wasser cluster lunz

Newsletter

July 2025 | #28

Editorial

by Libor Závorka

Content:

Project EUPHORIA 2

Project DIRT 3

The Micro World of Leaves in Streams 4

Project HYDROFAT 5

Fish Ecology and Behavior Studies 6

Research Education Cooperations 7

Notable Successes 8

Imprint 9

Why did summer break up with winter? Because climate change made things too hot to handle!

We are living in a time of profound environmental change, and no season is spared. At WasserCluster Lunz (WCL), we are committed to seeing the bigger picture by studying how environmental and climatic shifts impact aquatic ecosystems across the seasons.

Our new project **EUPHORIA**, led by a team of young scientists, investigates an often-overlooked topic: how seasonal changes shape the life cycles of aquatic plants across the European continent. Meanwhile, results from Project **DIRT** reveal that increased water temperatures in lowland Austrian streams during hot summers can reduce the streams' ability to absorb and process nutrients — a critical insight into the fragile balance of freshwater ecosystems. Autumn might mark the end of sunny days for many of us, but for streams, falling leaves signal a new chapter. Our latest publication highlights the crucial **role of leaf litter** in supporting bacterial and invertebrate communities. Remarkably, leaves that pass through the guts of tiny aquatic insects and return as fecal pellets become hotspots of bacterial activity — essential fuel for river food webs. In muddy carp ponds, the **HydroFat** project sheds light on how climate change alters food webs in these ancient aquaculture systems, with implications for the development of carp — a fish that many in Central Europe know as a classic Christmas dish. And as winter sets in, when nature slows down, our scientists continue their work. Because we cannot always wait for the seasons to shift, we are developing a **new aquarium setup** in our wet lab that allows us to simulate seasonal conditions — adjusting temperature, light, and other environmental variables — to study how the behaviour and physiology of fishes respond to environmental change.

If you'd like to dive deeper into these seasonal stories from freshwater research, this newsletter is here for you. We wish you an inspiring read.

EUPHORIA – Early Career Limnologists Investigating Macrophyte Phenology Across Europe

Distribution of sapling sites for the EUPHORIA project. © EUPHORIA

EUPHORIA
European plant phenology research in aquatic systems

Funding: EFFS and affiliated societies

Project start: 01.01.2025

Project Duration: 2 years

https://euphoria-fresh.jimdofree.com/

@euphoria_freshproject
@euphoriafresh.bsky.social
https://www.linkedin.com/company/euphoria-

wasser cluster lunz

Benjamin Misteli | CARBOCROBE

The EUPHORIA project (European Plant Phenology Research in Aquatic Systems) was launched as the 5th FreshProject by the European Federation for Freshwater Sciences (EFFS) at the beginning of 2025. The FreshProjects are supported by national limnological associations, including SIL Austria, and aim to foster collaboration and networking among young limnologists.

EUPHORIA is led by Benjamin Misteli, PostDoc at WCL, and Anne Lewerentz (PostDoc at KIT in Karlsruhe, Germany), who bring together a team of 110 early-career researchers (ECRs) ranging from bachelor students to PostDocs. The team consists of members from 13 national freshwater associations from 22 countries. The project aims to fill a critical knowledge gap by studying the seasonal life cycle events, also known as phenology, of aquatic plants across environmental gradients in Europe.

Phenological shifts signal climate change and impact ecosystem functions such as pollination. While terrestrial plant phenology is well studied, research on aquatic plants is limited, despite their key role in freshwater ecosystems. In particular, little is known about how aquatic plant phenology varies with environmental conditions.

EUPHORIA aims to improve the understanding and conservation of freshwater systems by studying how aquatic plants respond to different climates.

Sampling will consist of monthly monitoring of 15 phenological traits across five key aquatic plant species representing different growth forms of submerged (*Myriophyllum spicatum, Elodea nuttallii*, *Elodea canadensis*), floating-leaved (*Nuphar lutea*) and emergent species (*Phragmites australis*). In addition to phenological traits, field teams will collect environmental data and characterise sites. Fifty teams will sample freshwater systems across Europe. WCL is represented in the project by seven participants, including PostDocs and PhDs. We are sampling *Phragmites australis* and *Nuphar lutea* in Lake Lunz and in an urban pond in Vienna.

The first results will be presented at the SEFS14 conference (Bolu, Turkey) and at the IAPG conference (Lisbon, Portugal). By bringing together ECRs interested in macrophytes, we are convinced that EUPHORIA contributes to both science and capacity building by facilitating networking among future experts in the field. ▣

Photo: Taking samples from Ilzbach

Gabriele Weigelhofer | FLUVICHEM

Is Poor Water Quality Due to Warming?

