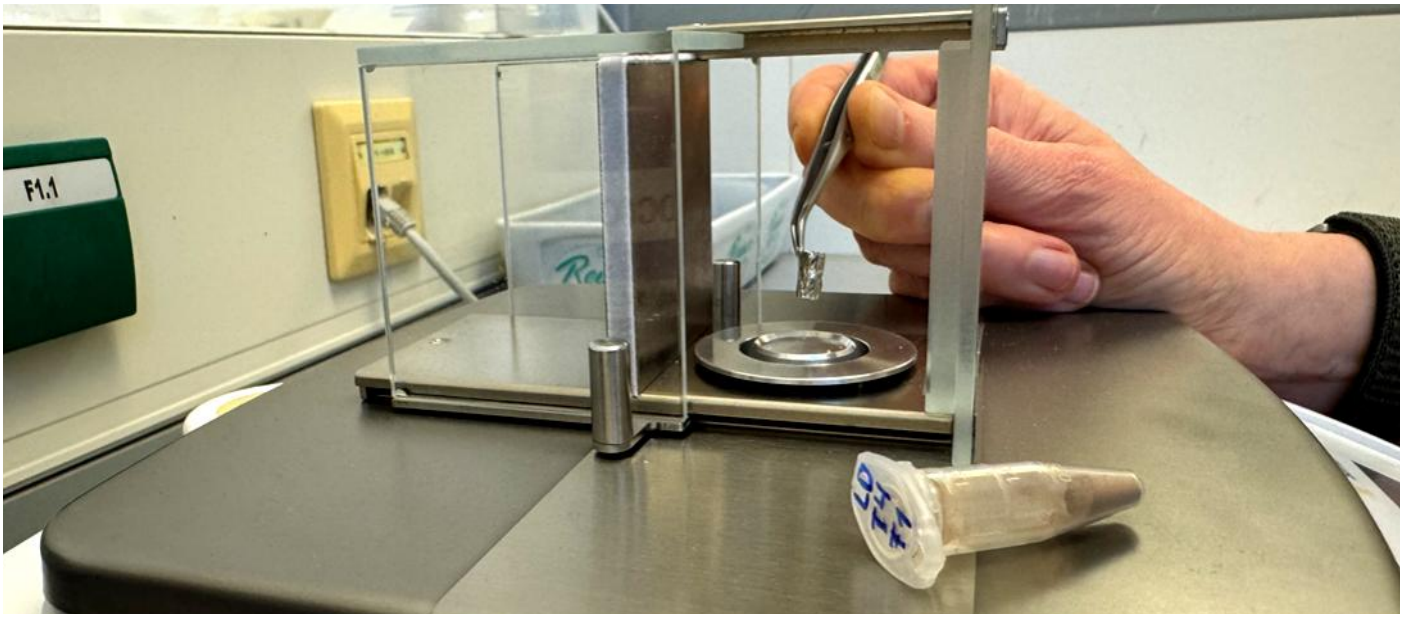
wasser cluster lunz

Newsletter

December 2025 | #29



Content:

Editorial

by Veronika Albrecht

The launch of a new research group at WasserCluster Lunz (WCL) will be accompanied by the expertise of molecular ecologist Bettina Thalinger, expanding the diversity of methods used. Innovative approaches such as eDNA analysis, barcoding, and metabarcoding will now be integrated into basic ecological research and routine monitoring programs to assess aquatic ecosystems, biodiversity patterns, and their responses to human impacts.

There are also new developments in methodology from projects conducted by WCL scientists directly at Lake Lunz and its catchment area, a site within the pan-European eLTER network for long-term data collection. In this location, researchers are now focusing their attention on the revealing sounds of nature.

The WCL is involved in scientific research on a section of the Ybbs River in Lower Austria. This involvement constitutes a contribution to a pan-European research infrastructure for river-sea systems. Consequently, the WCL makes an important contribution to large-scale investigations of climate and land-use impacts on water bodies. Current research projects also highlight the ecological significance of ponds as biodiversity hotspots and providers of essential fatty acids, and their role in the stability of entire ecosystems.

On a global scale, an international study on tropical inland waters is expanding our understanding of their contribution to the carbon cycle and revealing, among other things, previous overestimations of greenhouse gas emissions.

