Geophysical Research Abstracts
Vol. 18, EGU2016-4557, 2016
EGU General Assembly 2016

Long-term macroinvertebrate response to flow abstraction at Alpine water intakes

Chrystelle Gabbud, Amélie Savioz, and Stuart Lane
University of Lausanne, Institute of Earth Surface Dynamics - IDYST, Lausanne, Switzerland (chrystelle.gabbud@unil.ch)

The natural flow hydrological characteristics of Alpine streams, dominated by snowmelt and glacier melt, have been established for many years. More recently, the ecosystems that they sustain have been described and explained, following the hydrological, biochemical, morphodynamic, and biotic elements specific to Alpine streams. However, natural Alpine flow regimes may be strongly modified by hydroelectric power production, which impacts upon both river discharge and sediment transfer, and hence on downstream flora and fauna. These kinds of impacts are well studied where river are regulated by dams, with sediments retained behind walls, but they are much less focus on water intakes, whose storage capacity is very smaller and thus have to flush flow and sediment regularly.

Here we focus on the impacts of flow abstraction on macroinvertebrates, the most widely ecological group used in freshwater biomonitoring as they act typically as indicators of environmental health. Some key generalizations can be made. For instance, in European glacially fed river systems, Plecoptera, Chironomidae, Ephemeroptera, Simuliidae, and Diptera are the main taxa found in spring as they are better adapted to cold conditions.

Petts and Bickerton (1994) published macroinvertebrate samples from the upper part of the glacial stream system the Borgne d'Arolla (Valais, Switzerland), highlighting that: (1) taxa variability and productivity decline in the river because of flow abstraction, (2) 60 % of the communities were provided by tributaries, (3) there is migration upstream of the species in response to the passage from a dominant ice-melt to a snow-melt regime, (4) the colonisation is difficult because of a significant modification of the habitat in the river by sediment transport, until it becomes warmer, clearer and more stable further downstream.

In order to establish the long-term impacts of flow abstraction upon instream ecology where sediment delivery is maintained but transport capacity is reduced, and to determine if the above trends are accelerated, maintained or reversed, we revisited the study of Petts and Bickerton (1994) by repeating transects of interest for both the river and the tributaries during summer 2015. Based on macroinvertebrate sampling, determinations and statistics, preliminary results show that these trends have been maintained, with macroinvertebrate presence restricted to zones immediately downstream of unregulated tributaries. Despite the river having been protected as an alluvial zone of national importance since the 1990s, there is no evidence of life in the river except in isolated tributary-fed hotspots. The data suggest that restoring this kind of system will need new approaches to manage sediment, ones that environmental flows alone are unlikely to be able to address.

Reference

Petts GE, Bickerton MA (1994). Influence of water abstraction on the macroinvertebrate community gradient within a glacial stream system: La Borgne d'Arolla, Valais, Switzerland. Freshwater Biology, 32:375-386.