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WATER QUALITY ASSESSMENT OF PAGARA RESERVOIR, JOURA, MORENA DISTRICT, MADHYA PRADESH

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ABSTRACT

A study was undertaken to assess the water quality of Pagara reservoir, situated at Asan river, Jaura, District Morena in Madhya Pradesh. Physico-chemical properties of the reservoir were analyzed for the period June 2017 to May 2018. Water was analyzed for physical parameters like Temperature, Turbidity, Transparency, TDS and Conductivity and chemical parameters like pH, Total Hardness, Calcium and Biochemical Oxygen Demand were studied throughout the study period. The study revealed that most of the physico-chemical parameters lie in the standard values of drinking water as provide by WHO and BIS. The water of the Pagara reservoir is quite suitable for drinking purpose and fish culture.

KEYWORDS: Pagara Reservoir, Physico-chemical and Water Analysis

Water is nature's most wonderful, abundant and most useful chemical compound gifted by nature with physico-chemical and biological properties and unique characteristics. It is absolutely essential for domestic purposes for cleaning, cooking, bathing, and carrying away wastes, and in agriculture for irrigation, power generation, industries, navigation, propagation of wild life, fisheries, recreation, aesthetics etc. (Simpi *et al.*, 2011).

The healthy aquatic ecosystem is depended on the physico chemical and biological characteristics (Venkatesharaju *et al.,* 2010). Expanding human population brought about by the opportunities of good water supply, irrigation, fish production recreation and navigation offered by dams has put enormous pressure and stress on the quality of water impounded by the dam. The impact of human activities in and around the dam is felt on the unique physical and chemical properties of water on which the sustenance of fish that inhabit the reservoir is built as well as to the functions of the reservoir. Water quality is important in drinking water supply, irrigation, fish production, recreation and other purposes to which the water must have been impounded (Sidnei *et al.,* 1992). Pagara dam, located on Pagara reservoir could also have affected some of the properties of the reservoir.

Water quality deterioration in reservoirs usually comes from excessive nutrient inputs, eutrophication, acidification, heavy metal contamination, organic pollution and obnoxious fishing practices. The effects of these "imports" into the reservoir not only affect the socio-economic functions of the reservoir negatively, but also bring loss of structural biodiversity of the reservoir (Mustapha, 2008).

MATERIALS AND METHODS

Study Area

Morena is one of the districts of Madhya Pradesh that forms a part of the Gwalior – Chambal division. Pagara dam is situated on Asan river at about 13 Km from Jaura town of Morena District (Fig.1 and 2). The dam was constructed for the irrigation of the nearby villages. It is a masonry dam which was constructed in 1931. Geographically, the dam is located at latitude 26°09′27.9″N and longitude 77°48′22.3″E. The FTL (Full tank Level) of the dam is 199.34m. The dam was constructed mainly for irrigation purpose. The water is used for irrigation of 870 acre land of the nearby villages. Pagara is the nearest village, after the name of which the dam is known as Pagara dam. Besides irrigation, the water is also used for drinking purpose, and also for fish culture by local fishermen.

Collection of Samples

The water samples were collected from the four different sites of Pagara reservoir i,e. A, B, C and D (Fig. 2). The water samples were collected during the morning hours between 8 to 10 AM, each month for the study period from June 2017 to May 2018. The water samples were stored in dried plastic cans of 2 lit. capacity. pH, temperature, and Transparency were determined at the site while rest of the physico-chemical parameters were determined in the laboratory by using the standard methods APHA (2005) and Trivedi and Goel (1983).

