



ORIGINAL ARTICLE

To Study the Pollution Status and Biodiversity with Reference to Physico-chemical Factors of Daryaoganj Jheel in District Kasganj

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ABSTRACT

Biodiversity and pollution status with reference to physico-chemical factors of Daryaoganj Jheel (27°35'56"N and 79°04'58"E) was studied during the period from November 2015 to October 2017. The resultant study denoted that the Jheel has rich biotic potentiality with 50 sp. Of macrophytes, 97 spp of Planktons, 85 spp. of macroinvertebrates and 60 species of local fishes. Physico-chemical studies show that the temperature of water varies between 10.30°C and 39.09°C, pH between 6.3 to 7.23, dissolved oxygen between 2.15 to 7.2 mgL⁻¹, free carbon dioxide between 2.8 to 12.05 mgL⁻¹, nitrates between 0.4 to 1.21 mgL⁻¹ and phosphates between 0.005 to 0.068 mgL⁻¹ while pH of soil varies between 5.54 to 6.58, organic carbon between 2.11 to 15.92% , potassium between 66.5 to 140.0 mg100g⁻¹, nitrate between 2.68 to 80.0 mg100g⁻¹ and available phosphorus between 3.06 to 6.52 mg100g⁻¹. Studies show the Lake is now facing ecological deuteriation due to luxuriant growth of macrophytes, siltation, sedimentation, soil erosion, anthropogeny pressure, eutrophication and poor conservation and management strategies. The present study attention has been given on remedial measures to conserve the biotic fauna of Jheel.

Key word: Hydrobiology, ecosystem, plankton, macroinvertebrates

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INTRODUCTION

A Lake is a large water body than the pond and persists for a long time due to their gradual terrestrialization caused by several ecological factors. So, they are complex and dynamic example of water body. Terrestrialization process of Lake and other aquatic ecosystem. Hence proper conservation and management strategies are essential to maintain the biodiversity of the Lake ecosystem. This study of Daryaoganj Jheel aims to establish an approach to the people to earn by the effort of research attempts. The fishes can be cultivated in this Jheel and will be attract the local tourist to beauty of this Jheel especially for migratory bird during winter season and for number of Palm tree around of the Jheel. It will be fruitful for this area local people.

Several works have been done on the conservation and management of fresh water resources but no work has been done on Daryaoganj Lake. Thus, the present study trying to analyzed effects to the remedial processes for proper conservation and management of this Jheel and its biodiversity while their pollutant status.

ABOUT THE STUDY AREA

Daryaoganj town is situated in Kasganj district of Uttar Pradesh. The Holy River Ganga passes about 12 Km away from the town. This town was part of the kingdom of Awagarh's

king. According to ancient stories at the time of Mahabharat, king Drupad of Panchal state had donated this land to Guru Dronacharya. Daryaoganj is the place where the great saint Markandeya lived ever and traces of his existence can be seen even today.

In generally, Daryaoganj is not a tourism place but a Lake known as Thana Daryaoganj Jheel situated at a long distance in great picnic spot. Every year in the month of April and September (during Navratra) the town becomes a tourist-hub as the great and auspicious fair of Shyaur fair. At present time, Daryaoganj is an emerging town as it is situated at main district highway from Soron.

Administration to develop the Lake of Daryaoganj as tourist destination in 2017. For development of this Lake, DM instructed to forest department to maintaining and prepared the main road. DM said that this area will be protected as natural Lake. There are number of palm trees and winter birds from distant countries reached here. The intention is to develop this Lake on the lines of Patna Bird Sanctuary in Jalesar area of Etah district. The Lake will be made digital at the government level in Lucknow. This year, Lake has been marked as leading lake under CAMPA scheme, Namami Ganga Scheme and Budhi Ganga Rejuvenation Scheme. Beautification work is going on here and now more facilities have increased for the beauty of this Lake.



Map: Site Map (Source: Google)

MATERIAL METHOD

The studies were carried out from November 2015 to October 2017 in Daryaoganj Jheel at Kasganj district. Monthly sampling of water, soil, Planktons, macrophytes and other biota was done. During this period, water sample collecting in plastic cans of 2-liter capacity. Physico-chemical analysis of water was done following the standard method (APHA 1989). Collection of macroplanktons and fishes were done at the time of sampling. Collected materials were preserved in 10% formalin and after that were sort out and identified in laboratory. Soil and other biota were analysed by following methods of Trivedy and Goel (1987) and Das (1989).

