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RESEARCH ARTICLE

Use of liver histological alterations and erythrocytic nuclear abnormalities of two native fish species in Kelani River, Sri Lanka as biomarkers for pollution impact assessments

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Abstract: Multi-biomarker approach is recognised as a complementary tool for environmental monitoring studies to better appraise how pollutants affect ecosystems. This study examined histological alterations in the liver tissues and nuclear abnormalities in the peripheral erythrocytes of two native fish species inhabiting the Kelani River (*Etroplus suratensis* and *Dawkinsia singhala*) as 'effect biomarkers' for assessing pollution impacts. Surface water and native fish were sampled from two polluted sites in the lower reach (Kaduwela and Mattakkuliya) and a less polluted site in the upper reach (Ruwanwella) of the river covering rainy and dry periods. Physico-chemical analyses of surface water confirmed an increasing trend of pollution towards the lower reach of the river. Significantly greater liver histopathologic condition indices and erythrocytic nuclear abnormality frequencies ($p < 0.05$) were found in the fish inhabiting lower reaches of the river compared to those in the upper catchment at Ruwanwella. Biomarker responses revealed that the fish populations inhabiting the polluted sites in the river are under stress especially due to hepatic damage and genotoxicity. The results suggest that endemic and nationally threatened fish species in the riverine ecosystem may be at risk due to the contaminant stress under long term exposure. This study supports utility of erythrocyte nuclear abnormality and liver histopathological biomarker responses of native fish as cost effective tools for the identification of potential biological hazards of river pollution.

Keywords: Biomarker, *Dawkinsia singhala*, *Etroplus suratensis,* Kelani River, pollution impact assessment.

INTRODUCTION

River pollution could produce unintentional irreversible damage to the resident biota and reduce the resource values of the rivers (Pan *et al*., 2016). Kelani River, which is one of the largest water sheds in Sri Lanka, is increasingly being polluted due to urban, agricultural and industrial activities. The western region of the river, which passes through highly urbanised areas is becoming mostly polluted with industrial and urban waste. A recent study carried out to assess the surface water quality in Kelani River revealed that chemical oxygen demand levels in 90 % of the water samples were higher than the SLS drinking water quality standards (Mahagamage *et al*., 2014). The importance of monitoring biological impacts associated with river pollution has been stressed in the proposed action plan for management and conservation of the Kelani River basin (Mallawatantri *et al*., 2016).

Conventional river pollution monitoring approach focuses on a selected set of physico-chemical factors and pollutant levels. However, this approach does not completely provide information on the ecological conditions of the biota inhabiting the river (Colin *et al*., 2016). For assessing biological impacts of aquatic pollution, fish biomarker assessment is a promising

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