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Book of Abstracts

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1.1 SPATIO-TEMPORAL VARIATION OF CO2, CH4, and N2O IN LAKE NOKOUÉ, BENIN

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Lake Nokoué, Benin's largest surface water body embedded in the Ramsar complex 1018, supports 75% of the national freshwater fisheries and sustains the livelihoods of 500,000 people through traditional, non-fed aquaculture (“acadja”). However, the lake is eutrophic and experiences strong sedimentation. We hypothesized that organic matter inputs from rivers, macrophytes, and aquaculture support massive greenhouse gas emissions. Monthly sampling from April to December 2023 at river mouths, open water, and aquaculture sites revealed diffusive CO2, CH4, and N2O emissions were highest at river mouths, followed by the aquaculture sites. Mean daily fluxes at the river mouths were 4, 8, and 3 times greater, respectively, than in open water. Seasonal variations showed CO2 and N2O decreased during low water periods, while CH4 displayed no significantly dominant pattern.

1.2 Greenhouse gas production from mineralization of riverine organic matter under freshwater vs. marine conditions

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Rivers transport a lot of organic matter from the inland to the oceans, of which a large part settles and is mineralized within estuaries. Oftentimes, these dynamic environments are disturbed by the construction of barriers such as weirs and dams, which disrupts both the particle transport and the salinity gradient along the river-estuary system. As particularly methanogenesis is inhibited by sulphate, it likely makes a difference whether particulate organic matter (POM) is mineralized under freshwater or marine conditions. To compare GHG production from POM mineralization under freshwater versus marine conditions, we collected sediment from a freshwater weir and a marine river mouth and incubated it in a microcosm experiment. The GHG fluxes of CH4, CO2, and N2O were measured regularly over 20 days after the addition of different types of riverine POM (algae, river sediment). The addition of POM stimulated the GHG production under both freshwater and marine conditions. Total GHG emissions from the freshwater sediment were up to 14 times higher than from the marine sediment and were dominated by CH4 with regularly occurring ebullition events. N2O emissions also clearly increased in the freshwater over time. In the marine sediment CO2 was the dominant GHG, while only little CH4 and N2O were emitted. We therefore conclude that weir construction and the subsequent processing of carbon in freshwater sediment has the potential to considerably increase the overall GHG emissions and thus the climate effect of the coupled river-estuary system.

1.3 Salinity constrains methane while in-stream processes regulate CO_2 dynamics in a tropical estuary

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Estuaries are critical interfaces in the global carbon cycle, yet the processes controlling greenhouse gas dynamics in tropical systems remain poorly resolved. In many large tropical rivers, CO_2 and CH_4 emissions are attributed to strong lateral inputs from wetlands and floodplains. Whether this paradigm applies to smaller, less connected tropical estuaries remains unclear. Here, we investigate the drivers of CO_2 and CH_4 dynamics along the Gambia River estuary, a relatively unaltered system increasingly affected by saltwater intrusion. We combine spatially resolved greenhouse gas measurements with multivariate analyses to disentangle the relative influence of salinity, seasonality, and internal processes. We find that, although salinity captures first-order patterns in CO_2 and CH_4 concentrations, it does not explain the underlying biogeochemical controls. Instead, a persistent CO_2 maximum at intermediate distances, consistent across seasons, points to enhanced processing within the estuarine mixing zone. In contrast, CH_4 displays greater spatial variability, reflecting stronger control by local redox conditions. These results demonstrate that spatial structure—not seasonality—is the primary organizing force of greenhouse gas dynamics in this system. Moreover, the contrasting behavior of CO_2 and CH_4 highlights the need to consider gas-specific controls rather than assuming common drivers. Our findings suggest that small tropical estuaries may deviate from the wetland-dominated paradigm described for larger river systems.

1.4 Fishers as Lake Scientists: Traditional Ecological Knowledge, Governance Gaps, and Social-Ecological Resilience in Lake Victoria, Kenya

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Lake Victoria, Africa's largest freshwater lake, faces intersecting crises: collapsing fisheries, microplastic and transboundary pollution, biodiversity loss, and systemic governance failures. Despite these pressures, the traditional ecological knowledge (TEK) of fishing communities remains largely excluded from formal lake management. This study, centred on Muhuru Bay and Migingo Island (Kenya), documents fishers' TEK through participatory methods including 40 oral free-listing interviews, 50 semi-structured interviews, and immersive lakescape walks conducted over 12 months (2023–2024).

Fishers demonstrated diagnostic capacity exceeding conventional monitoring in several domains: sensory identification of pollutant hotspots (Osikonyodho), thermal perception of water temperature shifts ("water burning like tea"), and morphological recognition of cryptic haplochromine cichlid resurgences. These insights complement and, in some cases, challenge scientific assessments. Governance failures — corruption, conflicting licensing, gendered exclusion, and political manipulation of Beach Management Units — undermine both formal regulation and community-based adaptive strategies. A dietary-cultural paradox emerges: heavy reliance on sardines (Omena) masks wider biodiversity loss and raises food security risks.

We propose hybrid governance frameworks that blend TEK with empirical science through elder-led stock assessments, TEK-informed sediment tracing, and gender-responsive co-management reforms. By framing TEK as a form of lived lake science with both diagnostic and governance authority, this study advances pathways for equitable, resilient freshwater management — with implications for GLEON sites facing similar knowledge-governance tensions globally.

1.5 Traditional dark incubations overestimate microbial respiration

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Measurements of microbial respiration in oxic environments are traditionally done by quantifying oxygen consumption after dark incubations to avoid oxygen production by photosynthesis. Nevertheless, photoheterotrophic organisms are able to reduce their respiration in the presence of light, indicating a potential overestimation of the microbial respiration. We developed an infrared light incubation method that provides usable light for a relevant group of photoheterotrophic bacteria and demonstrated a decrease in the microbial respiration.

1.6 Borders of Ice: Tracking Ice Cover Phenology in Mediterranean High Mountain Lakes

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Interest in the winter limnology of seasonally ice-covered lakes has grown significantly, as these ecosystems act as sensitive sentinels of climate change. Their rapid response to temperature fluctuations allows for the early detection of environmental shifts in both aquatic systems and their catchments. However, research on the vulnerability of ice-covered lakes in the Northern Hemisphere often overlooks high-altitude Mediterranean systems. This study addresses this gap by analyzing the ice cover phenology of 26 high-mountain lakes in the Iberian Central System, situated between 1,600 and 2,300 m a.s.l.

Our findings reveal that different morphogenetic lake types exhibit greater homogeneity during the "ice-on" phase, which is primarily driven by regional synoptic meteorological conditions at the onset of winter. In contrast, the "ice-off" date shows higher variability, influenced by site-specific topoclimatic and morphometric factors. Statistical analysis indicates that while the autumn and spring 0 °C isotherms are critical, altitude and maximum depth best explain ice-on variability. Conversely, the ice-off timing is predominantly governed by altitude and solar radiation. Furthermore, ice cover intermittency throughout the winter is decisively linked to lower altitudes, and south-facing slopes with greater solar exposure. These results underscore the complex interplay between regional climate and local topography in shaping the cryosphere of Mediterranean mountain ranges.

1.7 Functional responses of Daphnia and Dreissena rostriformis bugensis feeding on a green alga and a filamentous cyanobacterium

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The functional responses of two competing filter feeders in Lake Geneva, Daphnia spec. and Dreissena rostriformis bugensis, feeding on a green alga Chlamydomonas reinhardtii and a filamentous cyanobacterium Planktothrix rubescens were established experimentally. Both species were fed 6 different food levels, either in unialgal treatments or in a mix of the two species in ratios of 25:75, 50:50, 75:25. Results of these experiments are being processed and will be presented on the poster.

1.8 Development of a transdisciplinary and collaborative process for managing freshwater ecosystems in Capçaleres del Ter i Freser protected area

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Mountain aquatic ecosystems have intrinsic value, supporting biodiversity, essential ecological functions, and providing key water resources for the human population. However, these systems are increasingly exposed to multiple environmental pressures, including the growing intensity of recreational use. Addressing these challenges requires not only robust scientific knowledge but also interdisciplinary and collaborative approaches that effectively translate research into informed ecosystem management.

In this context, a collaborative process was initiated in 2026 involving researchers from the University of Girona and managers of the Capçaleres del Ter i del Freser Natural Park, a protected area in the eastern Pyrenees. The initial phases focused on a co-production process to jointly identify the most relevant freshwater-related challenges in the area. Among the priorities identified, the impact of recreational activities canyoning and bathing emerged as a key concern due to their increasing popularity. We co-designed a fieldwork approach aimed at assessing the effects of these activities and monitored a range of physicochemical and biological parameters, including macroinvertebrates, microbial and virus communities. Preliminary results showed complex interactions between seasonality and anthropogenic impact factors, and highlighted the relevance of not only recreational activities at specific stream reaches but also the presence of human infrastructures at the watershed as further controlling fluvial ecosystem integrity.

This co-production approach provided a trust-based framework between park managers and researchers and generated valuable insights to support the development of management strategies that balance recreational use with the conservation of high-mountain freshwater ecosystems.

1.9 A preliminary assessment of spatial and temporal water-quality patterns along the Essequibo River, Guyana

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The Essequibo River is a major freshwater system in Guyana that supports transportation, livelihoods, biodiversity, tourism and recreation and freshwater resources in a landscape affected by rainfall runoff, settlement, and land-use activities such as mining. However, limited research has examined continuous water quality patterns along this river. This study used real-time sensor data from selected monitoring points along the Essequibo River, namely St. Marys, Saxacalli, and Bartica, to evaluate spatial and temporal patterns in water-quality conditions and potential drivers. The analysis was centered on water temperature, dissolved oxygen (DO), pH, turbidity, conductivity, total dissolved solids (TDS), and salinity, specifically focusing on oxygen status, suspended-sediment indicators, acidity, and ionic strength.

Preliminary observations at Saxacalli provided an initial snapshot of warm river conditions (28.7 °C), adequate DO (7.7 mg/L), slightly acidic pH (5.86), low ionic strength (conductivity: 20 uS/cm; TDS: 11.8 mg/L; salinity: 0.01 PPT), and elevated turbidity (167.71 NTU). These variables were compared across the St. Marys, and Bartica monitoring points to investigate whether they stay constant along the river or vary across sites and sampling periods. The site-level observations will be interpreted alongside rainfall data, riverbank disturbance, and land-use pressures, especially mining-related sediment disturbance to better understand potential drivers of water-quality variation along the Essequibo River.

Our study highlights the importance of real-time monitoring data to understand early water-quality trends along the river. This preliminary assessment lays the groundwork for identifying baseline river conditions, detecting short-term disturbance signals, and supporting future freshwater monitoring and management in Guyana.