RESULTS

The range of the physico-chemical characteristic of Jheel water are given in table 1. The soil analysis is presented in table 2.

(A). PHYSICO-CHEMICAL PROPERTIES OF WATER:

The water of Daryaoganj Jheel is transparent, clear with odorless and maximum depth of Jheel was 2-7 metres. Other physico-chemical properties are as following-

WATER TEMPERATURE

The temperature of surface water was recorded between 10.33– 39.09^o Celcius.

pH: The water is slightly acidic to neutral in range with pH value 6.3-7.23.

DISSOLVED OXYGEN

It was recorded between 2.15-0.8mg^l⁻¹.

FREE CARBON DIOXIDE

It was recorded between 2.8 to 12.05mg^l⁻¹.

NITRATES

It was recorded between 0.4-1.21mg^l⁻¹

(B). PHYSICO-CHEMICAL PROPERTIES OF BOTTOM SOIL:

The bottom soil of Lake is loam, is very rich in humus, calcium content and muddy.

pH: The pH value of soil between 5.54-6.58.

PHOSPHOROUS

It is measured between 3.06-5.52mg100g⁻¹.

ORGANIC MATTER AND ORGANIC CARBON

Organic matter was recorded between 4.53-30.12% while organic carbon was recorded between 2.11-15.92%.

NITRATES

It was recorded between 75-255mg100g⁻¹.

TOTAL CALCIUM

It varied between 6.00-822.00mg100g⁻¹.

Thus, the level of nutrients is very high amount in soil Jheel which indicate the growth of macrophytes and associated macroinvertebrates are enormous or large in amount.

(C). BIODIVERSITY IN JHEEL:

The Jheel is very in quantity and quality of flora and fauna (as tube 3) observes biota in Jheel are as follows-

PLANKTON:

During period of study 97spp of planktons were recorded in Jheel which indicates that the Jheel suitable for profuse growth of planktons. Some species of planktons were Microporas ssp., protococussp., Euglena acus., Euglena sp., Volvox sp., Sphaerocystis sp., Chlorosarcina sp. Coelastrum sp., Pediastrum spp., Ankistrodesmus sp., Closteriopsis sp.,

Scenedesmus spp., Closterium spp., Saturastrum spp., Cosmarium spp., Spirogyra sp., Mougeotia sp., Agmenellum sp., Arthrospira, Epithemia sp., Frustulio sp., Pinnulario sp., Diffugia Oblongata, Brachionus spp., Keretella sp., Polyorthra spp., Pompholyx sp., Diaphanasoma sp., Chydorus sp., Diaptomus sp., Mesocyclops sp., Gomphospharia sp., Nostoc sp., Anabaena spp., Cylindrospermum sp., Lyngbya spp., Phormidium spp., Dialoma spp., Diatomella spp., Synedera sp., Fragilaria sp., Cymbella sp., Colonies sp., Anomoeneis sp., Stauroneis sp., Gomophoneis sp., Arcella discordes., Arcella vulgaris, Lecone sp., Lecane luma, Monostyle spp., Asplanchna spp., Filinia spp., Testudinella sp., Diaphanasoma sp., Bosmine sp., Alon asp., Cypsis sp., Cyclops spp., Mesocyclops sp..

Table 1: Monthly variation in physico-chemical properties of water of Daryaoganj Jheel (Kasganj) (November 2015 – October 2017)

