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Water quality status of Halali reservoir (Vidisha-MP, India) by analysis of physiochemical parameters

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Abstract
Present paper embodies the phsiochemical data of Halali reservoir which is 40 kms away from the Bhopal. Results of different physico-chemical parameters like nitrate, phosphate, DO etc. have revealed that the water quality of the reservoir stands quite well to put in use for different purposes like agriculture, aquaculture, domestic and industrial. The DO content of water varies from 6.1-9.6 mg/l indicating the suitability of water for aquatic fauna residing in the reservoir which is the source of different fish varieties like *catla catla, rohu, mrigal, wallago attu, mystus, chitala* etc. Transparency ranges from 76–254 cm allows the solar radiations to penetrate the aquatic system to a considerable depth desirable by the aquatic flora for photosynthesis. Concentration of nitrate and phosphate (the two key nutrients) were observed below the ESEPA's prescribed level.

Keywords: physiochemical parameters, monthly variation, water quality, halali reservoir

Introduction
The total life of world depends on water and hence the hydrological study is important to understand the relationship between its different trophic levels and food webs. The environmental conditions such as topography, water movement and stratification, salinity, oxygen, temperature and nutrients are characterising particular water mass also determining the composition of its biota.
Evaluation of physiochemical factors is basic to understand the ecology of any aquatic ecosystem. Physical parameters like transparency, temperature, suspended solids, turbidity define those characteristics of water that respond to the sense of light, touch, taste or smell. Chemical parameters like free CO_2, DO, pH, organics and nutrients are related to the solvent properties of water and are also the parameters of concern in water quality management.

Materials and Methods
The Halali reservoir was subjected for present work because of its utility for aquaculture, agriculture, industrial and drinking purposes and because of its approachable nature located on Bhopal-Vidisha road. The reservoir was constructed in 1976, with catchment and water spread area of 699 km^2 and 5959 ha, shoreline 65 kms and maximum depth of 29.5 m. Water samples were collected monthly from the station where patra nala joins the reservoir and analysed as per standard methods [1, 2].

Results and Discussion
During the present study ten physiochemical parameters of water have been taken into consideration. Water temperature is the most important ecological factor which influences the physical, chemical and biological characteristics of water body [3]. The maximum water temperature of 31 ^{0}C was recorded in May and minimum 17 ^{0}C in October which is supported by other workers [4, 5]. Transparency is a measure of physical purity of water. Some pollutants are in dissolved form and are not visible to the naked eye. During the period of study transparency was recorded lowest in July (76 cm) which could be because of aquatic plant growth and high rate of runoff from surrounding unpaved areas which brings suspended solids to the water system and reduces the penetration of light to some extent while as highest value was recorded in January (154 cm). Transparency value of 43-171 cm is reported in Upper lake Bhopal [6]. Free CO_2 in water is the source of carbon that can be incorporated and assimilated into the skeleton of the living matter of all aquatic autotrophs. Free CO_2 value ranges from nil to 3.26 mg/l. CO_2 may be because of low temperature.

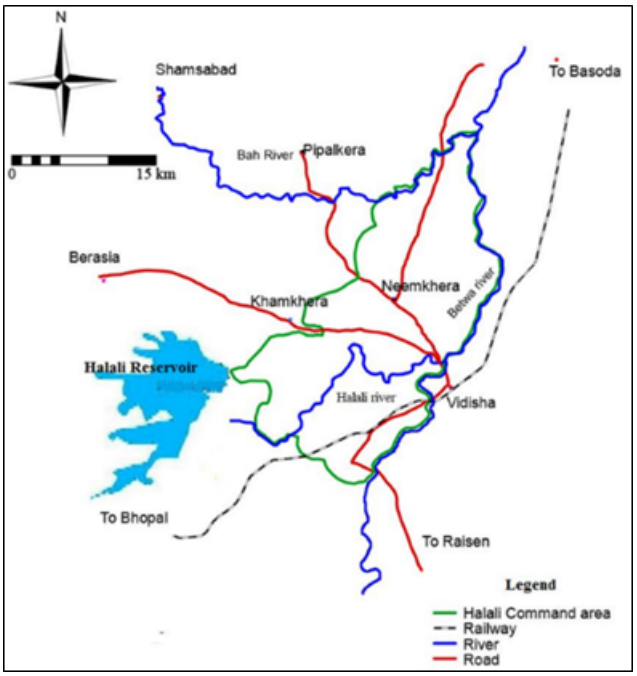

Fig 1: (Halali reservoir map)

