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A study on natural and man-made problems with some remedies of the East Kolkata wetland

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Abstract

Wetlands are the collection forms of marshes, swamps, bogs and similar areas. Wetlands are found in flat vegetated areas in depressions in landscapes and between water and dry land along the edges of streams, rivers, lakes and coastlines. These wetlands have been existing for more than one hundred years, a lasting tradition of disposal and utilization of urban waste in agricultural field and fisheries. The local people have employed a remarkable system of nature to help to meet the three basic problems of the developing countries-shortage of food, shortage of employment opportunities and shortage of funds to treat the waste. Wetlands also play a great role in flood control, treatment of waste water, reduction of sediments, productions of organic materials and control of pollution. Multistorage buildings on agricultural land, low ground water level, increased salinity in water and soil, Deforestation are the chief causes of imbalanced urban ecosystem. There are many parameters in this study. This study has analyzed the causes of environmental problems of East Kolkata Wetlands. This paper is concerned with the environmental problems of the wetlands and how its impact has changed the urban ecosystem and the urban environment. Many of the urban poor live in wetlands areas and are deprived of various basic needs. So this study proves that the environmental problems are there.

Keywords: 1. Ecosystem, 2. Employed, 3. Environment, 4. Landscape, 5. Pollution, 6. Wetland.

Objectives

The objectives of this study are manifold and encompass are the followings:

1. To know the probable causes behind the environmental problems of the East Kolkata Wetlands.
2. Study of the environmental problem of the East Kolkata Wetlands area.
3. To resolve the environmental problems of the East Kolkata Wetlands area.
4. To find the way of solving this problem and analyze the effort of government agencies.
5. To know and analyze the causes of urban disposal and garbage.
6. To identify the causes of depression from various basic needs of the East Kolkata Wetland's dwellers.
7. To know the impact of socio- economic environmental problems on the East Kolkata Wetlands.
8. To know how the East Kolkata Wetland's people are facing various types of problems.
9. To show the economical aspect of the East Kolkata Wetlands.
10. To help further study.

Methods used

The study is completely based on primary and secondary data. The observer calculates the location by G.P.S. handset and test the soil quality by soil ph kit. A household survey was carried

outs with help of a questionnaire to know about the socio-economic scenario of Chachchariya village in Hadia Mouza of East Kolkata Wetlands. The entire study has been completed through three stages i.e. pre-field, field and post field. In pre-field survey the observer collected data from the East Kolkata Wetlands Management Authority, Census Office, Fishery Department of East Kolkata and www.ekmap.com. Collected data have been represented by descriptive statistics for better understanding. The study totally depends on statistical analysis by tables, charts, and interpretations. Different types of cartograms have been used to represent the statistical data on the maps in a diagrammatic way. Mainly Pie-graphs have been used to show the distribution of house and the population. Bargraph, Cartograms etc. have also been used. The observer tabulated the primary and secondary data and prepared different types of cartograms with the help of Microsoft Word and Excel.

Database

The information and data have been collected basically from primary sources and the secondary data has been collected from various sources, which are given below...

1. The East Kolkata Wetlands Management Authority, Kolkata.
2. Report of Central Environmental Board of West Bengal.
3. Applied Economics and Statistics, Government of West Bengal (2014): District Statistical Handbook, Kolkata.
4. The Institute of Wetland Management and Ecological Design (IWMED).
5. Indian Institute of Chemical Biology (IICB).
6. Production report of P.F.C.S. under a category, South 24 Parganas.
7. District census Hand books (1951-2001), Kolkata.
8. Information of Nalban 2/1 Matsyagibi Samabay Limited, Kolkata.
9. List of old Bheris and their conversion at Salt Lake Office.
10. Information of Purba Kalikapur Matsyajibi Samabay Limited.
11. A case study of Kolkata Research papers.
12. Kolkata District Gazetteers; Kolkata, West Bengal.
13. Topographical Map Nos.79B/6 and 79B/7.
14. Fishery Department, East Kolkata Wetlands, Kolkata.
15. Few books and literature.
16. Some basic informations from internet.

Location of the study area

The study area is situated between the levee of the river Hooghly on the West and the river Kultiganga on the East, The East Kolkata Wetlands are distributed nearly equally on the two sides of the dry weather flow channel reaching the river Kultiganga to the East. The wetlands area lies approximately between latitudes $22°39' 18''$ North to $22°40'42''$ North and longitudes $88°34' 34''$ East to $88°35' 49''$ East.

