Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Laboratory of Hydraulics, Hydrology and Glaciology

Head: Prof. Dr. Robert Boes
Supervision: Dr. David Vetsch (VAW)
Dr. Luiz Silva (IfU)
External Partners: Dr. Julian Meister (Axpo)
Dr. David Gisen (BAW)

Master's Thesis or Project Work
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Last stop powerhouse?

Using CFD and ML in the headwaters of KW Wildegg-Brugg to quantify fish movement pathways

The establishment of fish passage at hydropower plants and thus the restoration of corridor function of watercourses is elementary for the maintenance of certain fish populations. While restoration of upstream migration is well on track, technologies and solutions for downstream fish migration are still under development. Approaches are usually site-specific, and their elaboration often lacks information about the fish movement behavior and local pathways. Thus, a quite unique acoustic telemetry study to track fish movement has been carried out in the headwaters of the run-of-the-river hydropower plant KW Wildegg-Brugg on the Aare river (Fig. 1). The goal of this project is to reconstruct the observed fish tracks in the headwater by using advanced computational techniques.

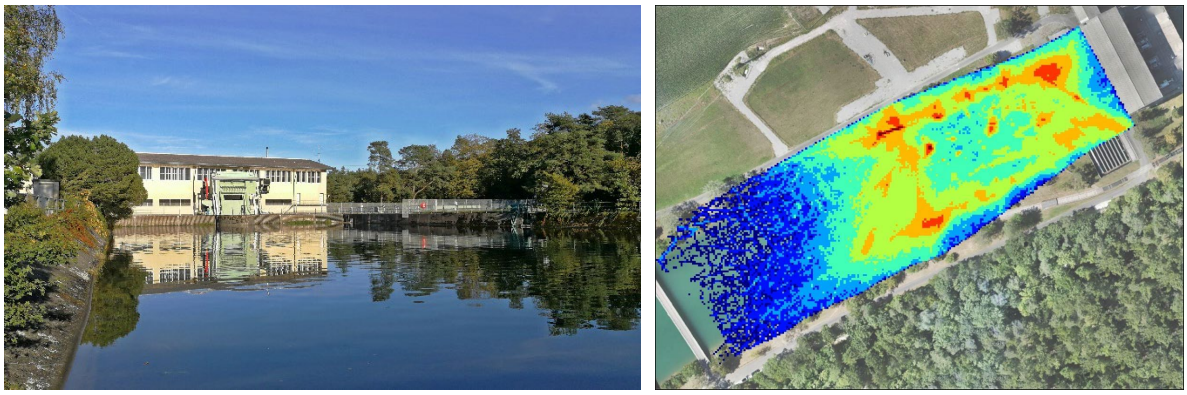

Fig. 1: Powerhouse KW Wildegg-Brugg (left, source VAW) and so-called heat map showing the frequency of tracked fish locations in the headwaters (right, reddish colors indicate high and blueish color low frequency, source: Axpo)

For the modelling of the fish movements a combination of computational fluid dynamics (CFD) simulations of the flow field and the Eulerian-Lagrangian-agent method (ELAM) will be applied. For the CFD simulations, the OpenFOAM software will be employed. The relevant fish behavioral traits will be trained by machine learning using observed tracks. The so trained combined CFD-ELAM model will be used to study the fish movements for different load cases and agreement with field data will be assessed.

Contact: Dr. David Vetsch
Computational Fluid- and Morphodynamics Group
vetsch@vaw.baug.ethz.ch

Remarks: Research-oriented thesis, can only be distributed once;
Skills in numerical modelling and scripting with Python required;
Thesis can be written in English or German