Our ACRP project DIRT ran experiments on the release of nutrients from aquatic sediments. Sediments from a total of 20 streams in Lower Austria, Burgenland, and Styria were incubated in stream water at temperatures of 20°C, 25°C, and 30°C in climate chambers for one week. By monitoring changes in nutrient concentrations in the water, we were able to determine whether higher temperatures lead to the release of substances from the sediments.
In all experiments, an increase in microbial respiration and a decrease in oxygen levels were observed. At higher temperatures, nitrate, ammonium, and dissolved organic carbon were released. Phosphorus, on the other hand, exhibited a distinct pattern: in less polluted streams, uptake occurred, whereas in heavily polluted streams there was generally no exchange between the sediments and the water column.
The data indicate that water warming leads to increased microbial degradation of organic material. Phosphorus is the limiting nutrient, so it is immediately reabsorbed by microbes after its release, unlike nitrogen.
Overall, increasing water temperatures can lead to a deterioration in water quality. Riparian buffer strips that provide shade to streams could help counteract this effect.

Advanced Knowledge

The aim of this project is to assess the impact of summer low flows on the remobilization of pollutants from river sediments. The analyses are carried out for eastern Austria, where agricultural input and the predicted risk of climate warming on low flow and water temperature are particularly high. The innovative combination of data-based models with laboratory experiments and water quality monitoring allows an overall assessment of the sediment-related risk of quality impairment along the water network. The added value of the derived information is presented for three selected catchments and discussed with stakeholders with regard to water management relevance. From this, recommendations for future climate scenarios will be developed.

https://short.boku.ac.at/drought-water-impact

Project **DIRT** (Drought Impact on Remobilizaion of water polluTants from river sediments)

Funding: **ACRP** (Austrian Climate Research Programme)
https://www.ffg.at/ACRP

Project start: 2022

Project Duration: 3 years

wasser cluster lunz

The Micro World of Leaves in Streams – And Why It Matters

Pratiksha Acharya | CARBOCROBE

Every fall, as trees shed their leaves, many of these end up in nearby streams. While it might seem like they simply sink and decay, these leaves play a vital role in supporting life in the stream. When leaves fall into the water, they begin to break down. This process is helped by small water insects, often called shredders, that chew the leaves into tiny particles, smaller than a grain of sand. These particles then become food for microorganisms, like bacteria, which in turn support other animals further down the stream. However, the role of microorganisms on fine particles produced during leaf decay has rarely been studied so far. Our recently published study explored how different types of leaves and the amount of oxygen in the stream affect the microbial activity of fine particles produced by shredders. We used three types of leaves—alder, beech, and maple—soaked in water with either high or no oxygen and fed them in the laboratory to caddisfly larvae (*Sericostoma sp.),* a type of insect that loves to eat leaves. The study also compared two types of FPOM produced by shredders: shredded leaves and their faeces. In our research we found that the type of leaf and how it was prepared made a big difference for the microbial activities on the fine particles. Furthermore, the study observed differences in microbial activity between shredded leaves and faeces. Interestingly, microbial growth efficiency and the proportion of bacterial fatty acids were higher in faeces than in shredded leaves, highlighting the crucial role of faeces as a microbial hotspot in streams.

Our study thus highlights an interesting linkage between the microbial processes and the insects' activity in determining the fate of fallen leaves in streams that may support many lifeforms during this process.

So, the next time you see leaves floating in a stream, remember they're not just debris. They're part of a fascinating process that keeps the stream alive, supporting a web of life far beyond what meets the eye.

Scientific Publication:

Acharya, P.; Yegon, M. J.; Haferkemper, L.; Misteli, B.; Griebler, C.; Vitecek, S., Attermeyer, K. (2025): **Leaf Conditioning and Shredder Activity Shape Microbial Dynamics on Fine Particulate Organic Matter Produced During Decomposition of Different Leaf Litter in Streams.**
Microbial Ecology Vol. 88, Article number 18; IF: 3.3
doi: 10.1007/s00248-025-02515-2

wasser cluster lunz

HydroFat:

Investigating the Role of Dietary Lipids in Eutrophic Pond Ecosystems

Martin Kainz | LIPTOX

Freshwater systems are among the ecosystems most affected by global warming. Despite their growing relevance for food security, fish ponds remain underexplored in this context. These systems face increasing environmental stress due to rising temperatures, enhanced nutrient input, and declining oxygen levels. The FWF-funded project 'HydroFat', a collaboration between the University for Continuing Education and the LIPTOX research group at Wasser Cluster Lunz, aims to understand how carp—the world's most widely farmed freshwater fish—cope and thrive under such extreme environmental pressures. The project pursues three primary goals:

a) To determine how invertebrates and carp, particularly in their neural and reproductive tissues, respond to dietary lipids in order to meet their fatty acid requirements under varying nutritional, light, and temperature conditions (experimental approach);

b) To trace the pathways of fatty acids to and within invertebrates and carp using cutting-edge, compound-specific stable carbon and hydrogen isotope techniques (biomarker approach);

c) To model the spatial and seasonal dynamics of lipid dependency in invertebrates and fish based on the elemental and molecular composition of resources found in eutrophic fish ponds (ecosystem approach).

