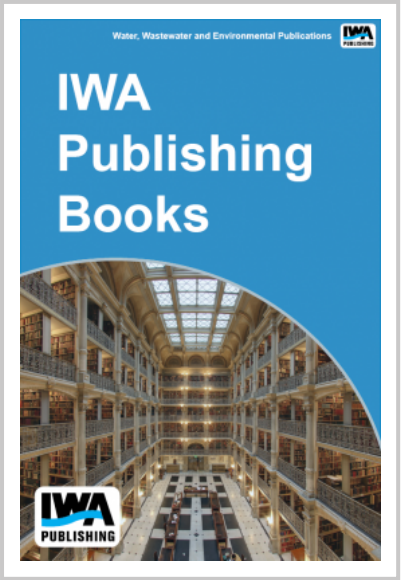
Chemical Exposure and Effects in Freshwater Aquatic Species



To protect aquatic ecosystems from stresses induced by toxic chemicals, risk models must be developed, calibrated and verified for feral populations. Although risk models require good estimates of chemical exposure (dose) and quantitative measures of effects (response), few models, if any, have been appropriately calibrated for linking dose and response in situ.

It is this lack of knowledge that limits the development of strong cause-effect relationships for aquatic species. Exposure models, using quantitative biomonitoring techniques, have been developed independently from bioassay and/or biomarker systems that are used to quantify stress.

The present research integrated these two approaches by comprehensively calibrating the brown bullhead (Ameiurus nebulosus) as an appropriate bioindicator of toxicological stress in aquatic ecosystems. This was achieved by integrating quantitative biomonitoring techniques with a novel, sensitive assay for genotoxicity of polynuclear aromatic hydrocarbons (PAHs).

Bullheads were exposed to Detroit River bottom sediment and environmentally-relevant levels of a major genotoxic PAH, benzo[a]pyrene (B[a]P), and dose-response models of metabolite formation were developed in order to determine the mass of PAH chemicals that are converted to DNA active metabolites.

Genotoxicity was assessed in these laboratory populations using the comet assay on erythrocytes and liver cells. The link between DNA damage and the down-regulation of apoptosis, which is characterized as one of the key initial steps of tumorogenesis, was assessed.

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