WasserCluster Lunz Newsletter

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THIS ISSUE

Editorial

A positive review – Overcoming obstacles together

by Bernhard Mang

After three and a half years in the management of WasserCluster Lunz (WCL), it is time for a brief summary. When I, together with Martin Kainz, took over the management of WasserCluster Lunz in January 2021, we had big plans. Looking back, I am now filled with joy that the path we chose, continued since 2023 with Gabriele Weigelhofer and all employees, is lined with numerous successfully implemented measures and projects, thereby further improving the opportunities for the traditionally excellent research at WCL.

In addition to the further development of the (scientific) strategy, the employment of a database manager to implement a data warehouse and the new and replacement investments in research equipment — not least due to the two infrastructure projects acquired — organizational steps were also taken to make working at WCL as pleasant and safe as possible for everyone. This ranges from the implementation of an intranet, including updating and creating new guidelines and instructions, the creation of an equality plan, the revision of all insurance policies, to the further development of reporting to funding agencies and shareholders. The sustainability initiative launched in 2021 is also particularly worth mentioning in this context, as it shows the commitment and passion of the employees here at WCL. Ultimately, this development is reflected in the number of publications, which has remained at an all-time high since COVID-19, and the continuous increase in research revenue over the years. Special thanks go to all WCL employees and those of the involved universities, as they have played a key role in achieving all of these goals. With the implementation of a new website for WCL and the gradual renewal and modernization of the building infrastructure in collaboration with Lower Austria, new tasks lie ahead. Unfortunately, the last few years have been marked by various crises — the pandemic, wars in Ukraine and the Middle East, and price explosions. But the fact that we have all been able to manoeuvre the WCL so skilfully around these obstacles, which were placed in our path as described at the beginning, makes me feel extremely positive about the future - because especially in difficult times, you can see the cohesion within an organization. ▣

Launch of the new working group *SciFish*

*The acronym **SciFish** stands for:*

***S**ynthesis of*
***c**hanges*
***i**n*
***Fi**sh*
***s**pecies and*
***h**abitats*

WasserCluster Lunz introduces a new research group **SciFish** led by Dr. Libor Závorka. The research of the SciFish group will focus on the role of anthropogenic pressures that shape functional diversity of fishes and on impacts of evolutionary changes on ecosystem functioning.

Lakes and rivers despite their relatively small surface host vast amount of biodiversity. These ecosystems are currently facing significant challenges, including biological invasions and the effects of climate change causing warming and more frequent extreme weather events. These issues pose a substantial threat to biodiversity and the services provided to us by these ecosystems.

Research of the SciFish group aims are to enhance our understanding of the ecological and evolutionary mechanisms operating on organisms within aquatic ecosystems, and thereby facilitating their effective conservation.

Photo: © Libor Závorka

Three main topics of the SciFish group are:

⇒ Eco-evolutionary dynamics in lakes and rivers

⇒ Fish behaviour and physiology

⇒ Biology of aquatic invasions

The leader of the new SciFish group Libor Závorka has been working at WasserCluster Lunz since 2020. He has a rich international experince from his previous research work in France, Sweden, UK, and Czech Republic. On question why to work at WasserCluster, he answers:

"WasserCluster Lunz with its long history of ecological monitoring, cutting edge infrastructure, and position in the beautiful pre-alpine landscape is an ideal playgroud for any biologist interested in ecology and evolution of fishes. Therefore, I am happy to have the opportunity to develop my research team and new collaborations at this institute." ⧈

