre since 2006, where currently she is Technical Manager of the Water Quality Laboratory. Since 2012, she has been working on the implementation of the national monitoring network for lakes, in accordance with WFD. She has supported the Ministry of Environment in water quality issues (contribution to assessment methods, reports, representation in working groups etc). She has undertaken the implementation of various projects related to conservation and management of natural resources, some of which received European recognition.*

Lake Kastoria, in northwestern Greece, is a shallow urban natural lake. The objectives of this study were a) to investigate spatial and temporal variations of benthic macroinvertebrate communities in Lake Kastoria and b) to assess the lake water quality with the use of a WFD-compliant national method. Samplings were undertaken at the littoral zone of the lake at 5 selected sites during spring 2017 and 2021, according to the Hellenic Lake Littoral Benthos (HeLLBI) assessment method. Non-metric multidimensional (NMDS) scaling and one-way analysis of similarity percentages were applied to visualize similarities and to identify the taxa responsible for the discrimination in benthic macroinvertebrate communities between different sampling periods, among sites and water quality classes. In total, 5569 individuals were collected and 37 taxa groups were identified. NMDS plot provided a useful display of the actual multivariate distance among samples (stress value: 0.14). Benthic invertebrate communities showed considerable spatial variation at local scale (sampling site level) except for one site but no clear temporal variation. The mean EQR value of HeLLBI showed moderate water quality of the lake. All sites showed no change in their water quality across time except for 2 sites that improved (poor to moderate and good respectively). Benthic macroinvertebrates communities at good water quality sites differed in composition and showed higher biodiversity compared to those at moderate and poor sites. Management measures should be site-adapted in Lake Kastoria and priority could be given to the conservation and restoration of the littoral zone.

# Spatial prioritisation of barrier removal in stream networks

Dr Virgilio Hermoso[1], Dr Filipa Filipe[2], Dr Miguel Clavero[3]
[1]Universidad de Sevilla, Sevilla, Spain, [2]Universidade de Lisboa, Lisboa, Portugal, [3]EBD-CSIC, Sevilla, Spain

4B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*

*I am a conservation biologist, especially interested on how to best manage threats to the persistence of biodiversity under dynamic conditions and limited resources. My work involves an interdisciplinary approach, from ecology to mathematics and computing science, to understand the ecological and socio-economic problems behind the decline of biodiversity and ecosystem services and provide novel methods and tools to address them. I am currently leading the Environmental Decision-making research group, focused on the evaluation of the adequacy of policy and management efforts to halt biodiversity loss and the development of data to help make better informed decisions.*

Barriers are a widespread impact in freshwater ecosystems worldwide, disrupting connectivity along river networks and key processes. Restoration of connectivity has risen in the last decade, and has become a priority in the EU associated with the need of reconnecting 25,000 km of rivers by 2030.
We demonstrate how Marxan, a publicly available tool, can be used to prioritise the allocation of barrier removal projects. We mapped the distribution of >900 barriers in the Tagus River (Spain and Portugal) and 29 freshwater fish species with different movement abilities and needs. We assessed the passability of each barrier by all species and relative removal cost. We then identified priority barriers for removal to achieve recovery targets of connectivity of populations of all species simultaneously. We tested two alternative scenarios: i) locking out barriers assesses as non-removable for their high strategic value or removal cost and ii) making all barriers available for removal.
We found that connectivity recovery targets could be achieved by removing a small proportion of barriers, and avoiding large infrastructure. However, for some species, large recovery targets could only be achieved by removing some of these large infrastructures at high increases in cost.
Our study demonstrates how to use a robust optimisation approach in an accessible tool, to address the complexity of prioritisation exercises commonly faced by stakeholders when deciding where to invest in barrier removal projects. This can help improve decision-making for river connectivity restoration through a transparent, reproducible, and better-informed approach than traditional opportunistic or ranking-based approaches.

# Spatio-temporal dynamics of habitat use by fish in a restored alluvial floodplain over two decades

Miss Anaëlle Bouloy[1], Dr Jean-Michel Olivier[2], Dr Jérémie Riquier[3], Dr Emmanuel Castella[4], Dr Pierre Marle[4], Dr Nicolas Lamouroux[1]
[1]INRAE – UR Riverly, Villeurbanne, France, [2]Univ Lyon, Université Claude Bernard Lyon 1, CNRS, ENTPE, UMR 5023 LEHNA, F-69622, Villeurbanne, France, [3]Université Jean Monnet Saint-Étienne, CNRS, UMR 5600 – Environnement-Ville-Société, F-42023, Saint-Etienne, France, [4]Department F.-A. Forel for environmental and aquatic sciences and Institute for Environmental Sciences, University of Geneva, Geneva, Switzerland

4B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*The six authors work in the framework of the RhônEco project that aims at the development and test of quantitative predictions of the ecological effects of river restorations. The project focuses on the Rhône River in France and on the restoration outcomes upon physical habitat (Lamouroux N.), fish communities (Olivier J.M., Marle P., Bouloy A.), aquatic macroinvertebrates (Castella E., Marle P.) and sediment dynamics (Riquier J.), both in the river and floodplain channels*

Floodplain channels of rivers can serve as reproduction, nursery or refuge areas for fish. Although the complementary use of floodplain and main channels is known, few studies attempted to quantify this use and even fewer analysed its controlling factors. The objectives of this study are (1) to describe the spatio-temporal use of floodplain habitats and to identify their roles as complementary habitats for fish and (2) to analyse how abiotic variations and their modifications under restoration impact habitat use by fish. To meet these objectives, we analysed multi-site data collected over 20 years in eight restored sectors of the Rhône River. Results show that habitat use by fish is mainly related to spatial effects. As expected, rheophilic species were more abundant in lotic stations and limnophilic species in lentic ones. In addition, we identified an euryecious guild, grouping youngs of the year taxa, that used all types of habitats and particularly lentic floodplain channels with short life-span. Temporal effects combine (1) the effect of restoration, particularly in floodplain channels for which the connectivity regime was modified, (2) the effect of high flows upon the habitat use by fish that reinforces the nursery and refuge functions of floodplain channels. To conclude, our results demonstrate the importance of restoring habitat diversity and connectivity because habitats may have complementary functions for fish. Furthermore, our results also highlight that it is essential to account for temporal variations in order to better estimate the potential effects of restoration on river and their floodplains.

# Species distribution models and molecular analyses indicate climate change promoted population expansion during the last glacial maximum for a caddisfly group in the Tibeto-Himalayan Region

Mrs Xiling Deng[1,2,3,4], Dr. Sami Domisch[4], Dr. Adrien Favre[5], Prof. Sonja C. Jähnig[4,6], Dr. Paul B. Frandsen[3,7,8], Dr. Fengzhi He[4,6,9], Dr. Deep Narayan Shah[10], Dr. Ram Devi Tachamo Shah[11,12], Dr. Qinghua Cai[13], Prof. Steffen U. Pauls[1,2,3]
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5G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*

*XilingDeng is a doctoral candidate at Senckenberg Research Institute and Natural History Museum in Frankfurt and Justus-Liebig-University Gießen. Xiling conducted her research on the evolution and phylogeography of a caddisfly group in the Tibeto-Himalayan Region. Xiling is also interested in the spatial biodiversity patterns of caddisflies in mountain areas.*

Caddisflies are a holometabolous insect group that the larvae inhabit an aquatic environment and the adults are aerial and terrestrial. Thus, unlike other aquatic taxa or terrestrial taxa, caddisflies strongly rely on an aquatic environment but still have the ability to disperse over land for a long distance, especially during a long time period. To evaluate the influence of historical climate change on caddisflies in mountain areas, we constructed a species distribution modelling on a group of caddisflies in the Tibeto-Himalayan Region for the last glacial maximum (LGM) and the present day. Considering the unique life habits of caddisflies, we included hydrological connectivity as additional information to build a spatially-explicit SDM. Afterwards, we compared the SDM with the population demographic history of each species. The results revealed that the potential habitats of these caddisfly species remarkably increased during the LGM and thus resulted in a demographic expansion. Our study indicates that climate fluctuations during the LGM promoted a local or regional movement of caddisflies along the elevational gradient accompanied by species expansions in the Tibeto-Himalayan Region.

# Stable carbon (δ13C) and nitrogen (δ15N) isotopic composition differentiation of Eloeda canadensis in the two types of lakes (softwater and hardwater) of northern Poland

B.S. Wiktoria Bączkowska[1], M.Sc.  Marek Merdalski[1], Dr hab. Krzysztof Banaś[1], Dr Eugeniusz Pronin[1]

[1]University of Gdańsk, Faculty of Biology, Departmant of Plant Ecology, Gdańsk, Poland

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*My scientific interest is hydrobiology, ecology and biogeochemistry. I currently work in the Department of Plant Ecology, University of  Gdansk, where I realise my scientific project related to the carbon and nitrogen stable isotopic composition of the plant, sediment and water from soft-water lakes in northern Poland. Moreover, I came back to hardwater lakes and focused on the carbon and nitrogen stable isotopic composition of plants' organic matter and comparison with soft-water ecosystems.*

A study of δ13C and δ15N values in Elodea canadensis was performed to check how those values differ in 17 lakes in northern Poland. We also checked which of the available environmental variables had the more significant influence on the recorded isotopic values of investigated plant. The plant material for this study was collected in 2008-2011 from 78 sites. We also used the measurements in the close location of plant sites (in many cases, in particular places of plant sites) of physicochemical parameters of water and sediments collected for further analysis. Our result shows that the values δ13C and δ15N of E. canadensis differ. The values of δ13C and δ15N were higher in softwater lakes than in hardwater lakes ($Z=-2.33$, $p < 0,05$; $Z=-2.73$, $p < 0,01$ U Mann-Witney test for δ13C and δ15N respectively). The results are as follows: the median of δ13C in softwater lakes equals -16,75‰; in hardwater -17.99‰. The median of δ15N in softwater lakes equals 1.34‰; in hardwater lakes -0.24‰. The Principal Components Analysis (PCA) was performed to check the differences between two types of lakes. The PCA analysis segregated the two groups of lakes (hardwater - 9 lakes and softwater - 8 lakes). Among physicochemical variables the conductivity, Ca2,+ and HCO3- ions concentration had negative relationships with δ13C. For δ15N values the relationships with all variables were negligible. UGrants–start program 533-D000-GS21-22 financed the study, and the study was also financially supported by Polish National Science Centre under project No 2019/32/C/NZ8/00147.

# Stable carbon (δ13C) and nitrogen (δ15N) isotopic composition differentiation of the three pondweeds in lakes of northern Poland

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[1]University of Gdańsk, Faculty of Biology, Gdańsk, Poland, [2]University of Gdańsk, Faculty of Biology, Departmant of Plant Ecology, Gdańsk, Poland

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*My scientific interest is hydrobiology, ecology and biogeochemistry. I currently work in the Department of Plant Ecology, University of Gdansk, where I realise my scientific project related to the carbon and nitrogen stable isotopic composition of the plant, sediment and water from soft-water lakes in northern Poland. Moreover, I came back to hardwater lakes and focused on the carbon and nitrogen stable isotopic composition of plants' organic matter and comparison with soft-water ecosystems.*

A study of δ13C and δ15N values in three pondweeds (Stuckenia pectinata, Potamogeton perfoliatus, Potamogeton crispus) was performed to check how those values differ in 21 lakes in northern Poland. We also checked which of the available environmental variables had the more significant influence on the recorded isotopic values of investigated pondweeds. The study was performed to increase the still not recognising enough knowledge about the main factors shaping the values of δ13C and δ15N of submerged aquatic plants. The plant material for this study was collected in 2008-2011 from 108 sites. In the field, the basic measurements of the physicochemical parameters of water were checked. Moreover, water and sediment samples were collected for further analysis in the close location of plants sites. Our result shows that the values δ13C and δ15N differ in three pondweeds (K-W H test $Z= 17.74$ and $Z =29.31$, $p < 0.001$ for δ13C and δ15N respectively). The higher δ13C values were recorded for S. pectinata and the lowest for P. perfoliatus and were statistically significant (post-hoc Dunn test with Bonferroni corrections, $p < 0.01$). For δ15N, the highest values were recorded for P. perfoliatus and the lowest for S. pectinata (Dunn test, $p < 0.001$) and the average for P. crispus. The essential variables for δ13C and δ15N were conductivity, $Ca^{2+}$, $HCO_3^-$ and nutrient concentrations. UGrants–start program 533-D000-GS21-22 financed the study, and the study was also financially supported by Polish National Science Centre under project No 2019/32/C/NZ8/00147.

## Stable carbon and nitrogen isotopes of invertebrate remains: a glimpse of food web structure change?

Dr Maarten Van Hardenbroek[1], Dr Hannah Robson[2], Dr Geoff Hill[3], Prof Matthew Wooller[4]
[1]School of Geography, Politics and Sociology, Newcastle University, Newcastle upon Tyne, United Kingdom, [2]Wildfowl and Wetlands Trust, Slimbridge, United Kingdom, [3]Higher Education Funding Council for England, Bristol, United Kingdom, [4]Alaska Stable Isotope Facility, Water & Environmental Research Center, Alaska Quaternary Center, University of Alaska Fairbanks, Fairbanks, United States

5F_RS08_The past is the key to the future: the role of palaeoecology in understanding and managing fresh waters, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*My research is focused on understanding the processes that cause environmental change – both natural or anthropogenic – and their impacts on aquatic ecosystems. I do this by studying lakes and sediment records from lakes as they contain evidence of environmental change happening over long time periods (from centuries to millennia). I am fascinated by the impact of humans on ecosystem structrual change.*

Assemblages of microscopic remains in sediment records provide a wealth of information about past environments. A further step can be taken by analysing stable carbon and nitrogen isotopes (δ13C and δ15N) of plant and invertebrate remains. Offsets in δ15N (trophic position) and δ13C (energy source) between organisms gives insights in food web structure and energy flow. Here we present a pilot study from Loch nam Fear in the Flow Country, Scotland. The assemblage composition of macrophytes and invertebrates indicated a distinct change in aquatic community around 1990 reflecting the 1986-9 establishment of a conifer plantation 500m from the lake. A 1-3 permille decrease in δ15N of plant and zooplankton remains suggest that the conifer plantation had a strong impact on nitrogen cycling and possibly led to reduced aquatic food chain length.

# Stable isotope ($^{15}N$) labelling facilitates the measurement of macroinvertebrate dispersal across species and feeding types

Mr Julian Enss[1,2], Dr. Milen Nachev[1,2], Pd. Dr. Christian K. Feld[1,2]
[1]University Duisburg-Essen, Essen, Germany, [2]Centre for Water and Environmental Research (ZWU), Essen, Germany

2C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Julian Enß is a doctoral researcher at the University of Duisburg-Essen, specialising in the field of aquatic ecology. With a focus on macroinvertebrate dispersal, Julian studies the movement and distribution of these organisms in their aquatic and terrestrial habitats. His research has important implications for the conservation and management of aquatic ecosystems, as well as for our understanding of the effects of environmental change under multiple stressors. Julian is a dedicated researcher committed to advancing knowledge of the natural world and its protection, and his work has the potential to inform policy and practice in the field of aquatic ecology..*

Macroinvertebrate dispersal plays an important role for recovery of streams from multiple stressors. Predictions of the dispersal capabilities of macroinvertebrates often rely on indirect proxies at species level (e.g., dispersal traits) rather than on actual dispersal measurements at the individual specimen level. This renders predictions of dispersal highly uncertain. Using stable isotope enrichment ($^{15}N$), we non-invasively labelled large quantities of macroinvertebrates at eight sites in sand-bottom lowland streams of Germany. At each site, between 15 and 40 g $^{15}NH_4Cl$ were dissolved in 40 l pure water and slowly released to the water column over a period of 42 days (enrichment). During enrichment, flow measurements were frequently taken at all sites. After enrichment, benthic invertebrates, phytobenthos, and coarse particulate organic matter (CPOM) were sampled repeatedly to evaluate the enrichment with and depletion of $^{15}N$ in the biomass over a distance of up to 2 km downstream of the release point. In order to estimate the total number of labelled individuals, larval density and adult emergence of selected species were determined using hand nets and emergence traps, respectively. Overall, between approx. 45.000 (Potamophylax rotundipennis) and 4.000.000 (Gammarus sp.) individuals could be labelled with $^{15}N$ at the eight sites. Species-specific results show that enrichment was highest in grazers (and phytobenthos) as compared to shredders (and CPOM) and predators. Our findings show that isotope enrichment is suited to label large quantities of macroinvertebrates across species and feeding types, thus providing a sound basis for the measurement of their dispersal distances and rates.

# Stable or increasing trends of macroinvertebrate richness in Swiss rivers

Dr Nele Schuwirth[1], Friederike Gebert[1,2], Martin K. Obrist[2], Rosi Siber[1], Florian Altermatt[1], Kurt Bollmann[2]
[1]Eawag, Dübendorf, Switzerland, [2]WSL, Birmensdorf, Switzerland
5D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Nele Schuwirth is head of the department Systems Analysis, Integrated Assessment and Modelling at Eawag, head of the Ecological Modelling group and lecturer at ETH Zurich. Her main research interests are:*

*1) the development of mechanistic and empirical models for aquatic ecosystems; use of these models for improving our understanding of ecosystem functioning and for the prediction of effects from measures or changing environmental influence factors; application of Bayesian techniques for model calibration and uncertainty analysis.*

*2) ecological assessment and multi-criteria decision support for environmental management to support decisions with multiple objectives and multiple stakeholder perspectives.*

Stream macroinvertebrates are highly valued bioindicators for water quality and important contributors to biodiversity. We compared cantonal and national monitoring programs regarding the change of macroinvertebrate richness over time [1,2]. While the national data covered the last decade, all cantonal data sets together covered a time range from 1977 to 2021. Overall, the results were rather consistent: the number of macroinvertebrate families per sampling site was stable or increasing over time in most cantons studied, as well as in the national monitoring programs.
Warm-adapted species increased at montane and (sub)alpine zones, while cold-adapted species showed stable trends at all altitudes. Moreover, common feeding guilds and pesticide-tolerant taxa showed increasing patterns, while rarer feeding guilds and pesticide-sensitive taxa displayed stable trends. Both climate and land-use-related factors were the most important explanatory variables for the observed richness patterns. Causes for the increase in macroinvertebrate families and species at the cantonal and national level could be related to rising temperatures and an improvement in water quality since the late 1970s. However, for a more thorough analysis of the causes, not only uniform data at the species level, but also data on the number of individuals and biomass are needed. Longer time series and a good understanding of the baseline are important to reveal if the increase in warm adapted and pesticide-tolerant species will lead to a decrease in specialized species and a homogenization of biotic communities in the long term.

[1] Gebert et al. 2022, https://doi.org/10.1098/rsbl.2021.0513
[2] Gebert et al. 2022, https://www.dora.lib4ri.ch/eawag/islandora/object/eawag:25875

# Standard vs. Natural: Assessing the impact of environmental variables on organic matter decomposition in streams using three substrates

Dr Verena Schreiner[1], Mr Moritz Link[1], Dr Alexander Feckler[1,2], Ms Liana Liebmann[3,4], Prof Dr Matthias Liess[3,5], Ms Anke Schneeweiss[1], Dr Amélie Truchy[6,7], Dr Wolf von Tümpling[3], Mr Philipp Vormeier[3,5], Dr Oliver Weisner[1,3], Prof Dr Ralf B. Schäfer[1], Prof Dr Mirco Bundschuh[1,6]
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2E_RS10_Biomonitoring, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***

*Verena Schreiner is a postdoctoral researcher at the Institute for Environmental Science at the RPTU Kaiserslautern-Landau, Germany. She studies the effects of multiple stressors with a focus on environmental contaminants on stream ecosystems, spanning from ecosystem functions such as leaf litter decomposition over macroinvertebrate communities to aquatic-terrestrial linkages in food webs. Furthermore, Verena assesses the contaminant exposure in streams using a wide range of techniques including passive and automatic sampling with the aim of improving future monitoring.*

The decomposition of allochthonous organic matter, such as leaves, is a crucial ecosystem process in low-order streams. Microbial communities, including fungi, colonise allochthonous organic material, break up large molecules via exo-enzymes and increase the nutritional value for macroinvertebrates. Environmental variables can affect microbial as well as macroinvertebrate communities and alter their decomposition ability. Studying the relationship between environmental variables and decomposition has mainly been realised using leaves, with the drawbacks of differing substrate composition and consequently between-study variability. To overcome these drawbacks, artificial substrates have been developed, serving as standardisable surrogates. Here, we compared microbial and total decomposition of leaves to the standardised substrates of decotabs and cotton strips, across 70 stream sites in a Germany-wide study. Furthermore, we identified the most influential environmental variables for the decomposition of each substrate from 26 variables including pesticide toxicity, concentrations of nutrients and trace elements using stability selection. In addition, we analysed which environmental variables were most influential for the functioning of fungal communities, namely the fungal biomass (via ergosterol) and the activity of exo-enzymes on leaves. The microbial as well as total decomposition of the standardised substrates (i.e., cotton strips and decotabs) were weak or not associated with that of the natural substrate (i.e., leaves, $r^2 < 0.01$ to $r^2 = 0.04$). Different environmental variables were identified as most influential for the decomposition of the different substrates as well as for the fungal community functioning parameters. Our results imply that standardised substrates are unsuitable surrogates when investigating decomposition of allochthonous matter.

# Stimulant or stressor? Enantio-dependent ecotoxicity of 3,4-methylenedioxymethamphetamine (MDMA) in Daphnia magna

Pedro Costa[1,2], Virgínia Gonçalves[3,4], Maria Tiritan[3,5,6], Cláudia Ribeiro[3,5], Bruno Castro[1,2]
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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Pedro Costa is a grant holder at CBMA (Centre of Molecular and Environmental Biology), University of Minho, Portugal, where he works under the scope of project EnantioTox (Enantioselective ecotoxicity and bioaccumulation studies of psychoactive substances). He has graduated (B.Sc.) in Applied Biology (University of Minho), and later progressed to a post-graduation (M.Sc.) in Toxicology and Environmental Contamination (Instituto de Ciências Biomédicas Abel Salazar, University of Porto), having spent 6 months at the Institute of Environmental Sciences of the Jagiellonian University (Poland), under the Erasmus program. His research interests include ecotoxicology of emergent pollutants and their interaction with other stressors.*

Recently, contamination of surface waters with pharmaceuticals and illicit drugs has become a point of concern since their ecological effects are mostly unknown. Besides, wastewater treatment plants are unable to completely remove many substances, thus releasing them unchanged into the environment. MDMA (3,4-methylenedioxymethamphetamine) is among the most consumed illicit drugs in Europe and its removal in wastewaters is low. Studies on the impact of MDMA on aquatic organisms are scarce, and even scarcer are reports on its enantioselective ecotoxicity. To fill this gap, we tested the toxicity of MDMA as racemate, (<i>R,S</i>)-MDMA, and in isolated enantiomeric forms, (<i>S</i>)-MDMA and (<i>R</i>)-MDMA, on the growth, reproduction and population rate of increase of <i>Daphnia magna</i> (Crustacea, Cladocera). For this purpose, daphnids were exposed for 21 days, under controlled laboratorial conditions, to seven sublethal concentrations (0, 0.10, 0.18, 0.32, 0.56, 1.0, and 1.8 µg/L) of each form. Unlike the racemate, (<i>R,S</i>)-MDMA, which was overall innocuous, enantiomers caused a reduction in <i>Daphnia</i> body size concomitantly with a decrease in fecundity and per capita rate of increase at realistic concentrations. Results were often context-dependent, and it was unclear which of the enantiomers was more toxic, despite previous observations that (<i>S</i>)-MDMA is biologically more active and capable of causing morphophysiological alterations in <i>D. magna</i>. Screening for enantioselective effects of drugs, such as MDMA, is important for accurate risk assessment of chiral pollutants.

# Strategies in the mussel farming of the Capo Peloro area (Sicily, Messina) for the national recognition of a good quality product: when science meets aquaculture activities

Dr Carmen Rizzo[1], Rosario Calogero[1], Giuseppe Cangemi[1], Chiara Giommi[1], Cristina Pedà[1], Maria Cristina Mangano[1], Teresa Romeo[1,3]
[1]Stazione Zoologica Anton Dohrn, , Italy, [2]Institute of Polar Sciences, CNR, Messina, Italy, [3]National Institute for Environmental Protection and Research - ISPRA, Messina, Italy

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I'm Researcher at Stazione Zoologica Anton Dohrn, Messina. My main research activities are focused on microbial ecology and marine biotechnology. I'm interested in studying prokaryotic populations in aquatic temperate and extreme environments, their structure and distribution related to environmental conditions and pollution, and their biotechnological potential in bioremediation, medical, pharmaceutical fields.*

Fishing and aquaculture activities are important field of Italian production chains, as source of food of high nutritional value and employment. Currently, mussel farming in the Lake Faro (Sicily, Messina Capo Peloro) is conducted according to traditional methods, with the use of polypropylene socks. Recently, the Lake Faro has obtained the recognition of sanitary status of Zone A, the best quality waters for shellfish farming. Therefore, it is important now to undertake all possible strategies for conferring to the mussels of the lake the denomination of controlled origin. Here we present the main goals of our project, consisting in the improvement of the mussel production in the Capo Peloro area; identification of the environmental conditions influencing the organoleptic characteristics of the products; create a continuous monitoring system as tool to provide for mussel farmers; perform the comparison between the genome of the two autochthon and allochthone products farmed in this area.
The use of high technological tools such as control units, and the experimentation of nurseries to extend the breeding period are foreseen in the project. Among the innovative interventions proposed by the project, there is also the intention to start trials of farming with the use of innovative biodegradable materials (i.e., Mater-Bi). The monitoring and improvement of the environmental conditions will allow a revaluation of the high cultural and scientific value Capo Peloro area in the view of the circular economy and climate changes. All the approaches and preliminary results will be discussed.

# Stream food webs between degradation and recovery – the history of a multiple-stressed urban stream catchment

Ms Alexandra Schlenker[1], PD Dr. Mario Brauns[1], PD Dr. Patrick Fink[1,2], Dr. Armin Lorenz[3], Prof. Dr. Markus Weitere[1]
[1]Helmholtz Centre for Environmental Research (UFZ), Department River Ecology, Magdeburg, Germany, [2]Helmholtz Centre for Environmental Research (UFZ), Department Aquatic Ecosystem Analysis, Magdeburg, Germany, [3]University of Duisburg-Essen, Aquatic Ecology, Essen, Germany

2C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Alexandra Schlenker (M.Sc. in Hydrobiology) is a doctoral researcher in the River Ecology Department of the Helmholtz Centre for Environmental Research (UFZ), Magdeburg, Germany. With the help of stable isotopes, Alex analyses food web responses to multiple stressors and their recovery in stream ecosystems.*

Effects of multiple stressors on stream ecosystems and their recovery are often analysed with a focus on structural community parameters such as species richness and community composition. However, not only biodiversity but also ecosystem functions may be affected by stressor increase and release. By assessing food webs, a community's structure can be linked to its function, e.g. energy and matter pathways and fluxes. In order to analyse the effect of stressor recovery on food web structure, we measured stable isotopes ($\delta^{13}C$, $\delta^{15}N$) from benthic macroinvertebrate communities sampled annually over 11 years at different stream sites in the Boye River catchment (North Rhine-Westphalia, Germany). All sites had formerly been used as open sewers and were restored between 1993-2011. We analysed responses of food web parameters, e.g. food chain length, resource diversity, and trophic niche width, and linked them to time since restoration. Our results show that time since restoration affects food chain length positively. Additionally, resource diversity showed a negative response to time since restoration; probably the increasing amounts of leaf litter input with re-growth of the riparian vegetation became the dominating food source with time. Overall, our study demonstrates the value of food web analysis for multiple stressor and restoration research by combining complex structural and functional responses.

# Stream Insect Responses to Aquatic-Terrestrial Ecotone Degradation

Mr Elmar Becker[1], Dr Ralf Verdonschot[2], Dr Arie Vonk[1], Dr Michiel Kraak[1], Prof Dr Piet Verdonschot[1,2]
[1]University of Amsterdam, Amsterdam, the Netherlands, [2]Wageningen Environmental Research, Wageningen, the Netherlands

7G_RS20_Aquatic terrestrial linkages, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Elmar Becker is PhD-candidate at the University of Amsterdam, from which he also received his BSc and MSc in Biology and Aquatic and Marine Biology, respectively. Currently his PhD work focusses on the responses of the insect assemblages of lowland streams to riparian habitat degradation and how this can inform restoration efforts. Key topics of interest are trait-habitat interactions, and the behavioural and developmental responses of invertebrates to environmental stressors. Side interests are ecotoxicology and wetland ecology.*

Extensive human alterations of streams and floodplains for agriculture and urbanisation have rendered many of these systems morphologically and ecologically degraded. In the Netherlands, less than five percent of the streams are considered to have (near) natural courses and high ecological quality. In such undisturbed streams, an extended lateral gradient forms the interface between aquatic and terrestrial habitats, which harbours a rich and diverse invertebrate assemblage. By degrading this interface, human alterations can assert strong negative effects on stream and adjacent wetland communities through multiple, potentially interacting pathways on multiple spatiotemporal scales. However, these processes are not fully understood, hampering the effectiveness of restoration measures. Stream insects are, due to their reliance on both the aquatic and terrestrial parts of the habitat, and their sensitivity to key stressors, uniquely suited to study the effects of degradation and the restraints for restoration of the aquatic-terrestrial interface. The present study aimed to assess the responses of stream insects to aquatic-terrestrial ecotone degradation. To this end we monitored the assemblages of nine stream reaches and their riparian zones, with different levels of hydromorphological degradation, in three catchments in the Netherlands. With this design, inter- and intra-catchment effects of hydromorphological degradation on the insect assemblage were separated. Furthermore, both aquatic and terrestrial stages were sampled for 15 months, using complementary methods. The species were identified using DNA meta-barcoding. This study elucidated the effects of hydromorphological degradation on stream insect responses to stream ecotone degradation and therefore paves the way toward successful restoration measures.