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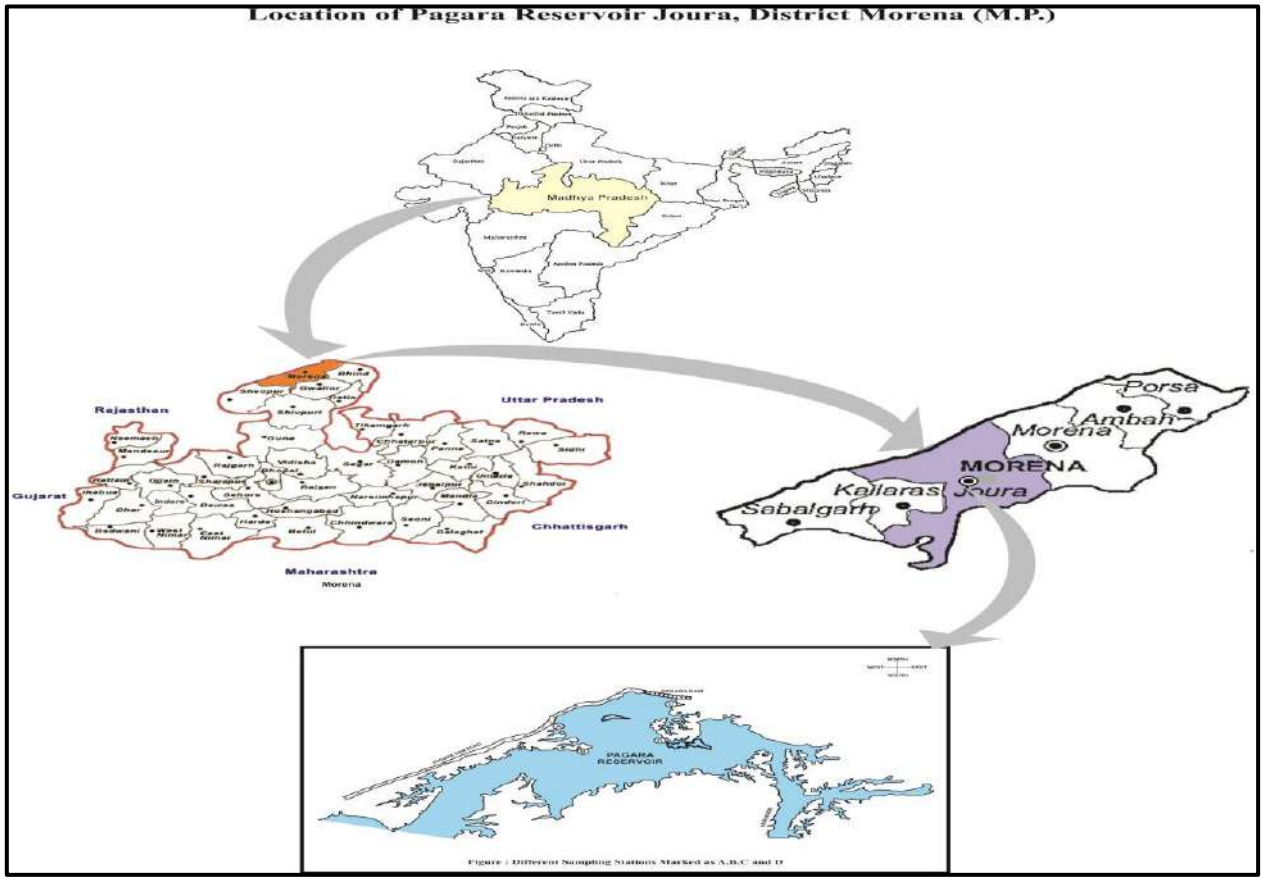

Figure 1: Location of Pagara reservoir, Jaura, District Morena (M.P.)

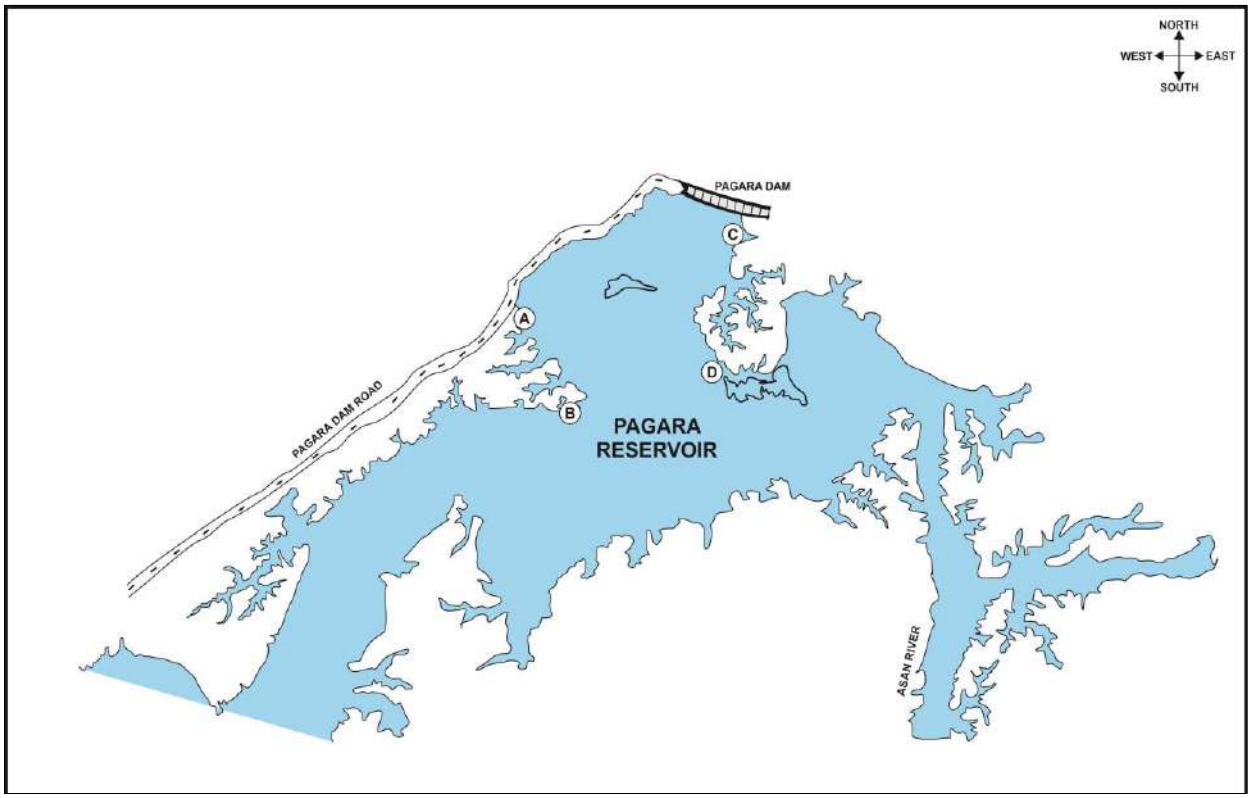

Figure 2: Different sampling stations marked as A, B, C and D

RESULTS AND DISCUSSION

Results are shown in Table 1 and figure 3 to figure11.