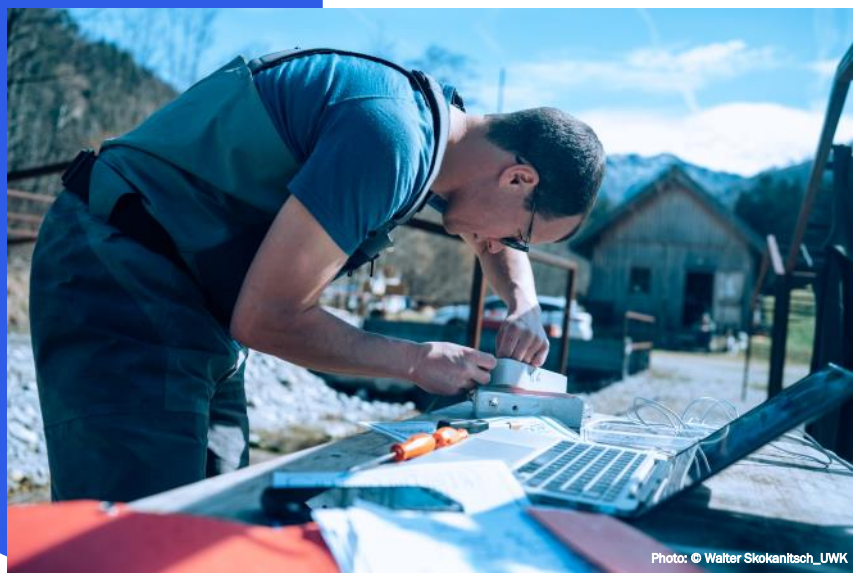


Photo: © Walter Skokanitsch_UWK

Microplastics impact the diversity and function of biofilms

by
Gabriele Weigelhofer

AG FLUVICHEM

Microplastics refer to tiny plastic particles smaller than 5 mm, which can be composed of various types of plastics. Microplastics are found in all waters. In a laboratory study at WasserCluster, in collaboration with the National Institute of Biology in Ljubljana, we demonstrated that microplastics can significantly alter biofilms in stream sediments.

For this study, sediments were mixed with microplastics and examined in bioreactors over several weeks in the lab, compared to sediments without plastics. The reactors were also exposed to different hydrological conditions: continuously flowing for a month, stagnant (i.e., saturated but without water flow), or drained (i.e., without water but moist).

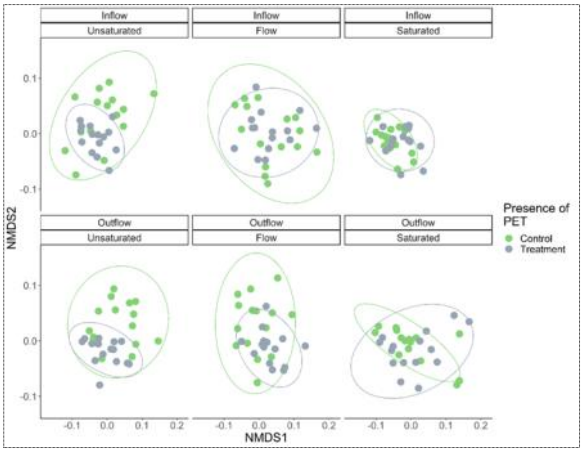
One of the bioreactors in the test facility.

The presence of microplastics in the sediments reduced both the growth and density of bacteria in the biofilms, regardless of hydrological conditions. Microplastics also affected bacterial metabolism, showing a decreased ability to degrade various (pollutant) substances, indicating a reduced diversity of the bacterial community. In contrast, bacterial respiration was mostly unaffected, except in reactors where the water was stagnant.

Our experiments show that microplastics not only impair the health and fitness of higher organisms but can also burden microorganisms. This disruption can affect crucial functions such as the self-purification of water bodies. Further studies are needed to assess the impact of microplastics on the entire stream ecosystem. ▣

Tjaša Matjašič taking a sample.

This graph shows the indication of a reduced ability to break down various (harmful) substances:



Deciphering the climate gas methane in streams

by Katrin Attermeyer

AG CARBOCROBE

Streams (here: Sierning in Lower Austria) - the unknown components of aquatic methane release into the atmosphere

Methane (CH_4), despite a very low concentration in the air of well below one percent, is a highly potent greenhouse gas. It is produced not only during the digestive process in the stomachs of cows and other ruminants but also during the decomposition of dead organic material at the bottom of our water bodies. Freshwater ecosystems are responsible for nearly half of the global methane emissions into the atmosphere. However, we still know very little about methane dynamics, especially in our streams and rivers.

