Hydrochemical assessment of a freshwater resource on Rottnest Island, Western Australia

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This project investigated the groundwater hydrochemical processes within an Island aquifer system on Rottnest Island, located ~18 km west of Perth, WA. A freshwater lens on the Island supplies around 25% of the Island's potable water requirements, however there is limited information regarding the dynamics of the lens and its resilience to ongoing abstraction and reduced recharge. Understanding the hydrochemical processes and residence times of the groundwater is essential for making use of the system sustainable. Groundwater samples were collected quarterly from 12 production bores to obtain seasonal information and from 15 monitoring bores biannually to monitor the mixing zone. Rainfall samples were collected on a weekly basis. The chemical composition of water samples were analysed by ion chromatography and inductively coupled plasma-mass spectrometry, while δ18O and δ2H stable water isotopes (SWIs) were analysed by isotope ratio mass spectrometry. Tritium was analysed by liquid scintillation after being distilled and electrolytically enriched. Hydrochemical analysis shows varied water types and suggests a mixing trend between a fresh and saline end-member. Samples range in composition from fresh Ca-Na-Mg-HCO3-Cl to saline Na-Cl groundwaters with increasing electrical conductivity (EC). The mixing trend is also observed in the SWIs results, with the values becoming more enriched with increasing EC. Fresh water within the lens was found to be 'young' and recharged within the last 10 to 30 years. While the fresh groundwater beneath Rottnest Island was found to be recently recharged and is arguably a sustainable resource, the hydrochemical results highlight the importance of a long-term management strategy to ensure that the mixing zone below the freshwater lens does not increase to a point where the freshwater source is no longer viable. The declining winter rainfall in the Perth region, resulting in reduced recharge to the lens, makes the management of this resource even more essential.