## Strength in numbers: a lake community project for ensemble modeling

Johannes Feldbauer[1], Dr. Jorrit Mesman[3], Dr. Robert Ladwig[2], Prof. Thomas U. Berendonk[1], Dr. Thomas Petzoldt[1]
[1]TU Dresden, Dresden, Germany, [2]University of Wisconsin-Madison, Madison, USA, [3]Uppsala University, Uppsala, Sweden

5G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Born 1989, München*

*2010 - 2014 B.Sc. Environmental Sciences, Eberhardt-Karls Universität Tübingen, Germany*

*2014 - 2017 M.Sc. Hydrosciences and engineering, TU Dresden, Germany*

*since 2018 PhD student TU Dresden, Germany*

While the lake modeling community has recognized the benefits of using ensembles of mechanistic models, the additional work of setting up and streamlining inputs and outputs for several models has hindered their broad application. To overcome these obstacles the R package LakeEnsemblR was developed in a community effort. The package enables the user to setup and run an ensemble of up to five different vertical one-dimensional hydrodynamic lake models (FLake, GLM, GOTM, Simstrat, MyLake) forced by the same input. In first applications the ensemble has been used to simulate climate impact scenarios for local lakes and reservoirs and we are preparing to run multi-lake climate impact simulations as part of the Inter-Sectoral Impact Model Intercomparison Project. The local case study on a drinking water reservoir in Germany demonstrates the opportunities of using an ensemble by quantifying and comparing different sources of uncertainty and their effect on the projection of climate impact. For the multi-lake data set we have calibrated the ensemble and want to provide a first comparison of the model performances in relation to the lake characteristics. These results can help to identify strengths and weaknesses of the applied models and further improve our mechanistic understanding. In the presentation we want to highlight some of the advantages and challenges of using an ensemble approach.

# Submerging networks in freshwater ecosystems

Dr Fredric Windsor[1]
[1]Cardiff University, Cardiff, United Kingdom
8A_RS15_Science dissemination/communication & education, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*I am a network ecologist interested in understanding how individuals and species within freshwaters interact with one another. In my research, I apply a range of techniques from gut content analysis through automated processing of video footage to answer fundamental and applied questions around the assembly, structure and function of ecosystems.*

Research in freshwater ecosystems has always had a strong focus on ecological interactions. The vast majority of studies, however, have investigated trophic interactions and food webs, overlooking a large suite of non-trophic interactions (e.g., facilitation, competition, symbiosis and parasitism) and wider ecological networks. Without a complete understanding of all potential interactions, ranging from mutualistic through to antagonistic, we may be missing important ecological processes with consequences for ecosystem assembly, structure and function. Ecological networks can be constructed at different scales, from genes to ecosystems, but also local to global, and as such there is significant opportunity to put them to work in freshwater research. To expand beyond food webs, we need to leverage technological and methodological advances and look to recent research in marine and terrestrial systems – which are far more advanced in terms of detecting, measuring and contextualising ecological interactions. Future studies should look to emerging technologies to aid in identifying the wide range of ecological interactions in freshwater ecosystems to advance the field and ultimately increase the efficacy of conservation, management, restoration and other applications.

# Synchronisms and antagonisms in the relations between agricultural environment, biodiversity and ecological functions in a constructed wetland

Mr Alexandre Michel[1], Ms Aliénor Jeliazkov[1], Mr Jérémie D. Lebrun[1], Mr Cédric Chaumont[1], Ms Virginie Archaimbault[1], Mr Mathieu Girondin[1], Ms Soline Bettencourt-Amarante[2], Ms Julie Tonial[1], Ms Fatima Joly[1], Mr Anthony Herrel[2], Mr Julien Tournebize[1]
[1]Inrae, UR HYCAR, CS 10030, 92761 Antony Cedex, France, [2]UMR 7179 CNRS/MNHN, Département Adaptations du Vivant, 75005 Paris, France

8E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*I am Alexandre MICHEL, a 25 years old french PhD. I get a bachelor's degree and a master's degree in biology-ecology-ecotoxicology at the "Université Reims Champagne-Ardenne" (URCA). Then I became a PhD in the fields of ecology-ecotoxicology. My thesis focuses on a constructed wetland for which one wonders if it is viable for the aquatic fauna.*

Pesticides are present in air, water, soil and biota at concentrations sometimes higher than quality standards, proposed for protecting the environment and wildlife. In agricultural landscapes, constructed wetlands, as nature-based solutions, enable the depollution of water contaminated with nitrates and pesticides through natural processes. However, such artificial ecosystems can also act as contaminant reservoirs likely to affect biodiversity. The site making the object of this study is the constructed wetland of Rampillon (CWR, Northeast of France, Brie region) which was constructed to collect water from a 355 ha subsurface drained catchment under intensive agricultural practices. Since 2012, the site is instrumented to monitor continuously physicochemical parameters and pesticides concentrations. In addition, faunistic inventories are frequently performed within the CWR. This work aims at determining whether the CWR is viable for the aquatic wildlife and associated ecological functions through a multi -taxa, -scale, -response approach. The focus is on amphibians and benthic macroinvertebrates. The first results show: (i) concordances between period of high biological activity in amphibians and macroinvertebrates and high pesticide exposure levels, and (ii) spatial variations in litter breakdown between upstream and downstream of the CWR in relation with pesticide concentrations. In addition, biochemical and morphological biomarkers are studied in amphibians to assess their health status and to determine whether pesticides are responsible for the observed effects.

## Taxonomic and functional reorganisation in Central European stream macroinvertebrate communities over 25 years

Dr Alessandro Manfrin[1,2,3], Dr Francesca Pilotto[4,5], Dr Stefano Larsen[6], Dr Jonathan D Tonkin[7,8,9], Dr Armin W Lorenz[3], Prof Peter Haase[3,10], Prof Stefan Stoll[2,3]
[1]RPTU University of Kaiserslautern-Landau, iES Institute for Environmental Sciences, Landau/Pfalz, Germany, [2]University of Applied Sciences Trier, Environmental Campus Birkenfeld, Birkenfeld, Germany, [3]University of Duisburg-Essen, Faculty of Biology, Essen, Germany, [4]Umeå University, Environmental Archaeology Lab, Department of Historical, Philosophical and Religious Studies, Umeå, Sweden, [5]Norwegian Institute for Nature Research (NINA), Oslo, Norway, [6]Fondazione Edmund Mach, Unit of Computational Biology, Research and Innovation Centre, San Michele all' Adige, Italy, [7]University of Canterbury, School of Biological Sciences, Christchurch , New Zealand, [8]Centre of Research Excellence in Complex Systems, Te Pūnaha Matatini, , New Zealand, [9]Lincoln University, Bioprotection Aotearoa, Canterbury , New Zealand, [10]Senckenberg Research Institute and Natural History Museum Frankfurt, Department of River Ecology and Conservation, Gelnhausen, Germany
3F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Dr A. Manfrin is a community ecologist, postdoc at the RPTU in Landau and coordinator and supervisor of the Research Training Program SystemLink. AM interests include theoretical and applied ecology, conservation, and evolution in freshwater and terrestrial ecosystems. AM combines observational and experimental studies, in both field and laboratory settings, to better understand the interactions between multiple abiotic and biotic stressors and structural and functional responses in communities. AM developed particular competence in the analysis of large spatial and temporal datasets using advances statistical modelling approaches.*

Climate warming can lead to a replacement of species that favour cold temperatures by species that favour warm temperatures. However, the implications of such thermic shifts for the functioning of ecosystems remain poorly understood. Here, we used stream macroinvertebrate functional traits to quantify the relative contribution of cold, intermediate and warm temperature-adapted taxa to changes in community functional diversity using a dataset of 3,781 samples collected in Central Europe over 25 years, from 1990 to 2014. Our analyses indicated that functional diversity of macroinvertebrate communities increased over the study period. This gain was driven by a net increase in the richness of taxa that favour intermediate temperatures which comprise the highest share in the community, and to an increase in the richness of taxa that favour warm temperatures. These taxa displayed a distinct and more diverse suite of ecological traits compared to taxa that favour cold temperatures, and thus contributed disproportionately to local functional diversity on a per-taxon basis. Taxonomic heterogeneity at the regional scale declined significantly within each thermal group, in association with increasing local taxon richness, suggesting a progressive homogenisation, with communities converging towards similar taxonomic composition. As the reported increase in local functional diversity can be attributed mostly to the intermediate temperature-adapted taxa and a few expanding warm temperature-adapted taxa, these patterns could mask more subtle loss of sensitive cold temperature-adapted taxa with irreplaceable functional traits. Considering increasing climate warming, preservation of cold habitat refuges should be considered a priority in river conservation.

# Taxonomic and functional response of chironomids (Diptera: Chironomidae) to climate change: a long term study of a tufa barrier in Plitvice Lakes, Croatia

Mrs Valentina Dorić[1], Dr Ivana Pozojević[1], Dr Viktor Baranov[2], Prof. Zlatko Mihaljević[1], Assoc. Prof. Marija Ivković[1]
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3E_RS10_Biomonitoring, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*My name is Valentina Dorić, I am a Ph.D. student at the University of Zagreb in Zagreb, Croatia. My main area of interest is freshwater monitoring and I specialize in chironomids so I investigate how chironomids are used in freshwater monitoring and how they can improve existing models for habitat evaluation. I am also lucky to be a part of long-term research on Plitvice Lakes so I can see how the chironomid community responds to climate change.*

Plitvice Lakes National Park is located in the Dinaric region of Croatia, it consists of 16 oligotrophic, dimictic and fluvial lakes divided by tufa barriers. The goal of this study is to evaluate effects of climate change on the chironomid composition of tufa barrier Kozjak - Milanovac. Adult chironomids were collected from 2007. until the end of 2020. using emergence traps at tufa barrier Kozjak - Milanovac. Water temperature was measured daily, 2 times a day using data loggers. Current velocity was measured monthly during collection of the animals. Discharge values were provided by Croatian Meteorological and Hydrological Service and data on organic material by Plitvice Lakes NP. More than 13 000 chironomids belonging to more than 80 taxa were collected during the 14 years. Increase in water temperature, velocity, discharge and amount of organic material was detected. Chironomid abundance and species richness did not change over the years but species composition and trophic structure did. Abundance of active filtrators and detritivores like Polypedilum scalaenum and Tanytarsus signatus declined and abundance of rheophilic passive filtrators like Rheotanytarsus reissi and R. curtistylus increased. Overall abundance of predators decreased but abundance of Rheopelopia maculipennis, a predatory species usually found among tubes of Rheotanytarsus genus, increased in these new conditions characterized by increased frequency and strength of spates. Although species richness and abundance did not change over the years species composition did. Species-level identification, as time-consuming as is, remains key for achieving a fine resolution of the early community response to various disturbances.

# Taxonomic and genetic diversity of caddisflies across latitudinal and altitudinal gradients in the Pyrenees (NE Spain): A vulnerability approach

Señorita Nieves López-Rodríguez[1,2,3], Carlos Raúl Acosta[4,5], David Cunillera-Montcusí[1,9,10], S.U. Pauls[6], Oskar Schröder[6], Bina Perl[6], Julio Schneider[6], Pello Isasi-Bea[1,2], Romina Álvarez-Troncoso[7], Pau Fortuño[1,2], José María Fernández-Calero[1,2], Guillermo Quevedo-Ortiz[1,2], María Soria[1,2,8], Narcis Prat[1,5], Miguel Cañedo-Argüelles[4,5], Nuria Bonada[1,2]
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5D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*

*I'm a Ph.D. student between the University of Barcelona and the company Eurofins-Cavendish. My research focuses on different applications of metabarcoding techniques in aquatic macroinvertebrates in Mediterranean rivers. We use fundamental approaches to determine taxonomic, functional and genetic diversity, conservation patterns and conservation areas in high mountain streams in the Pyrenees (NE Spain) and applied approaches using eDNA as a bioindicator of macroinvertebrates in temporary rivers.*

Global change (GC) is already affecting the structure and functioning of freshwater ecosystems, especially those isolated as high mountain streams. Trichoptera are one of the most important, diverse and endemic taxonomic orders in these ecosystems. Our aim was to analyze the spatial and seasonal variability of taxonomic and genetic diversity of caddisflies in 17 streams in the southern Pyrenees covering an elevational gradient, and to assess their vulnerability to GC. We sampled Trichoptera larvae in spring and summer and in three sites for each stream, with site 1 located close to the stream source or glacier, and sites 2 and 3 downstream after incorporating tributaries. We identified larvae combining traditional taxonomic methods and metabarcoding by using two primer pairs. We calculated taxa vulnerability to GC using biogeographic, ecological and biological traits, and used this to calculate site vulnerability. Site vulnerability, taxonomic and genetic alpha diversity showed a west-east pattern, with significant changes between spring and summer samples. Beta-diversity was higher for sites 3, especially in spring, most likely as a consequence of upstream movement of downstream species 3. Overall, our findings provide information to anticipate the effects of GC on aquatic biodiversity and to guide future conservation actions in these vulnerable ecosystems.

# Temporal disturbance of a model stream ecosystem by high microbial strain diversity from treated wastewater

Mr Tom Lennard Stach[1], Guido Sieber[2], Manan Shah[1,2], Sophie A. Simon[1], Andre Soares[1], Till L. V. Bornemann[1], Julia Plewka[1], Julian Kuenkel[1], Christian Becker[3], Folker Meyer[4], Jens Boenigk[2], Alexander J. Probst[1,5]
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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

The microbial community of freshwater streams plays a crucial role in ecosystem services being a cornerstone in central biogeochemical cycles. In densely populated areas, streams are under permanent stress by effluents of wastewater treatment plants, which can make up more than half of the total water during dry conditions. Yet, the effects of wastewater microbiome and resistome on the community of a previously anthropogenic stressed river remain largely unknown. Here, we show that the introduction of treated wastewater results in a temporal, but drastic change of the bacterial and viral community returning to the reference state within ten days by coupling a mesocosm approach (AquaFlow) to full-length 16S rRNA gene Nanopore sequencing and strain-resolved metagenomics. In this indoor mesocosm setup, two metal flow channels filled with stream sediment are connected to three water tanks. For ten days, restored river water with and without added treated wastewater (30%) was run in circle in triplicates and sampled for DNA-based analyses. As revealed by strain-resolved metagenomics, treated wastewater introduced a high bacterial and viral diversity that diminished over time. Analyses of the encoded resistome showed that low abundant microbes introduced additional antibiotic resistance genes (ARG) in treatment systems, yet resistant microbes from the reference stream were responsible for an increase of total ARG counts after ten days. We conclude that a substantial introduction of wastewater only temporarily alters the microbial community of a previously stressed river which seems to be resilient to a repeated stressor impact.

# Temporal dynamic of aquatic invertebrates in ephemeral wetlands on arable land

Alžbeta Devánová[1], Dr. Jan Sychra[1], David Výravský[1], Alexandra Černá[1], Dr. Michal Šorf[2], Dr. Jindřiška Bojková[1], Prof. Michal Horsák[1]
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6E_RS05_Small water bodies, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Alžbeta Devánová is a PhD. Student at Masaryk University in Brno. She focuses on ephemeral wetlands on arable land, studying their biodiversity and temporal dynamics. She also deals with large branchiopods, especially their biotic interactions and predictors of their distribution in northern Pannonia.*

The length of the aquatic phase has a strong influence on aquatic invertebrate communities and their temporal dynamics. These dynamics were studied primarily in temporary wetlands with long hydroperiods, where significant changes in species and functional community composition were observed. In contrast, no species replacement was observed in extremely ephemeral pools. To examine dynamics in pools with short but not extremely ephemeral hydroperiods, we focused on 10 ephemeral wetlands which develop spontaneously directly on arable land. Their hydroperiods ranged from 5 to 11 weeks. We observed significant changes in community composition, including species replacement. Temporal dynamics differed between macroinvertebrates and microcrustaceans and between groups of macroinvertebrates using different feeding and dispersal strategies. Copepods dominated the first half of the aquatic phase, while Cladocerans were most abundant during the second half of the aquatic phase. Passively dispersing macroinvertebrates, i.e. annelids, molluscs, and large branchiopods, reached their highest abundances in the middle phase. Insect abundance increased over time and was highest during the drying phase. Because we did not observe a significant effect of any environmental variable on community change over time, we hypothesise that dynamics were driven primarily by biotic interactions and differences in species dispersal strategies. This study makes an important contribution to our knowledge of the temporal dynamics of aquatic invertebrates. Unlike in pools with extremely short hydroperiods, we found clear dynamics in the assemblage composition. However, there were virtually no responses to changing environmental conditions as in temporary wetlands with long hydroperiods.

# Temporal dynamics of biodiversity in Swiss pondscapes and impacts of the implementation of pond Nature-based Solutions (NBS).

Ms Julie Fahy[1], Eliane Demierre[1], Prof. Beat Oertli[1]
[1]University Of Applied Sciences And Arts Western Switzerland, Geneva, Switzerland
3D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Julie Fahy is a PhD student and assistant at the University of Applied Sciences and Arts and at the University of Geneva. She holds a Master in environmental sciences from the University of Geneva, where her thesis revolved around the use of adult dragonflies (Insecta: Odonata) as indicators of the diversity and ecological integrity of alluvial river ecosystems. She is notably interested in the conservation of aquatic communities and their use as ecological indicators. For her PhD thesis, she investigates the long-term resilience and dynamics of freshwater communities in ponds and the impact of NBS implementation on biodiversity.*

Ponds and pondscapes are increasingly recognised as hotspots for biodiversity as well as providers of crucial ecosystem services. Their protection, restoration, and creation constitute efficient Nature-based Solutions (NBS) that benefit both human well-being and biodiversity. However, the impacts of pond NBS implementation on freshwater communities are not always monitored or evaluated. Near Geneva (Switzerland), the last 50 years have seen the implementation of several pond NBS in different pondscapes and for various purposes. Using data from old and recent surveys, we explored the long-term (10-35 years) temporal dynamics of aquatic macroinvertebrate communities and the impact of the implemented NBS for biodiversity at the pond (n=23) and pondscape (n=5) scales. Our results show a general increase in the number of Gastropoda and Coleoptera species at the pondscape level (by 32% on average, $p<0.05$) yet no significant temporal change in richness at the pond level ($p>0.05$), evidencing an increased heterogeneity between ponds. This was confirmed by a slight rise in spatial beta diversity (Sørensen dissimilarity) over the last 20 years. Species turnover between the 2001 and 2021 assemblages was high at the pond level (0.83 on average) and also at the pondscape scale (0.63). The implementation of NBS, which consisted mostly in pond creation, proved here to diversify the studied pond communities, bringing in new species (including threatened taxa) and enhancing the regional diversity.

# Temporary Ponds evolution patterns over three decades and ecological implications for micro- and macroscopic biodiversity

Dr Davide Taurozzi[1]
[1]Università degli studi Roma Tre, Roma, Italia

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Currently, I'm a Ph.D. student at the University of Roma Tre, since January 1, 2023.*

*In 2019 I earned a* ***Bachelor's Degree*** *in* ***Biology*** *with a grade of 91/110, with a thesis on marine ecology.*

*In 2020 I earned a* ***Master's Degree*** *in "****Biodiversity and Ecosystem Management****" with a grade of 110/110, with a thesis on freshwater ecology.*

*My research field is the conservation of Italian Temporary Ponds.*

*In particular, I focus on Temporary Ponds of Central Apennines, improving a project for mapping, monitoring, and characterizing ponds from an ecological point of view, through the use of diatoms and macroinvertebrates.*

Temporary ponds (TP) are unusual habitats seasonally flooded, with a short aquatic phase. They are extremely vulnerable habitats, recognized as priority habitats for the Habitat directive. There have been many controversies regarding the importance of temporary ponds in the past; this presentation will define the parameters to understand why these ecosystems are so worthy of protection and the variations on the ecological status over three decades. Here, we aimed to evaluate both hydroperiod and biodiversity health status of the temporary ponds neglected for more than 30 years. In this study, conducted within "The Presidential Estate of Castelporziano", a protected area in Italy, 169 temporary and permanent ponds were taken into consideration. Over six months of samplings, we found that about 30% of TP surveyed in the 1990's is now completely dry, although the bearings were taken during the wet season. Despite the premise, about 10% of the ponds were new generation, not existing during the last samplings; climate change is strong affecting the lifetime of temporary ponds, reducing the life of some and generating others. The large TP biodiversity was represented by Copepod, Cladocera, Dytiscidae for macroinvertebrates, and Gomphonema, Navicula, Nitzschia for diatoms. Although the minor abundances, Lepidurus spp. and Chirocephalus spp. show high frequencies through the surveyed ponds. These results represent a new database useful for further comparisons and discussions on the climate change effects on TPs.

# Temporary ponds in South-West of France: research, conservation and public awareness

Mrs Cristina Ribaudo[1], Miss Romane Darul[1], Mrs Sabine Schmidt[1], M. Frank Quenault[2], Miss Estelle Jardot[2], Mis Charlotte Dubrueil[2], Mrs Valérie Guéguen[3], M. Jérôme Fouert-Pouret[4], Mrs Barbara Lalève[5], M. Louis Massaloux[5], Mrs Laëtitia Maloubier[6], M. Kévin Royemer[7], M. Anthony Le Fouler[7], M. Pierre Lafon[7], M. Grégory Caze[7], Miss Lola Deschamps[8], M. Alexandre Pryet[1]
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3D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Cristina Ribaudo is a researcher and a teacher, working on the effects of global changes on aquatic ecosystems functioning and services. Much of her research currently underway has a specific focus on aquatic plants within shallow lakes and ponds, and their interplay with the aquatic carbon cycle.*

We present the multiplicity of actions carried out on the natural temporary ponds dotting the low-lying and low-relief marsh grasslands of the Landes de Gascogne (South-West of France). Here, about two thousand oligotrophic ponds develop on a sandy substrate and form biodiversity hotspots, by hosting amphibious assemblages typical of acid peat bogs. They constitute the remnant habitat for wetland organisms within a landscape dominated by intensive crop farming and pine forestry, and are for that subjected to the eutrophication risk. Temporary ponds also play an important role in nutrient cycling and carbon storage. These groundwater-fed systems are particularly at risk of drying up and filling, especially in the context of climate change and human-driven pressures on sub-surface aquifers.
Since 30 years, an active consortium of researchers and territory managers strives for the preservation of those sites, by nature conservation and restoration programs, scientific research and awareness improvement in collaboration with private and public stakeholders. Within the Natura 2000 network and naturalistic programs, a wide database has been constituted through floristic and animalistic observations along many years. Recent research is focusing on the probable loss of ecosystem services, such as carbon storage and aquatic habitat, linked to the perturbation of hydrological cycles. Results from monitoring and scientific research are in turn employed to plan conservation and restoration actions. Outcomes are systematically diffused through environmental education campaigns addressed to citizens, land owners and students, in order to raise public awareness on the topic.

# Temporary ponds of peninsular Spain: past, present, and future perspectives.

Mr Christian Arnanz[1], Mr Pablo Soto-García[1], Ms Marina Tomás-Martín[1], Ms María García-Camargo[1], Ms Laura Serrano[2], Ms Rocío Fernández-Zamudio[3], Ms Carmen Díaz-Paniagua[4], Ms Margarita Florencio[1]

[1]Departamento de Ecología / Centro de Investigación en Biodiversidad y Cambio Global (CIBC-UAM), Universidad Autónoma de Madrid, Madrid, Spain, [2]Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Sevilla, Spain, [3]ICTS-RBD, Estación Biológica de Doñana, CSIC, Sevilla, Spain, [4]Departamento de Ecología y Evolución, Estación Biológica de Doñana, CSIC, Sevilla, Spain

6B_SS18_Driving forward the network on the interpretation, conservation and management of temporary ponds, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*

*Graduate in Biology (2019) and Master in Ecology (2021) by the Universidad Autónoma de Madrid. I have studied the ecological impacts of recreational uses in the Lozoya River, and on the compatibility of amphibian conservation with traditional livestock management practices in drove roads.*

*Currently, i am working on my doctoral thesis in the ClimaRiskinPond project, at the Universidad Autónoma de Madrid, which seeks to create perspectives on the conservation of temporary ponds to face climate change and biological invasions.*

Temporary ponds are characteristic of the Mediterranean region, but despite being designated as priority habitats for conservation, they have serious threats such as land use and climate change, and biological invasions. Moreover, available information of temporary ponds in peninsular Spain is incomplete and scattered. We present preliminary results of a cartographic pond database elaborated from a bibliographic search and contact with experts (ca. 6500 ponds). Furthermore, we performed a comprehensive photointerpretation review about the location and condition of these ponds, detecting visible impacts and estimating the hydroperiod (temporary or permanent ponds). The most frequent impacts were pond edge and basin ploughing (57% and 26% of ponds, respectively). Only 22% showed no visible impacts, and we estimated that 11% have completely disappeared. Notably, we detected a gradient in pond disappearance due to ploughing impacts, indicating that the beforementioned 57% of these ponds are in severe risk. Another major threat is biological invasions, for which a comprehensive review of GBIF and IBERMIS databases is underway to estimate the risk of invasion on a broad spatial scale. Additionally, to assess the current conservation status of the temporary ponds of peninsular Spain, we have conducted a representative sampling along a latitudinal gradient (> 100 ponds), including physicochemical, biotic, and abiotic variables. The concentration of nutrients suggested that 24% of the sampled ponds were anthropogenically polluted, probably due to the input of residues from agricultural activity, which is also responsible for the disappearance gradient of temporary ponds, indicating that conservation actions are urgently required.

# Terrestrial buffer zones improve the ecological state of small ponds located in agricultural areas

Miss Louisa-Marie von Plüskow[1,2], Dr. Pieter Lemmens[1,2], Mr. Maxime Fajgenblat[1,3], Mr. Louis-Marie Le Fer[1,2], Mrs. Mareike Benedix[2], Mrs. Asja Vogt[2], Ms. Mariuxi Peso[1], Mr. Robby Wijns[1], Prof. Dr. Luc De Meester[1,2,4,5], PD Dr. Thomas Mehner[2]
[1]Katholieke Universiteit Leuven, Leuven, Belgium, [2]Institut für Gewässer Ökologie und Binnenfischerei, Berlin, Germany, [3]Data Science Institute (DSI), Interuniversity Institute for Biostatistics and statistical Bioinformatics (I-BioStat), Hasselt , Belgium, [4]Institute of Biology, Freie Universität Berlin, Berlin, Germany, [5]Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), Berlin, Germany

5E_RS05_Small water bodies, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Louisa-Marie von Plüskow is a PhD researcher at KU Leuven and at IGB Berlin. Being part of the Horizon 2020 Project PONDERFUL, she is studying ponds in a multifaceted way. Her research topics range from understanding the drivers of macroinvertebrates and macrophytes diversity and community composition to quantifying greenhouse gas emissions in permanent and temporal ponds. She has a special interest in studying ponds within a socio-ecological framework, investigating the feedback loop between people´s perception of ponds, people´s behavior and pond ecological state.*

Small lentic waterbodies such as ponds have a disproportionally strong contribution to regional biodiversity and provide multiple vital ecosystem services. Yet, they are increasingly exposed to human induced ecosystem alteration, which profoundly undermines their ecological integrity. A large number of ponds in Europe is located in densely populated regions with intensively managed agricultural land. Previous studies have shown that agricultural activities in close proximity of ponds can have strong detrimental impact on the ecological quality of ponds by increasing nutrient loads and favoring phytoplankton at the expense of macrophyte communities. The present study explores the potential of terrestrial buffer zones to reduce the detrimental impact of agriculture on pond trophic state and biodiversity. More specifically, we investigate the effect of buffer zone size on key physical and chemical variables, chlorophyll a, and the community characteristics of macrophytes. We use data from a stratified survey on 30 ponds located in agricultural areas in both Belgium and Germany. Our results suggest that even relatively small buffer zones can already be effective in reducing the negative effect of intensive agriculture in close proximity of ponds, and that increasing the size of the buffer zone leads to a larger effect. This research is part of the EU funded project PONDERFUL in which the role of ponds as nature-based solution for climate change adaptation and mitigation is investigated.

