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RESEARCH ARTICLE

Histological alterations and polycyclic aromatic hydrocarbon exposure indicative bile fluorescence patterns in fishes from Koggala lagoon, Sri Lanka

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Abstract: The Koggala lagoon is a coastal wetland affected by a major oil spill and other anthropogenic pollution sources. In this study, gill and liver histological alterations and polycyclic aromatic hydrocarbon (PAH) exposure indicative bile fluorescence patterns of the fish species inhabiting the lagoon were examined in order to explore the potential biological impacts. Fixed wavelength fluorescence patterns in the bile of *Mugil cephalus, Lutjanus russellii* and *Etroplus suratensis* showed bioavailability of naphthalene type-, phenanthrene type-, pyrene type- and benzo(a)pyrene type- metabolites indicating recent exposure of the fishes to petrogenic and pyrogenic PAHs. Histological analysis revealed the occurrence of prominent gill and liver lesions, especially in the tissues of *M. cephalus* and *L. russellii*. Of the fish species examined, which included 43 individual fishes, the liver tissues of *M. cephalus* (two fish) and *L. russellii* (one fish) displayed foci of hepatocellular alterations with nodular hyperplasia. This is the first record on pre-tumor type hepatic lesions seen in fishes living in Sri Lankan waters. This study provides scientific evidence for the biological impacts on the resident fishes in the Koggala lagoon, and calls for further research on the impacts of coastal water pollution in Sri Lanka and potential management strategies.

Keywords: Coastal pollution, fish histology, Koggala lagoon, oil spill.

INTRODUCTION

Lagoons and estuaries are the most vulnerable ecosystems to oil contaminations due to oil spills in the open sea. The oil slicks can drift towards the shore and further into the estuaries and lagoons (Jernelo¨v, 2010). The components in fuel oil that have been mainly associated with high health risks are the polycyclic aromatic hydrocarbons (PAHs). PAHs are a large group of organic compounds with two or more fused aromatic rings. Apart from oil spills and discharges, other anthropogenic sources of PAHs in the aquatic environment include industrial and municipal wastewater, refuse incineration and internal combustion engines. PAHs tend to be quickly adsorbed to particles and accumulate in sediments (Srogi, 2007). Studies on oil spill effects in tropical and subtropical waters indicate that there have been types of short-term effects that led to long-term damage that had not been seen in cold or temperate waters (Jernelo¨v, 2010).

Fishes are considered as indicators of environmental and ecological changes within estuaries (Whitfield & Elliott, 2002). PAHs are absorbed by fish *via* the gills, body surface and through ingestion of food and contaminated sediment. In the fish liver PAHs are rapidly transformed into more hydrophilic metabolites that are excreted mainly into the bile, thus the fish exposed to these compounds show only trace amounts of PAH in their tissues (van der Oost *et al.*, 2003). Exposure of fish to PAHs can be assessed by the presence of PAH metabolites in fish bile, where they are concentrated and stored prior to excretion. The levels of fluorescent aromatic compounds in bile detected by the fixed wavelength fluorescence (FF) technique has proven to be a simple and sensitive method for screening PAH contamination in fish, especially to discern between sites of varying PAH exposure (van der Oost *et al.*, 2003). PAHs comprise the largest class of chemical compounds known as cancer causing agents (Srogi, 2007). Depending on the chemical structure and the level of exposure, PAHs and their metabolites are putative toxic products that lead to mutagenic and/or carcinogenic effects (Srogi, 2007).

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