We are testing two main hypotheses:

→ First, that the endogenous conversion of polyunsaturated fatty acids (PUFAs) in aquatic organisms is temperature-dependent and results in isotopically "lighter" ^{13}C- and ^{2}H-PUFA signatures compared to the short-chain PUFAs in their diet.

→ Second, that a dietary deficiency in long-chain PUFAs enhances endogenous PUFA synthesis in fish liver cells, which then transfer isotopically unaltered PUFAs to neural, gonadal, and muscular tissues.

This project breaks new ground by applying compound-specific stable hydrogen and carbon isotope analysis to eutrophic pond systems. In doing so, it will uncover how dietary lipids are processed and allocated across different trophic levels—from algae to invertebrates to fish tissues including liver, gonads, brain, retina, and muscles.

Introducing stable hydrogen isotopes as novel tracers in aquatic food web research allows for a more detailed understanding of the origins and metabolic pathways of fatty acids in both invertebrates and various fish tissues. By integrating isotope data into trophic models, we aim to significantly deepen our understanding of nutrient and energy transfer in aquatic food webs—ultimately offering insights into how these processes affect human food sources.

Funding: **FFG** (Austrian Research Promotion Agency)

Project start: 2022

Project Duration: 3 years

Partner:

WasserCluster Lunz; University for Continuing Education Krems

Photos: Experimental facilities for carp, Vodany, Czech Republic

wasser cluster lunz

Advanced Research Facilities for Fish Ecology and Behavior studies

Libor Závorka | SciFish

As part of new efforts to establish fish ecology research at WasserCluster Lunz, we are currently developing specialized laboratory facilities to support a wide range of experimental studies. These facilities are designed to investigate the behavior and physiology of fish from Lake Lunz and surrounding watersheds, particularly in response to anthropogenic environmental stressors.

Changes in climate and land use in alpine regions often lead to increased water temperatures, reduced oxygen availability, and changes in water turbidity. To better understand how fish species might adapt to these rapidly shifting conditions, we have constructed a new system of 24 aquaria. This system allows for precise regulation of both temperature and lighting conditions, enabling us to simulate a variety of environmental scenarios with high accuracy and reproducibility.

In addition, each aquarium will be fitted with a dedicated camera system, enabling continuous video monitoring of fish behavior. This will provide invaluable data on both short- and long-term responses to experimental conditions. To complement this, we have also established a versatile multi-purpose space within our facility. This area supports the installation of up to 16 behavioral arenas, where we can simultaneously conduct experiments that challenge the cognitive abilities of various fish species.

Moreover, we are developing a low-cost, open-source system of wirelessly communicating feeders and stimulus triggers. These devices will be used to test learning and memory across different fish species. Our goal is not only to advance our understanding of fish cognition but also to make these tools available to the broader scientific community. By sharing the design and methodology of our experimental setups, we hope to foster collaboration among researchers interested in aquatic animal behavior, physiology, and ecology. ⧈

The **SciFish** group was established a year ago and has since been determinedly pursuing its objectives:

→ Eco-evolutionary dynamics in lakes and rivers

→Fish behaviour and physiology

→Biology of aquatic invasions

wasser cluster lunz

Photo: Workshop at Weissensee, May 2025

Educational materials (in German): https://bit.ly/40d8Nn1

Project leader: Gabriele Weigelhofer (FLUVICHEM)

Funding: State of Austria, EU

Across Austria with the Environmental Kit

7 Workshops in 6 Provinces: As part of a collaboration with the Association of Austrian Nature Parks (VNÖ), we visited nature parks across Austria this spring—from the Ötscher region to Lake Weissensee in Carinthia and the Ötztal Valley in Tyrol. The workshops served as preparation for the action day *"Landscapes Full of H_2O"* on May 22, engaging numerous nature park kindergartens and schools.
Together, we explored how climate change and pollution affect aquatic ecosystems and presented engaging hands-on activities for children and adults alike. As educational materials, we developed a brochure titled "Ideen und Tips – Landschaften voller HaZweiO" and two short films in cooperation with VNÖ.

rom: https://www.naturparke.at/schulen-kindergaerten/aktivitaeten/aktionstag/hazweio-2025

Project leader: Eva Feldbacher (FLUVICHEM)

Funding: FFG (Austrian Research Promotion

Environmental Research 2.0|Project Launch – Research, Wonder, Understand

by Elmira Akbari

The "Environmental Research 2.0" project was successfully launched with a joint kick-off event at the Haus der Wildnis in Lunz. Project and school partners took the opportunity to get to know each other, laying the foundation for two exciting school years full of research and discovery.
The project actively engages students from six schools in the region with environmental research and modern technology. The focus is on the regional forest and water ecosystems, which are explored through excursions, experiments, and research tasks. With virtual reality experiences, citizen science apps, and AI-supported tools, participants gain firsthand experience of how environmental research works -from data collection to the presentation of results.