# Terrestrial invertebrates strike back: Colonisation of the dry riverbed by air and ground

Miss Lea Ružanović[1], Dr Fran Rebrina[1], Dr Marina Vilenica[2], Mr Kristian Medak[1], Dr Martin H Entling[3], Dr Andreja Brigić[1]
[1]Faculty of Science, University of Zagreb, Zagreb, Croatia, [2]Faculty of Teacher Education, University of Zagreb, Petrinja, Croatia, [3]Institute for Environmental Sciences, RPTU Kaiserslautern- Landau, Landau, Germany

4A_SS14_Drying rivers in a time of global change, June 20, 2023, 10:30 AM - 12:00 PM

***Biography:***
*Lea Ružanović is a research assistant at the Department of Biology of the Faculty of Science, University of Zagreb, where she obtained her bachelor's and master's degree in Environmental sciences. She is a second-year PhD student working under the supervision of Assist. Prof. Andreja Brigić. She is working on a project that aims to advance our knowledge of the diversity and dispersal patterns of aquatic and terrestrial invertebrate communities of intermittent rivers in Dinaric karst. She is interested in terrestrial invertebrates in intermittent rivers, spider taxonomy, and ecology.*

Intermittent rivers are dynamic habitats that seasonally cease to flow, resulting in a dry phase suitable for colonisation by terrestrial invertebrates. This study aimed to identify dispersal patterns of flying and ground-dwelling invertebrates during the dry phase of the intermittent karst Krčić River in the Mediterranean region of Croatia. Flying invertebrates were sampled in the dry riverbed and riparian habitats using cross-vane window traps in July 2021. In addition, wind speed and directionality were measured continuously. Simultaneously, ground-dwelling invertebrates were collected using pitfall traps in the dry riverbed, riparian, and upland karst habitats. The activity patterns of flying invertebrates differed significantly between day and night, with no direction preference, suggesting that they both laterally colonise and use the dry riverbed as a corridor. We recorded a positive correlation between windspeed and the catch of flying invertebrates in the dry riverbed, suggesting colonisation as part of the aerial plankton. Taxa richness of the ground-dwelling invertebrates was significantly higher in riparian habitats than in dry riverbed and upland habitats, indicating possible spillover. A similar pattern was found for spider assemblages but not for orthopterans. Carabid beetle species richness, abundance, and diversity were significantly higher in the dry riverbed and riparian habitats than in upland habitats. The colonisation of a dry riverbed by flying and ground-dwelling terrestrial invertebrates increases the diversity and may support ecosystem functioning in intermittent rivers. Furthermore, our results indicate that dry rivers with their riparian vegetation may act as a refuge for terrestrial invertebrates during the hot Mediterranean summer.

# Testing food web theory at a continental scale

Dr Zacchaeus Compson[1], Morgan Bucher[1], Medha Gollapudi[1], Madison Peters[2], Roxanne MacKinnon[3], Kaley Cave[1], Megan Malish[4], Stephen Cook[4], Thomas Neeson[4], Daniel Allen[5]
[1]Department of Biological Sciences, Advanced Environmental Research Institute, University of North Texas, Denton, TX, USA, [2]Department of Environmental Sciences, Western Washington University, Bellingham, WA, USA, [3]Faculty of Forestry and Environmental Management, University of New Brunswick, Fredericton, NB, Canada, [4]Department of Geography and Environmental Sustainability, University of Oklahoma, Norman, OK, USA, [5]Department of Ecosystem Science and Management, Penn State University, College Station, PA, USA

8A_RS15_Science dissemination/communication & education, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*I am an Assistant Professor at the University of North Texas with a lab that specializes in food web ecology and environmental genomics. While my work in aquatic ecology is broad and interdisciplinary, intersecting the fields of community ecology, environmental genomics, and stable isotope ecology, food webs are the thread that weaves all of these interests together; they are a key tool I use to understand the growing, global threats to Earth's biodiversity.*

Food webs are powerful tools for biodiversity assessment, yet most food web studies span limited spatial and temporal scales. While modeling has produced a rich literature of food web theory, these ideas are seldom tested empirically. Here, we capitalize on a large, multi-trophic dataset from the U.S. National Ecological Observatory Network (NEON) to generate trait-based, heuristic food webs using a previously published pipeline. We constructed heuristic food webs for NEON streams, across several seasons and years, and extracted their network properties to explore how they vary through space and time, as well as what environmental drivers influence this variation. We then tested several hypotheses predicted from food web theory, but that have not been tested across large spatial and temporal scales: 1) food webs with higher maximum trophic position are more stable temporally, 2) omnivory stabilizes food webs, 3) as food web complexity increases, food web stability increases, and 4) trophic coherence increases food web stability. Testing these hypotheses will yield important insights into how real food webs function over space and time and help to reconcile different ecological predictions that have arisen from food web theory.

# Testing of the applicability of European macrophyte-based monitoring systems for rivers in southern Africa watercourses.

Dr Tinotenda Mangadze[1], Professor Krzysztof Szoszkiewicz[1], Professor Elhadi Adam[2]
[1]Poznan University of Life Sciences, Poznan, Poland, [2]University of the Witwatersrand, Johannesburg , South Africa

3E_RS10_Biomonitoring, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*

*Dr. Tinotenda Mangadze is a Freshwater Scientist at the Poznan University of Life Sciences, Poland. Since completing her PhD in Aquatic Ecology at Rhodes University in 2019, she has undertaken extensive research in water quality assessment using biomonitoring methods and has an excellent track record in scientific publications. Tinotenda has contributed to the advancement of science in various ways through research aimed at developing new tools and strategies to monitor water quality deterioration in aquatic systems and understanding ecosystem health and resilience in the face of persistent stressors and changing environmental conditions.*

Macrophyte-based biological tools are largely lacking in southern Africa, resulting in adoption of tools developed from Europe. In many cases, however, the applicability of these foreign tools to the new system has not been clearly assessed. Thus, the objective of this study was to assess the potential application of the European macrophyte-based monitoring system for rivers in southern Africa watercourses, with the view of stimulating research to develop improved approaches for assessing ecological integrity of rivers in southern Africa. The study compiled the list of aquatic plants for southern Africa using a variety of databases and sources. A set of potential macrophyte indicators for southern Africa was selected based on the list of indicative species which is utilized for European rivers. Three of the most widely used methodological approaches, the European Macrophyte Index for Rivers (MIR), Macrophyte Biological Index for Rivers (IBMR) and the British method Mean Trophic Rank (MTR) were applied to evaluate their suitability for biomonitoring of rivers in southern Africa. Our results confirmed a low number of species utilised in the MIR, IBMR and MTR system which are present in southern Africa region. The results further showed that there is a high degree of macrophyte species separation between the two regions, with just 61 species (32.9%) occurring in both European and southern African rivers. Therefore, we concluded that although macrophyte indices developed in Europe are useful, a macrophyte index unique to southern Africa including endemic species will have to be formulated.

# Testing the limits of a recovering stream community — a salinity gradient experiment in a multiple stressor context

Ms Iris Madge Pimentel[1], Mr. N. A. Serge Mayombo[2], Prof. Dr. Florian Leese[1], Ms. Anna-Maria Vermiert[3], Dr. Arne J. Beermann[1]
[1]Aquatic Ecosystem Research, University of Duisburg-Essen, Essen, Germany, [2]Phycology Group, University Duisburg-Essen, Essen, Germany, [3]Department of Animal Ecology, Evolution and Biodiversity, Ruhr University Bochum, Bochum, Germany

3C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I have studied Biology at the University of Bonn with a focus on Organismic Biology, Evolutionary Biology and Paleobiology. Since 2021, I am a research associate and PhD student at the University Duisburg-Essen. My research is part of the CRC RESIST, which focuses on effects of and recovery from multiple stressors in stream ecosystems. I use ExStream, a stream mesocosm system, to expose macroinvertebrates to common anthropogenic stressors such as salinity, warming and flow velocity alterations, and I use both genetic methods and morphological determination to derive community composition at a high taxonomic resolution and abundance data.*

Salinization of freshwaters resulting from human activities poses an increasing threat to aquatic ecosystems. Particularly streams in urbanized areas are affected by discharge of wastewater and industrial effluents, which often carry high salt loads. Typically, water quality deterioration can be assessed by focusing on indicator groups such as macroinvertebrates and microphytobenthos. However, recurrent exposure might lead to eco-evolutionary adaptations of populations. Consequently, shifts in community composition would not accurately reflect the stress levels, complicating the identification of threats to stream health. We investigated the salinity tolerance of macroinvertebrates and microphytobenthos from a restored river site in a highly urbanized area using ExStream, a stream mesocosm experiment. The communities were exposed to a salinity gradient (+ 0 to + 700 mg/l chloride) under different flow velocities (20 cm/s vs. 10 cm/s). Abundance data for drifting macroinvertebrates and chlorophyll-a concentrations were measured regularly and the communities were sampled after two weeks of stressor exposure to be analyzed with DNA-metabarcoding. Whereas a reduction in flow velocity negatively affected pollution-sensitive taxa and therefore altered macroinvertebrate taxon composition, even high salinity levels had only weak or even no effects on the communities. This salinity resistance is surprising and can be explained by eco-evolutionary adaptations that have altered the communities' response to stress, by incomplete community reassembly after environmental filtering or by a combination of both. Therefore, our data support that the trajectory that communities take and the resulting endpoints do not simply reflect current stress, but are also affected by their preceding stressor history.

# The accuracy and application of GLOBE hydrological data in Croatian schools

Prof Renata Matoničkin Kepčija[1], Mr Ibrahim Hafez El-Noby Abdelrady[1], Mr Danko Biondić[2], Mrs Diana Garašić[1], Mrs Vesna Gulin Beljak[1], Prof Mirela Sertić Perić[1]
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6D_RS17_Science dissemination/communication & education, June 20, 2023, 4:15 PM - 5:30 PM

***Biography:***
*Renata Matoničkin Kepčijas' scientific interest is freshwater ecology, especially protozoan ecology. She studied colonization by periphytic protozoa in karst waters, leaf litter dynamics, and organisms involved in tufa deposition. Part of her research involves the development of classification systems for freshwaters. More recently, she has been studying the effects of ecosystem restoration on protozoa, particularly ciliates and testaceans. She has been involved in the GLOBE program in hydrology for more than 20 years, helping students and teachers with their work. On the Faculty of Science, University of Zagreb she teaches courses on protists and invertebrates.*

Croatian schools have continuously participated in the GLOBE (Global Learning and Observations to Benefit the Environment) program for more than two and a half decades. Schools use numerous standardised protocols, including several on freshwater parameters, to monitor the waters near their school and learn about temporal variability of water parameters, their importance for living organisms, etc. Data are entered into a global, publicly available database that performs basic quality control to ensure use of replicates and accuracy. We analysed GLOBE hydrological data measured by several Croatian schools to test their continuity and accuracy between primary and secondary schools. Several parameters were analysed: water temperature, dissolved oxygen, pH, electrical conductivity, and nitrate concentration for 15 study sites on rivers and streams collected over a 10-year period (2010-2019). Hydrological GLOBE data collected from selected Croatian schools had higher temporal resolution than official monitoring data, but were less accurate. Primary and secondary schools had almost the same level of continuity and precision. These data can be used to analyse long-term trends in rivers and streams, but with quality control to eliminate possible mismeasurements. Through collaboration with scientists, many schools have developed projects on specific topics related to freshwaters that help them improve scientific thinking, develop understanding of freshwater processes, and monitor human impacts. By participating in programmes such as GLOBE, scientists can also present their research and initiate citizen-science measurement campaigns, thereby contributing to the science communication and encouraging educators to do the same among 21st century generations.

# The aftermath of climate change is already heavily present in shallow floodplains: the case of the Kopački Rit Nature Park

Dr Natalija Vuckovic[1], Mr. Mario Rumišek[1], Ms. Viktorija Ergović[2], Mr. Miran Koh[2], Prof. Dubravka Čerba[2], Marina Šumanović[1], Asst. Prof. Marina Vilenica[3], dr. Ivana  Pozojević[1], Prof. Zlatko Mihaljević[1]
[1]Faculty of Science, University Of Zagreb, Zagreb, Croatia, [2]Department of Biology, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia, [3]Faculty of Teacher Education, University of Zagreb, Petrinja, Croatia

3E_RS10_Biomonitoring, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I am a freshwater ecologist working in the Department of Biology, Faculty of Science at the University of Zagreb, Croatia. My research focuses on the community ecology of standing and running waters of natural or anthropogenic origin in general. I am specialized in aquatic Oligochaete taxonomy. I am interested in ecological water quality assessment tools, their improvement and implementation in governing policies.*

The floodplain of the Kopački Rit is situated between the Danube and Drava River. The Danube predominantly affects hydrology within the heterogeneous habitats of the floodplain The research on macroinvertebrates in this floodplain was planned for three years, with 15 different sampling sites and seasonal sampling efforts, all with the aim of determining possible environmental pressures and threats superimposed by climate change. So far, samples of macroinvertebrates were taken in the first and second year using benthos hand nets (totaling in 120 macroinvertebrate samples). The research period coincided with a significant drought with the highest magnitudes recorded in the last 20 years that started in the second year of the research. The research area also shows slow but steady decline in water levels since 1949, when measurements first started. Species richness and number of individuals, plummeted in the second year, even for very tolerant species such as oligochaetes and chironomids. Environmental factors that are normally indicators of eutrophication such as total nitrogen, nitrite and chlorophyll a showed significantly higher values in the year of drought than the year before. It is an additional factor affecting the already burdened benthic macroinvertebrate community. Climate change very soon reviled itself as the main stressor and threat to macroinvertebrate communities and the different floodplain habitats in general. Our unfortunate prediction is that if this trend of reduced rainfall continues, the Kopački Rit Nature Park, although legislatively protected, will have a major negative impact on the entire ecosystem, due to further changes in the climate.

# The aquatic invertebrate communities of urban canals – hidden biodiversity within our towns and cities

Prof Paul Wood[1], Sonia Levy, Dr Heather Swanson, Dr  Kate Mathers
[1]Loughborough University, Loughborough, United Kingdom
6G_RS23_Ditching misconceptions: the ecological diversity of artificial waterbodies, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*
*Paul is an ecohydrologist with research interests the response of instream organisms to hydrological variability and disturbances (including drought, sedimentation, pollution and invasive species) over a range of spatial and temporal scales.*

Canals were historically constructed to transport goods and services from the early stages of the industrial revolution. These canal systems facilitated the transport and delivery of goods around the landscape often linking catchments that were not previously connected hydrologically. Today, the majority of the remaining canal systems provide a recreational resource via angling and pleasure craft from traditional canal boats through to paddle boards. However, the ecology of these anthropogenic systems has been largely overlooked in the academic literature. This paper examines the aquatic invertebrate community associated with the Regent's Canal and two connected canal basins, Kingsland and City Road, in the heart of central London. Despite heavy anthropogenic recreation and limited habitat heterogeneity, a relatively diverse community of invertebrates were found to inhabit the canal system. Each of the three sampled canal areas supported distinct invertebrate communities. Communities were characterised by a dominance of Mollusca and Crustacea and a low proportion of aquatic insects, with around 20% of the fauna being considered non-native or invasive. The greatest number of taxa were associated with emergent and submerged macrophytes. The research raises important questions concerning how we should characterise and value freshwater communities within urban anthropogenic waterbodies.

# The benefits of blue spaces: a global systematic review of cultural ecosystem services provided by wetlands.

Dr Kevin Wood[1], Miss Lucy Jupe[1], Professor Francisca Aguiar[2], Dr Alexandra Collins[3], Dr Scott Davidson[4,5], Mr Liam Kirkpatrick[3], Professor Tatiana Lobato-de Magalhães[6], Dr Emma McKinley[7], Dr Ana Nuno[8,9], Dr Jordi Pagès[10], Dr Antonella Petruzzella[11], Dr Dave Pritchard[12,13], Professor Sidinei Thomaz[14], Dr Jonathan Reeves[1], Dr Sara Thornton[1], Dr Will Wharton-Freeman[1], Professor Hiromi Yamashita[15], Dr Julia Newth[1]

[1]Wildfowl & Wetlands Trust, Gloucester, United Kingdom, [2]Centro de Estudos Florestais, Instituto Superior de Agronomia, Universidade de Lisboa, Lisboa, Portugal, [3]Centre for Environmental Policy, Imperial College London, London, United Kingdom, [4]School of Geography, Earth and Environmental Sciences, University of Plymouth, Plymouth, United Kingdom, [5]Department of Geography and Environmental Management, University of Waterloo, Waterloo, Canada, [6]Faculty of Natural Sciences, Universidad Autónoma de Querétaro, Querétaro, Mexico, [7]School of Earth and Environment, Cardiff University, Cardiff, United Kingdom, [8]Interdisciplinary Centre of Social Sciences (CICS.NOVA), School of Social Sciences and Humanities (NOVA FCSH), NOVA University Lisbon, Lisboa, Portugal, [9]Centre for Ecology and Conservation, College of Life and Environmental Sciences, University of Exeter, Exeter, United Kingdom, [10]Centre d'Estudis Avançats de Blanes (CEAB), CSIC, Girona, Spain, [11]Centre for Biological Control, Rhodes University, Makhanda, South Africa, [12]Gulbali Institute for Agriculture, Water & Environment, Charles Sturt University, Albury, Australia, [13]Ramsar Culture Network, Hexham, United Kingdom, [14]Department of Biology, Universidade Estadual de Maringá, Maringá, Brazil, [15]Environment and Development Cluster, Ritsumeikan Asia Pacific University (APU), Beppu, Japan

7F_RS21_Wetland ecology and management, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*My current areas of research include improving our understanding of the benefits of wetlands, including their role in mitigating climate change through the storage of carbon ("blue carbon"), as well as understanding their provision of socio-cultural services to people and communities. I am particularly interested in understanding the factors that influence the provision of these ecosystem services by wetlands. My research also investigates anthropogenic threats to wetlands and their wildlife, as well as how species respond to conservation efforts. I have worked extensively on diagnosing the demographic and environmental causes of population declines in threated wetland species.*

Wetlands such as marshes, lakes, and rivers, make a disproportionately large contribution to global biodiversity and provide critical ecosystem services for humanity. These benefits include Cultural Ecosystem Services (CES), such as the aesthetic, inspirational, educational, recreational and spiritual values of wetlands. Despite their importance, our understanding of CES provided by wetlands remains limited, with benefits often known only at local scales. To address this knowledge gap, we conducted a global systematic review of wetland CES. Based on data extracted from 858 published papers (1968–2022) in 17 languages, we found evidence of CES provided by wetlands in 175 countries and territories, highlighting that wetlands are globally important for the provision of CES. Recreation/tourism was the most

frequently reported CES (40%), with cultural identity/heritage (16%) and education/learning/knowledge (13%) also well-represented in the literature. In contrast, examples of sense of place (4%) and bequest (4%) were least frequent. We observed a total of 80 recreational activities in wetlands, among which fishing, boating and swimming were predominant. Threats to wetlands and their provision of CES were documented in 45% of papers, and included wetland destruction, pollution, and climate change. Conservation outcomes related to CES, for example greater protection of sacred wetlands, featured in 13% of papers, whilst 10% made applied recommendations related to policy and management. Our study highlights the important links between wetlands and human culture and the implications of this for wetland conservation. These cultural benefits provided to people should inform future wetland creation and restoration projects.

# The biodiversity of boreal ditches in Sweden.

Dr Peta Zivec[1]

[1]Swedish University Of Agricultural Sciences, Umea, Sweden

6G_RS23_Ditching misconceptions: the ecological diversity of artificial waterbodies, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*

*I am currently working as a postdoc at SLU. My research explores patterns and drivers of vegetation, with a particular focus on novel ecosystems and hydrology. I have significant research experience within the riverine and floodplain communities, understanding vegetation responses to hydrological flows and agricultural histories. Currently, I am working on a project understanding the biodiversity of boreal ditches in Sweden.*

This project will investigate the biodiversity of boreal ditches, to better understand how they are fundamentally different or the same to natural streams. Previous work has demonstrated that ditches can have ecological value and environmental functions within boreal and temperate landscapes, acting as aquatic refugia within disturbed areas (i.e. Herzon and Helenius, 2008). Although currently, possible ecological benefits of ditches are poorly understood and accounted for in Sweden. Vegetation surveys will be conducted to better understand species composition and structure of ditches and drivers of biodiversity. Parts of this study will be completed within the Krycklan Catchment Infrastructure, but also a longitudinal study will be undertaken across boreal areas in Sweden. This knowledge will assist in identifying where ditches with high ecological value are likely located within the landscape. The findings will enable better conservation and landscape management to preserve more habitat and biodiversity.

## The case for ecological and water quality criteria in the 21st century

Prof Martyn Kelly[1], Dr Sandra Poikane, Dr Gary  Free, Professor Agnieszka Kolada, Prof Gabor Varbiro, Dr Anne Lyche Solheim, Dr Heliana Teixeira, Dr Fuensanta Salas Herrero
[1]Bowburn Consultancy, Durham, United Kingdom

7B_SS15_Who knows what is "good"? Defining aquatic ecosystem health targets for the United Nations Sustainable Development Goals, national and international policies, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Martyn Kelly is an environmental consultant, a Fellow of the Freshwater Biological Association and an honorary professor at the University of Nottingham, UK. A specialist in phytobenthos, he has developed methods for ecological status assessment for the UK, Ireland, Romania and Greece and has worked with the European Commission on intercalibration (harmonisation) of national methods.  More recently has has worked with the European Commission to develop approaches for setting criteria for nutrients and other "supporting elements".  His blog can be found at www.microscopesandmonsters.wordpress.com and he has also co-curated and contributed to the Flow.State event at SEFS.*

Water quality criteria have been part of the water manager's toolkit for about a century.   In recent decades, these have been supplemented by criteria based directly on ecological responses.   In the 20th century, the criteria were mostly abiotic and broadly applied. Modern developments have tended to focus on either specific types, or even individual, water bodies.  Some studies have even depreciated the role of criteria altogether.   Water quality and ecological criteria, however, should be seen as one step in a process of turning policy into action.  They do this by expressing ambition in terms to which managers and non-ecologists can relate.  Translating policy objectives into quantitative criteria starts a discussion about costs, likely impacts on other sectors and prioritisation of measures. Prioritisation, in turn, determines where more detailed monitoring and specific target-setting may be required.   The problem is that, in Europe, criteria are used for two purposes: classification of water bodies (generating maps which are often the most publicly accessible expression of the state of the aquatic environment) and setting targets for restoration. Fears over the cost of measures can lead to political pressure to justify lenient management criteria.   If these are then used as targets, then expenditure on improving water quality will often not lead to demonstrable improvements in ecology.   Using the Water Framework Directive as an example, we will show how uncertainty inherent in ecological data (including multistressor effects) can be managed in order to generate realistic thresholds that will support good ecological status.

# The combined effects of temperature and pre-exposure on the toxicity of thiacloprid to aquatic insects

Ms Laura Hesselink[1], Ms Karen Villari[1], Ms Eva De Jonghe[1], Ms Carmen Heemsbergen[1], Mr Elmar Becker[1], Dr Michiel Kraak[1]
[1]University of Amsterdam, Amsterdam, Netherlands

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Elmar Becker is a PhD candidate at the University of Amsterdam, from which he also received his BSc and MSc in Biology and Aquatic and Marine Biology, respectively. Currently, his PhD work focuses on the responses of the insect assemblages of lowland streams to riparian habitat degradation and how this can inform restoration efforts. Key topics of interest are trait-habitat interactions and the behavioural and developmental responses of invertebrates to environmental stressors. Side interests are ecotoxicology and wetland ecology.*

Surface waters are frequently polluted with neonicotinoid insecticides, which can have strong negative effects on aquatic insects. Simultaneously, climate change can cause water temperatures to increase, affecting aquatic organisms. Moreover, elevated neonicotinoid concentrations and increased temperature may interact, exposing aquatic insects to a multi-stress environment. Yet, these multi-stressor interactions are not well understood, especially for aquatic insects. Neonicotinoid insecticides are frequently present at sublethal concentrations, which may induce decreased sensitivity to these insecticides through increased tolerance, while simultaneously increasing sensitivity to other stressors through a deteriorated condition. Elevated temperatures, in turn, may increase the sensitivity of organisms to toxicants. Thus, this study aimed to investigate the effect of multi-stress, consisting of exposure to thiacloprid and elevated temperatures, on the mobility of pre-exposed and non-pre-exposed aquatic insects. To this end, chironomid and caddisfly larvae were exposed to a range of thiacloprid concentrations (0 to 125 µg/L) at ambient (19°C) and elevated (24°C) temperatures. Two experiments per species were performed: (1) a 72-hour ecotoxicity test with, and (2) without pre-exposure to a no observed effect concentration of thiacloprid (0.005 µg/L) for 72 hours. We showed that the sensitivity of non-pre-exposed chironomids and caddisflies to thiacloprid was similar at ambient and elevated temperatures. At ambient temperature, pre-exposure to thiacloprid indeed decreased the sensitivity of both test species. Yet, this lower sensitivity was negated at elevated temperatures. It is therefore concluded that pesticide exposure and temperature exhibit a non-linear interaction under multi-stress conditions, elucidating a higher sensitivity of organisms under future exposure scenarios.

# The combined effects of treated sewage discharge and land use on rivers

Dr Dania Albini[1], Ms Lauren Lester[1], Dr Philip Sanders[1], Dr Jocelyne Hughes[1], Associate Professor Michelle Jackson[1]
[1]University of Oxford, Oxford, United Kingdom
4C_SS01_Mechanisms underlying responses to multiple stressors, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Dr. Dania Albini is a Post Doctoral Researcher working on the ecological impacts of single and combined stressors in aquatic ecosystems. She studies the impacts of warming, sewage, chemicals and other stressors using microcosms, mesocosms and field experiments. She is particularly interested in plankton communities.*

*Associate Professor Michelle Jackson is interested in understanding how aquatic ecosystems respond to multiple anthropogenic stressors, such as warming, invasions and pollution events. She has given evidence to the government on sewage pollution, and works on numerous projects related to multiple stressor interactions.*

Freshwater ecosystems are increasingly threatened by multiple anthropogenic stressors. Release of treated sewage and pollution from agricultural and/or urban sources can independently reduce water quality with consequences for aquatic communities. However, little is known of the combined effects of these stressors. We performed a field experiment to study the combined effect of treated sewage discharge and land use on river nutrient concentrations, sewage fungus, macroinvertebrates and benthic algae abundance. Sampling four rivers over four seasons, we found that the interaction between sewage pollution and month of sampling was the best predictor of nutrient concentrations, abundance of algae and sewage fungus. Both macroinvertebrate and algae communities shifted downstream of sewage input. Specifically, more tolerant groups, such as cyanobacteria and crane flies, were more abundant. The Riverfly Macroinvertebrate Score, which indicates water quality, was best predicted by sewage pollution and month too. Overall, our results show that sewage discharge has a significant impact on water quality and benthic riverine communities, indipendently of the surrounding land uses. We need improvements to wastewater treatment processes to reduce threats to vulnerable freshwater communities.

# The Duhallow Farming for Blue Dot Catchments EIP Project - a case study of a results-based agri-environment scheme focussed on the protection and restoration of high-status rivers in an agricultural catchment in North Cork, Ireland.

Mike O Connor[1]
[1]IRD Duhallow, Cork, Ireland

4B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 10:30 AM - 12:00 PM

***Biography:***

*Mike O' Connor is the Project Ecologist for the Duhallow Farming for Blue Dot Catchments EIP Project. His responsibilities include farm planning, farmer training, monitoring of project measures and monitoring of water quality to target project measures. Mike is a firm believer in the importance of science communication and has worked both professionally and voluntarily on several community engagement projects in Counties Cork and Limerick to raise awareness of water quality and heritage and to train citizen scientists.*

Under the Water Framework Directive all waterbodies in EU member states are required to achieve at least good ecological status by 2027. Furthermore, waterbodies are not to be allowed to degrade in status, thus those that are currently or were previously achieving high status on a regular basis must continue to do so. Ireland still has a relatively high percentage of waterbodies achieving high status compared to most other European countries, however these have been rapidly declining in recent decades. Indeed, the EPA's most recent Water Quality in Ireland (2016-2021) report showed a net decline in the number of high-status waterbodies in Ireland from the previous monitoring period (2013-2018). Agriculture in Ireland is a major pressure on water quality and has been identified as a significant pressure in 22% of at-risk high-status waterbodies. The Duhallow Farming for Blue Dot Catchments EIP project is a five-year (2019-2023), €1.47m project focussed on the protection and restoration of high-status rivers in an agricultural catchment in North Cork. The project is now in its final year and is at full capacity with 100 participating farmers. These farmers are rewarded for 'farming for blue dot catchments' using the results-based approach, and additional funding is provided for innovative capital works that reduce runoff and sediment deposition from farm yards, roads and pastures. Knowledge transfer also plays an important role in the project and the project team work closely with the farmer at each stage, from the selection of measures to the scoring of habitats.