Introduction

Just about 10 km from the centre of Kolkata, one of the most densely populated mega-cities of India, an amazing spectacle takes a visitor by surprise. Very large shallow ponds with sparkling water lie wrapped in a cerci silence, but the important of these Bheris (as they are known) goes far beyond their natural beauty.

Wetland areas can be found in nearly every country and climatic zone. Inland wetlands receive water from precipitation, surface water, tides and ground water. Surface water sources include run-off and storm water. Wetlands are any of an array of habitats-including marshes, bogs, swamps, estuaries and prairie potholes in which land is saturated or flooded for some part of the growing seasons.

Ramsar is a city in Iran where the first world convention on wetlands was held on 2nd February, 1971.The Ramsar convention defines 'Wetlands' as given below:

"Wetlands are area of marsh, fen, peat land or water whether natural or artificial, permanent or temporary with water that is static or flowing fresh ,brackish or salt including area of marine water the depth of which at low tide does not exceed 6 metres"(Article 1.1).

"Provides that wetlands; may in corporate riparian and coastal zones adjacent to the wetlands and islands or bodies of marine water deeper than 6 metres at low tide lying within the wetlands''.

History of east kolkata wetland

The earliest known accounts (year 1784) of the wetlands' picture show that the wetlands have marshy salt lakes teeming with fish and birds. The lakes were spread over a vast area, stretching from the vicinity of river Hooghly to about 5-6 km. to the East. The present Clive House, near Dumdum to its North is required to have been the "Sikargarh" (hunting lodge) of the Nabs. According to these early accounts, the circumference of the lakes was much, much bigger than it is at present. In the North, the edge of the lakes entrained up to the foot of a 9 m high mound known as Dumdum.

Within forty years, from the late 18th century, the edge of the lakes had receded about one and half kilometre. The loss of head water feed from the river Hooghly, the gradual deterioration of the river Bidyadhari (within the wetland area), the ever-expending city of Kolkata with its increasing demands for drainage and waste disposal led to rapid silting and reclamation of the East Kolkata wetlands. Human interventions have played a decisive role in the shrinking of the East Kolkata wetlands to their present size.

Environment of the east kolkata wetland

Wetlands are an area where soil is remained saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes and bogs among others. The water found in wetlands can be saltwater, freshwater or brackish.

The East Kolkata Wetlands are a complex of natural and man-made wetlands lying in the East of the city of Kolkata, West Bengal, India. The wetlands cover 125 square km. and include salt marshes and salt meadows, as well as sewage farms and settling ponds. The wetlands are used to clean Kolkata and the nutrients contained in the wastewater sustain fish farms and agriculture.

Each hectare of a shallow water-body can remove about 273 Kg. of Bio-Chemical   Oxygen Demand (BOD) per day. In winter, the sky clearance factor is satisfactory (about 90 percent) for carrying out bio-chemical activities in water purification. The hot monsoon climate of the East Kolkata wetlands is largely governed by the Himalayan Mountains to the North, the Meghalaya plateau to the North-East and the proximity to the Bay of Bengal.

Being located almost within a degree of the East Kolkata wetlands broadly resemble that of Kolkata which is located almost within a degree of the tropic of cancer is at the limit of the Torrid Zone.

Component and type of the wetland

The wetlands have 3 basic components like (i) ground water, (ii) Hydria soils and (iii) specialised vegetation.

There are different types of wetlands found throughout Kolkata. All the wetlands have common characteristics, yet each is unique in their hydrology and bio-diversity. The main types are Bogs, Marshes, Swamps, Riparian and Fen.

