Ecological and environmental issues have aggravated over the last two decades, threatening extensive devastation of flora and fauna in many parts of the world. The presence of heavy metals in the aquatic environment is a major concern because of their toxicity and threat to plant and animal life disturbing the natural ecological balance. The specific problem associated with the heavy metals in the environment is their accumulation through food chain and persistence in nature. In fact, heavy metal pollution and its management has been a major global concern for environmentalists due to their non-biodegradable and hazardous nature. Fish absorb metals through ingestion of water or contaminated food. Heavy metals have been shown to undergo bioaccumulation in the tissue of aquatic organisms. On consumption of fish and other aquatic organisms these metals are transferred to man. Uptake of heavy metals like zinc and copper through food chain in human being may cause various physiological disorders like hypertension, sporadic fever, nausea, renal damage, cramps etc. Other toxic responses include irritability, less appetite, damage to nervous system and kidneys, anemia and gastrointestinal problems.

The present study entitled ‘Toxicity due to copper and zinc on the freshwater fish Puntius parrah (Day, 1865)’ was carried out to examine the concentration levels of some of the heavy metals and the bioaccumulation rate of copper and zinc in organs of Puntius parrah. Toxic effects of heavy metals on organs and organ systems are a major theme in classical toxicology. The present studies revealed the toxic effects of copper and zinc on the freshwater fish Puntius parrah. The toxicity of the heavy metals copper and zinc on the fish was assessed based on standard methods and LC$_{50}$ was determined for 24, 48, 72 and 96 hours respectively by probit analysis. During the lethal toxicity study, the fish mortality increased significantly with the increase in concentration and the time of exposure to the metals. This test was significant to get the preliminary information about the toxicity of copper and zinc on the fresh water edible fish Puntius parrah. Results indicated that copper is more toxic than zinc to Puntius parrah, and compared to zinc, low levels of copper induced lethal effects to the organism.

Heavy metals are high priority pollutants because of their relatively high toxic and persistent nature in the environment. There are principally three reservoirs of metals in the aquatic environment: water, sediment and biota. In this study the distribution, concentration and bioaccumulation of...
heavy metals -Cr, Cu, Mn, Pb, Zn- on these three reservoirs were conducted to point out its tendency of bio-magnification in the food chain. Since the toxic effect of these trace metals is influenced by environmental factors such as temperature, total dissolved solids (TDS), salinity, turbidity, conductivity and pH were studied from the water and sediment samples from the five selected Sites of Periyar River in the pre-monsoon period. The analysis of physicochemical variables of water and sediment samples collected from the five selected sites of Periyar revealed that Site I (Kuzhikundam creek) has conspicuous significant differences in the various parameters analyzed. Heavy metals zinc, lead and copper were in highest concentration in water and sediment samples in Site I as compared to the other sites.

Histopathological alterations in animal tissues have been identified as meaningful indicators of cellular responses to pollutant induced stress. Histopathological alterations can be used as an indicator for the effects of various anthropogenic pollutants on organisms and are a reflection of the overall health of the entire population in the ecosystem. Photographs of the histological sections are the clear indication of the gradual and severe histopathological alterations induced by copper and zinc during the exposure period.

Heavy metals can induce considerable changes in the biochemical parameters in fish tissues. In the present study copper and zinc, due to their potential toxicity, produced biochemical changes in *Puntius parrah*, which gave the first indication of stress in this study. A decrease in the concentration of the total protein and fat in *Puntius parrah* was found to be highly significant when compared to the control samples. At the same time there is an increase in amino acids in the liver tissue of the fish. It is revealed from the present study that the influence of heavy metals copper and zinc in fish *Puntius parrah* could be of highly negative impact on the biochemical process.

The circulatory system of fish is in close association with the external environment and with every tissue. It is sensitive to foreign stimuli and reflects the homeostasis of the animal. Thus haematological studies helped to check the systemic responses during stress conditions due to copper and zinc. In this study haematological variables such as RBC, WBC, Hb, Haematocrit, MCV, MCH and MCHC of the freshwater fish, *Puntius parrah* showed significant variation at the sublethal concentration. The changes in the hematological parameters indicated that they can be used as indicators of Cu and Zn related stress in fish on exposure to elevated levels in the water.
In conclusion, the influence of heavy metal copper and zinc in fish *Puntius parrah* could have highly negative impact on the tissues as well as they induce biochemical and haematological changes. Pollution of the water bodies should be monitored regularly and by means of an integrated approach, including investigation of fish and macro invertebrates. This level of monitoring could produce sufficient information to implement better management strategies, which would reduce the present negative impacts. Study on toxicity of the heavy metals copper and zinc on the freshwater fish *Puntius parrah* revealed that it causes severe cellular damage which ends in histological, biochemical and haematological changes at its sublethal concentration. These sublethal concentrations are much lower than the permissible standards of heavy metals in water proposed by WHO, USEPA and BIS guidelines. More investigations have to be done on different aquatic organisms to confirm the impact of these heavy metals on the sustainability of the aquatic ecosystem.

Presently, we are having enormous influence on the biosphere relative to its ability to provide an appealing home for us and for valued species like fishes. It is extremely important to understand that ecotoxicological knowledge and activities are no more or less important than our industrial knowledge and activities. We have the right to clean water and an aesthetically pleasing environment, but it is degrading day by day with the developing technologies. The river water quality deterioration is seen increased in the industrial areas and the extent of contamination exceeds the limit of potability standards prescribed by BIS and WHO.

- The present practice of discharging the industrial wastes and chemical effluents and dumping of municipal wastes in the water bodies especially rivers should be stopped.
- Proper effluent treatment facilities and solid waste management techniques should be adopted
- Modern technologies should be adopted to dispose the solid and liquid wastes and industrial effluents before final disposal to check the water quality deterioration of water bodies.
- Strict legislation to be enforced to regulate further development of River water in the critical areas like Periyar.
➢ There should be an institutional set up to protect the river basins. An interdisciplinary approach using expertise from academicians, hydrologists, agronomists, farm scientists, economists, sociologists, environmentalists are to be included in this set up.

This study is an attempt to transform the chimerical state of knowledge into investigations which must slowly foster conciliation of explanatory paradigms among levels of organizations. For this the collaborative and synchronized contributions of the policy makers, planners, scientists, government organizations and common man are needed. Thus effective management strategies are to be evolved and implemented to protect our water bodies and aquatic organisms from the arms of heavy metal pollution and its toxic effects.