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Evaluation of Physico-Chemical Parameters And Zooplankton Diversity Of Different Pond Water Ecosystem Of Haryana, India

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ABSTRACT

Physico-chemical character and minerals' social status is a significant features for the judgment or assessment of drinking, domestic use, industry use, farming use, etc., and water quality. There needs to be more literature on this side for pond drinking water quality and domestic use of village areas. Therefore, the present analysis was able to estimate different physicochemical parameters and a few necessary mineral deposit statuses in different drinking and useful pond water sources. These pond water sample specimens were collected and conglomerated from different pond water from different villages of Sonipat District, Haryana, India. As a result, it was examined for physicochemical parameters, namely temperature, EC, turbidity, total hardness, calcium, magnesium, chloride, DO, COD, BOD, alkalinity, chloride, phosphate, sulfate, and nitrate according to ordinary standard methods. After the analysis, we found out that if the season or climate changes, then the physicochemical parameter of water will also be changed. On another side, we found that the effects of season change be affected by the zooplankton diversity. For that reason, it can be concluded that pond water sources near the roadside and the village house area are more contaminated than the other sites. For this reason, the present conclusion indicated dissimilarity in the physicochemical parameters status of pond water of different Haryana region village pond sources.

Keywords: *BOD, COD, Dissolved oxygen, pond water*

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INTRODUCTION

Discernible freshwater or aqua is an irresistible component for people's survival and all vital breath [1]. Fresh aqua is an irresistible factor our eatable and dramatically contributes to several minerals and vitamins nutrients [2-4]. There is only more probability of lifemanship on earth with water [11]. Compulsory natural sprig of water levels fresh aqua such as lakes, streams, ponds, rivers, etc., and groundwater or mother earth water such as bore-wells and wells [9]. Mother earth water level bodies have become essential resources to comply with every kind of human and people requirements. However, unfortunately, nowadays, the freshwater quality of these freshwater estates is under severe circumjacent environmental exertion and intimidation because of several types of anthropogenic activities. The condition is exuberant and pathetic in lentic freshwater bodies. During various religious activities, anthropogenic actions such as soap, mass bathing, washing, oil, detergents, immersion of flour, and floral offerings, are also a few of the fateful causes that strike the freshwater attribute of a new aqua body. The pure fresh aqua bodies of India in the state of Haryana keep their enormous value in the precondition of the virtuous aspect, as the public of Punjab, Haryana, U.P., and other states of India also are spiritually and concerned emotionally with these fresh aqua bodies [15, 3]. Fresh aqua ponds and lacks etc., have been consumed so far as season immemorial as a stuffy origin of freshwater stockpile in India.

However, the river's fresh aqua, lakes, ponds, and wells are polluted preponderatingly or mainly reasonably to the emancipation of wastewater from the sewage outlets, motor machine oil wastes, residential areas, detergents, mixed solid wastes, fishery permissiveness, and predial pesticides from farmlands, etc. [10]. The planktons are indicated the excellent quality of the watery ecosystem [6]. Water attributes in a watery ecosystem are laid down by biological, physical, and chemical factors [11, 12]. The zooplankton belonged to the four most important groups, including Rotifera and crustacean zooplankton of Copep-oda, Ostracoda, and Cladocera. They are susceptible to ecological variation of water superiority. As a result, changes in their abundance, species composition, species diversity, and community structure

can signal environmental change or disturbance [8]. To grip a better or preferable flick of freshwater called WQI (water quality index). WQI can be called "a rating reflecting the composite impact or influence of new freshwater quality parameters on the overall or collective quality of freshwater" [5, 15, 16].
This research article aims to evaluate the physicochemical parameters of the different aqua sources and observation of the present study is to investigate seasonal variation in species composition, species richness, the population density of zooplankton, species diversity, and consistency of zooplankton from the four perennial ponds.

