SIL 100
BERLIN | GERMANY

36th Congress of the
International Society of Limnology

7 – 10 August 2022 | www.sil2022.org

ABSTRACT BOOK

IGB
Leibniz Institute of Freshwater Ecology and Inland Fisheries

SIL

THE NEXT 100 YEARS:
SENSING AND SAFEGUARDING INLAND WATERS

EP112

Nitrate treatment as a tool for lake restoration in agricultural watersheds

Renata Dondajewska-Pielka[1], Katarzyna Kowalczewska-Madura[1], Ryszard Gołdyn[1], Stanisław Podsiadłowski[2]
[1]Adam Mickiewicz University in Poznan, Department of Water Protection, Poznan, Poland, [2]Poznan University of Life Sciences, Department of Biosystems Engineering, Poznan, Poland

Lakes situated in agricultural watersheds suffers from cyanobacterial blooms due to extensive external loading. Nitrate-rich waters supply freshwater ecosystems, stimulating phytoplankton proliferation. At the same time, bottom sediments feeds water column with phosphates, especially in eutrophic lakes with anaerobic hypolimnion in summer. The utilization of nitrates by redirecting the water of the tributaries to deep lake water layer serves as a tool for lake restoration by: (1) an increase of the redox potential in the sediment-water interface to limit the internal phosphorus (P) loading, and (2) reduction of nitrogen concentrations due to the denitrification. This approach has been firstly applied in hypertrophic Lake Uzarzewskie (10.6 ha, max depth 7.3 m) in Western Poland since 2008, after partially successful P inactivation with iron sulphate in 2006-2007. Water analyses were conducted in 2005-2021, with special attention to nutrients and chlorophyll-a concentrations, to assess the effectiveness of restoration. *Ex situ* experiments on undisturbed sediment cores were conducted to determine the direction and intensity of P exchange in water-sediment interphase. The obtained results proved the efficiency of lake restoration by means of nutrient content reduction as well as chlorophyll-a till 2018. Internal phosphorus loading was gradually reduced and P binding in sediments was observed in 2016 and 2017. A deterioration of water quality in the peak of summer in 2019-2021 was noted, manifested by higher content of chlorophyll-a and nutrients, as well as by reduction in water transparency. It was related to changes in weather conditions and periodical malfunction of pipes delivering nitrate-rich waters.

EP006

Modelling a deep oligomictic lake: the relevance of the quality of input data

Claudia Dresti[1], Michela Rogora[1], Andrea Fenocchi[2], Fabio Buzzi[3], Diego Copetti[4]
[1]National Research Council - Water Research Institute, Verbania, Italy, [2]University of Pavia, Department of Civil Engineering and Architecture, Pavia, Italy, [3]ARPA Lombardia, Dipartimento di Lecco, Oggiono, Italy, [4]National Research Council - Water Research Institute, Brugherio, Italy

In the last decades, deep lakes have been strongly affected by climate change, which has impacted on mixing and stratification dynamics and consequently on nutrient and dissolved oxygen concentrations in the deep waters. In this framework, being able to model lake processes is critical to understand the ensuing lake evolution. The reliability of the models depends on several factors, among which the quality of input data is of primary importance. In this research, we calibrated and validated the 1D coupled hydrodynamic-ecological General Lake Model/Aquatic Ecodynamics (GLM/AED2) for the deep oligomictic Lake Como, Northern Italy. The lake belongs to the district of the Deep Subalpine Lakes (DSL) and is divided into three basins, being Y-shaped. Since 2020, the lake has been studied with high-frequency monitoring (HFM) stations under the cross-border cooperation project SIMILE (Integrated monitoring system for knowledge, protection and valorisation of the subalpine lakes and their ecosystems). The first results of the modelling activity will be presented with peculiar attention to the preparation of input data and to the potentialities of HFM to calibrate and validate lake models.

