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A Comparative Study on Limno-Chemical Parameters of Two Water Bodies Varanda and Ankarsol Ka Naka of District Dungarpur, Rajasthan

Rituraj Singh Chauhan, Sourindra Mohan Roy, Neeraj Pachori

Limnology & Fish Biology Research Laboratory, Dept. of Zoology, Govt. P.G.College, Pratapgarh Rajasthan, India

Abstract: ***The present investigation was carried out to high-lights the comparative water quality status of two water bodies Varanda and Ankarsol ka Naka of district Durgapur. The Study was conducted during the post monsoon period. Limno-chemical parameters are important criteria for determining the suitability of water for fish production. Water quality was determined by various parameters like turbidity, water color, pH, alkalinity, hardness, calcium, nitrate, Fluoride DO, etc. On the basis of results of water quality parameters in general, reservoir, Akarsol ka Naka having much more dissolve oxygen 6.8 mg/l as compare to Varanda i.e., 5.6 mg/l. it was also recorded that Akarsol ka Naka has significant low level of fluoride 0.05 mg/l as compare to Varanda 0.35 mg/l. Other parameters were also observed that Akarsol ka Naka showed low concentration of Calcium 28.0 mg/l as compare to 60.0 mg/l Varanda. There was no significant amount of Nitrate content found in both the water bodies. These water bodies are rain fed with some limited catchment area and water level exhibits fluctuations in season to season. Thus the present study indicates that the Ankarsol ka Naka reservoir is more productive for fish culture as compare to Varanda reservoir.***

Keywords: Akarsol Ka Naka, Varanda, Limno-Chemical, Fish culture

1. Introduction

In Rajasthan total water resources available for fisheries in the State are 15838 no. of water bodies covering an area of 4, 23, 765 hectare excluding rivers and canals (30, 000 ha.) and water logged area (80, 000 ha.) at Full Tank Level (FTL)(Ravi kumar et al., 2018)[1]. The present study was carried out during Post monsoon season of year 2019, two water bodies Varanda and Ankarsol ka Naka of district Durgapur. The Varanda (latitude $23^0$31'00", longitude $73^0$45'00") and Ankarsol ka Naka (latitude $23^0$37'20", longitude $73^0$41'20") are situated in district Durgapur of Rajasthan. The Varanda and Ankarsol ka Naka have water spread area of 300CCA and 780CCA respectively (Table 01). There are several varieties of fishes available in natural environment. Optimal water quality varies with species and must be monitored to ensure for proper growth and survival. Water quality measures the condition of water relative to the requirements of one or more biotic species (Johnson et al., 1997)[2]. Physico-chemical parameters of water play a significant role in the biology and physiology of fish (Dhawan and Kaur, 2002)[3]. However water is an essential component of the environment and all organisms depend on water for their survival (Smitha et al., 2007) [4]. The changes in limno-chemical characteristics like temperature, transparency and chemical elements of water such as dissolved oxygen, nitrate provide valuable information on the quality of the water. The physical and chemical characteristics of water are important parameters as they may directly or indirectly affect its quality and consequently its suitability for the distribution and production of fish and other aquatic animals (Moses, 1983)[5]. For fish culture productive water resources depends on a large number of physico-chemical parameters. Monitoring of these parameters is essential to identify the magnitude and source of any pollution load (Thirupathaiah et al., 2012) [6].

Therefore, the aim of the study was to investigate a comparative estimation of certain limno-chemical parameters of Varanda and Ankarsol ka Naka of district Durgapur to find out the suitability of fisheries potential.

2. Materials and Methods

Sampling stations

Sampling for estimating limno-chemical parameters was conducted in three sites of both the water bodies Varanda and Ankarsol ka Naka of district Durgapur. At each sites 3 surface water samples were randomly collected. The study period was conducted for 30 days.

