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**Kavindra J**

Research scholar, Department of Aquaculture, College of fisheries, MPUAT, Udaipur, Rajasthan, India

**SK Sharma**

Professor and Dean, College of fisheries, MPUAT, Udaipur, Rajasthan, India

**BK Sharma**

Professor and Head, Department of Aquaculture, College of fisheries, MPUAT, Udaipur, Rajasthan, India

**ML Ojha**

Assistant Professor and I/C Department of FRM, College of fisheries, MPUAT, Udaipur, Rajasthan, India

## Physico-chemical properties and primary productivity of Jawai dam, Pali, Rajasthan

**Kavindra J, SK Sharma, BK Sharma and ML Ojha**

### Abstract

The current research work was conducted to find out the water quality of Jawai Dam of Pali in Western Rajasthan. Attempt has been made to assess the status of current physico- chemical parameter of water of Jawai dam and its correlation with primary production and to suggest proper management practice for getting the optimum production. Level of orthophosphates- $0.024 \pm 0.002 \text{ mg l}^{-1}$ , nitrate-nitrogen  $0.016 \pm 0.002 \text{ mg l}^{-1}$ , was recorded during study period which was low. Relatively low level of nutrients in the Jawai dam acclaims it in the category of low to moderate productive nature of water. From the present it can be concluded that the water of the reservoir can be used for the agriculture and fisheries as well as for the drinking purpose.

**Keywords:** Water quality, correlation, physico-chemical parameters

### Introduction

The use of the physicochemical properties of water to assess water quality gives a good impression of the status, productivity and sustainability of inland water bodies. The changes in physical characteristics like temperature, transparency and chemical elements of water such as dissolved oxygen, nitrate and orthophosphate provide valuable information on the quality of the water, the source of the variations and their impact on the functions and biodiversity of the reservoir (Djukic *et al.*, 1994) [5]. In Rajasthan, for the estimation of fish production potential of different water bodies, their physico-chemical and primary productivity have been studied by several researchers Durve (1976) [6], Sharma *et al.* (1984) [14], Sharma *et al.* (1994) [12], Sharma and Kaushal (2004) [16], Rajkumar (2005) [10], Balai *et al.* (2014) [3], Mishra *et al.*, (2017) [8]. Trophic status of the Rana Pratap Sagar dam and the Chambal River in biological point of view studied by Sharma *et al.*, (2008) [13]. Mishra *et al.*, (2017) [8] made an attempt to access the water quality and physicochemical parameters of lake Pichola, Udaipur. The present study was carried out for access the primary productivity and physico-chemical parameters of Jawai Dam.

### Materials and Methods

#### Study area

The study will be conducted at Jawai dam. The dam is situated near Sumerpur town in Sumerpur tehsil of Pali district of Rajasthan. This is the biggest dam in the western Rajasthan, build across the Jawai River, a tributary of river Luni. The dam is surrounded by hills of Aravalli ranges.

**Table 1:** Geomorphological and hydrographic features of Jawai Dam

Year of completion	1957
Name of River	Jawai River
District	Pali
Latitude	25°6'40"N
Longitude	73°9'40" E
Dam height	61.25 feet (18.67 m)
Mean depth	7.7 m
Catchment Area	787 km <sup>2</sup>
Annual Average Rainfall	790 mm
Surface area at FTL	2590 ha
Capacity	198.2 X 10 <sup>6</sup> m <sup>3</sup>
Length of Dam	924 m
Max height above foundation	20.72 m