MATERIAL AND METHODS

Study area/ Collection of pond water samples

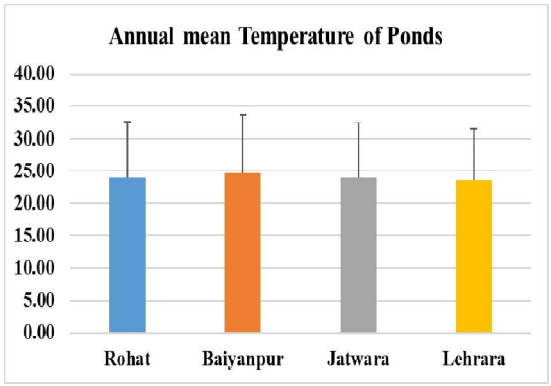
The research study was conducted at different ponds in Rohat village, Baiyanapur village, Lehrara village, and Jatwara village, Sonipat district, Haryana, India. All the ponds A, B, C, and D villages are now a hardly few kilometers (Km) away from Sonipat city. In the summer, rainy, and winter season, domestic animals like cow, buffalo, etc. is fully dependent on these pond systems. Different altitudes, latitudes, and longitude of all the sampling sites/places were recorded by GPS, and the sampling location map was made by the Google Earth software.

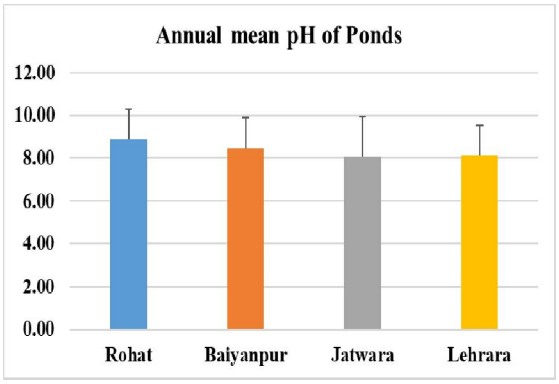
Analysis of physico-chemical parameters and zooplankton diversity

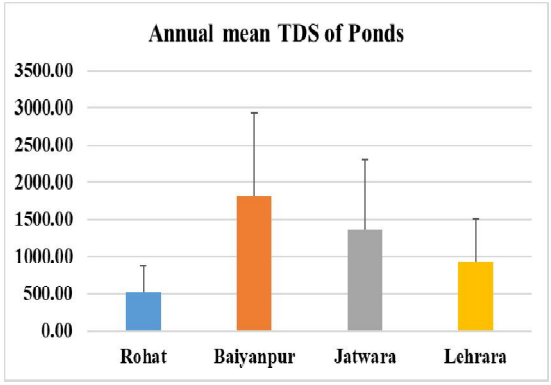
All the water samples were analyzed for temperature, EC, turbidity, TDS, tottle hardness, calcium, magnesium, DO, COD, BOD, alkalinity, chloride, phosphate, sulfate, and nitrate of pond water as per standard procedures used for water analysis [2] and Pond water samples Zooplanktons will be identified following [8, 17]. Zooplankton count will be done using Sedgwick Rafter plankton counting cell as mentioned in APHA, [2]. The plankton samples were collected and preserved with 4% formalin. Zooplankton species identification was done with the help of standard references. The quantitative analysis of planktonic organisms was carried out using Sedgwick Rafter plankton counting cells.

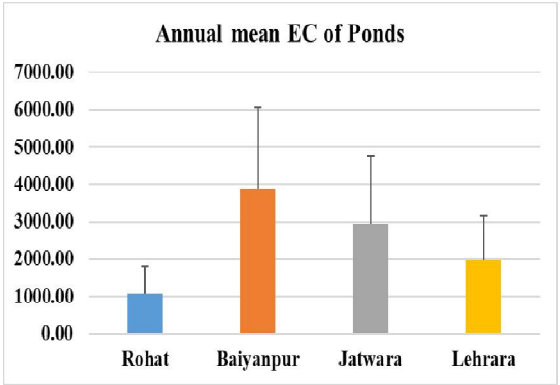
RESULTS AND DISCUSSION:

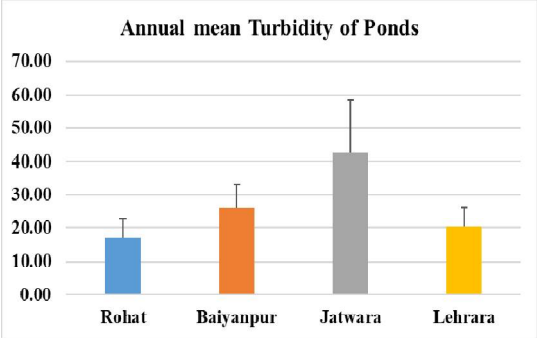
The physico-chemical parameters figure 1 and zooplankton diversity Table 1 shows the effect of the climate and season change on the pond water quality attributes. The Season changes affect soil moisture, river flows, evaporation rates, lake levels, and Pond levels also. Some physico-chemical parameters of pond water analysis show in figure 1.