Temperature

Temperature is one of the most valuable physical factors which regulates the natural process of the environment. Temperature plays an important role in aquatic ecosystem. The temperature of drinking water has an influence on its taste. Naturally water bodies show changes in daily and seasonally due to different activities that can contribute to change in surface water temperature. In Pagara reservroir water temperature ranged from 23.85 °C to 32.07 °C during different months. During the study period maximum water temperature was recorded in summer season and minimum was recorded in winter season. Kaushik and Saksena (1999) observed water temperature between 17°C and 36°C in Ranital. Sharma *et al.* (2000) recorded water temperature between 21°C to 29°C in Udaipur lakes. Khaire *et al.* (2011) recorded water temperature in the range of 19.2°C to 27°C in Mahakari reservoir in Beed district, Maharashtra. They found water temperature to be more than the atmospheric temperature. Pentawar (2018) recorded maximum temperature during summer (35.8°C) in the month of May, June and July and minimum during winter (16.4°C) in the month of December and January. In Powai lake, Mitter (2018) reported water temperature in the range of 28.7°C to 34.8°C. She observed high value of water temperature in summer and low in winter season.

Transparency

Transparency of water is related to the depth to which light penetrates water. Light is necessary for photosynthetic activity of aquatic plants. Transparency of water depends on the total solids, total dissolved solids and total suspended solids of the water. Transparency of Pagara reservoir varied from 158.5 cm to 196 cm. Maximum transparency was recorded in winter season and minimum transparency was observed in monsoon season. Sharma (2005) has also observed maximum transparency of the water of Makroda reservoir, Guna, during winter season and it was minimum during the rainy season. Garg *et al.* (2010) reported transparency in the range of 66.59 to 116.00 cm in Ramsagar reservoir. They observed maximum transparency during winter in the month of October and minimum during monsoon season. Sharma (2017) recorded water transparency between 152.75 cm to 211.5 cm in Tighra reservoir. He also observed maximum transparency during winter and minimum during monsoon. Mitter (2018) recorded water transparency varied between 73 cm. to 95 cm. in Powai lake, Mumbai.

Turbidity

It is the one of the most common way to measure the extent and undecomposed organic matter, sewage and industrial waste. It is an expression of light scattering and light absorbing properties of water. Turbidity of Pagara reservoir varied from 0.47 NTU to 5 NTU. During the study period the highest turbidity was recorded during monsoon followed by summer and lowest turbidity was observed during winter season. Alam *et al.* (2007) observed turbidity to be highest in monsoon in Surma river. Saksena *et al.* (2008) recorded turbidity to be between 1 to 178 NTU in Chambal river (M.P.). Mitter (2018) measured turbidity in the range of 2.9 to 5.3 NTU in Powai lake. In Godavari river, Pentewar (2018) mentioned minimum turbidity to be 66 NTU and maximum turbidity to be 130 NTU in Maharashtra. Bhoyar (2018) found turbidity in the range of 9.NTU to 21 NTU in Kudla lake, district Nanded, Maharashtra.

Electrical Conductivity

Electrical conductivity indicates the capacity of a substance or solution to conduct electrical current. Conductivity is the numerical expression of ability to carry electric current which, in turns depends on the ionic strength. It is an indicator of ionic composition. Conductivity of Pagara reservoir ranged between 162.75 µs/cm and 404.25 µs/cm. It was highest during summer and was lowest during winter . Mukherji and Nandi (2006) recorded conductivity to be more during summer season. Chandrashekhar (2006) reported water conductivity between 430 and 1720 µs/cm. in Kondakarla lake. Chauhan and Sharma (2007) observed electrical conductivity between 0.80 to 1.65 mmohms /cm. in the lake Budha, Pushkar near Ajmer, Rajasthan. Seasonally, maximum conductivity of water was observed during summer and minimum during winter. Gaur and Singh (2017) reported conductivity in the range of 350 to 450 µs/cm. in Ramganga river, Bareilly.