### Correspondence

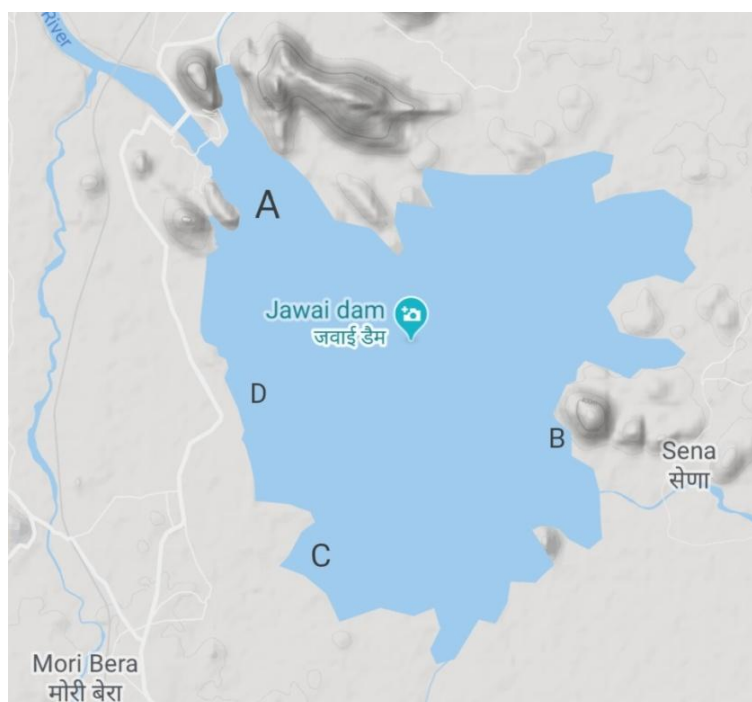
**Kavindra J**

Research scholar, Department of Aquaculture, College of fisheries, MPUAT, Udaipur, Rajasthan, India

### Sampling Stations

For estimating physico-chemical as well as biological parameters sampling was conducted at four stations. Sampling station A was located on the Western side of landing centre, B

near Jawai Sagar Resort, C near Jawai dam view point and D at the landing centre of department of fisheries as depicted in Figure 1. Samples were randomly collected at fifteen days interval up to 5 months (November, 2018 to March, 2019).



**Fig 1:** Satellite imagery of Jawai dam showing location of sampling stations

### Sample Collection

During the study period, surface water samples were collected using plastic bucket. However, water samples were collected separately in bottles of 1 liter for the analysis of certain chemical parameters of water quality in the laboratory.

### Water quality analysis

Water quality parameters such as water temperature and ambient air temperature of the dam, pH, dissolved oxygen,

electrical conductivity (EC), Total dissolved solid (TDS), carbonate alkalinity, bicarbonate alkalinity and total alkalinity were determined in the field itself, while the measurement of orthophosphate, free carbon dioxide and total hardness were analyzed in the laboratory of the Department of Aquatic Environment Management, College of Fisheries using standard methods of Trivedy *et al.*, (1987)<sup>[18]</sup> and APHA (2005)<sup>[11]</sup>. For analysis of primary productivity light and dark bottle method was used (Trivedy *et al.*, 1987)<sup>[18]</sup>.

### Results and Discussion

**Table 2:** Average physico- chemical parameters and primary productivity at four stations of Jawai dam

Sr No	Parameters	Station A	Station B	Station C	Station D	Mean	SD
1.	Air Temperature ( $^{\circ}\text{C}$ )	29.69	29.70	29.81	29.74	29.73	0.05
2.	Water Temperature ( $^{\circ}\text{C}$ )	23.16	23.25	23.27	23.17	23.22	0.05
3.	Depth of Visibility (cm)	113.90	112.60	106.20	114.90	111.90	3.91
4.	pH	8.06	8.16	8.07	8.06	8.09	0.05
5.	EC (mS/cm)	0.41	0.40	0.41	0.41	0.41	0.005
6.	TDS ( $\text{mg l}^{-1}$ )	261.80	259.90	260.70	260.20	260.65	0.83
7.	Dissolved $\text{O}_2$ ( $\text{mg l}^{-1}$ )	8.06	8.30	8.00	7.95	8.08	0.15
8.	Free $\text{CO}_2$ ( $\text{mg l}^{-1}$ )	0.00	0.00	0.00	0.00	0.00	0
9.	Carbonate Alkalinity ( $\text{mg l}^{-1}$ )	4.20	4.40	4.00	4.00	4.15	0.19
10.	Bicarbonate Alkalinity ( $\text{mg l}^{-1}$ )	107.20	108.40	110.60	107.40	108.40	1.56
11.	Total Alkalinity ( $\text{mg l}^{-1}$ )	111.40	112.80	114.60	111.40	112.62	1.52
12.	Total Hardness ( $\text{mg l}^{-1}$ )	153.50	154.40	152.70	147.9	152.13	2.90
13.	Nitrate-N ( $\text{mg l}^{-1}$ )	0.015	0.017	0.018	0.014	0.016	0.002
14.	Ortho-P ( $\text{mg l}^{-1}$ )	0.024	0.025	0.025	0.021	0.024	0.002
15.	Gross Primary Productivity ( $\text{gCm}^{-3}\text{h}^{-1}$ )	0.110	0.113	0.111	0.110	0.111	0.001
16.	Net primary productivity ( $\text{gCm}^{-3}\text{h}^{-1}$ )	0.066	0.065	0.067	0.064	0.065	0.001
17.	Community Respiration ( $\text{gCm}^{-3}\text{h}^{-1}$ )	0.045	0.047	0.044	0.046	0.046	0.001