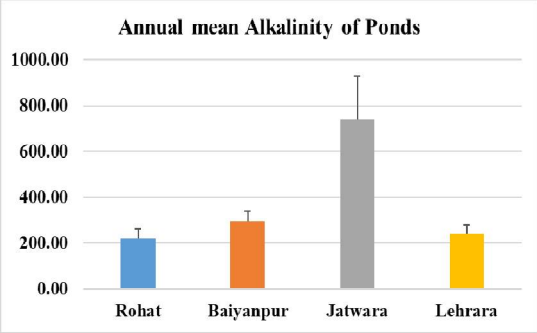


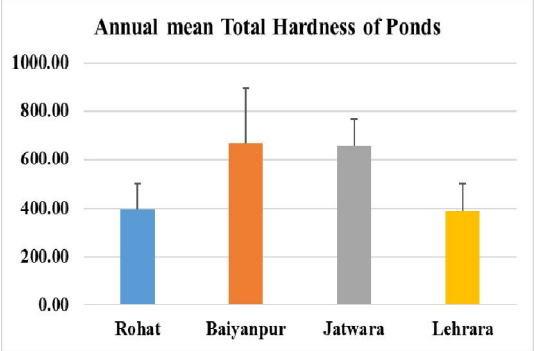


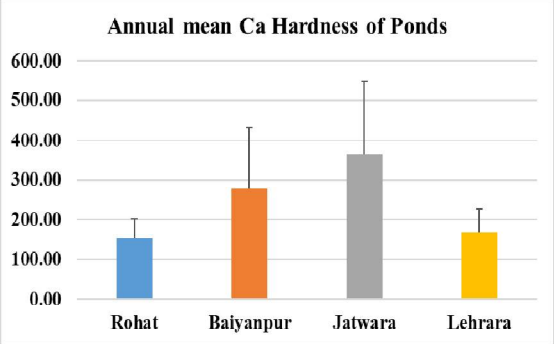


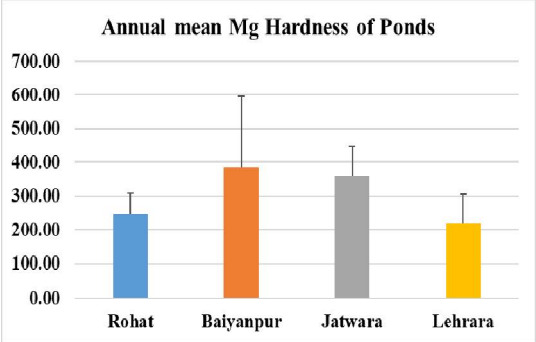


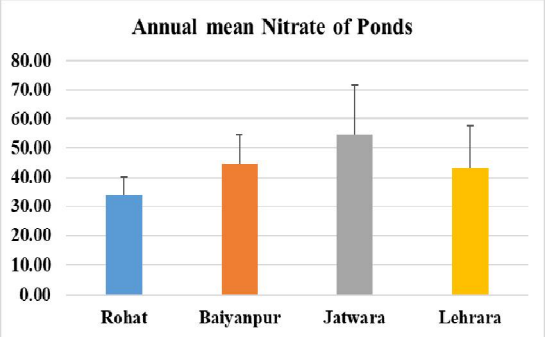

Annual mean Turbidity of Ponds
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Rohat
Baiyanpur
Jatwara
Lehrara