Table 1: Morphometric observations of two water bodies Varanda and Ankarsol ka Naka of district Durgapur

	Varanda	**Akarsol ka Naka**
Latitude	$23^0$31'00"	$23^0$37'20"
Longitude	$73^0$45'00"	$73^0$41'20"
Average Rain Fall	249 mm	249 mm
Water Spread Area	300CCA	780CCA
Maximum Length	65mtr^2	131mtr^2
Maximum Width	1.84Mcum	3.72Mcum
Maximum Depth	4.40meter	9meter
Reservoir Type	L-Nallah	Sabarmati basin L- Nallah
Year of Construction	2013	1977

Sample collection

During the study period, surface water samples were collected using plastic bottles of 1 liter for the analysis of limno-chemical parameters then analyzed as soon as possible using the standard method of (Trivedi 1987)[7] and (APHA 2005)[8], some parameters are tested in NABL lab Udaipur.

1. Temperature: Temperature was measured with the thermometer immersed directly in the water body.

2. Depth of visibility: Depth of visibility was determined by using a standard Secchi disc of 20 cm diameter.
3. pH: pH value of water sample is determined by using an electronic digital pH meter.
4. Electrical Conductance: Electrical conductivity was measured with the help of a pen type electronic conductivity meter and results were expressed as µS/cm.
5. Total dissolved solids (TDS): For the estimation of total dissolved solids in every sample by TDS metere (Hanna Make)
6. Dissolved oxygen (DO): The concentration of dissolved oxygen in water was estimated following the basic Winkler's method. .
7. Total alkalinity: The total alkalinity was estimated by titrating the sample with a standard solution of strong acid (H2SO4 or HCl). First to pH 8.3 using phenolphthalein as an indicator (carbonate alkalinity) and then further to the second endpoint of pH 4.5 using methyl orange as an indicator (bicarbonate alkalinity).
8. Fluoride content tested in NABL lab Udaipur, Rajasthan.
9. Chloride content tested in NABL lab Udaipur, Rajasthan.
10. Total Hardness: The estimation of total hardness is based on the fact that Eriochrome black 'T' forms wine red complex compound with metal ions (Ca++ and Mg++). The EDTA has got stronger affinity towards Ca++ and Mg++. When the solution is titrated by EDTA, the former complex is broken down and a new complex of blue color is formed.
11. Nitrate-nitrogen: This was analyzed using phenol disulphonic acid (PDA) method of APHA (2005).