EP111

The Future of the River Network Toolkit (RivTool)

Gonçalo Duarte[1,2], Pedro Segurado[1,2], Maria Teresa Ferreira[1,2], Paulo Branco[1,2]
[1]Forest Research Centre, School of Agriculture, University of Lisbon, Department of Natural Resources, Environment and Territory, Lisbon, Portugal, [2]Associate Laboratory TERRA, Lisbon, Portugal

Environmental, ecosystem functioning and human activities must be considered at multiple river scales for an effective research, conservation and management of freshwater ecosystems. The ability to integrate, at multiple scales, an ever-growing plethora of information of this nature into a hierarchical dendritic and directional network, such as river networks, is a challenging task. The river Network toolkit (RivTool) is a freely available, user-friendly and table-driven software of universal applicability that enables the integration of these inputs for large scale river network analysis. Downloaded in nearly 70 countries across all continents, this software is a platform with high potential for future scientific and management approaches with the flexibility to accommodate new features. Supported by the project Dammed Fish, three new add-ons are being conceptualized and developed to expand the ability of this software to contribute to the freshwater community: 1) RivFish, an add-on to integrate the rGBIF package resources with the framework of RivTool; 2) RivConnect, a plugin to enable the calculation of fragmentation metrics and river connectivity indexes using graph-theory, i.e., to perform quantitative network connectivity analysis; 3) RivOpt, an optimization tool to support decision making for barrier connectivity enhancement, accounting for conflicting ecological and socioeconomic goals. This set of new features increases the overall utility of RivTool, widening its potential scope of action for the freshwater science and management community. Thus, soon, RivTool will contribute towards enhancing the ability to interpret and manage river ecosystems, i.e., towards attaining European biodiversity goals.

EP161

Diverse diatom communities of an oxbow lake of the River Tisza with the description a new *Mayamaea* species

Mónika Duleba[1], Angéla Földi[1], Adrienn Micsinai[2], Rita Sipos[2], Gyula Szabó[2], Tibor Bíró[3], Zsuzsa Trábert[1], Edit Vadkerti[3], Carlos Wetzel[4], Éva Ács[1,3]
[1]Centre for Ecological Research, Institute of Aquatic Ecology, Budapest, Hungary, [2]Biomi Ltd., Gödöllő, Hungary, [3]University of Public Service, Faculty of Water Sciences, Department of Water Supply and Sewerage, Baja, Hungary, [4]Luxembourg Institute of Science and Technology, Environmental Research and Innovation Department, Belvaux, Luxembourg

Diatoms frequently constitute a dominant group in benthic aquatic habitats. These algae have significant role not only as primer producers but also as bioindicators in ecological status assessment. Traditional identification of species is morphology-based, besides, DNA-based method (metabarcoding) has been proposed recently.
Within the framework of a national scale project associated with the EU Water Framework Directive 92 Hungarian standing waters were studied aiming to assess their ecological status based on phytobenthos. In this project, spring and autumn epiphytic diatom assemblages from Körtvélyesi-Holt-Tisza, a hypertrophic oxbow lake of the River Tisza were investigated using light and scanning electron microscopy supplemented with metabarcoding. High diversity of species was revealed including several small-celled „naviculoid" diatoms. In the spring sample a *Mayamaea* species was dominant that separated from other species of the genus based on both morphology and DNA sequence. It is going to be described as a new species. In addition, light and electron microscopy and metabarcoding was used for the identification of other small „naviculoid" diatoms (e.g. *Brevilinea kevei*, *Navicula microrhombus*, etc.) from the sample. Due to global warming, oxbows are becoming increasingly vulnerable habitats due to the prolonged loss of lateral connectivity, although they play an important role in maintaining biodiversity.

EP032

Does solar activity affect the dynamics of cyanobacteria community worldwide and how?