1.10 Urbanization and Seasonality as Drivers of Dissolved Organic Matter Fate and Reactivity in a Tropical Watershed

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Urbanization significantly alters river biogeochemical cycles by increasing organic matter loading through untreated effluents and riparian vegetation removal. This study evaluated how urbanization and seasonality modulate dissolved organic matter (DOM) quantity, optical composition, and lability in the Itapecerica River basin (Brazil), focusing on its susceptibility to bio- and photodegradation. We integrated data from seasonal campaigns (2022–2026) across 18 sampling points, including the main channel and key tributaries, with ex situ experiments of photo- and biodegradation. DOM was characterized using spectrophotometry (a254, SR, SUVA254) and fluorescence (EEM-PARAFAC). Urbanization led to a significant increase in dissolved organic carbon and a254 values. Higher spectral slope ratios (SR) and protein-like components in urban stretches indicated lower molecular weight and higher lability. Seasonality modulated these effects: while the rainy season increased allochthonous aromatic input, urban impacts were most pronounced during the dry season due to reduced effluent dilution. Biodegradation experiments revealed significantly higher Biodegradable Dissolved Organic Carbon (BDOC) in urban areas, while photodegradation was most effective at reducing the humic-like components prevalent in rural sites. Our findings demonstrate that urbanization intensifies DOM transformation, making it more reactive and susceptible to mineralization. These results highlight urbanized inland waters as hotspots for carbon processing and emphasize the need for improved sanitation infrastructure to mitigate anthropogenic impacts on aquatic ecosystems.

Funding: FAPEMIG (APQ-03419-22), CNPq (Master's scholarship)

1.11 Update on the ZooSize project: Global patterns in freshwater microcrustacean zooplankton body-size distributions across environmental gradients

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Body size is a key functional trait that affects many physiological and ecological processes. In ectotherms, temperature variation strongly influences body size patterns. Consequently, climate change is likely to alter patterns of body size and thus ecosystem function, particularly in size-structured aquatic communities. However, predicting the impacts of a changing climate on aquatic communities is challenging due to interacting pressures (e.g., predation, nutrient enrichment). Therefore, building a comprehensive database of organism body sizes and their associated environmental characteristics is a crucial step toward unraveling the complex interactions between these factors. GLEON ZooSize project was launched in 2021 to create a unique large-scale global database of individual crustacean zooplankton body size measurements and environmental factors from over 300 freshwater lakes to address the following questions: (1) How do zooplankton body size metrics vary across lake thermal regions? (2) How do local environmental factors influence the body size structure and trophic interactions within and across thermal regions? We expect that the response of the zooplankton size structure to environmental stressors will vary across geographical and ecological gradients. For example, lakes in warmer regions with more intense fish predation and nutrient enrichment will have a greater relative abundance of small-bodied zooplankton and less variation in size structure, altering trophic interactions. Our unique dataset will contribute to a better understanding of how climate impacts global patterns of freshwater zooplankton and how body size can be used as an indicator of ecological status in the conservation and restoration of lakes worldwide.

1.12 Winter isn't dead or dark: seasonality of mean light across frozen and ice-free lakes

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Shifts in climate are changing lake thermal stratification and light attenuation, which are key physical drivers of lake ecosystem structure and function. In northern temperate dimictic lakes, the summer stratified season is becoming both stronger and longer. At the same time, winters are warming, leading to reduced lake ice cover and thickness. Warmer winter conditions not only shorten the duration of ice cover but also affect ice transparency and snow that accumulates on the lake surface. However, our understanding of how warming winters and decreasing ice will affect underwater physical parameters, specifically light, is unknown. Here, we examine how changing lake ice and snow cover is affecting mixing dynamics and light throughout all seasons using mean light as a proxy, with a focus on winter. We use a gradient of lakes with various winter conditions including long ice cover, intermittent ice, and no ice to examine the effects of changing seasons on mean light. Mean light is higher in lakes with clear ice cover and no snow than snow covered icy lakes or open water winters. Lakes could have increased light as snow cover is lost but decreased light with intermittent or the loss of ice cover. Light-limitation occurs in some lakes when fully mixed, which could suppress the primary production of many species of phytoplankton but promote others. Understanding how lakes respond physically to warming winters will provide insight into how lake food webs may change in the future.

1.13 Spatial distribution of microplastics in Lake Tanganyika

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Microplastics are emerging global pollutants, but their occurrence in tropical African freshwater systems remains poorly understood. Lake Tanganyika, the world's longest and second deepest freshwater lake, holds about 17% of global surface freshwater, supports rich biodiversity, and sustains millions of livelihoods. Despite its importance, microplastic contamination in the lake remains largely understudied.

This study presents the first large-scale assessment of microplastic contamination in Lake Tanganyika. Surface water samples were collected during the dry season from 10 geographically distinct sites across the lake. Sampling was conducted using manta nets, followed by filtration through a 250 µm sieve. Organic material was removed using H_2O_2 treatment, and the remaining particles were examined under a dissecting microscope. Suspected microplastics were first identified based on morphological characteristics and then confirmed using Raman spectroscopy. Particle size, shape, colour, and polymer composition were also recorded.

Microplastics were detected at all sampling sites, demonstrating widespread but uneven contamination. Higher concentrations were observed near urbanized and river-influenced areas, including the Port of Congo and Rusizi River inlet. However, microplastics were also found in remote and protected zones, indicating that lake-scale hydrodynamic processes may contribute to their transport and dispersal. Fragments and fibers were the dominant particle types, while polypropylene (PP) and polyethylene terephthalate (PET) were the main polymers identified.

Overall, the findings show clear spatial variation in microplastic pollution, shaped by anthropogenic inputs and hydrodynamic processes. Future wet-season sampling will help assess seasonal dynamics. This research was funded by the European Union through the TAKIWAMA project, implemented by Enabel.

1.14 Quantifying Global Lake Resilience to Land Use Changes

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Lakes are sentinels of environmental change, but changes in lakes are typically opposed due to shifts in the ecosystem services those lakes provide. To assess the general resilience of lake state in response to local land use changes, we use a 40-year dataset of annual lake colors from 76,000 lakes around the world, in combination with a global dataset of land use and per-lake characteristics like lake bathymetry and flow rate, to assess the degree to which lakes maintain or alter their color in response to changing land use.

1.15 Cyanobacteria effects on terrestrial ecosystem services: native pollinators

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Blooms of toxic cyanobacteria have become increasingly common in aquatic ecosystems due to eutrophication and climate change, potentially increasing the release of cyanotoxins into the environment. Although the effects of cyanotoxins on aquatic ecosystem services are relatively well documented, little is known about their impacts on terrestrial ecosystem services, particularly via pollinators. Cyanotoxins are known to reduce fitness in emerging aquatic insects, which can accumulate and transfer cyanotoxins to terrestrial environments, increasing the probability of exposure for predators and other organisms associated with riparian ecosystems. However, the potential harmful effects of cyanotoxins on key pollinators such as bees, is a major theoretical gap. This study aims to evaluate the acute effects of cellular and extracts of a microcyctin producing Microcystis aeruginosa strain on four native neotropical bees (Melipona subnitida, Plebeia flavocincta, Scaptotrigona depilis, and Melipona scutellaris) and compare tolerance and effects to the common honeybee (Apis melifera). Laboratory bioassays will be conducted using five concentration gradients, including environmentally relevant and sublethal levels, in order to investigate potential changes in the survival, behavior, and locomotor activity of exposed bees. Considering the ecological importance of pollinators for maintaining biodiversity and ecosystem functioning, understanding the effects of cyanotoxins on pollinators is essential for predicting the effects of eutrophication on ecosystem services beyond aquatic environments. The expected results may contribute to ecological risk assessments involving cyanotoxins and provide support for conservation strategies aimed at protecting native pollinators under increasing environmental pressures associated with climate change and the intensification of cyanobacterial bloom events.

1.16 Freshwater zooplankton diel vertical migration and carbon flux under varying levels of planktivory: A mesocosm-based approach

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Zooplankton often exhibit diel vertical migration (DVM) in lakes, whereby they reside in deeper waters during the day to avoid fish predation and migrate to surface waters at night to feed on phytoplankton. Zooplankton are expected to exhibit more pronounced DVM behavior in lakes with higher predation risk from planktivorous fish. However, zooplankton trait-based groups differ in their evasion capabilities, which may drive diverse behavioral responses to planktivory. Zooplankton DVM behavior contributes to the downward transport of organic carbon to deep waters and sediments in the ocean, but DVM-mediated carbon flux has not been quantified in freshwater systems. We manipulated densities of planktivorous fish in 14 large enclosures (9 m diameter x 20 m deep) at the LakeLab in Lake Stechlin, Germany for six weeks in spring 2023 to investigate differences in DVM behavior of zooplankton functional groups, and to quantify impacts of DVM on carbon cycling. DVM was quantified using AI-supported high-resolution in situ video (MDPI). Preliminary results indicate stronger migration responses for larger individuals and taxa with weaker evasion capabilities. We use zooplankton respiration and fecal pellet production models, combined with physical parameters and particulate and dissolved carbon concentrations, to investigate how DVM drives carbon flux dynamics through changes in respiration and excretion across time and space. Our results will contribute to better understanding impacts of fish community changes on zooplankton behavioral dynamics and roles in lake ecosystem function.

1.17 High-resolution temperature and oxygen monitoring in Swiss lakes - current state and recent observations

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The high-frequency temperature monitoring of Swiss lakes, a joint project by the Federal Office for the Environment, cantonal agencies, and the Swiss Federal Institute of Aquatic Science and Technology (Eawag), has recently transitioned from the pilot phase to a continuous deployment. Measurements are currently ongoing in three mid-sized and a two small lakes. The monitoring data is made available and visualized in near real-time on the Datalakes platform. With this poster, we present the current state of the monitoring network and exemplary recent observations that highlight the value of the high-frequency measurements to complement the traditional, typically monthly lake monitoring activities by the cantonal agencies.

1.18 Organic carbon burial of 1.4 million global lakes

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Inland waters are increasingly recognised as active components of the global carbon cycle, yet organic carbon (OC) burial in lakes remains poorly resolved at the scale at which it occurs—the individual lake. Existing global estimates rely on coarse biome- or watershed-scale extrapolations that obscure strong inter-lake heterogeneity and limit representation in Earth system carbon budgets. Here, we compiled a global database of sediment-dated lake cores (N = 723) and developed a Monte Carlo residual-weighted random forest modelling framework to estimate lake-specific OC burial rates for over 1.4 million lakes worldwide. Our analysis suggests that lacustrine OC burial rates of individual lakes range from 0.8 to 167 g C m^{-2} yr^{-1}, with a global average of 30 ± 19 g C m^{-2} yr^{-1}. Small, warm, and shallow lakes show higher burial rates across the studied sites. Globally, we estimate a lake OC sink of 70 ± 2.3 Tg C yr^{-1}. Our spatially explicit global map reveals pronounced latitudinal and regional patterns, emphasizing the combined influence of climate, morphology, and land cover. This framework provides the first globally consistent quantification of lake-specific OC burial and offers a spatially explicit baseline that can support future observational and modeling efforts aimed at understanding how inland-water carbon burial may respond to climate and land cover change.