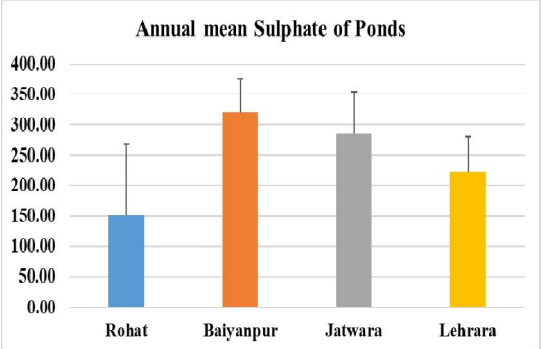

Annual mean Alkalinity of Ponds
1000.00
800.00
600.00
400.00
200.00
0.00
Rohat
Baiyanpur
Jatwara
Lehrara

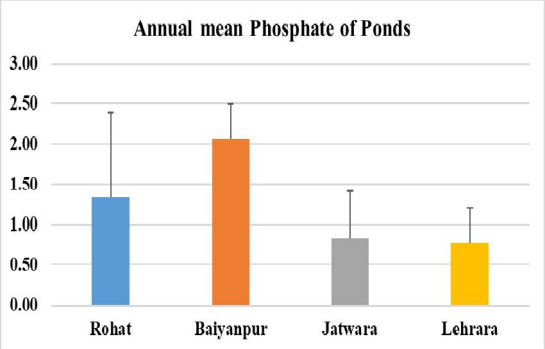

Annual mean Total Hardness of Ponds
1000.00
800.00
600.00
400.00
200.00
0.00
Rohat
Baiyanpur
Jatwara
Lehrara


Annual mean Ca Hardness of Ponds
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Rohat
Baiyanpur
Jatwara
Lehrara


Annual mean Mg Hardness of Ponds
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Rohat
Baiyanpur
Jatwara
Lehrara


Annual mean Nitrate of Ponds
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Rohat
Baiyanpur
Jatwara
Lehrara


Annual mean Sulphate of Ponds
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Rohat
Baiyanpur
Jatwara
Lehrara


Annual mean Phosphate of Ponds
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Rohat
Baiyanpur
Jatwara
Lehrara

