- ECO-ALPSWATER -

Innovative Ecological Assessment and Water Management Strategy for the Protection of Ecosystem Services in Alpine Lakes and Rivers

Priority 3: Liveable Alpine Space. SO3.2 - Enhance the protection, the conservation and the ecological connectivity of Alpine Space

Work Package WPT1 - Coordination: PP6 INRA
Activity A.T1.1 - Deliverable D.T1.1.4.
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D.T1.1.4 Identification and formalization of protocols for the use of HTS data in the next generation monitoring approaches

Biomonitoring studies are used to measure response and recovery of aquatic communities to disturbances, evaluate the ecological status of the studied ecosystem, protect biodiversity,… It is generally assumed that an ecosystem exhibiting a high biodiversity is more likely to increase its stability and resistance to environmental and anthropic pressures. In its simplest form, biomonitoring consists of recording species diversity and abundances across different locations and times (using taxonomic identification and a range of ecological metrics). The application of eDNA metabarcoding approach should enable a better characterization of freshwater biodiversity compared to classical morphological approaches which are often technically limited, especially when studying microorganisms (e.g. bacteria, diatoms).

Biodiversity is often measured by at least 3 components (figure 1):

- the richness, corresponding to the number of species observed on a site.
- the evenness, which reflect how equally the species are represented within a site. The maximum evenness is obtained when all species have the same proportion within the community.
- the diversity, which take into account the richness and the evenness, as for instance the well-known Shannon or Simpson indices.

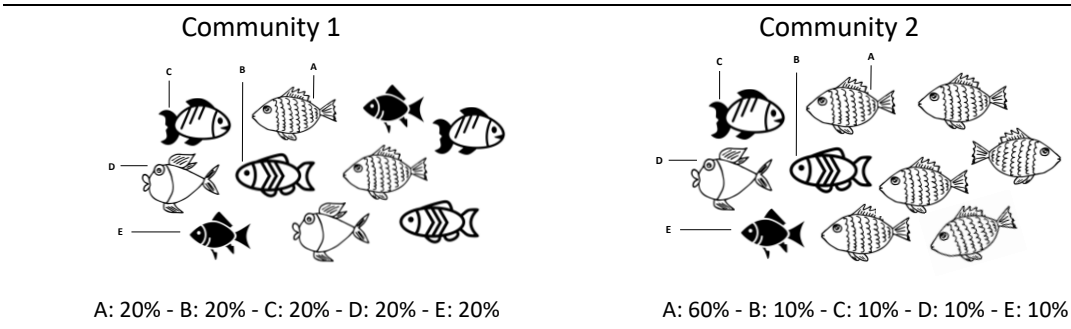

Figure 1 – Communities 1 and 2 have the same richness (5 species) but community 1 has a higher evenness as all species are present in the same proportion. Species diversity (e.g. Shannon indices) is therefore higher in the community 1.

Diversity indices that enable to characterize the biodiversity within a site (at a local scale) are descriptors of the alpha diversity, while beta diversity estimates species turnover between sites, i.e. differentiation among sites/habitats.
Additionally, a broader variety of metrics can be used for freshwater biomonitoring: if environmental preferences of taxa are known, it is possible to identify sensitive and resistant species for a specific pollution (e.g. nutrients, organic matter). Using this information and the species composition at one site makes possible to compute a quality index that rank this site according to its ecological status (like the IPS index for river quality assessment using benthic diatoms).

In the context of the Eco-AlpsWater project, the main biodiversity and ecological metrics that can be obtained from high throughput sequencing (HTS) data (after the bioinformatics process has been applied) are described in the deliverable D.T1.1.4. This technical document aims at reporting the main descriptors of diversity (richness and taxonomic composition, structure of biological communities) available for the studied biological groups. For specific bioindicators, as diatoms, this also includes the possibility to use the normalized eDNA taxonomic list to compute water quality indices.