## The dynamics of resources, consumers and ecosystem functions across a river network naturally fragmented by drying.

Dr Romain Sarremejane[2], Ms Teresa Silverthorn[1], Ms Angélique Arbaretaz[1], Ms Amélie Truchy[1], Nans Barthélémy[1,3], Dr Naiara Lopez-Rojo[4], Mr Arnaud Foulquier[4], Mr Laurent Simon[3], Mr Hervé Pella[1], Mr Gabriel Singer[5], Dr Thibault Datry[1]
[1]INRAE, Lyon-Grenoble Auvergne-Rhône-Alpes, UR RiverLy, Villeurbanne, Cedex, France, [2]Nottingham Trent University, Nottingham, Royaume-Uni, [3]Université Claude Bernard Lyon 1, Ecologie des Hydrosystèmes Naturels et Anthropisés , Villeurbanne, France, [4]Univ. Grenoble-Alpes, Univ. Savoie Mont Blanc, CNRS, LECA, Grenoble, France, [5]University of Innsbruck, Department of Ecology, Innsbruck, Austria

4A_SS14_Drying rivers in a time of global change, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Romain is a research fellow at Nottingham Trent University. In 2021-2022, he contributed to a collaborative research project investigating the effects of fragmentation by drying on organic matter cycling across aquatic–terrestrial river habitats at INRAE (France).*

In rivers, detrital organic matter (OM) is decomposed by diverse communities of organisms, including microorganisms and invertebrates, along the river network and across terrestrial-aquatic boundaries. Drying naturally fragments most rivers, disrupting network-scale connectivity and thus preventing communities from reaching and consuming their resources, thereby modifying OM transfers across ecosystems. However, little evidence of the effects of drying on network-scale OM cycling and dependent communities exists. We examined the effects of fragmentation by drying on the structure of consumer communities and ecosystem functioning within interacting aquatic-terrestrial river ecosystems. To do so, we monitored leaf resource stocks, invertebrate communities and decomposition rates in the instream and riparian habitats of 20 sites in a river network naturally fragmented by drying. Although instream resource quantity and quality increased with drying severity, decomposition decreased due to changes in invertebrate communities and particularly leaf-decomposer abundance. Invertebrate-led decomposition peaked at intermediate levels of upstream connectivity (i.e. proportion of permanently flowing reaches upstream), suggesting that intermediate levels of fragmentation can promote the functioning of downstream ecosystems. Relationships between invertebrate community structure and decomposition instream were weaker at sites with low connectivity and high drying severity, suggesting that such conditions can promote mismatches between communities and their functioning. Decomposition instream was correlated to decomposition in the riparian area, revealing one of the first network-scale evidence of the links between ecosystem functions across terrestrial-aquatic boundaries. Our river network-scale study thus confirms the paramount effect of drying on the dynamics of resources, communities and ecosystem functioning in river networks.

# The ecological disaster in the Oder River of 2022: What lessons can we learn?

Dr Gary Free[1], Dr Wouter van de Bund[1], dr Bernd Gawlik[1], Dr Sandra Poikane[1], Dr Trine Christiansen[2], Dr Caroline Whalley[2], dr Benoit Zerger[3], Dr Rolf-Jan Hoeve[3], Hans Stielstra[3]
[1]EC Joint Research Centre, Ispra, Italy, [2]European Environment Agency, Copenhagen, Denmark, [3]European Commission DG Environment, Brussels, Belgium

7B_SS15_Who knows what is "good"? Defining aquatic ecosystem health targets for the United Nations Sustainable Development Goals, national and international policies, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am an aquatic ecologist, currently employed at Sustainable Resources, Joint Research Centre of European Commission in Ispra, Italy. My research covers several aspects of applied ecology, focusing on aquatic bioassessment and the definition of biological integrity and ecosystem health. Currently, I am leading a pan-European intercalibration work, which has resulted in harmonization of ecological assessment of lakes, rivers and coastal waters. I am involved in a project focusing on nutrient thresholds associated with good ecological quality in lakes and rivers of Europe. I have authored 50 papers on these topics in peer-reviewed journals.*

During summer 2022 massive fish kills totalling approximately 360 tonnes of fish impacted the Oder River. It is almost certain that a substantial toxic algal bloom caused their deaths. The causal species: Prymnesium parvum (Haptophyta), is adapted to brackish salinities. A key factor enabling the proliferation of this species was the high salinity of the river during this time, probably in part resulting from discharges of saline industrial wastewater e.g. from mining. Other contributing factors were the drought and resulting low water levels reducing dilution and flow and also hydromorphological modifications to the river. High nutrient concentrations, especially phosphorus and nitrogen, are also key in promoting such blooms.

We review data collected during the bloom with a special focus on the salinity levels across the catchment and over time. While the disaster was multifactorial, climate change may act to compound pressures accelerating ecological damage. We present a series of recommendations including more active management of pollution management during low discharge events. The setting and implementing of salinity and nutrient standards can play a key role in prevent future bloom events. In addition, a preliminary risk assessment of rivers in Europe is presented.

# The effect of sertraline exposure on the interspecific interaction of freshwater mussel and its fish host

MSc. Katerina Gregarova[1], Ing. Shuran Zhao[1], Ing., Bc., PhD. Katerina Grabicova[2], doc. Ing. PhD. Pavel Horky[1], doc. Mgr., PhD. Roman Grabic[2], prof. Mgr., PhD. Ondrej Slavik[1], prof. Ing., PhD. Tomas Randak[2], Ing., PhD. Karel Douda[1]

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6F_SS11_Understanding ecological complexity of freshwaters under a chemical stress context, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*

*Katerina Gregarova is a current PhD candidate undertaking her research at the Czech University of Life Sciences Prague, where she focuses on the effects of the emerging pollutants on freshwater organisms and their interspecific interactions, mainly through ecotoxicological experiments and implications of their results at freshwater ecosystems. Furthermore, she also studies the associated ecosystem services of the freshwater organisms, particularly the freshwater filter feeders. She is involved in a Pan-European research network, which works on the standardisation of sampling methodology of the ecosystem services of freshwater mussels.*

The subject of freshwater ecotoxicology has been lately increasing in its popularity across scientists around the world, due to an increasingly recognized rise in concentrations of contaminants in freshwater systems and their possible impacts on the organisms inhabiting these systems. While many of these studies follow the impact of contaminants on a single organism, the knowledge of the effects on the host-parasite relationships is still insufficient, despite multi-trophic systems being particularly vulnerable to chemical stress. This study uses a full factorial 2x3 design following the exposure to different concentrations of globally used antidepressant drug, sertraline, on the interspecific interaction of parasitic larvae (glochidia) of freshwater mussel Unio tumidus and its fish host Squalius cephalus. The sertraline was applied at an asymmetrical exposure design with separate exposure of fish and glochidia. The findings of this study indicate that the exposure of sertraline at high concentrations (4 μg L-1) have significant effects on multiple parts of the interaction from both the fish and the larvae perspective, which could extensively affect the ecology of the whole ecosystem, mainly due to the effect on the reproductive success of the mussel and physiology of its fish host. These findings create a base for future studies following interspecific interactions of the freshwater organisms.

# The effects of pollution with polyethylene terephthalate (PET) fibers on microbial community functioning in the hyporheic zone: a 2-years field study

Mrs Tjaša Matjašič[1,2], Dr. Tatjana Simčič[1], Dr. Tjaša Kanduč[3], Dr. Oliver Bajt[1], Dr Zoran Samardžija[3], Dr Nataša Mori[1]
[1]National Institute of Biology, Ljubljana, Slovenija, [2]Jožef Stefan International Postgraduate School, Ljubljana, Slovenija, [3]Jožef Stefan Institute, Ljubljana, Slovenija

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*My research work encompasses ecosystem studies of freshwaters, both groundwater and surface. I am primarily interested in functioning and role of transitional areas between different ecosystems (groundwater-river, floodplains, springs) and the impact of anthropogenic disturbances on the structure and ecosystem processes. Concurrently, I am working on taxonomy, ecology and biogeography of Ostracoda (Crustacea) and biodiversity conservation and ecosystem services issues. Currently, my research focus is oriented towards better understanding of functional role of gravel bars and hyporheic zone in river and groundwater ecosystems and impacts of multiple stressors, including microplastics on river biofilms and aquatic invertebrate communities.*

The widespread use of plastic materials, which are anthropogenic polymers of different types, is resulting in continuous accumulation of high amounts of larger plastic debris and microplastics (MPs) in freshwaters. MPs are highly heterogeneous particles smaller than 5 mm, differing in origin, polymer type, size, shape, colour, and density. They are extremely persistent pollutants, which can remain for centuries in the environment, can act as long-lasting reactive surfaces for additives, organic matter, and toxic substances and can be a vector for invasive or pathogenic microbial species. The main metabolic pathways in rivers take place in the hyporheic zone and are driven by a diverse microbial community. PET fibers, mainly originating from WWTPs, are among most abundant MP particles contaminating rivers and hyporheic zones. The objective of this study was to investigate in situ whether the presence of PET fibers in riverbed sediments affects the seasonal dynamics of microbial metabolic activities in the hyporheic zone and vary among different river eco-types. The effects of the presence of PET on microbial metabolism were evaluated in situ over two years in different types of rivers (prealpine, karstic) exposed to different pressures (agricultural, urban land use) by measuring total protein content (TPC), and microbial respiration as respiratory electron transport system activity (ETSA) and by community-level physiological profiling (CLPP).

# The effects of woodchips-bioreactors and their aging on nutrient retention in laboratory and field studies

Ms Elmira Akbari[1,2], Tjaša Matjašič[4,5], Anna-Lisa Dittrich[1,2], Katrin Attermeyer[2,3], Ass.Prof. Priv.-Doz. Mag. Dr. Gabriele Weigelhofer[1,2]
[1]WasserCluster Lunz—Biological Station, Lunz am See, Austria, [2]Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences, Vienna, Austria, [3]Department of Functional and Evolutionary Ecology, University of Vienna, Vienna, Austria, [4]Jožef Stefan International Postgraduate School, Jamova cesta 39, Ljubljana 1000, Slovenia, Ljubljana, Slovenia, [5]National Institute of Biology, Večna pot 111, Ljubljana 1000, Slovenia , Ljubljana, Slovenia

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*I graduated from University of Vienna in 2016 with a master degree in Environmental sciences. Currently, I am in the 3rd year of the Ph.D. program in natural resources and life sciences at BOKU in Austria. My research interests are microbial nutrient uptake and multiple-scale flume experiments. My dissertation is a combination of small-scale and large-scale flume experiments that studies the effects of particulate organic carbon on the microbial uptake of nutrients and on the stream metabolism of nutrient-loaded streams in agricultural landscapes. My research is a part of the FTI project "RIBUST" (RIparian BUffer Strips).*

Agricultural streams are heavily polluted by diffuse nutrient inputs. The introduction of particulate organic carbon in the form of woodchip-bioreactors in stream channels has been suggested as a nature-based solution to mitigate nutrient pollution from diffuse sources. This study aimed to evaluate the potential effects of differently aged woodchip-bioreactors on ammonium ($NH_4$-N) and phosphate ($PO_4$-P) retention in stream systems. We performed short-term nutrient plateau additions with and without woodchip-bioreactors in small-scale laboratory flumes, medium-scale artificial outdoor flumes, and three agricultural headwater streams in Austria. Outdoor flumes had a gravel layers on the bottom as substrate for colonization by benthic microbial biofilms. We assessed nutrient retention by calculating $NH_4$-N and $PO_4$-P uptake lengths under plateau conditions based on the nutrient spiraling concept. Fresh woodchips generally released significant amounts of dissolved organic carbon and nutrients into the water. In the presence of pre-leached and -colonized woodchips, however, we observed significantly increased $NH_4$-N and $PO_4$-P retention compared to the control in laboratory flumes, which were more pronounced under dark conditions. In outdoor flumes, $NH_4$-N and $PO_4$-P retention did not differ significantly between woodchips and no woodchips, nor among differently aged woodchips. Under field conditions, pre-leached and -colonized woodchips showed no retention of $NH_4$-N and $PO_4$-P in all three streams. Our results provide insight into the implementation of OC-bioreactors as decentralized mitigation measures for diffuse nutrient loads in streams subject to strong land-use pressures.

# The food web structure of a heavily modified reservoir lake reflects habitat deterioration

Mrs Laura Tack[1], Dr. Harm G. van der Geest[1], Dr. J. Arie Vonk[1], Dr. Michiel H. S. Kraak[1], Prof. Dr. Jef Huisman[1]
[1]University Of Amsterdam, Institute for Biodiversity and Ecosystem Dynamics (IBED), Amsterdam, Netherlands

8A_RS15_Science dissemination/communication & education, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Laura F. J. Tack was born in Nijmegen, the Netherlands. After completing a research master in Freshwater and Marine Biology at the University of Amsterdam she is currently working on her PhD research on food web ecology and energy flows in Lake Markermeer, the Netherlands at the Institute for Biodiversity and Ecosystem Dynamics (IBED), department Freshwater and Marine Ecology (FAME). Besides her PhD research Laura works as an aquatic ecologist for Rijkswaterstaat (Dutch government), advising policy makers and constructing Natura 2000 management plans, thereby directly implementing lessons learned from scientific findings into environmental policy.*

Pristine wetland areas in coastal lowlands range from terrestrial to aquatic and from freshwater to marine, offering a mosaic of habitats which support a high biodiversity. Many coastal wetlands, however, are strongly impacted by human activities, like the reservoir lake Markermeer (the Netherlands). It was originally part of a temperate estuarine system, but through constructions of dikes, nowadays it is virtually isolated from the surrounding aquatic and terrestrial ecosystems. To determine how these impacts influenced trophic relationships and dietary compositions of this shallow reservoir, we characterized its food web structureusing stable isotope analysis and stable isotope mixing models. We observed that the food web of the strongly modified lake Markermeer is supported by only a few organic matter sources. In contrast to natural systems, the stable isotope composition of sediment organic matter reflected pelagic production rather than benthic and external (terrestrial) sources. Thus, most organisms in lake Markermeer rely heavily on pelagically produced organic matter with benthic primary production playing only a minor and seasonal role. This difference in the origin of organic matter in lake Markermeer versus natural estuaries and lakes highlights the strongly modified state of this enclosed ecosystem. These findings offer valuable insights into how the embankment of lakes impacts ecosystem functioning by changing the food-web structure. Finally, we discuss potential restoration measures to enhance benthic primary production and influxes of external organic matter to support lower trophic levels of the food web in this shallow reservoir.

# The freshwater biodiversity crisis: what role do plant invasions play?

Dr Zarah Pattison[1,3], Dr Wayne Dawson[2], Dr Mark Shirley[3], Professor Nigel Willby[1]
[1]University Of Stirling, Stirling, United Kingdom, [2]Durham University, Durham, United Kingdom, [3]Newcastle University, Newcastle, United Kingdom

8D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Zarah is a Senior Lecturer in Plant Sciences at the University of Stirling, Scotland. Zarah's research is focused on the drivers, impacts and management of biological invasions, particularly plants in freshwater habitats. She has a keen interest in the impacts of invasive species on food and water security in East and Southern Africa. Zarah also works on projects related to the safety and equality of researchers conducting fieldwork.*

Freshwater ecosystems, crucial to humanity, are in crisis and require immediate attention. Freshwater biodiversity has suffered a staggering 83% decline since 1970, a rate far exceeding that of marine or terrestrial systems, and one in three of the 28,000 species dependent upon freshwater habitats are considered to be threatened with extinction. Although biological invasions are one of the greatest modern threats to biodiversity, a global assessment of freshwater invasions and how they vary geographically compared to terrestrial species, is still lacking. To quantify the status of invasive aquatic alien plants in freshwater ecosystems globally, we integrated multiple global datasets such as Global Naturalized Alien Flora (GloNAF) and the Global Inventory of Floras and Traits (GIFT). By categorising alien plant species as aquatic or terrestrial; naturalised or invasive, we mapped the global distribution of aquatic invasive alien plants. These data show that aquatic alien plant species are more likely to become invasive when compared to terrestrial plant species, even though they represent <5% of alien flora. We used Structural Equation Modelling to identify which anthropogenic and background environmental variables drive the distribution of invasive alien plants in freshwater habitats globally, and how this differs from terrestrial systems. Understanding these drivers will enable predictions of future invasion risk and promote resilience of freshwaters.

# The freshwater ecosystem framework – integrating connected freshwater ecosystems

Dr Janine Rüegg[1]
[1]Brandenburg Technische Universität, Bad Saarow, Germany
5C_SS05_Freshwater Macroecology research and perspectives, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*My research bridges disciplines and ecosystems. I am interested to understand how organismal and ecosystem sciences can be linked, such as the study of communities or food webs and ecosystem metabolism. Furthermore, I believe that while boundaries between freshwaters facilitate the study of different types of freshwaters, these waters are in the end connected in one freshwater ecosystems and we need to focus more research on understanding the connectivity among different freshwater ecosystems along the flow continuum. Such connections may be different for organisms compared to ecological processes such as metabolism.*

Freshwaters are connected but disciplines rarely move across boundaries even though they can be directly linked such as streams flowing into lakes/wetlands and outlet stream water reflecting upstream lake/wetland characteristics. I propose a framework based on physical, chemical, and biological gradients by which ecological processes between ecosystems or along a sequence of ecosystems could be integrated into continuous freshwater ecosystem. At small scales, tributary waters alter the physical and chemical properties of the recipient ecosystem depending on the resources' gradients and limitations, potentially affecting ecosystem structure and function. Similarly, outflow ecosystems reflect the source ecosystem's characteristics where landscape characteristics will determine the processing and use of the source's resource. Considering the carbon budget of a lake-stream-lake continuum, for example, will likely require the understanding of how water residence time predicts alterations to the lotic organic subsidy and in-lake production of aquatic carbon from inlet to outlet and how stream morphology alters the processing of lacustrine carbon in the outlet. At larger scales, potential carry-over effects to multiple ecosystem (boundary) transitions such as "lake chains" need to be integrated based on landscape characteristics. For example, carbon processing of riverine carbon in lakes and the processing of lacustrine carbon in outlet streams are likely linked to the in- to outflow slopes, lake morphology, and catchment characteristics as well as the stream distance between consecutive lakes. Linking freshwaters along the water flow continuum, by accounting for the interactions of different aquatic ecosystems, is crucial to understanding the freshwater ecosystem in its entirety.

# The influence of bioturbation activity of Chironomus riparius on microplastic transport in sediments

Miss Khouloud Sebteoui[1], Professor Djuradj MILOŠEVIĆ[2], Dr Jelena STANKOVIĆ[3], Dr Viktor BARANOV[4], Professor Boris Jovanović[5], Professor Stefan KRAUSE[6,7], Professor Martin SOLAN[8], Professor Zoltan CSABAI[1]

[1]Department Of Hydrobiology, Faculty Of Sciences, University Of Pecs, Hungary, Pécs, Hungary, [2]Department of Biology and Ecology,Faculty of Sciences and Mathematics, University of Niŝ, Serbia, Niŝ, serbia, [3]Department of Hydrobiology and Water Protection, Institute for Biological Research “Siniša Stanković” National Institute of Republic of Serbia, University of Belgrade, Belgrade, Serbia, Belgrade, Serbia, [4]Estación Biológica de Doñana-CSIC / Doñana Biological Station-CSIC, Seville (Spain), Seville, Spain, [5]Department of Ecology, Evolution, and Organismal Biology, Iowa State University, Ames, Iowa, USA ., Iowa, USA, [6]School of Geography, Earth and Environmental Sciences,University of Birmingham, Birmingham, UK, [7]LEHNA- Laboratoire d’ecologie des hydrosystemes naturels et anthropises, University of Lyon, Darwin C & Forel, 3-6 Rue Raphaël Dubois, 69622 Villeurbanne, France, Lyon, France, [8]University of Southampton National Oceanography Centre Southampton (NOCS), Southhampton, UK

8E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

*My name is Khouloud SEBTEOUI, I am Tunisian, currently a PhD student in the university of Pecs in Hungary. My research interests are freshwater ecosystems, entomology and ecotoxicology. I am investigating the pathways and depositing of microplastic particles and conducting experiments regarding the effects of MPs on aquatic macroinvertebrates behaviour and ecological functions.*

In order to effectively assess the ecological risks associated with microplastics (MPs) in freshwater ecosystems, it is crucial to have a comprehensive understanding of their behaviour, which includes identifying major transport routes and accumulation zones and their interaction with natural processes. The behaviour of macroinvertebrates, such as bioturbation and burrowing, can significantly affect the bioavailability of toxic agents in aquatic environments. Our present study aimed to investigate the impact of bioturbation activity by Chironomus riparius on the vertical transfer of polyethylene MPs under ex-situ conditions. C. riparius larvae were exposed to an environmentally relevant, high concentration of MPs (80g/m2), and their bioturbation activity was estimated through a combined experimental protocol of sediment profile imaging using luminophore tracers and sediment coring. The results of the study indicate that spherical MPs were transported vertically to the sediment's lowermost layer due to the bioturbation activity of C. riparius larvae, and that the presence of these MPs particles affected the intensity of bioturbation activity over time. These findings emphasize the importance of understanding the behaviour of MPs in freshwater ecosystems and its potential impact on the macroinvertebrates and their ecosystem functions.

# The influence of network and lateral hydrologic connectivity on benthic algae composition and photosynthesis

Dr Elisabeth Bondar-Kunze[1,2,3], Marie-Christine Moser[1,2], Olena Bilous[1,2], Andrea Funk[1,2,3], Thomas Hein[1,2,3]
[1]University of Natural Resources and Life Sciences Vienna, Vienna, Austria, [2]Christian Doppler Laboratory for Meta Ecosystem Dynamics in Riverine Landscapes, University of Natural Resources and Life Sciences, Vienna, Institute of Hydrobiology and Aquatic Ecosystem Management, Vienna, Austria, [3]WasserCluster Lunz - biologische Station, Vienna, Austria

7F_RS21_Wetland ecology and management, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Current: Senior Scientist at the Institute of hydrobiology and water management*
*field of expertise: Ecohydrology ; Multiple stressors in riverine landscapes; mechanisms behind multiple stressor effects; Periphyton; physiology of periphytic algae; Limnology, floodplain ecology, nutrient and matter dynamics*
*PhD thesis: The effect of altered hydrology on periphyton development in riverine ecosystems*
*Diploma thesis: Phosphorus dynamics and biological activity in relation to an artificial water enhancement scheme in an urban backwater system in Vienna*

Large rivers are often affected by multiple human activities, such as flood control, land use change, navigation, hydropower, urban development, or agriculture. This also results in reduced or severely limited hydrologic connectivity between the river and adjacent floodplain areas, but network connectivity between different riparian areas or parts of the floodplain may also be significantly reduced. In this study, we use the meta-ecosystem approach to incorporate aspects of the meta-community and food web structures because it describes how spatial fluxes of materials (e.g., nutrients), organisms (e.g., algae), and environmental conditions between and within different spatial units determine ecosystem functioning, community composition, and species diversity. In addition, we aim to analyze the effects of local conditions (e.g., light, nutrients) and network structure (e.g., connectivity indices) on algal community composition and function.
To do this, we sampled benthic algae twice in spring and summer at 11 different sites in the Donau-Auen National Park, Lobau and Danube Island and measured algal community composition (e.g. pigments) and functional (e.g. photosynthesis) parameters to determine the influence of local and network parameters.
Such a meta-ecosystem approach for rivers will complement current assessment approaches by providing a more process-oriented perspective. Investigating the role of network characteristics on community structures and food web organization will help to understand the spatial dynamics of regional biodiversity, as well as ecosystem functions.

# The Llyn Brianne Stream Observatory: four decades of research into global change and stream ecosystems

Prof. Steve J. Ormerod[1]
[1]Water Research Institute, Cardiff University, Cardiff, United Kingdom

4F_RS13_Climate change and freshwaters: challenges and solutions, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Steve Ormerod has a long-standing research interest in the effects of global change on rivers. Outside his University role, he is Deputy Chairman of Natural Resources Wales, a member of the UK Joint Nature Conservation Committee and Vice-President of the RSPB - Europe's largest wildlife charity.*

The Llyn Brianne project in central Wales began in 1981 as an investigation of the role of land use and acid deposition in the acidification of upland streams. In over 40 years of continuous investigations that have followed, as well as providing one of the longest contemporary records of recovery from acidification, the research has diversified to appraise the influence of global warming, effects of the NAO, land use change and climate change adaptation on stream organisms and ecosystem processes. Centred on 14 replicate streams with contrasting land use and hydrochemistry, and now featuring unique stream mesocosms, the project is now one of the longest catchment-scale ecological projects in the world. In this presentation, I review some of the seminal results arising from the work of many students and ecologists who have worked at the Observatory.

# The microcrustacean fauna of two Mediterranean wetlands, with focus on exotic species

Ms. MARÍA BISQUERT-RIBES[1], Dr. JUAN RUEDA[1], Ms. CLAUDIA MILENA RODRÍGUEZ-SIERRA[1,2], Mr. ARTEM TSELIKOV[1,3], Mr. DANIEL GRILLO[1], Dr. FRANCESC MESQUITA[1], Dr JAVIER ARMENGOL DIAZ[1]

[1]University of Valencia, Valencia, Spain, [2]Universidad Surcolombiana, Neiva, Colombia, [3]Taras Shevchenko National University of Kyiv, Kyiv, Ukraine

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

***Biography:***

*Dr. Javier Armengol is a professor of ecology and his main line of research is freshwater zooplankton (rotifers, branchiopods and copepods). He currently belongs to the Limnology group of the Institute Cavanilles of Biodiversity and Evolutionary Biology (ICBiBE) of the University of Valencia, where he co-directs the Laboratory of Biogeography and Ecology of Aquatic Systems.*

The Albufera Natural Park (eastern Iberian Peninsula) is a coastal wetland encompassing a shallow lake surrounded by rice fields, which have been identified as potential gateways for the introduction of exotic species in protected wetlands. Our aim is to evaluate the presence of exotic species of microcrustaceans (cladocerans, copepods and ostracods), in rice fields and in other environments of the area with less anthropic impact. In addition, different flooded areas in a second wetland, the Pego-Oliva Natural Park, were also evaluated; given that it is a system similar to the Albufera, including rice fields and natural wetlands, but smaller in size and less impacted. We sampled 32 sites in both wetlands (Albufera and Pego-Oliva) during two inundation periods, in summer and winter. We also measured some environmental variables to relate them to the observed microcrustacean metacommunity. Alien species detected include Kurzia sp. (Cladocera), Candonocypris novaezelandiae, Cypris decaryi and Fabaeformiscandona subacuta (Ostracoda). We hypothesized that more exotic species would appear in summer, but we detected some of them also in winter samples, pointing to their capability of colonizing new environments. Moreover, we compared the community composition of both, rice fields and other naturalized areas, expecting to find different species composition, with a higher incidence of exotic species in rice fields. However, some exotic species were also detected in less impacted environments, probably due to the connection via irrigation channels of the area.

# The MixSIAR model as a potential tool for estimating the share of individual organic matter fractions in softwater lake sediments

Dr Eugeniusz Pronin[1], Dr hab. Krzysztof Banaś[1], Dr Rafał Chmara[1], M.Sc. Rafał Ronowski[1], M.Sc. Marek Merdalski[1], Prof. Józef Szmeja[1], Anne-Lise Santoni[2], Dr Olivier Mathieu[2]
[1]University of Gdańsk, Faculty of Biology, Departmant of Plant Ecology, Gdańsk, Poland, [2]Biogéosciences, UMR 6282 CNRS, Université de Bourgogne, Dijon, France

5G_SS12_Modelling meets data science - what can we and our machines learn from each other?, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*My scientific interest is hydrobiology, ecology and biogeochemistry. I currently work in the Department of Plant Ecology, University of Gdansk, where I realise my scientific project related to the carbon and nitrogen stable isotopic composition of the plant, sediment and water from soft-water lakes in northern Poland. Moreover, I came back to hardwater lakes and focused on the carbon and nitrogen stable isotopic composition of plants' organic matter and comparison with soft-water ecosystems.*

The Bayesian mixing model MixSIAR based on δ13C and δ15N values is often used to estimate the share of individual fractions of organic matter (OM) in lacustrine sediments. However, the components of constructed mixing model often come from the studies of unlike water ecosystems due to the limitation of isotopic data from specific aquatic environments. In our research of 14 softwater lobelia lakes in Poland (softwater lakes with at least one isoetid species: Isoëtes lacustris, Lobelia dortmanna, Luronium natans, Littorella uniflora), we used literature data and our isotopic results. The literature data for the soil OM, C3 terrestrial plants, phytoplankton and sewage and our isotopic results of aquatic vegetation (10 species, N=85) and sediments (N=85) collected below aquatic plants were used in the MixSIAR model to assess the source of OM in the sediments of lobelia lakes. The results show that macrophytes are usually the primary source of OM (median 58% contribution) in the sediments compared to phytoplankton (median 26%) and soil OM (median 15%). The C3 terrestrial plant and sewage share were negligible (<1%). In a low-productive environment such as softwater lakes, the model seems to have underestimated the contribution of macrophytes to sediment formation. The usefulness of the Bayesian mixing model in this type of research will increase due to higher recognition of isotope data for each component that may be involved in sediment formation for specific ecosystems and their catchments. The Polish National Science Centre financed the studies under project No. 2019/32/C/NZ8/00147.