In nature, the production and breakdown of methane are controlled by microorganisms. The methane produced in the sediments often rises to the water surface as small gas bubbles, and is released into the atmosphere. Current estimates, however, are highly uncertain because methane emissions from streams and rivers vary greatly in space and time, and the formation and release of methane bubbles are barely accounted for in current estimates. The responsible factors are likely very complex, complicating the prediction and modeling of the global carbon budget and future climate. Therefore, it is necessary to better understand the patterns of methane emissions from streams to gain a more comprehensive understanding of the global methane cycle. The new project "Methan-e-scape," funded by the Austrian Science Fund (FWF), aims to decipher the extent and drivers of methane emissions and its production in stream sediments, as well as the microorganisms involved. It is a collaborative project led by Katrin Attermeyer at WasserCluster Lunz, with colleagues from the University of Vienna and the Global Change Research Institute in Brno, Czech Republic. The research program will investigate the environmental and microbiological drivers of methane release and production in field and laboratory experiments. The results of this project will enhance our understanding of the drivers of methane dynamics in flowing waters and help to understand the impacts of projected environmental and climate changes on atmospheric methane. ▣

Methane bubbles in the ice of Lake Lunz ©Margaux Mathieu-Resuge

Emergence and phenology of aquatic insects at the Biological Station Lunz

by Simon Vitecek

AG QUIVER

At the Biological Station Lunz the emergence and phenology of aquatic insects has been researched for decades. The emergence in the context of aquatic insects describes the process of hatching of the adult land-living animals after the larval stages have matured. In contrast, phenology refers to the timing or period during which emergence occurs. There are significant differences between individual aquatic ecosystems and species. For example, aquatic insects can be categorized based on their hatching time into spring, summer, autumn, or, in rare cases, winter emergers.

Emergence and phenology are - in the genetically anchored predisposition - determined by various parameters, their interaction is still not fully understood.

Special efforts were made by Hans Malicky, who studied the emergence and phenology of aquatic insects (especially caddisflies) in the streams around Lunz over a long period. At Schreierbach, for example, he was able to demonstrate, that the photoperiod (day length) essentially determines the phenology of certain species under nearly constant water temperature.

Useful witnesses from the early 80s. © J. Aujesky

Another approach was taken within the RITRODAT project, conducted from 1977-2003 at the Biological Station Lunz under the leadership of Gernot Bretschko. Within the RITRODAT project, special traps were set at over 20 sites in the RITRODAT area (a section of the Upper Seebach, still researched by the WasserCluster Lunz today) to study the emergence and phenology of aquatic insects. The main goal was to understand which processes drive the productivity of the water body and what environmental influences affect it. The emergence of aquatic insects in this context was understood as an expression of so-called "secondary productivity," which, based on photosynthetic primary production (e.g., by algae) and terrestrial input (leaf fall), represents the link to higher levels of the food web. Unfortunately, these samples were never fully evaluated. Now, these samples have returned to Lunz. Combined with current samples, they can serve as important historical records, allowing for assessments of whether and how the emergence and phenology of aquatic insects have changed over the past 40 years.

"Gernot Bretschko likes to compare his RITRODAT with a mosaic - the long-term data series form the basis, the scientific work the individual stones. Thanks to the contributions of many colleagues, a picture of the structure and function of the river ecosystem has developed over 25 years. (...)"
This illustration and the text excerpt are taken from the final report "RITRODAT 1977-2003" by Franz H. Wagner and Maria Leichtfried. Today, another 20 years later, the picture has been sharpened once again...

