ECOHYDROLOGY

Ecohydrology is the scientific field studying the relationships between water and living organisms. Ecology is the study of organisms, the environment and how the organisms interact with each other and their environment. Hydrology is the study of the distribution and movement of water both on and below the Earth's surface. Hydrology and ecology are closely linked to geomorphology, which is the study of landforms, their processes, and the sediments that make up Earth's surface. The ecology of a river is influenced by the river hydrology, which in turn influences and is influenced by the geomorphology.

With atmospheric processes, these different realms and their relationships create the diverse natural landscapes of our planet, with its immense variety of topographies, climates, and life forms adapted to each local combination of factors. Human disturbances in the environment caused by deforestation, urbanization, pollution and climate change impact all of these spheres. In the hydrosphere, constructing dams is a major human disturbance, although dams provide water for human interests such as flood control, hydropower, navigation, recreation, agricultural and urban water supply. However, river regulation by dams also affects the three spheres. The flow of species up and downstream, such as salmon, is blocked. The flow of sediments that create and reshape habitats for species is blocked. The time, temperature, quantity, and quality of water in different parts of the river is also altered, affecting the distribution of sediments and species downstream.

Understanding ecohydrological interactions at different scales can help us improve water security and achieve more sustainable development practices while reducing the effects associated with human uses of water on the environment. When assessing the health of a river, we can use many abiotic variables to enhance our understanding, such as the pressure of the water column, rate of discharge, chemistry (water quality), and temperature. However, biotic variables such as aquatic insects are also good indicators, as they are sensitive to flow alteration and the other variables mentioned above. Understanding the biotic community that is present in the different habitats of a river (pools, riffles, floodplains), allows us to understand the overall health of the river better.

The quantity and diversity of insects within a river can tell us a lot. Sampling of species diversity can be done across a river section using a D-net. To have a good sample, we disturb a portion of the substrate upstream of the net for about a minute to ensure we catch insects on, around and below the rocks (Figure 1A). Some species are more tolerant to the constant change in flow levels and temperature throughout the day caused by hydropower flow releases from the upstream dams. In the Tuolumne river, the species we found in our sample mainly were very tolerant to disturbance, such as caddisfly and other fly larvae, and worms (such as the planaria highlighted in red in Figure 1B down below). That is not a good indicator of the river's ecosystem health, as the worms are highly resistant to flow alteration. That indicates that the artificial change in magnitude, timing, rate of change, duration, temperature, and frequency of flows caused by the reservoirs currently do not favor a wide range of aquatic life. Therefore, sensitive species are rare in the river, affecting the entire food web in the river. Consequently, the natural biodiversity is vulnerable to the variable conditions caused by human exploitation in the river channel.

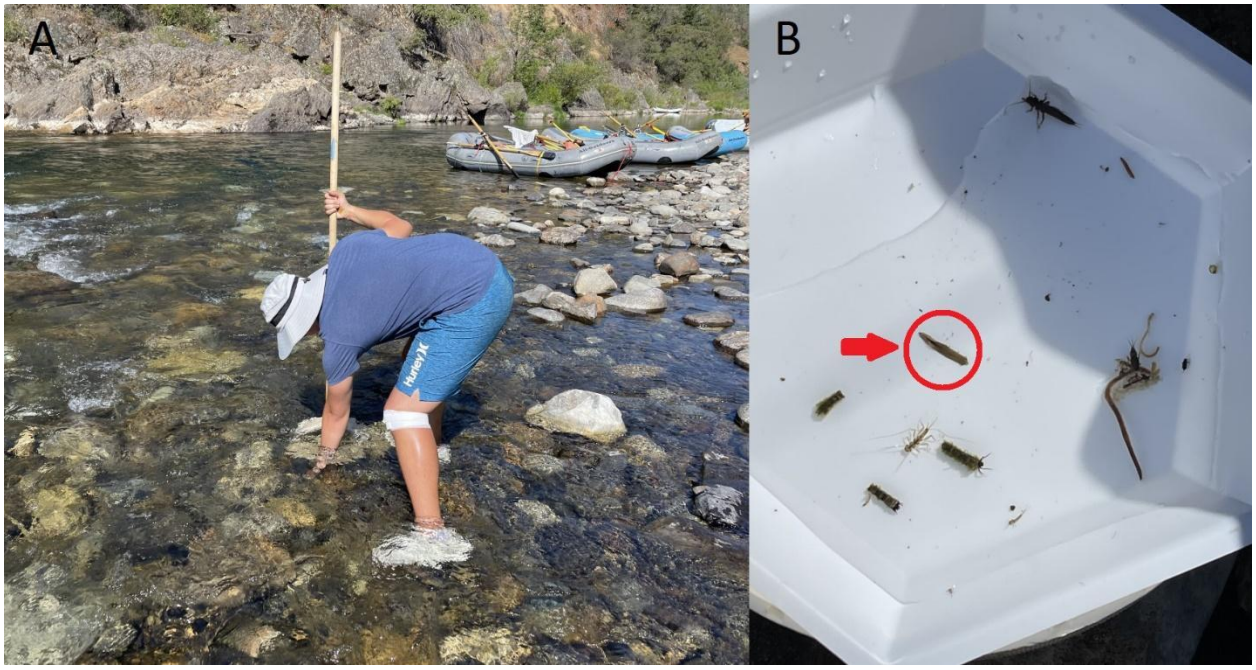

Figure 1. Cross-section sampling of aquatic insects in the Tuolumne River (A), and the organisms caught in four samples (B).

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