Characteristics of the wetland

i) The soil must remain water logged or submerged for the whole or part of the year. The wetland biota depends upon this water logging submergence for at least part of their life cycle.

ii) India has a varied terrain and climate that support a rich diversity of inland and coastal wetland habitats make a unique ecosystem. The coastal wetlands also hold rainwater and sediments which act as filters thereby protecting and purifying sources of drinking water.

iii) Wetlands have the dual capacity of being water providers and water users being critical components of water cycle that delivers the fresh water, the wetlands need some anilities of water the wetlands need some qualities of water to keep their functions in perfect order.

iv) Wetlands and water play an important role in the livelihood security of the rural poor. Globalizations have prevented rural poors for developing trading initiatives to market promoting sustainable trade in wetlands products in a way to alleviate poverty and conserve wetlands.

v) Wetlands are covered by shallow water bodies in which water keeps up for most part of the year and recedes below the surface level during the dry season. These are complex hydrological and bio-geo-chemical system and have been recognised as distinctly separate ecosystems between the terrestrial and aquatic ones.

vi) Wetlands provides suitable habitats for fish, winter ensures a variety of birds for shelter and feeding. Being a very good source of food fodder and other important biological product also harbour a vast array of animals, birds, reptiles, fish and other lower fallow all of which are of great economic, bio-aesthetic and specific scientific importance.

vii) Wetlands also play a great role in flood control, treatment of waste water, reduction of sediments, productions of organic materials and control of pollution.

Table no. - 01
Wetland or ramsar sites in india

Si.No	Indian ramsar sites	Name of the state	Effective from date	Area in hectre
1	Ashtamudi wetland	Kerala	19/08/2002	61400
2	Bhitarkanika mangroves	Orrisa	19/08/2002	65000
3	Bhog wetland	Madhya pradesh	19/08/2002	3201
4	Chandertal wetland	Himachal pradesh	08/11/2005	49
5	Chika lake	Orrisa	01/10/1981	116500
6	Deepor beel	Assam	19/08/2002	4000
7	East kolkata wetland	West bengal	19/08/2002	12500
8	Harike lake	Punjab	23/03/1990	4100

9	Hokera wetland	Jammu&kashmir	08/11/2005	1375
10	Kanjli	Punjab	22/01/2002	183
11	Keoladeo national park	Rajasthan	01/10/1981	2873
12	Kolleru lake	Andhra pradesh	19/08/2002	90100
13	Loktak lake	Monipur	23/03/1990	26600
14	Point calimere wild life and birds sanctuary	Tamil nadu	19/08/2002	38500
15	Pong dam lake	Himachal pradesh	19/08/2002	15662
16	Renuka wetland	Himachal pradesh	08/11/2005	20
17	Ropar	Punjab	22/01/2002	1365
18	Rudrasagar lake	Tripura	08/11/2005	240
19	Sambhar lake	Rajashthan	23/03/1990	24000
20	Sasthamkotta lake	Kerala	19/08/2002	373
21	Surinsar-mansar lakes	Jammu& kashmir	08/11/2005	350
22	Tsomoriri	Jammu- kashmir	19/08/2002	12000
23	Upper ganga river	Uttar pradesh	08/11/2005	26590
24	Vembanad-kol wetland	Kerala	19/08/2002	151250
25	Ullar lake	Jammu-kashmir	23/03/1990	18900

Regional classification of indian wetland

According to regional classification, Indian wetlands basically are of five types-Himalayan wetland, Central Himalayan wetland, Eastern Himalayan wetland, Indo-Gangetic wetland and Coastal wetland.

The East Kolkata Wetland is under coastal wetland type.
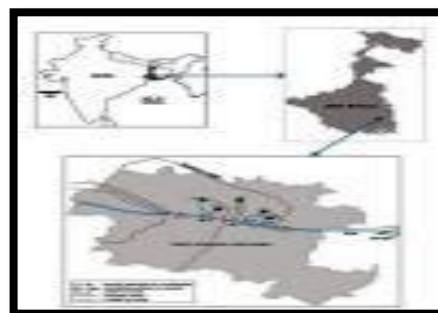
A. Natural problems with some remedies

1. Topography and drainage problem

Topography of the region is flat as the wetland is located in flood plain areas of rivers. Elevation is not more than 8 metres above mean sea level. The river Hooghly enriches the Southern part of the wetland region. River Bhagirathi is distributaries of the parent river Ganges. The river banks area is in relatively higher elevation, the ground slopping of the area is down gradually to the East and West sides. The area has a reserve groundwater available at a depth of as low as 3 metres from the natural water level in all over the area.

Photo plate no. - 03   **photo plate no. - 04**

(The East Kolkata Wetland is a part of the mature delta of the river Ganga and the wetlands are the 'inter distributaries' marshes in the delta.)

