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Profile of physico-chemical properties of water samples drawn from Kanjha Lake, Purnea, Bihar (India) with respect to its limnological status

Minki Kumari*
Department of Zoology, B.N. Mandal University, Madhepura, Bihar, India

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Abstract: Assessment of physico-chemical parameters of water samples drawn from four different corners viz. east, south, west & north of standing water body of Kanjha Lake situated in Purnea district, Bihar, India were carried out during January to December 2013-2014. PCP parameters such as turbidity, temperature, transparency, pH, DCO_2, DO_2, nitrate and phosphate were analyzed. The results indicate that most of the parameters from all four corners of the water bodies were suitable for fisheries as well as other human need. Nevertheless, unmindful anthopogenic activities like bathing, washing, cattle sitting etc. have introduced some undesirable pollutants which may worsen the lake status in few years if conservation measures are not taken.

Keywords:- PCP, turbidity, transparency, pH, DCO_2, DO_2, Kanjha Lake, Purnea, Bihar

INTRODUCTION

The physico-chemical properties of any water body and biological activity maintain the status of its aquatic ecosystem. Further water condition play a very important role in the production of air breathing fishes related to the limnological characteristics of the aquatic system. The polluted state of water resources has led to steady decline in aquatic productivity. Therefore, limnological investigation is needed. So, the monitoring of the lake water is necessary step to eliminate the pollutants and their effect on living organisms.[1]

The blend of physical and chemical properties ultimately constitute the profile of complete biological status of water body in general and that of Kanjha Lake in particular, hence the present study has been undertaken to investigate the limnological characteristics which can promote the fish production and fisheries in the lake as well as adjoining water bodies.[2&3]

*Corresponding author :
Phone : 9561258997
E-mail : dr.mkumari30@gmail.com

MATERIALS & METHODS

Water samples were collected for different physico-chemical analysis from four different corners viz. east, south, west and north of Kanjha Lake, Purnea district, Bihar. The samples were collected from each site once a day. The analysis for physiochemical characteristics of water was done following the standard methods given by APHA (1998)[4], Golterman (1969)[5], and Trivedi and Goel (1984)[6]. Some of the parameters were analyzed in the field while for most of the parameters the samples were preserved using the suitable preservatives.

The samples were collected in two liter polythene bottles during the morning hours between 8.00 am to 11.30 am. Water temperature were measured using centigrade mercury thermometer, transparency of the water was measured with the help of Secchi disc of 20 cm diameter.

Turbidity was measured with the help of nephelometer, pH was measured using digital pH meter while the dissolved carbon dioxide (DCO_2) and dissolved oxygen (DO_2) were estimated using reagents such as sodium thiosulphate, sodium

hydroxide and phenolphthalein indicator. Nitrate and Phosphate was estimated using calorimeter. Each of the samples (replications of four corners) was analyzed and the results have been given in the table.

OBSERVATION

Table 1 : Physicho-chemical profile of water samples of Kanjha Lake, Purnea, Bihar (January to December 2013)

