RESEARCH PAPER:

Seasonal variation in different physico- chemical parameters of Pariyej Lake, Kheda district Gujarat

F.J. THAKOR, D.K. BHOI, Y.D. PARMAR, A.B. PARMAR AND M.B.CHAUHAN

Asian Journal of Environmental Science, (June, 2011) Vol. 6 No. 1 : 37-41

See end of the article for authors' affiliations

Correspondence to :
F.J. THAKOR
Department of Biology, J & J College of Science, Nadiad, KHEDA (GUJARAT) INDIA

SUMMARY

Physico – chemical parameters of Pariyej lake were studied and analysed, during January 2008 to December 2008. The water parameters such as temperature, pH, DO,BOD, COD, Total alkalinity, Ca – Hardness, Mg – Hardness, Chloride, Sulphate, Phosphate, Nitrate and TDS of water. Our present investigation shows that all the above mention parameters are within the permissible limit of WHO standards. So, its good indicator for drinking, fisheries and growth for the phytoplankton and zooplankton.

Thakor, F. J., Bhoi, D. K., Parmar, Y. D., Parmar, A. B. and Chauhan, M.B. (2011). Seasonal variation in different physico- chemical parameters of Pariyej Lake, Kheda district Gujarat. *Asian J. Environ. Sci.*, **6**(1): 37-41.

Key words : Physico – chemical parameters, Pariyej lake, Dissolved oxygen, Water quality.

Received: *February, 2011*
Accepted : *March, 2011*

Water is one of the most important factor for every living organism on this planet. Water is generally used for drinking and other domestic purposes in this area. The use of fertilizers and pesticides, manure, lime, specific tank refuse dump, etc. are main sources of water pollution. (Hamilton and Helsel, 1995) In the absence of fresh water supply, people residing in this area are using lake water for their domestic and drinking consumptions. Many exhaustive and comprehensive studies carried out by Kataria *et al.,* 1997, Singh *et al.,* 2007, and Patil and Tijal, 2001). The available fresh water to man is hardly 0.3 to 0.5% of the total water available on the earth and therefore its judicious use in imperative. Lakes are one of the important water resources used for irrigation, drinking, fisheries, hydroelectric power generation, navigational and flood control purposes (Kumar *et al.,* 2006). On the other hand lakes also provide a habitat for invertebrates, fishes and aquatic birds. Therefore, scientific study needs to review strategies for conservation and better utilization of lakes.

Study area :

Pariyej lake is big in size covers an area of about 361 ha. It is situated at a distance of about 25 Km. from Nadiad and comes under Kheda district. It receives rain water from surrounding area and fresh water from Mahi Channel. It is located in N 22^0 32' latitude and E 72^0 37' Longitude. Pariyej lake is old and man made reservoir. The water is used for drinking and fisheries. The study was carried out for one year period during January 2008 to December 2008.

MATERIALS AND METHODS

The physico – chemical parameters of water were analysed twice in a month for one year in upper and lower layer and calculated average for season and year. Water samples were collected in the morning between 8 – 9 am in glass stoppered bottle. Temperature and pH were recorded at the time of sample collection using portable kit. Water for determination of dissolved oxygen water was fixed in the field and brought to the laboratory in an ice box for further processing – DO, BOD, COD, carbanotes, Bicarbonates, Ca - Hardness, Mg – Hardness, Chloride, Sulphate, Phosphate, Nitrate, and TDS were determined in the laboratory employing methods described by APHA *et al.* (1992), Trivedi and Goal and

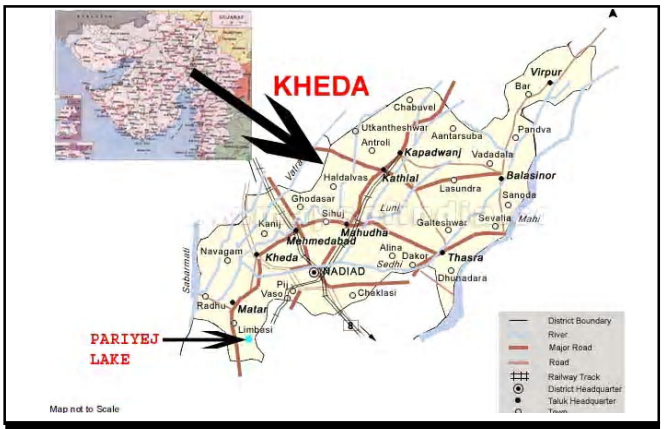

Fig. 1: Location of the study area

also from methodology by Kodarkar *et al.* (2005).

