General Conclusion
and
Future Scopes
12. GENERAL CONCLUSIONS AND FUTURE SCOPE

In spite of important progress made in recent decades, wetlands continue to be among the world’s most threatened ecosystems. Development as expected has increased consumerism in a small section of the society, but it has degraded and depleted invaluable natural resources like wetlands. Wetlands functions, values and attributes can only be maintained if the ecological processes of wetlands are allowed to continue functioning in right direction. East Kolkata Wetlands system is a unique example of environmental protection and development and management which is in harmony with nature and the benefits are achieved at a much lower cost. Knowledge about development and environment is not enough, rather the upsurge of the common people and pushing the principles of environmental security and justice are extremely important to conserve this important Ramsar site of West Bengal.

The characterization of wastewater and pond water of East Kolkata Wetland area clearly revealed the strong influence of urban pollution on wastewater canal and fish ponds. The deterioration of water quality in canal and ponds caused irreparable loss of pond ecosystem in terms of poor fish yield, loss of biodiversity and inefficient nutrient recovery. Good quality sewage, which is a critical component for sustainable resource recovery, was practically lacking for fish pond management. The imprudent practice of watershed management and within water body management inhibited the natural purification process of the canal and carrying capacity of the ponds. Water pollutants masked by the TSS have unknown fate and sometimes actual pictures of spatial and temporal trends of the pollutants remain elusive. It is also pertinent to note that certain percentage of wastewater is utilized to manage the fish ponds but no significant improvement of water quality of this canal through fish farming was observed. The magnitude of natural purification and use of wastewater in fish pond cannot provide the environmental security to the receiving water body (Coastal zone) for maintaining its unique and inherent characteristics. The impairment of water quality may be attributed to the major barriers highlighted in this study but these barriers can easily be overcome by changing attitude (performance of individual responsibility) and awareness (policies, objectives, procedures, instructions etc.) of concerned officials including top management. No major radical change is necessary at huge financial investment. The integrated management of aquaculture, watershed and within water body management
can make this largest natural wetland ecosystem a very valuable and productive resource without threatening their sustainability. Sometimes interpretation of data creates an illusion that pollutants in wastewater canal has been gradually decreased with the distance but critical evaluation reveals that dilution of wastewater by sea water intrusion reduced the level of pollutant concentration. This study also explores an opportunity to gain a better understanding of water quality of wastewater canal and its impact on fish ponds and natural water body. The management of waste-fed aquaculture is also suffering due to lack of appropriate policies, legislation, institutional frameworks and regulations at the national and local levels. Therefore developing a national policy framework is an emergent need to facilitate safe waste-fed aquaculture based on the WHO Guidelines. On restoration of this wetland, it may be unique and largest natural ecosystem in the world that can convert the wastewater into free wealth and this framework may be a unique example in the world. The complexity of watershed management questions has remained a key issue for managing the water quality of wastewater canal.

Aquaculture in the wetlands provided food for the ever increasing population of this peri urban region of Kolkata. Though, culture of only marketable species was a major setback for the protection of the indigenous fishes that were of less market acceptability but or else ecologically important. Therefore, the best way to conserve them is to reduce commercial aquaculture. However, this can had a major socio economic set back as more than 2000 farmers and 18,000 local residents were either directly or indirectly dependent on the harvest from wetlands. Conservation programmes were thus always at a major conflict with the local people who exploit natural resources without realizing the need to protect them for future use. Thus the present study highlight how the fish faunal diversity become more prominent and even same fish species gradually became endangered and even threatened if proper conservation and management strategies were not undertaken by the appropriate authorities. The impact of our present findings has close relation with the socio-economic status of the fishermen whose livelihood more or less depended on these wetlands.

The issue of the debate between conservation of environment and economic development reveals some crucial points for consideration, the debate beyond loss of environment and in terms of livelihood perspective of the marginal poor, who depend on
natural resources. The shrinking of EKW can be seen as a process of environmental degradation that lowers the potential of production and integration of rural poor into urban economy through diversification of livelihood strategies. It is clear that people living in the wetland area and dependent on wetland for livelihood are now depending more on non-wetland-based livelihood activities and wetland becomes secondary source of income or subsistence income. The marginal people living in the wetland area or the direct users of EKW are effectively playing no role on the conversions of the wetland. They either do not have proper land rights or any role to prevent the loss of wetland. Rather, they have to struggle to integrate themselves into urban economy through the diversification of their livelihood strategy. The comparative study across three villages and across households within the villages, located in the EKW area showed that the diversified households are better off in terms of income, and other socio-economic indicators. The comparative analysis revealed that average income and per capita income are higher in those households who depend on non-wetland-based livelihood. So it can be concluded that the process of development in the EKW have uplifted the socio-economic conditions of the direct users of the wetland. Despite of the fact that conversions in EKW area provides with high income but the issue of concern remains whether this upliftment leads to inclusive growth or not since, high income inequality has been observed in the distribution of income of the three villages. Welfare is a combination of growth (measured in terms of average income) and income inequality. Since, income inequality also exists among the household who have diversified, welfare depends on the relative strength of the two factors. But this upliftment of rural poor occurs at the cost of degradation of environment which may harm the whole society in long-run. For rural marginal people, immediate concern is to meet their livelihood needs rather concerning for environment. Thus, if the wetland has to be conserved because of its international ecological importance, the society and Government should concern for it rather demanding from marginal rural poor to preserve environment at the cost of their quality of life.

The present findings highlight the toxicity of tannery effluents and its component, chromium exposed to fish and fish food organisms with their diverse nature during their acute and chronic exposure. Acute toxicity studies are among the first steps in determining the water quality requirements of fish and fish food organisms which could allow a sensitive approach to predict the potential risk of persistent contaminants like
heavy metals or in their ecological risk assessment, which is helpful in formulating the “safe levels” of such contaminants. The values of the present study may provide useful data to set up national and local water quality criteria (WQC) for various heavy metals and fly ash. Further, this study may take crucial role in the determination of the safe disposal level of them.

The behavioural responses in fish and fish food organisms are extremely sensitive to toxicants; therefore the ethological responses are the most sensitive parameters for measuring the neurotoxicity caused due to heavy metals and could provide first hand warning mechanism to the toxicant. The haematological and biochemical study shows that heavy metals pose a serious threat to the biological functions of the fish and fish food organisms during their chronic exposure. On the basis of present studies in fish and snail, it would also be possible to forecast the physiological state of the aquatic organisms in freshwater ecosystem. Further the reduction in protein contents in hepatopancreas and gonad of snails under toxic exposure can be used to develop new vistas regarding the mechanism of action of a toxicant to the mollusc body.

Molluscan haemocytes are known to play a major role in immunological defence reactions (Borges and Andrade, 2003). Circulating haemocytes represent the primary mediators of cellular defence reactions in molluscs (Van der Knaap et al., 1987). But the present study focused on the new arena of the experiment where the alteration in haemocyte count in molluscs provides valuable information for assessment of water quality exposed to heavy metal pollutants. It can also be used as biomarker for assessing health status of the organisms exposed to altered environment agreeing Gustafson et al. (2005).

So, further studies on East Kolkata Wetlands are required to a frame work for prevention of discharge of crude pollutants from different industries situated around it. Appropriate authorities both Government and non government organisations should come forward to prevent the wetlands from different pollution load to conserve its biodiversity and sustainable development through diversified farming system with the involvement of local people resulting socio-economic upliftment.