1.19 CyaNoServices: Inter-continental Research on Cyanobacterial Bloom Effects on Biodiversity and Ecosystem Services Beyond Aquatic Boundaries

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Cyanobacterial blooms—mainly driven by global warming and eutrophication— are a major threat to aquatic ecosystems. Their effects are well known and include degraded water quality, toxicity, anoxia, and reduced biodiversity, among others. However, little is known about the potential spillover effects of cyanobacterial blooms on terrestrial biodiversity and ecosystem services. Here, we present preliminary results from the CyaNoServices project, in which we investigated the biodiversity of emerging insects and pollinators in ponds and adjacent riparian zones across a eutrophication gradient in central Spain. Our findings, which link pond characteristics to aquatic-terrestrial insect biodiversity, represent the first step towards understanding how water quality and cyanobacterial blooms influence terrestrial ecosystem services through pollination and cross-ecosystem subsidies. The CyaNoServices project will replicate this study across tropical and continental climates in Brazil and Sweden, respectively. This provides a unique opportunity to integrate our findings into current and future GLEON projects water quality, cyanobacterial blooms, cross-ecosystem fluxes, aquatic-terrestrial biodiversity, and ecosystem services.

1.20 Satellite observations reveal spatially heterogeneous summer warming across North Patagonian lakes (Argentina): A 26-Year (2000-2025) study of Landsat

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Climate warming is rapidly transforming inland waters worldwide, yet temperate lakes of the Southern Hemisphere remain poorly represented in global assessments. Northern Patagonia (Argentina) contains hundreds of lakes distributed across complex mountainous terrain where long-term monitoring is limited. We used satellite observations to assess lake surface water temperature (LSWT) in 77 lakes spanning ~4° of latitude in the Andean region of northern Patagonia over 26 years (2000–2025). LSWT was derived from Landsat 5, 7, 8, and 9 Level-2 Surface Temperature products and summer trends (January–March) were analysed using Sen's slope and generalised additive models (GAMs). Satellite-derived LSWT showed good agreement with field measurements after calibration of a systematic bias (−0.24°C).

Summer LSWT trends varied markedly among lakes, ranging from −0.51 to 5.55°C decade^{-1}. Positive trends occurred in 81% of lakes, although only 14% were significant ($p<0.05$), reflecting strong interannual climatic variability. No significant cooling trends were detected. Three small-shallow lakes showed exceptional warming (>2°C decade^{-1}), including the proglacial lakes Ventisquero Negro and El Antiguo.

Regional analyses based on aggregate LSWT anomalies indicated an average warming rate of 0.35°C decade^{-1}, with small-shallow lakes warming faster (0.37°C decade^{-1}) than large-deep lakes (0.27°C decade^{-1}). Air temperature strongly explained LSWT variability ($r=0.76$, $p<0.001$), particularly in high-altitude small lakes. These results reveal spatially heterogeneous warming and highlight the vulnerability of Andean Patagonian lakes to ongoing climate change.

1.21 Use of phytoplankton community SAS to predict ecosystem metabolic rates in a Mediterranean reservoir

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The ecosystem metabolism of a reservoir conditions its role as a CO2 source or sink. In such systems, the phytoplankton community, whose ecological function depends on cell size, is the most significant photosynthetic group from a biogeochemical perspective (Falkowski, 1994; Hillebrand et al., 2022). Currently, hydrological changes modify the metabolic balance of lakes and reservoirs, often resulting in net heterotrophy (Jenny et al., 2016). However, to what extent these changes can be attributed to shifts in the size-abundance structure (SAS) of the phytoplankton community remains unknown. Over an entire hydrological year, we recorded high-frequency dissolved oxygen and meteorological data and collected monthly phytoplankton samples from a Mediterranean reservoir (El Gergal, Seville). Aerobic metabolism was modelled following Giling et al., (2017). Phytoplankton SAS was reconstructed using flow cytometry and FlowCam analysis to accurately represent the entire size distribution. On an annual scale, El Gergal's aerobic metabolism was net heterotrophic, but autotrophic and heterotrophic periods alternated at different layers of the water column. Similarly, there was an alternation of the size groups dominating the phytoplankton community. Using this data, we assessed whether changes in the SAS of the phytoplankton community could be used to predict changes in ecosystem metabolic rates within the present context of hydrological change.

1.22 Leaf litter increases nutrients and zooplankton but not algal biomass in an alpine lake ecosystem experiment

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Alpine lakes are particularly vulnerable to global change due to their oligotrophic states resulting from low anthropogenic impacts and small watersheds with shallow soils and sparse vegetation. As the climate warms, woody vegetation is expected to increase in alpine lake watersheds. However, little is known about how the resulting increase in leaf litter might impact alpine lake biota. Decomposing litter releases nutrients and dissolved organic carbon, which can either stimulate or suppress primary production due to fertilization effects or reductions in photosynthetically active radiation (PAR). We conducted a mesocosm experiment in Colorado, USA to test the effects of litter on alpine lake ecosystems. In 2020 we seeded twenty plastic tanks with sediment from nearby alpine lakes and added dried willow leaves to half of the tanks. After allowing the tanks to fill with snow throughout the winter and melt in the spring, we inoculated the tanks with plankton from the same lakes in June 2021. We then measured PAR, chemistry, periphyton mass, chlorophyll-a concentration, and the zooplankton community in July and September. Tanks with leaves had elevated zooplankton biomass and dissolved N and P compared to control tanks, but PAR, DOC, periphyton, and chlorophyll-a were unaffected. It appears that leaves caused a fertilization effect that increased zooplankton, but that the larger populations of zooplankton may have counteracted any fertilization of algal biomass. These results suggest that the encroachment of woody vegetation into the alpine could push fishless alpine lakes to less oligotrophic states and significantly alter their biotic communities.

1.23 Stable DOC, changing dissolved organic matter composition: linking long-term trends with high-frequency carbon and oxygen dynamics in lakes

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Dissolved organic matter (DOM) comprises a heterogeneous pool of carbon that serves as a key component for nutrient cycling, light penetration, microbial respiration, and water quality in general. These processes can affect dissolved oxygen (DO) dynamics by altering oxygen demand and biogeochemical processes in lakes. Here we examined long-term trends in dissolved organic carbon (DOC) and DOM composition and linked those patterns to high-frequency measurements of DOC, DO and temperature across 30 lakes in the Kawartha Highland, Ontario, Canada, from 2015 to 2025. We characterized DOM composition, measured DOC and standard water quality variables and took DO profiles. In two of the lakes, we added sensors and continuously monitored total organic carbon (TOC), DOC, specific ultraviolet absorbance at 254 nm (SUVA254), temperature and DO levels for two years during the ice-free months, from May to October. Preliminary analyses suggest that DOC remained relatively stable through time (2015-2025), while DOM indices were more variable in composition, highlighting the importance of considering both carbon quantity and quality. Additionally, the high-frequency data revealed short-term variability in DOC and DO that was not captured in the discrete sampling. Linking long-term DOC and DOM trends with high-frequency DOC and DO observations, our work will provide new insight into the processes regulating carbon cycling and oxygen dynamics in lakes.

1.24 Cleaner Air, Browning Waters: Diverging Dissolved Organic Carbon Trends in Recovering Lakes

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Many lakes throughout northeastern North America and northern Europe have exhibited increases in dissolved organic carbon (DOC) concentrations in recent decades, a phenomenon known as “browning,” because it often imparts a brownish hue to water color. This phenomenon has primarily been attributed to recovery from historical acidification and concomitant water chemistry changes. However, other factors such as changes in climate and land use may also contribute to browning, potentially accelerating or decelerating rates over time. Additionally, chemical change may be ongoing in some regions. To understand the potential drivers and characterize relative rates in browning, we analyzed long-term trends in DOC concentrations among lakes throughout North America and Europe. We focused on distinguishing between linear, accelerating, and decelerating trends over time by identifying statistically significant breakpoints that separate time periods differing in browning magnitude and direction. We found that DOC trajectory patterns are diverse across lakes and regions, and have been exploring the extent to which this reflects similar diversity in deposition trends as opposed to different combinations of additional drivers operating across regions. Divergent trends in browning rates are likely to facilitate diverse ecological responses among lakes and regions. If you are interested in contributing long-term data from your study site(s), we welcome and encourage you to reach out to the listed authors for more information.

1.25 Modelling and Forecasting Coastal Eutrophication

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Inland water bodies transport extensive amounts of nutrients, pollutants, and more into coastal environments, connecting the land to the sea. This connection allows these ecosystems to offer a diverse range of habitats, which enables the survival of a multitude of species and supports a large proportion of the world's population. However, riverine exports can also have hugely negative consequences on coastal environments by causing eutrophication and phytoplankton blooms. Phytoplankton blooms, in turn, can lead to hypoxia, changes in species condition, and acidification. The southern and eastern US coasts are particularly susceptible to blooms.

This project's first aim was to investigate the drivers of coastal eutrophication in this region, using Chlorophyll A (Chla) as a proxy. The variables included were sea surface temperature, salinity, surface radiation, upwelling and riverine nitrogen flux, which were gathered from satellite and model data. Their impact on Chla was assessed using correlation tests and General Additive Modelling (GAM). The results highlighted the importance of riverine Nitrogen export and sea surface temperature, emphasising the need to both decrease pollution export and combat climate change.

The second aim was to develop a methodology to forecast Chla using machine learning. Different models were compared, such as Kolmogorov-Arnold Networks, Neural networks, and Random Forest. This poster presents the preliminary findings of this work.

1.26 An Assessment of the Socio-Cultural and Eco-Economic Effects of Sand Mining on Traditional Fishing Communities in Lagos State, Nigeria.

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Sand extraction, the removal of sand from beaches, riverbeds, and quarries for construction and industrial purposes, can significantly degrade aquatic ecosystems and affect dependent livelihoods. This study examined the ecological and economic impacts of sand dredging in selected coastal water bodies of Lagos State, Nigeria. Three sites were investigated: two active dredging locations (Lagos Lagoon at Baiyeku and Badagry Creek) and one undisturbed site (Kweme River). Over 20 months (October 2022–May 2024), water, sediment, and fish samples were collected and analysed. Physico-chemical parameters, sediment quality, and ecological risks of eight trace metals (Zn, Pb, Cu, Fe, As, Cd, Cr, and Ni) were assessed in three fish species (Sarotherodon melanotheron, Coptodon zillii, and Chrysichthys nigrodigitatus). Biodiversity indices and ecosystem modelling were also employed. Socio-economic data were obtained through structured questionnaires administered to 100 respondents per site. Results indicated significant spatial variation ($p < 0.05$) in half of the measured water quality parameters. Sediment pollution indices were generally low (<1), while ecological risk levels were lowest in Kweme River and highest in Badagry Creek. Fish diversity indices were highest in Kweme River, indicating a healthier ecosystem, while dredged sites showed reduced biodiversity. Most respondents acknowledged the economic benefits of sand mining, including employment (71.23%), but also reported negative effects on aquatic ecosystems, fisheries, and water quality. In conclusion, sand dredging adversely affects ecological integrity and fish diversity in Lagos Lagoon and Badagry Creek, underscoring the need for sustainable management strategies to balance environmental protection with economic benefits.