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following sub heads:

Physico – chemical parameters:

Water temperature :

In the present investigation the water temperature ranges from 24.8^{0}C to 32.5^{0}C of upper layer and 28.4^{0}C to 34.4^{0}C of lower layer during Jan. 2008 to Dec. 2008. The overall mean of water temperature was 28.5^{0}C in upper layer and 28.4^{0}C in lower layer. Seasonal analysis showed that it was highest in per monsoon and relatively lower in monsoon and post monsoon. Salve and Hiware (2006) observed that during summer, water temperature was high due to low water level and clear atmosphere which is quite similar with results obtained in the present investigation.

pH :

The pH values ranged from 7.5 to 8.5 of upper layer and 7.7 to 8.6 of lower layer during Jan. 2008 to Dec. 2008. The overall mean of pH was 7.6 in upper layer and 7.8 in lower layer. The pH values varied from 7.2 to 8.7 are suitable for aquatic organisms, Subbamma and Rama (1992). The maximum pH was recorded in pre monsoon and minimum in monsoon with slightly increased in post monsoon. Similar results were also reported by Rajshekhar *et al.* (2007) from a minor reservoir Nadergul. The low pH valve observed during the monsoon was due to heavy fresh water in flow into the water body. The tolerance pH limit is 6.5 – 8.5 (Bhoi *et al.* 2004).

Dissolved oxygen (DO) :

The dissolved oxygen values were ranged from 5.09 to 7.41 in upper layer and 5.07 to 6.9 in lower layer during Jan. 2008 to Dec. 2008. The overall mean was 6.8 in upper layer and 6.9 in lower layer. The DO values were maximum during post monsoon and minimum during pre monsoon months. The maximum DO in post monsoon may be due to low atmospheric temperature and minimum DO was recorded in pre monsoon months may be due to high metabolic rate of organism. Similar results were also reported by Hazalwood and Parker (1961) and Munawar (1970). The minimum tolerance range is 4.0 mg/L. (Bhoi *et al.,* 2005).

BOD :

The BOD values ranged from 5.6 to 7.2 mg/L in upper layer and 5.1 to 7.3 mg/L in lower level during Jan. 2008 to Dec. 2008. The overall mean was 6.4 mg/L in upper layer and 6.3 mg/L in lower layer. Higher values of BOD during summer could be result of reduced rate of water flow, degradation of organic waste and accumulation of waste due to anthropogenic activity, while low BOD values during monsoon could be attribute to dilution of river water as suggested by Upadhyay and Rana (1991).

COD :

The COD values ranged from 4.3 to 6.8 mg/L in upper layer and 4.5 to 6.9 mg/L in lower level during Jan. 2008 to Dec. 2008. The overall mean was 5.4 mg/L in upper layer and 5.6 mg/L in lower layer. In present study, maximum COD was recorded in summer season due to high temperature and increased rate of evaporation of water. High COD values indicate the presence of chemically oxidizable carbonaceous matter as well as inorganic matter such as sulphides, nitrates and reduced metal ions. (Chandra *et al.,* 2000). The low COD values during monsoon could be attribute to dilution of lake water.

Carbonate and bicarbonate :

The carbonates and bicarbonates ranged from 100 to 192 mg/l in upper layer and 172 to 198 mg/L in lower layer during Jan. 2008 to Dec. 2008. The overall mean was 146.6 in upper layer and 157.5 in lower layer. The low alkalinity was recorded in rainy season, this is because the inflow of more rain water in to the lake. The alkalinity is also directly proportional to the productivity of the lake. The high alkalinity in winter and summer months, may lead to higher productivity in these months. The same results were also reported by Mishra *et al.* (1989). Jain *et al.* (1996).