Total Dissolved Solids

Total dissolved solids is an important parameter for drinking water and water to be used for other purposes. Beyond the prescribed limit, it imparts a

peculiar taste to water and reduce its portability (Mitharwal *et al.* 2009). Total dissolved solids in Pagara reservoir varied from103.25 to 228 mg/lit. During the study period maximum total dissolved solids was observed in summer and minimum in winter. Uchchariya and Saksena (2012) reported total dissolved solids to be between 81.90 and 141.75 mg/lit in Tighra reservoir. They found maximum value of total dissolved solids during rainy season and minimum during winter season throughout the study period. Lingampally *et al.* (2018) also showed total dissolved solids in the range of 336 to 423 mg/lit. in Chakki talab, Bodhan, Telangana. They found highest value of total dissolved solids during summer in the month of June and lowest during winter in the month of October.

pH

pH is a measure of hydrogen ion concentration in water and indicates how much water is acidic or basic. pH is one of the most important parameters in the chemistry of water. If the pH value is high it indicates that water is more corrosive nature of water can be determined with the help of pH. There are various factors which bring about change in the pH of water. The average pH of the Pagara reservoir varied from 6.64 to 8.06. The minimum pH was recorded in winter season and the maximum pH was recorded in summer season. Bukhtar and Sakhare (2011) reported pH value between 8 and 8.4 with a mean of 8 in Wan reservoir in Maharashtra. Singh and Gaur (2017) also reported pH between 6.20 to 8.35 in Ramganga river in Bareilly. Pentewar (2018) also recorded pH ranged between 7.3 to 8.6 in Godavari river in Maharashtra. He found the water of Godavari river was slightly alkaline.

Total Hardness

Total hardness is predominately caused by cations of calcium, magnesium, alkaline earth metals etc. In the present study, Total hardness was recorded between 41.5 mg/lit and 99 mg/lit from Pagara reservoir. Shastri (2005) reported total hardness between 130 mg /l and 290 mg /l in a small percolation tank. Elamci *et al.* (2008) measured hardness of lake Uluabat to be in the range of 14.61 mg/lit. and 140 mg/lit. Saxena and Saxena (2015) recorded total hardness between 60 mg/lit and 2400 mg/lit in Bassi tahsil, district, Jaipur, Rajashtan. Peyami (2016) observed highest value of hardness during summer and lowest during winter from Phadke Pada pond at Diva, Thane. Sharma (2017) reported total hardness of Tighra reservoir between 66.25 mg/lit and 137 mg/lit. He found maximum hardness during summer and minimum during winter.

Calcium

Calcium is an important determinant of water hardness and also functions as a pH stabilizer, because of its buffering qualities. According to Thilaga *et al.* (2005) calcium forms the most abundant ions in fresh water. In the Pagara reservoir calcium ranged between 21.02 mg/lit and 27.64 mg/lit. During the study period maximum value of calcium was recorded in summer, and minimum during winter season. Sathya and Shankar (2009) observed maximum value of calcium during summer and maximum during winter of karveti lake. Bade *et al.* (2009) also reported calcium range between 17.92 to 23.41 mg/lit of in Sai reservoir district Latur, Maharashtra. Mahajan and Pokale (2017) found calcium hardness in the range of 18 to 117 mg/lit. of Mohabala lake near Bhadrawati. Prajapati and Rokde (2018) observed calcium in the range of 10 to 200 mg/lit in the drinking water of Indore city.

Biochemical Oxygen Demand

Biochemical oxygen demand or BOD is a measure of the quantity of oxygen consumed by microorganisms during the decomposition of organic matter. It is an important indicator of the pollution status of a water body. Biochemical oxygen demand has been used as a major of organic materials in an aquatic medium which support growth of microorganism. In Pagara reservoir, biochemical oxygen demand ranged between 0.56 and 5.54 mg/lit. Seasonally, biochemical oxygen demand was maximum during summer season and minimum biochemical oxygen demand was recorded during winter season. Kamat *et al.* (2006) recorded the BOD values between 1.23 to 4.5 mg/lit in Husali tank and between 4.8 to 32.00 mg/lit in Purle tank, district Shimoga, Karnataka. They observed maximum BOD during summer and minimum during monsoon. Peyami (2016) measured BOD to be maximum in summer and minimum during winter season in Phadke Pada pond at Diva, Thane. Pentawar (2018) recorded BOD in the range of 6.1 to 43.0 mg/lit in Godavari river, district, Nanded, Maharashtra.

Table 1: Average Values of four different sites of various Parameters of Pagara Dam, District Morena, M.P. from June 2017 to May 2018

Months	Temp. (°c)	Trans. (cm)	Turb. (NTU)	Cond. (µs)	TDS (mg/l)	pH	Hard. (mg/l)	Cal. (mg/l)	BOD(mg/l)
Jun. 17	31.55	176	4.1	320	123	8.06	99	27.32	1.52
Jul. 17	32.07	162	2.12	242.75	127	7.77	77.5	27.52	2.14
Aug. 17	30.52	158.5	2.47	243.25	123.75	7.71	79	24.23	2.32
Sep. 17	28.75	167	5	212.5	116.75	7.62	75.5	23.38	1.53
Oct. 17	26.4	182	0.52	196.25	115	7.26	64	21.32	0.82
Nov. 17	25.2	185.5	1.7	193.25	112.25	6.64	45.5	21.23	0.74
Dec. 17	24.3	196	0.47	162.75	103.25	6.87	41.5	22.94	0.56
Jan. 18	24.3	190.5	0.53	191.25	122.75	7.62	49.5	21.02	0.92
Feb. 18	23.85	183.62	0.69	218	137.75	7.52	43	21.39	1.72
Mar.18	26.42	181.5	1.04	249.5	185	7.23	51	21.19	1.84
Apr. 18	27.82	178	3.32	345.5	194	7.67	66.5	23.33	2.1
May 18	29.92	177.5	4.32	404.25	228	7.85	89.5	27.64	5.54
Minimum	**23.85**	**158.5**	**0.47**	**162.75**	**103.25**	**6.64**	**41.5**	**21.02**	**0.56**
Maximum	**32.07**	**196**	**5**	**404.25**	**228**	**8.06**	**99**	**27.64**	**5.54**

