



Persistence of aquatic refugia between flow pulses in a dryland river system (Cooper Creek, Australia)

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ABSTRACT: In many dryland rivers with intermittent flow, relatively deep segments of the river channel serve as refugia for aquatic life during protracted intervals between flows. Semipermanent channel segments are known as waterholes in the semiarid Cooper Creek system of western Queensland. Fractional water loss by evaporation was estimated in 15 Cooper waterholes from the increase in conservative ion (Na^+ and Cl^-) concentrations and independently from evaporative fractionation of oxygen and hydrogen isotopes in water. The major solute chemistry and isotope results indicated that evaporative water loss controlled the water levels between flows and that the surface waters were effectively isolated from underlying groundwater that had a distinctive chemical and isotopic composition. Fractional water loss rates combined with stage-volume relationships for each basin showed a mean evaporative loss rate of 2.1 m yr^{-1} ; during that time (April-October 2002), pan evaporation averaged 2.5 m yr^{-1} . Site-specific extrapolation of those estimated evaporative loss rates indicated that the waterholes would dry to 10% of their bankfull volumes in 6-23 months, although those estimates were based on sampling in 2002, when pan evaporation rates were 18% higher than the long-term mean. These persistence times show the importance of occasional, irregular flow pulses in sustaining these aquatic refugia; the desiccation of waterholes could become more common if future water withdrawals reduce the frequency and intensity of river flows to the point where they occur less often than annually.

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