# The negative effect of a riparian invader leaf litter is mitigated by the presence of a native species

MSc Daša Jaďuďová[1], Dr Vladimíra Dekanová[1], Dr Milan Novikmec[1], Dr Marek Svitok[1,2]
[1]Faculty of Ecology and Environmental Sciences, Technical University in Zvolen, T. G. Masaryka 24, 96001, Zvolen,, Slovakia, [2]Faculty of Science, University of South Bohemia in České Budějovice, Branišovská 1760, 370 05, České Budějovice,, Czech Republic

8G_RS20_Aquatic terrestrial linkages, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*I am a PhD student at the Technical University in Zvolen, Slovakia, specializing in hydrobiology. My dissertation deals with the impact of invasive riparian vegetation on the aquatic ecosystem. Specifically, I evaluate the impact of two invasive plants Fallopia japonica and Solidago canadensis on the biodiversity of benthic invertebrates and the decomposition rate of native litter species Alnus glutinosa.*

Riparian zones are frequently invaded by non-native plant species. Replacement of the native riparian vegetation by invasive plants may affect headwater stream ecosystems which heavily depend on terrestrial litter supply. The litter quality of native species meets the nutrient requirements of co-occurring detritivores, but this link could be disrupted by invasive plants with different leaf traits. Despite the pressure of invasive species on riparian zones, the influence of riparian invasions on aquatic ecosystems has been rarely investigated. We explored microbial- and shredder-mediated litter breakdown of two aggressive invaders - Japanese knotweed (Fallopia japonica) and Canada goldenrod (Solidago canadensis) in ten headwater streams and compared them with native black alder (Alnus glutinosa) using a litter bag experiment with mono-specific and mixed-species substrates (460 bags). We found that S. canadensis decomposed significantly faster than the native species (+41%, $p = 0.002$) while the decomposition of F. japonica was comparable to black alder (-17%, $p = 0.339$). However, the rapid decomposition of S. canadensis was diminished by the presence of native litter ($-k = 0.7$ vs 1.1 degree-days-1). While the leaf litter of F. japonica does not seem to impose adverse effects on streams, the fast decomposition of S. canadensis could cause rapid depletion of food resources and consequent changes in nutrient cycling and biodiversity. The presence of native riparian species is of key importance in mitigating the potential negative effects of terrestrial invaders on aquatic ecosystems. The study was supported by the Slovak Research and Development Agency under contract APVV-16-0236 and APVV-19-0134.

# The phytoplankton-zooplankton nexus and its bioindicator value in reservoirs: a case study in meso-oligotrophic systems in NW Portugal

Inês Meirinho[1,2,3], Rita Domingues[3], Bruno B Castro[1,2]
[1]CBMA, Centre of Molecular and Environmental Biology / ARNET - Aquatic Research Network, University of Minho, Braga, Portugal, [2]IB-S, Institute of Science and Innovation for Bio-Sustainability, University of Minho, Braga, Portugal, [3]CIMA - Centre for Marine and Environmental Research, ARNET - Aquatic Research Network, University of Algarve, Faro, Portugal

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am currently a professor and researcher at University of Minho (Portugal) working on the frontier between aquatic ecology, ecophysiology and ecotoxicology. I am mostly interested in understanding how freshwater organisms, particularly invertebrates, cope with stress on multiple dimensions, considering their ecological and evolutionary context, as well as their potential bioindicator role. I am motivated by the belief that we need solid scientific underpinnings to approach the current threats that freshwater ecosystems are facing and tackle the consequences of man-induced disturbance.*

*Centre of Molecular and Environmental Biology (CBMA) ::: http://cbma.uminho.pt/*

*Researcher profile @ ORCID ::: https://orcid.org/0000-0002-7130-6061*

Water pollution and uncontrolled use of freshwater resources threaten aquatic ecosystems worldwide. The European Water Framework Directive (WFD) was developed to protect and improve the quality of European waters, but its implementation in reservoirs (heavily modified waterbodies) revealed numerous problems, such as the artificiality of these systems, the absence of pristine conditions to be used as reference, and the lack of robust biological descriptors (often limited to phytoplankton). The aim of this work was to evaluate the seasonal and spatial variation of the phytoplankton community in four reservoirs of in NW Portugal (Andorinhas, Caniçada, Touvedo and Venda Nova), as well as its bioindicator value, linking it to the resident zooplankton community. By relating the two trophic levels, we expect to get further insight on the environmental health of these systems, whose productivity is constrained by low levels of phosphorus (which limits primary productivity) and calcium (which limits herbivory by large crustacean zooplankters). Results showed variation between reservoirs, with a particular contrast between deep and shallow systems, along with some degree of seasonal fluctuations. In deep reservoirs, zooplankton biomass (abundance of large cladocerans) correlated with a decrease in phytoplankton during spring. Ecological potential (sensu WFD) and water transparency of all reservoirs was context-dependent, but an overall decrease in quality was observed in the summer, which was most pronounced in shallow systems. Our work shows that using more than one biological descriptor gives a better understanding of the ecological potential of these semi-artificial systems, by elucidating abiotic and biotic regulation mechanisms.

# The recovery of zooplankton from acidification in Norwegian lakes depends on lake type

Dr Francesca Pilotto[1], Bjørn Walseng[1], Thomas C. Jensen[1], Ann Kristin Schartau[1]
[1]Norwegian Institute for Nature Research - NINA, Oslo, Norway

3E_RS10_Biomonitoring, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*F. Pilotto is freshwater ecologist with experience in the study of the responses of lake and stream biodiversity to diverse abiotic conditions, changing climate and human-induced pressures. Her recent research has focused on understanding long term changes in biodiversity across several biotic groups, with a special focus on freshwater invertebrates, the changes in their taxonomic and functional composition and their role as bioindicators.*

Acidification has harmed freshwater ecosystems in Northern Europe since the early 1900s. Stricter regulations aimed at decreasing acidic emissions have improved surface-water chemistry since the late 1980s, but the recovery of biotic communities has not been consistent. Generally, the recovery of flora and fauna has been documented only for a few lakes or regions and large-scale assessments of long-term dynamics of biotic communities due to improved water quality are still lacking. This study investigates a large biomonitoring dataset of pelagic and littoral zooplankton from 144 acid-sensitive lakes in Norway spanning 24 years (1997-2020). The aims are to assess the changes in zooplankton communities through time, compare patterns of changes across lake types (defined based on calcium and humic content), and identify correlations between abiotic and biological variables. Results indicate chemical and biological recovery after acidification in Norwegian lakes, as shown by a general increase in pH, changes in community composition and increases in the total number of species and number of acid sensitive species through time. However, the zooplankton responses differ across lake types. This indicates that the concentration of calcium (or alkalinity) and total organic carbon (or humic substances) are important factors for the recovery of zooplankton communities from acidification in Norwegian lakes. Therefore, assessment methods and management tools should be adapted to the diverse lake types. Long-term monitoring of freshwater ecosystems is needed to fully comprehend the recovery dynamics of biotic communities from acidification.

# The relative contribution of ponds to spatial and temporal aquatic macrophyte diversity at the catchment scale

Tahir Khanzada[1,2], Helen Bennion[1], Geraldene Wharton[2], Carl Sayer[1]
[1]Department of Geography, University College London, London, UK, [2]School of Geography, Queen Mary University of London, London, UK

4E_RS05_Small water bodies, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Tahir Khanzada is a PhD student on the London NERC DTP based at UCL Geography and Queen Mary Geography. He is supervised by Helen Bennion (UCL), Geraldene Wharton (Queen Mary), and Carl Sayer (UCL). His project focuses on analysing biodiversity changes in a freshwater landscape (the River Glaven, North Norfolk, UK) using both contemporary and palaeoecological techniques, supported by historic and contemporary mapping of waterbodies in the area. He previously completed an undergraduate degree in Geography and a master's degree in Climate Change, both at UCL Geography.*

Ponds can harbour a great diversity of aquatic species but are an often overlooked yet integral contributor to catchment scale biodiversity. Collectively ponds can support more plant and invertebrate species than larger waterbody types, and can act as refuges for rare species. Aquatic macrophytes play an important role in aquatic ecosystems providing food and habitat for a variety of species, and are important in determining the ecological function and structure of a waterbody. Examining the biodiversity of aquatic macrophytes can be a good indicator of overall waterbody health. The River Glaven catchment, north Norfolk, UK, provides a unique opportunity to examine the role of ponds in catchment scale biodiversity. The catchment has been surveyed for aquatic macrophytes extensively over the last 30 years, with almost 800 individual surveys at over 200 individual sites, around half of which are ponds. These surveys span multiple waterbody types including ponds, lakes, river sections, ditches, and backwaters. The dataset provides a unique opportunity to explore the spatial and temporal patterns of the biodiversity of a river catchment, and to closely examine which waterbodies contribute the most to biodiversity at the catchment scale. Analysis of pre- and post- restoration surveys provides insights into the importance of ponds for biodiversity, and the value of restoration for improving biodiversity at the catchment scale.

# The river restoration 'ecological toolbox': Simultaneously examining biomonitoring indices to guide catchment management strategies.

Miss Molly Bridger[1,2], Prof Paul Wood[1], Dr Kate Mathers[1], Dr Judy England[3], Dr Marc Naura[4], Dr James White[5], Prof David Hannah[5]
[1]Loughborough University, Loughborough, United Kingdom, [2]The Central England NERC Training Alliance (CENTA), Birmingham, United Kingdom, [3]Environment Agency, Wallingford, United Kingdom, [4]The River Restoration Centre, Cranfield, United Kingdom, [5]University of Birmingham, Birmingham, United Kingdom

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Molly Bridger is a first year PhD research student from Loughborough University partnered with CENTA. She previously studied a BSc in Environmental Science and Master's by Research at Bournemouth University. Molly has an interest in scientific issues surrounding ecologial management and conservaton outcomes.*

Declines in freshwater biodiversity globally have prompted an increase in river restoration projects. However, many restoration activities have resulted in limited ecological benefits being realised in some instances due to primary stressor(s) not being clearly identified, project objectives not being fully achieved, or an absence of post-restoration data. This study specifically seeks to develop an 'ecological toolbox' that can be used to inform river restoration practices. This will be achieved by examining macroinvertebrate and macrophyte communities alongside multiple biomonitoring indices developed for the assessment of ecosystem health. Most of the research to date does not typically examine the long-term sustainability of restoration projects. To overcome this knowledge gap, this project will examine secondary macrophyte and macroinvertebrate community data from sites where restoration projects have historically been completed, in association with primary data collection that will consider if the long-term effects of river restoration can be detected. Secondary data covering pre- and post-project appraisals will be used within a meta-analysis to help predict the ecological responses to different restoration techniques at varying spatial scales. The research will provide a greater understanding of how faunal and floral communities respond to restoration practices at a range of spatial scales which will help guide future sustainable river restoration projects that deliver benefits for the entire freshwater ecosystem.

# The role of environmental context, project design, and implementation in achieving ecological restoration goals

Prof. Stefan Stoll[1,2], Wolfram Remmers[1]
[1]University of Applied Sciences Trier, Trier, Germany, [2]University of Duisburg-Essen, Essen, Germany

4B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am professor in aquatic ecology. My research focuses on how aquatic ecosystems and species communities change over time, and which environmental variables play important roles at different spatial and temporal scales. I also analyze the ecological success of river restoration projects with the aim to identify success factors for various restoration targets.*

Studies have shown that the ecological effects of small river restoration projects (stretch length 100 - 1000m), which make up the majority of all projects, are usually limited. We investigated 16 projects implemented in lower-mountain streams and rivers funded by „Aktion Blau Plus“ of the state of Rhineland-Palatinate, Germany. Based on 51 indicators, we analyzed how ecological effects depended on characteristics of (1) the surrounding environment with its specific limitations, (2) the planning of the restoration compared to the hydromorphological reference of the respective river type, and (3) the concrete constructional implementation of the restoration. We focused on specific effects on functional indices based on fish and macroinvertebrate data related to the specific restoration targets instead of the achievement of an overall good ecological status. We identified projects that overall worked very well, but also examples for shortcomings at all three levels, i.e. unsuitable environmental settings, untargeted planning, and poor implementation. Recurring shortcomings were (1) too little land availability to address key degradation issues, (2) unambitious measures, inadequate to realize significant ecological benefits, (3) restoration goals not in line with the natural reference of the river type, and (4) too much focus on landscaping aspects and too little focus on activation of self-organizing hydromorphological processes. The findings from these analyses will now be used to assess future project applications in this ongoing state-wide funding program. The aim is to estimate the chances of success to reach specific project targets already in the application and planning phase.

# The role of filter feeding in the niche differentiation among coexisting invasive Ponto-Caspian mysids (Crustacea: Mysida)

Dr Péter Borza[1], Varsha Rani[1,2], Csaba F. Vad[1]
[1]Institute of Aquatic Ecology, Centre for Ecological Research, Budapest, Hungary, [2] Doctoral School of Biology, Institute of Biology, ELTE Eotvos Lorand University, Budapest, Hungary

8D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

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Mysids are small omnivorous crustaceans represented by four invasive Ponto-Caspian species in freshwaters of Central Europe. Although differences in their overall diet and habitat use may allow their stable coexistence, we expected that filter feeding might additionally foster differentiation by specialization on different particle sizes. We measured filter areas and mesh sizes in the four species and also conducted a grazing experiment to quantify their clearance rates on the microalga Cryptomonas. We found that differences in the areas of the primary filters were relatively small, indicating that due to morphological constraints filtering efficiency can only be increased by auxiliary filters (as in one of the species, Limnomysis benedeni). We also found consistent but relatively small differences among the mesh sizes of the primary filters, suggesting that the benefit of being able to capture small particles might outweigh the pressure for differentiation. Clearance rates corresponded to the observed morphological differences and also indicated that the contribution of the auxiliary filters of L. benedeni is rather low due to its less effective filtering mechanism. In conclusion, the relatively small but consistent morphological and functional differences proved that filter feeding can contribute to the niche differentiation of the species both by its overall share in the diet as well as by particle size selectivity, increasing the robustness of their coexistence.

# The Role of Micropollutants in a Multi-Stressor Context: Stressor Prioritization as Guidance to Water Quality Management

Ms Nele Markert[1,2], Ms Barbara Guhl[1], Mr Christian K. Feld[2,3]
[1]LANUV NRW, Ecotoxicology, Essen, Germany, [2]University Duisburg-Essen, Aquatic Ecology, Essen, Germany, [3]University Duisburg-Essen, Centre for Water and Environmental Research (ZWU), Essen, Germany

8E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***

*- Background in Ecotoxicology (M.Sc.RWTH University, Germany)*

*- Since 2018 scientific advisor at the North Rhine-Westphalian Office of Nature, Environment and Consumer Protection (LANUV NRW) in Germany*

*- Since 2020 PhD. student at University Duisburg-Essen (Aquatic Ecology) working on multiple stressor effects with a focus on effects of micropollutants*

River biology is threatened by a variety of anthropogenic stressors such as eutrophication, salinization, hydrological alteration and habitat degradation. Additionally, organisms are exposed to a multitude of micropollutants. To guide river ecosystem management, knowledge on the individual and combined effects of multiple stressors including micropollutants is required. For this purpose, it is reasonable to use available data that were collected for regulatory purposes. We used a comprehensive EU WFD monitoring dataset of German rivers to disentangle the effect of multiple stressors on riverine fish, macroinvertebrates and benthic diatoms. Random forests were applied to put different stressors into a hierarchical context including physico-chemical, hydrological and morphological stressors as well as risk variables representing the mixture toxicity for 51 selected micropollutants. The results show distinct differences between the organism groups but also between the different ecological metrics used. In general, most macroinvertebrate metrics strongly responded to eutrophication, salinization and oxygen depletion, whereas diatoms responded to a larger variety of stressors including micropollutants. In contrast, fish metrics often resulted in poor model qualities. Weak responses to micropollutants, especially for macroinvertebrates, point at the need for more reliable monitoring strategies for micropollutants. Furthermore, data sets originally compiled for regulatory purposes may pose severe problems for multivariate analyses especially regarding temporal and spatial resolution and consistency of data. Monitoring programs, therefore, should be developed to produce coherent high quality data sets. These are essential for a sustainable management as well as for monitoring the progress of achieving the EU policy objectives.

# The role of non-native plant species in modulating riverbank erosion: a global systematic review.

Mr James Hardwick[1], Dr Christopher Hackney[1], Ms Lizzie Keeen[1], Dr Zarah Pattison[2]
[1]Newcastle University, Newcastle , United Kingdom, [2]University of Stirling , Stirling , United Kingdom

Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

***Biography:***
*James Hardwick is a PhD student in the Invasion Ecology Research Group, Newcastle University. His focus is on the interactions between fluvial geomorphological processes and non-native plant invasions.*

Riverbank erosion is a product of numerous fluvial and terrestrial geomorphic processes acting on riverbanks, driving bank sediment loss. Riverbank erosion has marked effects on riparian and river ecosystems and human populations. Riparian zones are complex heterogenous habitats associated with high biodiversity. Native riparian vegetation can reduce riverbank erosion by providing structural bank reinforcement through a network of below-ground roots and above-ground biomass. The stabilising effect of native riparian has a marked influence on erosional regimes of fluvial systems. However, numerous global threats face river systems and their riparian zones including climate change and anthropogenic hydrological modifications that drive riparian zone perturbations. Marked changes in fluvial erosional regimes have been associated with the rapid proliferation of non-native plant species, e.g. Impatiens glandulifera (Himalayan Balsam) or Tamarix sp. (Tamarisk), into riparian zones globally. Non-Native plant species can benefit from riparian zone perturbations, by outcompeting native riparian vegetation, using the same hydrochory processes that maintains native riparian vegetations' high biodiversity. The proliferation of non-native plant species into riparian habitats has been attributed to modulating increased riverbank erosion. However, conflicting evidence indicates some non-native plant species can reduce riverbank erosion. This seemingly multi-faceted impacts of non-native plant species on riverbanks has noy yet been systematically assessed. In this study, we systematically reviewed the role non-native plant species play in modulated riverbank erosion to assess current research trends and identify priority knowledge gaps to aid future research directions and support riparian vegetation management decision making.

# The role of tolerances, competition and dispersal for colonisation patterns of benthic invertebrates in a multistressed urban stream system

Miss Svenja Gillmann[1,2], Dr. Armin W. Lorenz[1,2], Prof. Dr. Peter Haase[1,3], Dr. Wim Kaijser[1], Dr. Hong Hanh Nguyen[1,3], Prof. Dr. Daniel Hering[1,2]

[1]Department of Aquatic Ecology, University of Duisburg-Essen, Essen, Germany, [2]Centre for Water and Environmental Research, University of Duisburg-Essen, Essen, Germany, [3]Department of River Ecology and Conservation, Senckenberg Research Institute and Natural History Museum Frankfurt, Gelnhausen, Germany

3C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*

*Svenja Pfeifer is a doctoral researcher at the University of Duisburg-Essen, specialising in aquatic ecology with a focus on benthic invertebrates. With extensive experience in identifying all groups of benthic invertebrates and analysing community data in relation to environmental data, her work is primarily concerned with the recolonisation of restored streams. Her current research focuses on how tolerances, competition, and dispersal affect colonisation patterns of benthic invertebrates in a multistressed urban system.*

Stream restoration improves instream conditions and increases habitat diversity, which allows new species to colonise the formerly degraded streams. This recolonisation process is primarily controlled by three factors: species tolerances, competition and dispersal. To understand the community dynamics following stream restoration, these factors need to be investigated separately and their relative importance considered, but this has rarely been done. Here, we investigated the benthic community of an urban stream catchment, whose tributaries were restored over the past 20 years. Formerly, the streams transported raw sewage and removal of the wastewater initialized a recolonisation process. According to an analysis of ten years of monitoring data, the temporal changes in species assemblages are mainly driven by habitat development. The community variability decreased with time since restoration and the community generally changed from stone- to sand-preferring species. Closely linked to these changes was the increase in riparian cover because of natural succession. Monitoring was intensified for the past two years at 20 sites, which were restored in different years. This allows us to investigate the environmental and community filters that prevent (or foster) species from recolonizing individual sites. Species tolerances were obtained from an analysis of a Germany-wide dataset and compared to the conditions at the samplings sites. The degree of competition between species is analysed based on the overlap of selected species traits and co-occurrence patterns. Lastly, dispersal ability is compared using different dispersal indices. From the results, we can disentangle the filters that primarily affect and control recolonisation.

# The seasonal continuum [concept]: short-term temporal taxonomic turnover does not alter ecosystem functioning in boreal streams.

Dr Nathan Jay Baker[1,2], Dr Ellen Welti[2,3], Dr Francesca Pilotto[4], Dr Jonas Jourdan[5], Dr Burkhard Beudert[6], Dr Kaisa-Leena Huttunen[7], Prof Timo Muotka[7], Dr Riku Paavola[8], Dr Emma Göthe[9], Prof Peter Haase[2,10]

[1]Nature Research Centre, Vilnius, Lithuania, [2]Senckenberg Research Institute and Natural History Museum Frankfurt, Gelnhausen, Germany, [3]Smithsonian Conservation Biology Institute, Front Royal, USA, [4]Norwegian Institute for Nature Research, Oslo, Norway, [5]Johann Wolfgang Goethe University Frankfurt am Main, Frankfurt am Main, Germany, [6]Bavarian Forest National Park, Grafenau, Germany, [7]University of Oulu, Oulu, Finland, [8]University of Oulu Infrastructure Platform, Kuusamo, Finland, [9]County Board of Dalarna, Falun, Sweden, [10]University of Duisburg-Essen, Duisburg, Germany

3C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*

*Nathan is an aquatic ecologist interested in the spatio-temporal dynamics of invertebrate communities and the drivers shaping their structure and function. His academic journey started in his hometown of Johannesburg, South Africa. Thereafter, he obtained his PhD in Germany and now resides in Lithuania as a postdoctoral researcher. His main research goals are to (i) integrate taxonomic, functional and [phylo]genetic diversity using statistical models and ecological explorations, (ii) add to our collective understanding of how anthropogenic processes are driving changes in biodiversity, and (iii) provide updated information as to the status of riverine ecosystems in regions underrepresented in the literature.*

The river continuum concept describes community structure and function along a river's longitudinal gradient, whereby an exchange of carbon fuels the aquatic "economy". As global environmental change impacts these economies, variation in carbon budgets is likely to alter riverine community structuring and functioning across temporal (short- and long-term) and spatial scales. Boreal ecosystems are particularly dependent on these carbon budgets and are sentinels for environmental change. Using seasonally replicated (spring and autumn) data from 70 riverine sites, we investigated how seasonal variation in environmental conditions impacts the structure and function of macroinvertebrate communities across three boreal regions in Germany, Finland, and Sweden. Seasonal shifts in environmental conditions, including acidity and nutrient variability, drove fluctuations in taxonomic diversity which were decoupled and more pronounced than those of functional diversity. Seasonal variation in the quantity, quality, and state of organic carbon facilitated an exchange of taxa, leading to taxonomically unique communities that exploit the pool of available seasonal resources. Thus, similar levels of functional diversity across seasons—even as taxonomic diversity changes—suggest limited differences in interspecific changes in community function, potentially indicating functional resistance rooted in redundancy. These results point toward a seasonal carbon continuum, whereby community functioning is resilient to short-term environmental change and exhibits predictable responses to shifts in seasonal carbon budgets. Though, with regional differences in redundancy patterns between similar ecosystems, generalised conclusions become more challenging, paying dividends to localised research which is of relevance given future climate predictions.

Study partially funded by the Research Council of Lithuania (S-PD-22-72).

# The seasons of leaf litter decomposition in headwater stream catchments

Ms Eva Cereghetti[1,2], Prof. Dr. Florian Altermatt[1,2]
[1]Department of Aquatic Ecology, EAWAG, Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, Switzerland, [2]Department of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, Switzerland

7G_RS20_Aquatic terrestrial linkages, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am a PhD student with a keen interest in meta-ecosystem dynamics and the functional role of species. My current work focuses on the cross-system transfer of terrestrial leaf litter to headwater streams and on the processing of this detrital material by aquatic shredders. My aim is to use empirical data collected throughout a full year cycle to demonstrate how these ecological processes consist of individual aspects with unique seasonal dynamics, yet ultimately all linked to each other.*

The decomposition of leaf litter in headwater streams is not only a fundamental source of nutrition for aquatic microbes and macroinvertebrates, but also an essential contributor to the cycling of carbon and nutrients within and across ecosystems. Despite the recognized importance of this terrestrial subsidy for stream communities, studies have often focused on dynamics occurring in the months following peak litter input, overemphasizing the importance of short-term trajectories and largely overlooking how litter processing progresses across the seasons. Here, we investigated in-stream and forest floor decomposition of leaf litter in repeated six and twelve week-long decomposition assays, respectively, covering the course of a whole year. We show that higher microbial and macroinvertebrate processing rates are ubiquitously associated with higher temperatures. However, temperature-adjusted decomposition rates suggest that microbes also importantly contribute to the processing of litter in the colder winter months. The effects of temperature on shredding by aquatic macroinvertebrates was less apparent and was likely confounded by the in-situ availability of leaf litter of different nutritional content and palatability. Overall, we highlight the need to investigate litter subsidies dynamics over realistic, yearly time-periods, and to consider the relative role of abiotic variables alongside that of the phenology of leaf litter and detritivore communities. Accounting for such longer temporal dynamics is crucial for the understanding of how litter is processed and integrated within and across ecosystems.

# The secret world of ditches: Drivers of aquatic insect diversity in agriculturally-dominated landscapes

Ms. Natalie Rideout[1], Dr. Alex Bush[2], Dr. Nellie Gagné[3], Dr. Mehrdad Hajibabaei[4], Dr. David Lapen[5], Dr. Teresita Porter[4], Dr. Royce Steeves[3], Dr. Donald Baird[1]

[1]Environment and Climate Change Canada @ Canadian Rivers Institute, Department of Biology, University of New Brunswick, Fredericton, NB, Canada, [2]Lancaster Environment Centre, University of Lancaster, Lancaster, United Kingdom, [3]Fisheries and Oceans Canada, Moncton, NB, Canada, [4]Centre for Biodiversity Genomics and Department of Integrative Biology, University of Guelph, Guelph, ON, Canada, [5]Ottawa Research Development Centre, Agriculture and Agri-Food Canada, Ottawa, ON, Canada

6G_RS23_Ditching misconceptions: the ecological diversity of artificial waterbodies, June 20, 2023, 4:15 PM - 5:30 PM

*Biography:*

*PhD Candidate with the Canadian Rivers Institute at the University of New Brunswick, interested in examining how biodiversity and ecosystem function are linked in freshwater ecosystems impacted by anthropogenic disturbance*

Agricultural drainage ditches are designed for utility, helping farm operators control water levels on their fields, but in increasingly homogenised landscapes, they can represent biodiversity refugia, hosting rich communities of plants, macroinvertebrates, fish and associated riparian wildlife. Management of these habitats to support delivery of ecosystem services is becoming increasingly important as agricultural intensification and extensification increases and climate change modifies agroecosystems globally. Agricultural water extraction, storage behind dams, diversions, dredging and clearing of riparian vegetation can impact the hydrology and ecology of ditch ecosystems. Ditches are subject to direct runoff and drainage from fields, which can include an array of agro-chemicals, such as pesticides and increased nutrient loads. Our objective is to examine the effect that ditch management has on aquatic insect production as a key element of habitat provisioning. To do this, we established drivers of aquatic insect trait diversity and redundancy across differently managed/maintained ditch systems in South Nation, an agriculturally-dominated river basin in eastern Ontario, Canada. This river basin is currently the focus of the Environmental Change Onehealth Observatory (ECO2), a Canadian federal interdepartmental project to study consequences of erosion of natural capital and associated ecosystem services on:1. Biodiversity; 2. [Re]emergence of infectious zoonotic diseases of importance to human health; and 3.[Re]emergence of infectious diseases of importance to livestock health, with the aim to find a balance between producing food and other commodities which support the well-being of Canadians, with the need to provide increased biosphere stewardship.

# The use of woody dams in natural flood management – temporal implications on hydrology, geomorphology and ecology

Mr Matt Taylor[1,2], Dr Lucy Clarke[2], Dr Laura Weldon[1], Anne Harrison[1], Dr Hannah Robson[1]
[1]Wildfowl And Wetlands Trust, Slimbridge , United Kingdom, [2]University of Gloucestershire, Cheltenham , United Kingdom

5B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I am a Researcher at the Wildfowl and Wetlands Trust, where I currently work on monitoring our Natural Flood Management (NFM) projects. This project focuses on looking at the wider biodiversity benefits of NFM. We have been collecting data on in-stream macroinvertebrates, water quality, emergent insects and bat activity. My presentation combines the work at WWT with my MSc by Research at the University of Gloucestershire. This primarily focused on hydrological and geomorphological differences between three different sites in the Cotswolds of varying NFM age during five different flow events of varying magnitude.*

High-magnitude flood events are becoming increasingly common and anthropogenic climate change is expected to escalate flood risk. Natural Flood Management (NFM) strategies work with natural processes to slow the flow of water through the catchment, provide storage areas to attenuate water and encourage infiltration. A commonly used NFM intervention are in-channel woody dams that slow the flow of water during flood events. As well as flood mitigation, woody dams can bring multiple benefits for the ecology, water quality and geomorphology of watercourses.

The Stroud Frome and Twyver catchments in Gloucestershire, UK have had multiple NFM interventions implemented since 2012, most often woody dams. Three sites with similar environmental characteristics were monitored: (1) no woody dams (control); (2) woody dams recently installed; and (3) older woody dams installed more than five years previously. Velocity, channel dimensions, and turbidity were measured following five flow events of increasing magnitude. In-stream macroinvertebrates were monitored monthly and bed sediment material recorded bi-annually.

Woody dams mitigated the impact of high magnitude flow events by reducing channel velocity, increasing water storage and preventing the transportation of sediment downstream. The data shows that woody dams performed similarly at new and old woody dam sites providing confidence in the longevity of their effects. The addition of woody dams to these streams has improved channel habitat diversity and introduces the potential positive impacts on in-stream macroinvertebrates.

