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MULTIPLE ISOTOPE AND HYDRO-CHEMICAL TECHNIQUES INVESTIGATING DYNAMICS AND SOURCES OF DIC WITHIN A MULTIPLE AQUIFER SYSTEM OF A GROUNDWATER FED LAKE CATCHMENT (LOUGH GUR, IRELAND)

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Traditionally, Lake groundwater discharge (LGD) has been disregarded in many lake nutrient and eutrophication studies (Lewandowski et al. 2015). Hence, there is an urgent need for detailed research to quantify different groundwater nutrient sources and the likelihood of transport, transformation and storage along subterranean flow path conduits to and from lake systems. Understanding the temporal and spatial distribution of dissolved inorganic carbon (DIC) species is an important step in understanding the geochemistry of groundwater systems (Han et al., 2010). Isotope techniques including $\delta^{18}O_{H2O}$ and $\delta^{2}H_{H2O}$, in conjunction with hydro-chemical species were used to constrain sources of water to the lake and along a flowpath line which emerges as a spring outflow from the lake. In addition, other isotope tracers such as $\delta^{13}C$ in DIC and $\delta^{15}N$ and $\delta^{18}O$ in dissolved nitrate along with catchment well-lake gradients, vertical lake-aquifer hydraulic gradients and geophysical surveys were used to trace groundwater seepage and biogeochemical processes impacting lake hydrochemistry and transformation of nutrient to the lake and along the conduit flow path outflow. Hydrographs of wells and lake level from the north-east of Lough Gur along with precipitation data show rapid GW-SW connectivity. Groundwater flux data from the piezometer nest at the amenity centre to the north-east indicate nearshore groundwater seepage rates (~0.035 $m^3/m^2/day$) from the upper piezometer (1.07m). Falling head tests show the existence of a layer of lower hydraulic conductivity in the sediments in the upper piezometer depth, with higher values at the deeper depths. Rn survey on the lake identified three areas with strong anomalies and discharge. Negative correlation between $\delta^{13}C_{DIC}$ (‰) and DOC (mgl^{-1}) indicate dissolution of carbonates by carbonic acid in groundwaters. In contrast, positive correlation between $\delta^{13}C_{DIC}$ (‰) and DOC (mgl^{-1}) implies that oxidation of organic matter was a major source of DIC in surface waters and piezometers. ERT survey results show lateral and vertical variations in electrical and help constrain the orientation and extent of the subsurface conduit system at Lough Gur.

References

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