Hardness – Ca :

The calcium values is 29 to 75 mg/l in upper layer

Table 1: Following physico-chemical parameters are analysed during pre mansoon, mansoon and post monsoon in our project work

Phy. ch.	W. Temperature		pH		DO		BOD	
Season	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
Pre monsoon	32.5 ^{0}C	34.4 ^{0}C	8.5	8.6	5.09	5.07	5.6	5.1
Monsoon	28.4 ^{0}C	27.3 ^{0}C	7.1	7.3	8.1	8.2	7.2	7.3
Post monsoon	24.8 ^{0}C	23.4 ^{0}C	7.5	7.7	7.41	7.4	6.8	6.9
Mean	28.5 ^{0}C	28.4 ^{0}C	7.6	7.8	6.8	6.9	6.4	6.3

Phy. ch.	COD		Carbonate and bicarbonate (Total alkalanity)		Hardness – Ca	
Season	Upper	Lower	Upper	Lower	Upper	Lower
Pre monsoon	6.8	6.9	192	198	75	77
Monsoon	4.3	4.5	100	112	38	41
Post monsoon	5.2	5.4	148	162	29	32
Mean	5.4	5.6	146.6	157.5	47	50

Phy. ch	Hardness – Mg		Chloride		Sulphate		Phosphate	
Season	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
Pre monsoon	41	43	34	36	16	16.9	12	13
Monsoon	25	27	37	37.5	12	13.01	16	17.01
Post monsoon	21	23	40	40.9	14	14.8	14	14.7
Mean	29	31	37	38.1	14	14.9	14	14.9

Phy. ch.	Nitrate		TDS	
Season	Upper	Lower	Upper	Lower
Pre monsoon	4.4	4.6	346	351
Monsoon	3.2	3.7	240	247
Post monsoon	2.8	3.1	260	264
Mean	3.4	3.8	282	287

and 32 to 77 mg/l in lower layer during Jan. 2008 to Dec. 2008. The overall mean was 47 mg/l in upper layer and 50 mg/l in lower layer. In the present investigation Ca was within the permissible limits of WHO (1984) and ISI (1983). The calcium hardness values were maximum during pre monsoon and minimum during post monsoon months. The recorded increase in Ca concentration during pre monsoon may be the effect of bacterial decomposition. Jayabhaye and Madlapure (2005) reported high values of calcium in Parola dam, Dist. Hingoli, Maharashtra. The tolerance range for Ca – Hardness is 75–200 mg/l (Mekee *et al.,* 1975 and Dhambare *et al.,* 1998).

Hardness – Mg:

The Magnesium values ranged 21 to 41 mg/L in upper layer and 23 to 43 mg/l in lower layer during Jan. 2008 to Dec. 2008. The overall mean was 29 mg/l in upper layer and 31 mg/l in lower layer is within the limits of WHO (1984) and ISI (1983). The Magnesium hardness values were maximum during pre monsoon and minimum during post monsoon months. The recorded increase in Mg concentration during pre monsoon may be the effect of bacterial decomposition. Jayabhaye and Madlapure (2005) reported high values of calcium in Parola dam, Dist. Hingoli, Maharashtra. The tolerance range for Mg – Hardness is 50–100 mg/l (Dhembare *et al.,* 1995).

Chloride :

The chloride content ranged between 34 to 40 mg/l in upper layer and 36 to 40.9 mg/l in lower layer during Jan. 2008 to Dec. 2008. The overall mean was 37 mg/l in upper layer and 38.1 mg/l in lower layer. The higher values of chloride were recorded in pre monsoon and lower in post monsoon. Similar results were also reported by Rajshekhar *et al.* (2007) from Nadergul reservoir. The high values may be attributed to low water levels during summer, Gonzalves and Joshi (1946) are also of the same opinion. The tolerance range for chloride is 200–600 mg/l.

