

STUDIES ON THE EFFECT OF AQUATIC POLLUTION ON ICHTHYOFAUNAL DIVERSITY OF THE EAST KOLKATA WETLANDS

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ABSTRACT

East Kolkata wetlands, an ecologically important Ramsar site in West Bengal, India include a rich floral and faunal diversity and act as kidney of Kolkata through recycling of waste water and sewage water come from Kolkata city through different canals. These sewage fed wetlands are threatened by aquatic pollution, renovation, developmental activities and large scale commercial aquaculture. These wetlands which are famous for fishery activities receive Pollutants like heavy metal, sulphate, oil, grease etc. through effluent of different industries like tannery, electroplating, plastic and dye industries of surroundings and alter the Ecosystem. Here, the organic load of city sewage and industrial effluents are used as nutrients for fish. During Ichthyofaunal survey 23 commonly cultured species and 14 wild fish species are recorded. Now few no. of fishes are in threatened condition due to aquatic pollution and economically less feasible fishes are also declined due to extensive culture of Indian Major Carp. Few indigenous fishes show severe indications of decline over the years. Now, about four fish species are endangered and eleven are vulnerable (CAMP report 2010). Declining ichthyofaunal diversity is destructive to the entire food chain of the wetland as well as the livelihood of fisher folks and the local people.

KEYWORDS: Ichthyofaunal Diversity, Wetlands, Sewage, Pollution, Industrial Effluent, Ecosystem Degradation

INTRODUCTION

East Kolkata Wetland, vast lowland is located at eastern fringes of Kolkata, West Bengal, India. East Kolkata Wetland was declared as Ramsar site on 19th August 2002 by Ramsar Convention Bureau. This Wetland stretches its area from South 24 Parganas to North 24 Parganas district, adjacent to eastern edges of Kolkata. East Kolkata Wetland is very significant for use of sewage water, mainly in pisciculture, irrigation, for wastewater aquaculture and harboring the biological diversity. About 600 million litre of sewage and waste water is being discharged daily in this wetland. Besides, it also receives more than 2500 tons of garbage. This wetland acts as natural sink to solid and soluble wastes which are generated by twelve million inhabitants of the city, Kolkata. This unique system where treatment of the sewage is done, then allowed for pisciculture. This wetland is also important for its fishery activity and is now producing about 13000 tons of fish per year. This aquatic ecosystem receives toxic and hazardous substances like heavy metals (Cu, Cr, Pb etc.), sulphate, oil, grease etc through industrial effluents from tanneries and related industries, battery industry, small electro plating, metal handicraft industries situated around the wetland. Agricultural land is also present around the wetland. Wetland includes many biological resources that maintain the ecological equilibrium of the system. Productivity

and food chain, bio-geo-chemical cycle, water purification, and maintaining of oxygen- carbon dioxide budget are the main roles of the wetland. Different industrial effluents especially tannery effluent is considered as the main source of aquatic pollution. Considering the above, a survey based work was undertaken to evaluate the pollution load in the wetland. Different water quality parameters were measured in different points of the wetland area. Our work also focused on the biodiversity declination in this area especially how ichthyofauna of the wetland faced problems due to aquatic pollution was also measured.

East Kolkata Wetland – at a Glance

- State - West Bengal
- District - Kolkata
- Co-Ordinates - 22^o 25' to 22^o 40' N and 88^o 20' to 88^o 35' E
- Area - 12741 hectare
- Ownership - Govt of West Bengal and Private.
- Declared as Ramsar Wetland - 19th AUG 2002
- Area - 12,741 hectares (Source: State Govt. report.)
- Ramsar criteria - 1
- Ramsar wetland type - O (Permanent fresh water bodies)
- Number of Bheries - 264

