Submitted Abstract

ID IMC22-FSAbstr- 335

First Author First Name / Last Name	Juliette Becquet
Submitting Author First Name / Last Name	Juliette Becquet
Correspondence	juliette.becquet@gmail.com
Co-Authors >> E-Mails will be not listed	Cauvy-Fraunié, Sophie; Lamouroux, Nicolas; Forcellini, Maxence
Organisations	INRAE, France
Country	France
Region	Western Europe

Title	Macroinvertebrate Hydraulic Preference Models: A Tool For Predicting And Mitigating The Impacts Of Water Abstractions In Mountain Streams.
Keywords	Flow Velocity, Shear Stress, Froude Number, Preference Curves, Mixed-Effects Models
Type	List Of Focus Session
Focus Session ID	04

Abstract

Alpine streams face rapid hydrological changes due to the combined effects of global warming and increased water abstractions. More and more small hydropower plants are built at high altitudes, changing local habitat conditions with profound effects on the aquatic biodiversity. Impacts of flow alteration can be mitigated by environmental flows (e-flows) assessment. Among existing tools, hydraulic habitat models allow predicting change in habitat suitability for aquatic species under different flow scenarios, coupling hydraulic models of stream reaches with hydraulic preference (biological) models. The hydraulic component predicts the frequency distributions of microhabitat hydraulic conditions at various discharges. The biological component describes the variation of species abundance with microhabitat hydraulic conditions. Initially developed for fish, hydraulic preference models have never been adapted to high-altitude, often fishless, streams. It is urgent to develop new hydraulic preference models on alpine species to assess the impact of flow alteration on alpine stream ecosystems. In this study, we aimed to (1) develop hydraulic preference models on dominant macroinvertebrate taxa in alpine streams, (2) test whether macroinvertebrate responses to hydraulics varied between streams with or without glacial influence, (3) identify the hydraulic drivers that best explain microhabitat selection by alpine taxa, and (4) compare hydraulic responses with those obtained at low altitudes. For this purpose, we analysed a database of 150 macroinvertebrate samples. Microhabitats were characterized by four hydraulic variables: bed shear stress, water column velocity, Froude number, and water depth. We performed generalized linear mixed models to examine the impact of each hydraulic variable on macroinvertebrate abundance and compared their performance for explaining microhabitat selection. We also compared our results with a similar study realized in low-altitude streams to assess the consistency of hydraulic response of macroinvertebrate between lowland and alpine environments for common taxa. Hydraulic preference models have been developed on 41 alpine taxa, of which 18, 20, 21, and 11 had a significant selection for shear stress, flow velocity, Froude number, and water depth, respectively. Macroinvertebrate response to hydraulics was similar among alpine stream types. Power of models with shear stress and flow velocity to predict macroinvertebrate abundances was higher than with Froude number and water depth. We also observed similar macroinvertebrate response to hydraulics between alpine and lowland streams for 11 common taxa. Our results showed a good transferability of macroinvertebrate hydraulic preference models among stream types that combined with hydraulic models, will be an effective tool to assess e-flows in alpine regions.