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BOOK OF ABSTRACTS

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Contribution of large-scale mesocosm experiments in interdisciplinary river science: an overview of the SMART experimental activities

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Assessing the ecological impacts of anthropic alteration of aquatic ecosystems is difficult due to the presence of confounding and interacting factors. Large-scale mesocosms enable experiments with greater complexity, e.g., by including different trophic levels, to be conducted and to separate effects of multiple stressors on whole ecosystems. Thus, results can be extrapolated to natural systems. Within the SMART programme, four PhD projects included interdisciplinary mesocosm experiments. Two different facilities were used: i) a set of five open-air, stream-side flumes, fed by a 2nd order gravel-bed Alpine stream ("Fersina flumes", Trentino, NE Italy); ii) 24 large lake mesocosms (enclosures) reaching into the sediments ("LakeLab", IGB, Lake Stechlin, Germany).

The Fersina flumes were used by three SMART PhD students. The experiments aimed to disentangle the effects on macroinvertebrates and periphyton of: 1) HYDROPEAKING: we simulated daily 5-h hydropeaking events for five consecutive days in spring and autumn, and assessed the effects on periphyton biomass and nutritional quality, and on macroinvertebrates drift. For both biotic targets, we assessed the use of wood as a mitigation measure. 2) artificial light at night (ALAN): we simulated the light conditions of a light-polluted area in spring and autumn, and assessed the effects on periphyton growth by measuring biomass and community composition, and on zoobenthos by measuring density and composition and the induction of drift. The main findings were: 1) Repeated hydropeaking alter primary producers biomass and nutritional quality (fatty acids content), and zoobenthic communities densities and composition by inducing catastrophic drift, and availability of wood substrate may mitigate part of these effects; 2) ALAN alters biomass and composition of periphyton and potentially its nutritional quality in artificially-lit waters, and suppresses macroinvertebrates drift densities resulting in changes in benthic densities and composition.

One SMART PhD student attended a LakeLab experiment within the 'Illuminating Lake Ecosystems' (ILES) project. This project aimed to elucidate the effects of increased levels of diffuse luminance of the night sky due to human presence and activity (i.e., skyglow) on lake ecosystem function. As part of this project, a large scale mesocosm experiment was carried out, simulating three skyglow conditions (no, low and high skyglow). Through the use of a mechanistic mathematical model and a stochastic calibration of model parameters in a Bayesian framework, metabolic rates were calculated: gross primary productivity, ecosystem respiration, and net ecosystem productivity. Interpretation of results will be supported by additional laboratory results still in preparation.

This presentation will demonstrate the importance of mesocosm facilities in interdisciplinary research training and how this led to insights that would not have been possible otherwise.