The East Kolkata wetlands area is within the South Bengal ecotone. This region is a part of the mature delta of the river Ganga and the wetlands are the 'inter distributaries' marshes in the delta (Ghosh and Sen,1987).The city of Kolkata grew on the levee of river Hooghly. Riverbanks are always raised first to allow human settlement and for productive activities.

The process of land formation in this region has largely been influenced through centuries by the Ganga river system where upland and tidal depositions continue to create land. This pattern of delta building itself has also undergone significant changes on account of natural and man-made reasons. The tributaries, distributaries and re-distributaries of the river Ganga were once active in this area. In the early 15th century, the river Ganga changed its main course from the river Bhagirathi to the river Padma. This Eastward shift in the course of the main flow of the river Ganga brought metamorphic changes in the process of the delta building in central and South Bengal.

A number of distributaries and re-distributaries were cut off from upland flow, resulting decay. Thus while some of them were still building up land on both sides, in between the tract, annual deposition of silt, remained comparatively depressed. With the death of the river Bidyadhari, the tidal channel that used to deposit silt in this area, the process of natural deposition and raising the level of the spill area completely stopped since the end of the nineteenth century.

This incomplete process of delta building did not allow the low-lying areas behind the river Hooghly levee. Human interference in the region further reduced the spill area and the channel beds heaved up to quicken the process of decay. In this way, the river Bidyadhari became defunct and opportunity of silt deposition in its spill areas ceased. This led to the formation of the vast saltwater marsh to the East of Kolkata between the levee of the river Hooghly on the West and the river kultiganga on the East.

The mouths of some of the streams opened directly into the Bay of Bengal and were influenced by tidal action, which accounted for the tides and salinity of these salt water lakes, originally spill reservoirs of the tidal river Bidyadhari (Ghosh and Sen, 1987).The land, in general slopes to the East and South-East, with the natural drainage in those direction. The gradient is, however, practically imperceptible. As obtained from the records of the nineteenth century, the gradient of the land from the bank of the river Hooghly to the salty lakes was about 0^0 to 2^0 and distance of the margin of the lakes was 3 kilometre from circular road, Kolkata (Clarke,1865). In the delta buildings stage, the rivers had excessive loads of silt and became slow, losing their gradients, so that only the recession of tidal inflow could wash out the silt. Until 1830, the river Bidyadhari was an active delta-building tidal channel and was a navigation route from the Bay of Bengal to Kolkata.

The East Kolkata Wetlands is made of natural process but later it is changed by man. River in mature stage, make the delta and various branches of river flow in a braded condition for deposit of sand. In this situation, various wetlands are made in active delta. The East Kolkata Wetlands is one of them. These wetlands are situated in very low distance from Bay of Bengal. As a result it is a marshy land and its ground water level is near the earth surface.

2. Hot and humid climate

The hot, monsoon climate of The East Kolkata Wetlands are largely governed by the Himalayan mountains of the North, by the Meghalaya plateau to the North-East and by the proximity to the Bay of Bengal.

With some variations, temperature remains high throughout the year in three major seasons like cold, hot and rainy. On the whole the East Kolkata Wetlands has the features of a tropical region with ample sunshine and vast water regime.

Table no. - 04
Climatic data

Season	Month	Temperature(˚C)	Rainfall (mm)	Relative humidity (%)	Average wind speed (kmph.)
Cold	Mid November to February	20.6˚c to 23.2˚c	75 mm to 80 mm	67%	2.9 kmph.
Hot	March to mid June	35.4˚c to 37.15˚c	100 mm to 150 mm	64% to 79%	7 kmph.
Rainy	Mid June to mid September	30.4˚c to 33.15˚c	1200 mm to 1300mm	80% to 85%	5 kmph.

Source: Ghosh. Dhrubajyoti, Waste Water Utilization in the East Kolkata Wetland from Local Practice to Sustainable Option, Page 36-38

Temperature remains high throughout the year. The three major seasons are as follows:

Cold season: It sets in from the middle of November and lasts till the end of February. The mean temperature in December and January are 20.6^0 C and 20.2^0 C respectively with mean monthly minimum at 14.2^0 C and 13.6^0 C respectively. Total rainfall remains in-between 75 mm to 80mm in four months, indicating relative humidity around 67 percent. Average wind speed during this summer remains at about 2.9 km. / hour.