The goal is to spark curiosity, promote scientific thinking, strengthen methodological skills, and create a deep awareness of ecological connections and sustainability. The project is supported by a dedicated consortium consisting of the WasserCluster Lunz, the Dürrenstein-Lassingtal Wilderness Area Management, the IT company Deckweiss, and regional educational institutions.
We look forward to two years full of curiosity, creative ideas, and shared "aha" moments with young people experiencing science!

from: https://science-education.at/environmental-research-2-0-project-launch-research-wonder-understand/

Notable Successes

Photos: ©LK NÖ Georg Pomassl Martin Kainz and the group of Experts at the celebratory event in Litschau, May 2025

FAO: Food and Agriculture Organisation of the United Nations
GIAHS: Globally Important Agricultural Heritage System

As of March 2025, a total of 89 systems in 28 countries have been designated as GIAHS. This includes notable examples such as the stone terraces in the drylands near She in China, saffron cultivation based on qanats in Gonabad in Iran, and the Hanging Gardens of Djebba El Olia in Tunisia.

Waldviertel Carp Pond Farming: A Globally Important Agricultural Heritage System

The carp pond farming tradition of Austria's Waldviertel region has recently been recognized by the Food and Agriculture Organization of the United Nations (FAO) as a *Globally Important Agricultural Heritage System* (GIAHS)—making it the only aquaculture system in Europe to receive this designation. Established in 2002, the GIAHS program honors sustainable regional production systems of global relevance, based on their integrated agricultural, ecological, landscape, economic, historical, and cultural value.
The designation not only acknowledges the heritage of such systems but also aims to ensure long-term food security and foster their adaptive development by leveraging the ecosystem services they provide. This future-oriented recognition is tied to the implementation of a comprehensive action plan. It marks the result of a multi-year, rigorous nomination process led by the Lower Austrian Association of Pond Farmers, in collaboration with experts and partners across all relevant disciplines.

Scientific insights into the aquatic ecosystem of these traditional ponds have long been provided by the LIPTOX group at the WCL. Their research has shown that Waldviertel carp, raised in sustainable pond systems, are free of mercury and pesticides and are rich in beneficial long-chain omega-3 fatty acids. These over 2.500 carp ponds in Lower Austria's Waldviertel region are human-created ecosystems that support remarkable biodiversity both within and beyond the ponds themselves—contributing significantly to Austria's Biodiversity Strategy 2030.

wasser cluster lunz

Academic Qualifications

Bachelor of Science:

Samuel Karl Kämmer, University of Vienna, March 2025

Timon Kis, BOKU, February 2025 (Restore4Life)
Georg Kern, BOKU, May 2025 (Restore4Life)
Raphael Gruber, BOKU, May (Restore4Life)
Julia Seiser, BOKU, June (Restore4Life)

Podcast-Serie One Water

In the new podcast series from the Lower Austrian business agency **ecoplus**, Ursula Strauss talks to renowned experts about water, our most precious resource. In the first episode, released on 20 March 2025, Gabriele Weigelhofer, authorised representative of WasserCluster Lunz and head of the FLUVICHEM working group, discusses the topic with further professionals. She will also appear in another episode in July.

All episodes are available here **(in German)**:

https://one-water-wasser-ist-leben.stationista.com/

SCIBORG – The SCIence literacy BOaRd Game

in the 'Print and Play' download version can be found here:

https://science-education.at/projects/game-sciborg/

Time for Research!

The Science and Research Department of Lower Austria developed the third edition of the **ForscheN** magazine on the topic of water in collaboration with the WCL and other partners. It contains a lot of background knowledge and exciting experiments for young researchers:

The magazine is published three times a year and can be subscribed here **(in German)**:
https://tinyurl.com/forschennoe

The next WCL-Newsletter will be published in December 2025.

Imprint

Execution:
Veronika Albrecht

Photos:
WasserCluster Lunz
(unless otherwise stated)

WasserCluster Lunz -
Biological Station GmbH

Dr. Carl Kupelwieser
Promenade 5
3293 Lunz am See
AUSTRIA

Tel: 0043 7486 20060
E-Mail: office@wcl.ac.at
Web: www.wcl.ac.at