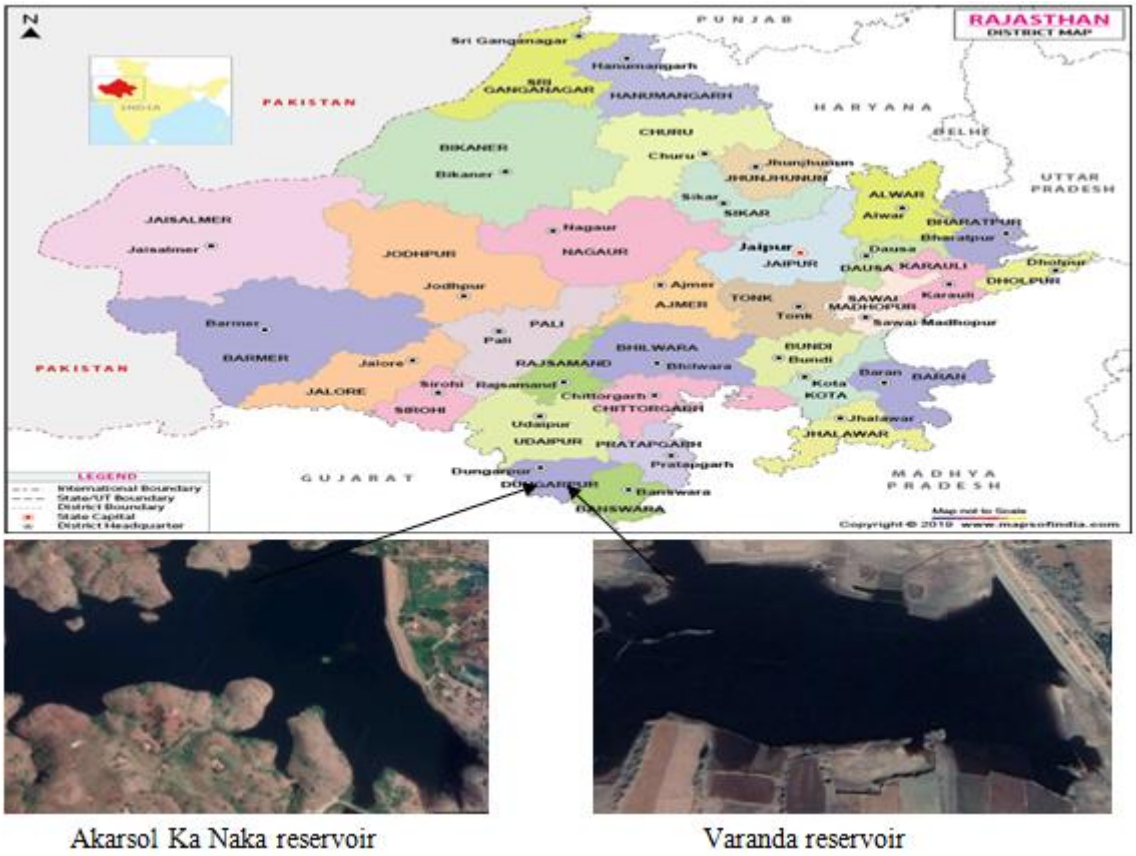

Figure 1: Showing Location map of the study area and satellite imagery of both reservoirs

3. Results and Discussions

The suitable conditions of water quality in ponds, lakes and reservoirs are essential for successful production of fish and other aquatic resources (Mustapha and Omotosho, 2005)[9]. Results vary in respect to the sites of the reservoir. However there could be always a chance for a difference in test result in different pre research because of laboratory approach, sample preservation, quality of chemicals used and testing methods applied (Weldemarim, 2013)[10].

Results of the limno-chemical parameters obtained from this study are discussed below-

Temperature

Temperature is one of the important physical parameter of water quality to measure because it influences the aquatic life by altering the dissolved oxygen (DO) concentration in the water. Fish respires through gills and utilize oxygen dissolve in water bodies. In the present study temperature ranged from 24.6 °C to 29.3 °C in both the water bodies.

Depth of visibility

The Depth of visibility of water relates to the depth that light will penetrate water. The transmission of light into a water body is extremely important since the sun is the primary source of energy for all biotic community. In the present

investigation, the water clarity values were found within this range in Varanda (140.10 to 310.24cm) and Akarsol ka Naka (157.94 to 325.08cm) throughout the study period. (Jones et al., 1997)[11] reported reservoir transparencies ranging from 20–470 cm.

pH

pH maintains the acidic or basic property of water bodies. It is a vital characteristic of any aquatic ecosystem since all the biochemical activities and retention of physico-chemical attributes of the water are greatly depending on pH of the surrounding water (Jalal and Sanal Kumar, 2013)[12]. In the present study, pH found 7.26 in Varanda and 7.46 in Akarsol ka Naka.

However, (Rajkumar 2005)[13] and (Balai 2007)[14] found alkaline water in the Daya reservoir and Jaisamand lake of Udaipur (Raj.), respectively. (Sumitra et al. 2007)[15] reported a pH of 8.3-9.3 in Lake Pichhola which is fairly inclined towards an alkaline nature of water.

Electrical conductivity

The electrical conductance (EC) represents total ionic load in water due to dissolved substances and sometimes considered as an index of productivity. In the present study, the electrical conductance 386 µS/cm Varanda and 276 µS/cm Akarsol ka Naka was observed. (Sharma et al., 2008)[16] recorded EC value to range between 0.3 to 0.97 mS cm-1 in Udaipur lake.

Total dissolved solids

The amount of total dissolved solids (TDS) in water indicates salinity of water and the higher values of total dissolved solids in natural waters are generally due to increased anthropogenic activity, stagnation and concentration of water. During the present study, total dissolved solids (TDS) recorded 204 mg/l in Varanda and 188 mg/l Akarsol ka Naka. (Pawar et al. 2009)[17] recorded TDS values between 186 to 284 mg/l in Paneshewadi dam, Kandhar, Nanded dist.