Physico-chemical parameters of Jawai dam (Table 2) were found throughout the study period were suitable for agriculture and domestic use as well as fisheries purpose.

The average of air temperature and water temperature at all stations was  $29.73 \pm 0.05^{\circ}\text{C}$  and  $23.22 \pm 0.05^{\circ}\text{C}$  respectively. The relationship between air and water temperature was

clearly seen in the present study where a positive relationship was established between air and water temperature. The average visibility was  $111.90 \pm 3.91$  cm. It point out the low level of nutrient and thus can be acclaimed as “low eutrophic nature of water” as described by Sharma and Durvey (1990)<sup>[6]</sup>. Similar to our findings Sharma *et al.* (2012)<sup>[16]</sup> also found positive relationship of depth of visibility with various parameters as stated above.

The mean value of pH was  $8.09 \pm 0.05$ , found during the study period, which is moderately alkaline and supports fairly good aquatic productivity and mesotrophic status of dam. pH showed a positive correlation with electrical conductivity, total dissolved solids, bicarbonates, total alkalinity, orthophosphate and nitrate-nitrogen. Same pattern was observed by Sumitra *et al.* (2007)<sup>[17]</sup> in Lake Pichola and Ranu (2001)<sup>[11]</sup> in Bandi River of Pali.

The average of EC and TDS at all stations was  $0.41 \pm 0.005$  mS  $\text{cm}^{-1}$  and  $260.65 \pm 0.83$  mg  $\text{l}^{-1}$ , respectively. The Jawai dam with moderate EC and TDS could be considered mesotrophic and having low productive water body. The dissolved oxygen was relatively moderate. The average of dissolved oxygen found at Jawai dam was  $8.08 \pm 0.15$  mg  $\text{l}^{-1}$ . Correlation between DO and other water quality parameters *viz*: air -water temperature, electrical conductivity, pH, carbonate, bicarbonates, total alkalinity, TDS, nitrate nitrogen and orthophosphate were observed. Similar results were observed by Sharma (2008)<sup>[13]</sup>, Sumitra *et al.* (2007)<sup>[17]</sup> and Mishra *et al.*, (2017)<sup>[8]</sup> in their studies.

Average total alkalinity value was recorded  $112.62 \pm 1.52$  mg  $\text{l}^{-1}$  at all sampling sites of the dam, hence fall under low to moderate productive water body. Carbonate alkalinity was also present in the lake water during the study period as free carbon dioxide was absent throughout the study period. Dangi *et al.*, (2017)<sup>[4]</sup> also reported nil free  $\text{CO}_2$  in Lake Pichola during his study period.

A low level of average productivity was recorded in Jawai Dam *i.e.*  $0.111 \pm 0.001$  gCm<sup>3</sup>h<sup>-1</sup> GPP,  $0.065 \pm 0.001$  gCm<sup>3</sup>h<sup>-1</sup> NPP and  $0.045 \pm 0.001$  gCm<sup>3</sup>h<sup>-1</sup> community respiration was recorded. The low primary productivity found in the present study may be assigned to low concentration of nutrients, low TDS, moderate temperature and lower photosynthesis during the study period. GPP in present investigation was positively correlated with air temperature, water temperature, orthophosphate, bicarbonates and nitrate nitrogen while negatively correlated with depth of visibility. Similar pattern was also reported by Baghela<sup>[2]</sup> (2006) from Jawai Dam, Pali.

## Conclusion

From the above discussion it is clear that on the basis of water quality parameters and observations on productivity, it is appropriate to place this water body somewhere between “low to medium productive water”.

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