Another significant aspect of the broad research spectrum at our institute is science education and communication. The following pages also provide information on innovative developments and new teaching materials designed to help young people experience science as an open, curious, and life-relevant process through playful and hands-on learning.

All these initiatives and projects demonstrate how WasserCluster Lunz combines local long-term research, international networking, methodological innovation, and important educational work—fostering a deeper understanding and more sustainable management of water bodies.

Photo: ©private

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Barcoding:
A scientific method which uses a short, standardised section of DNA to uniquely identify individual species, in a similar way to the barcode on product packaging. Samples from a single organism are examined.

Metabarcoding analysis:
This method uses the same approach as traditional barcoding, but is used for mixed samples (e.g. soil, water and faeces). By sequencing many barcodes simultaneously, it is possible to detect hundreds of species at once, enabling entire species communities to be analysed.

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New Research Group: TRIDENT

At the beginning of 2026, molecular ecologist **Bettina Thalinger** will commence her work at the WasserCluster Lunz. The detection of trace amounts of DNA from environmental samples (so-called environmental DNA or short: eDNA) lies at the center of her research. She has studied Ecology, International Business, and Economics at the University of Innsbruck and completed her PhD on the trophic ecology of cormorants. After a first post doc project in Innsbruck studying fish eDNA in Tyrolean rivers, she moved to The University of Guelph (Ontario, Canada) and continued working on fish ecology and distribution patterns in anthropogenically influenced river systems. Additionally, she expanded her work towards studying bird migrations and incorporating the support of citizen scientists into her research projects. Before accepting the group leader position at WCL, she worked for three years as a Senior Scientist at the University of Innsbruck and led research projects on

a) whale ecology and marine biodiversity www.ewhale.eu
b) arthropod-plant interactions and biodiversity monitoring in Austria and
c) the standardization of eDNA-based biodiversity data.

TRIDENT – Applied Biodiversity Research & Molecular Ecology

The TRIDENT group at WCL will continue along this trajectory and use eDNA-based methods to study patterns of biodiversity in space and time in relation to anthropogenic influences. On the one hand, TRIDENT will contribute to the implementation of molecular methods into routine monitoring programs for aquatic ecosystems, invasive, alien species, and species of conservation concern. On the other hand, non-invasive molecular methods will be used to further the knowledge on vertebrate ecology from trophic interactions to migration patterns and population structure. Additionally, TRIDENT will support the other WCL research groups via barcoding and metabarcoding analyses carried out at the molecular laboratory located at the old research station at Lunzer See.

Would you like to follow or join the TRIDENT Group? Stay tuned for job postings in spring 2026 and check out our social media channels – links in the blue info box.

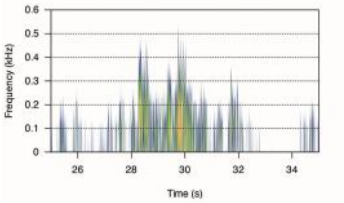

Fig. 1.

Fig. 2.

Sound of Nature: A New Biodiversity Monitoring Project at Lake Lunz

Libor Závorka | SciFish

eLTER (Integrated European Long-Term Ecosystem, Critical Zone and Socio-Ecological Research)

https://www.lter-austria.at/wassercluster-lunz/

One of the responsibilities of the SciFish group is the long-term ecological monitoring of Lake Lunz and the coordination of WasserCluster Lunz's involvement in **eLTER** (Integrated European Long-Term Ecosystem, Critical Zone and Socio-Ecological Research). Approximately 200 eLTER sites—including WasserCluster Lunz—represent key habitats and environmental gradients across Europe. Together, they form the backbone of an ambitious infrastructure aimed at improving our understanding of ecosystem functions and their long-term responses to environmental, societal, and economic pressures.

Currently, we are participating in a project focused on developing biodiversity monitoring protocols that could be applied across eLTER sites throughout Europe. One method developed in the project is called passive acoustic monitoring. This involves a set of microphones placed around the lake that "listen" to sounds—such as bird or bat calls. Based on these recordings, we can identify species living around the lake and better understand their diversity and patterns of activity throughout the year (Fig. 1).
Another method involves a tool called a Malaise trap. It resembles a tent and is used to catch flying insects. Insects are collected from the traps every two weeks, and the samples are then analyzed by geneticists, who can determine which insect species inhabit the area (Fig. 2). Next year, we will also collect samples of water for the analysis of so-called environmental DNA (eDNA), a genetic method that provides information about species living in the lake based on small pieces of tissue or mucus they shed into their environment.

