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Groundwater and dependent ecosystems

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Integrated groundwater management with dependent ecosystems

title: **The ecology of a groundwater fed wetland in relation to the surrounding gravel aquifer: micro-hydrological and micro-meteorological controls on survival of an indicator specie of the whorl snail *Vertigo geyeri***

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Vertigo geyeri is a rare, tiny species of mollusc, living only in calcareous, spring fed wetlands. It is considered to be a threatened species within the territory of EU; therefore it is protected under Annex II of the EU Habitat Directive (92/43/EEC). The snail is very small and reaches 2 mm height only; therefore it has very limited movement capacity. Subsequently, in order to survive, the snail requires very specific micro-habitat conditions, which although recognized as to be “damp and humid” were largely unknown until now. This study was initiated to provide more information on the detailed micro-hydrogeological and micro-meteorological requirements for this microscopic species in order to manage their future existence within their habitats of spring-fed wetlands, which are often threatened by human activities, such as groundwater abstractions, drainage schemes, groundwater pollution, etc.

The hydrology of the of the snail’s preferred habitat was studied at a site in Ireland, at Pollardstown Fen, during an extensive research project carried out in connection with dewatering of the major gravel aquifer in Ireland. The reason for the dewatering was construction of a major road in a cutting below the water table in the local sand and gravel aquifer. There was a serious concern that dewatering operations might lead to a decline in water levels and hence a reduction in spring flows to the fen, with consequent impacts on the fen ecology, including the sensitive *V. geyeri* snail.

This paper addresses the snail’s micro-habitat, which was studied at a total of four sites around the fen margin, and then describes the relationship between the fen micro-habitat, micro-hydrology and the regional hydrogeology. The ecology of the fen and its relationship with the surrounding aquifer was studied in detail between 2002 and 2005.

The results show that high relative humidity (above 80%) and close proximity to a phreatic water surface (approximately 0.1 m below ground surface) are the most important factors for maintaining populations of the snail. A study of the groundwater inflows to the fen, involving measurements of vertical and lateral hydraulic gradients, coupled with an evaluation of soil thermodynamics and meteorological observations, suggested that the hydrological regime of the fen is sensitive to both the groundwater inflow rate and the transpiration process of the wetland vegetation. Local topography and geomorphology are important considerations when deciding on the extent of potential snail conservation areas, as the long-term viability of conservation sites is likely to be greater in areas with gentle slopes that allow seepages to emerge at lower levels, if such seepages are reduced or lost at higher elevations.

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