Hot season: It starts from March and lasts till mid-June with mean monthly temperature 30.65^0 C to 31.15^0 C and 30.4^0C is in the months of April, May and June. The temperature however, touches as high as 38^0 C to 40.2^0 C during this month for a few days. The lowest temperature of the season does not fall below 16.4^0 C (March). Rainfall, which occurs more frequently towards the end of this season, is associated with thunder and lightning (Northwesters), with the relative humidity varying between 64 % to 79 %, 64 percent in March and 79 percent in June. The average wind speed rises to about 7 km. / hour.

Rainy season: It begins from mid June and lasts till mid September.

3. Unconsolidate sediment and floodplain problem

Floodplain area is adjacent to a stream, composed of unconsolidated sedimentary deposits (alluvium) and subject to periodic inundation by the stream. The floodplain is caused by lateral movement of a stream and by overbank deposition.

There are large areas of land which fail to drain out the water which causes waterlogged during the monsoon. Some of them are shallow basins with wide shores. These waterlogged areas in the floodplain have almost imperceptible slopes of fringe and the shorelines fluctuate appreciably in different seasons. These seasonally flooded regimes with a few pockets of permanent water logging are some of the least productive lands. In most of such areas the local villagers can grow paddy and jute in a wetland. An interesting phenomenon of oscillation takes place with respect of crop rotation. The villagers take advantage of the receding shoreline and keep on extending the area under cropping till the whole area is again flooded, most of, if not all, the developmental efforts of these wetland regions are based on the premise that the land will have to be drained properly.

Suggested actions

- To modify the hydraulic regime
- To make the resources systemic and more efficient.
- To develop agriculture and fisheries.
- To develop specific schemes on the basis of study of existing practices.

4. High P_h Soil and high P_h Water

At the time of field investigation observer tested the soil and water samples of Chachcharia village in the East Kolkata Wetland. The findings are as follows:

Table no. - 05
Soil testing results

Soil P_h	8.2 - 8.6
Nitrate Nitrogen	45 lbs / acre as N
Ammoniac Nitrogen	25.09 - 65 lbs / acre as N
Phosphate	65 lbs / acre as P_2O_5
Organic Carbon	< 0.6 %

(Source: Primary data collected from chachcharia village)

Table no. - 06
Water testing results

Water Ph	8.0 - 9.0
Water Hardness	For water bodies 1720 - 2000 mg/l. For deep tube wells 1305 -1435 mg/l.
Alkalinity	Buffer
Dissolved Oxygen	51.5 mg/l
Suspended Solids	Low Residue

(Source: Data collected from primary survey at chachcharia village)

Table no. - 07
Turbidity measurement of water in inches

Water Body 1	7.5 inches
Water Body 2	11.5 inches

(Source: Data collected from primary survey at chachcharia village)

From the above data it can be opined that the soil is not healthy and enough to support agriculture and other types of primary activities.

5. High saline water

The National Committee on the Development of Backwards Areas has submitted their report to the Planning Commission in 1981 and identified that coastal areas are affected by salinity. The committee identified that great depth water in coastal area was saline and top 30 ft. had fresh water due to rainfall alone. The committee has appreciated the prospect of development of brackish water fisheries in mud-flats.

Over a large area in the estuarine region of West Bengal, the flooding area is about 100 acres at the Ranigachhi mouza in the district of South 24-Parganas. A big swing has taken place in using the land for brackish water fish culture independently or along with paddy cultivation. A favourable ecological condition and a lucrative export market may influence the above primary

works. Although profitable, the brackish water fisheries are not technically scientific which causes comparatively low-yielding.

Suggested actions

- To give the effect of recommendations to the National Committee for the development of backward areas in relation to coastal saline areas.
- To remove the uncertain policy over the land.
- To considered ecologically feasible brackish water fisheries.
- To oppose the deposition of silt in the wetland.

6. Lack of biodiversity

Biodiversity does not just refer to the biological variation of species and protection of the threatened ones but covers the whole spectrum of the natural environment. Biodiversity studies in The East Kolkata from the quantities study of the birds. Fin fish and mollusc and community of the East Kolkata Wetlands and the interrelationship between various physicochemical variables of the water bodies of the East Kolkata Wetlands (Ghosh and Mitra, 1997).