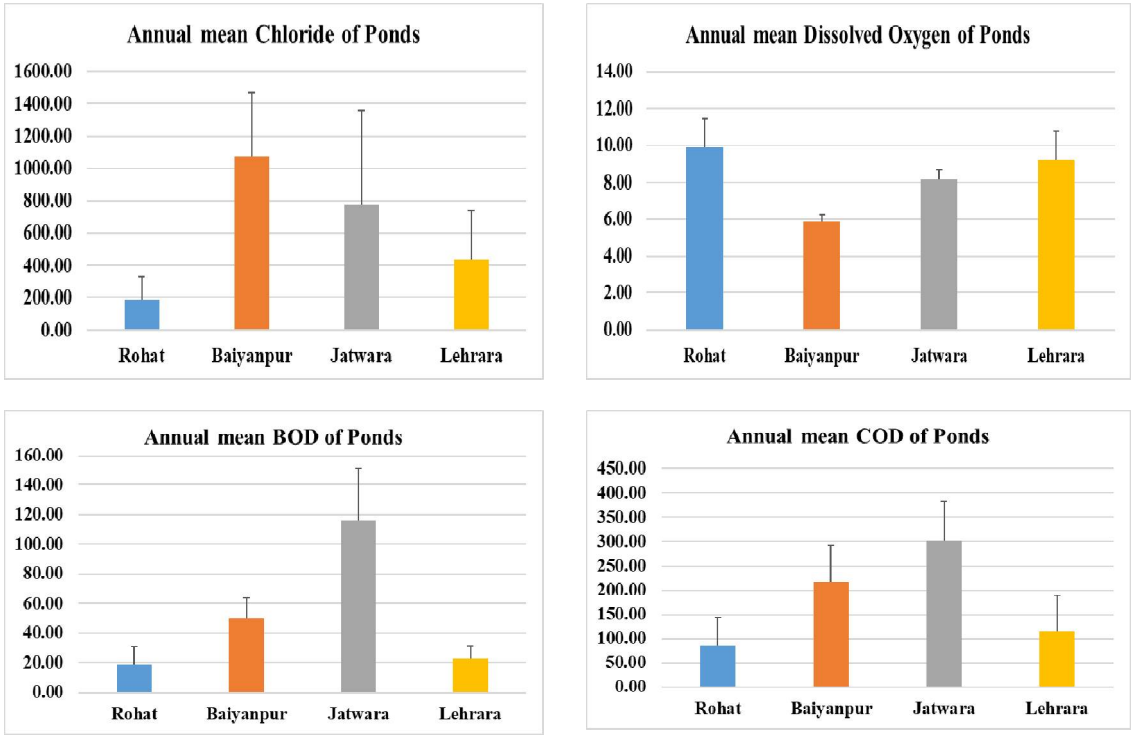


Figure 1: Physico-chemical parameters recorded at the study sites – (March 2021 to February 2022). (pH, Temp., TDS, EC, Turbidity, Alkalinity, Total Hardness, Ca, Mg, Nitrate, Sulphate, Phosphate, Chloride, DO, BOD, COD) Different physico-chemical parameters show the effect of seasonal change effect on the pond water attribute.

The mean temperature for the year was calculated i.e., March 2021 to February 2022. The maximum mean temperature during this period was obtained in the Baiyanpur pond i.e., 24.61 ±9.01˚C, followed by Rohat and Jatwara pond i.e. i.e. 23.93 ±8.67˚C and 23.88 ± 8.52˚C. The least temperature was recorded in the Lehrara village, where mean temperature was 23.53 ± 7.94˚C. The mean pH for the year was calculated i.e. March 2021 to February 2022. The maximum mean pH during this period was obtained in the Rohat pond i.e., 8.93 ± 1.36, followed by Baiyanpur and Jatwara pond i.e. i.e. 8.48 ±1.44 and 8.08 ± 1.87. The least pH was recorded in the Lehrara village, where mean pH was 8.15 ± 1.35. The mean TDS for the year was calculated i.e. March 2021 to February 2022. The maximum mean TDS during this period was obtained in the Baiyanpur pond i.e. 1821.25 ±1110.184, followed by Jatwara and Lehrara pond i.e. i.e. 1373.08 ± 937.1646 and 928.83± 577.7199. The least TDS was recorded in the Rohat village, where mean TDS was 521.58 ± 353.8152. The mean EC for the year was calculated i.e. March 2021 to February 2022. The maximum mean EC during this period was obtained in the Baiyanpur pond i.e. 3868.06 ± 2205.587, followed by Jatwara and Lehrara pond i.e. 2941.30 ± 1830.539 and 1967.00 ± 1194.845. The least EC was recorded in the Rohat village, where mean EC was 1084.45 ± 725.23. The mean turbidity for the year was calculated i.e. March 2021 to February 2022. The maximum mean turbidity during this period was obtained in the Jatwara pond i.e. 242.71 ± 15.62203, followed by Baiyanpur and Lehrara pond i.e. 26.13 ±7.16 and 20.33 ± 5.868988. The least turbidity was recorded in the Rohat village, where mean turbidity was 16.98 ± 5.668865. The mean alkalinity for the year was calculated i.e. March 2021 to February 2022. The maximum mean alkalinity during this period was obtained in the Jatwara pond i.e. 740.78 ± 187.65, followed by Baiyanpur and Lehrara pond i.e. 296.14 ± 46.89 and 240.47 ± 36.850. The least alkalinity was recorded in the Rohat village, where mean alkalinity was 219.67 ± 42.32. The mean total hardness for the year was calculated i.e. March 2021 to February 2022. The maximum mean total hardness during this period was obtained in the Baiyanpur pond i.e. 668.58 ± 226.77, followed by Jatwara and Rohat pond i.e. 657.11 ± 108.3 and 397.86 ± 105.56. The least total hardness was recorded in the Lehrara village, where mean total hardness was 386.17 ± 114.49. The mean Ca hardness for the year was calculated i.e. March 2021 to February 2022. The maximum mean Ca hardness during this period was obtained in the Jatwara pond i.e. 365.19 ± 184.16, followed by Baiyanpur and Lehrara pond i.e. 278.31 ± 154.05 and 167.81 ± 61.27. The least Ca hardness was recorded in the Rohat village, where mean Ca hardness was 151.75 ± 52.15. The mean Mg hardness for the year was calculated i.e. March 2021 to February 2022. The maximum mean Mg hardness during this period was obtained in the Baiyanpur pond i.e. 383.28 ± 213.73, followed by Jatwara and Rohat pond i.e. 361.00 ± 85.73 and 246.67 ± 62.84. The least Mg hardness was recorded in the Lehrara village, where mean Mg hardness was 218.36

