including GWAAE identification, characterization and monitoring. Some examples from Central Italy are provided as reference points.

31-O Surface water - groundwater interactions: effect on nutrient transport over watersheds.

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Many studies over the last years have highlighted how surface water and groundwater represent interconnected environments whose physicochemical features are strongly influenced by their interconnections. For instance, water exchange at the interface between rivers and aquifers plays an important role on nutrient cycling because of the biogeochemical reactions that occur in hyporheic sediments and influences nutrient export through the river network. Physicochemical alterations of rivers and their surroundings induced by anthropic activities impact the interactions between surface waters and groundwater and can thus negatively affect riverine ecosystems. However, it is still difficult to quantify the impact on these ecosystems of surface-subsurface water exchange and of its alterations because of our limited understanding of the underlying physical and biological processes and also because of the intrinsic heterogeneity of river and aquifer properties.
This contribution stems from the need for predictive tools of water and nutrient exchange between surface water and groundwater and describes some lessons obtained from modeling studies of surface-subsurface exchange at different spatial scales. Water exchange flows at small (e.g., meter) scales are predicted to provide the largest contribute to nutrient reactions. These small-scale flow processes are mainly driven by local stream morphology, but they are also strongly influenced by groundwater flow at larger (e.g., kilometer) scales. A conceptual framework to describe the interactions between surface water and groundwater over a wide range of spatial scales is discussed.

31-O The assessment of quality standards in eu groundwater dependent ecosystems: the case of ionized ammonia (NH_4^+).

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Groundwater contamination represents a threat to groundwater dependent ecosystems (GDEs) with acute and chronic effects on aquatic organisms, as well as on human health. EU legislation provides for measures against chemical pollution of freshwaters, through either setting EQSs (European Quality Standards) for single substances of EU-wide concern (priority substances, such as pesticides) or delegating the Member States (MS) to set the QSs for substances of national or local concern (such as NH_4^+). According to the Annex V of the Water Framework Directive (WFD 2000/60/EC), a good chemical status is reached for a water body when it complies with the EU and national QSs. However, there are several concerns about the approach indicated in the EU technical guidance document (TGD) to derive QSs for GDEs, with particular reference to ecotoxicological data. According to Annex V of the WFD, the base set of taxa that should be used in ecotoxicological trials to set QSs are algae and/or macrophytes, the cladoceran crustacean *Daphnia* and epigean fish. However, none of these taxa naturally dwell in groundwater bodies nor are dominant or even occur in some GDEs. Although the TGD underlines that the ecotoxicological trials should not be restricted to this base set, the actual QSs for EU groundwater bodies have been generated from experiments on epigean species, so far.
The objectives of our studies were: (i) to test the acute and chronic effects of two compounds widely used in EU farming, namely NH_4^+ and the herbicide Imazamox, as well as of their binary mixture, to an epigean and a hypogean copepod species belonging to the same family; (ii) to derive the QSs for NH_4^+ computed respectively as single chemical and in the binary mixture with Imazamox by species sensitivity distributions (SSDs) based on a set of freshwater species including groundwater copepods. We selected the Crustacea Copepoda since it is by far the most abundant and species-rich group in groundwater and GDEs.
The results of our studies warned about using epigean species to derive QSs for GDEs. In our studies, the two copepod species showed a differential sensitivity to NH_4^+ when assayed as single chemical. In details, the hypogean species was 3 and 37 times more sensitive than the epigean species under acute and chronic exposure to NH_4^+, respectively. However, the difference in the sensitivity between the two species was far less evident when NH_4^+ was assayed in the

mixture. The QS of NH_4^+ obtained by the SSD curve computed for the single compound highly underestimated the fraction of the potentially affected species, that were more sensitive to NH_4^+ when it was considered in the mixture with Imazamox in the SSDs. According to the QS of NH_4^+ derived from our studies, the actual environmental policy fails to protect groundwater copepods from acute exposure to NH_4^+ in at least 4 EU Member States.

31-O Interactions between geochemical and ecological status of the groundwater ecosystem: what do the resident biological communities tell us?

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The groundwater ecosystems are threatened by the increasing water demand and anthropic activities. Groundwater hosts numerous organisms belonging to a wide range of faunal groups that generally are neglected by the monitoring plans, commonly based on the hydrogeochemical parameters. Basic research is needed to establish the effects of the environmental stress on the whole system.
The groundwater ecosystems are populated by highly adapted biota, dominated by microorganisms and invertebrates. Microbial communities are at the base of the heterotrophic food chain, playing a key role in the organic matter processing, including organic pollutants. Important ecosystem services are attributed to groundwater metazoa, especially invertebrates, such as the maintenance of hydraulic conductivity in porous sediments, through their feeding on microbial biofilms, and bioturbation. The analyses of the microbial and crustaceans communities in the groundwater along with changes in hydrogeochemical parameters may contribute to shed more light upon the state and dynamics of such ecosystems. A comprehensive study of a water table aquifer flowing through a quaternary volcanic district (Latium Region, central Italy) was performed. Field data (GPS localization, well depth, water table level, temperature, pH, alkalinity, dissolved oxygen, conductivity) were measured together with the analysis of major cations (Optical Emission Spectroscopy), major anions (Ionic Cromatography), trace elements (Coupled Plasma Mass Spectrometry), NO_2, PO_4, NH_4 (Spectrophotometry) and dissolved organic carbon (Shimadzu TOC-5000 analyzer). The Colilert-18 test was used to verify the occurrence of fecal contamination (total coliforms and *Escherichia coli*). Flow cytometry and epifluorescence microscopy was utilised to determine the prokaryotic abundance and cells with high and low nucleic acid content (HNA, LNA). BIOLOG EcoPlates™ were utilised to describe changes in the metabolic profiles of the microbial communities. Pore water ($1m^3$) was filtered through a 63-µm mesh net to sample crustaceans specimens, successively sorted under a stereomicroscope for taxonomic identification.
The sampled sites were differently affected by natural and anthropogenic factors (arsenic, fluoride and fecal pollution). The analysis of the results showed as differences in the aquifer typologies affect the structure and functional properties of the bacterial communities(range 10^3-10^4 cells/ml). The microbial communities metabolic profiles (BIOLOG) were surprisingly different among the sites for all the classes of substrata analyzed (amines/amides, amino acids, carboxylic acids, carbohydrates, polymers), implying a high metabolic diversity. The crustacean community was constituted by 12 taxa, nine of which were stygobionts. Interestingly four sampling sites, belonging to the same sector of the aquifer, with a lower salinity and sulfate content, harbored no crustacean specimens.

31-O Groundwater biodiversity in the challenging sulfidic karst: copepod assemblages of the Frasassi cave system (Italy).

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The Frasassi cave system hosts one of the few worldwide examples of groundwater metazoan communities depending on chemoautotrophic microbes. Despite the challenging conditions represented by high levels of hydrogen sulphide and low concentration of oxygen, this cave system is home to many species of ostracods, amphipods, and copepods. We analysed here the copepods inhabiting three sulfidic lakes and two dripping pools fed by non-sulfidic water to investigate how the extreme environmental conditions of sulfidic habitats influence community structure. To this end, we have sampled copepod assemblages in both low- and high-water periods characterised by different physico-chemical conditions. Overall similarity in species composition among species assemblages was investigated by cluster analysis