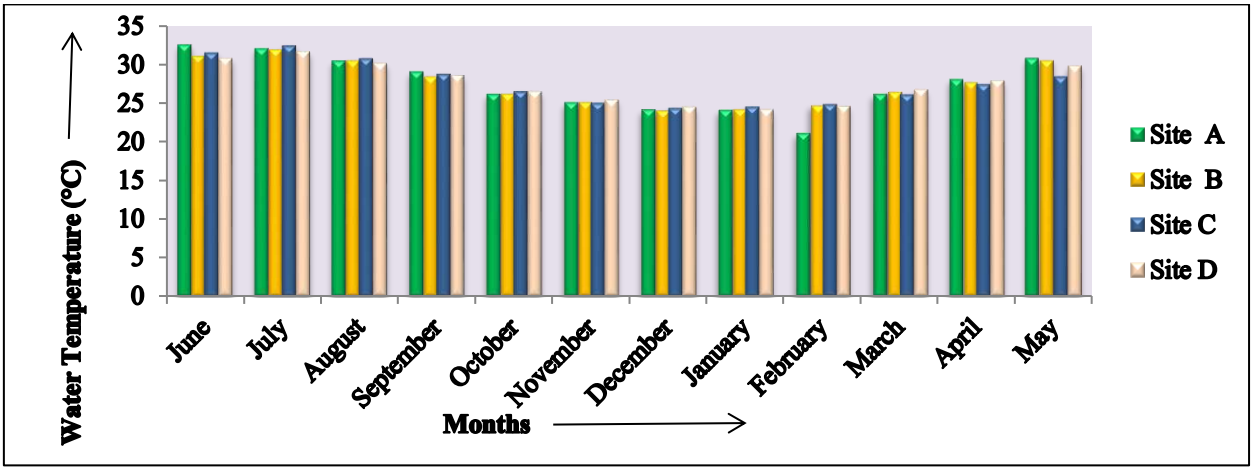

Figure 3: Monthly variations in Water Temperature (ºC) water of Pagara reservoir,from June 2017-May 2018

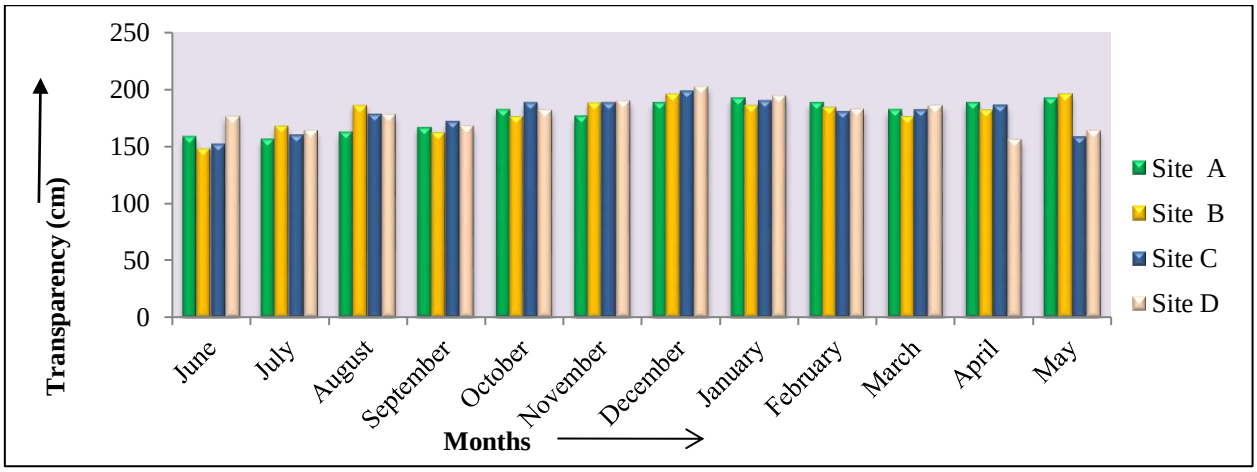

Figure 4: Monthly variations in Transparency (cm) water of Pagara reservoir , from June 2017 to May 2018