Different Land Use Classes in East Kolkata Wetland

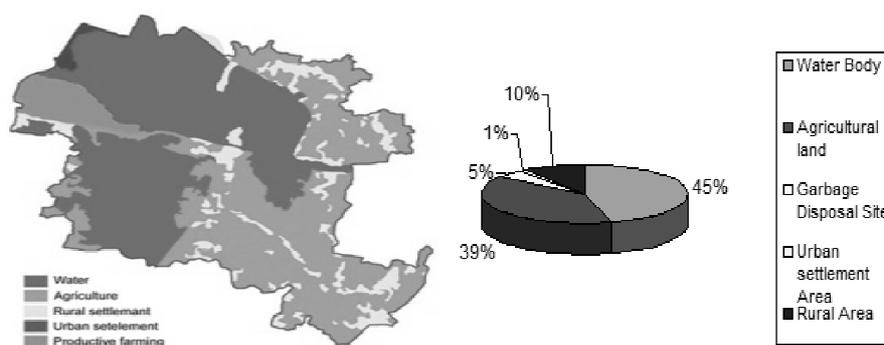


Figure 1: Different Land Use Patterns in East Kolkata Wetland Area

Floral and Faunal Diversity of East Kolkata Wetland

Flora

Mainly some floating macrophytes dominate in the sewage fed ponds. Some emergent macrophytes also present at the edge of wetlands which are not used for fishery. From the East Kolkata Wetland 38 species of dicot from 19 families, 62 species of monocot from 12 families, 3 species of fern from 3 families of aquatic plants are recorded. (Majumder 1965). Among planktonic diversity *Anabena sp*, *Microcystis sp*, *Closterium sp*, *Diatoma sp*, *Ocellatoria sp*,

Phytoconis sp, *Microcystis sp*, *Navicula sp*, *Syndera sp* are dominant. Among aquatic Macrophytes *Eichhornia sp*, *Lemna sp*, *Marsilea sp*, *Ipomoea sp*, *Azolla sp*, *Hydrilla sp*, *Pistia sp* are dominant. (State Government Report, 2004).

Fauna

14 aquatic, 12 semi aquatic, 11 species of non aquatic birds, 6 aquatic and 4 semi aquatic species of reptiles, 6 species of amphibian, 40 species of fish, 20 species of mollusk, 26 species of insects were recorded by De *et.al.*, (1989). Among zooplankton rotifers like *Filinia sp*, *Brachionus sp* and *Keratella sp*, cladocera like *Moina sp* and *Macrothrix sp*; copepoda like *Mesocyclops sp*, *Cypris sp* etc are dominant. Among benthic fauna 8 gastropod species and 2 bivalvia are common in distribution. Common gastropods are *Bellamyia sp*, *Pila sp*, *Thiara sp*, *Lymnea sp*, *Indoplanorbis sp* and *Lamellidens sp* is dominant bivalve in this wetlands. 4 fresh water crustacean are dominant in this wetland.

They are *Macrobrachium lamacaei*, *M. rude*, *M. malacomi* (pukure chingri), *Sartoriana spinigera* (Telo kakra) (State Government Report 2004). Survey result reveals that 37 species of fishes are recorded among which 14 species are commonly cultured and 23 species are wild species. Among cultured species *Catla catla*, *Labeo rohita*, *Cirrrhinus mrigala*, *Oreochromis mossambica*, *O. nilontica* are dominant. Among wild species *Aplocheilus panchax* is most common in this wetland.

MATERIALS AND METHODS

- Survey base analysis have done around East Kolkata Wetland (EKW) to locate different industries situated around the EKW and how the effluent discharged into the aquatic body and hamper the aquatic life of the wetland.
- The various fishponds were surveyed and fish species were identified. A detailed survey of fish species of the East Kolkata Wetlands were done to record the number and abundance of each species for a period of two years.
- Survey has done in the fish markets around the wetland area. The listed markets were Kasba, Chingrighata, Anandapur. A survey has also done on the fish availability in the major fish landing points of Chowbaga and Bantala.
- During this survey base study different zooplankton and mollusks are collected to identify them from four sites i. Topsisia, ii. Chowbaga, iii. Bantala and water is collected from the different wetland of this area and water quality parameters are measured in our laboratory following the standard methods of APHA (1998)