Samples and Parameter		Mean Monthly Data											
		Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
S-I:P.P	Turb.	1026	1136	575	775	710	804	1180	690	888	680	868	1165
	Temp.	18.00	19.10	24.90	25.30	29.70	30.90	26.70	27.30	26.80	25.70	23.30	17.90
	Trans.	43.00	43.00	42.00	44.00	60.00	17.00	6.00	7.00	23.00	13.00	28.00	47.00
C.P	pH	8.24	8.54	8.10	7.60	7.65	7.80	8.10	8.20	8.10	8.10	8.10	8.20
	DO_2	10.30	11.00	10.50	7.60	4.10	4.50	7.70	6.50	7.40	7.40	10.50	12.60
	DCO_2	2.00	1.70	1.40	1.50	2.10	2.40	2.20	2.10	2.40	2.80	2.60	2.70
	Nitr.	0.20	4.8	4.8	3.0	3.0	3.0	2.3	3.6	4.8	4.0	4.7	2.0
	Phosp.	0.10	0.20	0.20	0.30	0.40	0.20	0.10	0.10	0.10	0.10	0.10	0.10
S-II:P.P	Turb.	1206	1452	1452	1070	1460	1310	1430	1240	1220	1036	1126	145
	Temp.	19.20	19.90	26.30	25.90	30.80	31.80	30.70	29.80	26.90	29.30	22.30	21.10
	Trans.	42.00	41.00	27.00	58.00	65.00	17.00	6.00	6.50	19.00	12.00	27.00	46.00
C.P	pH	8.30	8.40	7.70	7.60	7.00	7.00	7.50	7.60	8.00	7.00	7.00	7.00
	DO_2	10.20	11.10	10.80	7.10	5.00	5.00	8.20	7.00	8.30	7.50	10.00	9.30
	DCO_2	1.70	1.80	1.00	1.40	2.00	2.20	0.50	2.00	2.00	2.30	2.60	2.50
	Nitr.	88.0	1100	1225.0	150.0	225.0	1750.0	32.0	45.0	105.0	110.0	70.0	85.0
	Phosp.	0.20	0.30	0.30	0.30	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.20
S-III:P.P	Turb.	1150	1300	1240	840	1150	1180	1300	1240	900	800	1000	1215
	Temp.	18.00	19.40	24.60	25.90	32.80	34.30	28.20	28.50	27.20	27.30	20.00	17.80
	Trans.	30.00	27.00	40.00	40.00	45.00	21.00	21.00	9.00	10.00	27.00	29.00	60.00
C.P	pH	8.35	8.40	8.30	8.30	8.25	8.15	8.15	8.20	8.20	8.20	8.25	8.30
	DO_2	10.10	11.00	11.50	8.00	5.00	6.30	7.00	9.60	9.80	8.00	8.30	10.00
	DCO_2	2.00	2.00	1.80	1.40	1.80	1.80	2.00	2.30	2.00	2.00	1.20	2.50
	Nitr.	60.0	160.0	110.0	90.0	35.0	40.0	29.0	35.0	90.0	95.0	58.0	55.0
	Phosp.	0.10	0.20	0.20	0.40	0.30	0.20	0.10	0.10	0.10	0.10	0.10	0.10
S-IV:P.P	Turb.	1206	1452	1452	1070	1460	1310	1430	1240	1220	1036	1126	145
	Temp.	19.20	19.90	26.30	25.90	30.80	31.80	30.70	29.80	26.90	29.30	22.30	21.10
	Trans.	42.00	41.00	27.00	58.00	65.00	17.00	6.00	6.50	19.00	12.00	27.00	46.00
C.P	pH	8.30	8.40	7.70	7.60	7.00	7.00	7.50	7.60	8.00	7.00	7.00	7.00
	DO_2	10.20	11.10	10.80	7.10	5.00	5.00	8.20	7.00	8.30	7.50	10.00	9.30
	DCO_2	1.70	1.80	1.00	1.40	2.00	2.20	0.50	2.00	2.00	2.30	2.60	2.50
	Nitr.	88.0	1100	1225.0	150.0	225.0	1750.0	32.0	45.0	105.0	110.0	70.0	85.0
	Phosp.	0.20	0.30	0.30	0.30	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.20

RESULTS & DISCUSSION

The results of physico-chemical characteristics as furnished in the table indicate that water temperature fluctuated from 17.90-30.90°C in sample I, 19.20-31.80°C in sample II, 17.80-34.30°C in sample III, 19.20-31.80°C in sample IV respectively. Water temperature was found to be higher in summer season and low in winter. More penetration of sunlight and longer duration of receiving sunlight in a day is the reason for higher temperature during summer season. The summer temperature (May-Jul) was always above the winter temperature (Jan- Feb) due to lack of sunlight. The water temperature recorded in all the sample was below the WHO standard of 30°C to 35°C.