The exact same measurements are being simultaneously conducted at ten other sites across Austria—from the plains of Neusiedl See to high mountain valleys such as Jamtal in Tyrol (Fig. 2).

We hope that this project will help establish permanent biodiversity monitoring at Lake Lunz and across Austria.

Fig. 1. - top: AudioMoth microphone deployed by the lake Lunz

Fig. 1. - bottom: Spectrogram of a bird call recorded by the lake Lunz (©Libor Závorka, WCL)

Fig. 2. - left: Malaise trap deployed by the lake Lunz (©Libor Závorka, WCL)

Fig. 2. - right: Malaise trap deployed in Jamtal valley in Tyrol (©Marcela Violeta Lauria, Institut f. Interdisziplinäre Gebirgsforschung)

Fotos: © G. Weigelhofer
Components of the measuring station at the Ois in Lower Austria

WasserCluster Lunz: A Cornerstone of Europe‘s River-Sea Research Infrastucture

Gabriele Weigelhofer | FLUVICHEM

WasserCluster Lunz (WCL) stands as a key partner—alongside BOKU University (lead), the University of Vienna, TU Wien, the University of Innsbruck, and the Austrian Environment Agency—in the pan-European DANUBIUS RI research infrastructure initiative. Focused on the study of river-sea systems, **DANUBIUS RI** achieved the status of a European Research Infrastructure Consortium (ERIC) in June 2025. This infrastructure provides researchers with access to automated observation systems, data, and expertise on rivers and their coastal zones. The overarching aim of this initiative is to advance the sustainable management and protection of these critical ecosystems.

The DANUBIUS RI initiative unites a multidisciplinary group of experts from diverse fields, including hydrology, oceanography, ecology, and socioeconomics, with the objective of addressing complex challenges that necessitate interdisciplinary solutions. The initiative is driving forward cutting-edge research and technological innovation, including the development of advanced monitoring systems, data analytics tools, and predictive models for river-sea environments.

Austria is pivotal to this endeavour. Its "Upper Danube Austria" Supersite is at the core of it, with two areas equipped with networks of surface and groundwater stations. One is in the Lobau wetlands near Vienna and the other is along the Ybbs River, operated by WCL. Starting next year, these sites will conduct high-frequency measurements of water quality parameters and water levels. This will generate vital data on the impacts of climate change and land use on the Ybbs.

The research conducted under DANUBIUS RI delivers essential, evidence-based insights that inform policy and management strategies at local, national, and international levels. ▣

https://danubius.boku.ac.at/

Danubius RI obtains ERIC legal status

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European study highlights the importance of small water bodies for biodiversity and ecosystem functions

Photos: © Lena Fehlinger

Lena Fehlinger | LIPTOX

Ponds are small but globally abundant freshwater bodies, providing key ecosystem services to people and habitats for many organism groups.
Semi-aquatic insects, such as dragonflies, can develop as larvae in ponds, feeding on algae that are rich in polyunsaturated fatty acids (PUFA).
When these insects emerge as adults, they transfer these essential nutrients to land, where terrestrial predators such as birds or bats feed on them, a vital part of their diet and necessary for overall fitness.

In the project **EUROPONDS**, over 70 early career aquatic ecologists studied insect emergence from ponds in 19 European countries, focusing on biomass and PUFA exports. One of the two principal investigators was Lena Fehlinger, a MSc student at the WasserCluster Lunz (LIPTOX group under Dr. Kainz). Pond exports varied greatly and decreased toward northern latitudes, strongly shaped by seasonality, with winter freezes causing minimal exports, impacting consumer species. The highest exports, recorded in a large Polish pond in summer, reached around 100 grams of PUFA per day, including about 66 grams of omega-3.

Water temperature explained nearly 28% of the biomass export variation, showing a unimodal response with a peak around 22 degrees which highlights the vulnerability of these exports to climate change. Ponds with high insect diversity exported more and more diverse PUFAs, confirming the importance of maintaining ponds with taxonomic richness. The trophic state of ponds, influenced by surrounding land use, was also a key factor influencing overall exports, indicating that adequate land management will directly affect this ecosystem service.

This project underlines that protecting, restoring and creating ponds is vital for maintaining biodiversity and nutrient fluxes between ponds and their environment.