± 87.01. The mean Nitrate for the year was calculated i.e. March 2021 to February 2022. The maximum mean Nitrate during this period was obtained in the Jatwara pond i.e. 54.61 ± 17.04, followed by Baiyanpur and Lehrara pond i.e. 44.46 ± 10.36 and 43.14 ± 14.57. The least Nitrate was recorded in the Rohat village, where mean Nitrate was 34.02 ± 6.12. The mean Sulphate for the year was calculated i.e. March 2021 to February 2022. The maximum mean sulphate during this period was obtained in the Baiyanpur pond i.e. 319.87 ± 55.43, followed by Jatwara and Lehrara pond i.e. 285.50 ± 68.95 and 221.97 ± 60.12. The least sulphate was recorded in the Rohat village, where mean sulphate was 150.96 ± 117.15. The mean Phosphate for the year was calculated i.e. March 2021 to February 2022. The maximum mean Phosphate during this period was obtained in the Baiyanpur pond i.e. 2.07 ± 0.42, followed by Rohat and Jatwara pond i.e. 1.34 ± 1.05 and 0.82 ± 0.59. The least Phosphate was recorded in the Lehrara village, where mean Phosphate was 0.77 ± 0.44. The mean Chloride for the year was calculated i.e. March 2021 to February 2022. The maximum mean Chloride during this period was obtained in the Baiyanpur pond i.e. 1072.28 ± 398.04, followed by Jatwara and Lehrara pond i.e. 777.39 ± 579.24 and 436.06 ± 301.19. The least Chloride was recorded in the Rohat village, where mean Chloride was 187.25 ± 144.68. The mean Dissolved oxygen for the year was calculated i.e. March 2021 to February 2022. The maximum mean Dissolved oxygen during this period was obtained in the Rohat pond i.e. 9.87 ± 1.60, followed by Lehrara and Jatwara i.e. 9.25 ± 1.52 and 8.18 ± 0.48. The least Dissolved oxygen was recorded in the Baiyanpur village, where mean Dissolved oxygen was 5.84 ± 0.41. The mean BOD for the year was calculated i.e. March 2021 to February 2022. The maximum mean BOD during this period was obtained in the Jatwara pond i.e. 116.42 ± 34.94, followed by Baiyanpur and Lehrara i.e. 50.36 ± 13.63 and 22.64 ± 8.51. The least BOD was recorded in the Rohat village, where mean BOD was 18.92 ± 11.92. The mean COD for the year was calculated i.e. March 2021 to February 2022. The maximum mean COD during this period was obtained in the Jatwara pond i.e. 302.61 ± 80.85, followed by Baiyanpur and Lehrara i.e. 215.28 ± 77.49 and 114.39 ± 73.58. The least COD was recorded in the Rohat village, where mean COD was 84.56 ± 59.20.

According to an analysis of the pond water sample we found the different types of zooplankton are present or absent in the pond sample, the data are following in the table.

Table 1: Zooplankton recorded at the study sites- (March-2021 to February-2022) Rohat village, Baiyanapur village, Lehrara village, and Jatwara village, Sonipat district, Haryana, India.