Dissolved Oxygen

Dissolved oxygen is the most critical water quality variable in an aquatic ecosystem. It is of primary importance both as a regulator of metabolism of plant and animal communities and as an indicator of water condition. During the present study, the dissolved oxygen concentration of 5.6 mg/l in Varanda and 6.8 mg/l Akarsol ka Naka were recorded. (Mishra et al. 2018)[18] reported that Oxygen concentration of lake Pichhola ranged from 5.28 to 6.63 mg l^{-1} mg l^{-1}.(Manjare et al. 2010)[19] recorded values of DO fluctuate from 5.09 to12.78mg/l in Wadgaon tank, Kolhapur (M. S.). (Ghantaloo et al. 2011)[20] recorded DO range between 5.6 to 8.3 mg/lit. in Nira left bank canal Sharadnagar, Taluka Baramati.

Alkalinity

Alkalinity expresses the buffering capacity of the water. The main factors responsible for alkalinity are carbonates, bicarbonates, hydroxide ions, organic acid etc. During the present study carbonate alkalinity found 70.0 mg/l Varanda and 40.0 mg/l Akarsol ka Naka.

Ravi kumar et al., (2018)[1]. recorded that Bicarbonate alkalinity showed 28 to 68 mg l^{-1} in Mahi Bajaj Sagar. Lodh et al., (2014)[21] reported the alkalinity range between 60.68 to 116.9 mg/l at different water bodies of Udaipur (Tripura). Basavaraja et al., (2014) [22] reported Total alkalinity range between 40.08 to 61.50 mg/l at Anjanapura reservoir, Karnataka, India.

Total Hardness

Hardness is caused due to the presence of metallic carbonates of Ca+2, Mg+2, Fe+3 etc. The hardness of water is referred to by three types of measurements: grains per gallon, milligrams per liter (mg/L), or parts per million (ppm). During present study total hardness to be found 160.0 mg/l Varanda and 120.0 mg/l Akarsol ka Naka. Rahane et al, . (2015)[23] reported total harness mean range between 81.56-151.29 mg/l at Girna, Reservoir in Nasik district (M.S.). Ravi kumar et al., (2018.)[1] recorded total hardness ranged from 90 to 152 mg l^{-1} in Mahi bajaj sagar.

Nitrate

Inorganic nitrogen that presents in water as Nitrate is the main nutrient that accelerates the growth of hydrophytes and algae. Nitrate occurs in water from various natural sources and due to human activities like food production, agriculture and disposal of domestic and industrial sewage. During the present study, there was no significant level of nitrate to be found in both the studied reservoir.

Chloride

In the present study we had tested the chloride content in two reservoirs. It was found that, the chloride content recorded 19.99 mg/l in Varanda and 29.99 mg/l in Akarsol ka Naka. Sabyasachi and Ratul (2013)[Reported 70mg/l chloride content in the Mangalpur Pond, Ranigunj West Bengal.

Fluoride

District Dungarpur is fluoride prone zone because of that fluoride content of these two reservoir water were tested and the results recorded 0.35mg/l Varanda and 0.05mg/l Akarsol ka Naka respectively. Sabyasachi and Ratul (2013)[24] determined 1.8 mg/l Fluoride content in the Mangalpur Pond , Ranigunj West Bengal.

Calcium and Magnesium

In our present study, we recorded the Calcium level concentration in reservoir, 60mg/l in Varanda and 28.0mg/l in Akarsol ka Naka respectively. It requires for fish growth and development. Magnesium is also recorded 2.4mg/l in

Varanda and 12.0mg/l in Akarsol ka Naka. Both are responsible for water hardness as well as for biology of fish.

Table 2: Compare Study of limno-chemical parameters of all three sites of Varanda and Akarsol ka Naka water bodies of district Dungarpur

