XXV Congresso AIOL – Plenary lectures

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Plenary lecture

Does productivity decrease as phosphorus levels drop?

I am now at the end of my career as a lake research scientist to Eawag and EPFL – and this question was in the background behind the set design of my entire scientific activity. This question is motivation twofold: (i) With the phosphorus levels decreasing since the early 1980s, the water quality responsibles of Governmental agencies were constantly looking out for answers whether the management goal of «medium productivity» is achieved or whether additional measures are needed to reduce nutrient inflows to lakes? This question became more urgent in Switzerland as the professional fishermen started to complain that catches dropped disproportionally during the last decade. (ii) For various reasons, it is expected that the physical environment of the surface layer affects productivity. With lakes developing towards reoligotrophication, the recycling of nutrients by deep winter mixing and the seasonality of nutrient inflows become increasing relevant as the nutrient stock in lakes are dropping. My goal for this talk is to create a unified

framework for what we have learned over the past two decades and give an outlook what the newly established LéXPLORE Platform on Lake Geneva can provide to this fascinating topic.

Biosketch

Since 2012, I am a Full Professor at ENAC-EPFL for the Physics of Aquatic Systems Laboratory (Margaret Kamprad Chair). My original background is in medium-energy particle physics (U of Zürich) before I turned to aquatic physics with a PhD at Eawag/EHZ-Zürich. I spend most of my scientific career at Eawag and EPFL in Switzerland besides one-year stays at UW (Seattle), UBC (Vancouver), IOS (Sidney, Victoria), and UNZA (Lusaka, Zambia). Since 1989, I was head of the Aquatic Physics Group at Eawag, where I focused on (i) microstructure observations of small-scale turbulence of boundary layers and stratified mixing as well as double diffusion, (ii) turbulence modelling and internal wave analysis and (iii) the relation of physical processes on biogeochemical cycling in lakes. The third aspect was one of my key interests and I initiated several interdisciplinary projects related to primary production (Lake Brienz, Lake Geneva) and its anthropogenic disturbance by water resources management (Lake Ohrid, Lake Kivu, etc). Besides more than 170 peer-reviewed publications with more than 10k citations, I contributed to over 2500 pages of consulting and expert services - mainly to governmental agencies. I also served in numerous national and internal activities, including editor services to AS, L&O, and WRR and I was member of the Eawag Directorate for six years.

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Selected publications

Wüest, A., D. Bouffard, J. Guillard, B.W. Ibelings, S. Lavanchy, M-E. Perga, N. Pasche (2021). LéXPLORE – a floating laboratory on Lake Geneva offering unique lake research opportunities. WIREs Water, accepted

Fernández Castro, B., H.E. Chmiel, C. Minaudo, S. Krishna, P. Perolo, S. Rasconi, and A. Wüest (2021). Primary and net ecosystem production in a large lake diagnosed from high-resolution oxygen measurements. *Water Resources Research*, **57**(5): e2020WR029283. https://doi.org/10.1029/2020WR029283

Krishna S., H.N. Ulloa, O. Kerimoglu, C. Minaudo, O. Anneville, and A. Wüest (2021). Model-based data analysis of the effect of winter mixing on primary production in a lake under reoligotrophication. *Ecolog. Modelling.* **440**: 109401

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Steinsberger, T., A. Wüest, and B. Müller (2021). Net ecosystem production of lakes estimated from hypolimnetic organic carbon sinks. *Water Resources Research* **57**(5): e2020WR029473. https://doi.org/10.1029/2020WR029473.

Steinsberger, T., R. Schwefel, A. Wüest, and B. Müller (2020). Hypolimnetic oxygen depletion rates in deep lakes: Effects of trophic state and organic matter accumulation. *Limnology and Oceanography* **65**(12): 3128–3138, doi: 10.1002/lno.11578

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Schwefel, R., B. Müller, H. Boisgontier and A. Wüest (2019). Global warming affects nutrient upwelling in deep lakes. *Aquatic Sciences* **81**(3): 50, Doi: 10.1007/s00027-019-0637-0

Schwefel, R., T. Steinsberger, D. Bouffard, L.D. Bryant, B. Müller, and A. Wüest (2018) Using small-scale measurements to estimate hypolimnetic oxygen depletion in a deep lake. *Limnology and Oceanography* **63**(S1): S54–S67, doi: 10.1002/lno.10723.