

Use of Rapid Bio-assessment Protocol (RBP) to assess the suitability of benthic macro- invertebrates as bio-indicators of water quality monitoring in the Ja Ela canal

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Rapid Bio assessment Protocols (RBP) developed by United States Environmental Protection Agency (USEPA), are efficient and cost effective method used in many parts of the world to assess water quality and ecological health in aquatic ecosystems. This study assessed the suitability of using benthic macro-invertebrates as bio-indicators of water quality using RBP techniques in Ja-Ela canal. Five study sites to cover the total length of the stream, which are adjacent to five different land uses (reference site, agricultural land use site, industrial discharge receiving site, urban site and a rural site) were selected and sampled from April to October 2015. Variation of water pH, temperature, conductivity, total dissolved solids, dissolved oxygen concentration, salinity, secchi disk visibility, BOD₅, COD, nitrate concentration and total and dissolved phosphorus concentrations in the surface water were measured. Further, organic matter content, pH, percentage sand, silt and clay content of the sediments were measured. The sediment samples collected from the sampling sites were preserved in 5% rose bengal solution at the sites and in the laboratory. macro-benthic invertebrates were separated using wet sieving which were then identified up to the family level as much as possible. Shannon-Weiner diversity index (H'), Hilsenhoff Family Biotic index (FBI), Taxa richness (TRI), and Ephemeroptera, Plecoptera & Trichoptera (EPT) index were calculated for each site. Spatial and temporal variation of selected water and sediment quality parameters were analyzed using ANOVA followed by Tukey's pairwise comparison test. The variation of water and sediment quality parameters in five sites was assessed by Principal Component Analysis (PCA). MINITAB 14 and PRIMER 5 statistical software packages were used in the statistical analysis.

The results indicted significant spatial variations in BOD₅, COD, and total and dissolved phosphorus concentrations in the water and secchi disk visibility. Total organic carbon content in sediments also showed significant spatial variation. The PCA revealed minimum human disturbances and pollution level at the reference site while other four sites reflected different pollution levels. Further, the urban site was characterized by the physico-chemical parameters which were considered as pollution indicators, indicating high level of pollution. Significantly higher EPT index in the reference site indicated abundance of pollution sensitive invertebrate families while other indices suggested that the sites with higher level of pollution are

dominated by more pollution tolerant invertebrate taxa. The categorization of sites according to FBI was much more similar to the characterization of sites according to their water quality parameters and sediment characteristics. Significantly higher FBI was recorded from the industrial and urban sites, indicating that they are significantly polluted with higher degree of organic pollutants. The FBI indicated that the water quality of the reference site as "fair" while the other sites as "poor". This study concludes that the level of water pollution in the selected sites of the Ja-Ela canal is well reflected by RBP methods using the abundance and composition of benthic macro-invertebrates indicating possibility of using macro-invertebrates as bio-indicators.

Keywords: Rapid Bio-assessment Protocol, benthic macro-invertebrates, bio-monitoring, water quality, Ja Ela canal