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ENVIRONMENTAL POLLUTION AND FISH MORTALITY AT CHALTIA BEEL, A WETLAND UNDER FISHERMEN CO-OPERATIVE SOCIETY IN MURSHIDABAD DISTRICT OF WEST BENGAL

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Author BM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author AKP supervised the work. Both authors read and approved the final manuscript.

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ABSTRACT

Anthropogenic factor is an important issue for environmrntal pollution that leads to destruction of aquatic environment. Urban and semiurban wetlands are frequently affected by the direct release of untreated municipal sewage water. It may cause large scale destruction of aquatic organisms, particularly fishes. Chaltia Beel is one of the important wetland of Murshidabad district and is located under Bhakuri Gram Panchayat, adjacent to Berhampore Municipality of the District. Untreated sewage water of the municipality is directly released to the Beel at two points. In this beel, heavy mortality of fishes has been frequently observed and on 22nd August, 2016, all fishes of the beel were died. This beel is managed by a fishermen Co-operative Society, Bhakuri Matshyajibi Samabay Samity Ltd. Now, the livelihood of 71 families of fishermen of this society is under threat. An intensive study of the water quality of this beel and pathological examination of dead fishes have been carried out and it revealed that the frequent mass mortality of fishes of this beel was due to depletion of dissolved oxygen (DO), elevated biological oxygen demand (BOD), high level of molecular ammonia and eutrophication as pathological symptoms were not found in most of the fishes. The need for the good governance to save the aquatic bodies from pollution and protection of livelihood of fishermen has also been discussed.

Keywords: Chaltia beel; environmental pollution; fish mortality; fisherman co-operative society.

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1. INTRODUCTION

Wetlands are very important for maintaining urban ecosystem. Wetlands function as kidneys of landscape due to remediation of contaminants (which include nutrients, heavy metals, etc.). These fragile ecosystems are vulnerable to even small changes in their biotic and abiotic factors. In recent years, there has been concern over the continuous degradation of wetlands due to unplanned developmental activities Ramachandra, [1]. Environmental pollution due to anthropogenic factor is an important issue that leads to destruction of aquatic environment of the wetlands Benjamin et al., Patil et al. [2,3]. Direct release of untreated municipal sewage water to the aquatic bodies is causing large scale destruction of aquatic organisms, particularly fishes. Chaltia Beel is one of the largest water body, located under Bhakuri Gram Panchayat, adjacent to Berhampore Municipality of Murshidabad District. Untreated sewage water of the municipality is directly released to the Beel at two points. Seventy one fishermen depend on this beel for their livelihood by catching and selling fish from the beel under the supervision of Bhakuri Matshyajibi Samabay Samity (BMSS) Ltd. This Fishermen Co-operative Society was one of the leading Co-operatives in Murshidabad and won Presidential Medal for their performance. In this beel, heavy mortality of fishes has been frequently observed and on 22nd August, 2016, all fishes of the beel were died. Presently, the livelihood of the fishermen depending on this beel is under threat as mass mortality of fishes due to sustained release of untreated sewage water of the adjacent Municipality significantly reduces fish production in the beel.

1.1 Objectives

The study has been made with the following three specific objectives:

1. To find out the level of water pollution of Chaltia beel due to sustained direct release of untreated sewage water of Berhampore Municipality to the Beel.
2. To find out the exact cause(s) of mass mortality of the fishes of Chaltia Beel.
3. To propose suitable recommendations to save the Chaltia Beel from pollution.

2. MATERIALS AND METHODS

2.1 Study Area

Chaltia Beel is located in Bhakuri Gram Panchayat adjacent to Berhampore Municipality of Murshidabad District of West Bengal. (Latitude: 24°4'2"N to 24°4'45"N; Longitude: 88°14'33"E to 88°15'43"E and total water area of 0.59 sq. Km./ 0.23 sq. Miles).

2.2 Study Periods

The entire study has been done within the period from August 2016 to September, 2019. Collection of water samples were made once in a month at four fixed spots.