1.27 Health Risk Assessment of Heavy Metals in Chrysichthys nigrodigitatus (Lacépède, 1803) from Badagry Creek, Lagos State, Nigeria

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Metallic elements are naturally ubiquitous, and transported by water, posing a significant threat to the aquatic ecosystem and biodiversity. Heavy metals are introduced into the aquatic environment as a result of anthropogenic activities, and other natural activities. This research quantifies the level of heavy metals in the tissues of Chrysichthys nigrodigitatus, and also measures the physico-chemical parameters in water samples collected at Badagry Creek. The samples were collected for 10 months consecutively and then transported to the laboratory for analysis. The result revealed that the mean temperature 30 degree C, pH 6.62, electrical conductivity 152.7 µS/cm, Salinity 0.1 ppt, and dissolved oxygen 6.2 mg/L. The level of heavy metals in fish gill, muscle and liver ranges within Cd (0.01-0.07 mg/kg), Cu (0.05-0.09 mg/kg), Fe (15.08-46.01 mg/kg), Cr (0.001-0.05 mg/kg), Ni (0.001-0.04 mg/kg) and Zn (5.67-25.10 mg/kg). The result from the laboratory toxicity test revealed the water quality, and heavy metal concentrations for Pb, Cr, Mn, Zn, Cu, As, Ni, and Cd in the fish tissues samples are low, and within permissible limit recommended by WHO and USEPA. However, the findings indicate that Fe content was above the FAO/WHO standards. All metals had an estimated dietary intake (EDI) below the threshold, and the mean differences between sample stations were not statistically significant ($p>0.05$). Similarly, the values of target hazard quotients (HQs) and hazard indices (HIs) were (< 1). This suggests that the fish species examined does not pose a non-carcinogenic threat to human health and is safe for consumption.

1.28 Microscopic Pandemic: A collaborative imaging classification pipeline for host–parasite interactions across lakes

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Parasitic infections are a major, yet understudied, driver of phytoplankton population dynamics, influencing bloom termination, community succession, and carbon cycling across freshwater ecosystems. Despite their ecological importance, host–parasite interactions remain poorly quantified at scale, largely due to the labor-intensive nature of microscopy-based detection.

The goal of this initiative is to build a semi-automated pipeline for large-scale phytoplankton–parasite monitoring: sampling lakes worldwide, imaging plankton communities using FlowCam, and training machine-learning models to classify images by taxon and infection status. This standardized workflow is designed to scale across highly diverse lake systems while remaining applicable to past FlowCam acquisitions, opening the door to reconstructing host–parasite dynamics over long time series, not just across space. The network currently includes 28 collaborators sampling more than 100 lakes worldwide. This poster presents the project's motivation, methods and what we have achieved so far.

We are actively expanding this network and welcome new collaborators — whether you have FlowCam data, can share lake samples, or expertise in phytoplankton identification — to join this effort to build a shared, scalable framework for studying host–parasite dynamics across freshwater systems.

1.29 Bright but overlooked: revealing whiting events in global lakes

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Pelagic calcite ($CaCO_3$) precipitation is an important yet poorly quantified component of carbon cycling in lakes. In theory, calcite precipitation may occur in up to half of the world's lakes where alkalinity exceeds 1 mM. These events arise when intense primary production increases pH, shifting the carbonate equilibrium, and driving $CaCO_3$ supersaturation leading to calcite precipitation and CO_2 release. Suspended $CaCO_3$ crystals strongly enhance optical backscattering by particles and, consequentially, water-leaving reflectance, turning surface waters milky blue and enabling detection from optical satellite imagery. However, the global magnitude and frequency of these "whiting" events, and the optical variability of lakes during such events, remain unknown.

To address this gap, we analysed ESA Lakes_cci reflectance data for 2,024 lakes worldwide from 1999–2025 using MERIS, MODIS, and Sentinel-3 OLCI observations. We first characterized the optical and temporal signatures of documented whiting events and developed a detection algorithm based on the temporal variability of bright surface-water pixels. We found that whiting events often generate reflectance anomalies large enough to be flagged during standard Lakes_cci quality-control procedures, underlining the requirement to better characterize these events as naturally occurring and not observation artefacts. Preliminary results using the satellite products prior to quality flagging reveal hundreds of whiting events across lakes spanning diverse climatic regions, morphometries, and alkalinity levels. Ongoing analyses investigate their environmental drivers and implications for inland-water carbon budgets.

1.30 Modelling the Impact of Pumped-Storage Hydropower on Stratification at Loch Ness

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Pumped-storage hydropower (PSH) stations store energy by transporting water to elevated reservoirs and are becoming increasingly important in supporting renewable energy infrastructure. The periodic transfer of large water volumes is often associated with a significant flux of turbulent kinetic energy and thermal energy, which can alter stratification patterns and have detrimental consequences for local ecology. This study uses a three-dimensional hydrodynamic model to assess the effects of a proposed 2 GW PSH scheme at Loch Ness across multiple timescales. Multi-site and multi-variable autocalibration methods were applied to optimise model performance for temperature and flow velocity across all monitoring stations. The model successfully captures the complex internal wave structure of the Loch, and is the first of its kind to couple both reservoirs over multiple cycles of operation. High-resolution simulations are used to examine local effects of PSH mixing during a single cycle, while longer simulations reveal lake-wide impacts on seasonal stratification patterns, including changes in layer temperatures, thermocline depth, stability, and timing.

1.31 Machine learning-based seasonal forecasting of dissolved organic matter to support drinking water management at the source

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The amount of dissolved organic matter (DOM) in freshwaters impacts many processes in aquatic ecology and, therefore, on derived ecosystem services such as water supply. Surface drinking water sources are increasingly subjected to unforeseen increases in both the concentration and variability of DOM which can affect tap quality and users through the unintentional formation of toxic disinfection by-products (DBPs) during the water treatment process.

Ecological forecasting provides a way to support water quality management by generating predictions of future environmental conditions within decision-relevant timeframes. However, forecasting DOM remains challenging due to the complex interactions between in-lake processes and catchment-scale drivers. In this study, we developed a seasonal forecasting framework to predict monthly average concentrations of surface fluorescent DOM (fDOM) one to seven months ahead. The framework consists of a machine-learning workflow that simulates daily fDOM and is applied to two contrasting study sites: a lake in Ireland and a reservoir in Spain. Forecasting is driven by a set of predictors selected based on their relative importance in historical simulations and their availability in open-access seasonal forecast datasets.

The workflow integrates meteorological variables, soil conditions, hydrological outputs, lake model variables and a seasonal indicator. The analysis highlights how seasonal forecasts of DOM can support drinking water management by providing information on expected conditions in source waters in advance. The framework is designed to be transferable to and tested in other lake and reservoir systems where similar data are available.

2.1 Towards a mechanistic understanding of methane emissions in Mediterranean reservoirs

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Reservoir methane emissions remain highly uncertain due to the complex interactions between hydrodynamics, sediment processes, and microbial activity. Process-based models offer a promising framework to better understand these dynamics, although their application in Mediterranean reservoirs is still limited. Here, we present the first implementation of the ALBM methane model in a small eutrophic Mediterranean reservoir in southern Spain. This contribution focuses on the model structure, required forcings, and the main challenges associated with adapting the framework to Mediterranean systems. We present preliminary simulations exploring the influence of stratification, mixing, and water-level fluctuations on CH_4 dynamics, together with the main limitations identified during the first model runs, including uncertainties related to sediment carbon inputs, methane oxidation, and emissions under highly variable hydrological conditions.

2.2 Climate-Driven Changes in the Italian Deep Subalpine Lakes: Insights from Long-Term Monitoring of deep subalpine lakes in the face of climate change

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Climate change is increasingly affecting the ecological functioning of large and deep lakes, leading to significant modifications in their physical and biogeochemical processes. The Italian subalpine lake district (DSL), comprising Lakes Lugano, Maggiore, Como, Garda, and Iseo, offers a valuable case study for investigating these long-term transformations. Located in northern Italy and formed through fluvioglacial processes, the DSL share similar morphometric features and have experienced comparable histories of anthropogenic influence. Their ecological trajectories have been documented through extensive limnological monitoring programs carried out by research institutions and environmental agencies since the 1980s. Despite differences in trophic conditions and oxygen dynamics, these lakes exhibit several common responses to ongoing environmental change. One of the most evident effects concerns alterations in thermal structure and water-column dynamics. Rising temperatures and stronger stratification limit the effectiveness of spring overturn, reducing vertical mixing and influencing both nutrient redistribution and dissolved oxygen availability. As a consequence, nutrients tend to accumulate in deeper layers while surface waters receive a lower nutrient supply during the mixing period.

Beyond their ecological relevance, these lakes provide a wide range of ecosystem services, including drinking water resources, support for agriculture and industry, and opportunities for recreation and tourism. In this contribution, we present an updated overview of the long-term changes observed across the DSL, focusing particularly on recent developments. We also examine how existing lake water-quality assessment approaches may need to be revised to better address the challenges posed by global environmental change.

2.3 Prediction of water quantity and quality in reservoirs to support adaptive water management

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Reservoir management is increasingly challenged by climate variability and extreme events that affect both water availability and water quality. Prolonged droughts, intense rainfall periods, and shifting seasonal patterns can simultaneously alter hydrological regimes and biogeochemical processes, increasing uncertainty for water supply operators and environmental managers. Anticipatory tools capable of integrating hydrological and limnological dynamics are therefore essential to support adaptive management strategies.

Here we present an integrated forecasting framework that combines hydrological and limnological models to generate seasonal predictions (1–7 months) of key variables related to water quantity (inflows, storage levels, and reservoir volume) and water quality (temperature, nutrients, dissolved oxygen, and chlorophyll). The approach integrates climate-driven forcing with process-based models to produce predictive scenarios relevant for operational decision-making.

Preliminary applications to pilot reservoirs show that seasonal forecasts can capture major variability patterns in both hydrological and ecological conditions, providing early information for anticipating risks such as water scarcity or deterioration of water quality. This work highlights the potential of integrated forecasting systems to enhance resilience and adaptive management of reservoirs under increasing climatic uncertainty.