Para-meter	Color	Odor	Turbidity	pH	Mg	Ca	DO	TDS	Total Hard-ness	Nitrate	F	Cl	Alkali-nity	Cond-uctivity
Units	Hazen	--	NTU	--	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	µS/cm
A1	<5	Unobj	<1	7.44	14	27	6.9	191	114	BDL	0.05	30.05	40	279
A2	<5	Unobj	<1	7.46	12	28	6.8	188	120	BDL	0.05	29.99	36	276
A3	<5	Unobj	<1	7.48	10	29	6.7	185	126	BDL	0.05	29.93	44	273
Mean	**<5**	**Unobj**	**<1**	**7.46**	**12**	**28**	**6.8**	**188**	**120**	**BDL**	**0.05**	**29.99**	**36**	**276**
B1	<5	Unobj	<1	7.27	2.3	59	5.4	203	157	BDL	0.37	19.97	68	385
B2	<5	Unobj	<1	7.26	2.4	60	5.6	204	163	BDL	0.35	19.99	70	386
B3	<5	Unobj	<1	7.25	2.5	61	5.8	205	160	BDL	0.33	20.01	72	387
Mean	**<5**	**Unobj**	**<1**	**7.26**	**2.4**	**60**	**5.6**	**204**	**163**	**BDL**	**0.35**	**19.99**	**70**	**386**

A1, A2, A3= Three sampling sites of Akarsol Ka Naka
B1, B2, B3 = Three sampling sites of Varanda
BDL = Below Detection Limit

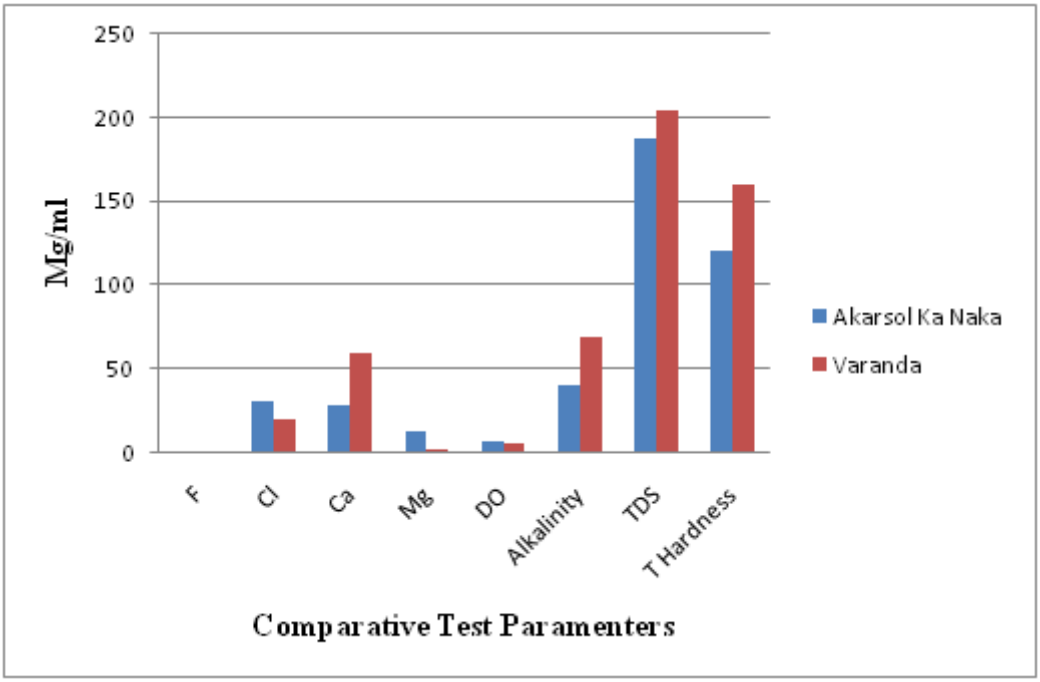

Figure 2: Histogram showing comparative test parameters of both the reservoirs

4. Conclusions

In our comparative study it indicates that the water quality status of Akarsol ka Naka reservoir of Dungarpur is more suitable for fisheries potential as compare to Varanda reservoir. The study revealed that all the limno-chemical parameters exhibit lesser quantity in Akarsol ka Naka reservoir. Fluoride content in water of Akarsol ka Naka reservoir significantly low as compare to Varnada reservoir. Our present study has provided information's regarding moderate level of nutrients which can helps in planktonic growth. Thus, the present investigation clearly shows that water in both the reservoirs can be used for culture based fisheries as well as for domestic purpose and agriculture. However, Akarsol ka Naka reservoir is more productive for fisheries potential.

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