S. No.	Zooplankton	Rohat	Baiyanpur	Lehrara	Jatwara
A	COPEPODA				
1.	*Ectocyclops sp.*	+	+	+	+
2.	*Neodiaptomus sp. 1*	+	+	+	+
3.	***Thermocyclops decipiens***	+	+	+	+
4.	***Heliodiaptomus viduus Sp 1***	+	+	+	+
5.	***Heliodiaptomus viduus Sp 2***	+	-	+	+
6.	*Copepod naupliar stage Sp*	+	+	+	+
7.	*Neodiaptomus sp. (Microsetella noryegica)*	+	+	+	+
8.	*Acrocalanus gracilis*	+	-	+	-
9.	*Neodiaptomus sp. 2*	+	-	+	-
10.	*Calanus finmarchicus*	+	-	+	-
11.	*Sinodiptomus (Rhinediaptomus) indicus*	+	+	+	+
12.	*Paraclanus parvus*	+	-	-	-
13.	*Centropagus abdominalis*	+	-	+	-
14.	*Macrosetella gracilis*	+	-	-	-
15.	*Thermocyclops hyalinus*	+	+	+	+
16.	*Diacyclops bicuspidatus odessanus.*	+	-	+	-
17.	*Oithona nana*	+	-	+	-
18.	*Microsetella rosea*	-	-	+	+
B	*ROTIFER*				
19.	*Keratella sp.*	+	+		+
20.	*Monogononta Sp.1*	-	+	+	-
21.	*Monogononta Sp. 2*	+	+	-	+
22.	*Brachionus bidentatus Sp.1*	+	+	-	-
23.	*Brachionus caudatus*	+	+	-	-
24.	***Keratella tropica***	+	+	-	-
25.	***Brachionus quadridentatus***	+	+	-	-
26.	*Brachionidae (Brachionus dimiatus Bryce) Sp.2*	+	+	+	+
27.	*Brachionus bidentatus Anderson Sp 1*	+	+	-	+

28.	*Brachionus bidentatus Anderson Sp 2*	+	+	+	+
29.	*Brachionus budapestinesis var punctus*	+	+	-	+
30.	*Brachionus rubens*	+	+	+	+
31.	*Brachionus calyciflorus*	+	+	+	+
32.	*Brachionidae Sp. B. rubens Ehrenberg,*	+	+	+	+
34.	*B. calyciflorus Pallas*	+	+	-	+
35.	*B. calyciflorus Sp. (A mictic female carrying haploid meiotic eggs (embryos))*	-	+	-	+
36.	*Brachionus calyciflorus Sp3*	+	+	+	-
37.	*Brachionidae Sp. Keratella tropica*	-	+	+	-
38.	*Brachionidae Sp. Brachionus calyciflorus*	-	+	-	-
39.	*Brachionus diversicornis*	-	+	-	+
40.	*B. Quadridentatus*	-	+	-	+
41.	*B. dimidiatus*	+	+	-	+
42.	*Filinia sp 1*	+	+	-	+
43.	*Filiniidae (Filinia longiseta) Sp2*	+	+	+	-
44.	*Trichocera porcellus*	+	+	+	+
45.	*Testudinella sp. 1*	+	+	-	-
46.	*Testudinella (Monogononta Sp)*	+	+	-	+
47.	*A. Brightwelli*	-	+	-	+
48.	*A. Anuraeopsis*	+	+	-	-
49.	*Asplanchna Sp 1*	+	+	-	-
50.	*Asplanchna Sp 2*	+	+	-	-
C	*CLADOCERA*				
51.	*Moina Sp. 1*	-	+	-	+
52.	*Moina Sp. 2*	+	+	+	+
53.	*Moina Weismanni*	+	+	+	+
54.	*Moinodaphnia macleayi*	+	+	+	+
55.	*Moina brachiata*	+	-	+	+
56.	*Ceriodaphnia Sp 1*	+	+	+	+
57.	***Ceriodaphnia reticulate***	+	+	+	+
58.	***Ceriodaphnia reticulata***	+	+	+	+
59.	***Ceriodaphnia cornuta Sp 1***	+	+	+	+
60.	***Ceriodaphnia cornuta Sp2***	-	+	-	+
61.	***Daphnia magna Sp1***	-	+	+	+
62.	*Daphnia magna sp 2*	+	-	+	+
63.	*Daphnia carinata*	-	+	+	+
64.	*Daphnia lumholtzi*	+	+	+	+
65.	*Daphnia pulex*	+	+	+	+
66.	*Diaphanosoma Sarsi*	+	+	+	+
67.	*Diaphanosoma Excisum*	+	-	+	+
68.	*Diaphanosoma spinulosum Herbst, 1967*	-	+	+	-
D	*OSTRACODE*				
69.	*Strandesia elongata*	-	+	-	-
70.	*Cypris*	+	+	+	-
71.	***Cypretta fontinalis***	-	+	-	-
72.	***Cyprinotus nudus***	+	+	+	-
73.	***Eucypris bispinosa***	-	+	+	-
74.	*Seed Shrimps (seed-shrimps-ostracoda)*	+	+	-	-
E	*INSECTA*				
75.	*Mosquitoes Larva*	-	+	-	-
76.	*Chironomidae Larva*	+	+	+	+
77.	*Oligochaeta Worms Sp1*	+	-	-	-
78.	*Oligochaeta Worms Sp2 (Aphlenchoides)*	+	-	-	-