RESULTS AND DISCUSSIONS

East Kolkata Wetland acts as a natural sink of waste water and sludge. Huge amount of sewage and wastewater is being discharged daily in it. It also receives large amount of garbage. Other than this a huge load of heavy metal released from different industries. The vast population play role to the generation of hazardous pollutant like sulphate arising from domestic pollution and industrial activity. This is to particular relevance to Kolkata where untreated effluents from different factories and sewage are directly discharged into the East Kolkata Wetland through Bagjola, Bhangar, Tiljala canals. The water of these canals further mixed with water from Dhapa dump through leaching, making aquatic pollution around wetlands. Therefore during survey we also found that different types of pollutants listed below Table 1 were released in EKW and pollute the whole aquatic environment.

Table 1: Different Pollutants Discharged in East Kolkata Wetland

1	Sewage and Waste Water	600 million lit/day
2	Garbage	More than 2500 tones
3	Heavy Metals	Cr, Cu, Pb, Rb Etc
4	Sulphate	—
5	Oil	—
6	Grease	—

From the above table it is found that per day 600 million litre of sewage along with waste water discharged in the canal which inurns drains into EKW. A large amount of heavy metals also released in EKW through different industrial effluents. List of heavy metals are represented in the Table 2 and List of different industries are presented in Table 3.

Table 2: Different Heavy Metals Discharged from Different Industries

Sl. No.	Name of the Heavy Metal	Name of the Industries
1	Chromium (Cr)	Tannery and leather industries
2	Copper (Cu)	Metal handicraft and electroplating industries
3	Lead (Pb)	Tannery and battery manufacturing industries
4	Rubidium (Rb)	Painting and Dye industries

Table 3: Industries Located in East Kolkata Wetland Area

Sl No	Name of Industries
1	Tannery and leather industry
2	Small scale electroplating industry
3	Battery manufacturing industries
4	Metal handicraft industries
5	Motor servicing company
6	Dyeing industries
7	Printing and bleaching industries
8	Moulded rubber factory
9	Plastic footwear manufacturing company

From the table 2 it is observed that tannery industries were the most powerful resource for East Kolkata Wetland's pollution beside other industries. Chromium (Cr) comes from illegal tanneries situated around EKW which directly dump their wastes to the raw sewage canal which in turn drains into nearby bheri. Copper (Cu) comes into the wetland from small scale industries involved in electroplating and metal handicraft manufacturing at different place around East Kolkata Wetland.

Rubidium (Rb) comes mainly from mica that is disposed in the effluent is generated by paints used in glow sign. Lead (Pb) comes from the battery industries. Wastes from illegal tanneries along the Basanti highway include tannin, Pb and Cr discharged in fish pond and kills fish.

The study revealed that out of the above industries situated around EKW tannery industries are responsible most for aquatic pollution of the wetland. Other industries are also responsible more or less but it is less comparison to tannery industries. So, in our study we emphasized on the pollutional impact of tannery effluent in fish and fish food organisms. During the survey we also observed that untreated tannery effluents were also released in the water body by some tanneries though most of the tannery released treated effluent.

When untreated tannery effluents were released, fish mortality and abrupt change in water quality were found. Dead mollusk and other benthos in dyeing condition we found around the bank of the wetland. As the wetland partly

covered with the macrophytes which might be play a vital role to minimize the heavy metal pollution through absorption of pollutants as there are many reports in this line.

Condition of Water Quality Parameters Tested at Different Selected Spots of East Kolkata Wetlands

Water quality parameters were analyzed by collecting of water sample from 3 different selected spots of East Kolkata Wetland to compare the variation in different parameters as well as to certain the impact of pollutant on different water quality parameters. The spots are divided into 3 site like Site I, Site II, Site III and results are shown in the following tables.