Wetland plants are efficient in removing nutrients from polluted water, minimise eutrophication of the aquatic habitats, otherwise, it may create oxygen depletion and cause the fish to die. There are at least 12 aquatic vascular hydrophytes in and around the East Kolkata Wetlands that are significant for their bio-filtering potential particularly with respect to BOD, COD, nitrate and phosphate level (Ghosh and Santra, 1996).

The system as a whole according to the study (Ghosh and Mitra, 1997) is one of the most biologically productive, taxonomically diverse and aesthetically celebrated system, consisting of a series of Bheris and canal system with a present floristic resource of about 104 species, it has immense value in terms of global biodiversity. The picture of floristic diversity was however different in earlier times. Biswas (1927) identified three zones of vegetation in the salt lake region. They are:

a) Vegetation of embankments and bunds were mostly dominated by Fimbristylis ferruginous, Sued maritime, Acanthus ilicifolius, Excoecaria agallocha, Avicenna official is, etc.
b) While Salt Lake proper was dominated by numerous algal floras, bushes of phragmites karaka, Algeciras magus, Typhus elephantina etc.
c) The vegetation of swamps and dry lands,were mostly dominated by oligohaline and mesohaline shrubby species and several halophytic trees like sonneratia apetala,Avicenia officialises along with quite a good number of bushy shrubs and few filamentous algae like Enteromorpha intestinally , Eprolifera etc. Dasgupta (1973) recorded 97 species belonging to 41 families of which 34 species belong to the wetland habitat. He also maintained the presence of Mangrove Flora. In course of time, these mesohaline and oligohaline wetlands have been changed to sewage fed fisheries and has resulted in shifting of aqua ting vegetation.

Significant amount of policy attention has already been given to Sundarbans for conserving its biodiversity and is being declared as one of the biosphere reserve in India. Preservation of the mangrove system is necessarily the prime objective of any programme related to this wetland ecosystem. However a new area that is now gaining significant attention is the matter related to the well being of the communities sustained by this wetland system. In many cases the conditions of living of many of such communities are sub-human. Very little research, planning, policy and

financial support has gone to these ecologically handicapped communities who in fact are the caretakers of the ecosystem which present them with hostile challenges even for a meagre survival.

Suggested actions

- Strengthening appropriate activities of preserving and restoring mangroves.
- Initiating actions to provide comprehensive assistance to the ecologically handicapped communities of Sundarbans area.
- Biodiversity studies in East Kolkata Wetlands have dealt with vascular plant diversity, some common ecological indices computed from the quantities study of the birds, fin fish and mollusc and community of the East Kolkata Wetlands and the interrelationship between various physic-chemical variables of the water bodies of the Kolkata Wetlands.

There are about hundred species of flora in and around East Kolkata Wetlands. They include Sagittarian montividensis, Cryptocoryne ciliate, Cyprus sap; Acrostic hums aurums, Ipomoea aquatic, etc. It is also the habitat of several mammals like the marsh mongoose, small Indian mongoose, palm civet and small Indian civet.
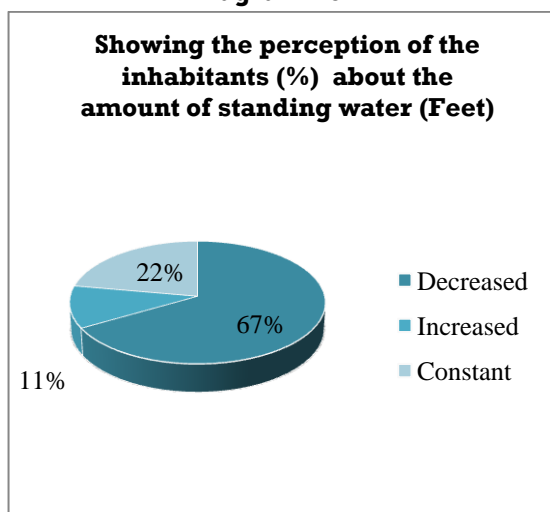
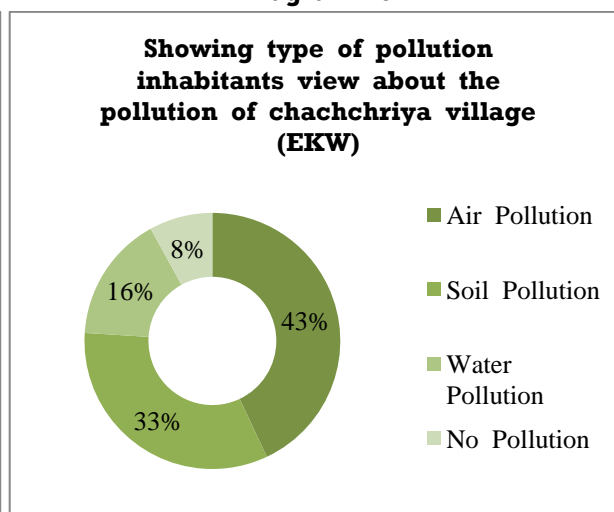### B. Man-Made problems with some remedies