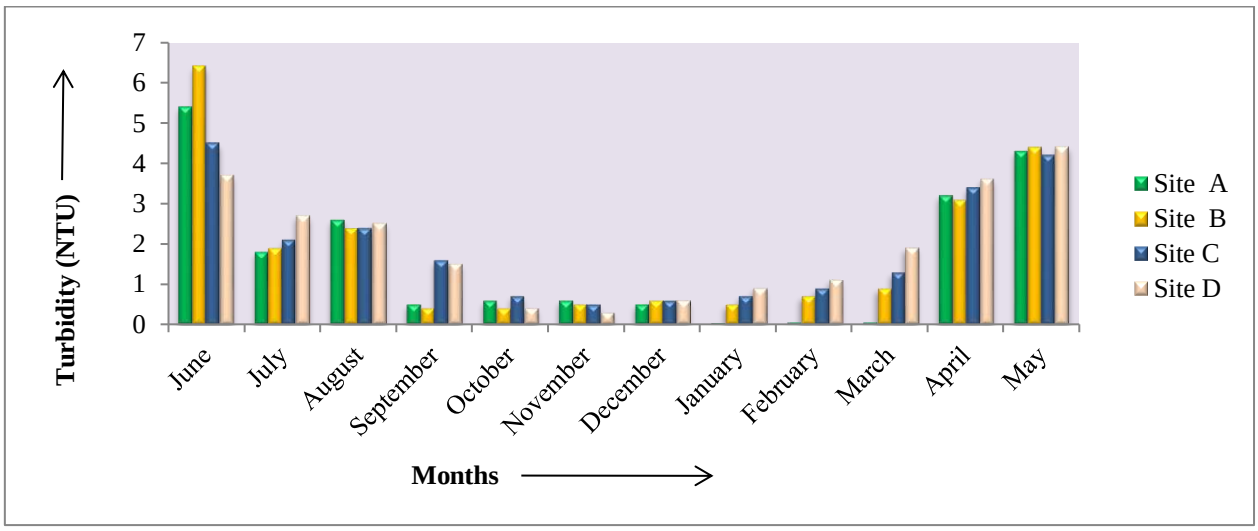

Figure 5: Monthly variations in Turbidity (NTU) water of Pagara reservoir, from June 2017-May 2018

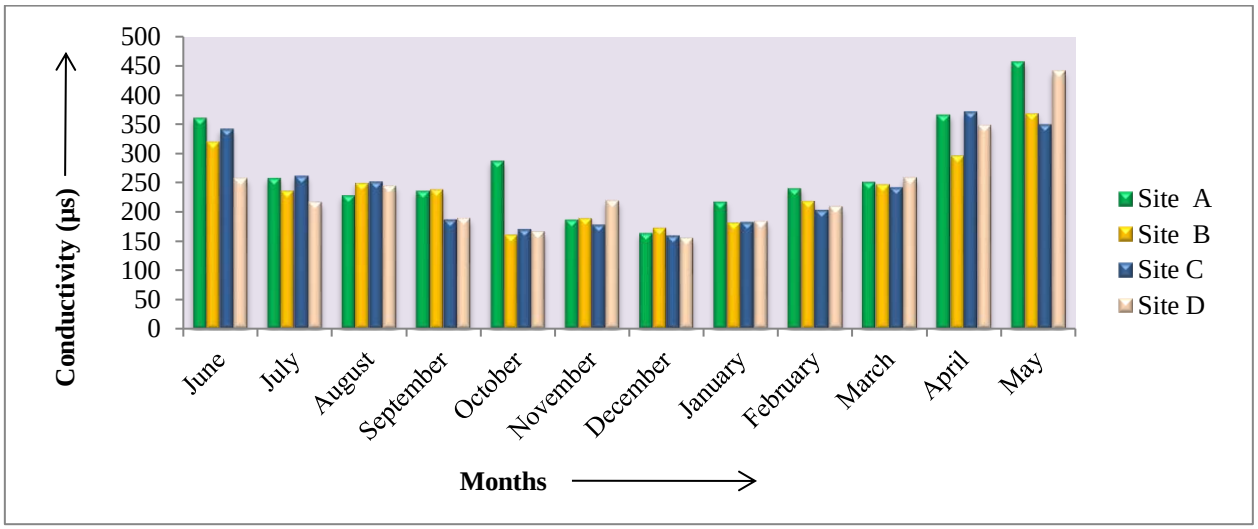

Figure 6: Monthly variations in Conductivity (µs) water of Pagara reservoir, from June 2017-May 2018