2.4 Apparent reversal of long-term declining calcium concentrations and the implications for biological communities in lakes

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Globally, lakes have experienced widespread declines in calcium concentrations largely attributed to historic acid deposition. Declining calcium trends have been persistent throughout acidification recovery and continually documented in the last several decades. This reduction in calcium negatively affects many biotic organisms, particularly calcium carbonate-forming zooplankton. Additionally, these changes in zooplankton communities can have implications for entire lake food webs. Recently, we have detected the reversal of long-term declining calcium concentrations in a region heavily impacted by historic acid rain, Adirondack State Park, NY, USA. Using data collected by the Adirondack Long-term Monitoring Program, we show that over 85% of study lakes exhibit a reduction in slope or a complete slope reversal in the last 10 years when compared to historic calcium trends. These apparent trend-reversals have important implications for lake communities, especially considering biological recovery has lagged behind chemical recovery in many acid-impacted lakes. We hope to expand this analysis outside of our geographic study area and welcome colleagues with data from other acid-impacted regions to contribute to this collaboration.

2.5 Nordic Big Data Limnology Network

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The Nordic Big Data Limnology Network (BigLimNet) is a Nordic research network funded by NordForsk with the aim to foster networking and collaborations across Early-Career Researches in the Nordic countries, who are interested in the physics, chemistry, biology and ecology of inland waters. BigLimNet aims to build a joint research platform to co-develop new research directions, and align on shared water-related challenges and opportunities. Through meetings, a summer school, short-term research visits, and shared outreach, the network will build interdisciplinary capacity in both natural sciences (limnology, freshwater ecology, hydrology, micrometeorology) and related engineering fields (sensor technology, modeling, IoT-based monitoring). Networking across the Nordics and the training of the next generation of aquatic scientists will be central, supporting interdisciplinary skills in innovative monitoring, data analysis pipelines, and mathematical modeling of lake-watershed systems.

2.6 Citizen-Science Monitoring and Modelling of Forgotten Small Waters in the Netherlands

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Small water bodies such as ponds, ditches, canals, and small lakes are widespread across the Dutch landscape, yet many remain weakly represented in Water Framework Directive monitoring programme. These “forgotten waters” can act as early receivers of agricultural runoff, sewer overflows, storm-driven pollution pulses, algal blooms, and pathogen contamination, while also supporting biodiversity, recreation, primary productivity, decomposition, carbon storage, and greenhouse-gas regulation. This PhD, embedded in the SlimmeBurger project, develops a citizen-science-driven monitoring and modelling framework to assess ecological quality, bathing-water risk, and ecosystem functioning in under-monitored small waters.

The research is structured around two sites: Willemspolder, focused on ecological and biogeochemical functioning, and Meren van Borculo, focused on recreational water quality. Seasonal citizen-science campaigns will generate repeated observations through structured protocols, including GUPPY measurements, Secchi-style transparency readings, water-colour scoring, photographs, visible algae, odour, and recreational-use information. These observations will be complemented by reference measurements, satellite products, and laboratory validation.

A central component is the evaluation of GUPPY as a citizen-deployable optical platform. The device will first be assessed for turbidity and transparency monitoring and then tested as a biological-growth screening tool by analysing growth curves after substrate addition. Curve features such as starting turbidity, time-to-response, growth rate, curve shape, and final turbidity increase will be compared with microbiological reference measurements to determine whether GUPPY can indicate E. coli-related growth, broader bacterial activity, or general biological change. The project aims to identify a scalable monitoring configuration linking citizen observations, low-cost sensing, satellite products, and ecological modelling.

2.7 A Multi-Scale Ecological Approach to Assessing Antimicrobial Resistance in a Freshwater Fish

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Antimicrobial resistance (AMR) genes are increasingly recognized as an emerging environmental contaminant. Yet, the ecological mechanisms shaping their distribution across natural landscapes remain poorly understood. Here, we quantified AMR gene abundances in microbial communities sampled from wild fish from eight freshwater lakes on Vancouver Island and paired these gene-level measurements with fine-scale limnological and land-use data. Using droplet digital PCR, field surveys, and an iterative spatial forecasting framework that integrates Random Forest models with regression kriging, we explored how watershed-scale processes relate to variation in AMR genes across lakes. Our analyses reveal potential associations between elevated AMR gene levels, changes in water quality, deforestation, and geographic proximity to salmon aquaculture. By integrating data across biological and spatial scales, from genes within microbial communities to lake-level conditions and landscape patterns, this study illustrates the value of combining quantitative molecular measurements with geospatial modeling to identify environmental factors that may promote antimicrobial resistance in natural systems. Our approach provides a proof-of-concept and a general predictive framework for generating hypotheses and informing future monitoring efforts aimed at understanding, managing, and forecasting environmental reservoirs of resistance.

2.8 Carbon burial in reservoirs is not a relevant net anthropogenic perturbation of the global carbon cycle

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The role of reservoirs as an anthropogenic perturbation of the carbon cycle remains debated. On one hand, their function as methane emitters following impoundment is now widely acknowledged and incorporated into the IPCC guidelines for National Greenhouse Gas Inventories. On the other hand, some authors have argued that reservoirs can also act as carbon sinks through the burial of organic carbon in sediments, potentially offsetting part or all of their methane emissions. Here we present a new global‐scale model for carbon burial along the land‐to‐ocean aquatic continuum (LOAC‐OCB v1.0), including lakes, reservoirs, floodplains and blue‐carbon coastal ecosystems. By analysing different scenarios related to the global prevalence of reservoirs in river networks, we use LOAC‐OCB to show that organic carbon burial in reservoirs does not constitute a significant net anthropogenic perturbation of the global carbon cycle from a carbon accounting perspective. Most of the organic carbon currently sequestered in reservoir sediments would, in the absence of these systems, be buried in other ecosystems along the LOAC. In particular, floodplains would retain most of this organic carbon under natural conditions. Although some regional differences exist, our results indicate that carbon burial in reservoirs is generally not a relevant net anthropogenic perturbation of the global carbon cycle. Consequently, methane emissions from reservoirs are unlikely to be substantially offset by net organic carbon burial in these systems at large scales. In any case, the substantial burial occurring in other LOAC ecosystems under natural conditions must be considered a perturbation from damming beyond carbon accounting.

2.9 Browning and mining increase the nitrous oxide production in sediments of large boreal lakes during winter

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There is limited knowledge on 1) the N (nitrogen) cycling in winter, 2) the role of organic matter quality on N cycling, and 3) the microbes involved.

We studied Lakes Viinijärvi and Höytiäinen, large boreal lakes in Finland with clear-water and brown-water sides. Viinijärvi has an additional side affected by mining activities in the catchment. During winter of 2021 we sampled 5 sites at the beginning and at the end of the ice-covered period. Using the Isotope Pairing Technique we incubated sediment cores with 15NO3- and quantified the products of 1) complete denitrification (N2), 2) truncated denitrification (nitrous oxide, N2O), and 3) DNRA, (NH4+) to infer the process rates. We characterized the DOM using FT-ICR MS. We explore the genetic potential (DNA) of the sediment microbiome by sequencing.

During winter the sediment-water interface is an active compartment. The top sediment microbiome has heterotrophic bacteria with flexible metabolism, breaking-down OM during winter despite most of the DOM is recalcitrant. Impacts of browning and mining with major differences between sites. The genetic potential of the sediment microbiome indicates more DNRA and N2O consumption in clear-waters, while in the mining-impacted site and brown-water sites the dominant pathway depends on the sediment layer with truncated denitrification in top layer, and methanogenesis and N-fixation in sub-top layer. The N2O production (d14), that fits the genetic potential, is highest in the mining-impacted site (35-43 µmol

N/m2/d), followed by the brown-water sediments (6-11 µmol N/m2/d), with the lowest rates in the clear-water sediments (0-1 µmol N/m2/d).

2.10 Perceived Human Health Risks and Practices around Lake Chivero

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Lake Chivero, an urban lake, receives partially treated wastewater from Harare, Zimbabwe's capital, and serves as the city's main source of domestic water. This eutrophic lake also supports fisheries, which many communities and residents depend on for livelihoods, as well as other uses such as recreational services. The aim of this study was to understand local perceptions of water-borne diseases, human health risks associated with the lake, and their interactions. A mixed-methods approach was used in a cross-sectional study to understand health risk perceptions, attitudes, and practices among communities in high-density suburbs of Harare. A quantitative survey included 342 household-level participants, linked to drinking water and fish consumption. Qualitative data were collected from three Focus Group Discussions (FGDs) with fishermen and fish vendors. Three Interviews were conducted with the City's water utility, Harare Water Treatment, the regulatory body, the Environmental Management Agency (EMA), and a fish expert at the local university. Using these combined datasets, perceptions of microbial hazard exposure and pathways were determined. The preliminary findings indicate that health risk perceptions vary between the different groups in each interaction: water or fish cycle. Variability in risk perception and response was influenced by several key determinants, including perceived visual indicators of water and fish quality, knowledge asymmetry between suppliers and consumers, normalization processes influencing safety perceptions, and system-level capacity to define and classify risk. These determinants shaped how risk was understood and acted upon across stakeholder groups.

2.11 A global assessment of the plastisphere and its contribution to aquatic metabolic processes

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Plastic pollution is widely recognized as a pervasive global issue affecting ecosystems worldwide, including freshwater environments. Its effects have traditionally been assessed using ecotoxicological frameworks that assume direct exposure–response relationships. However, this perspective may underestimate broader ecosystem-level processes, particularly for larger plastic particles that do not directly interact with organisms at the cellular level. One important, yet less explored, pathway through which plastics can influence ecosystem functioning is via the "plastisphere", biofilm communities that develop on plastic surfaces. Despite increasing attention, coordinated large-scale studies across environmental gradients remain limited, restricting understanding of plastisphere biodiversity and functional implications. In this global study, we incubated pristine polypropylene and low-density

polyethylene substrates under semi-natural conditions in the subsurface waters of ~70 lakes worldwide for 30 days to allow natural biofilm development. We quantified biofilm biomass and structure using chlorophyll-a and ash-free dry mass, and characterized microbial community composition through 16S, 18S rRNA, and ITS metabarcoding. In addition, short-term incubations were performed to estimate net ecosystem productivity (NEP) associated with plastic-colonized biofilms. This approach will allow us to address key questions regarding (i) the specificity of epiplastic communities across different polymer types, (ii) the relative influence of environmental versus substrate-driven factors during biofilm development, and (iii) the extent to which plastisphere formation may shift ecosystem metabolism toward net autotrophy or heterotrophy. By integrating data across diverse freshwater systems, this study provides new insights into the ecological role of plastics as novel substrates and their potential to alter biogeochemical processes at a global scale.