The REBORN-Project — an eco-evolutionary approach

by Thomas Ruiz

AG LIPTOX

Find here an overwiew of current research projects of the WasserCluster Lunz:

https://wcl.ac.at/en/research/projects

Warming and eutrophication constitute major challenges for freshwater ecosystems, disrupting trophic structure and ecosystem function. Predictive models aiming at anticipating ecosystem alterations under these stressors are thus critical and needs to integrate the eco-evolutionary capacities of key organisms whose adaptive responses will shape future populations dynamics and, subsequently, ecosystem functioning. To that aim, the REBORN project will examine how temperature increases and nutrient enrichments might act as selective forces on daphnids and copepods, two pivotal zooplankton genus modulating energy transfers from primary producers to higher trophic levels. By applying approaches from resurrection ecology on zooplankton resting eggs extracted from sediment cores, the project will assess the physiological responses of ancient populations to warming and eutrophication to model individual evolutionary adaptations. The project will mainly focus on how evolution of metabolic rate and polyunsaturated fatty acids (PUFA) bioconversion capacities may reverberate on individual growth and reproductive rates. Metabolic rate is a critical life history trait controlling energy acquisition and allocation within biological functions, constituting a cornerstone for energetic models. Yet, recent studies revealed that metabolic rate vary depending on environmental stressors, especially nutritional constraints in terms of PUFAs. In warm and eutrophic ecosystems, understanding the interaction between metabolic activity and PUFA conversion capacities thus appear critical to anticipate population responses as well as the consequences for ecosystem structure and functions. In this context, energetic models developed in this project will help characterizing how warming and eutrophication might affect freshwater populations and ecosystem structure at long timescale, thus facilitating the development of management policies to mitigate the effect of global change on these environments. ▣

The project: "Long-teRm Evolution of zooplankton resting metaBolic rate and pOlyunsaturated fatty acids conversion under waRming and eutrophicatioN: an eco-evolutionary approach" is funded by the ESPRIT program of the FWF.
Responsible is Thomas Ruiz (WCL), cooperation partner is Andrew Jackson (Trinity College of Dublin, Ireland)

A complex new task: Building the WCL data warehouse

by Šárka Grubner

Data Scientist

Generating extremely large amounts of data is a daily routine in science and research. At WasserCluster Lunz, data is collected everyday from monitoring stations, it is continuously generated by scientific experimental setups, and produced and processed by various laboratory devices. All of this is aimed at being able to answer research questions.

Therefore, it is fundamental to integrate the principles of *data governance* [1] into the institute to ensure high-quality data management. Data governance refers to a set of procedures, processes, policies, and tools that guarantee high security throughout the entire data lifecycle and proper data usage across the organization. With data governance, users can more easily find, prepare, use, and publish trustworthy datasets.

At WasserCluster Lunz, this specificly means to establish a Data Vault system. This system encompasses several aspects not only of implementing and managing a data warehouse but also of creating long-term plans for data usage and presentation [2]. The data warehouse represents a centralized data collection of organizational data. With the integration of the data vault, processes for data cleansing, consolidation of the various data sources, implementation of specialized evaluations, creation of metadata and data quality assurance will be possible.

WCL is currently in the early stages of development. Initially, a development environment was implemented to link data from measurement stations with other long-term monitoring data. At the same time, guidelines for metadata were created to ensure that the data is understandable not only for internal scientists but also for other research institutions.

The path to achieving our vision is still a long way of course, as we are just at the beginning. However, the idea that researchers will have a contemporary, well-structured, high-quality, and centralized data base for their work, and that the public can also enjoy an interactive and illustrative data presentation on our homepage, motivates us to take further steps. ▣

[1] Info: What is data governance?

[2] Linstedt, Dan & Olschimke, Michael. (2016). Data Vault 2.0 Modeling. 10.1016/B978-0-12-802510-9.00004-0.

SUSTAINABILITY INITIATIVE
6 Steps towards enhancing sustainability at WCL

Sustainability Initiative 2024: Appreciative handling of food

Last February marked the third anniversary of the sustainability initiative at WasserCluster Lunz. The responsible core team took this opportunity to humorously present an overview of past successes and planned activities during a small celebration.

The initiative boasts consistently respectable results: the consistent development and implementation of energy-saving measures at WasserCluster since 2022 have led to a 20% reduction in electricity consumption.

The carpool system and internally ride-sharing exchange, as part of the "Mobility Challenge," has been well established. Since the *"Waste"* pilot project of 2021, special attention has been paid to the disposal of waste from the laboratory, office, and kitchen, focused on careful separation, collecting, recycling and avoiding wast materials.