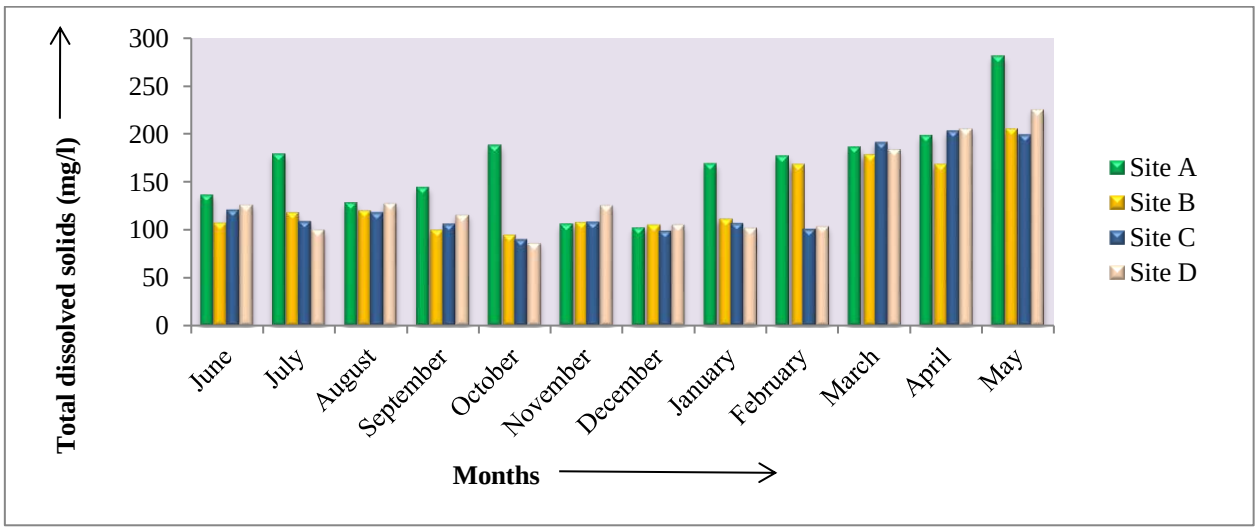

Figure 7: Monthly variations in Total dissolved solids (mg/l) water of Pagara reservoir, from June 2017-May 2018

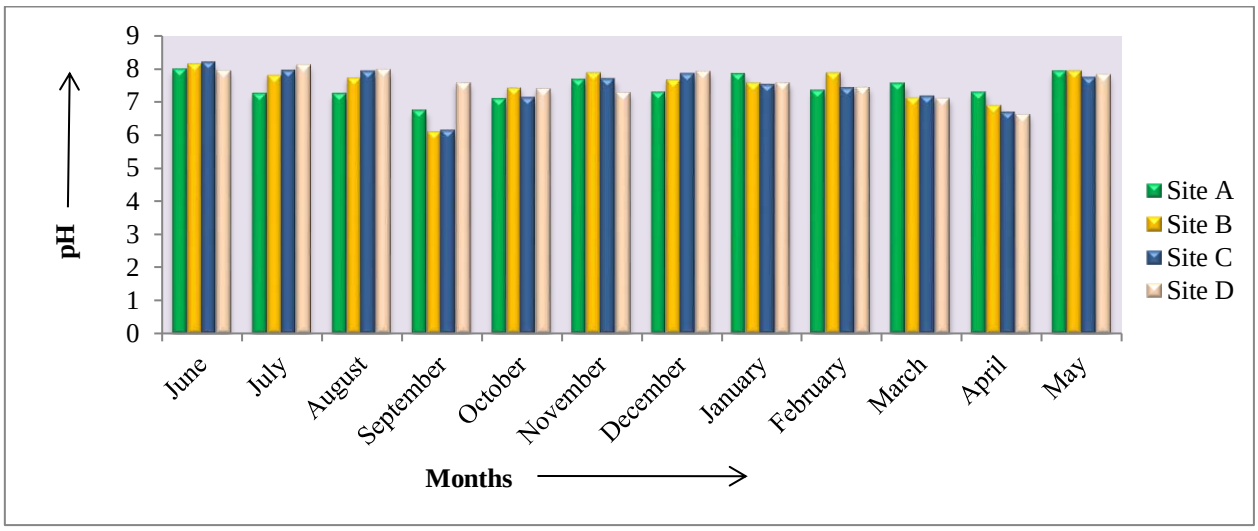

Figure 8: Monthly variations in pH water of Pagara reservoir, from June 2017-May 2018

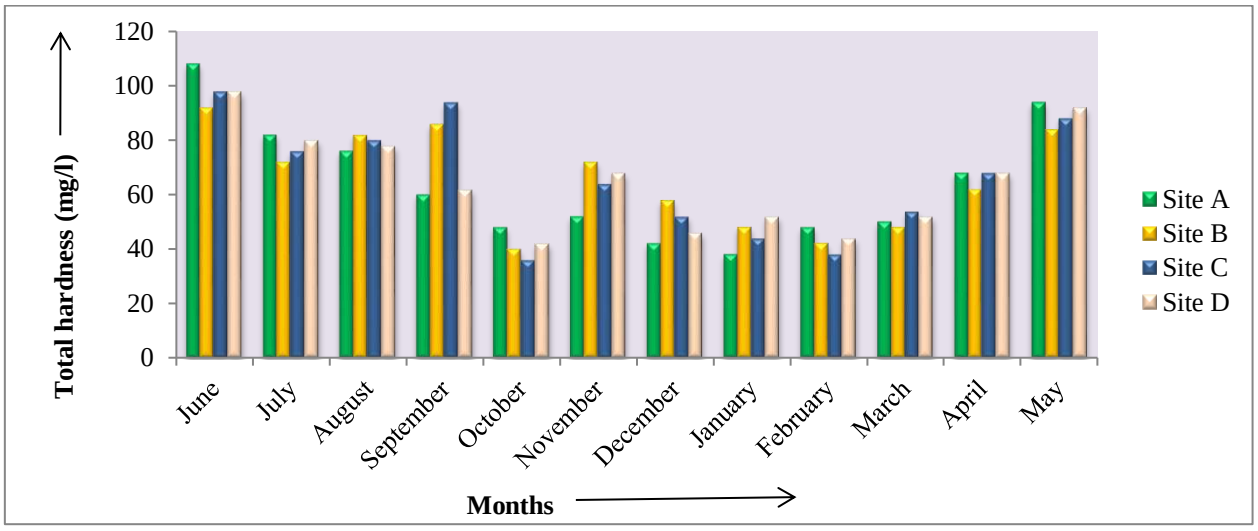

Figure 9: Monthly variations in Total hardness (mg/l) water of Pagara reservoir, from June2017-May 2018

