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Evaluation of the use of microbial measures to characterise impact of acid rock drainage on Australian rivers

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In this study, microbial phospholipid-fatty acid (PLFA) analysis, microbial carbon substrate utilisation assays (Biolog), assays for phosphatase, aminopeptidase, glucosidase, exoglucanase and DMSO reductase activity, and estimation of viable biomass using laboratory culturing, were conducted on sediment and water samples from two riverine systems to characterise impact of Acid Rock Drainage (ARD) on the ecosystem at the microbial level. The sites were Dawesley Creek/Brukunga River in South Australia, and the East Branch of the Finniss River in the far north of Australia, representing a temperate system impacted by, eutrophication and dry-land salinity, and a tropical system rehabilitated following significant degradation due to ARD.

For the Dawesley Creek/Brukunga River system, multivariate (PCA and RDA) analysis of the relationship between water or sediment quality data (metals, pH, anions, conductivity) and either PLFA (Individual acids) or Biolog data indicated that the techniques were capable of demonstrating the impact of the pollution down a gradient in the river and of discriminating between sites impacted by ARD, salinity, or nutrients. Statistical agreement between all the methods (Pearson Correlation Co-efficient) was examined and phosphatase activity followed by exoglucanase gave the best correlations across the suite. Total biomass as estimated by total PLFA did not correlate except with DMSO reductase activity.

At Rum Jungle, the picture was more complex with the PCA of PLFA and sediment quality indicating more extensive impact than that obtained using water quality pa-

rameters and PLFA. Carbon substrate utilisation results (Biolog) were consistent with the latter conclusion. Comparison of the various techniques yielded best correlations between phosphatase, glucosidase and total PLFA. The results and their implications will be discussed in detail.