# The vulnerability of temporary ponds in an arable landscape: the interplay of cropping regime and weather variation

Dr Mike Jeffries[1]
[1]Northumbria University, , United Kingdom

3D_SS06_Ponds as integral part of aquatic and terrestrial landscapes, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*Mike is an ecologist from Northumbria University. The ponds and wetlands of Northumberland are the focus of his work, in particular the spatial and temporal changes to their invertebrate and plant communities over the years*

Temporary ponds support a specialist wildlife but these habitats are vulnerable because they are ephemeral, small and sensitive to adjacent land-use. They are also very dependent on hydrology, so that climate change is an additional threat. Separating the effects of land-use from climate is challenging. This study reports changes to the flora of temporary ponds in lowland arable fields on a farm north-east England over a five-year period, exploiting the opportunity of a change to land-use due to increased cropping and how this interacted with local weather variation to impact the ponds' flora. Arable field ponds supported a unique flora combining inundation specialists and weed species not found in other ponds, adding to regional pond biodiversity. The arable ponds' plant communities varied markedly between years whilst the flora from ponds in adjacent wetland did not. In the last two years of the study more of the arable field ponds were planted with crops due to a change in farm management. Dry summers resulted in the survival of crop species and, in these cropped ponds, the temporary pool flora was severely degraded, in particular the loss of inundation taxa, compared to uncropped ponds. The drying out and ploughing of the arable field ponds without actual crop planting did not degrade the flora. Cropping regime was the immediate threat to the pond flora but the survival of crop species depended on drier summers. Extreme wet weather disrupted the homogenisation of the arable landscape and sustained the distinct inundation flora.

## The warming of rivers and streams in the European Alps

Dr Georg H. Niedrist[1], Ms Vanessa Semino[1], Prof. Leopold Füreder[1]
[1]River and Conservation Research, Department of Ecology, University of Innsbruck, Innsbruck, Austria

4F_RS13_Climate change and freshwaters: challenges and solutions, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*He is a stream ecologist based in the European Alps at the University of Innsbruck and his research centers on the understanding of life in mountainous freshwater habitats and how rapid environmental changes affect entire biocenoses and the integrity of ecosystems. In this presentation he reports on increasing temperature extremes in mountain streams, on the lengthening of warm periods, and on the differential warming between distinct types of rivers.*

Aquatic ecosystems around the world are currently warming with unprecedented rates since observations started, but warming occurs highly variable among ecoregions. So far, mountain rivers were expected to experience attenuated warming due to cold water input from snow or ice. But since air temperatures in mountain areas are increasing faster than the global average, these cold rivers are expected to warm accordingly. In this presentation we summarize warming dynamics in different river types in the European Alps by comparing results from different studies. We compared the warming rates of different river types (low-order vs. high order) during the last decades and assessed longitudinal and daily temperature dynamics along rivers draining small catchments in high altitudes, leading to the following findings: a) large Alpine streams warmed size-dependent during the last decades (with average rates between +0.24 and +0.44 °C decade-1), warmed also during winter, and exhibited increases in extreme water temperatures and lengthening of warm phases, b) high-altitude rivers are warming only during summer but at higher rates (around +0.25 year-1), and c) smallest rivers at high altitudes show very high daily and longitudinally temperature dynamics with changes up to 2°C during same days or +2°C per 100 m. This presentation demonstrates substantial warmings of mountain rivers with size- and season-dependent rates (also evidencing phenological shifts) and river-type-specific sensibilities to rising air temperatures. Given the dominant role of water temperature for ecological processes and functioning in aquatic habitats, this presentation adds to the understanding of climate change affects in mountain rivers.

# Threatened species assessment and recovery in fire affected Australian Wallum wetlands

Dr Luke Carpenter-Bundhoo[1], Dr  Patrick Norman[2], Ms Eva Ford[3], Prof Mark Kennard[1]
[1]Australian Rivers Institute, Griffith University, Brisbane, Australia, [2]Climate Action Beach, Griffith University , Gold Coast, Australia, [3]Mary River Catchment Coordinating Committee, Gympie, Australia

6C_SS03_Fish Ecology and Conservation, June 20, 2023, 4:15 PM - 5:30 PM

***Biography:***

*Luke is an aquatic ecologist with the Australian Rivers Institute at Griffith University in Australia. His research expertise centres around freshwater ecology, focusing on the effects of altered flow regimes, environmental flows and methods used to study animal movements in these systems. Luke's work also includes biomonitoring of aquatic ecosystems impacted by the 2019/2020 fires across eastern Australia.*

Acid wetlands of wallum and dune systems in coastal eastern Australia are critical habitat for multiple threatened fish and frog species. Much of this habitat was recently affected by severe drought and wildfires. The extent of aquatic habitat degradation and impacts on threatened species populations is poorly understood. Prompted by the potential localised extinctions of species we know little about, we conducted surveys of the distribution and abundance of freshwater fish and frogs in more than 100 eastern Australian wallum wetlands, investigating the extent and severity of threats to habitats and populations. The study focussed on three species of fish and four species of frog of conservation concern that inhabit Wallum wetlands. Our results provide up to date information on the distribution and population status of these fish and frog species, including discovery of new populations for several species. Alien fish species (Poeciliidae) were widespread, occurring at over 1/3 of survey sites and were considerably more prevalent at fire affected sites than native species. A number of localised extinctions occurred at heavily burned sites, however these sites were also subject to extended periods of drought, possibly drying before the fires. While the direct impact of fire alone was likely minimal at most locations surveyed, it is difficult to disentangle the concurrent and likely compounding effects of other stressors, including drought, riparian degradation, and invasive species. This project has established an updated baseline for future monitoring of freshwater fish and frogs, habitats and threats in coastal wallum ecosystems.

# Towards a modern assessment of riparian bird diets in North Texas

Haley Daniels[1], Lindsey Davis[1], Zacchaeus G. Compson[1]
[1]Department of Biological Science, Advanced Environmental Research Institute, University of North Texas, Denton,TX, United States

8C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***
*Haley joined Dr. Zacchaeus G. Compson's lab at the University of North Texas in 2021 as an undergraduate field technician and continues to work in the lab pursuing her MSc in Environment Science. Previously she earned her AS in Liberal Sciences from North Lake College and her BS in Ecology for Environmental Science from the University of North Texas. Haley is broadly interested in habitat restoration and conservation in prairies, wetlands, and riparian areas. Her thesis research uses fecal DNA metabarcoding to assess passerine diets in riparian areas.*

Understanding trophic relationships of organisms is critically important for understanding how best to conserve them, the role they play in local food webs, and how they contribute to ecosystem functioning. One way to contribute to this understanding is by utilizing fecal DNA metabarcoding for animal diet analysis. Use of this approach is growing, though it is used relatively infrequently for birds compared to mammals. As bird feces differ from mammal feces, DNA extraction, cleanup, and amplification requires different treatment. In addition, most extraction protocols require more starting mass than what is obtainable from passerine individuals. We sampled feces from North Texas passerines across multiple seasons and species with the aim to determine the ideal passerine fecal DNA mass range for standard DNA extractions. We also compared DNA extracts generated using two popular Qiagen DNA extraction kits:QIAamp PowerFecal Pro Kit and QIAamp Fast DNA Stool Mini Kit. We report results in terms of DNA quantity (ug/uL) from standard Qubit assays and quality (based at ratios of absorbance) generated from a NanoDrop spectrophotometer, both before and after PCR with several plant and invertebrate primer sets. These efforts will progress avian DNA metabarcoding pipeline development and in turn aid in increasing accuracy of future research using this tool.

# Towards a more sustainable use of fungicides: addressing the mismatch between pesticide sales and research on their ecological effects

Ana Rita Pimentão[1,2], Ana Cuco[1,2,3], Cláudia Pascoal[1,2], Fernanda Cássio[1,2], Bruno Castro[1,2]
[1]CBMA - Centre of Molecular and Environmental Biology / ARNET - Aquatic Research Network, University of Minho, Braga, Portugal, [2]IB-S - Institute of Science and Innovation for Bio-Sustainability, University of Minho, Braga, Portugal, [3]University of Aveiro, Aveiro, Portugal

8E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Rita Pimentão is a PhD student, funded by FCT, at the University of Minho. Completed a Masters in Ecology and a Degree in Biology, at the University of Minho. Currently her interests are focused on ecotoxicology, host-parasite interactions, leaf litter decomposition process and fungicide contamination. During the initial training, acquired experience in the maintenance of freshwater aquatic organisms (invertebrates, zooplankton, microalgae), as well as in the evaluation of the effects of stressors through toxicity tests involving these organisms. During her international internship, she acquired experience participating in fieldwork involving aquatic ecosystems, collecting and processing samples of water, sediment and organisms.*

Pesticide use is far from being sustainable and a sizable faction of these agrochemicals fails to reach the application target or is later transported, reaching aquatic systems where they can jeopardize biodiversity. Fungicides are the second most sold class of pesticides and are crucial to ensure global food supply and security. Current scientific knowledge has not yet identified the full consequences of fungicide pollution on ecosystem functioning, and despite legislative efforts throughout the world these chemicals are still overlooked. This work aimed to cross sales data with research efforts, in an attempt to identify potential gaps of knowledge and mismatches, by: (i) systematizing current trends in the global use of fungicides, with particular detail on the European context (where fungicide usage is high); (ii) reviewing the scientific literature on the impacts of synthetic fungicides on non-target aquatic organisms. Ultimately, the goal is to promote critical discussions on the scientific underpinnings of regulatory initiatives towards a more sustainable use of fungicides. Sales data revealed pertinent global and regional asymmetries in the relative importance of fungicides and in the usage of the most relevant active ingredients. The literature review on the ecological effects of fungicides disclosed a mismatch between the most studied and the most sold substances, as well as a bias towards the use of single species assays with standard test organisms. To ensure a proper evaluation of risk scenarios at a regional scale, research agendas must focus on sensitive ecorreceptors and improve the crosstalk with analytical and sales data.

# Towards better biomonitoring of wet and dry temporary rivers and streams

Prof. Rachel Stubbington[1], Dr Judy  England[2], Kieran Gething[1], Dr Chloe Hayes[1,2], Tim Sykes[2]
[1]Nottingham Trent University, Nottingham, United Kingdom, [2]Environment Agency, Bristol, United Kingdom

4A_SS14_Drying rivers in a time of global change, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Rachel Stubbington is a Professor of River Ecology at Nottingham Trent University, England.*

Temporary streams are widespread and diverse in cool, wet countries such as the UK. Here, the chalk streams of south and east England are among the UK's most iconic rivers, and their 'winterbourne' reaches naturally dry in response to fluctuating groundwater levels. Chalk streams are celebrated for their international rarity, high water quality, biodiversity, and provision of cultural ecosystem services, but are also subject to a breadth of human impacts including eutrophication and geomorphological degradation. In addition, climate change and water abstraction are increasing the spatial and temporal extent of their dry phases. River managers thus need tools to assess the ecological health of winterbourne chalk streams regardless of whether they are wet or dry. This presentation will introduce winterbourne chalk streams and explore research done by academic and practitioner collaborators to improve their biomonitoring. We will discuss research guiding the adaptation of current biomonitoring methods for use during flowing phases, then will focus on our use of newly collected field data to evaluate plant and invertebrate communities (including both their terrestrial and aquatic species) as biomonitors that enable ecological health assessments during dry phases. We call for testing, adaptation and use of our approaches to promote effective dry-phase biomonitoring to inform evidence-based management strategies that protect biodiversity in winterbournes and a diverse range of other drying rivers and streams.

# Towards gender-fair teaching in freshwater sciences courses

Dr Núria Catalán[1], Dr Pablo Rodríguez Lozano[1], Dr Maria Anton-Pardo[1], Dr Mireia Bartrons[1], Dr Xavier Benito Granell[1], Dr Susana Bernal[1], Eliana Bohorquez[1], Dr Miguel Canedo-Arguelles[1], Dr Isabel Fernandes[1], Dr Anna Freixa[1], Dr. Ana Genua-Olmedo[1], Dr Elizabeth León-Palmero[1], Dr Anna Lupon[1], Dr Clara Mendoza-Lera[1], Dr Ada Pastor[1], Dr Silvia Poblador[1], Dr Aitziber Zufiarre[1], Dr Maria del Mar Sánchez-Montoya[1]
[1]Grupo Gender & Science, Asociación Ibérica de Limnología, Calle El Porche, 2, 46920 , Mislata (Valencia), Spain

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*The Gender & Science AIL Commission was launched in 2014 with the aim of acting as an observer of the gender bias within freshwater sciences. We study the barriers that female scientists face during their career, and lead different activities to accomplish gender equity in the field of Limnology.*

*The Commission is formed by more than 20 researchers from different institutions.*

Women scientists, as well as researchers belonging to groups historically excluded from academia, have vastly contributed to our understanding of aquatic ecosystems, but their contributions are still neglected in university curricula. Increasing their visibility is a matter of justice, and also a way to make visible diverse role models, which can help remove barriers for future scientists. Teaching practices and students' evaluations can also be gender biased. Perhaps you think that your teaching practices are gender-fair, but are you sure? Just stop by for 10 minutes and take this self-assessment questionnaire that we have prepared for you to figure it out. This poster includes a QR code that invites you to respond to a self-assessment questionnaire about the inclusion of the gender perspective on University teaching on Aquatic Sciences. The questionnaire includes aspects about self-awareness, teaching preparation, teaching practices, and evaluation practices. Based on your answers, the questionnaire will provide you with a general evaluation as well as guidance to improve the inclusion of gender perspective on your teaching. This educational resource has been developed by the Gender & Science Group of the Iberian Association of Limnology (AIL), as part of the Gender LimnoEdu project (https://www.genderlimno.org/). We have also developed open ready-to-use resources that you can apply to your University courses to improve the visibility of women scientists.

# TP or not TP? The value of mutual validation of palaeo inference approaches to nutrient management

Dr Madeleine Moyle[1], Dr John Boyle[1], Prof Helen Bennion[2], Prof Richard Chiverrell[1]
[1]University of Liverpool, , UK, [2]University College London, , UK

5F_RS08_The past is the key to the future: the role of palaeoecology in understanding and managing fresh waters, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I am a palaeolimnologist, with a background in archaeology, interested in how humans have impacted their environments through time. I primarily use lake sediment geochemical records to reconstruct changes in landscape phosphorus supply and lake water nutrient concentrations through the Holocene. I use this long-term perspective to give context to today's freshwater systems and to consider how we might better manage these environments for people and nature.*

Freshwater management targets are predicated on assumptions that cannot be critically tested, owing to both the short duration of directly measured lake water total phosphorus (TP) data and doubts over the reliability of palaeoenvironmental inference approaches. Diatom inference methods (DI-TP) have made a valuable contribution to defining TP reference conditions for lake management, but have lacked critical independent validation over the crucial 'pre-disturbance' and 20th century timeframes. Here, a new method based on sediment geochemical records (SI-TP) offers a fully independent approach, and for the first time enables mutual validation of TP inference methods. We present the first critical comparison of DI-TP and SI-TP, using sediment records from Crose Mere, a small eutrophic UK lake. Both methods produce significantly similar trends in long-term TP concentrations; TP concentrations increase through the late 19th century, peaking at ca. 1930, followed by gradual recovery up to ca. 1980. The two methods also produce comparable TP magnitudes without any model tweaking. From the agreement shown between SI-TP and DI-TP, we can only conclude that both methods have successfully reproduced historical long-term lake water TP, given the independent factors controlling each proxy. This is the first time that two fully independent lake water TP inference methods have been applied at a single site. This mutual validation of the two TP inference methods paves the way for resolving the uncertainty over the relative importance of landscape P sources and pathways, enabling critical analysis of eutrophication drivers, and thus better targeting of measures for management and conservation.

# Tracking the long term changes of Ecological Status of Rivers: Biodiversity pathways of Aquatic Macroinvertebrates

Dr Gabor Varbiro[1], Tamás Bozoki[1], Júlia Szeles[1], Judit Fekete[1], Pál Boda[1]
[1]Centre for Ecological Research, Institute of Aquatic Ecology, Debrecen, Hungary
4D_RS04_Addressing freshwater biodiversity decline, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Gabor Varbiro is an expert in the field of aquatic ecology, with a particular focus on freshwater ecosystems and macroinvertebrate communities.With over 15 years of experience in environmental research and conservation, he has developed a comprehensive understanding of the factors that impact freshwater ecosystems, particularly with respect to macroinvertebrates as bioindicators. Gabor has played a key role in several national assessments of freshwater quality, utilizing his expertise in water quality assessment tools and ecological metrics*

This study aimed to follow the decadal changes in the ecological status of Hungarian water bodies. As a result of the Water Framework Directive (WFD) specific biological index for assessing water quality that takes into account multiple features of biological quality elements has been developed. Five distinct types of water bodies were identified based on catchment area and altitude, and a specific multimetric index was developed for each type, incorporating metrics such as composition, abundance, tolerance, and diversity. The index was tested against various chemical and landscape variables and was found to be specific to stressors and meet all criteria of the WFD. This study highlights the importance of using specific, multifaceted indices for accurate and comprehensive ecological quality assessments. In this presentation, we focus on pathways for improving ecological quality. Macroinvertebrate communities are threatened by habitat degradation, pollution, and climate change. To improve their status, pathways such as habitat restoration, pollution control, and climate change mitigation can be pursued. We discuss the importance of each biodiversity pathway and highlight case studies of macroinvertebrate-based ecological status changes to recognize their importance. By understanding these pathways, we can develop targeted measures to protect and restore freshwater ecosystems.
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# Transforming controversies around river restoration into a co-construction opportunity : approaches to building a shared river culture among stakeholders

Dr Maria Alp[1], Ms. Elsa Picard[1], Dr. Marie Lusson[1], Dr. Béatrice Maurines[2], Dr. Sylvie Morardet[1], Dr. Oldrich Navratil[2], Dr. Christelle Gramaglia[1]
[1]INRAE, Villeurbanne, France, [2]Lumière University Lyon 2, Lyon, France

4B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I'm a freshwater ecologist specialised in the assessment of anthropogenic impacts on freshwater animals. After a PhD at Eawag (Switzerland) focusing on terrestrial stages of aquatic insects, I worked in several labs in Germany and France acquiring tools in population genetics, functional and spatial ecology and studying different model organisms (invertebrates, fish, crayfish). Two major axes of my current research today are 1) connectivity of river networks (in its different dimensions) for freshwater animals; and 2) socio-ecological effects of river management and restoration.*

River restoration projects often raise controversies and generate conflicts involving various stakeholders. In some cases, this can even prevent projects from being implemented. Our hypothesis is that opening a space for discussion very early in the process may allow practitioners to avoid suffering from controversies later on. On the contrary, we think it helpful to use controversies as a starting point for initiating a dialogue around restoration and co-constructing projects that are shared and expected by different stakeholders. We elaborated interdisciplinary participative workshops to promote the definition of desired future states of the river Auzon in southern France. We tested several tools: image and video screening, direct experimentation and sensory model building to accompany stakeholders in the elaboration of their scenarios. We also used practical workshops and sensory mediation to balance the relationship between experts and local residents and open space for sharing different types of knowledge. The involvement of researchers from several disciplines contributed to building up a common river culture and care for the river at stake.

# Trends in freshwater salinisation in German waterways

Ms Theresa Piana[1], Jun-Prof Elisabeth Berger[1]
[1]Rptu Kaiserslautern-landau, Institute For Environmental Sciences, Department Of Social-ecological Systems, Landau, Germany

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*Ms Piana is conducting her PhD studies at RPTU Kaiserslautern-Landau, investigating trends in freshwater salinisation across Germany. She is experienced in ecological ecotoxicology, having conducted research and published on the effects of microplastics on freshwater oligochaetes.*

Salinisation can negatively impact river ecosystems. However, little is known about the relative contribution of different drivers of salinisation in Germany and across Europe. Drivers of freshwater salinisation include anthropogenic factors – such as agricultural runoff, mining, road de-icing, wastewater treatment, and industrial effluents – as well as natural factors – such as geological weathering, atmospheric salt deposition, and climatic as well as hydrological conditions.

To identify and assess the contribution of different drivers to freshwater salinisation in Germany, we compile an extensive dataset from routine state monitoring programs across Germany, covering the years 2000 to 2022. We use time series analysis to explore the spatial distribution and temporal development of salinity parameters, such as electrical conductivity and salt ion concentrations, and evaluate the relation of these factors to potential drivers of freshwater salinisation (e.g., geology, location of wastewater treatment plants, proximity of roads). On this basis, we generate the first nationwide view on the current state of German freshwater salinisation and its development over the last 20 years. Results indicate an increasing trend in salt loads, accounting for seasonal fluctuations.

Our study will help quantify the relative contributions of different drivers to freshwater salinisation in German rivers, which is essential for developing effective regulations, particularly as the dilution capacity of rivers will locally decrease due to climate change. Moreover, it demonstrates the value of merging monitoring data from various states and institutions, underlining the importance of data standardisation efforts.

# Twenty years endorsing the European Water Framework Directive (WFD) implementation: a bibliometric analysis and critical assessment

Dr Diego Copetti[1], Dr Stefania Erba[1]
[1]Irsa-cnr, Brugherio, Italy

7B_SS15_Who knows what is "good"? Defining aquatic ecosystem health targets for the United Nations Sustainable Development Goals, national and international policies, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*

*My research interests are mainly on lake ecology. I am interested in how these environments respond to local (e.g., nutrient loads) and global (e.g., climate change) forcings. During my research career I used both experimental and modelling approaches. I am interested in the water cycle in urban agglomerations and in the impact that they have on surface aquatic ecosystems. The use of scientific knowledge to support the management and remediation of surface water bodies is also part of my professional background. I like photography and the study of history, and philosophy of science.*

The Water Framework Directive is now at more than 20 years from its birth and can be considered one of the most studied legislation works. Many papers were produced since 1998, date of the first WFD citing document. To draw a picture of the evolution of the studies concerning this European Directive we conducted a systematic literature search. We analysed the results through a bibliometric and a concise-review analysis. The authors implemented a database to facilitate article analysis. Bibliometric analysis and mapping were carried out using VOSViewer software. We retrieved from the WoS core collection database 4120 records linked to WFD. Articles were published in 591 journals, with contributions from 92 countries. The number of overall produced papers remains high and almost unvaried since 2012, oscillating around 250 per year. The amount of scientific production was pushed by the new integrated vision of ecological quality evaluation for all water bodies, jointly with strict deadlines to put into practice WFD. This posed many challenges to the scientific community. Central themes, as apparent from keyword map and concise-review analysis, were water quality as a transversal issue to biological communities and water management: all these being milestones in WFD. WFD, as the legally binding text for EU member states, sees a strong participation of all EU countries, but it was also evident that many EU neighboring countries looked at this text to inspire their policies. As a concluding remark authors think this analysis can help researchers to look for topics to be deepened.

# Uncovering drivers of freshwater Cladoceran zooplankton in Flanders, Belgium

Mr Robby Wijns[1], Mr Maxime Fajgenblat[1,5], Ms Renée Blanckaert[1], Mr Pieter Lemmens[1,2], Mr Luc De Meester[1,2,3,4]
[1]Laboratory of Freshwater Ecology, Evolution and Conservation, KU Leuven, Leuven, Belgium, [2]Leibniz Institute für Gewasserökologie und Binnenfischerei (IGB), Berlin, Germany, [3]Institute of Biology, Freie Universität Berlin, Berlin, Germany, [4]Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), Berlin, Germany, [5]Data Science Institute (DSI), Interuniversity Institute for Biostatistics and statistical Bioinformatics (I-BioStat), Hasselt University, Hasselt, Belgium

5E_RS05_Small water bodies, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Robby Wijns is a PhD student at the lab of Freshwater Ecology, Evolution and Conservation at the KU Leuven in Belgium. His PhD deals with investigating drivers of zooplankton metacommunity structure, using novel statistical approaches.*

Identifying the factors that underpin the structure of metacommunities is a key goal of ecology. Multiple solid conceptual frameworks have been developed in order to achieve this aim. Novel statistical advances have enabled the development of comprehensive joint species distribution models that consider the complexity of empirical community data. Such analytical approaches can provide novel insights into the internal structure of metacommunities by linking empirical results to predictions of the conceptual frameworks. By capitalizing on these advances, our goal is to uncover drivers of freshwater cladoceran zooplankton communities in Flanders (northern Belgium). To this end, we compiled a unique dataset comprising qualitative information on zooplankton community composition and major local environmental conditions of more than 450 ponds in Flanders that have been investigated using the same protocol over a period of 20 years. This database has been complemented with an assessment of land cover at different perimeters around each pond. Building further on the influential hierarchical modelling of species communities (HMSC) framework, we developed a joint species distribution model that allows us to assess the relative importance of land cover characteristics, local environmental pond characteristics, spatio-temporal patterns as well as interspecific associations that drive cladoceran metacommunity structure in this set of ponds.

# Under pressure: macroinvertebrate community responses to agriculture in temporary streams

Mr Kieran Gething[1], Dr Romain Sarremejane[1], Dr Judy England[2], Mr Tim Sykes[2], Prof Rachel Stubbington[1]
[1]Nottingham Trent University, Nottingham, United Kingdom, [2]Environment Agency, Bristol, United Kingdom

4A_SS14_Drying rivers in a time of global change, June 20, 2023, 10:30 AM - 12:00 PM

***Biography:***

*Kieran Gething is a PhD Researcher from Nottingham Trent University studying the aquatic–terrestrial biodiversity of temporary stream ecosystems.*

Temporary streams are widespread and often occur in catchments dominated by agricultural land uses. Drying and agriculture can both negatively impact aquatic communities, for example by decreasing dissolved oxygen concentrations and increasing fine sediment deposition. However, the combined effects of drying and agriculture have rarely been studied. We used 98 macroinvertebrate samples collected from the perennial (n = 49) and temporary (n = 49) headwaters of the Hampshire Avon, England. We quantified the proportion of agriculture surrounding each site, assigned samples to high (n = 62) and low (n = 36) agricultural land use categories, and tested whether variability in community composition differed between perennial and temporary reaches and between high and low agricultural categories. We also tested whether the occurrence of temporary stream specialist species (including a nationally rare stonefly) was affected by agriculture. Regardless of agriculture, temporary reach communities were more variable than those in perennial reaches, suggesting drying is a bigger influence than agriculture in shaping headwater communities. Within temporary reaches, communities were comparably variable regardless of agriculture, whereas agriculture increased variability among perennial reach communities. The occurrence of temporary stream specialists was unaffected by agriculture. Our results suggest that tolerance of drying by temporary stream communities and their specialist species promotes tolerance of agriculture. However, drying, agriculture and other human pressures are intensifying, with potentially detrimental impacts for the long-term stability of headwater temporary stream communities.

# Underground Plastics - Relevance and Magnitude of Microplastics in Groundwater Systems

Prof. Anne Robertson[1], Prof Stefan Krause[2], Dr Uwe Schneidewind[2], Dr Julia Reiss[1], Dr Daniel Perkins[1]
[1]Roehampton Unviersity, London, United Kingdom, [2]University of Birmingham, Bimingham, United Kingdon

8E_RS07_Freshwater quality: research to support progress towards zero pollution targets, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***
*Anne is a freshwater community ecologist specializing in the ecology of meiofaunal sized aquatic fauna and in sub-surface ecology. She combines field observations with field and laboratory experiments to ask:-*

*1. What are the main drivers of hyporheic zone and groundwater community assembly?*

*2. What is the functional role of meiofaunal assemblages in sub-surface ecosystems?*

*3. What is the interaction between sub-surface aquatic food webs and disturbances such as flooding and pollutants.*

*Funders include NERC, AHRC, Leverhulme, EU-MSCA & Environment Agency.*
*She is increasingly involved in interdisciplinary research and collaborates with hydrologists, contaminant scientists, economists, lawyers, social anthropologists and philosophers*

Plastics have been an integral part of human society since the 1950's. Their unsustainable use, often inadequate waste management and durability pose severe environmental and public health concerns. Plastic waste is predicted to continue to accumulate in aquatic and terrestrial ecosystems even if current commitments to its reduction are fully implemented. Groundwater represents the largest reservoir of liquid fresh water on earth; globally 2.5 billion people exclusively depend on groundwater to meet their daily freshwater needs. Furthermore, groundwater ecosystems, comprising simple food webs of biofilms, microcrustacea and macrofauna, supply globally relevant ecosystem services such as biodegradation of contaminants. Groundwaters are open systems and therefore often vulnerable to pollutants from surface freshwaters and the land. We present the initial results of a 4 year project that aims to 1) determine the worldwide magnitude, and establish the first global baseline of microplastic contamination of groundwater ecosystems, 2) identify pathways of microplastic uptake into groundwater food webs and the impact of microplastic properties and major environmental constraints such as nutrients on uptake, 3) establish how microplastics change the functioning and resilience of groundwater food webs and 4) develop a global model to identify environmental relevance and predict trends of groundwater microplastic pollution.