1. Suspended materials

The Topsia -Tangra area has more than 900 industries of which 45 units have a water requirement of more than 3000 ltr. / a day. Types of manufacturing processes include bleaching, dying, printing, leather and allied processing, chemical products for textiles, paper and leather, moulded rubber and plastic footwear, rubber plastic tools, electric lamp etc. Total water requirement of all these industries is more than 2.5 million ltr. / a day.

Preliminary studies have been conducted in estimating metal iron depositions in five types of fish grown in the East Kolkata Wetlands at the Zoology Department, of the University of Kolkata. Initial result has shown differential depositions of metals in various locations. Quantities estimation of heavy metal deposition has revealed that the accumulation essentially takes place in the liver. More importantly, with increasing age depletion of metal deposits has been recorded. This phenomenon needs careful examination. It has also been found that biological magi fiction of heavy metals does not occur in aquatic organisms.

Diagram no. - I	Diagram no. - II

Showing the perception of the inhabitants (%) about the amount of standing water (Feet)

22% — Decreased 67%, Increased 11%, Constant

Showing type of pollution inhabitants view about the pollution of chachchriya village (EKW)

8% 16% 43% 33% — Air Pollution, Soil Pollution, Water Pollution, No Pollution

Metals are essential ingredients for carrying out physiological activities. However, for animals living in ecosystems with excessive concentration of metal iron there may be higher dose of metals deposited in the animal body. As the body's natural defence mechanism excess deposition is excreted. Metallothinein, a metal sequestering protein, is produced to drive out excess metal deposited in the body. In the present study on fish species this phenomenon of excretion has been observed. A major limitation of this study in fish toxicity is the lack of representative fish samples.

Toxicity in vegetables is being studied by the Indian Institute of Chemical Biology (IICB) and the Institute of Wetland Management and Ecological Design (IWMED).The first set of results has already come from IICB, which is continuing the study to examine the genetic damage induced by these metals.

Here also lead (Pb) along with Chromium (Cr) has shown very high levels of deposition. Closer enquiry of the first hand data can also distinguish between vegetables grown by using direct sewage and those using settled sewage. Acute toxicity studies have shown that at least three cauliflowers will have to be consumed by a human per day to invite any cause of concern. Similar results are also true for some other vegetables.

2. Discharge of sewage water and municipal wastes in east kolkata wetland

The Wetlands play a significant role in treating the sewerage and it term convert the Municipal wastes into resources and protect the river and environment from pollution and also save the people of Kolkata from water logging and other problems. Through this unique natural process, discarded waste (both solid and liquid) is transformed to produce food for our consumption, through sewage pisciculture and agriculture activities (paddy-rice, vegetables, floriculture).

Table no. - 02
Data showing discharge of sewage water

Si. No	Pumping station	Maintained by	Outflow channel	Discharge (Dry season)	Capacity
1	Palam Bazar	KMC	Town Head Cut(THC)	110 MGD	39.09 million gallons per hour.
2	Ballygunge	KMC	Strom Water Flow(SWF)	105MGD	28.8 million gallons per hour
3	Topsia	KMC	Dry Water Flow(DWF)	25 MGD	4.86 million gallons per hour
4	Dhapa	KMC	Feeder channel to town head cut Canal(THC)	22.5 MGD	10.8 million gallons per hour
5	Different small pumping stations such as Chingrighata, Paglaganga, Kulia Tangra etc.	KMC	Town Head Cut(THC)	4.8 MGD	4.58 million gallons per hour
6	Chowbhaga	IRRIGATION DEPT.	Strom water flow(SWF)	15.9 MGD	32.6 million gallons per hour.
	Total			283.2 MGD	

Source:MukherjeeMadhumitaDatta.arindam,,Mukherjee.Musfiqua,Punch.Samantha,Bunting.Stuart; Department Of Fisheries, Government of West Bengal, Kolkata, India Department of Applied Social Science, University of Stirling, Stirling, Scotland Institute of Aquaculture, University of Stirling, Scotland; female livelihood strategies in peri-urban Kolkata: nature, constraints and opportunities.

