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Zambian Macrophyte Trophic Ranking scheme (ZMTR): assessing the trophic status of tropical southern African rivers

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A new river bioassessment scheme to indicate the trophic status of tropical southern African river systems was developed using newly collected data from macrophyte and water chemistry surveys, conducted during 2006 – 2012. 271 samples were collected from 228 sites in Zambian rivers and associated floodplain waterbodies, mainly located in the five freshwater ecoregions of the world which are primarily represented in Zambia. A typology based on these ecoregions, and three categories of stream order (standing waters; small streams; larger streams and rivers) was set up to structure the data and determine reference conditions for PO₄-P. The biomonitoring protocols for the Zambian Macrophyte Trophic Ranking system (ZMTR) were based on schemes used in non-tropical parts of the world, particularly the UK and South Africa, but recalibrated and adapted to reflect tropical conditions and include tropical macrophyte species. Zambian Trophic Ranking Scores (ZTRS-sp) were calculated for each of 225 macrophyte species recorded in the survey, using a quantitative procedure based on relative occurrence of each species in six end sample-groups, of differing mean orthophosphate status, produced by TWINSPAN classification of the dataset. ZMTR-sample values were then calculated based on the occurrence of macrophyte species in each sample. The outcome suggests that the scheme predicts the (mainly mid-range) trophic status of Zambian river systems quite well but tends to underestimate high enrichment, and overestimate the trophic status of some low nutrient rivers. Case studies are presented of application of the methodology, and the potential of the method for hindcasting river trophic status in the wider geographic region is outlined.