2.12 A catchment to coast evaluation of extreme rainfall effects on water quality using remote sensing

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Extreme rainfall events play a crucial role in shaping water quality by altering hydrological processes, nutrient loadings and sediment dynamics. However, quantifying their intensity and impacts remains challenging. This study applies an integrated remote sensing and time series analysis approach, combining satellite observations, water storage data, and long-term rainfall records to assess water quality responses after an extreme rainfall event in 2022 across the lake-river-bay system of the Brisbane River catchment in southeast Queensland, Australia. Areal rainfall derived from long-term records and Thiessen polygons identified the event as exceeding the 99.9th percentile. Satellite-derived indices, including Normalized Difference Chlorophyll Index (NDCI) and the Normalized Difference Turbidity Index (NDTI), were calibrated using exponential models and analysed using interrupted time series analyses (ITSA) to quantify immediate and delayed responses. Results show contrasting turbidity responses across water bodies following the event, with the largest increase and fastest recovery observed in Lake Wivenhoe, while turbidity initially decreased in Brisbane River and Moreton Bay due to dilution and dispersion before gradually stabilising. In contrast, chlorophyll a exhibited an immediate decline followed by delayed recovery, with lagged increases most evident in the lake and bay. ITSA further identified delayed responses approximately five months after the event, particularly in the lake and bay. Overall, these findings demonstrate that extreme rainfall triggers distinct, non-linear, and spatially variable water quality responses, with rapid physical disturbance followed by delayed biological adjustment, highlighting the importance of integrated monitoring across connected catchment systems.

2.13 Pesticides in European ponds: risk assessment and environmental drivers

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Pesticide pollution thresholds for lakes, reservoirs, and rivers are established under the European Water Framework Directive. However, small ponds are not covered by this regulation. This lack of criteria to determine the ecotoxicological risk status of ponds hampers proper assessment and management. In this study, we analyse pesticide concentrations in the waters of 74 European ponds across seven pondscapes in three countries. Since no Environmental Quality Standards for determining ecological and chemical status of these water bodies are defined, we propose the use of toxic units (TU) as an evidence-based criterion to assess the ecotoxicological risk of ponds in the absence of specific legal regulation.

Different criteria based on scientific literature have been used. Our results show that the way TU are calculated can dramatically affect conclusions about ecotoxicological risk in ponds. Depending on the assessment factor (AF) used to calculate toxic units, the number of ponds determined to be under ecotoxicological risk would span from 0 to 14 ponds out of 74.

In addition, a wide range of environmental variables —including morphological, limnological, climatic and land-use variables— were explored to identify patterns of pesticide pollution in ponds and to provide insights for their management. Overall, pesticide load was higher in ponds with steep littoral, weirs made out of soil and increasing percentages of improved grasslands around it ($p\text{-}v < 0.05$). Pesticide composition was very much linked to livestock grazing and land use parameters like woodlands, arable and improved grasslands covers.

2.14 ZooST is coming home to roost: progress on assessing the utility of space-for-time substitution in freshwater zooplankton

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Space-for-time substitutions (SFTS) have long been used to derive relationships between zooplankton and the variables that determine their richness and abundance, particularly when extensive temporal datasets are absent. However, the reliability of space to act as a surrogate for time when describing the relationship between an ecological response and explanatory variable is rarely tested. Using a subset of the ZIG dataset (lakes for which at least 8 years and 6 months per year of zooplankton data and corresponding estimates of chlorophyll, pH and temperature exist), we set out to examine whether relationships between response and explanatory variables were consistent among years within each lake and whether consistency increases when response variables are aggregated at higher levels of organization (e.g., community > order > genus). The data analysis sub-group of the ZooST project has extracted the appropriate data, wrestled with numerical (e.g., what to do with zeroes and how to transform) as well as statistical challenges (e.g., deriving the optimal analytical approach and testing assumptions) to generate the final working dataset of 52 taxa X 50 lake time series for each combination of response and predictor variables. We used a GLM-based Hurdle model to test the consistency of slopes between zooplankton taxa (and their aggregates) and explanatory variables (temperature, pH, chlorophyll) to test our hypotheses (H1 so far). Early results indicate the existence of a diversity of strong to weak relationships among lakes for each response-predictor analysis, but weak relationships dominate and aggregation does not seem to change this outcome.

2.15 Investigating food web dynamics and response to environmental change in a deep humic lake

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Lough Feeagh, a deep freshwater lake within the Burrishoole catchment in County Mayo, has been the focus of longterm ecological monitoring since the 1950s pertaining to the populations and movements of diadromous fish species. Alongside this, since the early 2000s monitoring of water chemistry, temperature, and other trophic levels provide a rare opportunity to examine ecosystem change over multiple decades, as well for creating a detailed snapshot of this ecosystem. This catchment is dominated by peatlands, which strongly influence lake carbon dynamics, water quality, and trophic production. Over the past 70 years, this landscape has undergone major shifts, including forestry expansion, increased grazing pressure, and a steady increase in lake water temperature, all of which may alter nutrient inputs, foodweb structure, and ecosystem functioning. This project will integrate biological and environmental datasets to construct a whole foodweb model of Lough Feeagh using Ecopath with Ecosim, quantifying energy flows and identifying how changes at one trophic level propagate through the system. The model may be used to test scenarios such as water temperature change, landuse change, and declines in key species. By creating a clear, quantitative picture of how Feeagh functions, this work aims to establish Lough Feeagh as an index site for predicting how similar lakes may respond to future climate and landuse pressures, supporting evidence-based conservation and management decisions.

2.16 Environmental drivers of zooplankton functional diversity in European pond ecosystems.

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Functional diversity is increasingly recognized as a key driver of ecosystem processes and resilience. Yet, most research has focused on terrestrial ecosystems (mainly terrestrial plants) while freshwater systems, especially small waterbodies such as ponds, remain relatively understudied. Ponds are crucial habitats for biodiversity, supporting a large proportion of freshwater species pool in the landscape, while also providing important ecosystem functions and services, such as climate change mitigation, nutrient cycling or pollination. In this study, we quantified the functional richness (i.e., number of functional traits) of zooplankton species in 130 ponds across Europe to identify the environmental factors shaping these communities and their potential vulnerability to climate change, as part of TRANSPONDER project. We found that nutrient concentrations and pond morphometric characteristics, including depth and area, were the strongest predictors of zooplankton functional assemblages. Importantly, our results suggest that increases in temperature can alter zooplankton functional diversity by shifting the relative abundance of species with different feeding traits, for instance, favouring herbivorous cladocerans over more carnivorous copepods. These shifts can cascade through the ecosystem, influencing phytoplankton densities and broader community dynamics. Our findings highlight the urgent need for conservation and careful management of pond ecosystems to preserve functional diversity, and safeguard ecosystem processes in the face of multiple anthropogenic pressures.

2.17 A winter snapshot of plankton diversity across the Küçükçekmece Lagoon salinity gradient using eDNA metabarcoding

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Coastal lagoons are dynamic interfaces between freshwater and marine environments, yet their biodiversity remains difficult to monitor with conventional approaches alone. Küçükçekmece Lagoon, a Marmara Sea-connected urban lagoon in Istanbul, offers an important model system for applying environmental DNA (eDNA) metabarcoding across a strong salinity gradient. We conducted a winter-season sampling campaign in late 2025 to generate an initial snapshot of plankton diversity.

Water samples were collected from nine stations representing lake, transitional lagoon, and marine zones, with key physical parameters measured in situ. The mitochondrial COI region was targeted using them lCOIintF/dgHCO2198 primer pair, and prepared libraries were sequenced on an Illumina NovaSeq 6000 platform using paired-end 150 bp reads. For this preliminary workflow, reads were processed using a single-end approach, followed by quality filtering, operational taxonomic unit assignment, reference-database comparison, taxonomic list generation, and diversity analyses.

Preliminary results suggest spatial structure across the lagoon–sea gradient. Shannon diversity was broadly comparable among marine and transitional lagoon stations, while Lake 1 showed a higher diversity signal in the initial dataset. Many taxonomic assignments returned “No Match,” highlighting reference-database gaps. This winter snapshot will be expanded through seasonal sampling in 2026, supporting a molecular framework for monitoring lagoon biodiversity and informing future conservation and management efforts in Türkiye.

2.18 Risk analysis of toxic phytoplankton species in inland waters

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The occurrence of Harmful Algal Blooms (HABs) in inland waters is predicted to increase due to eutrophication and the effects of climate change. HAB events provoked by toxic phytoplankton species in freshwater systems have caused important environmental and human health impacts such as fish kills, the death of domestic and wild animals, and human illnesses. Despite the widespread distribution of toxic phytoplankton species and the impacts caused by their blooms, there is no systematic knowledge of which taxa are most frequently reported and may therefore represent the highest potential risk to environmental and human health. Therefore, in this literature review we aimed to i) identify the most frequently reported potentially toxic phytoplankton taxa in freshwater bodies from temperate and arid climates and ii) analyze the risk level those taxa pose to environmental and human health. We conducted a systematic quantitative literature review to identify frequently reported phytoplankton taxa in scientific literature, compiled evidence of their documented impacts, and developed a risk analysis framework. The ten most frequently reported taxa were *Microcystis, Dolichospermum, Aphanizomenon flosaquae, Raphidiopsis raciborskii, Planktothrix agardhii, Pseudanabaena limnetica, Planktothrix rubescens, Limnothrix redekei, Umezakia ovalisporum, and Aphanocapsa delicatissima*. Four taxa (*Microcystis, Dolichospermum, A. flosaquae, and R. raciborskii*) showed the highest impact and risk scores, reflecting documented intoxication and mortality for aquatic fauna and terrestrial animals, and intoxication for humans. These findings provide an evidence-based framework to support monitoring and risk assessment of specific potentially toxic phytoplankton taxa.

2.19 Impacts of Lake Drying on the Dissolution of the Sedimentary Inorganic Carbon Sink

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Lakes are important carbon sinks due to the burial of both organic and inorganic carbon (IC), the latter associated with pelagic precipitation processes linked to planktonic metabolism and geochemical constraints. In medium- to high-alkalinity systems, the sedimentary IC pool is mainly driven by the deposition and dissolution of authigenic calcite crystals, processes regulated by water chemistry (e.g., pH, alkalinity, calcium concentration) and CO_2 dynamics. However, increasing drying is altering the hydrological regime of lacustrine systems, leading to declining water levels, reduced surface area, and greater sediment exposure to the atmosphere. The effects of these changes on sedimentary IC stocks remain poorly understood, particularly regarding how drying influences calcite dissolution and IC fluxes.

To address this, incubation experiments are conducted using surface lake sediment amended with synthetic ^{13}C-labeled calcite under two conditions: permanently inundated and progressively dried sediments. Dissolution rates are quantified through isotopic mass balances and compartment-specific measurements of carbon and calcium in sediment, pore water, overlying water, and headspace, together with respiration measurements. We evaluate how calcite dissolution responds to sediment drying and changing redox conditions.

We hypothesize that calcite dissolution rates decrease during drying relative to inundated conditions. These experiments aim to improve understanding of how drying affects carbonate sediment dynamics and inorganic carbon cycling in lakes under changing hydrological conditions.

