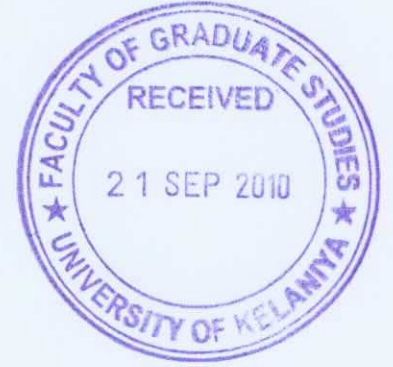# SC

Assessment of Pollution Impacts in Two Selected Water Bodies in Sri Lanka Using Multiple Biomarkers in Nile Tilapia

(*Oreochromis niloticus*)

By

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ABSTRACT

Biomarkers measured at the molecular and cellular level in fish have been proposed as sensitive "early warning" tools for biological effect measurements in environmental quality assessments. The present study was aimed at assessing the impacts of two selected water bodies in Sri Lanka with different degrees of pollution viz. Bolgoda North Lake (an urban water body) and Bathalagoda reservoir (a non urban water body) using multiple biomarker responses of Nile Tilapia (*Oreochromis niloticus*), a food fish inhabiting the water bodies. The tested biomarker responses include biliary fluorescence metabolites for Polycyclic Aromatic Hydrocarbon(PAH) exposure, hepatic Ethoxy Resorufin – O – Deethylase (EROD) activity for exposure to Aryl Hydrocarbon Receptor (AhR) agonists, Glutathion – S – Transferase (GST) activity for detoxification capacity, serum Sorbitol dehydrogenase (SDH) activity for hepatocellular damage, brain and muscle Cholinesterase activities (ChE) for neurotoxicity, formation of erythrocytic micronuclei and nuclear abnormalities for genotoxicity and histopathology for tissue damage. The present study is the first systematic long term biomonitoring programme carried out in Sri Lanka to evaluate the biological effects and impacts of aquatic pollutants.

The selected study sites of Bolgoda North Lake and Bathalagoda reservoir were visited bi monthly for a period of two years from September 2007 to July 2009, and selected environmental characteristics were monitored. Nile Tilapia samples were examined for gross abnormal conditions and multiple biomarker responses in the fish were evaluated in the laboratory using standard procedures. The samples of sediments and water from each study site were analyzed for heavy metals viz. Cu, Pb and Cd using Atomic Absorption Spectrophotometry. Results were analyzed using univariate and multivariate statistical methods.

Heavy metal analysis of water and sediment samples showed higher availability of Cu, Cd and Pb in Bolgoda North Lake than Bathalagoda reservoir. Although significant temporal variations in most of the biomarker responses in the fish collected from each study site during the study period were evident, there was no consistent seasonal pattern. Despite temporal variations, the fish collected from Bolgoda North Lake had significantly elevated biliary PAH (Naphthalene, Phenanthrene, Pyrene and B[a]Pyrene type) metabolites, hepatic EROD and GST activities, serum SDH activities, micronuclei and nuclear abnormality formation and histopathological changes in comparison with the fish collected from Bathalagoda reservoir. In addition, the fish collected from Aththidiya site of Bolgoda North Lake had significantly reduced brain and muscle ChE activities in comparison to the fish collected from Bathalagoda reservoir. Cluster analysis and Principal Component Analysis differentiated Bolgoda North Lake from Bathalagoda reservoir based on environmental characteristics and biological characteristics.

Environmental conditions prevailing in Bathalagoda reservoir do not seem to cause a greater threat to the fish populations inhabiting the reservoir. However evaluation of multiple biomarker responses of the fish revealed that the study sites of the Bolgoda North Lake is contaminated with AhR agonists including PAHs, neurotoxic, genotoxic and hepatotoxic compounds. Hence fish populations inhabiting Bolgoda North Lake are under threat due to stress caused by complex mixture of pollutants present in the Lake. Therefore immediate remedial measures should be taken to minimize the input of pollutants to the Bolgoda North Lake by the surrounding pollution sources in order to improve the health status of this valuable aquatic resource.