# Understanding the chain of effects from global change to primary producer biomass in a stressed Mediterranean basin

Ms Gabriela Córdoba Ariza[1,2], Ramon J. Batalla[1,3], Josep Mas-Pla[1,4], Sergi Sabater[1,5]
[1]Catalan Institute For Water Research, Girona, Spain, [2]University of Girona, Girona, Spain, [3]Grup de Recerca de Dinàmica Fluvial, RIUS, Universitat de Lleida, Lleida, Spain, [4]Grup de Recerca Geocamb-GAiA, Universitat de Girona, Girona, Spain, [5]Institut d'Ecologia Aquàtica, Universitat de Girona, Girona, Spain

4F_RS13_Climate change and freshwaters: challenges and solutions, June 20, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Gabriela Córdoba is a third-year Ph.D. student at the Catalan Institute of Water Research in Girona, Spain. Her research focuses on investigating the complex relationships between hydrological patterns, nutrient dynamics, and ecosystem functions and processes using a combination of modeling and field observations.Before pursuing her Ph.D., Gabriela completed her master's and undergraduate studies in Biology at the National University of Colombia, where she worked on assessing food webs in a Guiana shield stream and examining the potential effects of riparian forest loss.*

The impacts of global change on hydrological patterns in the Mediterranean region are already significant, with decreased streamflow, reduced stream network connectivity, and increased stressors like groundwater demand and nutrient concentration. We used the Onyar River basin in NE Spain to better understand the chain of effects from global change, including land use changes, water withdrawal, and climate change, on hydrological patterns, water quality, and primary producer biomass. We used a hydrological model to simulate river flow and compared the results to hydrochemical data and ecological observations of algal biomass at 23 sampling points. Our model showed that water flow in the river network is progressively decreasing due to climate change (i.e., increased evapotranspiration) and anthropogenic pressures (i.e., increased water abstraction and land use changes). These changes were also reflected in water chemistry, with increases in nutrient concentrations, particularly nitrogen forms. The intense exploitation of the alluvial and deep sedimentary aquifers in the lower basin areas contributed to water flow interruption in extensive parts of the river network. Following on this network disconnection and nutrient loads increase, algal biomass shows significant spatial and temporal variations, and the higher occurrence of large algal growths. These findings highlight the challenges that climate change and human overuse of water resources directly affect water quality and ecological integrity, which require of appropriate management strategies to make compatible the preservation of ecosystems and sustainable resource exploitation.

# Understanding the Impacts of River Network Fragmentation on Freshwater Fish Species

Miss Tamara Leite[1], Dr. Florian Borgwardt[2], Dr. Paulo Branco[1]
[1]Forest Research Centre, Associate Laboratory TERRA, School of Agriculture, University of Lisbon, Lisboa, Portugal, [2]University of Natural Resources and Life Sciences, Vienna; Institute of Hydrobiology and Aquatic Ecosystem Management (IHG), Vienna, Austria

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*
*I am a biologist, attending the doctoral program FLUVIO–River Restoration and Management, and working on freshwater ecology focusing on fish species. My research is based on river network connectivity, and connectivity loss, the impacts of river network fragmentation on freshwater fish species, fish movements, and freshwater fish biology.*

Longitudinal connectivity of freshwater systems allows upstream/downstream movements of migratory species and can be disrupted by natural or artificial barriers. Barriers can affect habitat quality downstream by creating changes in flow regime, sediment and nutrient transport, and water temperature. Most European rivers are modified by dams and other barriers, resulting in around 1.2 million instream barriers in 36 European countries. The impacts of fragmentation are escalating, with construction of additional barriers, and interaction of exiting barriers with other human-induced pressures. Hence, it is important to assess the impacts of barriers on the structural and functional longitudinal connectivity of riverine systems, and the consequences for fish communities, to improve conservation measures and ecosystem management to halt biodiversity loss. The goal of this project is to understand the impacts of riverine longitudinal connectivity loss, regarding potamodromous and diadromous fish species across Europe. The research will focus on: (i) determining connectivity loss caused by large dams in Europe, using graph theory analysis; (ii) understanding if we are over or underestimating the effects of artificial barriers by comparing the effects of natural to artificial fragmentation—regarding waterfalls, dams and smaller barriers, and the upstream water reservoir; (iii) distinguishing the effects of different types of barriers; and (iv) determining if functional resilience of fish communities can be improved by restoring connectivity. We expect that fragmentation of freshwater systems will greatly reduce structural and functional longitudinal connectivity within river basins, which will ultimately have effects on fish communities, leading to a decrease of functional resilience.

# Unravelling the microalgal community in the plastisphere: preliminary results from the PhytoPlastic project

Dr Veronica Nava[1], Mona Abbasi[2], Dr. Oloyede Adekolurejo[3], Patrick Aurich[4], Nans Barthélémy[5], Berenike Bick[2], Bryan Burri[6], Dr. Marco J. Cabrerizo[7], Dr. Teofana Chonova[8], Dr. Vanessa De Santis[9], Dr. Flavia Dory[1], Annemieke M. Drost[10], Lena Fehlinger[11], Dr. Aida Figler[12], Dr. Emma Gray[13], Dr. Dariusz Halabowski[14,15], Daniel Harvey[16], Dr. Benjamin Misteli[17], Laureen Mori-Bazzano[6], Valentin Moser[18], Kyra Nowakowski[4], Valentina Orlandi[1], Julia Pasqualini[4], Federica Rotta[19,20], Bianca Schmid-Paech[21], Michael Seewald[4], Camille Touchet[5], Konstantinos Vaziourakis[2], Víctor Vázquez[22], Dr. Solomon Wagaw[23], Azdeh Yousefi[24], Julia Gostyńska[25]

[1]University of Milano-Bicocca, Department of Earth and Environmental Sciences, Milano, Italy, [2]Department of Ecology and Genetics/Limnology, Uppsala University, Uppsala, Sweden, [3]School of Biology, University of Leeds, Leeds, United Kingdom, [4]Helmholtz Centre for Environmental Research, UFZ, Magdeburg, Germany, [5]Université Claude Bernard Lyon 1, Villeurbanne, France, [6]Université de Genève, Département Forel, Geneva, Switzerland, [7]University of Granada, Granada, Andalucía/Spain, [8]Department Environmental Chemistry, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Zurich, Switzerland, [9]Water Research Institute - National Research Council of Italy, Verbania, Italy, [10]NIOO-KNAW, Wageningen, Netherlands, [11]University of Vic, Department of Biosciences, GEA Research Group, Vic, Catalonia/Spain, [12]Semmelweis University, Budapest, Hungary, [13]Atlantic Technological University, Galway, Ireland, [14]University of Lodz, Faculty of Biology and Environmental Protection, Department of Ecology and Vertebrate Zoology, Lodz, Poland, [15]University of Silesia in Katowice, Faculty of Natural Sciences, Institute of Biology, Biotechnology and Environmental Protection, Katowice, Poland, [16]UK Centre of Ecology & Hydrology, Lancaster University, Lancaster/Newcastle, United Kingdom, [17]WasserCluster Lunz, Lunz, Austria, [18]Community Ecology, Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland, Department of Aquatic Ecology, Swiss Federal Institute of Aquatic Science and Technology Eawag, Dübendorf, Switzerland, Zurich, Switzerland, [19]University of Applied Sciences and Arts of Southern Switzerland, Institute of Earth Sciences, Mendrisio, Switzerland, [20]University of Applied Sciences and Arts of Southern Switzerland, Institute of Earth Sciences, Pavia, Italy, [21]Weihenstephan-Triesdorf University of Applied Science, , Germany, [22]Department of Research and Development, Coccosphere Environmental Analysis, Málaga, Spain, [23]Wolkite University Biology Departement, Wolkite, Ethiopia, [24]Department of civil, mechanical and environmental engineering, Trento, Italy, [25]Adam Mickiewicz University in Poznan, Institute of Environmental Biology, Department of Hydrobiology, Poznan, Poland

8A_RS15_Science dissemination/communication & education, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*

*Veronica Nava is a postdoctoral researcher at the University of Milano-Bicocca (Italy) and a visiting postdoc at the Global Water Center, University of Nevada-Reno (USA). Her research focuses on the study of the impacts of anthropogenic stressors on lentic and lotic systems, through the analysis of long-term trends. She studies plastic pollution in freshwater* *ecosystems, specifically focusing on the effect of these pollutants on the wider ecological context through the study of the interaction of plastic debris with microalgae and the subsequent effects on metabolic traits (i.e., productivity).*

The ‘plastisphere’, the diverse microbial community growing on the surface of floating plastic debris, represents a new artificial habitat for drifting aquatic organisms. Despite the presence of microalgae within this epiplastic biofilm has been documented, it is still unclear how these materials influence the structure and dynamics of microalgae communities, in particular in freshwater ecosystems. Here, we present the first results of the 4th collaborative FreshProject "PhytoPlastic". The project is aimed at investigating the temporal establishment of phytobenthos on different plastic polymers in lakes over a wide geographical scale. We incubated two widely used plastic polymers (low-density polyethylene-LDPE, polyethylene terephthalate-PET) and glass substrates (as control) in 14 lakes across Europe. To assess the temporal and seasonal evolution of the colonisation, samples were collected in each season after 3, 7, 15, and 30 days. For each substrate, we assessed the phytobenthic biomass estimating the chlorophyll a, and the ash-free dry mass. Moreover, microalgae composition was taxonomically determined on a subset of samples. This project represents, to the best of our knowledge, the first coordinated experiment conducted at a large spatial scale that explores the microalgae-plastic interaction. We will thereby generate a unique dataset, providing additional knowledge about the key drivers of the processes involved. Besides the valuable scientific knowledge, the project represents a large collaboration among early career researchers in freshwater sciences and will set the basis for further partnerships.

# Urban streams: effects on diatom community diversity and structure

Prof. Salomé Almeida[1], Dr Ana Raquel Calapez[2], Dr. Sónia Serra[2], MSc Manuela Sales[1], Dr. Maria Feio[2]
[1]Department Of Biology & GeoBioTec, University of Aveiro, 3810-193, Aveiro, Portugal, Aveiro, Portugal, [2]MARE & Department of Life Sciences, University of Coimbra, Portugal, Coimbra, Portugal

5A_SS08_Freshwater ecosystems and urbanization – is the sustainable development of cities really possible?, June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Salomé FP Almeida is an assistant professor at the Biology Department of the University of Aveiro and GeoBiotec research Centre and member of the social bodies of the non-profitable association "PROAQUA – Association for promotion of knowledge in Ecology". Her main interests are ecological assessment of freshwater using aquatic flora. The impact of degradation gradients in rivers and streams is also of interest. She has experience in taxonomy and ecology of freshwater diatoms and study from the cell to the community level.*

Streams running through cities are more vulnerable to degradation due to the increase of impervious surfaces. Urban runoff usually drains all sorts of contaminants into streams, therefore degrading water and biota. The preservation of natural areas within cities is essential for ecosystem health but is also beneficial for Humans. To understand the impact of urbanization on diatom communities a degradation gradient from nine streams was studied. Pearson correlations between three urbanization measures (global water quality score – nutrients, TDS, oxygen saturation; percentage of impervious area; percentage of tree cover) and three diatom metrics (Shannon-Wiener diversity index (H'); taxa richness; and water quality class provided by diatom EQRs for each site) were all non-significant except for the correlation between the global water quality score and diatom EQRs ($R=0.79$, $p<0.05$). Diatom community structure was significantly different between good and bad water quality sites (PERMANOVA analysis). The average dissimilarity (SIMPER) of diatom communities between good and bad water quality sites was 66%. The taxa that most contributed to this dissimilarity were: Sellaphora seminulum, Eolimna minima (dominant at bad water quality sites), Amphora pediculus and Achnanthidium minutissimum (more abundant at good water quality sites), which are very frequent and common in rivers and streams. We can conclude that diatom communities were able to identify a water quality gradient, but were not responsive to the other urbanization metrics tested. We believe that an increase in the urbanization gradient may provide clearer correlations with diatom communities.

# Use of multi-omics to assess stress in juvenile freshwater pearl mussels (Margaritifera margaritifera)

Dr Louise Lavictoire[1,2], Mr Chris West[3]
[1]Freshwater Biological Association, Newby Bridge, United Kingdom, [2]Lancaster University, Lancaster, United Kingdom, [3]West Cumbria Rivers Trust, Keswick, United Kingdom

8C_RS06_Advancing our understanding of freshwater ecosystems with molecular approaches, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***

*Louise is the Head of Science at the Freshwater Biological Association. Her research focusses on species recovery, principally the use of ex-situ methods to save particularly imperilled species. Louise is particularly interested in studying biological processes of threatened or vulnerable species to inform recovery efforts.*

*Additionally, Louise heads up a team at the FBA focussing on various citizen science projects and methods monitoring a wide range of parameters including water quality, bacteria potentially harmful to human health, riverfly communities and priority habitats.*

Freshwater mussels are one of the most imperiled groups in the world. The freshwater pearl mussel (Margaritifera margaritifera) is the subject of significant conservation effort across Europe, with over a dozen captive breeding programmes attempting to save populations from local extinction. Despite this, there is much we still don't know about this species, particularly what the physiological effects are of sub-optimal habitat conditions and how the species may respond to a changing climate.

We conducted a multiple stressors experiment under laboratory conditions to assess the physiological effects of high temperature and turbidity on juvenile freshwater pearl mussels. We used transcriptomics and non-targeted metabolomics to investigate the effects of these stressors on gene expression and the metabolome. Our results will help inform the physiological impact of these stressors on juvenile freshwater pearl mussels and provide baseline data for the species. This is particularly important given that the stressors we investigated are ecologically relevant and pressures caused by higher temperatures and sediment run off are likely to be exacerbated with a changing and more extreme climate.

# Using a 30 year macroinvertebrate and chemical record to reveal what has driven the recovery in biodiversity in English rivers

Prof. Andrew Johnson[1], Dr Dinara Sadykova, Dr Yueming Qu, Dr Francois Edwards, Dr Monika Juergens, Dr Virginie Keller, Dr Pete Scarlett, Dr Nuria Bachiller-Jareno
[1]UKCEH, Wallingford, United Kingdom

2C_SS01_Mechanisms underlying responses to multiple stressors, June 19, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Prof. Johnson obtained a PhD in Soil Science at Reading University in 1988. Since 1992 he has been employed at the UK Centre for Ecology and Hydrology. His work has focused on the impact of chemicals on the natural environment, including soils, rivers, sewage and groundwater. The contaminants studied include pesticides, endocrine disrupting compounds, pharmaceuticals, personal care products, persistent organic pollutants, metals, nanoparticles and microplastics. To better understand these impacts, he has worked with hydrologists, modellers, ecotoxicologists, ecologists and statisticians at UKCEH and in academia. He is currently leading the NERC-funded ChemPop project looking at chemical impacts on wildlife populations.*

National macroinvertebrate diversity has steadily improved in England over the past 30 years, but why? In this study we matched macroinvertebrate records over 30 years with location, chemical and physical records across England. The measurement locations and sample timings were different, so this required considerable effort to reconcile 62,000 biological records with about 500,000 chemical (and physical) records. We selected 1,519 macroinvertebrates sites across England from the Freshwater river macroinvertebrate surveys (Biosys) dataset, on the basis of their long and consistent records. The analysis focused on family richness, Ephemeroptera, Plecoptera, Trichoptera (EPT) family richness, BMWP_NTAXA and BMWP_ASPT. In this exercise, we matched macroinvertebrate sites with the nearest chemical measurement sites from the WIMS chemicals dataset. All environments showed improvements, although high upstream urban land use exerted a greater drag than high wastewater exposure or high cropland use in the catchment. Whilst improvements in family richness and BMWP_NTAXA have slowed in the last decade, EPT family richness and BMWP_ASPT have not. This implies that water quality is no longer the key limiting factor. We used GLMM statistical analysis to identify which stressor or stressors can best explain the variability in macroinvertebrate family richness over 30 years in English rivers. All possible combinations were compared by GLMM which requires up to 26,000 different model runs (no a priori assumptions are made). Zinc, copper, ammonia and BOD are currently coming out strongly as most closely associated with the selected indices for macroinvertebrate diversity. The latest results will be presented at the conference.

# Using bio-diagnostic tools to unravel multiple human pressures and guide river restoration strategies

Dr James White[1], Professor David Hannah[1], Dr Kieran Khamis[1], Miss Molly Bridger[2], Professor Paul Wood[2], Dr Kate Mathers[2], Dr Judy England[3]
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5B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 2:15 PM - 3:45 PM

***Biography:***
*Dr James White is a freshwater ecologist and his research interests cover various water science challenges. He has a particular passion for informing effective and sustainable management interventions in riverine environments and has two primary applied research focusses. First, he possesses considerable expertise in quantifying ecological responses to hydrological modifications to help inform water resource management operations. Second, he specialises in the guidance of ecologically successful river restoration initiatives. These skillsets have been applied alongside an interdisciplinary team aiming to guide real world restoration designs.*

River ecosystems globally continue to be degraded by a multitude of anthropogenic pressures. Identifying the key stressor(s) determining the ecological health of river systems is critical in guiding effective management decisions. While river restoration interventions often report biodiversity improvements as a primary ambition, few collect baseline data characterising how human impacts have limited ecological health. In this paper, we examined secondary data sources from one of the most urbanised UK catchments to inform where and what type of river restoration interventions could be prioritised. Specifically, macroinvertebrate community bio-diagnostic tools were examined in relation to different environmental controls and anthropogenic pressures (e.g., flow regime modifications and water quality stressors). The catchment displayed widespread nutrient enrichment issues that limited ecological health. While such water quality pressures prevail, river restoration practices addressing physical habitat conditions alone may limit freshwater biodiversity recovery trajectories. Consequently, further analyses was undertaken to identify future project locations where restoration is likely to yield maximum ecological benefits. This entailed assessing physical habitat conditions alongside potential ecological dispersal pathways and land cover types that are more conducive to certain restoration techniques. Optimal potential restoration sites were typically located in the headwaters, in urban parks or rural areas where faunal communities were less impacted and there is greater scope to alter the lateral profiles of channels. Hence, findings from this research could help inform future restoration efforts within the catchment (e.g., planned rewilding initiatives and reach-scale interventions), and could be easily implemented in other systems to prioritise management interventions.

# Using compound-specific stable isotope analysis to trace essential fatty acid bioconversion in invertebrates and fish from freshwater lakes

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7A_RS15_Science dissemination/communication & education, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Post-Doc at WasserCluster Lunz, Research focuses on aquatic ecophysiology, particularaly on the limitation of organism survival by micronutrients and how these support the growth and function of neurological structures.*

Survival, growth, and reproduction of consumers depend on the acquisition of sufficient dietary energy and essential micronutrients. Organisms at the base of the aquatic food web synthesize essential polyunsaturated fatty acids (PUFA), which are transferred to consumers at higher trophic levels. Many consumers, requiring omega-3 long-chain (n-3 LC)-PUFA such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), have limited ability to biosynthesize them from the essential dietary precursor α-linolenic acid (ALA) and thus rely on dietary provision of LC-PUFA. If the dietary supply of such PUFA does not match the physiological needs, consumers may need to bioconvert dietary precursors into the required molecules. Such conversion may provide an ecological disadvantage over consumers that have direct access to required dietary compounds. We present a method, based on compound-specific stable hydrogen isotopes, to elucidate metabolic processing of fatty acids in both laboratory and field experiments. We show how compound-specific stable hydrogen isotopes of fatty acids can be used to study dietary limitations and bioconversion of n-3 PUFA in zooplankton and in fish.

# Using eDNA to detect changes in aquatic communities through time in temporary rivers

Señorita Nieves López-Rodríguez[1,2,3], Zeynep Ersoy[1,2], Martina Weiss[4], Dominik Buchner[4], Till Hendrik Macher[4], Florian Leese[4,8], Cesc Múrria[2,10], Guillermo Quevedo-Ortiz[1,2], Raul Acosta[5,6], Pau Fortuño[1,2], María Soria[1,2,9], Narcis Prat[1,6], Nuria Cid[1,7], Dolors Vinyoles[1,2], Joan Gomà[1,2], Miguel Cañedo-Arguelles[5,6], Núria Bonada[1,2]
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1A_SS14_Drying rivers in a time of global change, June 19, 2023, 10:30 AM - 12:00 PM

*Biography:*

*I'm a Ph.D. student between the University of Barcelona and the company Eurofins-Cavendish. My research focuses on different applications of metabarcoding techniques in aquatic macroinvertebrates in Mediterranean rivers. We use fundamental approaches to determine taxonomic, functional and genetic diversity, conservation patterns and conservation areas in high mountain streams in the Pyrenees (NE Spain) and applied approaches using eDNA as a bioindicator of macroinvertebrates in temporary rivers.*

Temporary rivers (TRs) are dynamic systems that typically shift between flowing, disconnected pools and dry phases. TRs are inhabited by several endemic and specialized aquatic and terrestrial biota and have great conservation value for freshwater and terrestrial taxa. In particular, disconnected pools serve as refugia for many species during the dry season and represent sources of colonizers once flow ressumption occurs. However, traditional sampling methods used in these pools can be harmful and a large proportion of the community can be depleted. Nowadays, environmental DNA (eDNA) metabarcoding has been established as a complementary and non-invasive method to investigate communities from environmental samples without the collection of specimens. Our aim was to evaluate the potential of eDNA metabarcoding from TRs sediments to account for temporal changes of macroinvertebrates and diatoms across different hydrological phases and in comparison to traditional methods. We sampled sedimentary eDNA every 15 days in pools located from three river reaches. Additionally, we sampled macroinvertebrates and diatoms three times in the sample pools (connected, disconnecting and disconnected pools) using traditional

methodologies. We identified traditional samples and processed sediments using metabarcoding Leray-XT primers. Preliminary results showed sedimentary eDNA metabarcoding represented macroinvertebrate as good as traditional methods. However, this was not the case for diatoms of which the majority could not be assigned to species level. Despite these challenges, sediment eDNA metabarcoding was able to detect changes in the macroinvertebrate community and allowed identification at lower taxonomic resolution, opening opportunities to understand the spatiotemporal changes of aquatic communities in TRs.

# Using palaeolimnology to inform conservation of a rare Malaysian flood pulse wetland

Prof Suzanne McGowan[1,2], John Boyle[3], Charlotte Briddon[4], Stefan Engels[5], Jack Lacey[6], Melanie Leng[6], Yu Li[7], Keely Mills[7], Virginia Panizzo[2], Muhammud Shafiq[8], David Ryves[7], Lara Winter[7], Chew Ming Yee[9]
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5F_RS08_The past is the key to the future: the role of palaeoecology in understanding and managing fresh waters, June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Aquatic ecologist and palaeolimnologist who investigates how and why aquatic ecosystems respond to environmental changes over a variety of timescales. Interested in how people interact with water. Works with algae and their pigments as bioindicators. Head of the Department of Aquatic Ecology and NIOO-KNAW and Fellow of the Freshwater Biological Association.*

There are few natural standing waters in Peninsular Malaysia. Tasik Chini is one such rare shallow lake-wetland complex located in Pahang. The lake is supplied both by numerous small rivers that drain locally, and flooding from the large Pahang River, which inflows during the wet season. This UNESCO-designated site which supports local indigenous communities has fringing lake-swamp vegetation with rare hydrosere communities. Due to the scarcity of similar sites and long-term monitoring data, it is difficult to derive targets for conservation of natural and cultural heritage at this site. Therefore, we used palaeolimnology combined with analysis of local documentary archives to understand the nature, rates and drivers of change. Archives indicate extensive farming in the Pahang River watershed and local mining and logging activities over recent decades, which increased soil erosion and nutrient pollution. A dam constructed in 1995 to boost ecotourism has altered the natural hydrology of the lake. Pb-210 dating on several cores from the lake basin indicates major increases in sediment infilling over the past 50 years, set against a baseline of much reduced sedimentation rates since the lake formed around 4500 years ago. Diatoms, elemental analysis, chlorophyll and carotenoid pigments, and carbon and nitrogen stable isotopes, indicate large changes in hydrology and water quality over the past 150 years, especially since the 1950s. Together these sedimentary indicators demonstrate major shifts in the ecosystem of this tropical lake system, which were initiated by land use changes and exacerbated by shifts in hydro-climate.

# Using Remote Underwater Videos (RUV) to enhance freshwater invasion science.

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[1]University Of Leeds, Leeds, United Kingdom, [2]APEM Ltd, Stockport, United Kingdom

8D_SS16_Unravelling biological invasions in freshwaters: challenges and knowledge gaps in a hyper-connected world, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Matthew Harwood is a first year PhD student at the University of Leeds investigating the use of novel technology to monitor and manage invasive species.*

Remote Underwater Videos (RUV) have huge capacity to enhance freshwater invasion research but are as yet underused in the discipline and lack the standardised methodology needed to create meaningful and comparative data. Via systematic review, we assess the current extent of use in invasion science and recommend standard operating procedures for application. The first reported use of RUVs in freshwater was in England in 1988 and as of December 2022 there had been 163 pieces of literature published involving the use of RUVs in freshwater environments. Despite this there has been limited use towards invasion science, with only seven pieces of the returned literature mentioning it. The most common use of RUVs for invasion science has been to assess invasion recovery, deploying RUVs into waterbodies treated for invasive species and assessing the abundance of native fish post treatment, while also testing for observations of invasive species. Other uses include testing to see how native populations differ between invaded and non-invaded sites, determining dominance and contest between natives and invasives, determining the abundance of invasive species and the habitat usage of invasives. The lightweight and low-cost nature of RUVs presents a tool that can be rapidly deployed to effectively assess invasive species and there is less risk of cross contamination as they can be efficiently cleaned by submergence in sterilising buckets. We suggest creative applications of RUVs to support robust hypothesis testing and management in invasion science.

# Utilizing historical map sources to quantify the spatio-temporal development of riverine landscapes

Ms Victoria Scherelis[1,2], Dr. Patrick Laube[1,2], Dr. Michael Doering[1]
[1]ZHAW- Zurich University of Applied Sciences, Institute of Natural Resource Sciences, Zurich, Switzerland, [2]UZH -University of Zurich, Department of Geography, Zurich, Switzerland
9C_SS13_River connectivity: processes, methods and case-studies, June 23, 2023, 10:15 AM - 12:00 PM

***Biography:***
*V. Scherelis is a doctoral researcher in the Department of Geography at UZH and part of the Geoinformatics and Ecohydrology research groups at ZHAW. Her research interests include GIScience, spatio-temporal GIS, and environmental geography. Her current research is centered on the development and derivation of static and dynamic metrics of hydro-morphological features extracted from historical maps of Switzerland. With a background in geoinformatics, her work applies GIS techniques to quantify changes observed in the past which can give insight on the present and future in terms of river management and conservation.*

Spatio-temporal morphological changes have a fundamental influence on the structure and function of riverine ecosystems. Changes can be natural or human induced and drive the temporal variability or directional changes of terrestrial or aquatic habitat components. Change detection is a very practical technique to capture spatial and temporal ecosystem changes of a region on a pixel-based scale, such as land use changes, vegetation cover or hydrological dynamics through space and time. Pixel-based change detection usually involves the comparison of high-resolution satellite or aerial imagery at two time intervals to identify where changes occurred. However, this approach lacks the temporal depth of pre-digital, and perhaps pre-modified, times. Here, we applied a pixel change detection technique on historical maps of Switzerland to detect morphological changes along a section of the Aare river. Using four time-steps from 1876 to 1930, we detect and quantify historical spatio-temporal changes and their patterns of aquatic and terrestrial habitat components, such as changes from river to wetland or variability between channels and islands. First results of our analyses have shown that the Aare river section was subject to fundamental human-induced aquatic to terrestrial changes. Quantifying and including these historical changes and their patterns highly complement important information on river development and dynamics over larger timescales. Utilizing historical map sources clearly supports the evaluation of river development, the detection of potential legacies, and present and future efforts in freshwater management and conservation.

# Vanishing rivers vis-à-vis Water Security, life and livelihood nexus of the lower Gangetic delta

Dr Anirban Mukhopadhyay[1]
[1]Asian Institute Of Technology, Bangkok, Thailand
6A_SS17_Delta Ecosystems in transition, June 20, 2023, 4:15 PM - 5:30 PM

***Biography:***
*Researcher and affiliated faculty of AIT, with several publications*

We tried to analyze the changing pattern of the tributaries and distributaries of the rivers of Lower Gangetic Delts using multitemporal satellite images. This was followed by the analysis of the changing pattern of the drainage density. Key-informant interviews and multi-stakeholders feedback from four workshops conducted in Sundarbans also helped to understand the situation. River discontinuity issue is profound in the lower western Gangetic Delta. River Matla and Bidya have lost their upstream connection with the decay of the Bidyadhari system, and many distributaries like Bhairab, Jalangi, Mathabhanga-Churni, Ichhamati, Gorai-Madhumati were left moribund, and Saraswati became extinct. The overall drainage density during the last three decades continuously decreased. The results indicate that though the Ganges Brahmaputra Meghna Delta receives a huge amount of freshwater supply through riverine systems and rainfall, the Western part of the lower Gangetic Delta is losing its freshwater supply day by day. This impacts the landscape dynamics as well as Agrei -based life and livelihood of the delta dwellers. Reduced flow of fresh water in the western part of the Delta directly impacts the Mangrove species of Sundarbans as the species diversity is directly aligned with the salinity. Which ultimately changes the forest-based ecosystem services.