This project was awarded by the European Federation for Freshwater (EFFS), with funding from federated societies: AFL, SIL Austria, AIOL, AIL, DGL, FBA, HUSEK, MHT, PTH, and SSHL.

Contact:
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https://europonds.jimdofree.com/

FA publication:
doi: 10.1002/lno.70180

Review paper:
doi:10.1080/20442041.2022.2111180

Lena Fehlinger was one of two people primarily responsible for the EUROPONDS project.
While studying for her MSc at the WCL, she worked in the LIPTOX group under the supervision of Martin Kainz.

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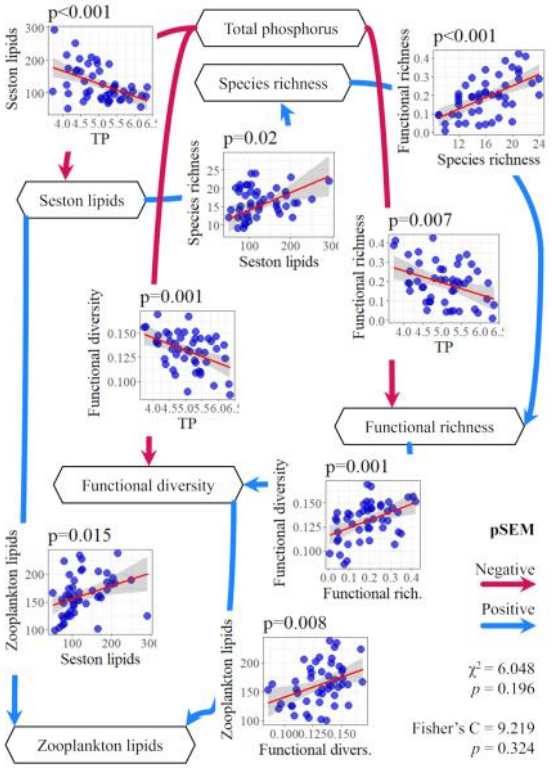
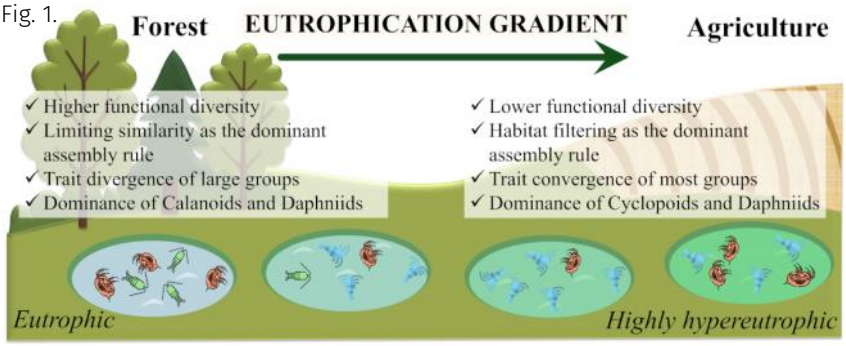


Fig. 1.



Higher eutrophication leads to the loss of functional diversity and reduces essential nutrients

Cihelio Amorim & Martin Kainz | LIPTOX

Fig. 2.

Amorim, C.A.; Kainz, M.J. (2025): *Shifts in Assembly Rules and Loss of Zooplankton Functional Diversity Across Hypereutrophic Fishponds*, Ecology Letters 2025, Volume 28, Issue 12, e70289

doi: 10.1111/ele.70289

Ponds, like fishponds, are vital biodiversity hotspots, but are increasingly threatened by eutrophication—nutrient enrichment that alters their ecological functioning. Our recent research[1] shows that when fishponds become hypereutrophic, zooplankton assemblages experience pronounced loss in functional diversity, i.e., fewer ecological functions and roles are represented, despite stable species numbers.

This simplification undermines ecosystem resilience, potentially destabilizing nutrient cycling, water quality, and food webs. Our study identifies shifts in community assembly rules driven by nutrient enrichment, illustrating how eutrophication filters zooplankton traits towards fewer, more functionally similar species (trait convergence) (Fig. 1).

These results call for monitoring not only species richness but also functional traits to preserve freshwater ecosystems from human pressures. This improved understanding of the mechanisms underlying biodiversity loss will guide sustainable management and conservation practices in fishponds.

