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BIOMARKER RESPONSES IN FISHES: A TOOL FOR MONITORING WATER QUALITY OF THE RIVER NILE



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CHAPTER 1

Water quality

Water is a key resource for our quality of life, the beings we grow and produce. It also provides natural habitats and eco-systems for plant and animal species. Access to clean water for drinking and sanitary purposes is a precondition for human health and well-being. Water is considered to be the main factor controlling the state of health and disease in man, animals and plants. According to the available statistics, 80% of all illnesses result directly from waterborne pathogens and 5 million people die each year as a result of contaminated drinking water. 2.5 billion incidents of illness are caused by contaminated water every year. The main cause of death for children under the age of five is infection from waterborne diseases (see <http://www.cdc.gov/nceh/vsp/training/videos/transcripts/water.pdf>). About, 1.2 billion people do not have access to safe drinking water. The World Health Organization predicts that by 2025, this number will increase to more than 2 billion.

Water pollution is thus a cosmopolitan problem that needs urgent attention and prevention. Water pollution resulted from many sources, e.g. accidental spillage of chemical wastes, discharge of industrial or sewage effluents, agricultural drainage, domestic wastewater and gasoline from fishery boats. The numbers of more than 100,000 chemical compounds that have already been released into the environment are increasing by 1,500 new chemicals per year (Schnurstein and Braunbeck 2001), which poses a threat to both, aquatic ecosystems and the health of human populations. Some of these chemicals are highly persistent and highly toxic. Accurately assessing the effects of aquatic pollution on freshwater ecosystems is an essential step in the development of efficient decision support tools for environmental managers (Statzner and Beche 2010). Aquatic pollution can have serious consequences for biota that may not become apparent until changes occur at the population or ecosystem level, a



point at which it may be too late to take effective countermeasures (Linde-Arias et al. 2008).

Water quality is a term used to express the suitability of water to sustain various uses or processes. Consequently, water quality can be defined by a range of variables which limit the water use. The composition of surface water is dependent on natural factors in the drainage basin and varies with seasonal differences in weather conditions and water fluctuations. Human intervention also has significant effects on water quality. The quality of water may be described in terms of the concentration of organic and inorganic material present in the water, together with certain physical characteristics. Apart from water, sediments are also responsible for pollutant transportation in aquatic environment and are considered to be the potential pollution source of toxicity for aquatic organisms. Sediments are known to capture hydrophobic chemicals pollutants entering water bodies. Therefore, ensuring a good sediment quality is crucial to maintain a healthy aquatic ecosystem, which ensures good protection of human health and aquatic life. The main elements of water quality monitoring are, therefore, on-site measurements, the collection and analysis of water and sediment samples, the study and evaluation of the analytical results, and the interpretation of the findings. The principal reason for monitoring water quality has been the need to verify whether the observed water quality is suitable for intended uses. However, monitoring has also evolved to determine trends in the quality of the aquatic environment and how the environment is affected by the release of contaminants, by other human activities, and/or by waste treatment operations.

In Egypt, water quality of the river Nile still frequently does not meet basic biological and ecotoxicological standards. Little attention has been paid to problems of aquatic pollution by anthropogenic sources in Egypt as economic and social problems have been afforded greater priority than environmental contamination. The impact in Egypt staggers and results in needless suffering



and death where the struggle for life is already difficult. Much water borne diseases were recorded in Egypt including Bilharzias, Gastroenteritis, Diarrhea, Respiratory infections and Typhoid. The number of patients diagnosed with typhoid during 2010 was 3,398. Nearly all types of Hepatitis (A, B and C) were recorded which represent the highest prevalence in world (14.7%; see www.hcvegypt.com). Kidney and liver failure and even cancer (due to DNA damage) were also recorded in higher percentages (four times higher in Egypt than in the rest of the world; see <http://allaboutegypt.org>). The water born-diseases also include reproductive and endocrine damage including interrupted sexual development, degraded immune function, and increase in some types of cancers. The Egyptian children are most at risk (every year some 17,000 children die from gastroenteritis caused by polluted water; see <http://allaboutegypt.org>).