Under chemical parameter, pH of water is very important factor in determination of water quality act as it may be acidic, neutral or basic in nature. pH usually affects the other chemical

reactions such as solubility, ionization and metal chelating which is responsible for toxicity. Sample wise examined pH value was found to range between 7.60-8.54 ppm (S I), 7.00-8.40 ppm (S II), 8.15-8.40 ppm (S III) & 7.00-8.40 ppm (S IV) respectively. Accordingly water samples of the pond can be regarded as either neutral or basic. Dissolved oxygen is also one of the important parameters of water which directly effects the survival and distribution of flora and fauna in an ecosystem. The value of DO_2 ranges from 4.10- 12.60ppm.

In summer dissolved oxygen decreased due to increase in temperature and also due to increased microbial activity. The high DO_2 in winter may be due to decrease in temperature and less duration of bright sunlight has less influence on the percent of soluble oxygen and carbon dioxide. The value of DO_2 of four different corners remained constant except during the winter season ranging high 10-12ppm in all four corners. The high concentration of DO_2 during winter may be due to dense growth of algae or plant due to photosynthesis. The royal commission has reported a scale for deciding the quality of water based on DO_2. The content of DO_2 of 7ppm in water is considered as very clear, 6ppm as moderate, 5ppm as doubtful and 4ppm or below as bad.

Table 2 : Physicho-chemical profile of water samples of Kanjha Lake, Purnea, Bihar (January to December 2014)

Samples and Parameter		Mean Monthly Data											
		Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
S-I:P.P	Turb.	1206	1452	1452	1070	1460	1310	1430	1240	1220	1036	1126	145
	Temp.	19.20	19.90	26.30	25.90	30.80	31.80	30.70	29.80	26.90	29.30	22.30	21.10
	Trans.	42.00	41.00	27.00	58.00	65.00	17.00	6.00	6.50	19.00	12.00	27.00	46.00
C.P	pH	8.30	8.40	7.70	7.60	7.00	7.00	7.50	7.60	8.00	7.00	7.00	7.00
	DO_2	10.20	11.10	10.80	7.10	5.00	5.00	8.20	7.00	8.30	7.50	10.00	9.30
	DCO_2	1.70	1.80	1.00	1.40	2.00	2.20	0.50	2.00	2.00	2.30	2.60	2.50
	Nitr.	88.0	1100	1225.0	150.0	225.0	1750.0	32.0	45.0	105.0	110.0	70.0	85.0
	Phosp.	0.20	0.30	0.30	0.30	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.20
S-II:P.P	Turb.	1165	868	680	888	690	710	1180	804	775	575	1136	1026
	Temp.	17.90	23.30	25.70	26.80	27.30	26.70	30.90	29.70	25.30	24.90	19.10	18.00
	Trans.	47.00	28.00	13.00	23.00	7.00	6.00	17.00	60.00	44.00	42.00	43.00	43.00
C.P	pH	8.24	8.54	8.10	7.60	7.65	7.80	8.10	8.20	8.10	8.10	8.10	8.20
	DO_2	10.30	11.00	10.50	7.60	4.10	4.50	7.70	6.50	7.40	7.40	10.50	12.60
	DCO_2	2.00	1.70	1.40	1.50	2.10	2.40	2.20	2.10	2.40	2.80	2.60	2.70
	Nitr.	0.20	4.8	4.8	3.0	3.0	3.0	2.3	3.6	4.8	4.0	4.7	2.0
	Phosp.	0.10	0.20	0.20	0.30	0.40	0.20	0.10	0.10	0.10	0.10	0.10	0.10
S-III:P.P	Turb.	1206	1452	1452	1070	1460	1310	1430	1240	1220	1036	1126	145
	Temp.	19.20	19.90	26.30	25.90	30.80	31.80	30.70	29.80	26.90	29.30	22.30	21.10
	Trans.	42.00	41.00	27.00	58.00	65.00	17.00	6.00	6.50	19.00	12.00	27.00	46.00
C.P	pH	8.30	8.40	7.70	7.60	7.00	7.00	7.50	7.60	8.00	7.00	7.00	7.00
	DO_2	10.20	11.10	10.80	7.10	5.00	5.00	8.20	7.00	8.30	7.50	10.00	9.30
	DCO_2	1.70	1.80	1.00	1.40	2.00	2.20	0.50	2.00	2.00	2.30	2.60	2.50
	Nitr.	88.0	1100	1225.0	150.0	225.0	1750.0	32.0	45.0	105.0	110.0	70.0	85.0
	Phosp.	0.20	0.30	0.30	0.30	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.20
S-IV:P.P	Turb.	1150	1300	1240	840	1150	1180	1300	1240	900	800	1000	1215
	Temp.	18.00	19.40	24.60	25.90	32.80	34.30	28.20	28.50	27.20	27.30	20.00	17.80
	Trans.	30.00	27.00	40.00	40.00	45.00	21.00	21.00	9.00	10.00	27.00	29.00	60.00
C.P	pH	8.35	8.40	8.30	8.30	8.25	8.15	8.15	8.20	8.20	8.20	8.25	8.30
	DO_2	10.10	11.00	11.50	8.00	5.00	6.30	7.00	9.60	9.80	8.00	8.30	10.00
	DCO_2	2.00	2.00	1.80	1.40	1.80	1.80	2.00	2.30	2.00	2.00	1.20	2.50
	Nitr.	60.0	160.0	110.0	90.0	35.0	40.0	29.0	35.0	90.0	95.0	58.0	55.0
	Phosp.	0.10	0.20	0.20	0.40	0.30	0.20	0.10	0.10	0.10	0.10	0.10	0.10