	Temp. °C	pH	DO ₂ Mg/l	FCO ₂ Mg/l	Na Mg/l	K Mg/l	Ca Mg/l	Mg Mg/l	NO ₃ -N Mg/l	PO ₄ -P Mg/l
2015										
Nov.	22.75	7.23	8.23	0.00	35.52	1.42	24.24	8.68	1.21	0.020
Dec.	21.63	6.96	7.40	0.00	30.33	1.45	19.22	6.61	1.16	0.008
2016										
Jan.	10.33	6.88	7.40	0.00	29.95	1.42	25.44	9.02	0.74	0.006
Feb.	20.30	6.83	7.00	2.80	26.33	1.61	27.55	10.28	0.57	0.009
Mar.	24.23	6.85	6.58	0.00	24.34	1.65	28.90	11.53	0.64	0.015
Apr.	25.13	6.65	5.85	0.00	24.80	1.79	30.51	13.40	0.76	0.026
May	27.83	6.48	5.20	5.05	30.74	2.21	32.30	17.10	0.88	0.030
Jun.	20.93	6.30	4.23	6.60	34.60	1.78	37.55	15.47	1.13	0.030
Jul.	26.43	6.60	4.65	6.15	38.20	1.92	39.94	15.71	1.10	0.031
Aug.	25.10	7.05	6.80	7.70	35.70	1.70	35.60	116.16	0.83	0.015
Sep.	27.53	6.88	5.93	7.48	34.10	1.80	27.11	15.74	0.90	0.015
Oct.	25.40	6.63	6.60	5.40	34.60	1.77	33.60	12.96	0.80	0.009
Nov.	24.68	6.95	5.87	0.00	26.20	1.77	49.80	16.73	0.71	0.019
Dec.	20.50	6.40	4.59	4.12	28.53	1.80	73.50	21.73	0.69	0.016
2017										
Jan.	20.40	6.65	4.52	7.05	29.07	1.81	76.36	23.81	0.56	0.010
Feb.	21.75	6.62	3.52	10.40	30.66	1.83	91.62	23.27	0.54	0.006
Mar.	23.25	6.77	3.37	10.88	31.04	1.87	102.54	25.16	0.63	0.026
Apr.	24.20	6.60	3.18	12.05	33.87	1.93	105.24	26.19	0.66	0.034
May	26.95	6.65	2.85	0.00	34.64	2.00	116.24	28.19	0.75	0.054
Jun.	39.09	6.75	2.15	0.00	35.64	2.38	124.32	28.58	0.82	0.067
Jul.	27.75	6.97	4.23	8.30	24.23	1.79	84.43	14.72	0.55	0.043
Aug.	27.45	6.87	4.26	5.80	22.09	1.74	81.84	12.30	0.52	0.037
Sep.	27.73	6.95	4.35	5.32	20.47	1.56	76.24	11.33	0.47	0.027
Oct.	25.80	6.90	5.50	4.20	19.05	1.35	71.14	8.62	0.40	0.011

MACROPHYTES:

The Jheel has profoundus growth of macrophytes especially of Phragmites karka-all around in circle. Other important species are these of Azella, Ipomoea, Nechamandra, Echnornia Pistia, Nymphia, Wolfia, Hydrozoa, Dentella, Cyperus, Scripus, Eleocharis, Xanthium, Commelina, Hydrilla, Lemna, Potamogeton, Vallisneria, Rumer, Utricularia, Trapa, Euryale, Nelumbo, Solvinia, Ceralophyllum, Nitella, Najas, Chara.

MICROINVERTEBRATES:

Recorded macroinvertebrates sp. in Jheel about 85 approximately. Among Annelids sp. of Tubifex, Branchura, Limnodrilus, Dero Nais, Hirudinaria were present. Among Arthropods sp. of Paratelpusa, Macrobramchium, Cybister, Hydrophilus, Corixa, Micronecta, Anisops, Plea, Mesovela, Hydrometra, Ranatra, Laccophilus, Hyphydrus, Sandracottus, Hydrocoptus, Canthydrus, Hydraticus, Erectes. Rhantaticus, Yola, Guignotus, Orectochitus, Dineutus, Amphiops, Berosus, Enochrus, Hydrocoptus, Canthydrus, Ischnura, Baetis,

Ephemerella were recorded. Among Mollusca sp. of Bellamya, Pila, Digoniostoma, Gibba, Mytelus, Lamellidens, Lymnaea, Indoplanorbis and Gyraulus etc were recorded.

FISHES:

60 species of fresh water fishes recognized from Jheel- Cirhinus, Danis, Labeo, Oxygaster, Noemacheilus, Ompok, Wallago, Mystus, Pseudoxygastes, Puntius, Rasbora, Botia, Gudusia, Goniolosa, Notopterus, Amblypharygodon, Brilius, Catla, Chela, Aorichthys, Heterapnastus, Clarias, Xenentron, Channa, Monopteus, Chanda, Nandus, Anabas, Colisa, Glossogobius, Macrognathus, Mastacembellus and Tetradon.

BIOTIC COMMUNITY SPECIES DIVERSITY:

Species diversity value of different groups of biota in the Lake were computed and recorded between 2.001 to 4.012 (Mycrophyceae 2.485, Euglenophyceae 1.932, Total Phytoplankton 2.682, Protozoa 2.871, Rotifera 2.581, Cladocera 2.619, Copepoda 2.961, Ostracada 1.23, total Zooplankton 3.012, Annelids 2.882, Arthropods 3.122, Molluscs 3.158 and total macroinvertebrates 3.179).