In the current year 2024, *„the value appreciative handling of food“* is the main topic: the constant coming and going of students, guests, and traveling employees requires considerable mindfulness regarding our practiced culinary self-sufficiency at WCL to ensure that unused food doesn't become unusable more quickly than expected. Additionally, processing the fruit gifts that the garden seasonally provides requires effort and some logistics.
When the whole team occasionally gathers for a communal lunch, the effort extends beyond the value appreciative handling of food to also promote well-being and community spirit.
Many small everyday decisions add up to a big difference. ▣

3 years of the sustainability initiative were celebrated interactively, with performance miniatures and, last but not least, a delicious brunch together.

Long Night of Reasearch

At this year's *Long Night of Research* on May 24, WCL was represented at two locations: One team explored along with numerous visitors the question "What happens when water bodies warm up?" at the Federal Agency for Water Management in Petzenkirchen. At the University for Continuing Education Krems, the WCL station was focused on „The importance of omega-3 fatty acids for the development of cognitive abilities in fish—How do fish sense global change?" Once again we had a successful event for science enthusiasts!

Meeting of the Scientific Advisory Board

In early March, the Scientific Advisory Board held its regular meeting at WCL. After informative presentations on the research activities of all working groups and personal discussions with all staff members from technical and laboratory departments as well as house, office, and scientific staff, the board members, as an independent panel of experts, were able to gain a comprehensive overview of the institute's developments. At the end of the conference, they were able to draw up their conclusions and recommendations for the future direction of WCL.

On the set

Photo: © Rosa Maria Plattner

Editors from TV, print, radio and podcast productions convey via their respective media as valued partners the scientific work at WCL. Recently, a segment for a TV documentary about the Austrian lakes was produced, a report by the local "Film Chroniclers" on "The Message of Water," and a documentary from the "Land der Berge" series also focused on Lake Lunz and the expertise of our ecologists in descriptive video clips. Find here an overview and some more links to additional broadcasts and reports:

https://wcl.ac.at/en/outreach/press

WCL Open Day

Impressum

Editor: Veronika Albrecht

Photos: WasserCluster Lunz
(unless otherwise stated)

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Successful Graduations

Leonie Haferkemper (CARBOCROBE) achieved her Master's degree at the University of Vienna with the successful defense of her thesis: „*Microbial Activity and Biochemical Particle Composition Along a Fine Particle Size Continuum in Mountain vs Agricultural Streams*“.

Five scientists who formerly worked at WCL earned their doctorates with their successful dissertations:

Marina Ivanković (AQUASCALE): „*Mixotrophic bacterivory in lake ecosystems under current and potential climate conditions.*“
Tjaša Matjašič (FLUVICHEM): „*Plastic pollution in the hyporheic zone: occurrence and its interaction with microorganisms.*“
Florian Caillon (ECOCATCH): „*Understanding the Dynamics of Dissolved Organic Carbon and Microbial Diversity in Small Headwater Streams.*“
Martin Tschikof (BIGER): „*Effects of floodplain restoration on nutrient retention and multifunctionality on the river reach and basin scales.*“
Yinzhe Zhang (LIPTOX): „*Studies on the trophic ecology of silver carp and bighead carp pelagic food webs in lakes based on fatty acids markers.*“

We wish them all the best and success for their scientific work!

Awards and honors

Thea Schwingshackl is the winner of the 2024 sponsorship award of the Austrian Entomological Society (ÖEG). It was awarded to her for her Master's thesis: "Tiny but Mighty Mayfly. Probing *Prosopistoma pennigerum* (Müller 1785) as the Flagship-Species for the Vjosa National Park.“

In the summer of 2023, **Katharina Frey** completed an FFG-funded talent internship for students at the WCL. Her report on her experiences was honored last February as one of the best internship reports of the year at a ceremony in Vienna. On this occasion, the commitment of the technicians and internship supervisors Annette Puritscher and Theresa Reichenpfader was also emphasized.

Photo: © K. Frey

The next WCL newsletter will be published in November 2024.