Sulphate :

The sulphate ranged from 12 to 16 mg/l in upper

layer and 13.01 to 16.9 mg/l in lower level during Jan. 2008 to Dec. 2008. The overall mean was 14 mg/l in upper layer and 14.9 mg/l in lower layer. Sulphate are naturally occurring anion present in all kinds of natural water bodies (APHA, 1992) and primarily related to the types of minerals founding watershed and acid rain and are carried into the lakes by rainfall (Yalcin Tepe *et al.,* 2005). The values of the sulphate in all water samples were within the permissible limit. Similar report was recorded by the studies of Mazher Sultana and Dawood Sharief (2004). The minimum tolerance range is < 200 mg/l.

Phosphates (Po_4) :

Phosphate concentration ranged between 12 to 16 mg/l in upper layer and 14.7 to 13 mg/l in lower layer during Jan. 2008 to Dec. 2008. The overall mean was 14 mg/l in upper layer and 14.9 mg/l in lower layer. The phosphate hardness values were maximum during pre monsoon and minimum during post monsoon months. Similar results were also reported by Lendhe and Yeragi (2004) from Phirange Kharbav lake, Maharashtra. During monsoon and pre monsoon period high values of phosphate were recorded, this was contributed by the surface run off, draining the agricultural fields and mixing with the influent water of the lake. The higher values of phosphate are mainly due to use of fertilizers and pesticides by the people residing in this area. If phosphate is consumed in excess, phosphine gas is produced in gastro-intestinal tract on reaction with gastric juice. (Andhra Pradesh State Forensic Science Laboratories, 1998).

Nitrates :

The nitrate ranged from 2.8 to 4.4 mg/l in upper layer and 3.1 to 4.6 mg/l in lower level during Jan. 2008 to Dec. 2008. Whereas the overall mean was 3.4 mg/l in upper layer and 3.8 mg/l in lower layer. According to Jhingram and Sugunan (1990) the water with the 0.2 to 0.5 ppm of nitrates is of high productive reservoirs, upto 0.2 ppm nitrates is medium productive reservoirs and in low productive reservoirs, the nitrates are negligible. According to the above classification present reservoir belongs to high productive nature. Pawar and Mane (2006) reported the low nitrate levels in Sadatpur lake, Maharashtra. The tolerance range for nitrate is 20–25 mg/l. Nitrate nitrogen is one of the major constituents of organism along with carbon and hydrogen as amino acids, proteins and organic compounds in the lake water. (Miller *et al.*, 1981). If the nitrate reduces to nitrite, then it causes methaemoglobinaemia in in infants. (NEERI, 1972 and White,1975).

Total dissolved solids (TDS) :

Total dissolved solids in the lake ranged from 260 to 346 mg/l in upper layer and 264 to 351 mg/l in lower layer during Jan. 2008 to Dec. 2008. The overall mean was 282 mg/l in upper layer and 287 mg/l in lower layer. The TDS values were high in pre monsoon followed by monsoon and post monsoon months. According to Jhingram and Sugunan (1991), the total dissolved solids up to 200 were in medium productive reservoir and more than 200 were in highly productive reservoirs. According to the above classification, present lake belongs to high productive nature. Sakhare and Joshi (2001) reported high values of total dissolved solids in Yeldari reservoir, Maharashtra. According to WHO and Indian standards, TDS values should be less than 500 mg/L Nawalakhe *et al.,*1995 and Jayaseeli *et al.,* 2006 observed the TDS in ground water in shivpuri distrtict was in range of 48-840 mg/l and 236-1200 mg/l, respectively.

Acknowledgement:

We thank Mr. Y. D. Parmar Range Forest Officer, Gujarat state, Govt. Forest department for providing boat for sample collection in different sampling station of Pariyej lake, Dist. – Kheda, Gujarat. He also help in identification of different birds in and around the Pariyej lake.