Dissolved carbon dioxide in the present study found at the range between 0.50 and 2.80mg/l. the maximum free CO_2 (2.80mg/l) was recorded in site I and minimum CO_2 (0.50mg/l) in site II. Respiration by zooplankton and other organisms may be one of the probable cause of very high concentration of dissolved carbon dioxide in present investigation. Nitrate concentration ranged from 0.20-0.70ppm being the maximum at site II and minimum at site II of Muzaffarpur district. The observed value of nitrate was found below the WHO permissible limit 45ppm. Nitrate is attributed mainly due to anthropogenic activities such as agricultural runoff, refuse dump runoff or contamination with human or animal wastes. The concentration often fluctuates with the season and may increase when the river is fed by nitrate rich qualifiers. The fluctuation in nitrate concentration was due to degradation of organic matter.

Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eyes, similar to smoke in air. The measurement of turbidity is a key test of water quality. Turbidity ranged from 145ppm to 1452ppm having maximum value at site II and minimum at site I. Turbidity in open water may be caused by growth of phytoplankton. Human activities that disturb land, such as construction, mining and agriculture, can lead to high sediment levels entering water bodies during rain storms due to storm water runoff. Areas prone to high bank erosion rates as well as urbanized areas also contribute large amounts of turbidity to nearby waters, through storm water pollution from paved surfaces such as roads, bridges and parking lots. Some industries such as quarrying, mining and coal recovery can generate very high levels of turbidity from colloidal rock particles. In drinking water, the higher the turbidity level, the higher the risk that people may develop gastrointestinal diseases. This is especially problematic for immunocompromised people, because contaminants like viruses or bacteria can become attached to the suspended solids.

Phosphate has been found trace to 0.10-0.40ppm. The value of phosphate usually remained constant however fluctuated to maximum during the month of April and May in both the site I&II which indicates the moderate to high level of pollution in the Kanjha Lake, Purnea, Bihar.

CONCLUSION

On the basis of experimental findings obtained from the present investigation it can be concluded that the physico-chemical profile of the water samples drawn from all the four corners of the water body is well within the limits WHO standard. However, samples of south and west corners are where slightly polluted, anthropogenic interferences regularly happen. Unmindful anthropogenic activities like bathing, detergent washing and agricultural runoff etc are likely to affect the Kanjha Lake water body. Hence it can be concluded that turbidity, temperature, transparency, pH, DO_2, DCO_2, nitrate, phosphate are within WHO limits which are the vital water quality parameters for drinking, irrigation, aquatic life & surface water.

The complete profile of physico-chemical properties of water samples from the lake therefore suggest that samples drawn from east & north corner of the lake are more promotive, those from west moderately promotive & from south are least promotive to fish production as per the available data of annual spatial yield of fish production.

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