Table 2: Monthly variation in physico-chemical properties of soil of Daryaoganj Jheel (Kasganj) (November, 2015 – October, 2017)

	Total Na mg/100g	Total K mg/100g	Total Ca mg/100g	Total Mg mg/100g	Nitrates mg/100g	Available Phosphorus mg/100g
2015						
Nov.	29.04	107.4	623.69	31.76	143.0	3.08
Dec.	27.06	101.9	600.00	30.25	139.0	3.06
2016						
Jan.	24.40	81.4	643.84	34.08	141.0	3.61
Feb.	23.30	81.4	643.84	34.08	141.0	3.61
Mar.	23.90	72.6	696.92	47.76	147.0	3.87
Apr.	24.7	80.4	715.39	47.76	147.0	4.24
May	25.9	94.6	741.16	55.98	148.0	4.95
Jun.	26.8	103.9	757.00	70.89	149.0	3.76
Jul.	27.4	113.7	676.04	73.69	151.0	5.52
Aug.	29.1	138.9	627.03	103.71	129.0	4.67
Sep.	28.8	120.4	712.91	124.59	75.0	4.50
Oct.	28.7	104.6	743.47	95.55	83.0	4.86
Nov.	27.8	96.7	694.64	83.52	237.0	4.58
Dec.	27.0	82.6	673.11	76.20	249.0	4.50
2017						
Jan.	26.4	76.9	649.05	69.12	255.0	4.43
Feb.	25.1	71.8	630.07	62.97	230.0	4.25
Mar.	25.0	76.8	644.58	67.60	185.0	4.44
Apr.	25.7	79.8	658.90	72.74	234.0	4.64
May	26.3	89.6	701.56	75.50	187.0	5.36
Jun.	27.4	96.4	731.90	80.76	185.0	4.95
Jul.	27.9	93.4	822.00	84.39	139.0	4.79
Aug.	26.1	91.6	693.98	69.14	137.0	4.79
Sep.	25.6	84.4	657.49	58.91	129.0	3.96
Oct.	24.9	76.3	647.80	53.39	150.0	3.84

DISCUSSION

Due to higher level of nutrients in the Lake representing large quantitatively and qualitatively biotic fauna is abundant. Higher level of calcium is coordinate with profuse growth of molluscs, while higher level of magnesium stimulates growth of macrophytes and phytoplankton in the Lake. Similar observation found in Alwara Lake of Kaushambi by Prakash *et al.* (2015). Kant and Raina (1999) stated that algae have very higher demand of magnesium for their growth. So, that algal richness in this Lake is mainly due to higher level of magnesium in Jheel water. Other than this sodium and potassium also

influence the growth of all type of plant and animals (Verma *et. al.*, 2015). Blue green algae have an unconditional regiment for sodium. On the contrary, potassium is essential for all algae studied as for, if it is absent both photosynthesis and growth are inhibited. Potassium is also essential for osmoregulation in halophytes and submerged aquatic plant (Walkar and Barbet 2015). The level of nitrate and phosphate is also suitable for the growth of plankton, macrophytes and macroinvertebrates fauna. Both nutrients are essential for the growth of primary produces. Phosphate generally plays an important role in growth of aquatic plants. In the Jheel phytoplankton dominants over zooplankton which supplies abundant food for proper growth.

Macrophytes showed spatial difference the quality and quantity. This Jheel showed a reed belt, having reed plant into Phragmites and Typha. Another belt of plants with floating leaves ex- Polamogeton, Nymphaea, Nelumba was observed. In deep water Jheel, submerged aquatic plants Chara, Nitella, Vallisneria, Myriophyllum etc also were found. Similar observations have been observed by Bhawana (2014), Hossain (2015) and Prakash (2015). The profuse growth of macrophytes in this Jheel is due to higher level of nutrients in water and soil.

Profuse growth of Phragmites karka in the Jheel is responsible for frequent drying of the Jheel as this plant has very high transpiration capacity. Raghiv *et. al.* (2015) states that Phragmites karka is responsible for early terrestrialization of the Lakes and wetlands.

Due to profuse growth of macrophytes in this Jheel resultant growth of macroinvertebrates which provide food shelter and diverse niches for thier proper growth, maintenance and reproduction.

At least, species diversity index of different biotic community has higher values indicates non polluted natural of Jheel.

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