Biodiversity, particularly functional diversity, is known to enhance ecosystem functioning and stability, thereby improving the ecosystem services delivered to humanity. One key ecosystem function is the provision of essential dietary nutrients by aquatic organisms, such as long-chain polyunsaturated fatty acids (PUFAs). Our preliminary research demonstrates intricate direct and indirect effects of eutrophication (total phosphorus, TP) and taxonomic and functional diversity on plankton lipids. More specifically, higher TP levels reduced total lipids in algae (seston), which positively influence zooplankton species numbers. TP directly impaired functional richness and functional diversity, which, together with algae lipids, boosted zooplankton lipid content (Fig. 2). Hence, safeguarding functional diversity will enhance zooplankton lipid content, providing more essential nutrients for fish and, consequently, improving human health.

Fig. 1. Consequences of increased eutrophication on fishpond zooplankton assembly rules.

Fig. 2. Piecewise Structural Equation Model (pSEM) disentangling complex interactions among eutrophication, zooplankton taxonomic and functional diversity, and total lipids.

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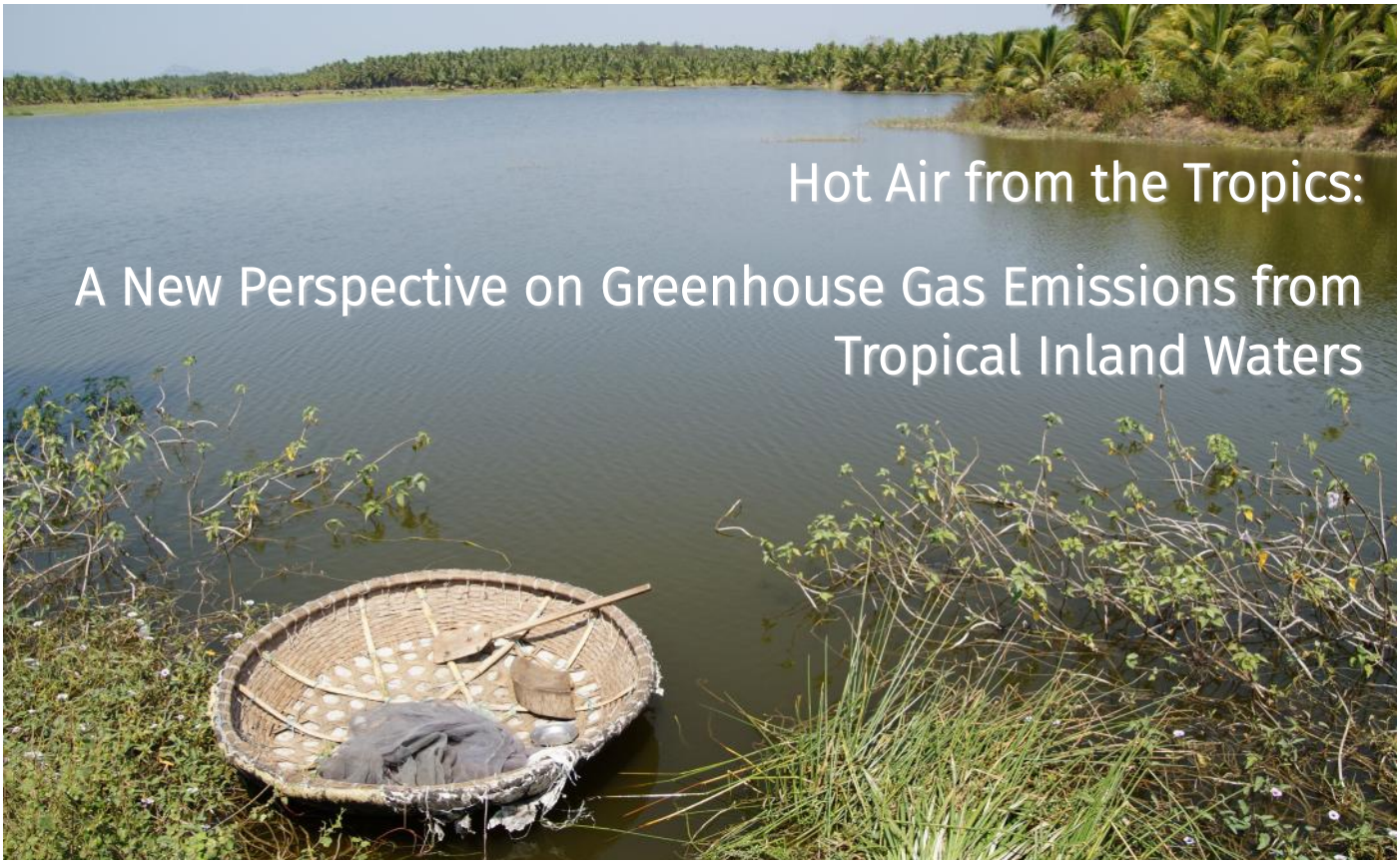