2.3 Water Quality Analysis

Water quality analysis has been done using standard methods of Trivedi and Goel [4] and APHA [5]. Total water area was divided into four Sampling Points designated as SP1, SP2, SP3, and SP4. SP1 and SP2 were located close to two Sewage discharge

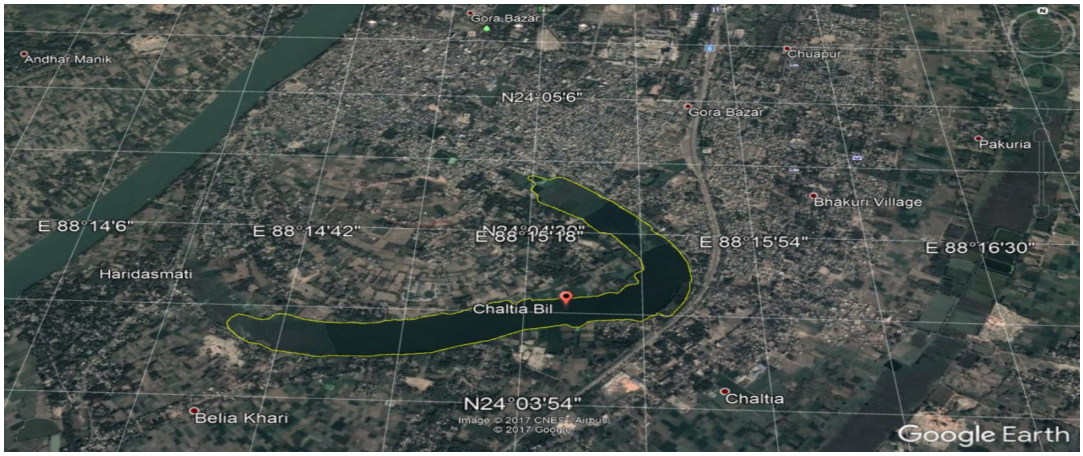

Fig. 1. Google earth image of Chaltia Beel, Berhampore, Murshidabad

Fig. 2. Photographic view of Chaltia Beel, Murshidabad

sites and SP3 and SP4 were located nearly 0.5 KM away from the sewage discharge sites. Total numbers of water samples collected and analysed were 38 X 4 = 152.

2.4 Examination of Dead Fishes

Samples of dead fishes have been collected and examined in the laboratory of Dept. of Zoology of Berhampore Girls' College. Total numbers of dead fishes examined were 200.

3. RESULTS

3.1 Water Quality Analysis

The mean values (±SD) of Water quality parameters at four different Sampling Points (designated as SP1, SP2, SP3 and SP4) throughout the period of study have been given in the following table.

3.2 Examination of Dead Fishes

Examination of dead fishes in laboratory indicates pathological symptoms in some fishes (28%). Out of the fishes with pathological signs, most of the fishes (75%) were affected by Dropsy disease as evidenced by pathological symptoms Dash et al., Sharma et al, Molnar et al., [6,7,8]. Some fishes (20%) with red spots and ulcers were found which indicate presence of Epizootic Ulcerative Syndrome Jhingran & Das, Pradhan et al. [9,10]. Fungal infection to gills Verma, Mastan, [11,12] was found in 5% of the total fishes examined. Majority of fishes (72%) were with no examinable pathological signs.

Table 1. Water quality analysis

Parameters	Sampling points			
	SP1	SP2	SP3	SP4
Temperature(°C)	27.49±4.60	27.65±4.67	28.15±4.76	28.27±4.78
pH	8.75±0.24	8. 92±0.32	7.87±0.28	7.65±0.22
Transparency (cm)	47.17±10.46	46.34±10.58	51.33±11.22	49.92±10.92
EC (µS)	456±58.10	458±65.30	510±67.24	490±62.57
TDS (mg/L)	226±45.20	248±49.32	153±47.39	146±49.20
Dissolved Oxygen (mg/L)	2.40±0.12	2.94±0.26	4.46±0.23	3.72±0.21
Free Carbon dioxide (mg/L)	10.45±0.34	10.67±0.57	10.34±0.46	10.59±0.40
Alkalinity(mg/L)	205±23.56	207±31.52	198±26.89	196±24.36
Total Hardness (mg/L)	95.67±9.30	98.72±9.71	88.45±8.18	79.32±8.91
BOD, mg O_2/L	148.46±10.67	108.76±10.72	87.34±9.05	86.78±8.92
COD, mg O_2/L	206.89±12.60	212.30±13.04	134.42±12.69	118.34±12.42
Ammonia, mg /L	5.99±1.06	6.36±1.04	4.63±0.32	4.74±0.29
Phosphate (mg/L)	6.24±0.56	7.43±0.78	3.32±0.47	3.98±0.42
Nitrate (mg/L)	4.66±0.39	4.56±0.35	2.97±0.23	2.99±0.28