(+) Present, (-) Absent

During the study sites- (March-2021 to February-2022) Rohat village, Baiyanapur village, Lehrara village, and Jatwara village we found a total of 78 types of zooplankton in different ponds. All the zooplankton were recorded at four study sites of which Rotifera, Copepoda, Cladocera, Ostracode, and, Insecta. We found the different types of zooplankton are present in three selected ponds within the selected period (March-2021 to February-2022) only the Jatwara village pond has the absence of Ostracode zooplankton. The population composition of different groups of zooplankton is shown in Fig.1.

Effect of physico-chemical parameters on zooplankton

The pH reading of fewer than 4.5 shows indicates that yonder is powerful mineral acidity; it is injurious to zooplankton like fish. Little minimal salt content is favored to help muscle or fish maintenance their osmotic equilibration. The uppermost boundary is different from muscle species. The channel catfish, for example, is able to go through salinities up to 1/2-strength seawater. The mass of calcium callousness is very signification in pond water fertilization since the highest rates by phosphorus manure are undersigned upon the highest calcium Callousness concentrations. Since 5 mg/l of calcium Callousness is a necessity in muscle piscina or fishpond aqua supplies. Whether an aqua pond necessity is stocked instantly after stuffing, aeration may be supplied to motion the oxidation procedure or transferor the aqua safe for muscle. As the relative amounts by the forms of manganese or iron energy transformation during mizzen or load ibid total difference will be untouched. Ibid toxicity of nitrite to muscle differs greatly with the species of muscle. Some species are quite a receptor while others are very resistant [14]. The distinctness or transparency of freshwater between 30 - 40 cm shows the indicates optimal productivity of a water pond for very nice muscle culture [16] probes, bacteria, and bacillus, etc. existing at indifferent or basic pH, such as saltwater or maritime a free-living bacteria are exposed to inferior iron availability for the in discerptibility of ferric iron [5]. The highest chloride concentration in aqua is considered to injurious or harmful to plankton development. The rising in chloride concentration by 0.25 mg/l may detract primary productivity by much more than 50% while slaughtering more than 40% of water zooplankton and plankton populations [7]. In this way, the fish are getting abstention, hunger dearth, and reduced growth of fish life. So, the fishes indirectly or directly do not survive in an aquatic environment [4], Ammonia defecation by zooplankton has a probable effect on phytoplankton growth. Low or Inferior dissolved oxygen concentration would introduce in the matter of a reduction in the figure or number of species thriving in the atmosphere. Low or Inferior dissolved oxygen may be attributed to eutrophication [8]. Pond freshwater or saltwater apart or different muscle species normally exhibit cheesy toleration to large changes in aqua salinity. Oft salinity range changes from plankton to plankton level [3].

CONCLUSION AND FUTURISTIC APPROACH

This research study suggests that the physico-chemical parameters and zooplankton diversity level of ponds varies seasonally. Due to changing of the season varies they are changing the zooplankton diversity. So, from the results obtained in the research study, it can be included that Also, due to over-exploitation these water bodies are continuously being deteriorated and degraded. The polluted water is unsuitable for domestic use, human life, fish farming, farming, and animal use consumption. Assessment and monitoring of water bodies should be done on a time-to-time and regular basis. Collective and collaborative efforts by the urban peoples, local peoples of villages, and the Indian government can help to conserve and protect these water bodies. Regular monitoring, awareness campaigns, and improved regulation of the ponds may help in the conservation of these ponds.

AUTHOR CONTRIBUTION

SR collected all the samples, performed all the analysis part with the help of PD. SR also compiled all the data, data analysis, and prepared the final manuscript with the help of PD. AG designed, and edited the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

Data will be available from the corresponding author upon good scientific reason and request.

ETHICS DECLARATIONS

Ethics approval and consent to participate

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

COMPLETING INTERESTS

All authors declare that they have no proprietary, financial, professional, nor any other personal interest of any kind in any product or services and/or company that could be construed or considered to be a

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