The wondrous world beneath our feet – researching groundwater fauna

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Topics: Drinking Water | Biodiversity | Ecosystems

Switzerland's groundwater is home to a multitude of hitherto unknown organisms. An Eawag research project is shining a light into the darkness and revealing this habitat's exceptional biodiversity.

Switzerland has plentiful groundwater reserves. Found in cavities under the earth, groundwater is almost ubiquitously present, and is the country's biggest source of drinking water. Unlike the drinking water that comes out of our taps, however, groundwater is also a natural habitat and, as such, is home to a wide range of organisms – from the smallest of microorganisms to larger creatures such as amphipods.

"Generally speaking, the fact that there are creatures living in the groundwater is a good sign," explains Florian Altermatt, "as these organisms are dependent on a high level of water quality. However, it is not entirely clear at what levels of pollution they start to be affected." Altermatt is a Research Group Leader at the aquatic research institute Eawag and a professor at the University of Zurich. As yet, scientists know very little about the identity and distribution of groundwater organisms, so the team have set themselves the task of researching the groundwater ecosystem in greater detail. Altermatt's team is therefore conducting the first Switzerland-wide study of biodiversity in groundwater – the "AmphiWell" project – as part of the Naqua National Groundwater Monitoring programme on behalf of the Federal Office for the Environment (FOEN).

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Amphipods are abundant in groundwater. Since they live in a dark environment, they lack pigments. (Photo: Eawag)

Strong support from the water supply companies

Mara Knüsel, who is working on the project for her PhD thesis, explains the project's approach: "Although groundwater is present everywhere beneath our feet, it's very hard for us to get at. The best way to access it is via Switzerland's countless spring boxes." However, these spring boxes are not accessible to the general public and are maintained by the water supply companies. The researchers are therefore working with the water industry (water supply managers, water control officers, private spring operators, etc.) to collect as many samples as possible from different locations as part of a citizen science project. Of the 700 water utilities approached, almost half have already agreed to take part. "They're very keen and happy to be involved, and they're also interested in the results," explains Knüsel. "We're really lucky to be able to sample the spring boxes in this way."

In the project video (see below), we see a water supply manager fitting a filter net directly to an inlet point. The net collects a number of organisms – above all amphipods – over the course of a week, which are then preserved in ethanol in a sample tube and sent to Eawag. Genetic analysis allows the collected amphipods to be assigned to a known – or new – species, and Knüsel then notifies the water utilities of the organisms that were found in the net.

Using filter nets attached directly to the inlet points, a number of organisms – above all amphipods – are collected over the course of a week. The animals are then preserved in ethanol and sent to Eawag. Genetic analysis allows the collected amphipods to be assigned to a known – or new – species. (Photo: Eawag)

Exceptional biodiversity

In a pilot project in 2019, this method has already been used to identify several amphipod species found for the first time in Switzerland, and even to discover species that are new to science. “The newly discovered species are endemic species,” explains Florian Altermatt. This means they have emerged in and are unique to Switzerland – sometimes even to a very localised area. Switzerland has an important duty to protect this exceptional biodiversity.” He expects further species to emerge over the course of the project.

Altermatt’s research group has also developed an identification key to enable water professionals to identify the amphipods. In addition, the project uses “environmental DNA” (eDNA) to determine the biodiversity and distribution of species in Switzerland’s various regions and aquifers.

Watch the video on Youtube.

Cover picture: Amphipods are collected from groundwater and then genetically characterised. (Photo: Eawag)

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Related Links

Project Amphiwell

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