Hot Air from the Tropics:

A New Perspective on Greenhouse Gas Emissions from Tropical Inland Waters

Katrin Attermeyer | CARBOCROBE

Tropical inland waters—rivers, lakes, and reservoirs—are key components of the global carbon cycle. While greenhouse gas emissions to the atmosphere from northern regions have been extensively studied, the tropics have so far received far less attention. The diversity of climate zones, landscapes, and human pressures across the tropics makes it particularly challenging to develop a comprehensive picture. A new study conducted by an international research team, including Katrin Attermeyer from WasserCluster Lunz, has now addressed this gap by compiling and analyzing data from more than 500 studies.

This comprehensive assessment synthesizes existing knowledge on greenhouse gas emissions from tropical inland waters and delivers new, and in some cases surprising, insights. The results reveal the pronounced variability of emissions across the tropics and highlight the key drivers involved—ranging from climatic conditions to human interventions. Tropical rainforest regions and seasonally dry tropics emerge as the largest sources of greenhouse gases, whereas arid and semi-arid regions exhibit comparatively lower emissions.

A central finding of the study is that greenhouse gas emissions from tropical inland waters have previously been overestimated. The revised estimates are 29–82% lower than earlier assumptions, with significant implications for global carbon budgets. This reassessment can be attributed to the utilisation of a considerably more extensive dataset and the employment of enhanced modelling approaches. Nevertheless, there are still uncertainties, particularly in relation to remote regions and smaller water bodies.

The findings emphasise the necessity of explicitly incorporating tropical inland waters into global climate models. The role of these ecosystems in climate change is thereby advanced, and important guidance is provided for the conservation and sustainable management of inland waters in the tropics.

Duvert, C.; Borges, A.V.; Calamita, E.; Rocher-Ros, G.; Linkhorst, A.; Rosentreter, J.A.; Liu, S.; Taillardat, P.; Attermeyer, K.; (...) Oviedo-Vargas, D.; Riveros-Iregui, D.A.; Marzolf, N.S. (2025): *Hydroclimate and landscape diversity drive highly variable greenhouse gas emissions from tropical and subtropical inland waters.*
Nature Water, 3, p.1303–1317
published: October 17, 2025

doi: 10.1038/s44221-025-00522-8

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Photos:
left | Materials for secondary level I on 'Characteristics of the natural sciences' © E. Feldbacher
Centre | Presentation of materials at the Lower Austrian Research Festival 2025 © A. Jung
right | Presentation of materials at the Environment Knowledge Conference © E. Feldbacher

INSE Project Unveils New Teaching Materials: Making Science Come Alive

Eva Feldbacher | FLUVICHEM

How does science actually work? And how can it be made more relatable to children and young people? The **INSE project** has been working to connect schools and research for the past three years. INSE stands for Interdisciplinary Network for Science Education in Lower Austria. The GFF NÖ is the organization that funds INSE. The goal is to encourage people to understand science, be curious, and see what scientists do.

Scientists from the natural sciences, social sciences and educational sciences (WasserCluster Lunz, Austrian Competence Centre for Biology Didactics, PH NÖ) have developed and tested innovative concepts for science education in collaboration with partner schools (BORG Wr. Neustadt, VS and MS Lunz), the Lower Austrian Education Region 3 and Haus der Wildnis. The resulting teaching materials promote inquiry-based learning and strengthen scientific skills – for all school levels. INSE demonstrates that science is not far away – it begins right in the classroom.

What was developed?

Teaching materials for primary school to upper secondary school:
In primary school, the focus is on inquiry-based learning, storytelling, and creative methods. In lower secondary school, students learn about the characteristics of science through interactive tasks. In the upper grades, students design their own research projects, ranging from experiments in aquatic ecology to social science surveys.

Research Quartet Game
A card game that playfully demonstrates how science works – from question to conclusion.