Table 4: Test Report of Water: At Topsia (Site I)

Sl. No.	Parameters	Results
1	Dissolved oxygen(Mg/l)	4.6
2	pH	7.1
3	Total suspended solids(Mg/l)	156.40
4	BOD 3days(ppt)	240
5	COD(ppt)	345

Table 5: Test Report of Water: At Chowbaga (Site II)

Sl. No.	Parameters	Results
1	Dissolved oxygen(Mg/l)	4.0
2	Ph	7.1
3	Total suspended solids(Mg/l)	188
4	BOD 3days (ppt)	390
5	COD(ppt)	562

Table 6: Test Report of Water: At Bantala (Site III)

Sl. No.	Parameters	Results
1	Dissolved oxygen(Mg/l)	4.2
2	pH	7.1
3	Total suspended solids(Mg/l)	176
4	BOD 3days (ppt)	280
5	COD (ppt)	403

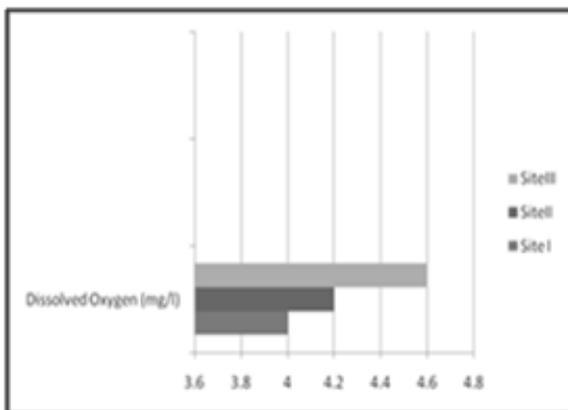


Figure 2: Dissolved Oxygen (mg/l) in 3 Spots of EKW

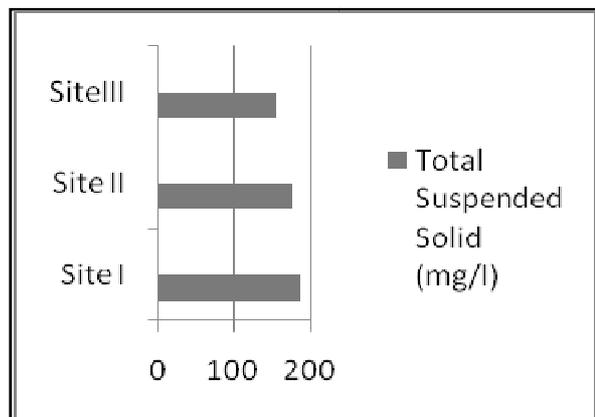


Figure 3: Total Suspended Solids (mg/l) in 3 Spots of EKW

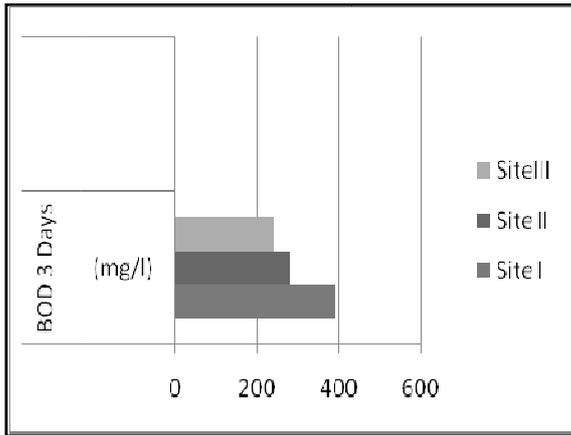


Figure 4: BOD 3 Days (mg/l) in 3 Spots of EKW

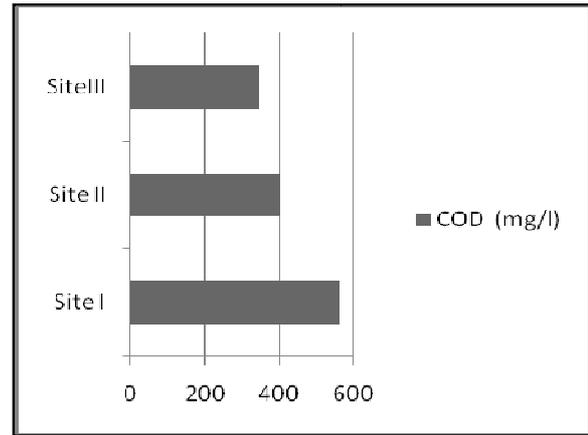


Figure 5: COD in 3 Spots of EKW

The water parameters of three spots namely, Topsia, Chowbaga, Bantala studied following variation are observed. Dissolved oxygen level is gradually increasing trend 4to4.6 mg/l from site I to site III. Total suspended solids, BOD, COD are in decreasing trend from site I to III. It might be due to more industrial effluent to the canal in site I in respect to other. It is also observed that during study sewage gate where the sludge were checked and only the liquid form are allowed to move forward.

