Sediment bypass tunnels and biodiversity

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Mountain rivers swollen by heavy rainfall deposit large amounts of sediment in reservoirs. To prevent the loss of storage capacity, some reservoirs are equipped with bypass tunnels which convey sediment-laden waters to downstream reaches. The fact that such tunnels offer ecological benefits as well as economic advantages was shown, for example, by a study carried out on the Solis reservoir in Graubünden.

Eawag scientists, in collaboration with Japanese colleagues, have now investigated the effects of sediment bypass tunnels (SBTs) on macroinvertebrates (e.g. insect larvae or amphipods). In the study, analysis of DNA metabarcoding data was used for species identification. This method is less time?consuming and more precise than morphology-based assessments of macroinvertebrates.

Positive influence on biodiversity

The scientists assessed macroinvertebrate communities in three dam-fragmented rivers with SBTs (Reuss/Pfaffensprung, Rabiusa/Egschi and Albula/Solis) in comparison with two free-flowing rivers and two dam-fragmented rivers without SBTs. Overall, they collected almost 7000 larvae from 16 sampling sites and analysed 2.3 million gene sequences, which were assigned to 131 species.

Comparison of upstream and downstream communities showed that SBTs have a positive influence on macroinvertebrate diversity: species composition at downstream sites becomes increasingly similar to upstream sites the longer a tunnel has been in operation and the more frequently it is operated. In contrast, if no sediment is transported to residual reaches, marked dissimilarities are observed between upstream and downstream communities.

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Suitable method

The results of the genetic analysis correlated well with the morphological assessments carried out in parallel. The scientists thus demonstrated that DNA metabarcoding is a suitable method for obtaining quantitative estimates of diversity.

Publication (open access)

Serrana, J. M.; Yaegashi, S.; Kondoh, S.; Li, B.; Robinson, C. T.; Watanabe, K. (2018) Ecological influence of sediment bypass tunnels on macroinvertebrates in dam-fragmented rivers by DNA metabarcoding, *Scientific Reports*, 8, 10185 (10 pp.), doi:10.1038/s41598-018-28624-2, Institutional Repository

Stonefly larva, family Perlidae. Typical for this family are the gills on the underside of the thorax.
(Photo: Silvana Käser, Eawag)

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