

## A (one-off) showcase project

Artificial flooding is being used to revitalize the Spöl, a mountain stream in the Swiss National Park. Although this rehabilitation project has been successful, the same method has not yet been employed on other Swiss mountain streams. This may be because amending the terms of complex concession agreements involves substantial legal efforts for hydropower plant operators. *By Simon Koechlin*



Swiss National Park

Fig. 1: Reduced residual flow: as a result of hydropower production, only around 12 per cent of the original water volume now flows through the Spöl.

The Spöl is actually quite wretched to look at. The broad bed of the biggest waterway in the Swiss National Park offers only a trickle of water. It's not what one would expect of a healthy, rushing mountain stream. But since 1970 the Engadine Power Plants (EKW) have been using the Spöl to produce electricity, which is why the river has to make do with just 12 percent of its original volume of water. Nevertheless, in contrast to other Alpine streams that have been similarly tamed, the Spöl is home to a wide range of organisms typical of this habitat. This is thanks to a long-term research project, in which Eawag has played a leading role.

Using the Spöl to generate power took away its momentum, so it was no longer able to trans-

port pebbles and sediment downstream. The riverbed solidified, pools formed, and instead of the Spöl being home to mountain stream specialists, more mundane organisms established themselves. Some types of algae and moss proliferated. In the 1990s, the National Park Research Commission had the idea of using artificial flooding to improve the ecology of the Spöl. “The result was a process of rapprochement between business and environmental protection that took several years,” says Thomas Scheurer, the manager of the Research Commission. In the end, it was agreed with the EKW that the Spöl should be flushed with a large amount of water from the Livigno reservoir two or three times a year, from 2000 onwards.



Fig. 2: Thanks to artificial flooding, species typical of natural stream habitats have returned to the Spöl.

Swiss National Park

### Increased biodiversity

Christopher Robinson and Michael Döring of Eawag, along with other researchers, have since been investigating how the biodiversity of the Spöl has changed as a result of this artificial flooding. It brings a dynamism to its otherwise monotonous, measured flow, flushing fine sediments downstream. This helps to prevent compaction of the riverbed, says Döring, and its positive effects on the biological community quickly became visible. The Spöl’s high concentration of freshwater shrimps had been relatively atypical for a mountain stream in the region, but there was a significant reduction even over the first three years. Instead, aquatic organisms more typical of this environment became more frequent – such as mayflies, stoneflies and caddis flies.

The new flow regime also had a positive effect on larger species. Brown trout – the only type of fish naturally occurring in the Spöl – make spawning redds with their tails in the gravelly riverbed. Flushing the riverbed means that this can now happen more often again. The

researchers found that the number of trout spawning redds has risen fivefold since the beginning of the project. “We can’t return to a natural state with this method. But overall the species composition in the Spöl is once again getting close to that of the natural rivers in the region,” says Döring.

The artificial flooding is organized so that the EKW suffer no loss of production. The volume of water required for flooding is “saved up” throughout the year by means of a slight reduction in daily outflows. “It’s a win-win situation,” says Jachen Gaudenz of the EKW. The new system actually means the company is losing less water than before, because the EKW already had to perform regular flushing to remove silt from the bottom outlet. And for the National Park, the solution adopted is “a good approach”, as research director Ruedi Haller confirms. “We regret the fact that the Spöl is no longer a natural waterway. But the flooding has recreated near-natural conditions – and the project has also yielded a lot of general information about revitalization schemes.”

### **International showcase**

Indeed, the Spöl is now regarded as a showcase project for the revitalization of mountain streams. “Several rivers in other countries are being flooded artificially according to a similar principle,” says Döring. These include the Snowy River in Australia and the Colorado in the US. In Switzerland, however, there are hardly any comparable projects – even though many Alpine streams are dammed. Thomas Scheurer believes that this is mostly due to concession agreements, which regulate down to the smallest detail how much water can be released from a reservoir, and when. If one wished to introduce a more dynamic residual-flow regime, as in the case of the Spöl, then these concessions would have to be modified – “which would require massive legal efforts that power plant operators would rather avoid.”

All the same, an Eawag spin-off founded by Döring is currently collaborating with the Oberhasli Hydroelectric Power Company (KWO) to see if a dynamic residual-flow system would be possible at the outlet of the Trift Glacier in the Bernese Oberland, where the KWO is considering creating a reservoir. “The situation is different: The Spöl flows down to the valley largely without forming side streams, whereas the ramified alluvial landscape below the Trift Glacier differs in the complexity of its discharge and its dynamics,” says Döring. So it first has to be clarified what kind of residual-flow regime would be most suitable for preserving the main functions of the Trift Glacier foreland.

### **Environmental disaster?**

In March 2013, the Spöl project team had a taste of the risks associated with intervening in nature. When water levels were low, large amounts of sediment from the Livigno reservoir found their way into the Spöl, and a four-kilometre stretch was submerged. Thousands of trout and innumerable macroinvertebrates perished, and there were reports in the media of an “environmental disaster”. But it is now clear that the biodiversity of the Spöl is recovering surprisingly rapidly, as Eawag studies have confirmed. In early December, the task force set up after

the incident declared that community composition was approaching its previous state, especially in the lower part of the stream.

The accident may also have a positive side. "Such events also occur in other residual-flow stretches," says Haller. But because the state of biodiversity prior to contamination is usually unknown, the consequences remain unclear. "However, thanks to many years of monitoring, we can now assess the effects quickly and precisely, and thus help to improve the unsatisfactory situation regarding the management of residual-flow stretches."

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