2.20 Predicting the cumulative effects of land use and climate change on stream benthic macroinvertebrates with physiology and machine learning

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Climate change and land use intensification can have interactive (non-additive) effects on riverine biota. While these effects remain challenging to predict, trait-based approaches informed by physiology could help determine whether the thermal affinity of species–and thereby the climate vulnerability of communities– varies systematically with watershed land use. Macrophysiological studies on riverine fishes have shown that the mean thermal affinity of species composing a community (the community temperature index, or CTI) does vary with land use, suggesting an antagonistic stressor interaction whereby both land use and climate warming favour the same set of species. Here, we conduct a similar analysis with stream benthic macroinvertebrates across the United States. We combine a large-scale biomonitoring dataset with bioclimatic variables to compute the thermal affinity of all benthic macroinvertebrate genera found in the US National Rivers and Streams Assessment (US-NRSA). A review of the ecophysiological litterature corroborated that thermal affinities calculated from realized thermal niches correlated strongly with physiological measures of thermal tolerance (e.g. CTmax). To determine whether watershed land use can influence the thermal traits of benthic macroinvertebrate communities, we then calculated the CTI of all communities sampled by the US-NRSA. Finally, we used random forest models to identify the natural and anthropogenic drivers of stream macroinvertebrate CTI across the US.

2.21 A Modular Low-Cost Control System for Continuous Dissolved CO_2 Measurements in Aquatic Environments

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Continuous high-frequency measurements of dissolved carbon dioxide (pCO_2) are essential for understanding carbon cycling and air–water gas exchange in aquatic systems, yet current monitoring approaches are often expensive, energy intensive, and difficult to deploy autonomously in remote environments. This study presents the development and validation of a low-cost, portable, and modular control system for continuous CO_2 monitoring using gas equilibrators. The system integrates a closed-loop gas circuit, passive silica-gel desiccation, a SenseAir K30 nondispersive infrared (NDIR) CO_2 sensor, Arduino-based control, and automated data logging within a compact “dry box” architecture compatible with different equilibrator configurations. A marble-type equilibrator was implemented to maximize gas–water contact and reduce equilibration time. System performance was evaluated through humidity stress tests, calibration against a Los Gatos Research (LGR) greenhouse gas analyzer, comparison with chemically derived pCO_2 values, and a one-month deployment in the Passaúna Reservoir (Brazil). Under extreme humidity loading (>90 mL water input over 2.5 h), relative humidity increased by only 1.5%, demonstrating effective moisture control and long-term stability. Calibration against the LGR analyzer showed a highly linear response (R^2 = 0.999), while comparison with chemical calculations yielded strong agreement (R^2 = 0.989) and a small mean bias (−12.2 ppm). Continuous field measurements successfully captured diel variability in pCO_2 and dissolved oxygen, demonstrating that the system provides reliable, stable, and cost-effective monitoring suitable for aquatic metabolism and carbon cycling studies.

2.22 Hydrological connectivity drives functional and taxonomic diversity of phytoplankton in a North Patagonian lake system (Argentina): implications for ecosystem resilience

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Phytoplankton communities are key components of aquatic ecosystems, responding rapidly to environmental fluctuations. This study analyzes the spatial and seasonal variability of the phytoplanktonic assemblages in a connected North-Patagonian lake system, integrating shallow (Ezquerra and Morenito) and deep (Moreno Oeste Bay) lakes across a trophic gradient from mesoeutrophic to ultraoligotrophic conditions. Over two years of monitoring, we evaluated hydrological connectivity, nutrient availability and morphometric variations as main drivers of community structure. Using a taxonomic and a trait-based approaches, together with beta diversity decomposition into turnover (βrepl) and nestedness-resultant (βnes) components, we identified the mechanisms driving community assembly. Beta diversity partitioning revealed that community differences were primarily driven by turnover, although the relative importance of the nestedness component varied according to the hydrological period. Taxonomic turnover remained high and stable between low-water (LWP) and high-water (HWP) phases (70.2% in LWP vs. 73.6% in HWP). However, at the functional level, nestedness contributed 41.9% during LWP, whereas functional turnover increased during HWP, reaching 69.0%. These patterns suggest a transient increase in functional redundancy during LWP, when communities occupied similar functional niches despite taxonomic differences, particularly due to the dominance of dinoflagellates and motility traits. Nevertheless, a strong coupling between taxonomic and functional structures was detected (Mantel r = 0.714), suggesting limited functional buffering capacity against biodiversity loss. Overall, community structure was associated with a morphometric–trophic gradient and seasonal hydrological variability, emphasizing that the maintenance of natural hydrological connectivity is essential to preserve regional functional diversity and ecosystem resilience.

2.23 Long-Term Warming in High-Mountain Lakes in Spain: A 20-Year Sensor Record.

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Water column temperature is a key driver of the seasonal dynamics of high-mountain lakes and is closely linked to climate change. A chain of thermistors installed at the deepest point has been monitoring the water column temperature of three high-mountain lakes in the Spanish Central System for approximately 20 years (Lake Peñalara, Lake Cimera, and Lake Grande de Gredos). These lakes are located between 1940 and 2015 m a.s.l., with maximum depths ranging from 5.1 to 10.5 m and surface areas between 6,770 and 74,700 m². On average, these lakes remain ice-covered between 105 and 185 days per year. This long-term sensor record provides one of the few multi-decadal temperature datasets available for alpine lakes in southern Europe. Here we analyze long-term temperature trends over the last two decades. All three lakes show clear warming during the summer period. We also examine changes in water column stability during both the ice-covered and ice-free seasons, and evaluate the extent to which lake morphometry modulates the response of these systems to regional climatic forcing. Within the context of the GLEON meeting, we aim to explore potential collaborations to compare analogous long-term temperature observations from mountain, boreal, and polar lakes, with the goal of assessing whether similar warming and stability responses are emerging across cold-region lake systems.

2.24 INVESTIGATING THE INFLUENCE OF SPATIAL ENVIRONMENTAL CONTEXT ON THE TOXICITY OF ROAD DE-ICERS TO ZOOPLANKTON COMMUNITIES

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Rising chloride concentrations (Cl-) in freshwater systems, primarily driven by increased use of NaCl-based de-icers, threatens aquatic biodiversity. Consequently, alternative de-icers containing salt mixtures are gaining popularity, yet research on their impact is scarce. Understanding the implications of elevated salt is challenging as biotic responses often vary, likely due to environmental context. For example, declining calcium concentration in Precambrian Shield lakes can increase the Cl- sensitivity of zooplankton taxa and alter community composition. To investigate the influence of environmental context on salt toxicity, we conducted concurrent mesocosm experiments in a soft and hard water lake, exposing plankton communities to a gradient of 10 Cl- concentrations (ambient to 765 mg/L) over a 6-week period for both rock salt (primarily NaCl) and Thawrox (TR) (NaCl mixed with MgCl2 and CaSO4). In soft water conditions, we found that at the aggregate community level, significant differences in biomass between de-icers, were less pronounced, with a 2.2% reduction under TR at week 6. However, for dominant species and groups, 71% showed significant differences between de-icers; among these, 80% exhibited biomass reductions under TR, ranging from 18 to 99%. Notably, the largest reductions were observed for cyclopoid copepodids (99%) and copepod nauplii (93%). This differential effect at early life stages has important implications for assessing alternative de-icer toxicity and underscores the need to test the interactive effects of constituent compounds.

2.25 Exploring the unseen: chytrid fungi in Arctic and Antarctic microphytobenthic communities

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Fungal parasites have been recognized as critical and abundant components of every ecosystem. They have the potential to regulate host populations, mediate interspecific competition between hosts and other species, and thus affect biodiversity and food web structure. However, parasite diversity is still poorly known, particularly for fungal parasites in aquatic ecosystems, and only rough estimates exist on total species diversity and abundance. Few recent studies in polar regions indicate that parasitic species, in particular of the early fungal lineages, are highly abundant in both Arctic and Antarctic aquatic ecosystems, yet their diversity at ecological roles are still poorly understood. Therefore, we aimed to address these gaps and investigate the relevance of fungal parasites for phytoplankton and microphytobenthic communities, forming the basis of aquatic food webs and are key components for trophic interactions in polar ecosystems. We show that fungal parasitic taxa are present in these habitats in high abundances, whereby their correlations with benthic diatoms indicate potential parasitic interactions. Moreover, we show that temperature and salinity are major drivers of fungal diversity, community composition, and interactions with potential hosts. We emphasize the need for further research, considering the effects of increased water temperatures and salinity following climate warming.

2.26 Natural Acid Rock Drainage Enhancing Regional Diatom Diversity in the Baiau Valley (Pyrenees)

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Weathering of sulphur-bearing rocks produces natural acid rock drainage (NARD), lowering water pH, mobilizing metals, and forming metal-precipitate coatings in streambeds. This study examined how NARD and flow regime influenced benthic diatom diversity, community composition, and ecological traits in the Baiau watershed (central Pyrenees, Alt Pirineu Natural Park, 14 km2). Three stream reaches above the treeline (2320-2380 m a.s.l) were sampled in spring (high-flow period) and late-summer (low-flow period). This included two lake-fed streams, one acidic (pH < 5.5) and one neutral (pH ≈ 7), and a downstream confluence reach with observable white metal precipitates (5 < pH < 6). Surprisingly, alpha diversity was the highest in the acidic reach, mainly driven by unique species, and this was consistent across the two periods. Community composition differed between reaches but not between sampling periods. Acidophilic genera like Pinnularia and Eunotia dominated the acidic and the confluence reaches, with the latter genus being the most indicative of acidic conditions. Meanwhile, Achnanthidium and Staurosira dominated the neutral reach .However, diatom communities at the confluence differed less from the other two reaches than the acidic and neutral reaches differed from each other. For instance, Staurosira persisted at the confluence, probably due to its tolerance to transitional environments. Motile and large diatoms were slightly more abundant in the acidic reach, suggesting that these traits could act as functional adaptations to this environmental stress. This study demonstrates that naturally acidic environments may act as biodiversity hotspots; by supporting unique diatom communities with specialised adaptive strategies.

2.27 Depth-integrated ecosystem metabolism dynamics in Lake Superior: Insights derived from Autonomous Underwater Glider Data

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Lakes are key players in the global carbon cycle, yet many function as net heterotrophic systems, where ecosystem respiration (ER) exceeds gross primary production (GPP), leading to CO_2 supersaturation and atmospheric emissions. Large lakes, which represent nearly 90% of global lake surface area, remain poorly characterized in terms of whole-ecosystem metabolism due to limitations of traditional, sparse, site-specific measurements. In this study, we quantified ecosystem metabolism across the epilimnion and metalimnion of Lake Superior using high-resolution data collected by autonomous underwater gliders (AUGs). We analyzed data from 15 glider missions conducted between 2014 and 2021, during stratified days. Generalized linear mixed-effects models were used to compare associations of GPP, ER, and net ecosystem production (NEP) with limnological variables across layers. Results showed net heterotrophy in the epilimnion (NEP = -1.09 ± 1.98 g m^{-3} day^{-1}) with high variability, whereas the metalimnion exhibited near-balanced metabolism (NEP ≈ 0). Temperature was the dominant driver of epilimnetic GPP, while epilimnetic ER was driven by both temperature and offshore distance. In the metalimnion, GPP was regulated by temperature, relative thermal resistance to mixing (RTRM), and offshore distance. The temperature–RTRM interaction played a critical role in maintaining metabolic balance in the metalimnion. These findings highlight pronounced vertical differences in metabolism and demonstrate that conventional surface-focused approaches may overestimate net heterotrophy in large oligotrophic lakes.