Authors' affiliations:

D.K. BHOI AND M.B.CHAUHAN, Department of Chemistry, J. and J. College of Science, Nadiad, KHEDA (GUJARAT) INDIA.

Y.D. PARMAR, Social Forestry Division, Extention Range Matar, Nadiad, KHEDA (GUJARAT) INDIA.

A.B. PARMAR, Department of Biology, J. and J. College of Science, Nadiad, KHEDA (GUJARAT) INDIA

REFERENCES

APSFSL (1988). Andhra Pradesh State Forensic Science Laboratories. Annual Report.

Bhoi, D.K., Raj, D.S. and Mehta, Y.M. (2005). *Asain J. Chemistry*, **17**(I):404 – 408.

Bhoi, D.K., Raj, D.S., Mehta, Y.M., Machhar, M. T. and Chauhan, M. D. (2004). *Oriental J. Chem.*, **20**(2): 361 – 364.

Dhembare, A.J., Pondhe, G.M. and Singh, C.K. (1998). *Poll. Res.*, **17**: 87.

ISI (1983). Indian stadard specification for drinking water ISI : 105 – 500.

Jayaseeeli, A., Priya, K.S., Delphine Rose, M.R., Nirmala, T. and Narayanan, M. (2006). Critical analysis of ground water quality of Nilakkottai taluka of TamulNadu, India. *J. Curr. Sci*., **9**(2):931-934.

Kataria, H.C., Iqbal, S.A. and Shandilya, A.K. (1997) MPN of total coliform as pollution indicator in Halali river water of *Madhya Pradesh Poll. Res*., **16**(4): 225-257.

Kodarkar (2006). Methodology for water analysis physico – chemical biological and microbiological IAAB Publication No. 2, 3rd Edition, IAAB, Hyderabad.

Kumar, Adarsh, Qureshi, T. A., Parashar, Alka and Patiyal, Alka (2006). Seasonal variation in physico – chemical characteristics of Ranjit Sagar reservoir, Jammu and Kashmir. *J. Ecophysiol.* Occup. Hlth.6.

Lendhe, R.S. and Yeragi, S.G. (2004). Physico chemical parameters and zooplankton diversity of phirange kharbav lake, Dist. Thane, *Maharashtra. J. Aqua. Biol.,* **19**(1) : 49 – 52.

Mekee, J.F. and Wolf, H.W. (1998). Water quality criteria. The Resources Agency of California State Water Quality Control Board.

Miller, D.G. (1981). Nitrate in drinking water, Water Research Centre, Medmenham.

Nawalakhe, W.G., S.L. Lutade, P.M. Patni and Deshpande, INITIALS? (1995). Ground water quality in Shivpuri district in Madhya Pradesh. *Indian J. Environ. Hlth*., **37**(4):278-284.

NEERI (1975)**.** National Environment Engineering Research Institute. Disinfection of small community water supplies, Nagpur (1972).

Patil, B.D. and Tijar, R.V. (2001). Studies on water quality of Gadchiroloike. *Poll. Res.*, **20**(1):257-259.

Rakesh Chandra, Bahadur Y. and Sharma B.K. (2000). Studies on the physico chemical parameters of shankha River at Barelly. In pollution and Biomonitoring of Indian rivers. Trivedi R. K. (ed), ABD publishers, India. 260 – 267.

Singh, R.K., S.A. Iqbal and Seth, P.C. (2001). Bacteriological pollution in a stretch of River Narmada at Hoshanbad, Madhya Pradesh. *Poll. Res.*, **20**(1):211-213.

Standard Methods for Examination of water and waste water (1992). 20th Edition by APHA *et al.*

The Gazette of India (1991). Extraordinary, Part – II 3, 11.

Upadhyay, R.K. and Rana, K.S. (1991). Pollution studies of river Jamuna Mathura, *Internat. J. Nat. Environ.,* **8**: 33 – 37.

White, J.W. (1975). *J. Agri. Food Chem.,* **13**:886.

WHO (1984) : Guideline for drinking water quality – Recommendations World Health Organization.