Frequent sediment flushing threatens macroinvertebrate diversity in Alpine streams

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Aquatic organisms are adapted to harsh conditions at high altitudes and are tolerant of a certain level of disturbances. However, according to a study conducted in the canton of Valais, frequent flushing of water intakes leads to a dramatic decline in populations of macroinvertebrates, such as insects or worms.

Alpine streams have been extensively modified by dams and water intakes to permit hydropower exploitation. This leads to changes in flow regimes and sediment dynamics, and thus also in the distribution of animal and plant species. To keep ecological impacts to a minimum, it is important to ensure adequate minimum flows and, in addition, to restore natural sediment dynamics. A new study carried out by Eawag and Lausanne University shows that, particularly in the case of water intakes, sediment management is essential for the survival of aquatic life.

Large amounts of sand and gravel accumulate in water intakes. In highly glaciated basins, intakes may have to be flushed up to 17 times a day to empty the sediment traps. The consequences are devastating: the researchers found that during the summer months – when intake flushing is most frequent – downstream reaches of the Borgne d'Arolla (a glacial stream system in the south-west Swiss Alps) were almost devoid of life. This was due to the adverse impacts of the deposition of coarse and fine sediments. Populations only recover when the rate of disturbances is reduced in the autumn. Christopher Robinson, an aquatic ecologist at Eawag, says: "Surprisingly, macroinvertebrates were then able to rapidly recolonise the stream from tributaries." However, species richness was relatively low, and the populations disappeared again as soon as regular flushing was resumed.

More frequent flushing due to increased sediment delivery

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When researchers studied macroinvertebrate communities in the Borgne d'Arolla around 25 years ago, the situation was quite different. Although water intakes were already in operation, the ecological impacts were found to be relatively limited. But as a result of glacier recession in the catchment, sediment delivery has increased, and the number of flushes required per day has risen to the point where life downstream is virtually eliminated. According to Robinson, "The situation could become even more acute in the short term – at least until the glaciers have completely melted." To enable aquatic life downstream of intakes to survive throughout the year, he adds, the frequency of flushing needs to be reduced: "Improvements in environmental flows must be accompanied by sediment management." This is essential if sediments are to be discharged from intakes and distributed on the stream bed in a more natural manner, thus improving ecosystem function.

A water intake in the Borge d'Arolla
(Photo: Chrystelle Gabbud)

Original publication

Gabbud, C.; Robinson, C. T.; Lane, S. N. (2019) Summer is in winter: disturbance-driven shifts in macroinvertebrate communities following hydroelectric power exploitation, *Science of the Total Environment*, 650, 2164-2180, doi:10.1016/j.scitotenv.2018.09.180, Institutional Repository

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