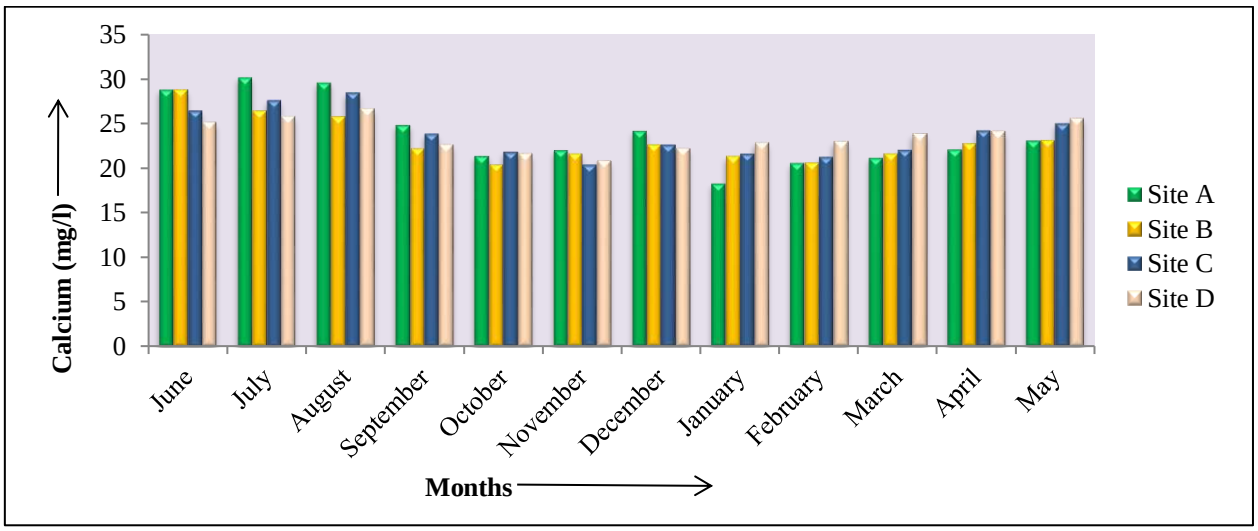

Figure 10: Monthly variations in Calcium (mg/l) water of Pagara reservoir, from June 2017-May 2018

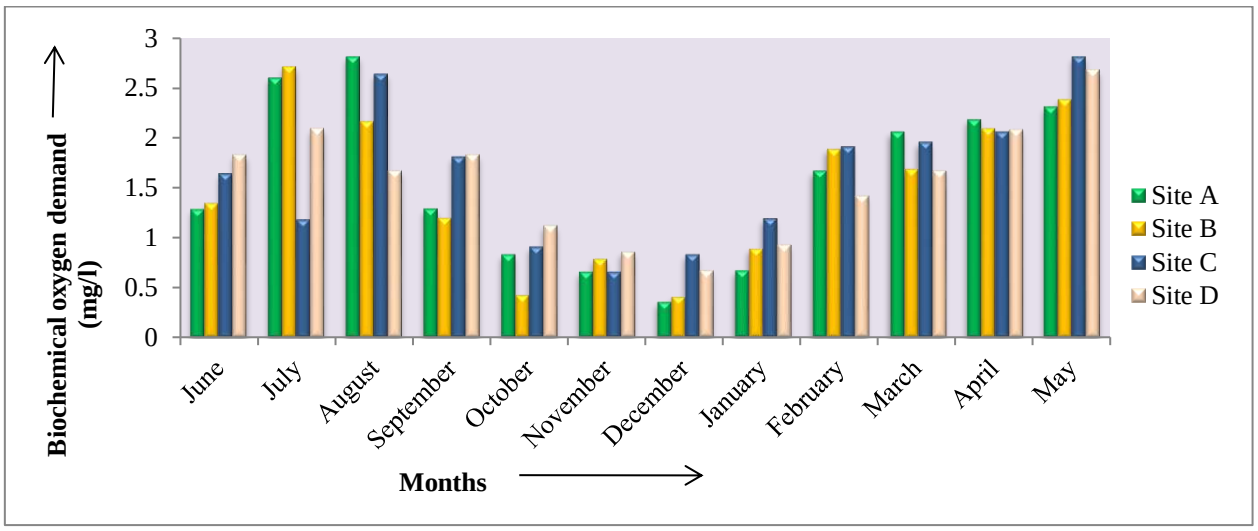

Figure 11: Monthly variations in Biochemical oxygen demand (mg/l) water of Pagara reservoir, from June 2017-May 2018

CONCLUSION

In the present study most of the physico-chemical parameters ranged in permissible limit of drinking water. The study indicates that the water of Pagara reservoir is suitable for drinking purpose. Different parameters indicate that the water is also suitable for fish culture and agriculture.

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