Digital App:
This new app uses digital technology to bring science education to life and enable playful learning.

Free Download:

All of the materials encourage curiosity, critical thinking, and the enjoyment of research, and they are all available here free of charge:

www.science-education.at

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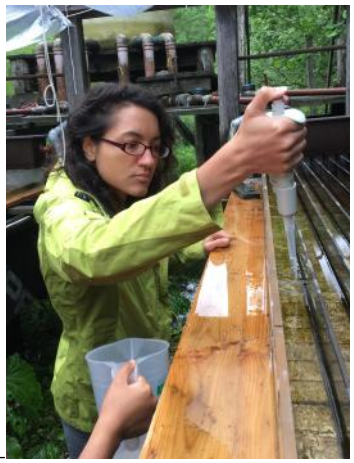
Reintroduction of river lampreys

Stefano Mari, PhD student in the SCIFISH group, has been in Sweden for the past few months. He has been working at the University of Gothenburg (Sweden), hosted by the Salmonid Ecology Group led by Johan Höjesjö. He conducted experiments on the burrowing behaviour of river lamprey larvae (*Lampetra fluviatilis*), investigating the effects of light, sediment size, and chemical cues on burrowing performance. This study forms a part of a project led by Ningping Gong, that focuses on the reintroduction of river lampreys in Europe.

Excellent Presentation

Pratiksha Acharya, also a PhD candidate at WCL, was awarded the "Colin S. Reynolds Prize for Best Presentation" at the 14th Symposium for Freshwater Sciences (SEFS14, 20-25 July 2025, in Bolu, Turkey).
Title: "Comparative analysis of bacterial assemblages in shredder-derived particles and the gut reveals taxa-specific differences."

Academic Theses



PhD Defence:

Nadine Ebm, University of Vienna, September 2025: 'Trophic pathways of omega-3 polyunsaturated fatty acids in stream food webs.' [image on the right]

MSc Defence:

Oliver Wijffels, BOKU University, Vienna, October 2025: 'The role of citizen science in the recording and assessment of wetlands. Evaluation of methodological approaches and their comparative significance.'

SUSTAINABILITY INITIATIVE
6 Steps towards enhancing sustainability at WCL

05 PP 02 PE-HD

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Donating Plastics for Recycling

The utilization of single-use plastic items is an inevitable component of experimental laboratory and fieldwork. For several years now, we at WCL have been collecting PE and PP waste for the association ***Helfen statt wegwerfen*** (‚*Help instead of discard*'), which meticulously processes the material before sending it to a recycling company and uses the proceeds to support children with special needs. In addition to contributions from laboratories, Helfen statt wegwerfen expresses a particular interest in the donation of caps, plugs, and screw tops manufactured from HDPE and PP. To date in the current year, the association has received a total of 37,290 metric tons of plastic caps.
It should be noted that the recently implemented deposit system does not affect the processes of collecting and donating. Empty plastic bottles can be returned even if they are capsless, without any consequence for the deposit refund.

www.helfenstattwegwerfen.at

Fig. right: Screenshot of the site

https://edu4life-wetlands.vercel.app/

Restore4Life Wet-Edu Tool available online

„Living Floodplains: Learn, Explore, Restore4Life Dashboard“ is a digital learning environment that integrates all components developed in the Resore4Life project for knowledge transfer.

The Dashboard includes:

- Downloadable Restore4Life 5E teaching materials (protocols and worksheets) with direct Zenodo links
- A gamified interactive illustration for each topic, serving as an engaging entry point to the 5E teaching materials and repository
- Access to the Wetland Education Repository with related educational activities and best practices
- Links to complementary tools developed under Restore4Life, including the Blue-Green Space4All online game and the Wetland Fresk Participative Workshop

Podcast Tip:
One Water - Wasser ist Leben

The 9th episode of the ecoplus podcast series has been online since Nov. 27, 2025:

"One Water: Water as a Habitat and How to Research It."
This time, host Ursula Strauss welcomes scientists Eva Feldbacher and Gabriele Weigelhofer, who discuss their work at the WasserCluster Lunz. This exciting episode provides insights into aquatic ecosystem research, the importance of long-term data, modern science education in schools, and international collaborations at the WCL—sometimes even with Italian pathologists. All episodes are available here (in German):

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

The next WCL-Newsletter will be published in June 2026.

Imprint

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