From the observer's primary survey at Chachcharia village they have come to know from the local people that recently the effluent discharge which is the backbone of fish production has a continuous decline. Large number of unauthorised Industries drains their waste water without treatment to these wetlands. Recently laid storm sewers from the city are flowing eastwards. This metal deposition declines water quality and fish production at Chachcharia village.

3. Toxic problem

In recent times, a number of studies have pointed out towards the chances of heavy metal deposits in fish and vegetables grown in this area.

Most metals are precipitated as insoluble sulphides or hydrated oxides in the anaerobic conditions of raw sewage. Although fish readily absorb metals from the water through their gills and food in their gut, they regulate the concentrations of inorganic heavy metal compounds in muscle tissues.

Table no. - 03
Concentrations of heavy metals in chachcharia fisheries of east kolkata wetland

Concentration of heavy metals (mg / kg)				
Typesof fish/Metal	Zn	Cr	Cd (0.05-1.0)	Pb (0.2)
American Ruhi Flesh	19.4	0.13	<0.1	<0.1
American Ruhi Liver	135.9	0.55	<0.1	<0.1
American Ruhi Gill	179.2	0.76	0.85	0.13
Tilapia	8.5	0.26	<0.1	<0.1
Tilapia	21.3	0.66	<0.1	<0.1
Tilapia	20.6	0.81	<0.1	<0.1
Ruhi	7.2	0.16	<0.1	<0.1
Ruhi	65	1.91	<0.1	<0.1
Ruhi	106.8	0.73	1.01	0.16

Source: Wrigley, Dr. Tim, In cooperation with Jadavpur University School of Water Resources Engineering, India: Capacity Building for the protection of the East Kolkata Wetlands-project-specific study, September 2008, p-2

Conclusion

The east kolkata wetland as a waste recycling region:

The East Kolkata Wetlands are used to recycle all the garbage and pollutants in the following manner:

   a) Fulfil substantially the requirement of fish, vegetables and food-grains in the city.
   b) Absorb the pollution form, and purify the air that the citizens breathe.
   c) Absorb and treat urban solid, sewage, wastewater, air waste generated, in the most efficient, economical and natural way.

d) Fulfil substantially the requirement of fish, vegetables and food-grains in the city.

e) Absorb the pollution from, and purify the air that the citizens breathe.

f) Absorb and pass down to downstream creeks and the sea.

g) The flood waters are checked thus provides comfort to the city dwellers.

h) Provide a habitat for a variety of flora and fauna and living organisms in wetlands.

i) Provide the food chain and waste-to-wealth recycling.

j) Maintain the micro climatic condition of the region.

k) Maintain the delicate ecological balance in a fragile environment and ecosystem.

l) Provide livelihood support for thousands of local villagers who also have the unique skill of using wastewater to grow fish and vegetables and thereby help to sustain a stable urban fringe.

This region is part of the mature delta of the river Ganga, and the wetlands are the "inter distributor" marshes in the delta. Here, the streams-which were the tributaries, distributaries and re-distributaries of the river Ganga were once active. But with the shifting of the main river, the streams became inactive and some of them even dead with consequent loss of headwaters while some of them were still building land on both sides. Between those raised tracts the land was combatively depressed, being deprived of the annual deposition of silt. The East Kolkata Wetlands are located in such a low-lying region. It was once covered with salt-water marshes. These salt-water marshes were between the river Hooghly to the West and the river Bidyadhari to the East.

The mouths of some of the streams opened into the Bay of Bengal and were influenced by tidal action, which accounted for the tides and salinity of these salt-water lakes in the East of Kolkata. These lakes were actually the spill-reservoirs of the tidal channel river Bidyadhari which opened into the Bay of Bengal through the river Matla. One of the spill channels of the river Bidyadhari, the central Lake Channel, was extended practically into the heart of the city. The East Kolkata Wetland are consists of 264 operating Fisheries / Bheris which are the most economic prosperous zone in future.

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