Sampled Methods

A total of 27 wetlands were sampled (Figure 1), including four pit lakes; a rehabilitated pit lake (NL), a satellite wetland with limited connection to NL, an old unlined small pit wetland lake (NO), and a created shallow wetland (NS). Sampling occurred in September 2007 at the time of peak water levels, in a replicated stratified design encircling each major habitat in the littoral area (<1 m deep).

At each site, a range of physicochemical parameters were measured in situ, and a composite water sample was taken. Water samples were analysed for NH 4, NO 3, N, Al, filterable reactive phosphate (FRP), total P and total N (T N), Cd, Zn and Ni concentrations (Carson et al., 1991) and the metals Ag, Au, Be, Ba, Cd, Co, Cu, Fe, Na, Mn, Ni, Sn, Sr and V. Aquatic macroinvertebrates were collected in a 250 μm mesh net (area 0.5 x 0.2 m) along a 50 m transect at each site. All macroinvertebrate samples were preserved in 80% ethonal, sorted, counted and identified under stereo microscopy.

Data Analysis

Multivariate data analyses used PRIMER v6 software (Clarke, 1993). Principal Components Analysis (PCA) was used to produce ordinations of normalised physico-chemical and nutrient, DOC, guild and metal data. An ordination of taxon abundance data was completed using a (log+1) transformation (Faith et al., 1987) and the Bray-Curtis dissimilarity matrix (Faith et al., 1987). Differences between a priori treatment groups were tested using the Analysis Of SIMilarity (ANOSIM) (Clarke, 1993).

Results

A total of 27 wetlands were sampled (Figure 1), including four pit lakes; a rehabilitated pit lake (NL), a satellite wetland with limited connection to NL, an old unlined small pit wetland lake (NO), and a created shallow wetland (NS). Sampling occurred in September 2007 at the time of peak water levels, in a replicated stratified design encircling each major habitat in the littoral area (≤1 m deep).

Macroinvertebrates were collected in a 250 μm mesh net (area 0.5 x 0.2 m) along a 50 m transect at each site. All macroinvertebrate samples were preserved in 80% ethonal, sorted, counted and identified under stereo microscopy.

Data Analysis

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Figure 1. Location of Kiemerton Silk Sand Mine and wetlands sampled.

Figure 2. PCA of nutrients, glucose, Cl and SO 4 for all wetlands PC1 45.7%, PC2 23.4%.

Figure 3. Mean aquatic macroinvertebrate abundance and taxa richness per transect in Kiemerton wetlands.

Figure 4. nMDS of natural and new pit lake wetland macroinvertebrate assemblages.

Conclusions

KiS natural wetlands were oligotrophic and had high aquatic macroinvertebrate biodiversity. The small test pit lake (NL) was discoloured to NL, presumably due to nutrient input rather than groundwater influx. The satellite waterbody (NO) around NL were more physiologically similar to NL and had slightly higher macroinvertebrate taxa richness compared to pit lake NL. This suggests that greater shallowness areas and/or more riparian vegetation would develop as complete macroinvertebrate assemblages to be more representative of natural wetlands. The newly created wetland site NL had similar taxa richness to natural wetlands, indicating the importance of bathymetry. Higher taxa richness and macroinvertebrate assemblage richness of new pit lakes were all significantly different to the natural wetlands. Pit lake NL intercepted deeper and warmer/more alkaline than wetlands, except wetland 5. The permanence and depth of pit lake NL, as well as distinctive features ensuring that its water quality will always be different to the natural wetlands. Pit lake NL is only a test site created in its infancy to ascertain natural wetland vegetation and suitable for many macroinvertebrates, limiting their abundance and diversity.

The new pit lake wetlands habitat appear to be on a water quality and ecological trajectory to representativeness of regional wetlands. However, it appears that physical structure is one of the most important determining factors influencing the development of representative aquatic macroinvertebrate taxa. Pit lake NL is relatively new and it is anticipated that with enhanced riparian vegetation the lakes will continue to increase in diversity and abundance. Due to its permanence and depth, Pit lake NL will likely never be representative of a natural regional wetland; however, it can still contribute significantly to regional aquatic ecosystem values that are currently severely threatened on the SCF.

References


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