Fig. 3. Direct release of untreated sewage water at Chaltia beel

Fig. 4. Accumulation of waste products at sewage water entry point

Fig. 5. Direct release of untreated sewage and municipal wastewater to Chaltia Beel (Higher Eutrophication leads to massive growth of Macrophytes)

Fig. 6. Red spots and ulcers in Diseased fishes

4. DISCUSSION

The Analysis of water quality parameters of Chaltia beel revealed that frequent mass mortality of fishes of Chaltia Beel was largely due to asphyxiation as a result of depletion of dissolved oxygen (DO), elevated biological oxygen demand (BOD), high level of molecular ammonia and eutrophication by the release of untreated sewage water of Berhampore Municipality. As majority of fishes (72%) were with no examinable pathological signs, mass mortality of fishes due to disease can be excluded. The pathological symptoms observed in fishes may be correlated with the water pollution caused by the municipality sewage. Direct sustained inflow of untreated sewage to the wetland is the violation of Water (Prevention and Control of Pollution) Act, 1974, 1977. Lack of Clean air, water and environment to the citizen violates the norms of 'Right to Water' and 'Right to Healthy Environment' guaranteed under Article 21 of the Indian Constitution. So, there is a need for Good governance in these autonomous or semi-autonomous or government organizations maintaining all norms of "The Environmental (Protection) Act, 1986".

5. RECOMMENDATIONS

1. Need to penalize the Polluter as per 'Polluter Pays Principles'

2. Setting up of STP for the treatment of Sewage before release to the Beel.
3. Bioremediation of the sewage polluted water with suitable remediation microbes, plants and animals like Bacteria, Algae, Macrophytes such as Water hyacinth, Ciliophoran protozoa etc.
4. Removal of silt and sediment near the entry point of sewage into the beel.
5. Maintenance of at least 30 meter buffer zone with riparian vegetation to enhance hydrologic regime and remediation.
6. Regular monitoring of water quality of the beel involving local educational institutions.
7. Socio-economic improvement of fishers attached to the beel and affected by the pollution, with the help of various social welfare schemes.
8. Formation of functional beel protection and management committee.

6. CONCLUSION

Wetlands are very important for urban and semi-urban ecosystems. Most of the urban and semi-urban wetlands are affected by the anthropogenic release of untreated sewage water that are very harmful for aquatic biota, particularly fishes. The large scale fish mortality was frequently observed in Chaltia beel, located adjacent to Berhampore Municipality of Murshidabad district of West Bengal. Sustained release of untreated sewage from Berhampore municipality was observed in Chaltia beel. The analysis of water quality parameters and examination of dead fishes indicated that the frequent mass mortality of fishes in the beel were largely due to asphyxiation as a result of depletion of dissolved oxygen (DO), elevated biological oxygen demand (BOD), high level of molecular ammonia and eutrophication by the release of untreated sewage water of Berhampore Municipality. The pathological symptoms observed in some dead fishes may be correlated with water pollution caused by municipal sewage water. Due to reduction in fish production, the livelihood of fishermen (working under a fishermen co-operative society called Bhakuri Matsyajibi Samabay Samity or BMSS) was under threat. Necessary recommendations have been suggested to save the aquatic life of the beel and livelihood of the fishermen depending on it. Suitable remedial measures should be taken up by the local administration as per the provisions of 'Environment Protection Act, 1986'.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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