DO is the most important parameter in water quality assessment and of paramount importance to all aquatic biota and it is considered the lone factor which can indicate the nature of whole aquatic system. The value of DO was recorded from 6.2 mg/l in April-May to 9.6 mg/l in September. The higher value may be attributed to the combined effect of churning of water by heavy wind action and mixing of monsoon rains. DO is of great significance as it gives an idea about the magnitude of eutrophication. DO concentration in water is mainly dependent upon temperature, dissolved salts, velocity of wind, pollution load, photosynthetic activity and respiration rate [7, 8]. This parameter can also be used as an index for net production [9]. A pH is a measure of hydrogen ion concentration present in a solution and provides an idea about the acidity and alkalinity. During the present work pH value was observed from 6.1 to 9. The highest value of 9 recorded in June, may be because of high temperature and availability of organics drained by runoff due to heavy downpour during monsoon and because of high metabolic rate of microbes decaying organic matter present in water. The pH value of 6.86 to 8.06 was also recorded in two basins of Bhoj wetland, Bhopal [10]. Chlorides are usually present in low concentration in natural waters and metabolically play an active role in photolysis of water and photorespiration reactions in autotrophs. Maximum chloride content has been correlated with high degree of organic pollution and eutrophication [11]. During the study chloride value ranges from 29.34 mg/l to 39.11 mg/l. Though chloride is present naturally in water but it also gets imparted from surrounding agricultural fields by chemical fertilizers, saline residues from soil and animals.

Table 1: Monthly variation of Physiochemical parameters of Halali Reservoir (2010-11)

Parameter	Month											
	Nov 07	**Dec 07**	**Jan 07**	**Feb 08**	**Mar 08**	**Apr 07**	**May 07**	**Jun 07**	**Jul 07**	**Aug 07**	**Sep 07**	**Oct 07**
Water temp. (^{0}C)	18	18	20	23	25	30	31	28	24	21	18	17
Transparency (cm)	146	149	154	142	126	112	95	81	76	80	79	84
Free CO_2	3.26	2.87	2.94	2.14	Nil	Nil	Nil	Nil	1.61	2.18	2.96	3.10
pH	6.5	6.2	6.3	6.8	7.6	8.7	9.3	9.0	7.8	7.1	6.4	6.1
DO	7.1	7.5	7.4	6.9	6.4	6.2	6.2	6.7	7.4	8.6	9.6	8.4
Chloride	31.74	30.84	29.34	32.16	34.10	38.19	39.82	41.66	44.49	39.11	37.02	34.22
Total Alkalinity	110	127	145	148	153	167	151	144	146	133.02	119.71	106.15
Total Hardness	147.61	159.67	145.01	138.84	124.10	113.12	102.61	92.40	99.17	115.10	128.07	136.91
Phosphate	0.466	0.431	0.393	0.422	0.464	0.491	0.529	0.543	0.551	0.537	0.531	0.482
Nitrate	0.308	0.287	0.304	0.342	0.347	0.389	0.426	0.461	0.409	0.351	0.298	0.374

All values in mg/l otherwise given

Carbonates and bicarbonates are the reasons of total alkalinity, and is used as a tool for the measurement of productivity [12]. Total alkalinity was recorded from 106 mg/l to 167 mg/l means the reservoir has a moderate nutrient content. The hardness of water is mainly governed by the presence of calcium and magnesium salts largely in combination with bicarbonates and carbonates (temporary hardness) with sulphates, chlorides and other anions of minerals (permanent hardness). During the study the hardness was recorded from 92 mg/l to 159 mg/l. The total hardness value of 72 mg/l to 325 mg/l was reported in Kshipra River [13].

Phosphate is present in many forms among them orthophosphate plays important role in an aquatic ecosystem. Orthophosphate is the soluble reactive phosphorus (also called inorganic phosphate). It plays a dynamic role in aquatic ecosystem and is taken up widely by phytoplanktons [14]. Phosphate concentration was recorded from 0.393 mg/l to 0.551 mg/l. The higher value recorded in June may be attributed by monsoon runoff from surrounding agricultural fields fed by chemical fertilizers. Phosphate is considered to be the most significant among the nutrients responsible for eutrophication, as it is the primary initiating factor for such a process.

Nitrate is the most oxidised form of nitrogen. The raw sewage is the source of nitrates and phosphates in the water [15]. Its concentration in freshwater apart from autochthonous production may be attributed to wastewater loading, agricultural runoff and ground water inputs. The presence of nitrate indicates that nitrogenous organic matter have undergone oxidation or nitrification. The recommend safe nitrate concentration for the drinking water is 40 ppm [1] and during the study period it was found within the acceptable limits.

Conclusion

From the above it can be concluded that the physiochemical parameters of Halali reservoir are within the acceptable limits, so the water body can be used for agricultural, domestic, Industrial and aquaculture purposes. Steps should be taken to divert or to give a pre-treatment to different types of wastes that are entering into the reservoir for its sustainable future otherwise these wastes will soon deteriorate its quality and snatch the beneficial sources in that the reservoir is in the possession of.

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