Abstract

Mountains are considered nature's 'water towers' if they are storing large amounts of freshwater. Being able to know the origins of freshwater, a scarce natural resource, is important, for modelling purposes and appropriate freshwater resource management. With an increasingly dynamic climate, predicting changes through global modelling of freshwater resources will enable humanity to adapt to a changing climate. Alpine regions are highly sensitive to small changes in physical conditions impacting the amounts and types of precipitation. Therefore, hydrological systems in these areas may be individualistic and highly variable, so need to be analysed in more detail. The *Vallon de Nant (VDN)* is an Alpine area in Switzerland. It became a protected area in 1969. The catchment area is a small steep hillslope and its hydrological regime is highly influenced by snowmelt. To understand the hydrological regime of the area, samples of water were collected between February 2017 and August 2017 and analysed for their conductivity, temperature, and stable isotope compositions. For one sampling campaign, samples of water were also collected for analysis of ionic composition of the water and dissolved inorganic carbon. Samples were collected over 3 hydrological seasons; groundwater-dominated flow in the winter, snowmelt-dominated flow in the spring and high precipitation-dominated flow in the summer. Additionally, samples for analysis of environmental DNA (e-DNA) were taken. E-DNA is DNA from the environment that is present in natural water and derived from the organisms living in the surrounding environment.

Biodiversity is highly dependent on the hydrology of the area. Sampling took place at 10 different points within the Vallon de Nant (VDN) with an approximate distance of 3.1 kilometres between the highest point of sampling and the lowest (outlet) point of sampling. Sampling took place over a period of seven months in 2017 and a total of 122 e-DNA samples were collected. It is not currently known whether e-DNA can be used as an effective hydrological tracer. Due to unfortunate circumstances, this research will not be conclusive in terms of the robustness of e-DNA as a hydrological tracer. Instead, the objective of this study is to explore other tracers currently in use (stable isotopes, ionic composition, conductivity, temperature and dissolved inorganic carbon) to assess the hydrological basis for potential variations in e-DNA diversity across 3 hydrological seasons and 3 different water "pools" being the springs, the tributaries and the river. Overall there were differences between each of the three pools in isotopic composition, ionic composition and conductivity. The tributaries were the most variable in terms of isotopic composition whilst the rivers were largely source and spring water fed. The spring water was homogenous. Therefore, it can be expected that the e-DNA results will show the tributary to be the most dynamic and seasonal like the flow of water in the tributary. The springs and river maintain a permanent water flow and therefore can support biodiversity all year. However, it can be expected that the springs will host a higher and larger diversity than the river due to the lower flow spend and turbulence at the springs and offers a relatively consistent calm and moist region all year whilst the river has a large discharge and is very turbulent during the snowmelt and precipitation periods.