Our study revealed that the pollution load is not minimized satisfactory. A proper treatment of effluent is extremely needed. So, the pollution load in main wetland will be minimized and the treated waste may be utilized for fish production in the vast water bodies.

List of Some Ichthyofauna of EKW with Their Conservation Status

Table 7: Important Fish Fauna of EKW with Their Conservation Status

Name	Conservation Status
• <i>Chela cachus</i> , Hamilton	Not evaluated
• <i>Salmostoma bacaila</i> , Hamilton	Lower risk least concern
• <i>Hypthalmichthys molitrix</i> , Bleeker	Abundant
• <i>Amblypharyngodon mola</i> , Bleeker	Lower risk least concern
• <i>Esomus dandricus</i> , Hamilton	Lower risk least concern
• <i>Brachydanio rerio</i> , Hamilton	Lower risk near threatened
• <i>Puntius ticto</i> , Hamilton	Lower risk near threatened
• <i>Puntius chola</i> , Hamilton	Vulnerable
• <i>Mytus vittatus</i> , Bloch	Vulnerable
• <i>Ompak pabda</i> , Hamilton	Endangered
• <i>Pangasius pangasius</i> , Valenciennes	Vulnerable
• <i>Notopterus notopterus</i> , Pallas	Threatened
• <i>Notopterus chitala</i> , Hamilton	Endangered
• <i>Channa maurulius</i> , Hamilton	Vulnerable

Our preliminary evaluation of fish fauna of the East Kolkata wetlands reveals that about seven species are exotic while 37 are endemic to this region. The local people consider forty-five species, as food fish and twenty-five are ornamental or aquarium fish. Seventeen species are cultivable while others are stocked with the incoming floodwaters from the rivers. About seven species biologically control aquatic insects or mollusk and many are of prospective medicinal value (*Heteropneustis fossilis*). Some fish are also of religious significance. The commercially cultured Indian Major Carps

(IMC) and the exotic carps generally give high market return. Among these *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala* and *Labeo kalbaus* are highly priced, Indian Major Carps while *Labeo bata* is a minor carp. However, *Labeo kalbaus* occurs rarely. *Cyprinus carpio*, *Ctenopharyngodon idella* and *Hypothalmichthys molitrix* are exotic carps that are cultured along with the Indian ones in a mixed polyculture system for effective utilization of aquatic resources. Currently, *Piranha* sp, an exotic fish has been also cultured which is an ardent predator and destructive to other species (Daniels, 2002). The local migratory fish are *Anabas* and *Mastacembelus armatus* (Devi Prasad, 2009).



Figure 6: Natural View of East Kolkata Wetland



Figure 7: Sewage Collecting Channel



Figure 8: Factories and Housing besides Wetland



Figure 9: Solid Wastes Dump beside Canal



Figure 10: Effluent Directly Discharged into Canal



Figure 11: Polluted Wetland with Industrial Effluents

CONCLUSIONS

It is concluded that this wetland area and its biodiversity is seriously affected by pollution. Declining ichthyofaunal diversity is destructive to the entire food chain of the wet land. Thus, local as well as migratory birds which were attraction of this area are in declining condition at present. Thus, Moreover, it also pessimistically affects the livelihood of fisher folk and local people. So, proper Management practices as well as precautionary measures are urgently needed.

During present study in this survey, all the vast area of East Kolkata Wetland is not covered. In order to control the pollution load certain aquatic plants can be used. A detail study in this line is under process to evaluate the effect of pollutants on fish and fish food organisms and measures for its control.

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