# Warding off freshwater salinisation: Do current criteria measure up ?

Dr Sandra Poikane, Dr Gary Free, Dr Prof Agnieszka Kolada, Dr Prof Geoff Phillips, Dr Stuart Warner, Dr Georg Wolfram, Dr Prof Martyn Kelly

7B_SS15_Who knows what is “good”? Defining aquatic ecosystem health targets for the United Nations Sustainable Development Goals, national and international policies, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*I am an aquatic ecologist, currently employed at Sustainable Resources, Joint Research Centre of European Commission in Ispra, Italy. My research covers several aspects of applied ecology, focusing on aquatic bioassessment and the definition of biological integrity and ecosystem health. Currently, I am leading a pan-European intercalibration work, which has resulted in harmonization of ecological assessment of lakes, rivers and coastal waters. I am involved in a project focusing on nutrient thresholds associated with good ecological quality in lakes and rivers of Europe. I have authored 50 papers on these topics in peer-reviewed journals.*

Salinisation is a global threat to freshwater habitats intensified by climate change. Monitoring, assessment and management of salinity is therefore essential. The first step is setting criteria that are sufficiently stringent to protect ecosystem health. However, just under half of EU countries have set standards relating to salinity for rivers, and they differ widely. Even fewer countries have set salinity standards for lakes. Similarly, different approaches and widely different values were reported for setting salinity standards for implementing UN Sustainable Development Goal (SDG) 6.3.2. for “good ambient water quality”. Much of this information has not been published and is not readily available, hindering further efforts to address the problem.
We first discuss implications of salinisation for freshwater ecological health, illustrated by the recent ecological disaster in the Oder river. Then, we provide an up-to-date and comprehensive review of salinity criteria set by European countries to implement the Water Framework Directive (parameters, metrics used and thresholds to protect good ecological status). In addition, we provide an overview of criteria set to implement UN SDG 6.3.2. (“good ambient water quality”). Finally, we discuss the principles and guidelines on how salinity criteria to protect ecology should be established.

# Water / people / nature - key ingredients for any successful restoration project: the case of the Tzipori stream, Israel

Dr Yaron Hershkovitz[1], Avital Katz[1]
[1]The Steinhardt Museum of Natural History, Tel Aviv University, Tel Aviv, Israel
5B_RS11_Restoration and conservation (incl. nature-based solutions), June 20, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Dr. Yaron Hershkovitz is a stream ecologist. Since 2015 he is the managing director of the "Israel National Center for Aquatic Ecology" at Tel Aviv University. For more than a decade he has been part of several EU-funded projects, including assessment of climate change impacts on freshwater ecosystems (FP-7 REFRESH), stream bioassessment in the Lake Kinneret Catchment (German – Israeli Foundation), and recently the H2020 project MERLIN, which focuses on upscaling restoration measures of streams across Europe. He is leading ecologist in several restoration projects in Israel and acts as a professional advisor to the Israeli authorities.*

Water is the key component of any river ecosystem. Water is also vital for any human society, and freshwater overexploitation has led to the degradation of riverine ecosystems worldwide. Such conflicts are mostly prevalent in water-scarce areas, such as the Mediterranean region and the Middle East, in particular. Water availability must therefore be considered in river restoration plans in these regions.
The Tzipori stream restoration project is probably one of the only catchment-scale plans in the Middle East. Located in a historically agricultural and multicultural region, the Tzipori watershed have been providing ecosystem services to the local communities, for centuries. These include the use of stream flow for operating watermills, and utilization of water for irrigation and drinking. Over the years, population growth has led to severe degradation of the riverine ecosystem and its surroundings.
Improving the ecological conditions of the stream, while meeting the needs of local residents, is a major challenge. The regional master plan is aiming to provide local farmers with a steady supply of external freshwater, thus allowing the natural flow of the stream to resume. It will also ensure that crop yields will not be affected by droughts, which are expected to increase due to climate change. Other planed measures include reduction of pollutants (point and diffuse sources), improving channel morphology, reconnecting floodplains, and widening riparian buffer strips. At the same time, a comprehensive monitoring programme will assess changes in ecosystem health, in relation to the progress of the implementation of the restoration measures.

# Water quality and land-use impacts on development of larval amphibians in the UK

Dr Frances Orton[1], Ms Chloe Houseman, Mr John Howieson, Prof Charles Tyler
[1]Uk Centre For Ecology & Hydrology, , United Kingdom

3E_RS10_Biomonitoring, June 19, 2023, 4:15 PM - 6:00 PM

*Biography:*
*I am a freshwater ecotoxicologist, passionate about protecting wildlife and ecosystems from environmental hazards. I take a holistic approach to research and combine environmentally relevant laboratory exposures with field-work to investigate the driving factors contributing to the loss of biodiversity; in particular for amphibians. I am internationally recognised, and have regularly been invited to present my work and to advise on policy.*

Amphibians are the fastest declining vertebrate group. As the vast majority of amphibians incorporate an aquatic larval phase during their lifecycle, water quality and the surrounding land use of the water body have importance for their development. The small size, high spatial density, and tendency to complete development within a small water body, make larval amphibians excellent models for assessing environmental stressor impacts on animal health. Here, we collected snout-vent length (SVL) and/or body mass and developmental stage data for wild tadpoles from two anuran species (common toad: Bufo bufo; common frog: Rana temporaria) and a newt species (Lissotriton sp.) over several years (2015, 2019, 2021, 2022) along with pond water quality parameters and made assessments of the surrounding land using a GIS approach. As expected, over pre-metamorphic development, there was a positive correlation between SVL/body mass and developmental stage in all species/sampling years; however, the strength of this association differed between years and species (R2 range: 0.42-0.91). Data were further analysed using generalised linear mixed models with SVL/body mass data normalised by developmental stage prior to statistical analysis. For common frogs (2015, 2021), higher pH (range: 5.7-8.2) was associated with larger body mass. A similar effect was observed for common toads (2019, 2022), whereby higher pH (range: 5.2-7.8) was associated with larger SVL. However, for common frogs/newts (2022), no relationship was found between pH (range: 5.6-8.1) and SVL. The resulting data will provide an important baseline for studies using morphology for wild UK larval amphibian populations.

# Water quality monitoring and environmental awareness - A Comparison study of Water Quality Legislation: Case European and Brazil rivers.

Miss Camila Pimenta[1], Gábor Várbiro[2]
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8E_RS07_Freshwater quality: research to support progress towards zero pollution targets,
June 22, 2023, 3:45 PM - 5:30 PM

The regulation and supervision of water resource management programs depend heavily on evaluating and monitoring water quality. Analysing the enrichment of nutrients in water bodies
is important to evaluate water quality, considering confounding variables for the nutrient1biology interaction. This study compared nutrient limit values outlined in the Water Framework
Directive (WFD) (using EQR - Ecological Quality Ratio) values in broad river types in Hungary and Brazil's water quality index (IQA). In Hungary, the best-performing nutrient parameters for macroinvertebrates were BOD, PO4-P, TOC, and Conductivity, while COD, DO, NH4-N, and TOC were the best for diatoms. Hungary's river EQR evaluations show a good to moderate ecological status, while Brazil's results indicate that phosphorus values ranged between 0.05-0.10 mg/L (Bad) and 0.03-0.05 mg/L (Regular), with most sampling points having good BOD values and excellent DO levels. However, in research by the SOS Mata Atlântica Foundation, these limits are high for Brazilian rivers, as only 2.5% of the evaluated locations had good quality, and 27.5% had poor or very poor quality, showing that 70% of the sites were in regular condition. Brazil and Hungary share similarities in terms of their legal frameworks, recognition of the importance of water resources, cooperation with international organizations, and challenges in monitoring water quality. Despite their differences, both countries are committed to protecting water resources and ensuring access to
safe and clean water for their populations

# Water quality monitoring of the Indian Ganges-Brahmaputra-Meghna (GBM) delta

Dr Virginia Panizzo, Abhra Chanda[2], Souvik Shil[2], Tuhin Ghosh[2], Jodie Brown[1], James Fielding[1], Adrian Bass[3], Gina Henderson[4], Andrew Henderson[4], Jorge Salgado[5], Prof Suzanne McGowan[6], Andrew Lange[4]
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Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

From a total of 23 sites across the Indian GBM delta (including the Hooghly and Matla rivers as well as other main tributaries) we present a comprehensive monitoring of seasonal physicochemical, stable isotope and algal (biomass and pigment) data from both dissolved and river particulate matter. Sampling was conducted three times over the course of 2021-2022, capturing the post monsoon period (November 2021), pre-monsoon period (March 2022) and monsoon periods (July 2022), with sampling taking place both at low and high tides. Data show the great variability in dissolved oxygen, conductivity and salinity concentrations between both high and low tides, spatially across the region (upstream and downstream), as well as between the different sampling periods (pre- and post-monsoon). Of particular note are the very high levels of salinity in even upstream reaches, highlighting the now acute freshwater scarcity that is taking place in the dry season. N/P ratios are also deviated from the ideal Redfield ratio indication anthropogenic nutrient enrichment of the dominant river channels across the estuary. Furthermore, all sites documented high total suspended sediment loads during the 2022 monsoon period, with almost all station data pointing to the GBM acting as a as an atmospheric CO2 source. While Chl a biomass increases following the monsoonal period. Spatial and seasonal trends across the entire dataset will be more fully explored, highlighting the value of in-depth, seasonal monitoring records from the GBM delta as a means to more fully explore the role of coastal saline intrusion and upstream water management impacts on this unique ecosystem.

# Water-driven transport of microorganisms from glaciers to the Kongsfjorden through the Bayelva River (Western Svalbard, High Arctic Norway)

Dr Angelina Lo Giudice[1], Mr Alessandro Ciro Rappazzo[1,2], Dr. Maurizio Azzaro[1], Dr. Gabriella Caruso[1], Mrs. Giovanna Maimone[1], Dr. Maria Papale[1], Dr. Franco Decembrini[1], Mr. Alessio Lena[1,3], Dr. Luisa Patrolecco[1], Dr. Francesca Spataro[1], Dr. Jasmin Rauseo[1], Mrs Marianna D'Amico[1,2], Dr. Marco Vecchiato[1,2], Dr. Matia Menichini[4], Dr. Linda Franceschi[4], Dr. Ilaria Baneschi[4], Dr. Marco Doveri[4]

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Poster Session 1, June 20, 2023, 1:15 PM - 2:15 PM

*Biography:*

*Angelina Lo Giudice is Senior Researcher in Microbial Ecology at the Institute of Polar Sciences (CNR-ISP) in Messina, Italy. Her research activities are mainly addressed to the study of the prokaryotic communities in polar environments. Particular attention is paid to: Microbial ecology (diversity and function) of aquatic and terrestrial systems; Associations between prokaryotes and benthic filter-feeders; Response by bacterial communities to human impact; Biotechnological potential of cold-adapted bacteria; Relationships between chemical contamination and prokaryotic biodiversity. Angelina Lo Giudice has published more than 100 papers in highly ranked scientific journals (IF 29). She is Associate Editor of Polar Biology.*

Glacier melting results in the mobilization-transport of microorganisms and organic-inorganic compounds stored since a long time, and solid particles via meltwaters. The Bayelva catchment (79°N 12°E, Svalbard Islands, Norway) is a crucial site for establishing the links between microbial communities and hydrology dynamics in the Svalbard glaciers, in a continuum from the glaciers to the fiord. Within the project ICEtoFLUX (grant PRA2021-0027), two field campaigns (spring and summer 2022) were conducted in the Bayelva River catchment, from its glaciers (Austre and Vestre Brøggerbreen) and periglacial/proglacial systems up to the Kongsfjorden, in a sector significantly affected by the river. Glacier snowpack, snow and glacial meltwater, river and fjord waters were collected to quantify the microbial biomass mobilization and its transfer to the fjord. Flowrates varied between 2 and 9 $m^3/s$ in June at the Bayelva River section close to the fjord. Samples were analysed for culturable heterotrophic bacteria and total prokaryotes, microbial enzymes (leucin aminopeptidase, LAP, beta-glucosidase, GLU, alkaline phosphatase, AP), and chlorophyll-a concentration. Prokaryotic abundance was quite low in snowpack ($10^3$ cells/g), but it increased in river and fjord waters. Prokaryotes were predominantly coccus-shaped, and morphologically as individual cells or aggregates. Viable counts, differing among the used culture media, were in the order of $10^2$ CFUs/g, with low values in snow. Low enzymatic activities were recorded in snow samples, with higher LAP than GLU and AP values. Mean chlorophyll-a concentration was high in the sea river (0.5 $mg/m^3$) compared to the river (0.1 $mg/m^3$), where the greatest variability was observed.

# Wetland type, conservation status and temperature determine the structure and carbon-related metabolisms of prokaryotic communities in Mediterranean wetlands

Mr Javier Miralles-Lorenzo[1], Dr Antonio Picazo[1], Dr Carlos Rochera[1], Dr Daniel Morant[1], Dr Antonio Camacho[1]
[1]University of Valencia, València, Spain
9E_RS03_Microbial ecology in freshwaters, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*PhD student whose research deals with the regulation of the carbon cycle by aquatic microorganisms and the implications for greenhouse gas emissions and carbon sequestration in Mediterranean wetlands and shallow lakes.*

The Mediterranean region hosts a wide variety of wetlands and shallow lakes, which are very dynamic in relation to the exchanges of carbon-greenhouse gases (C-GHGs), such as carbon dioxide (CO2) and methane (CH4). Prokaryotic assemblages are actively involved in the carbon fluxes of these ecosystems given its high abundance and metabolic diversity. Therefore, any event that alters the structure and function of prokaryotic communities can significantly affect the carbon biogeochemistry and carbon balances of Mediterranean wetlands. In this work, we have analysed the structure and potential carbon-related metabolisms of the prokaryotic communities of three broad categories of Mediterranean wetlands: coastal wetlands, freshwater inland wetlands, and inland saline shallow lakes. Furthermore we examined how the ecological characteristics of the wetlands (wetland types), their conservation status, and temperature affect the structure, function, and pattern of interactions of their water and sediment prokaryotic communities. The results of this work show that each wetland category and conservation status is associated with specific prokaryotic assemblages, and that an increase in temperature can affect both gene expression and relationships between microorganisms, thereby altering carbon fluxes. This work was supported by project CLIMAWET-CONS (PID2019-104742RB-I00), funded by Agencia Estatal de Investigación and the Ministerio de Ciencia e Innovación (Gobierno de España).

# What evidence exists on the impacts of flow variability on fish and macroinvertebrates of temperate floodplain rivers in Central and Western Europe?

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9B_RS12_Advances in environmental flow science and practice, June 23, 2023, 10:15 AM - 12:00 PM

*Biography:*
*Graduated in 2013 from University of Warsaw in Environmental Management. Currently pursuing PhD studies at Warsaw University of Life Sciences in environmental engineering. My research interests focus on environmental flows, climate change and stakeholder engagement.*

This systematic review aims at mapping current state of knowledge on the impacts of natural, anthropogenic, and climate change-induced flow variability on riverine fish and macroinvertebrates in Europe. Particular focus was placed on the effects of extreme low and high discharges, as these rare events regulate population size and taxonomic diversity. The review was conducted according to the guidelines of Collaboration for Environmental Evidence. First, evidence was searched for in 1) academic repositories, 2) specialist websites (e.g. limnological associations), 3) Google Scholar, as well as through 4) direct contact with specialists and 5) open call for evidence. Thus, the search covered both primary and grey literature. No date, language, or document type restrictions were applied. All studies were screened in two steps: title and abstract, and full-text. The eligibility criteria included: geographical scope, population, exposure/intervention, outcome and comparator. Geographically, the map covered freshwater ecoregion of Central and Western Europe. Eligible populations included fish and macroinvertebrates (both native and introduced) of temperate floodplain rivers. Flow variability included (1) anthropogenic causes; (2) natural causes; or (3) climate change. Outcome metrics such as abundance, richness, diversity, growth, migration, reproduction, survival, or biomonitoring indices, were considered relevant. The comparators of BACI (Before/After, Control/Impact) design, or temporal or spatial trends were considered eligible. The included studies were carefully scrutinized to extract such details as location, timespan, sampling methods, etc. and to create a searchable database on flow-biota studies in the region. The resulting dataset was further analysed to identify knowledge clusters and knowledge gaps.

# What happens in Xanthi does not stay in Xanthi. City pressures in peri-urban river, the case study of Laspias basin (Greece).

Dr Chrysoula Ntislidou[1], Dr Dionissis Latinopoulos[2], Dr Vassiliki Papaevangelou[2], Ms Katerina Bakalakou[2], Associate Professor Christos Akratos[2], Professor Ifigenia Kagalou[2]
[1]Aristotle University of Thessaloniki, School of Biology, Department of Zoology, Thessaloniki, Greece, [2]Democritus University of Thrace, School of Engineering, Department of Civil Engineering, Xanthi, Greece

Poster Session 2, June 22, 2023, 1:15 PM - 2:15 PM

*Biography:*

*Dr. Chrysoula Ntislidou is a Biologist from Aristotle University of Thessaloniki. She has more than 13 years of experience in ecological assessment of freshwater ecosystems. Her research activities cover aspects of the ecological assessment of inland waters, based on benthic macroinvertebrates, and the human impacts on inland waters. She was involved in conducting 28 research projects and she has (co) authored 20 journal articles and 2 book chapters. She has participated in 32 international/national conferences. She was involvement in the evaluation, protection and management of water ecosystems and mainly in the implementation of EU Directive 2000/60/EC and 92/43/EEC in Greece.*

Multiple pressures in rivers, especially those connected with urban areas, receive anthropogenic “burden” due to socioeconomic activities. Laspias river form its springs acts as sink of a wastewater treatment plant (WWTP), military exercises field, landfill, industrial parks and animal farms, all connected to Xanthi’s productive spectrum. The Eye4Water project the past two years conducted five sampling campaigns (18 samples) to collect benthic macroinvertebrates in the wet and dry season, as biotic indicators of river’s health. Our aim was to identify how these stressors shape biota, measuring the effects of nutrient pollution on benthos. Laspias water quality was constantly inferior to moderate. A series of abiotic parameters (physicochemical, nutrients and eutrophication metrics) were additionally measured. Different types of correspondence analyses were performed along with basic statistical procedure. Main finding is that the combination of farms with industrial effluents (point and diffused) is the primer pressure, followed by the mal-operating WWTP, generating nutrient and organic loads (maximum values of BOD5= 0.001 – 34 mg/l, NO3-N = 4.77 mg/l, PO4–P = 5.48 mg/l, NH4-N = 42.53 mg/l) that cause hypoxia (range D.O. = 1–3 mg/l), and consequently reduce macroinvertebrate diversity (mean H’ = 0.71; SD ± 0.58) favoring the most tolerant taxa dominance. Macroinvertebrates were further influenced by SO4 and total COD, explaining 70.6% of the variation, without seasonal pattern. Moreover, macroinvertebrate diversity (Shannon, Simpson, Margalef indices) declines across a pollution gradient. The knowledge of multiple stressor effects on diversity and benthic macroinvertebrate assemblages could provide insights on the hazards affecting inland ecosystems.

# What happens when salinization meets eutrophication? A microcosm experiment

Mr Álvaro Javier Moyano Salcedo[1,2], Lluís Beltran Tubau[3], Meritxell Abril Cuevas[3], Narcís Prat[1], Lorenzo Proia[3], Dr Miguel Cañedo-Argüelles[4,5]
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8F_SS10_Freshwater salinization: causes, consequences and management, June 22, 2023, 3:45 PM - 5:30 PM

*Biography:*
*Environmental engineer with experience in consulting, environmental consulting, university teaching and research. Specialist in Environmental Management, Master in Water Resources Management from the University of Buenos Aires, Argentina, and Master in Environmental Science and Technology from the Federal University of ABC in São Paulo, Brazil. I am currently pursuing a PhD in Ecology, Environmental Sciences and Plant Physiology at the University of Barcelona.*

Here we assessed the interactive effects of nutrient and salt pollution on stream biofilm and macroinvertebrate communities using microcosms. We used a set of artificial streams under controlled light and temperature and filled with reconstituted river water. The experiment included six treatments: control (C: N-NH4 = 0.05; P-PO4 = 0.037; Cl = 33.5 mg/L), salt (S: N-NH4 = 0.05; P-PO4 = 0.037; Cl = 3000 mg/L), intermediate nutrient (IN: N-NH4 = 0.4; P-PO4 = 0.271; Cl = 33. 5 mg/L), high nutrient (HN: N-NH4 = 0.84; P-PO4 = 0.80; Cl = 33.5 mg/L), salt with intermediate nutrient (SIN: N-NH4 = 0.4; P-PO4 = 0.27; Cl = 3000 mg/L) and salt with high nutrient (SHN: N-NH4 = 0.84; P-PO4 = 0.80; Cl = 3000 mg/L). Chlorophyll-a progressively increased in the biofilm in all treatments during the 14 days of exposure, with diatoms and green algae being replaced by cyanobacteria. Biofilm showed a strong reduction in photosynthetic efficiency and P uptake rate in the S, SIN and HN treatments. The greatest decline in macroinvertebrate richness and diversity was in S, followed by SIN and SHN. IndVal analysis resulted in 26 significant indicator taxa, some of which were exclusive of certain treatments, like for example five predatory chironomids for C (Tanypodinae), Chaetocladius for S and several Eukiefferiella species for HN. Overall, we found weak evidence of interactive effects of nutrient and salt pollution on the functioning and structure of the communities, except for an antagonistic effect on cyanobacteria biomass.

# What is ‘good’ wetland vegetation? Defining the bounds of resilient variability in dynamic wetland systems

Cherie Campbell[1], Professor Ross Thompson[1], Professor Samantha Capon[2], Professor Fiona Dyer[1]
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[2]Australian Rivers Institute, Griffith University, Nathan, Queensland, Australia
7F_RS21_Wetland ecology and management, June 22, 2023, 10:30 AM - 12:00 PM

*Biography:*
*Cherie is a vegetation ecologist interested in the maintenance and recovery of wetland and floodplain vegetation in river-floodplain ecosystems. Cherie is currently undertaking a PhD which explores the way condition is used to envisage and evaluate non-woody vegetation responses to environmental flows. Cherie is a member of the Flow-MER vegetation evaluation team and has been involved in monitoring and evaluating patterns in vegetation responses through several programs for ~15 years. Cherie lives in Mildura, Australia near the junction of the Millewa and Barka – the Murray and Darling Rivers – and appreciates the significant role rivers have in river-floodplain communities.*

Floodplain-wetlands are dynamic, cyclic and variable – which presents challenges to target setting and the notion of what is ‘good’. Natural wet-dry patterns in hydrology means these systems cycle through wetting-wet-drying-dry phases with variability in the frequency, length or timing of phases. Plants and vegetation communities in floodplain-wetland systems have various mechanisms for coping with patterns of wetting and drying – for example the ability to resist or respond to transitions between the hydrological phases. Given these systems are naturally dynamic, can we untangle natural variability from a loss of resilience? By conceptualising the bounds of resilience for non-woody vegetation as it transitions through natural wet-dry cycles can we more clearly identify what is ‘good’? Here, we explore the characteristics of broad non-woody vegetation types and hypothesise vegetation responses, considering composition, structure and processes, through all phases of wetting-wet-drying-dry cycles, under ‘exemplar’, drier and wetter hydrological scenarios. We apply the idea of adaptive and maladaptive spaces to help frame the bounds of resilience. We consider our conceptualisation in the context of a current basin-scale monitoring program and national (Australian) environmental water policy.  We conclude by discussing additional considerations to address the notion of what is ‘good’ – including alignment with social-ecological functions and values.

# What is the future of cold stenothermic crenobiont species in the era of changing climate? - a cautionary tale of Drusus croaticus (Insecta: Trichoptera)

Dr Ivana Pozojevic[1], Dr Marija Ivković, Dr Ana Previšić, Dr Zlatko Mihaljević
[1]Faculty Of Science, University Of Zagreb, Zagreb, Croatia
2F_RS13_Climate change and freshwaters: challenges and solutions, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*I am a freshwater ecologist working in the Department of Biology, Faculty of Science at the University of Zagreb, Croatia. My research focuses on the community ecology of springs, lakes and running waters and freshwater organisms in general. I am especially interested in ecological water quality assessment tools, their improvement and implementation in governing policies.*

We asked ourselves this question when analyzing population dynamics of an endemic caddisfly species, found only in the springs of the mountainous Dinaric ecoregion of Western Balkans. Monthly monitoring of emergence trends of D. croaticus was performed from 2008 - 2021 in a spring that is part of a pristine hydrological network in the Plitvice Lake National Park in Croatia. Six emergence traps were continuously monitored resulting in a total of 1008 samples. Change point analysis showed a significant drop in population abundance and discharge values in 2011 that coincided with a drought, with the highest magnitudes reported to date for the research area. After the drought, a short period od population convergence was detected, but since 2013 a steady population decline is observed. Forecast models built on 14 years of emergence patterns suggest further population decline, whereas simple generalized linear models even suggest that this population will cease to exist in the near future. In the periods after 2013, extreme maximum discharge values ("flushes") became increasingly present and seemed to be the most likely cause of population decline, showing significantly negative correlation to population abundance. The population decline is so severe that the September abundance peaks of this species dropped from 1436 individuals caught from all traps in 2011 to only 16 individuals caught in September of 2020. The dynamics of this population raises great concern for the crenobiont species in the region, particularly for the populations not inhabiting springs under the highest conservation regime of a National Park.

# What's an otters favourite food? - A molecular investigation into the dietary preferences of the Eurasian otter (Lutra lutra) across the River Hull catchment

Mr James Macarthur[1,2], Dr Nathan Griffiths[1,2,3], Dr Lori Lawson-Handley[1], Dr Graham Sellers[1], Dr Robert Donnelly[1], Dr Jonathan Bolland[1,3], Dr Bernd Hanfling[1,2]
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8A_RS15_Science dissemination/communication & education, June 22, 2023, 3:45 PM - 5:30 PM

***Biography:***
*James Macarthur is a PhD student with a particular interest in integrating molecular techniques into biodiversity monitoring and management frameworks. He has recently completed a research masters at the University of Hull where his project provided a molecular methodology for calculating dietary selection, which incorporated faecal metabarcoding of spraints in conjunction with eDNA water sampling of local fish communities to investigate dietary preferences of the Eurasian otter (Lutra lutra) within the River Hull catchment.*

*His PhD integrates both molecular and traditional techniques to investigate the impacts of the Eurasian beaver (Castor fiber) on migratory fish and conservation priority mammals.*

Knowledge of top predator diets is fundamental to designing appropriate management strategies which ensure the protection of both predator and prey populations. The Eurasian otter (Lutra lutra) has traditionally been described as an opportunist; however, modern studies have demonstrated clear feeding preferences towards slow moving fish species. Prior dietary studies on Eurasian otters have used morphological analysis of spraints to determine the prey eaten, and electrofishing to inform the fish communities present locally. Traditional morphological analyses are challenging, as it is difficult to identify bones down to the species level. Meanwhile, electrofishing may underestimate rare fish species present in the catchment. This study provides a non-invasive molecular methodology, in which DNA extracted from otter spraints (n = 81) was sequenced using broad scale vertebrate primers to inform the prey eaten; and compared with eDNA from water samples (n = 48) collected along the River Hull to inform the prey available. Otter diet varied significantly across the upper, middle, and lower River Hull depending on the available fish community, and a consistent preference was observed towards the European bullhead (Cottus gobio). Otter diet did not vary between seasons, with bullhead and three-spined stickleback (Gasterosteus aculeatus) remaining the most common prey species.

# Working 9 to 5: diurnal variability in invertebrate activity does not compromise ecosystem health assessments in dry stream channels

Mr Kieran Gething[1], Mr Tim Sykes[2], Prof Rachel Stubbington[1]
[1]Nottingham Trent University, Nottingham, United Kingdom, [2]Environment Agency, Bristol, United Kingdom

2E_RS10_Biomonitoring, June 19, 2023, 2:15 PM - 3:45 PM

*Biography:*
*Kieran Gething is a PhD Researcher from Nottingham Trent University studying the aquatic–terrestrial biodiversity of temporary stream ecosystems.*

Temporary streams, which transition between flowing and dry phases, are among the globe's most widespread lotic ecosystems. However, their dry phases are routinely excluded from biomonitoring efforts, preventing holistic assessments of ecosystem health, which incorporate both their aquatic and terrestrial communities. A potential barrier to conducting such holistic assessments is the extended sampling periods (sometimes up to 28 days) commonly used to collect terrestrial communities. Therefore, we compared the effectiveness of two short-duration sampling techniques for assessing in-channel, dry-phase terrestrial invertebrate communities, and inform their potential use by managers and citizen scientists to increase representation of such communities in temporary stream biomonitoring. We collected samples at different times of day using two methods: 6-h pitfall trapping and 30-min hand searching. We also recorded environmental variables that may indicate human impacts (e.g. temperature, sediment composition). Invertebrate richness and abundance were comparable regardless of method or time of day and did not respond to any environmental variables, suggesting metrics alone are insufficient to characterise dry-phase communities. Invertebrate assemblage composition differed between methods but was comparable throughout the day, suggesting both methods are needed to characterise community composition. Despite low richness (mean ± SD: 12 ± 4 taxa per sample) and abundance (48 ± 29 individuals per sample), assemblage composition responded to temperature and silt (but not sand), indicating that even short-duration sampling methods may be sufficient to capture responses to human impacts. A standardised multi-method sampling approach may thus allow biomonitoring of temporary streams regardless of their wet or dry in-channel conditions.