Gaël Dur[1], Yusuke Kikuchi[2], Orlane Anneville[3], Jason D. Stockwell[4], Vijay Patil[5], Rita Adrian[6], Jennifer Bentrup[7], Rosalie Bruel[8], Jonathan P. Doubek[9], Aleksandra Lewandowska[10], Shin-ichiro S. Matsuzaki[11], James A. Rusak[12], Nico Salmaso[13], Dietmar Straile[14], Stephen J. Thackeray[15], Patrick Venail[16]
[1]Shizuoka University, Creative Science Course, Shizuoka, Japan, [2]Shizuoka University, Graduate School of Geoscience, Shizuoka, Japan, [3]INRAE, UMR CARRTEL, Thonon Les Bains, France, [4]University of Vermont, Burlington, United States, [5]USGS, Anchorage, United States, [6]IGB Berlin, Berlin, Germany, [7]Cary Institute of Ecosystem Studies, New York, United States, [8]iEES-Paris, Sorbonne-Université, Paris, France, [9]Lake Superior State University, Sault Ste. Marie, United States, [10]University of Helsinki, Helsinki, Finland, [11]National Institute for Environmental Studies, Tsukuba, Japan, [12]Dorset Environmental Science Centre, Dorset, Canada,

[13]Fondazione Edmund Mach, Research and Innovation Centre, San Michele all`Adige, Italy, [14]University of Konstanz, Limnological Institute, Konstanz, Germany, [15]UK Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster, United Kingdom, [16]University of Engineering and Technology UTEC, Lima, Peru

The sun has critical influences on our planet; it drives weather, ocean currents, seasons, and climate. The sun also affects the activity of aquatic organisms. Cyanobacteria are a crucial aquatic organism from an ecological, economic, and evolutionary point of view. These photosynthetic prokaryotes made life on earth possible, as the source of our oxygenated atmosphere and ozone shield. Conversely, in high numbers, cyanobacteria may produce toxins that pose a human health risk. Sporadic reports from different parts of the world mention a relationship between the activity of the sun and cyanobacteria blooms. Additionally, cyanobacterial growth and bloom potential in fresh water are affected by the climate. This suggests that there may be a downscaling process from the sun's activity to the occurrence of cyanobacterial blooms. To test this hypothesis, we used a recently compiled global data set of more than 15 lakes and investigated the potential effects of solar activity and weather variability on cyanobacteria biomass. We used wavelet analysis on long-term times series to evaluate the relationships among cyanobacteria dynamics, the cycle of the sun's activity, and large-scale atmospheric pressure systems. We then tested the causality between solar activity and the cyanobacterial biomass using shorter time series datasets. We applied regression tree (CART) models and explored whether a common threshold of weather variables (i.e. irradiance, humidity, wind speed, rain) and sunspot number exists for cyanobacteria growth. Our work provides a global perspective on the role of weather variability and solar activity on the occurrence of cyanobacteria blooms.

EP132

My Research in Lake Biwa Part 1

Naoki Endo[1]
[1]Biwako trust, JST Junior Dr Promotion School, Otsu, Japan

This autumn, I had fun observing a lot of plankton using a microscope on the research vessel, HAKKEN of Lake Biwa Trust. I am interested in why water quality and odor deteriorates in summer, and went around Lake Biwa to find the characteristics of the waters at the beaches of Lake Biwa. I was able to feel the size of Lake Biwa and the conditions were different depending on the location. I was able to see the differences between water quality in beach areas but unfortunately, I was unable to find much zooplankton on the surface of Lake Biwa. I couldn't find any of my favorite daphnia. The cause could be that the water temperature was too low. Because it was so cold that there was news that full-thickness circulation was confirmed a few days after the water was collected.

EP060

Evolution of surface temperatures in Austrian alpine lakes under climate change

Katharina Enigl[1], *Hanna Pritsch*[2], *Rainer Kurmayer*[2]
[1]Zentralanstalt für Meteorologie und Geodynamik, Department for Climate Research, Vienna, Austria, [2]University of Innsbruck, Research Department for Limnology, Mondsee, Austria