2.28 Unlocking lake value: A roadmap for quantifying and integrating ecosystem services across biophysical, social, and economic methods

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Lakes are critical components of Earth's freshwater resources, providing ecosystem services that span provisioning, regulation, and cultural domains. As climate change and anthropogenic activities increasingly alter the lake ecological status, robust quantification of these services is essential to guide sustainable management and equitable resource allocation. Yet quantification approaches remain fragmented across disciplines, limiting our ability to assess trade-offs among services and evaluate sustainability implications of current use patterns. Here, we provide a structured roadmap for assessing lake ecosystem services, organized along a progression from biophysical measurement of ecological capacity, through social assessment of human demand and beneficiary perspectives, to economic valuation of service worth. We evaluate methods along four dimensions: supply and demand orientation, spatial and temporal scope, resource requirements, and decision relevance and uncertainties. By prioritizing management and sustainability objectives over disciplinary convention, the roadmap guides users from study goals to tailored methodological approaches through sequential filtering steps, and identifies bridging strategies that can link biophysical, social, and economic outputs into integrated assessments. Together, the roadmap and accompanying listed methods provide a practical, unified framework for comprehensive and comparable quantitative assessments of lake ecosystem services, supporting sustainable pathways for freshwater resource management and informing policy and stewardship decisions.

2.29 Deep-Water Temperature and Ice Phenology Variations in Lakes of Japan and the European Alps

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Recent climate change has strongly affected winter temperatures. However, surface temperatures exhibit large short-term variability, making it difficult to detect long-term trends and regime shifts. In contrast, lake-ice phenology and deep-water temperatures may reflect cumulative effects of winter cooling and lake circulation processes and therefore serve as useful indicators of long-term winter variability.

Lake Suwa, located in central Japan, has documentary records of ice formation spanning more than 600 years, making it a valuable long-term winter climate proxy. To reconstruct past climate variability using this proxy, we investigated the relationship between ice formation and instrumental temperature records since 1900. Marked changes in ice formation corresponding to a regime shift in winter climate were identified. A major climate regime shift in Japan has previously been reported around 1986/87.

Following this shift, a substantial decrease in ice formation was observed not only in Lake Suwa but also in Lake Mashu, Hokkaido. In addition, an increase in deep-water temperature, suggestive of changes in winter mixing conditions, was detected in Lake Biwa, a warm monomictic lake.
To examine whether similar changes occurred outside Japan, we compared these results with long-term deep-water temperature records from European alpine lakes, including Lake Zurich, Lake Geneva, Lake Constance, and Lake Maggiore. Preliminary analyses suggest that several mid-latitude deep lakes exhibit potentially coherent long-term changes in deep-water temperature and winter mixing conditions.

These results indicate that recent winter climate changes may have broadly influenced overturn processes and deep-water environments in temperate lakes across both East Asia and Europe.

2.30 Lower nutritional quality of lake zooplankton under a warming winter

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Winter is warming rapidly across the Northern Hemisphere, causing widespread declines in lake ice cover. However, our capacity to anticipate the ecological consequences remains constrained by the paucity of long-term winter studies in seasonally ice-covered lakes. Predicting how communities will reorganize under a warming winter requires a mature understanding of the environmental-vs-organismal mechanisms regulating overwintering dynamics. In lake zooplankton, the seasonal accumulation of high-quality fats, such as omega-3 fatty acids (FAs), is a strategy used to overcome cold stress and nutritional shortage under ice, but whether these fat stores will diminish under warming winters remains unclear. Here we exploit space-for-time substitution approaches to evaluate how zooplankton FA profiles vary along gradients of winter severity. We combine a latitudinal survey in Canada (14 lakes from 44ºN to 69ºN) and a data synthesis (17 lakes across 8 countries), spanning a broad range of winter conditions from ice-free to short to long ice-covered periods (≤9.5 mo.). Our analyses reveal that the accumulation of omega-3 FAs is common in winter-active zooplankton across biomes, with winter FA peaks declining with warming winter conditions irrespective of taxonomic composition, resolution, and affiliation. Thus, our findings suggest strong environmental forcing, whereby both relative and absolute quantities of omega-3 FAs stored in zooplankton are driven by winter severity, implying lower nutritional quality at the base of food chains with lake ice losses. Our winter study echoes previous open-water work showing lower nutritional quality under warming, but highlights that such declines may be greater in winter than any other season.

2.31 Wet and Dry Hydrological Conditions Reduce Chlorophyll-a at River-Connected Lakes

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Hydrological variation is intensifying under climate change, yet its net effects on lake water quality remain uncertain. Wet and dry hydrological conditions are commonly assumed to exacerbate eutrophication by increasing nutrient inputs during wet conditions or concentrating nutrients during dry conditions. However, these events can also activate counteracting processes—such as dilution, or enhanced mixing— that shorten residence time or redistribute nutrients in ways that suppress eutrophication. Here, we evaluate how hydrological variability shapes chlorophyll-a (Chl-a) dynamics across 53 large lakes spanning broad gradients in morphometry, watershed extent, and nutrient availability. Focusing on inflow-dominated nearshore “impact zones”, we used boosted regression trees to relate satellite-derived Chl-a (1998–2019) to inflow discharge, climatic forcing, and watershed characteristics. Inflow discharge, indexed using the Standardized Streamflow Index (SSI), emerged as the most influential predictor of Chl-a anomalies, exceeding the effects of lake surface temperature and direct precipitation. However, overall explanatory power was low (5% variance explained in cross-validation), indicating that hydrological forcing represents only one component of a complex cological system. Both wet and dry hydrological conditions were associated with reduced surface Chl-a relative to intermediate inflow states, revealing a non-linear response in which hydrological variation tended to suppress, rather than uniformly enhance, phytoplankton biomass. However, the direction and magnitude of responses varied substantially among lakes. Together, these findings challenge the assumption that intensifying hydrological variation will consistently exacerbate eutrophication. Instead, hydrological variation interacts with lake structure and watershed characteristics to shape ecosystem responses under changing hydroclimatic conditions.

2.32 GREAT Institute: A Decade of Monitoring and Advancing Research in The Gambia

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The Gambia has one of West Africa's most important transboundary rivers, extending over 1,100 km from the Fouta Djallon Highlands to the Atlantic Ocean. These aquatic systems support fisheries, agriculture, transportation, mangrove ecosystems, biodiversity, and carbon sequestration, while facing increasing pressure from climate change, sea level rise, salinity intrusion, land-use change, nutrient inputs, and habitat degradation. For the past years, GREAT (Gaining Research Experience in Africa for Tomorrow) Institute has conducted long-term environmental monitoring of these ecosystems to address environmental challenges through research and education. Using standardized field protocols, instrumentation, and data analysis, GREAT Institute collects data through routine field campaigns to assess ecosystem health and track environmental change over time. This monitoring underpins a portfolio of multidisciplinary projects spanning blue carbon research, biodiversity conservation, climate resilience, ecosystem restoration, and community engagement. Beyond data collection, GREAT Institute trains the next generation of environmental scientists, connects decision-makers with scientific evidence, and works with local communities to promote conservation of aquatic and terrestrial ecosystems. Over the past decade, this work has supported more than 25 students' research projects, conducted over 100 field campaigns, and fostered multiple international collaborations with partner universities and institutions. These datasets provide critical insight into environmental change and water quality in the River Gambia and the Atlantic Ocean, improving understanding of ecosystem resilience and supporting evidence-based management. Through sustained research, education, and outreach, GREAT Institute contributes to the long-term conservation of one of West Africa's most important aquatic systems while strengthening local scientific capacity.

New Site: Online observatory of cyanobacterial bloom and dissolved oxygen concentration in Lake Taihu by hyperspectral proximal sensing technology

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Hyperspectral proximal sensing is quite new online monitoring technology for lake surface ecological condition. Lake Taihu is a famous bloom suffered drinking water supply huge lake in Wuxi-Suzhou-Shanghai megacity. Cyanobacterial bloom and related hypoxia event is the big challenge for drinking water supply of Lake Taihu. Using a near-water surface hyperspectral proximal sensing technology, dynamics of cyanobacterial bloom and its related low DO event were recorded during 2022 to 2024. The result shows that summer heatwaves increased surface DO by 21.7% (6.67 ± 2.67 mg/L) compared to non-heatwave periods (5.48 ± 1.54 mg/L), alongside a doubling of Chla concentrations (59.09 ± 40.10 µg/L vs. 28.85 ± 15.75 µg/L). Using Random Forest modeling with SHAP analysis, we quantified that Chla contributed 54.6% to DO variability, effectively counteracting thermal deoxygenation. Structural equation modeling further revealed that heatwaves amplified the positive coupling between Chla, dissolved organic carbon, and DO. Despite the rise in surface DO, bottom-layer hypoxia probability at 7:00 increased by 226.9%, exacerbating ecological risks. These findings uncover a heatwave-driven photosynthetic compensation mechanism, where enhanced algal blooms offset thermal deoxygenation, fundamentally altering our understanding of extreme climate impacts on eutrophic lakes.

Site Update: Discoveries from a 40-year limnological record of Lake Annie, FL: Insights from student research and a profiling buoy update

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Lake Annie (FL, USA) is one of the few subtropical lakes worldwide with continuous, long-term monitoring. Monthly vertical profiles of temperature, light, pH, conductivity, and dissolved oxygen have been collected since 1983, with measurements of nutrients, chlorophyll a, and water color added in 2001. Expanded sampling, including monthly plankton and quarterly comprehensive water chemistry, began in 2005. These data were used in an advanced limnology course, where graduate students developed hypotheses grounded in prior research demonstrating that this meso-oligotrophic lake alternates between clear and stained states in response to variation in chromophoric dissolved organic material inputs. Students found that stained years are characterized by a persistent metalimnetic pH minimum, substantial accumulation of phosphorus and nitrogen in the hypolimnion during summer stratification, and elevated epilimnetic chlorophyll a during the wet season. In contrast, clear years exhibit pronounced metalimnetic oxygen minima in some summer profiles and a significant relationship between increasing air and water temperatures. Across the full record, manganese concentrations were consistently ~40× higher than the EPA drinking water guideline, for reasons that remain unclear. These findings are presented in the context of existing literature to solicit feedback and interpretation. We also provide an update on a high-frequency profiling buoy installed in 2022. The poster additionally includes instructional materials designed to support and inspire the use of long-term limnological datasets for discovery in classroom settings.