Lake Surface Temperature (LST) is a key characteristic that reflects meteorological and climatological influences on lakes. In general, LST data from high-altitude lakes are scarce as these areas are remote and not part of regular monitoring programs. Nonetheless, in order to develop effective management strategies for high-altitude lakes, it is important to understand their response to climate warming. This study aims on both the reconstruction of LST and the projection of LSTs for 21 alpine lakes (1500-2300 m a.s.l.) in the Niedere Tauern region in Austria until the year 2100. For the determination of the relationship between atmospheric variables (temperature and precipitation), near-lake snow depth and observed LST, general additive models were trained with a daily temporal resolution for the years 1998-2003, and 2019-2020. We subsequently employed the model with the highest fit to reconstruct LSTs for the whole period 1998 to 2003. Furthermore, we estimate LST until 2100 using an ensemble of regional climate projections for the RCP2.6 (in-line with the COP 21 Paris Agreement) and RCP8.5 ("worst-case") scenario. Under the RCP8.5 scenario, the average rise for August temperatures in the distant future (2071-2100) is predicted to increase by 2.3°C compared to temperatures in the near future (2020-2049). Consequently, the ice-free period is expected to rise on average 1-1.2—fold in the near future (2031-2060) and 1-1.5-fold in the distant future. These alterations in the lakes' temperature regime probably affect multiple limnological parameters related to ecological quality such as primary productivity and trophic state.

EP100

Pathways of nutrient pollution in the Volga Reservoirs

Oxana Erina[1], *Maria Tereshina*[1], *Dmitry Sokolov*[1], *Valeria Kalenichenko*[1]
[1]Lomonosov Moscow State University, Hydrology, Moscow, Russian Federation

The reservoirs of the Middle and Lower Volga are affected by cultural eutrophication due to extremely high anthropogenic impact from agricultural, industrial and urbanised areas. It is necessary to have accurate data on the nutrient load of reservoirs, which comes mainly as river inflows, to better understand the exact factors determining this process, but information on the structure of the nutrient budget of the rivers in Russia is extremely scarce. Our summer field studies of the Gorky, Cheboksary and Kuibyshev reservoirs in 2017-2021 provided a detailed picture of the dynamics of suspended and dissolved nitrogen and phosphorus as the Volga experiences significant hydrological and biogeochemical changes. It is demonstrated that the Oka River is the main source of nutrients in the Cheboksary Reservoir, which creates some distinctive features of the nutrient regime of more than 100-km long part of the Volga cascade and contributes to a considerable increase in the nutrient load on the main river.

EP070

Past, present and future anthropogenic stressors in a large Swedish lake

Friederike Ermold[1], *Malin Setzer*[1], *Måns Lindell*[1]
[1]Lake Vättern Society for Water Conservation, Jönköping, Sweden

Lake Vättern is the second largest lake in Sweden (and sixth largest in Europe) and home to a unique ecosystem due to its large size and cold, ultra-oligotrophic water. In the past century, sewage emissions, industrial pollution and agriculture led to eutrophication as well as pollution with both persistent organic pollutants and metals, thereby affecting nutrient concentrations, water clarity, species distribution and resource usage. Due to the implementation of countermeasures in cooperation around the lake, Lake Vättern recovered. Today, many of the problems of the mid-20th century are solved and the lake is, again, an (ultra-)oligotrophic lake with clear water and rich biodiversity. Management and monitoring of Lake Vättern has been conducted intensively since the 1960s, coordinated by the Lake Vättern Society for Water Conservation. New challenges are on the horizon. To measure the prevalence and effect of new anthropogenic stressors, a number of studies have been conducted in cooperation with Swedish universities – from microplastic pollution in the water column and sediment to organic micropollutants and PFAS. A changing climate already now significantly affects water temperature, ice coverage and water levels. New alien species are likely to enter the lake. These 21st century pressures will affect the lake ecosystem, management and resource usage moving forward.

EP083

Transcriptome response of *Gasterosteus aculeatus* in natural habitats affected by multiple anthropogenic stressors

Camilo Escobar-Sierra[1], *Kathrin Lampert*[1], *Lampert AG*
[1]University of Cologne, Institute of Zoology, Cologne, Germany

European running waters are heavily affected by human activity which can have detrimental effects on the fish fauna. Some species, however, seem to be able to cope well with anthropogenic changes e.g. increased salinity and temperature. The mechanisms and underlying pathways of this adaptation in natural conditions, however, remain poorly understood. Here we present evidence of differential gene expressions in *Gasterosteus aculeatus* that correlate with different levels of anthropogenic stressor conditions